



# LIBRARIES

UNIVERSITY OF WISCONSIN-MADISON

## Minerals yearbook: Mineral fuels 1964. Year 1964, Volume II 1965

Bureau of Mines

Washington, D. C.: Bureau of Mines : United States Government Printing Office, 1965

<https://digital.library.wisc.edu/1711.dl/PPYAWXJZXOESO8L>

<http://rightsstatements.org/vocab/NoC-US/1.0/>

As a work of the United States government, this material is in the public domain.

For information on re-use see:

<http://digital.library.wisc.edu/1711.dl/Copyright>

The libraries provide public access to a wide range of material, including online exhibits, digitized collections, archival finding aids, our catalog, online articles, and a growing range of materials in many media.

When possible, we provide rights information in catalog records, finding aids, and other metadata that accompanies collections or items. However, it is always the user's obligation to evaluate copyright and rights issues in light of their own use.

# MINERALS YEARBOOK

1964

Volume II of Four Volumes

MINERAL FUELS



*Prepared by staff of the*  
**BUREAU OF MINES**



**UNITED STATES DEPARTMENT OF THE INTERIOR • Stewart L. Udall, Secretary**

**BUREAU OF MINES • Frank C. Memmott, Acting Director**

Created in 1849, the Department of the Interior—a Department of Conservation—is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.

**U.S. GOVERNMENT PRINTING OFFICE  
WASHINGTON : 1965**

*For sale by the Superintendent of Documents, U.S. Government Printing Office  
Washington, D.C., 20402 - Price \$2.75 (Cloth)*

# FOREWORD

The 1964 MINERALS YEARBOOK is the second annual review to be presented in four volumes, the fourth volume portraying international mineral industry events on a country-by-country basis. The general content of the four-volume edition follows:

*Volume I, Metals and Minerals (Except Fuels)*, contains chapters on metal and nonmetal mineral commodities except mineral fuels. In addition, it includes a chapter reviewing these mineral industries, a statistical summary, and chapters on mining and metallurgical technology, employment and injuries, and technologic trends.

*Volume II, Mineral Fuels*, contains a chapter on each mineral fuel and on such related products as helium, carbon black, peat, coke and coal chemicals, and natural gas liquids. Also included are data on employment and injuries in the fuel industries and a mineral-fuels review summarizing recent economic and technological developments.

*Volume III, Area Reports: Domestic*, contains chapters covering each of the 50 States, the U.S. island possessions in the Pacific Ocean, the Commonwealth of Puerto Rico, the U.S. island possessions in the Caribbean Sea, and the Canal Zone. Volume III also has a statistical summary chapter, identical with that in Volume I, and a chapter on employment and injuries.

*Volume IV, Area Reports: International*, contains chapters presenting the latest available mineral statistics for more than 130 foreign countries and areas. A separate chapter reviews minerals in the world economy. In its first year—1963—the international review volume presented considerable background information on the mineral resources of individual countries, which has been omitted from the 1964 issue. Thus the length of volume IV has been greatly reduced.

The Bureau of Mines' continuous effort to enhance the Yearbook's value to its wide readership can be aided by constructive comments and suggestions of its users. Such comment is particularly invited during the formative years of the new International review volume.

FRANK C. MEMMOTT, *Acting Director*.



Engineering

ML

17413

MI

1964

2

## ACKNOWLEDGMENTS

The chapters in this volume of the MINERALS YEARBOOK were prepared by the staffs of the Division of Anthracite, Division of Bituminous Coal, Division of Petroleum, Division of Statistics, Division of Economic Analysis, Division of Accident Prevention and Health, and Assistant Director—Helium.

Charles E. Hennig directed preparation of the "Petroleum and Related Products" chapters and T. W. Hunter directed preparation of the "Coal and Related Products" chapters. Preparation of this volume was coordinated by James G. Kirby and Thelma K. Stewart.

World production tables were compiled under the direction of Berenice B. Mitchell, Division of International Activities, from many sources including data from the Foreign Service, U.S. Department of State.

Because of the many sources of data presented, the Bureau cannot credit each individually but acknowledgment is made to the splendid cooperation of producers and users of fuels and of the business press, trade associations, scientific journals, international organizations, and Federal agencies that supplied information.

State agencies that supplied information used in this volume are listed in the acknowledgments section of Volume III.

WILLIAM C. ELLIOTT, JR.  
*Chief, Division of Petroleum*



# CONTENTS

	Page
Foreword, by Frank C. Memmott.....	III
Acknowledgments, by William C. Elliott, Jr.....	v
Review of the mineral-fuel industries in 1964, by Warren E. Morrison and Edward E. Johnson.....	1
Employment and injuries in the fuel industries, by Forrest T. Moyer.....	35
Coal and related products:	
✓ Coal—bituminous and lignite, by W. H. Young and R. L. Anderson.....	41
✓ Coal—Pennsylvania anthracite, by J. A. Vaughan and Marian I. Cooke.....	163
Coke and coal chemicals, by J. A. DeCarlo and Eugene T. Sheridan.....	209
Fuel briquets and packaged fuel, by Eugene T. Sheridan.....	271
Peat, by Eugene T. Sheridan.....	287
Petroleum and related products:	
Carbon black, by Carl W. Kelley.....	305
✓ Natural gas, by Richard F. Zaffarano and Ivan F. Avery.....	319
Natural gas liquids, by J. D. Lankford and Ivan F. Avery.....	353
Crude petroleum and petroleum products, by James G. Kirby and Betty M. Moore.....	381
Helium, by Edwin M. Thomasson.....	499
Appendix: Tables of measurement.....	509



# Review of the Mineral-Fuel Industries

By Warren E. Morrison<sup>1</sup> and Edward E. Johnson<sup>1</sup>



## Contents

	<i>Page</i>		<i>Page</i>
Production.....	2	Prices and costs.....	24
Consumption.....	7	Income and investment.....	29
Physical stocks.....	16	Government activities.....	30
Transportation.....	17	International.....	32
Labor and productivity.....	20		

Stimulated by 4 years of continuous economic growth without inflation, demand for energy in the United States reached an alltime high in 1964. Total value of production of goods and services (gross national product—GNP) for the year was \$629 billion, an increase of 6.8 percent from 1963. Allowing for price changes based on 1958 dollars, the gain in real terms was 5 percent. In 1964 the Federal Reserve Board Index of Industrial Production stood at 132, a rise of 6.2 percent. With the impetus provided by personal income and corporate tax reductions during the year, aggregate wages, profits, and consumption reached record levels. Even the persistent balance of payments problem improved.

Against this background the national consumption of commercial energy increased 4.2 percent. Energy needs continued to be met largely from domestic resources with imports, mainly crude petroleum and refined petroleum products, accounting for but 7 percent of the total. Mineral energy resources, namely gas, coal, and petroleum, contributed 96 percent of the input of energy into the economy during the year. The remaining 4 percent came from hydropower and nuclear power.

Output of all major energy resources increased, except the dwindling anthracite component of coal. Bituminous and lignite production rose to 487 million tons; natural gas output, to 15,546 billion cubic feet; and crude petroleum, to 2,805 million barrels. Hydropower output was 180,033 million kilowatt hours, and nuclear power was 3,341 million kilowatt hours. Crude petroleum and natural gas together contributed two-thirds of the total domestic production of energy resources. Coal followed with one-quarter of the total. For the second year the calorific content of natural gas output exceeded that of crude petroleum.

Demand for energy increased in all of the major energy markets (consuming sectors) in 1964. In the household and commercial sector natural gas, used mainly for space heating, superseded petroleum as

<sup>1</sup> Economists, Division of Economic Analysis.



the ranking energy source. Utilization of petroleum products in this sector actually declined during the year along with coal, and only gas showed a net gain. Natural gas, used mainly for process heat, was also the predominant source of energy in industry. Coal and petroleum followed in that order. Gains in industrial demand for petroleum products were most notable in raw materials uses, particularly the growing offtake of liquefied petroleum gases for the petrochemicals industry. The largest increase in industry demand, however, was for coking coal to meet the coke needs of the booming iron and steel industry. Demand for coal also increased significantly in the electric utility market with utilities absorbing almost half of the total production of bituminous coal. Inputs of natural gas and petroleum at utility plants also increased. As for transportation, direct fuels, mainly petroleum products, continued to dominate demand. Among the major petroleum products, gasoline accounted for three-quarters of total petroleum utilized in transportation and registered the largest gain. In addition to direct consumption of energy resources within the various energy markets during the year, an estimated 55 percent of the electric power generated by utility plants was distributed for household and commercial use. Most of the remainder went to industry. In these energy markets utility electricity is a growing competitor with direct consumption of mineral energy resources.

Accompanying the expansion in production of mineral energy resources were significant gains in the dollar value of primary and secondary products. With no inflation, prices and costs in the mineral industries remained relatively stable, nor were there any significant shifts in employment and wages. National income generated by the energy resource industries increased but at a slower rate than total income generated by all industries. With the continuing expansion of the economy were increases in expenditures for new plants and equipment in the mining sector, and in the petroleum and coal segments of the manufacturing sector. No significant changes occurred in the levels of United States foreign trade in energy resources, either in imports or exports.

Several new tables are included in this chapter. Shown for the first time in tables 9 through 13 are individual supply and demand balances for the major mineral energy resources that contribute to the energy balances in table 7. Several tables formerly featured in the international section of this review chapter have been transferred to Volume IV Area Reports—International. These include the index of world production of coal, crude petroleum, and natural gas; production of electricity and mineral fuels in selected Organization for Economic Cooperation and Development (OECD) countries; and world-trade price indexes.

## PRODUCTION

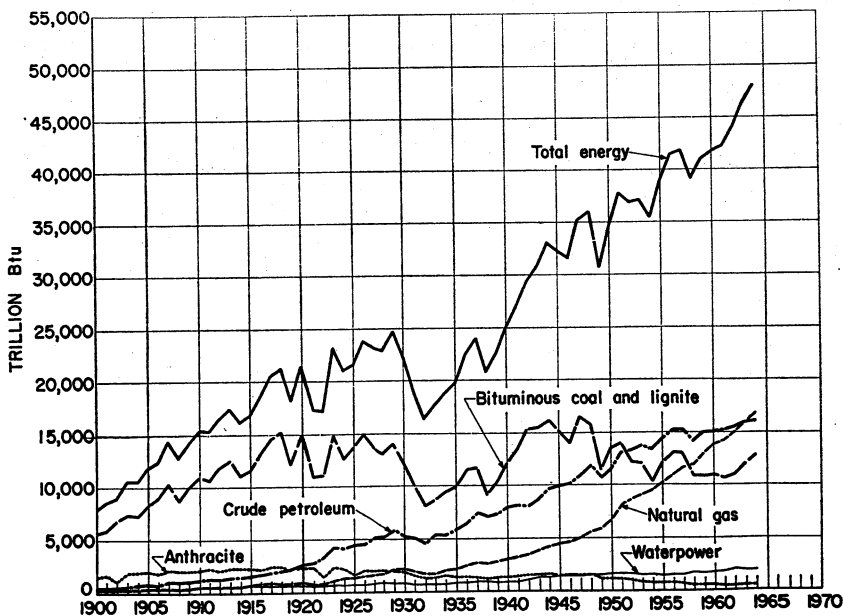
**Production by Source.**—Total production of mineral energy resources and electricity from hydropower and nuclear power (table 1) was equivalent to 48.1 quadrillion British thermal units (Btu) in 1964. Continuing its rising trend, natural gas output increased to 36 percent of total energy resources production. Crude petroleum with a somewhat lower growth rate than gas accounted for 33 percent of the

total, while the coal portion was 27 percent. The contribution of hydropower was less than 4 percent, and nuclear power was less than 1 percent. Figures 1 and 2 show the trend of production of major

**TABLE 1.—Production of mineral energy resources and electricity from hydropower and nuclear power, in British thermal units (Btu), and percentage contributed by each in the United States <sup>1</sup>**

Year	Trillion Btu <sup>1</sup>						Total
	Bituminous coal and lignite	Anthracite	Crude petroleum	Natural gas, wet (unprocessed)	Electricity		
					Hydropower	Nuclear power	
1960.....	10, 886	478	14, 935	13, 822	1, 578	5	41, 704
1961.....	10, 558	443	15, 185	14, 691	1, 605	17	42, 499
1962.....	11, 060	429	15, 495	15, 365	1, 774	23	44, 145
1963.....	12, 024	464	15, 741	16, 271	1, 741	33	46, 274
1964.....	12, 759	436	15, 925	17, 138	1, 853	34	48, 145
	Percentage						
1960.....	26.1	1.1	35.8	33.2	3.8	-----	100.0
1961.....	24.8	1.0	35.8	34.7	3.7	-----	100.0
1962.....	25.0	1.0	35.1	34.8	4.0	.1	100.0
1963.....	26.0	1.0	34.0	35.1	3.8	.1	100.0
1964.....	26.5	.9	33.1	35.6	3.8	.1	100.0

<sup>1</sup> Hydropower and nuclear power include installations owned by manufacturing plants and mines, as well as Government and privately owned public utilities. The fuel equivalent of hydropower and nuclear power is calculated from the kilowatt-hours of power produced, converted to coal input equivalent at the prevailing average pounds of coal per kilowatt-hour each year at central electric plants, using 12,000 Btu per pound.



**FIGURE 1.—Production of mineral energy resources and energy from hydropower in continental United States, 1900 to 1964.**

TABLE 2.—Mineral energy resources production in the United States

Mineral	1961		1962	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Asphalt and related bitumens, native:				
Bituminous limestone and sandstone				
short tons.....	1, 558, 792	\$12, 818	1, 647, 063	\$14, 601
Gilsonite.....do.....				
Carbon dioxide, natural, estimated				
thousand cubic feet.....	545, 354	82	1, 144, 107	146
Coal:				
Bituminous and lignite <sup>1</sup>				
thousand short tons.....	402, 977	1, 844, 563	422, 149	1, 891, 553
Pennsylvania anthracite.....do.....	17, 446	140, 338	16, 894	134, 094
Helium.....thousand cubic feet.....	551, 785	10, 263	599, 519	20, 905
Natural gas.....million cubic feet.....	13, 254, 025	1, 996, 241	13, 876, 622	2, 145, 301
Natural gas liquids:				
Natural gasoline and cycle products				
thousand gallons.....	6, 105, 463	412, 019	6, 244, 522	444, 817
LP gases.....do.....	9, 085, 465	370, 186	9, 409, 083	353, 334
Peat.....short tons.....	531, 067	5, 036	566, 441	5, 186
Petroleum, crude.....thousand 42-gallon barrels.....	2, 621, 758	7, 565, 582	2, 676, 189	7, 774, 051
Total mineral energy resources.....		12, 357, 000		12, 784, 000
Total all other minerals.....		5, 873, 000		6, 054, 000
Grand total, mineral production.....		18, 230, 000		18, 838, 000
		1963		1964
Asphalt and related bitumens, native:				
Bituminous limestone and sandstone				
short tons.....	r 1, 632, 645	r \$8, 383	1, 935, 344	\$10, 038
Gilsonite.....do.....				
Carbon dioxide, natural, estimated				
thousand cubic feet.....	1, 295, 545	178	1, 236, 816	166
Coal:				
Bituminous and lignite <sup>1</sup>				
thousand short tons.....	458, 928	2, 013, 309	486, 998	2, 165, 582
Pennsylvania anthracite.....do.....	18, 267	153, 503	17, 184	148, 648
Helium.....thousand cubic feet.....	627, 344	21, 957	667, 440	23, 360
Natural gas.....million cubic feet.....	14, 746, 663	2, 328, 030	15, 546, 592	2, 387, 689
Natural gas liquids:				
Natural gasoline and cycle products				
thousand gallons.....	6, 534, 967	439, 173	7, 000, 181	463, 600
LP gases.....do.....	10, 302, 250	359, 770	10, 743, 591	362, 792
Peat.....short tons.....	546, 621	5, 423	639, 365	6, 181
Petroleum, crude.....thousand 42-gallon barrels.....	2, 752, 723	r 7, 965, 743	2, 786, 822	8, 017, 078
Total mineral energy resources.....		r 13, 295, 000		13, 585, 000
Total all other minerals.....		6, 320, 000		6, 887, 000
Grand total, mineral production.....		r 19, 615, 000		20, 472, 000

r Revised.

<sup>1</sup> Includes small quantity of anthracite mined in States other than Pennsylvania.

energy resources in the United States from 1900 to 1964. Table 2 features production of major resources in conventional units.

Indexes showing recent trends of physical production of energy resources in relation to each other and to all minerals are shown in tables 3 and 4. Table 3, a Bureau of Mines index, highlights the gain in coal output in recent years following a prolonged decline. Also notable is the continued rise in the combined crude oil-natural gas index. In 1964 the rise in the coal index exceeded that for the indexes of major fuels and all minerals. Table 4 features the energy resource components of the Federal Reserve Board Index of Industrial Production. The separate index shown for gas and gas liquids highlights the significant gains made by gas, and more par-

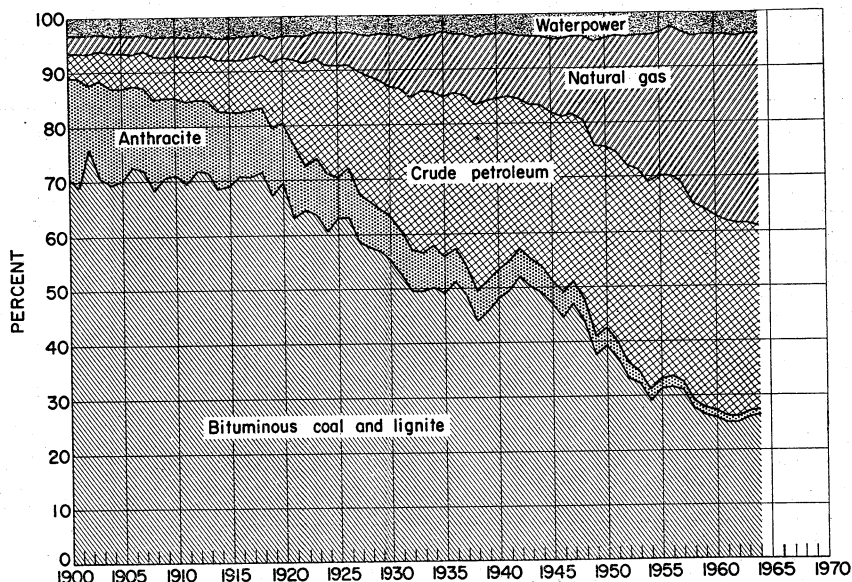


FIGURE 2.—Percentage of total production of British thermal units equivalent of mineral energy resources and energy from hydropower in continental United States, 1900 to 1964.

TABLE 3.—Indexes of physical volume of mineral production in the United States by groups and subgroups<sup>1</sup>

(1957-59=100)

Year	All minerals	Energy resources			Metals	Nonmetals
		Total	Coal	Crude oil and natural gas <sup>2</sup>		
1960.....	102.1	100.3	94.0	102.3	107.5	108.0
1961.....	102.9	101.2	90.8	104.6	103.3	110.3
1962.....	106.0	104.0	94.7	107.0	106.2	115.4
1963.....	110.8	108.8	102.9	110.7	107.6	121.7
1964.....	114.8	111.6	107.4	112.9	115.6	126.1

<sup>1</sup> For description of index see Minerals Yearbook 1956, V. 1, Review of the Mineral Industries, pp. 2-5. Indexes for components of the fuels index go back to 1880 (initial year of the overall index) in Minerals Yearbook 1963, v. II, pp. 9-10.

<sup>2</sup> Does not cover isopentane, LP-gases, and other natural gas liquids.

ticularly, by gas liquids which are in increasing demand for petrochemicals. The slower rate of growth shown for mining, relative to industrial production, indicates the tendency of the mining industry to lag behind industrial production during periods of economic expansion.

**Value of Production.**—The dollar value of mineral production including mineral energy resources is shown in table 5. Total value of primary energy resources exceeded the combined values of metals and nonmetals and was about two-thirds of the value of all mineral production. Separate values for the major energy resources are

TABLE 4.—Indexes of industrial production, mineral energy resources, seasonally adjusted

(1957-59=100)

Year	Total industrial production	Total mining	Coal, oil, and gas	Coal	Crude oil and natural gas		
					Total <sup>1</sup>	Crude oil	Gas and gas liquids
1960.....	108.6	101.6	97.9	93.7	101.0	100.9	113.2
1961.....	109.8	102.6	100.9	90.1	103.1	103.0	116.8
1962.....	118.3	105.0	103.8	95.3	105.5	105.1	120.4
1963.....	124.3	107.9	107.0	102.5	107.9	108.1	128.7
1964 <sup>p</sup> .....	132.0	110.9	109.4	104.3	110.4	109.8	136.5
January.....	127.7	108.8	107.5	104.0	108.3	108.5	132.2
February.....	128.2	108.9	107.4	99.2	109.1	107.8	136.2
March.....	129.0	108.8	107.1	94.5	109.7	109.0	133.3
April.....	130.5	109.9	108.1	98.7	110.0	109.6	134.8
May.....	131.3	111.3	109.9	106.1	110.7	110.1	135.3
June.....	131.6	111.4	109.8	105.1	110.8	110.2	137.1
July.....	132.9	110.9	110.1	105.0	111.1	110.3	139.0
August.....	133.8	111.9	110.7	107.9	111.3	109.8	139.6
September.....	134.0	111.9	111.0	105.1	112.3	111.1	139.1
October.....	131.2	112.0	110.8	109.2	111.1	110.8	136.3
November.....	135.0	112.7	110.1	108.7	110.4	110.2	136.5
December.....	137.7	112.3	110.1	107.2	110.7	110.9	133.8

<sup>p</sup> Preliminary.<sup>1</sup> Total includes oil and gas drilling.

Source: Board of Governors of Federal Reserve System. Industrial Production 1957-59 Base, and Statistical Releases for Feb.-June, 1965.

shown in table 2 along with physical quantities produced. It is interesting to note that while the calorific content of natural gas produced during the year exceeded that of crude petroleum (table 1), the dollar value of crude petroleum produced in 1964 was more than half of the value of total mineral energy resources production and almost 3½ times the value of natural gas output (table 2). The value of natural gas output during the year was 18 percent of the energy resources total while coal, mainly bituminous, was 16 percent. Natural gas liquids and helium (table 2) are byproducts of the primary production of natural gas. To determine the value of primary mineral energy resources production, the value of secondary products should be deducted.

TABLE 5.—Value of mineral production in the United States, by mineral group<sup>1</sup>

(Millions)

Mineral groups <sup>2</sup>	1960	1961	1962	1963	1964	Change in 1964 from 1963 (percent)
Metals and nonmetals, except fuels:						
Nonmetals.....	\$3,868	\$3,946	\$4,117	\$4,318	\$4,662	7.0
Metals.....	2,022	1,927	1,937	* 2,002	2,265	13.1
Total.....	5,890	5,873	6,054	6,320	6,887	9.0
Mineral energy resources.....	12,142	12,357	12,784	* 13,295	13,585	2.2
Grand total.....	18,032	18,230	18,838	* 19,615	20,472	14.4

<sup>r</sup> Revised.<sup>1</sup> Includes Alaska and Hawaii.<sup>2</sup> For details, see table 1 in the chapter "Statistical Summary of Mineral Production" of the 1964 Minerals Yearbook.

## CONSUMPTION

**Consumption by Source.**—The calorific content of inputs of resources into the energy economy was equivalent to 51.7 quadrillion Btu, an increase of 4.2 percent from 1963. Table 6 shows demand for energy by source. During the year petroleum, including natural gas liquids, was 44 percent of total energy resources consumed; residue natural gas was 30 percent; and coal, 22 percent. The balance of consumption, less than 4 percent, came from hydropower and nuclear power. Among the various resources, natural gas consumption increased most during the year, 5.4 percent to 15.1 trillion cubic feet (equivalent to 15.6 quadrillion Btu). This was followed by bituminous coal, with a demand of 431 million tons (equivalent to 11.3 quadrillion Btu), an increase of 5.3 percent. Consumption of petroleum products including natural gas liquids rose to 4,050 million barrels (equivalent to 22.4 quadrillion Btu) and 3.2 percent greater than in 1963. Hydropower use which had declined in 1963 increased during the year, and nuclear power made modest gains as several new plants became operative.

**Consumption by Consuming Sector.**—Table 7 shows composite energy balances for the United States by energy source and consuming sector. Table 8 shows apparent consumption by source in conventional units. Tables 9 to 13 show separate supply and demand balances for major mineral energy resources that contribute to the balances in table 7.<sup>2</sup>

**TABLE 6.**—Calculated consumption of mineral energy resources, and electricity from hydropower and nuclear power in British thermal units (Btu), and percent contributed by each in the United States<sup>1</sup>

Year	Trillion Btu								Total
	Bituminous coal and lignite	Anthracite	Crude petroleum	Petroleum products net, imports	Natural gas dry (processed)	Natural gas liquids	Electricity		
							Hydro-power	Nuclear power	
1960-----	9,967	447	17,172	1,436	12,736	1,427	1,626	5	44,516
1961-----	9,809	404	17,372	1,617	13,228	1,498	1,628	17	45,573
1962-----	10,160	363	17,853	1,809	14,027	1,605	1,780	23	47,620
1963-----	10,722	361	18,434	1,797	14,843	1,668	1,740	33	49,598
1964-----	11,295	365	18,742	1,965	15,648	1,769	1,858	34	51,676
	Percentage								
1960-----	22.2	1.0	38.4	3.2	28.4	3.2	3.6	0.1	100.0
1961-----	21.5	0.9	38.1	3.5	29.0	3.3	3.6	0.1	100.0
1962-----	21.3	0.8	37.4	3.8	29.5	3.4	3.7	0.1	100.0
1963-----	21.7	0.7	37.2	3.6	29.8	3.4	3.5	0.1	100.0
1964-----	21.8	0.7	36.5	3.8	30.1	3.4	3.6	0.1	100.0

<sup>1</sup> Heat values employed are anthracite, 12,700 Btu per pound; bituminous coal and lignite, 13,100 Btu per pound; crude oil, 5,800,000 Btu per barrel; weighted average British thermal units for petroleum products obtained by using 5,248,000 gasoline, 5,670,000 kerosine, 5,825,000 distillate, 6,287,000 residual, 6,064,800 lubricants, 5,537,280 wax, 6,636,000 asphalt, and 5,796,000 miscellaneous; natural gas dry, 1,035 Btu per cubic foot; natural gas liquids weighted average British thermal units based on production of natural gasoline at 110,000 Btu per gallon, and LP-gas at 95,500 Btu per gallon. Hydropower and nuclear power converted to coal equivalent at the prevailing rate of pounds of coal per kilowatt-hour each year at central electric stations, using 12,000 Btu per pound.

<sup>2</sup> See: Morrison, Warren E. Summary Energy Balances for the United States: Selected Years 1947-62. Bureau of Mines Information Circular 8242, 1964, 32 pp. (Showing comparable balances for years preceding 1963.)

TABLE 7.—United States gross consumption of energy resources by major sources and consuming sectors <sup>1</sup>

(Trillion Btu)							
Consuming sectors	Anthracite	Bituminous and lignite	Natural gas dry <sup>2</sup>	Petroleum <sup>3</sup>	Hydropower <sup>4</sup>	Nuclear <sup>4</sup>	Total gross energy
<b>Household and commercial:</b>							
1961.....	129	783	4,477	5,028			10,417
1962.....	121	799	4,849	5,227			10,996
1963.....	103	671	5,027	5,258			11,059
1964.....	85	560	5,343	5,193			11,181
<b>Industrial:</b>							
1961.....	46	4,693	6,025	3,682			14,446
1962.....	49	4,762	6,293	3,880			14,954
1963.....	57	5,015	6,776	3,994			15,842
1964.....	46	5,362	7,136	4,052			16,596
<b>Transportation: <sup>4</sup></b>							
1961.....	(neg)	22	391	10,575			10,988
1962.....	(neg)	20	396	11,001			11,417
1963.....	(neg)	19	439	11,506			11,964
1964.....	(neg)	20	451	12,067			12,538
<b>Electricity generation, utilities:</b>							
<b>Fuel burning plants:</b>							
1961.....	64	4,311	1,889	577			6,841
1962.....	58	4,580	2,034	579			7,251
1963.....	55	5,017	2,218	600			7,890
1964.....	57	5,353	2,403	636			8,449
<b>Hydropower and nuclear plants:</b>							
1961.....					1,628	17	1,645
1962.....					1,780	23	1,803
1963.....					1,740	33	1,773
1964.....					1,858	34	1,892
<b>Miscellaneous and unaccounted for:</b>							
1961.....	165		446	625			1,236
1962.....	135		454	580			1,169
1963.....	146		383	541			1,070
1964.....	177		315	528			1,020
<b>Total gross energy:</b>							
1961.....	404	9,809	13,228	20,487	1,628	17	45,573
1962.....	363	10,160	14,027	21,267	1,780	23	47,620
1963.....	361	10,722	14,843	21,599	1,740	33	49,598
1964.....	365	11,295	15,048	22,476	1,858	34	51,676

<sup>1</sup> Gross energy is that contained in all types of commercial energy at time it is incorporated in economy, whether energy is produced domestically or imported. Gross energy comprises inputs of primary fuels (or the derivatives) and outputs of hydropower and nuclear power converted to theoretical energy inputs. Gross energy includes energy used for production, processing, and transportation of energy proper.

<sup>2</sup> Excludes natural gas liquids.

<sup>3</sup> Petroleum products including still gas, liquefied refinery gas, and natural gas liquids.

<sup>4</sup> Represents outputs of hydropower and nuclear power converted to theoretical energy inputs at prevailing rate of pounds of coal per kilowatt-hour at central electric stations, using 12,000 Btu per pound of coal. Excludes inputs for power generated by nonutility plants, which are included within the other consuming sectors.

<sup>5</sup> Includes bunkers and military transportation.

TABLE 8.—Apparent consumption of energy resources and selected related products

Commodity	1963	1964	Percent change from 1963
<b>Primary energy resources:</b>			
Bituminous coal..... million net tons	409.2	431.1	+5.4
Crude petroleum, runs to stills..... million barrels	3,170.7	3,241.6	+2.2
Natural gas <sup>1</sup> ..... million cubic feet	14,341.3	15,118.2	+6.1
Anthracite..... million net tons	14.1	14.4	+2.1
Hydropower..... million kilowatt-hours	168,869.0	180,033.0	+6.6
Nuclear power..... do	3,212.0	3,341.0	+4.0
<b>Products:</b>			
All oils, domestic product demand <sup>2</sup> ..... million barrels	3,924.5	4,050.2	+3.2
Coke..... million net tons	55.0	62.6	+13.8
Petroleum asphalt..... do	21.3	21.8	+2.3

<sup>1</sup> Revised.

<sup>2</sup> Residue gas excludes extraction loss but includes transmission loss.

<sup>3</sup> Includes natural gas liquids.

TABLE 9.—Supply and demand for anthracite, domestic

	1963		1964	
	Thousand net tons	Trillion Btu	Thousand net tons	Trillion Btu
<b>Supply:</b>				
Production <sup>1</sup> .....	18,267.0	464.0	17,184.0	436.5
Imports.....				
Exports.....	-3,353.2	-85.2	-1,575.1	-40.0
Stock change.....				
Losses, gains, and unaccounted for.....	-713.8	-18.2	-1,208.9	-30.7
<b>Total</b> .....	<b>14,200.0</b>	<b>360.6</b>	<b>14,400.0</b>	<b>365.8</b>
<b>Demand by major consuming sectors: <sup>2</sup></b>				
Household and commercial <sup>3</sup> .....	4,055.0	103.0	3,334.0	84.7
Industrial <sup>4</sup> .....	2,232.0	56.7	1,803.0	45.8
Transportation <sup>5</sup> .....	( <sup>6</sup> )	( <sup>6</sup> )	( <sup>6</sup> )	( <sup>6</sup> )
Electricity generation, utilities.....	2,155.0	54.7	2,239.0	56.9
Miscellaneous and unaccounted for.....	5,758.0	146.2	7,024.0	178.4
<b>Total</b> .....	<b>14,200.0</b>	<b>360.6</b>	<b>14,400.0</b>	<b>365.8</b>

<sup>1</sup> Includes use by producers for power and heat.

<sup>2</sup> With the exception of small quantities used as raw material for coal chemicals, all anthracite is used for fuel and power.

<sup>3</sup> Data represent "retail dealer deliveries to other consumers". These are mainly household and commercial users, with some unknown portion of use by small industries.

<sup>4</sup> Includes consumption by coke plants, steel and rolling mills, and other industrial users.

<sup>5</sup> Includes bunkers and military transportation.

<sup>6</sup> Data not available. Believed to be small and of minor significance.

TABLE 10.—Supply and demand for bituminous coal and lignite, domestic

	1963		1964	
	Thousand net tons	Trillion Btu	Thousand net tons	Trillion Btu
<b>Supply:</b>				
Production <sup>1</sup> .....	458,928.2	12,023.9	486,998.0	12,759.3
Imports.....	172.2	4.5	283.1	7.7
Exports.....	-47,078.4	-1,233.4	-47,969.4	-1,256.8
Stock change.....	-450.8	-11.8	-431.1	-12.9
Losses, gains, and unaccounted for.....	-2,346.2	-61.6	-7,714.6	-202.1
<b>Total</b> .....	<b>409,225.0</b>	<b>10,721.6</b>	<b>431,116.0</b>	<b>11,295.2</b>
<b>Demand by major consuming sectors:</b>				
<b>Fuel and power:</b>				
Household and commercial <sup>2</sup> .....	23,548.0	671.0	19,615.0	560.2
Industrial <sup>3</sup> .....	171,527.3	4,888.0	182,878.0	5,222.6
Transportation <sup>4</sup> .....	670.0	19.1	711.0	20.3
Electricity generation, utilities.....	209,038.0	5,016.9	223,032.0	5,352.7
<b>Total</b> .....	<b>404,783.3</b>	<b>10,595.0</b>	<b>426,236.0</b>	<b>11,155.8</b>
<b>Raw material: <sup>5</sup> Industrial:</b>				
Crude light oil.....	1,090.8	31.1	1,243.0	35.5
Crude coal tar.....	3,350.9	95.5	3,637.0	103.9
<b>Total</b> .....	<b>4,441.7</b>	<b>126.6</b>	<b>4,880.0</b>	<b>139.4</b>
<b>Total</b> .....	<b>409,225.0</b>	<b>10,721.6</b>	<b>431,116.0</b>	<b>11,295.2</b>

<sup>1</sup> Includes use by producers for power and heat.

<sup>2</sup> Data represent "retail deliveries to other consumers". These are mainly household and commercial users, with some unknown portion of use by small industries.

<sup>3</sup> Includes consumption by coke plants, steel and rolling mills, and other industrial users.

<sup>4</sup> Includes bunkers and military transportation.

<sup>5</sup> Coal equivalent based on British thermal unit value of raw materials used for coal chemicals.



TABLE 11.—Supply and demand for natural gas, domestic

	1963		1964	
	Million cubic feet	Trillion Btu	Million cubic feet	Trillion Btu
<b>Supply:</b>				
Production <sup>1</sup> .....	14,746,661	16,271.3	15,546,592	17,137.8
Imports.....	406,204	420.4	441,325	457.0
Exports.....	-16,957	-17.6	-16,763	-17.3
Stock change.....	-130,772	-135.3	-129,507	-134.0
Transfers out extraction loss <sup>2</sup> .....	-670,251	-1,702.4	-722,665	-1,796.0
Losses, gains, and unaccounted for.....	6,370	6.6	-908	-----
<b>Total</b> .....	<b>14,341,255</b>	<b>14,843.0</b>	<b>15,118,174</b>	<b>15,647.5</b>
<b>Demand by major consuming sectors:</b>				
<b>Fuel and power:</b>				
Household and commercial.....	4,856,804	5,026.8	5,162,009	5,342.7
Industrial.....	6,259,334	6,478.4	6,607,581	6,838.8
Transportation.....	423,783	438.6	435,670	450.8
Electricity generation, utilities.....	2,142,930	2,217.9	2,321,889	2,403.2
<b>Total</b> .....	<b>13,682,851</b>	<b>14,161.7</b>	<b>14,527,049</b>	<b>15,035.5</b>
<b>Raw material: <sup>3</sup> Industrial:</b>				
Carbon black.....	117,378	121.5	106,759	110.5
Other chemicals <sup>4</sup> .....	* 170,000	* 176.0	* 180,000	* 186.3
<b>Total</b> .....	<b>287,378</b>	<b>297.5</b>	<b>286,759</b>	<b>296.8</b>
Miscellaneous and unaccounted for.....	371,026	383.8	304,366	315.2
<b>Total</b> .....	<b>14,341,255</b>	<b>14,843.0</b>	<b>15,118,174</b>	<b>15,647.5</b>

\* Estimate.

<sup>1</sup> Marketed production includes wet gas sold or consumed by producers, losses in transmission, producers additions to storage, and increases in gas pipeline fill; excludes repressuring and vented and wasted. British thermal unit value of production is for wet gas prior to extraction of natural gas liquids. Higher values assigned to extraction loss are reflected in value of production for each year.

<sup>2</sup> Extraction loss from cycling plants represents offtake of natural gas for natural gas liquids as reported to Bureau of Mines. Values for extraction loss are based on annual outputs of natural gasoline and associated products at 110,000 Btu per gallon and annual outputs of liquefied petroleum gases at 95,500 Btu per gallon.

<sup>3</sup> Includes some fuel and power use by raw materials industries.

<sup>4</sup> Estimated from partial data.

TABLE 12.—Supply and demand for petroleum,<sup>1</sup> domestic

	1963		1964	
	Million bbl	Trillion Btu	Million bbl	Trillion Btu
<b>Supply:</b>				
Crude oil: <sup>2</sup>				
Production.....	2,752.7	15,740.7	2,805.1	15,924.6
Net imports.....	411.0	2,350.2	437.2	2,482.0
Stock change.....	14.6	83.5	7.3	41.4
Losses and transfers for use as crude.....	-7.6	-43.5	-8.0	-45.6
Total.....	3,170.7	18,130.9	3,241.6	18,402.4
Petroleum input, runs to stills:				
Crude oil <sup>2</sup> .....	3,170.7	18,130.9	3,241.6	18,402.4
Transfers in natural gas liquids <sup>3</sup> .....	190.2	818.8	195.0	901.0
Total.....	3,360.9	18,949.7	3,436.6	19,303.4
Output:				
Refined products.....	3,360.9	18,949.7	3,436.6	19,303.4
Unfinished oils, net.....	31.9	179.9	27.3	153.3
Overage or loss.....	73.6	415.0	79.3	445.4
Total.....	3,466.4	19,544.6	3,543.2	19,902.1
Imports <sup>4</sup> .....	362.1	2,294.1	388.2	2,440.6
Exports.....	-74.2	-417.2	-72.4	-406.7
Stock change, including natural gas liquids.....	-13.0	-89.6	-11.0	-61.8
Transfers in, natural gas liquids <sup>3</sup> .....	188.2	883.6	226.0	895.0
Losses, gains, and unaccounted for.....	-5.0	-265.5	-23.8	-392.9
Total.....	3,924.5	21,950.0	4,050.2	22,476.3
<b>Demand by major consuming sectors:</b>				
Fuel and power:				
Household and commercial.....	790.8	4,433.6	779.7	4,352.4
Industrial.....	455.9	2,738.8	472.9	2,823.3
Transportation <sup>6</sup> .....	2,146.7	11,506.1	2,251.1	12,066.6
Electricity generation, utilities.....	95.7	599.8	101.4	635.7
Total.....	3,489.1	19,278.3	3,605.1	19,878.0
Raw material: <sup>7</sup>				
Household and commercial: Asphalt and road oils.....	124.2	824.2	126.7	840.8
Industrial:				
Petrochemicals.....	156.2	714.2	165.7	756.3
Other nonfuel use.....	89.9	541.0	79.0	472.5
Total.....	370.3	2,079.4	371.4	2,069.6
Miscellaneous and unaccounted for.....	65.1	592.3	73.7	428.7
Total.....	3,924.5	21,950.0	4,050.2	22,476.3

<sup>1</sup> Supply and demand for crude oil and petroleum products. Petroleum products include products refined and processed from crude oil, including still gas and liquefied refinery gas; also natural gas liquids transferred from natural gas.

<sup>2</sup> Value for crude oil for each year shown is based on average British thermal unit value of total output of petroleum products (including refinery fuel and losses) adjusted to exclude natural gas liquids inputs and their implicitly derived values. Value for net imports of crude is based on the average value of crude runs to stills.

<sup>3</sup> Values for natural gas liquids for each year shown are implicitly derived from weighted averages of major natural gas liquids, with natural gasoline and associated product converted at 110,000 Btu per gallon and liquefied petroleum gases at 95,500 Btu per gallon.

<sup>4</sup> Value for imported refined products for each year shown is based on the value of residual fuel and unfinished oils. The value for exports of refined products is based on the average value of domestic petroleum products output.

<sup>5</sup> Includes natural gas liquids other than those channeled into refinery input as follows: petrochemical feedstocks, direct uses for fuel and power; and other uses.

<sup>6</sup> Includes bunkers and military transportation.

<sup>7</sup> Includes some fuel and power use by raw materials industries.

TABLE 13.—Petroleum consumption by major products,<sup>1</sup> and by major consuming groups, domestic

	1963											
	Household and commercial		Industrial		Transportation <sup>2</sup>		Electricity generation, utilities		Miscellaneous and unaccounted for		Total domestic product demand	
	Million bbl	Trillion Btu	Million bbl	Trillion Btu	Million bbl	Trillion Btu	Million bbl	Trillion Btu	Million bbl	Trillion Btu	Million bbl	Trillion Btu
Fuel and power:												
Liquefied gases .....	120.3	482.6	20.2	81.0	23.8	95.4					164.3	659.0
Military jet fuel .....					116.6	624.4					116.6	624.4
Commercial jet fuel .....					75.1	425.8					75.1	425.8
Gasoline .....					1,634.9	8,580.0					1,634.9	8,580.0
Kerosine .....	79.9	453.0	14.1	80.0							94.0	533.0
Distillate fuel .....	465.4	2,711.0	52.1	303.5	178.1	1,037.4	4.1	23.9			699.7	4,075.8
Residual fuel .....	125.2	787.0	196.3	1,234.1	118.2	743.1	91.6	575.9			531.3	3,340.1
Still gas .....			129.5	777.0							129.5	777.0
Petroleum coke .....			43.7	263.2							43.7	263.2
Total .....	790.8	4,433.6	455.9	2,738.8	2,146.7	11,506.1	95.7	599.8			3,489.1	19,278.3
Raw material: <sup>3</sup>												
Lubes, waxes, coke <sup>4</sup> .....			73.0	439.6							73.0	439.6
Asphalt and road oil .....	124.2	824.2									124.2	824.2
Petrochemical feedstock offtake <sup>5</sup> .....			156.2	714.2							156.2	714.2
Other <sup>6</sup> .....			16.9	101.4							16.9	101.4
Total .....	124.2	824.2	246.1	1,255.2							370.3	2,079.4
Miscellaneous and unaccounted for .....									65.1	592.3	65.1	592.3
Total product demand .....	915.0	5,257.8	702.0	3,994.0	2,146.7	11,506.1	95.7	599.8	65.1	592.3	3,924.5	21,950.0

## Fuel and power:

Liquefied gases.....	130.4	523.0	29.0	116.3	28.0	112.4					187.4	751.7
Military jet fuel.....					118.6	635.1					118.6	635.1
Commercial jet fuel.....					87.9	498.4					87.9	498.4
Gasoline.....						1,704.1	8,943.1				1,704.1	8,943.1
Kerosene.....	71.2	403.7	17.7	100.4							88.9	504.1
Distillate fuel.....	451.9	2,632.3	52.0	302.9	188.5	1,098.0	3.8	22.1			696.2	4,055.3
Residual fuel.....	126.2	793.4	200.3	1,259.3	124.0	779.6	97.6	613.6			548.1	3,445.9
Still gas.....											131.3	787.8
Petroleum coke.....			42.6	256.6							42.6	256.6
Total.....	779.7	4,352.4	472.9	2,823.3	2,251.1	12,066.6	101.4	635.7			3,605.1	19,878.0
Raw material: <sup>3</sup>												
Lubes, waxes, coke <sup>4</sup> .....			77.3	465.7							77.3	465.7
Asphalt and road oil.....	126.7	840.8									126.7	840.8
Petrochemical feedstock offtake <sup>5</sup> .....			165.7	756.3							165.7	756.3
Other <sup>6</sup> .....			1.7	6.8							1.7	6.8
Total.....	126.7	840.8	244.7	1,228.8							371.4	2,069.6
Miscellaneous and unaccounted for.....									73.7	528.7	73.7	528.7
Total product demand.....	906.4	5,193.2	717.6	4,052.1	2,251.1	12,066.6	101.4	635.7	73.7	528.7	4,050.2	22,476.3

<sup>1</sup> Includes liquefied refinery gas and natural gas liquids.

<sup>2</sup> Includes bunkers and military transportation.

<sup>3</sup> Includes some fuel and power use by raw materials industries.

<sup>4</sup> Includes portions of petroleum coke estimated to be consumed in nonfuel uses.

<sup>5</sup> Partly estimated. Includes LPG and LRG, 103.8 million barrels and 416.3 trillion Btu; naphtha, 22.0 million barrels and 115.5 trillion Btu; still gas, 7.8 million barrels and 46.8 trillion Btu; "Other," 22.6 million barrels and 135.6 trillion Btu.

<sup>6</sup> Partly estimated. Includes LPG used for secondary recovery, 0.5 million barrels and 2.1 trillion Btu; "Other," 16.4 million barrels and 99.3 trillion Btu.

<sup>7</sup> Includes LRG, 47.2 million barrels and 189.3 trillion Btu; LPG 45.4 million barrels and 182.1 trillion Btu; liquefied gases for synthetic rubber, 15.5 million barrels and 62.2 trillion Btu; naphtha, -400 degrees, 24.6 million barrels and 129.1 trillion Btu; still gas, 7.7 million barrels and 46.2 trillion Btu; "Other," +400 degrees, 25.3 million barrels and 147.4 trillion Btu.

<sup>8</sup> Includes LPG used for secondary recovery, 0.2 million barrels and 0.8 trillion Btu; "Other," 1.5 million barrels and 6.0 trillion Btu.

Although smallest of the major markets for energy resources, electric utilities have the fastest rate of growth. Inputs of resources at fuel-burning thermal plants, together with theoretical inputs at hydropower and nuclear power plants, amounted to one-fifth of total energy consumption, an increase of 7 percent during the year. The ratio of power output at conventional thermal plants to outputs at hydro and nuclear plants in 1964 was about 4.5 to 1. Bituminous coal remained the principal energy source at powerplants and accounted for almost two-thirds of total resource inputs at such plants. The remaining third came from natural gas and petroleum products, the latter consisting mainly of residual fuel oil. Utilities have been responsible for much of the increase in coal utilization in recent years, and in 1964 consumed almost half of the total output of bituminous coal. Table 14 shows electric energy sales to ultimate consumers by region. In 1963, the latest year for which data are available, total sales increased 7.1 percent. This includes utility sales and sales by nonutility plants. The East-North-Central region was the largest power-consuming area, accounting for 22 percent of total sales.

Industry remained the largest of the energy markets in 1964. Energy resources consumed directly as fuel or raw material in this sector accounted for one-third of total energy consumption. In addition, industry absorbed about 45 percent of the output of electricity by utilities. In direct consumption of resources, natural gas accounted for 43 percent of sector energy inputs; coal, for 33 percent; and petroleum, for 24 percent. Of petroleum products consumed by industry, 473 million barrels was consumed as fuel and 245 million barrels was consumed for nonfuel uses. Among the latter is the off-take for the petrochemical industry which amounted to 166 million barrels of natural gas liquids and related petroleum products. Industrial consumption of bituminous coal increased 6.6 percent to 183 million tons. Increased use of coal was related to increased output of coking coal to meet the growing coke requirements of the iron and steel industry.

Direct consumption of energy resources for household and commercial use amounted to one-fifth of total energy consumption. This sector also absorbed an estimated 55 percent of the total output of utility power. Natural gas and petroleum were the main products consumed as direct fuels, mainly for space heating. Coal use continued to decline, and for the first time petroleum demand did also. Natural gas continued to command an increasing portion of the space-heat market.

For transportation, direct fuels accounted for the majority of demand—only small quantities of utility power are used. Petroleum products accounted for 96 percent of sector consumption, and the remaining 4 percent was natural gas utilized within the pipeline system either for pumping or for pipeline fill. Motor and aviation gasoline accounted for three-quarters of petroleum demand in transportation; military and commercial jet fuel, for 9 percent; and distillate and residual fuel oil combined, for 14 percent.

TABLE 14.—Electrical energy sales to ultimate customers in the United States

(Million kilowatt-hours)

Region	1958			1959		
	Total consumption	Residential <sup>1</sup>	Industrial and commercial	Total consumption	Residential <sup>1</sup>	Industrial and commercial
New England.....	22, 573	8, 149	13, 644	24, 790	8, 701	15, 237
Middle Atlantic.....	89, 626	25, 466	57, 925	98, 021	27, 401	63, 706
East North Central.....	125, 797	34, 548	85, 820	139, 596	37, 393	96, 380
West North Central.....	34, 717	14, 673	18, 829	38, 157	16, 106	20, 780
South Atlantic.....	69, 817	24, 446	43, 181	77, 763	26, 648	48, 676
East South Central.....	78, 794	14, 943	63, 102	84, 015	16, 437	66, 781
West South Central.....	46, 419	13, 729	30, 275	51, 612	15, 220	33, 766
Mountain.....	23, 714	7, 288	15, 209	26, 010	8, 105	16, 541
Pacific.....	77, 704	26, 889	48, 251	86, 779	30, 390	53, 617
<b>Total.....</b>	<b>569, 161</b>	<b>170, 131</b>	<b>376, 236</b>	<b>626, 743</b>	<b>186, 401</b>	<b>415, 484</b>
	1960			1961 <sup>2</sup>		
New England.....	26, 570	9, 213	16, 434	28, 652	10, 140	17, 432
Middle Atlantic.....	106, 013	28, 594	69, 534	112, 080	30, 785	73, 095
East North Central.....	147, 088	39, 541	102, 033	151, 885	41, 748	104, 358
West North Central.....	44, 176	17, 368	25, 419	46, 415	18, 402	26, 260
South Atlantic.....	86, 388	29, 368	54, 334	93, 274	32, 129	57, 601
East South Central.....	87, 543	18, 504	68, 049	88, 821	19, 075	68, 736
West South Central.....	57, 363	17, 290	37, 013	60, 399	17, 331	39, 831
Mountain.....	29, 611	8, 947	19, 353	33, 514	8, 538	23, 430
Pacific <sup>3</sup> .....	98, 447	33, 884	61, 129	105, 688	30, 873	71, 548
<b>Total<sup>3</sup>.....</b>	<b>683, 199</b>	<b>202, 709</b>	<b>453, 298</b>	<b>720, 728</b>	<b>209, 021</b>	<b>482, 201</b>
	1962 <sup>3</sup>			1963		
New England.....	30, 558	10, 738	18, 655	32, 086	11, 263	19, 596
Middle Atlantic.....	119, 026	32, 051	78, 368	126, 287	33, 978	83, 486
East North Central.....	162, 756	44, 046	112, 397	172, 816	45, 914	120, 037
West North Central.....	51, 257	20, 384	28, 954	54, 005	20, 985	31, 076
South Atlantic.....	102, 766	34, 915	63, 918	110, 782	37, 653	68, 885
East South Central.....	92, 624	21, 172	70, 288	98, 883	23, 061	74, 580
West South Central.....	68, 930	20, 412	45, 069	78, 946	22, 969	49, 993
Mountain.....	35, 897	9, 192	25, 080	38, 225	9, 985	26, 573
Pacific <sup>3</sup> .....	112, 274	33, 504	75, 282	120, 781	35, 884	80, 709
<b>Total<sup>3</sup>.....</b>	<b>776, 088</b>	<b>226, 414</b>	<b>518, 011</b>	<b>830, 811</b>	<b>241, 692</b>	<b>554, 915</b>

<sup>1</sup> Includes rural.<sup>2</sup> Rural included in all three classes.<sup>3</sup> Includes Alaska and Hawaii in 1960, 1962, and 1963.

Source: Edison Electric Institute, Statistical Yearbook of the Electric Utility Industry, 1958 through 1963.

**Projections of Energy Demand.**—Projections of the future demand for energy resources and forecasts of selected economic indicators are shown in table 15. Growth rates for projections and forecasts are based on 1964 data and extend to 1980. Total energy is projected to expand at the rate of 3.2 percent during the 16-year period; the rate for 1947-63 was 2.5 percent. Demand for natural gas and petroleum is expected to expand at a slower rate than the last 16 years. Conversely, coal demand which declined throughout most of the 1947-63 period is projected to increase at rates ranging from 2.2 to 3.7 percent. The range of the coal projection reflects the uncertainty concerning

the future role of coal in power generation as this relates to increasing air pollution and encroachment of nuclear power on conventional thermal utility power. Also, improved technology in the iron and steel industry continues to decrease the ratio of coke required per ton of pig iron output. Utility power output is projected to increase at the rate of 6.6 percent during the forecast period. The portion of the utility market to be supplied by nuclear energy in 1980 is predicted to be 18 percent with 11 percent to be supplied by hydropower and 71 percent supplied by conventional fuel-burning plants. This analysis is predicated with the lower rate of 2.2 percent shown for coal growth in table 15.

TABLE 15.—Projections: Mineral energy resources and general economic indicators

	1964 actual	1980 projection	1964-80 projected growth rate (per- cent per year)
Population.....thousands..	192, 120	1 245, 313	1.6
Labor force.....do.....	76, 971	2 101, 408	1.7
Gross national product.....billions of 1964 dollars..	516	3 955	3.9
Index of industrial production (1957-59=100).....	132	3 250	4.1
Energy consumption—United States.....trillion Btu..	51, 676	4 85, 934	3.2
Petroleum consumption, including natural gas liquids million barrels.....	3, 974	5 6, 530	3.1
Natural gas consumption.....billion cubic feet..	15, 536	5 25, 619	3.2
Coal consumption.....million tons.....	445	6 624-800	2.2-3.7
Electrical energy, utility, consumption.....billion kilowatt-hours..	980	5 2, 739	6.6

<sup>1</sup> Bureau of the Census. Current Population Reports. Series P-25, No. 286.

<sup>2</sup> Bureau of Labor Statistics. Special Labor Force Report No. 49.

<sup>3</sup> Division of Economic Analysis, Bureau of Mines, U.S. Department of the Interior.

<sup>4</sup> U.S. Department of the Interior. An Appraisal of the Petroleum Industry of the United States. January 1965.

<sup>5</sup> Vogely, William A. Pattern of Energy Consumption in the United States. Paper in General Papers prepr. vol., 149th Meeting, Am. Chem. Soc., Division of Fuel Chemistry, Symposium of Fuel and Energy Economics, Detroit, Mich., Apr. 4-9, 1965, pp. 205-221.

<sup>6</sup> Lower of range from source 5. Higher of range projection by Division of Bituminous Coal, Bureau of Mines.

## PHYSICAL STOCKS

Stocks of the major energy resources are shown in table 16. Along with significant expansion in bituminous coal production, stocks rose 6.7 percent. The sharp rise in demand for metallurgical coke for the iron and steel industry caused coke stocks to decline below the 2-million-ton level. There were no appreciable shifts in stocks of crude petroleum or petroleum products during the year. However, reported stocks of natural gas declined after rising steadily for a number of years as additional storage facilities were constructed near major consuming areas for meeting seasonable peak demand.

## TRANSPORTATION

Natural gas is moved almost entirely by pipeline. Crude petroleum and related products are moved by pipeline, rail, water, and highway. Coal is transported primarily by rail, with some movement by water and truck. In 1962, the latest year for which data are available, total petroleum pipeline mileage was 200,543 miles (table 17)—including gathering lines and trunklines for crude petroleum and products. In 1963 there were 710,200 miles of utility gas pipelines (table 18). Of the total, 98 percent were natural gaslines, and the remaining 2 percent were manufactured, mixed, and liquefied petroleum gaslines.

TABLE 16.—Physical stocks of mineral energy resources and related products at yearend

(Producers stocks, unless otherwise indicated)

Fuel	1960	1961	1962	1963	1964
Coal and related products: <sup>1</sup>					
Bituminous and lignite <sup>2</sup> .....net tons...	76,898,317	74,449,230	72,577,910	73,028,665	77,939,559
Coke.....do.....	4,738,088	4,041,873	3,906,811	2,884,931	1,971,892
Petroleum and related products: <sup>3</sup>					
Carbon black.....thousand pounds	292,982	287,899	293,434	r 254,216	231,121
Crude petroleum and petroleum products.....thousand barrels...	784,558	825,074	834,296	835,559	839,235
Crude petroleum.....do.....	239,800	244,664	252,011	237,361	230,057
Natural gas liquids.....do.....	28,931	37,067	31,385	33,747	35,679
Gasoline.....do.....	194,774	184,167	188,683	190,937	199,512
Distillate fuel oil.....do.....	138,455	152,018	143,961	156,677	155,846
Residual fuel oil.....do.....	44,870	44,869	49,775	47,638	40,403
Petroleum asphalt.....do.....	12,991	12,999	14,252	14,354	14,234
Other refined products.....do.....	124,737	149,290	154,229	154,945	163,507
Natural gas <sup>4</sup> .....billion cubic feet...	2,184	2,344	2,504	2,745	2,313

r Revised.

<sup>1</sup> Series on anthracite stocks in ground storage has been discontinued.

<sup>2</sup> Stocks at industrial, consumer, and retail yards and on upper lake docks.

<sup>3</sup> Stocks of petroleum and related products are calculated on a new basis beginning with 1962 due to product reclassification resulting from separately reported data for petrochemical feedstocks.

<sup>4</sup> American Gas Association.

TABLE 17.—Mileage of petroleum pipelines in the United States, selected years  
(Miles)

Year	Trunklines		Gathering lines	Total
	Crude	Products		
1950.....	71,373	20,881	60,560	152,814
1953.....	75,228	27,236	68,040	170,504
1956.....	78,594	36,420	73,526	188,540
1959.....	70,317	44,483	75,182	189,982
1962.....	70,355	53,200	76,988	200,543

Source: Bureau of Mines, Crude Oil and Product Pipelines, Triennial.



TABLE 18.—Miles of utility gas main by type of gas and by type of main <sup>1</sup>

Type of gas and type of main	1950	1955	1960 <sup>2</sup>	1961 <sup>2</sup>	1962 <sup>2</sup>	1963
<b>All types:</b>						
Field and gathering.....	32,850	45,680	55,850	56,730	58,680	60,980
Transmission.....	113,050	145,970	183,660	191,840	196,380	200,550
Distribution.....	241,570	305,090	391,440	410,390	428,170	448,670
Total.....	387,470	496,740	630,950	658,960	683,230	710,200
<b>Natural gas:</b>						
Field and gathering.....	32,850	45,680	55,850	56,730	58,680	60,980
Transmission.....	109,360	142,490	181,770	189,990	194,970	199,630
Distribution.....	172,270	260,600	370,360	390,400	409,910	434,010
Total.....	314,480	448,770	607,980	637,120	663,560	694,620
<b>Manufactured gas:</b>						
Field and gathering.....	0	0	0	0	0	0
Transmission.....	2,230	420	20	30	20	( <sup>3</sup> )
Distribution.....	53,190	11,540	1,550	1,480	1,480	1,490
Total.....	55,420	11,960	1,570	1,510	1,500	1,490
<b>Mixed gas:</b>						
Field and gathering.....	0	0	0	0	0	0
Transmission.....	1,370	2,990	1,860	1,810	1,380	920
Distribution.....	10,620	28,450	17,590	16,640	15,080	11,890
Total.....	11,990	31,440	19,450	18,450	16,460	12,810
<b>Liquefied petroleum gas:</b>						
Field and gathering.....	0	0	0	0	0	0
Transmission.....	90	70	10	10	10	0
Distribution.....	5,490	4,500	1,940	1,870	1,700	1,280
Total.....	5,580	4,570	1,950	1,880	1,710	1,280

<sup>1</sup> Excludes service pipe. Data not adjusted to common diameter equivalent. Mileage shown as of end of each year.

<sup>2</sup> Includes data for Hawaii subsequent to 1959 and for natural gas only for Alaska subsequent to 1960.

<sup>3</sup> Less than 5 miles.

NOTE: For earlier years please refer to Historical Statistics of the Gas Industry.

Source: American Gas Association, Gas Facts 1963.

Rail transportation was the principal method for shipping coal in 1964. As shown in table 19, 349 million tons or 72 percent of total bituminous coal production during the year was shipped via railroad. Table 20 shows rail transportation of major energy resources. Coal, mainly bituminous, accounted for 88 percent of total energy resources shipped by rail in 1963, the latest year for which data are available. Freight costs of bituminous coal shipped by rail have declined in recent years owing to downward pressure on rates caused by interfuel competition in the electric utility market and to the continued transportation of the majority of powerplant coal by rail. Rail shipments of crude petroleum, gasoline, and fuel oil continued to decline during the year due to increasing competition from pipeline and truck distribution.

Water transportation of major energy resources (table 21), increased during the year. About one-third of the total water movement of energy resources was of coal, while 17 percent was crude petroleum. Refined petroleum products of which gasoline is the largest component were 51 percent of the total.

TABLE 19.—Methods of shipment of bituminous coal and lignite from mines and used at mines in the United States

Year	Method of shipment from mines			Used at mines <sup>1</sup>	Total production
	Shipped by rail and trucked to rail	Shipped by water and trucked to water	Trucked to final destination		
	Thousand net tons				
1960.....	303,865	46,784	52,699	12,164	415,512
1961.....	* 293,546	* 46,348	51,044	12,039	402,977
1962.....	* 307,328	* 48,106	54,853	11,862	422,149
1963.....	* 333,989	* 50,664	60,901	13,374	458,928
1964.....	349,377	59,349	65,532	12,740	486,798
	Percentage of total				
1960.....	73.1	11.3	12.7	2.9	100.0
1961.....	* 72.9	* 11.5	12.6	3.0	100.0
1962.....	72.8	11.4	13.0	2.8	100.0
1963.....	* 72.8	* 11.0	13.3	2.9	100.0
1964.....	71.7	12.2	13.5	2.6	100.0

\* Revised.

<sup>1</sup> Includes coal used at mine for power and heat, made into beehive coke at mine, used by mine employees, used for all other purposes at mine, and transported from mine to point of use by conveyor, tram, or pipeline.

TABLE 20.—Rail transportation of mineral energy resources and related products in the United States<sup>1</sup>

(Thousand short tons)

Product	1961	1962	1963	Change from 1962 (percent)
Coal:				
Anthracite <sup>2</sup> .....	14,963	15,157	16,564	+9
Bituminous.....	296,884	312,179	331,667	+6
Coke.....	14,328	15,467	16,436	+6
Crude petroleum.....	2,027	1,756	781	-56
Gasoline.....	6,861	6,187	5,380	-13
Distillate and residual fuel oils.....	6,369	6,209	5,812	-6
Asphalt.....	2,810	2,853	2,894	+1
Other <sup>3</sup> .....	15,482	15,824	16,140	+2
Total.....	359,724	375,632	395,674	+5

<sup>1</sup> Revenue freight originated, excluding forwarder and less than carload shipments, for which categories commodity detail is not available.

<sup>2</sup> Includes shipments to breakers and washeries.

<sup>3</sup> Includes lubricants, petroleum products, and gases.

Source: Interstate Commerce Commission, Freight Commodity Statistics, Class I Railroads in United States, for 3 years ended December 31 from 1961 to 1963.

**TABLE 21.**—Water transportation of mineral energy resources and related products in the United States, by products <sup>1</sup>

(Thousand short tons)

Product	1962	1963	1964 <sup>2</sup>	Change from 1963 (percent)
Coal:				
Anthracite.....	573	423	390	-8
Bituminous.....	136,765	141,673	154,936	+9
Coke.....	686	573	558	-3
Crude petroleum.....	80,970	83,236	79,998	-4
Gasoline.....	92,896	98,177	93,827	-4
Distillate fuel oil.....	79,001	77,357	71,153	-8
Residual fuel oil.....	45,215	46,360	44,910	-3
Asphalt.....	4,760	4,487	5,059	+13
Kerosine.....	9,314	8,307	8,273	(2)
Other <sup>3</sup> .....	15,263	15,183	18,563	+22
Total.....	465,443	475,776	477,667	(2)

<sup>2</sup> Preliminary.<sup>1</sup> Domestic traffic only: Traffic with Canal Zone, the Virgin Islands, and military cargoes carried in Department of Defense vehicles are excluded.<sup>2</sup> Less than 0.5 percent.<sup>3</sup> Includes lubricants, jet fuel, naphthene, and briquets.

## LABOR AND PRODUCTIVITY

**Employment.**—Total employment in the mineral energy resources industries declined slightly in 1964 although oil and gas field services, one of the groups shown in table 22, increased about 2 percent. Table 23 shows a comparison of employment data in the mineral energy resources industries from three separate sources—the Bureau of Labor Statistics (BLS), the Bureau of Employment Security (BES), and the Bureau of Mines. Generally, the three series move together but in 1964 BES anthracite and petroleum employment data moved contrary to Bureau of Mines and BLS data. This anomaly resulted from differences in sources of information and methods used to construct the series. BLS data, a sample survey, were revised in December 1964 using a new benchmark (comprehensive counts of employment) adjusted to March 1963 payroll data. The BES data are compiled using company reports to State agencies under the unemployment security laws, while the Bureau of Mines data are compiled from questionnaires sent to producers. Injury-experience data and related employment information collected by the Bureau of Mines may be found in the chapter on Employment and Injuries.

**Productivity.**—While an index of labor output has not been computed for 1964, a continued trend toward increased mechanization and automation is expected to result in productivity increases in the mineral energy resources industries during 1964. As shown in table 24, output per production worker man-hour in petroleum refining and bituminous coal mining increased 5 and 6 percent, respectively, in 1963.

**Average Hours and Gross Earnings.**—Weekly and hourly earnings for all mining and manufacturing industries are shown in table 25. The largest increase was in hourly earnings paid to coal miners, resulting from increased wage rates and the trend to automation which requires a more skilled, higher paid labor force.

**TABLE 22.—Total employment in the mineral energy resources industries**  
(Thousands)

Year and month	Mining				Total	Manufacturing		
	Bituminous	Other coal	Crude petroleum and natural gas fields	Oil and gas field services		Petroleum refining	Other petroleum and coal products <sup>1</sup>	Total
1960.....	168.5	17.6	178.2	131.1	495.4	177.2	34.7	211.9
1961.....	147.1	14.2	171.3	131.8	464.4	168.4	33.6	202.0
1962.....	140.0	11.9	167.6	130.4	449.9	160.5	34.7	195.2
1963.....	136.9	11.2	164.3	124.8	437.2	154.7	35.1	189.8
1964:								
January.....	137.3	11.2	161.4	123.7	433.6	153.9	31.9	185.8
February.....	135.9	11.4	161.5	120.0	428.8	153.0	32.7	185.7
March.....	132.3	11.3	160.6	121.8	426.0	152.7	32.8	185.5
April.....	132.7	10.8	160.5	122.7	426.7	152.8	33.3	186.1
May.....	130.7	11.0	160.4	124.5	426.6	152.2	35.0	187.2
June.....	132.1	11.2	164.6	130.6	438.5	153.4	36.4	189.8
July.....	131.6	11.3	165.1	132.2	440.2	153.1	36.6	189.7
August.....	131.5	11.3	165.0	132.3	440.1	152.9	36.7	189.6
September.....	132.8	11.2	162.4	129.4	435.8	151.8	36.6	188.4
October.....	133.6	11.1	159.6	128.4	432.7	151.3	35.6	186.9
November.....	134.0	11.2	159.1	130.3	434.6	149.2	34.8	184.0
December.....	134.7	11.0	158.2	129.1	433.0	149.0	32.7	181.7
Average, 1964.....	133.3	11.1	161.5	127.1	433.0	152.1	34.6	186.7

<sup>1</sup> Standard Industrial Classification Industry 295, paving and roofing materials included in total.

Source: U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings Statistics 1909-64, Bull. 1312-2, December 1964, and monthly reports December 1964 through March 1965.

**TABLE 23.—Comparison of data on total employment in the mineral energy resources industries**  
(Thousands)

Year	Petroleum		Bituminous coal			Anthracite		
	BLS <sup>1</sup>	BES <sup>2</sup>	BLS	BES	Bureau of Mines	BLS	BES	Bureau of Mines
1960.....	309.2	299.6	168.5	163.2	169.4	17.6	14.9	19.1
1961.....	303.1	294.1	147.1	145.6	150.5	14.2	12.8	15.8
1962.....	298.0	289.1	140.0	138.8	143.8	11.9	11.6	14.0
1963.....	289.1	280.2	136.9	135.5	141.6	11.2	11.2	13.5
1964.....	280.8	282.0	133.3	132.3	128.7	11.1	11.4	13.1

<sup>†</sup> Revised.

<sup>1</sup> BLS: Bureau of Labor Statistics.

<sup>2</sup> BES: Bureau of Employment Security.

Source: BLS data from U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings for the United States, 1909-64 and Employment and Earnings, March 1965, table B-2. BES data from the Bureau of Employment Security.

**TABLE 24.—Index of labor output**  
(1957-59=100)

Year	Petroleum refining			Bituminous coal and lignite mining		
	Employee	Production worker	Production worker man-hour	Employee	Production worker	Production worker man-hour
1959.....	109.5	109.6	† 109.7	105.6	107.8	† 106.3
1960.....	† 113.0	115.2	† 114.1	112.8	116.3	† 114.2
1961.....	† 120.2	122.8	† 122.0	125.3	129.9	† 127.2
1962.....	129.7	133.5	132.4	137.7	142.8	135.8
1963.....	136.7	140.0	139.6	153.2	158.5	143.4

<sup>†</sup> Revised.

Source: U.S. Department of Labor, Bureau of Labor Statistics. Indexes of Output per Man-hour for Selected Industries (forthcoming).

TABLE 25.—Average hours and gross earnings of production workers in the mineral energy resources and related industries

Year and month	Mining											
	Total fuels <sup>1</sup>			Total coal mining			Bituminous coal			Crude petroleum and natural gas		
	Weekly earnings	Weekly hours	Hourly earnings	Weekly earnings	Weekly hours	Hourly earnings	Weekly earnings	Weekly hours	Hourly earnings	Weekly earnings	Weekly hours	Hourly earnings
1960.....	\$105.99	39.6	\$2.70	\$110.41	35.5	\$3.11	\$112.41	35.8	\$3.14	\$103.32	42.0	\$2.46
1961.....	107.44	39.7	2.72	110.62	35.8	3.09	112.01	35.9	3.12	105.75	41.8	2.53
1962.....	110.50	40.3	2.77	113.06	*36.9	*3.09	114.46	*37.0	*3.12	109.20	42.0	2.60
1963.....	114.98	41.0	2.82	119.98	*38.8	*3.12	121.43	*38.9	*3.15	112.41	42.1	2.67
1964:												
January.....	117.01	41.0	2.86	125.29	39.4	3.18	127.12	39.6	3.21	112.71	41.9	2.69
February.....	116.02	40.9	2.85	121.09	38.2	3.17	123.52	38.6	3.20	113.36	42.3	2.68
March.....	113.86	40.5	2.83	115.97	36.7	3.16	117.76	36.8	3.20	112.78	42.4	2.66
April.....	115.01	40.6	2.85	121.82	37.6	3.24	123.33	37.6	3.28	111.57	42.1	2.65
May.....	116.91	40.9	2.87	126.49	38.8	3.26	129.03	39.1	3.30	112.14	42.0	2.67
June.....	117.51	41.4	2.85	131.86	40.2	3.28	134.53	40.4	3.33	110.62	41.9	2.64
July.....	116.13	NA	NA	121.32	NA	NA	122.84	NA	NA	113.63	42.4	2.68
August.....	113.38	41.0	2.89	131.01	39.7	3.30	133.27	39.9	3.34	112.32	41.6	2.70
September.....	117.18	40.3	2.90	124.50	37.5	3.32	126.67	37.5	3.36	113.57	41.6	2.73
October.....	121.95	41.6	2.94	133.72	40.4	3.31	136.35	40.7	3.35	116.05	42.2	2.75
November.....	121.89	41.3	2.96	134.34	40.1	3.35	136.62	40.3	3.39	115.64	41.9	2.76
December.....	121.48	41.4	2.94	135.20	40.6	3.33	138.17	41.0	3.37	114.53	41.8	2.74
1964 average.....	117.89	41.0	2.89	126.88	*39.0	*3.26	129.10	*39.2	*3.30	113.40	42.0	2.70

	Manufacturing								
	Petroleum refining and related industries			Petroleum refining			Other petroleum and coal products		
	Weekly earnings	Weekly hours	Hourly earnings	Weekly earnings	Weekly hours	Hourly earnings	Weekly earnings	Weekly hours	Hourly earnings
1960.....	118.78	41.1	2.89	123.22	40.8	3.02	98.3	42.6	2.32
1961.....	124.31	41.3	3.01	129.24	40.9	3.16	102.10	42.9	2.38
1962.....	126.88	41.6	3.05	131.43	41.2	3.19	107.75	43.1	2.50
1963.....	131.77	41.7	3.16	137.45	41.4	3.32	108.28	42.8	2.53
1964:									
January.....	132.16	41.3	3.20	138.69	41.4	3.35	102.82	40.8	2.52
February.....	131.65	41.4	3.18	137.94	41.3	3.34	105.34	41.8	2.52
March.....	131.24	41.4	3.17	137.20	41.2	3.33	107.02	42.3	2.53
April.....	130.92	41.3	3.17	136.20	40.9	3.33	108.71	42.8	2.54
May.....	133.14	42.0	3.17	137.94	41.3	3.34	114.62	44.6	2.57
June.....	133.46	42.1	3.17	138.02	41.2	3.35	116.87	45.3	2.58
July.....	134.09	42.3	3.17	138.69	41.4	3.35	117.39	45.5	2.58
August.....	133.88	42.1	3.18	138.77	41.3	3.36	116.10	45.0	2.58
September.....	140.51	43.1	3.26	146.53	42.5	3.45	118.88	45.2	2.63
October.....	133.86	41.7	3.21	138.24	41.7	3.33	117.48	44.5	2.64
November.....	134.69	41.7	3.23	141.52	41.7	3.41	109.98	41.5	2.60
December.....	135.53	41.7	3.25	141.86	41.6	3.25	109.46	42.1	2.60
1964 average.....	133.76	41.8	3.20	139.52	41.4	3.37	112.49	43.6	2.58

NA Not available.

‡ Weighted average using employment as weight computed by author.

‡ 11-month average.

Source: U.S. Department of Labor, Bureau of Labor Statistics. Employment and Earnings for the United States, 1909-64, Bull. 1312-2, December 1964, and monthly issues December 1964 through March 1965.

**Labor-Turnover Rates.**—Labor-turnover rates, shown in table 26 did not fluctuate greatly from 1963 except for coal mining in which all rates declined. Separations slightly exceeded accessions. Conditions in the coal mining industry indicated that the skills of the accessions are usually higher than those of the separations.

**TABLE 26.**—Average labor turnover rates, mineral energy resources and related industries

(Per thousand employees)

Rates, year	All manu- facturing	Petroleum refining and related industries <sup>1</sup>	Petroleum refining	Coal mining
Total accession rate:				
1963.....	39	15	10	20
1964.....	40	16	11	17
Total separation rate:				
1963.....	39	20	14	21
1964.....	39	18	13	18
Layoff rate:				
1963.....	18	7	3	12
1964.....	17	7	4	9

<sup>1</sup> Standard Industrial Classification Industry 295, paving and roofing materials included in total.

Source: U.S. Department of Commerce, Bureau of Labor Statistics. Employment and Earnings Statistics for the United States 1909-64, Bull. 1312-2, December 1964 and monthly issues December 1964 through March 1965.

## PRICES AND COSTS

**Value.**—The 1964 index of average unit mine value for mineral-energy resources, shown in table 27, declined slightly as a result of lower prices paid producers of crude oil and natural gas. This index shows changes in the return to producers of crude minerals at the point of production. Table 28, the index of implicit unit value, is a measure of relative rather than absolute prices and is designed to represent the real price changes of mineral commodities. It is derived by dividing the index of physical volume into an index of value.

**Prices.**—The wholesale price index for the fuels related products, and power, shown in table 29, decreased 2.7 percent in 1964. Anthracite and coke were the only items in the group to increase but these increases were more than offset by a 4.7 percent decrease in refined petroleum products, a series more heavily weighted in the index than anthracite and coke combined. Comparative fuels prices are shown in table 30.

**Fuel Costs, Electricity Generation.**—Although the price of coal increased, the cost of fuels consumed in steam electric power generation shown in table 31 decreased for all fuels. This was largely due to increased efficiency of coal utilization in power generation. The differential in regional prices indicates the significance of transportation cost in these industries.

TABLE 27.—Index of average unit mine value of minerals produced in the United States, by group and subgroup<sup>1</sup>

(1957-59=100)

Year	All minerals	Metals total	Nonmetals total	Mineral energy resources		
				Total	Coal	Crude oil and natural gas
1960.....	98	105	102	96	95	98
1961.....	98	103	102	97	93	99
1962.....	98	102	102	97	91	100
1963.....	98	106	102	96	90	99
1964.....	99	118	103	95	91	98

<sup>1</sup> For description of index, see "Review of Minerals Industries" chapter in Minerals Yearbook, v. 1, 1969, pp. 22-24.

TABLE 28.—Index of implicit unit value of minerals produced in the United States, by group and selected subgroup<sup>1</sup>

(1957-59=100)

Year	All minerals	Mineral energy resources			Metals total	Nonmetals total
		Total	Coal	Crude oil and natural gas		
1960.....	100.9	99.3	94.9	100.0	106.8	100.7
1961.....	101.1	100.5	93.0	101.3	102.8	100.4
1962.....	* 101.6	* 101.3	91.0	102.9	* 103.6	* 99.7
1963.....	* 101.4	* 100.8	* 89.6	* 103.1	* 106.9	* 98.9
1964.....	102.4	100.9	89.1	103.4	112.7	99.8

\* Revised.

<sup>1</sup> The entire index has been revised from 1960 to present.

TABLE 29.—Average monthly wholesale price indexes for selected mineral energy resources

(1957-59=100, unless otherwise specified)

Year and month	Wholesale price index, all commodities	Fuels and related products, and power	Coal	Anthracite	Coke	Gas fuels <sup>1</sup>	Electric power <sup>1</sup>	Crude petroleum <sup>2</sup>	Petroleum products refined
1960.....	100.7	99.6	98.8	99.9	103.6	116.6	101.9	97.2	97.6
1961.....	100.3	100.7	97.7	95.7	103.6	118.6	102.4	97.5	99.3
1962.....	100.6	100.2	96.8	94.2	103.6	119.2	102.8	97.7	98.2
1963.....	100.3	99.8	96.9	96.0	103.6	122.8	102.0	97.3	97.2
1964.....	100.5	97.1	96.9	98.2	106.3	121.3	101.1	96.9	92.7
January.....	101.0	99.5	98.3	102.0	103.6	124.8	101.3	97.2	96.6
February.....	100.5	99.0	98.1	102.0	103.6	126.8	101.3	97.2	95.3
March.....	100.4	97.0	97.1	102.0	103.6	123.2	99.4	97.2	92.9
April.....	100.3	96.1	95.0	93.9	106.1	120.4	101.3	97.2	91.1
May.....	100.1	96.4	95.1	93.9	107.3	116.6	101.3	97.2	92.2
June.....	100.0	96.3	95.3	93.9	107.3	116.0	100.9	96.8	92.3
July.....	100.4	96.7	96.1	97.1	107.3	120.2	100.6	96.8	92.5
August.....	100.3	96.4	96.6	97.1	107.3	121.2	101.4	96.7	91.4
September.....	100.7	95.2	97.3	97.1	107.3	118.4	101.5	96.7	89.5
October.....	100.8	96.7	97.7	99.8	107.3	120.4	101.5	96.7	91.9
November.....	100.7	97.6	98.0	99.8	107.3	123.1	101.4	96.7	93.3
December.....	100.7	98.1	98.2	99.8	107.3	124.0	101.3	96.7	94.0

<sup>1</sup> January 1958=100.<sup>2</sup> Not included in the group, "Fuels and related products, and power."

Source: U.S. Department of Labor, Bureau of Labor Statistics. Monthly Labor Review, v. 87, No. 3, March 1965, p. 372. Wholesale Prices and Price Indexes, monthly issues from February through December 1964.



TABLE 30.—Comparative mineral energy resource prices

Fuel	1963	1964
Bituminous coal:		
Average prices:		
Average retail price.....dollars per net ton..	17.46	(1)
Costs of coal at merchant coke ovens.....do.....	9.35	9.85
Anthracite, average sales realization per net ton at preparation plants, excluding dredge coal:		
Chestnut.....dollars.....	12.24	12.92
Pea.....do.....	10.15	10.82
Buckwheat No. 1.....do.....	9.06	9.69
Petroleum and petroleum products:		
Crude petroleum, average price per barrel at well.....do.....	2.89	2.88
Gasoline, average dealers net price (excluding taxes) of gasoline in 55 U.S. cities <sup>2</sup> cents per gallon.....	15.22	14.82
Residual fuel oil:		
No. 6 fuel, average of high and low prices in Philadelphia <sup>3</sup> dollars per barrel (refinery).....	3.05	3.05
Bunker C, average price for all Gulf ports <sup>3</sup> .....do.....	2.12	2.10
Distillate fuel oil:		
No. 2 distillate, average of high and low prices at Philadelphia <sup>3</sup> cents per gallon (refinery).....	9.80	9.24
No. 2 distillate, average price for all Gulf ports <sup>3</sup> .....do.....	8.76	8.13
Natural gas:		
Average U.S. value at well.....cents per thousand cubic feet.....	15.8	15.4
Average U.S. value at point of consumption.....do.....	51.2	51.6

\* Revised.

<sup>1</sup> Series discontinued.<sup>2</sup> Platt's Oil Price Handbook.

TABLE 31.—Cost of fuel in steam-electrical power generation, United States

(Cents per million Btu)

Region	Coal	Oil	Gas	Coal	Oil	Gas	Coal	Oil	Gas
	1958			1959			1960		
New England.....	40.1	40.7	37.8	37.7	35.8	34.5	36.5	36.0	35.6
Middle Atlantic.....	32.3	38.5	32.0	30.8	35.5	33.0	30.0	35.1	35.7
East North Central.....	25.8	68.5	24.6	25.6	73.2	24.5	25.3	65.5	25.3
West North Central.....	28.1	51.3	22.0	27.5	46.7	22.4	27.0	43.4	23.0
South Atlantic.....	28.6	39.7	27.6	27.2	35.5	29.7	26.3	35.6	31.8
East South Central.....	19.4	37.6	21.6	19.1	47.1	23.4	19.6	50.3	24.8
West South Central.....	15.6	41.8	12.9	15.8	43.2	15.0	32.3	45.1	16.7
Mountain.....	21.9	25.2	22.2	21.3	24.3	25.7	20.2	25.0	27.8
Pacific.....	.....	42.0	26.5	.....	34.8	32.0	.....	32.3	33.4
Average.....	27.4	39.6	19.5	26.5	35.2	22.3	26.0	34.5	23.8
	1961			1962			1963		
New England.....	36.2	37.7	36.3	35.5	36.1	35.1	34.1	34.7	34.6
Middle Atlantic.....	29.9	36.2	37.7	29.0	34.2	37.2	27.2	32.1	33.3
East North Central.....	25.0	64.7	26.4	24.9	70.5	25.7	24.8	69.8	24.9
West North Central.....	26.2	47.4	22.8	26.6	49.7	23.8	26.4	50.1	23.8
South Atlantic.....	25.8	35.2	32.5	25.6	34.6	32.3	25.5	34.4	32.6
East South Central.....	19.7	50.9	25.4	19.3	48.9	25.4	20.0	47.5	24.5
West South Central.....	.....	43.8	19.0	.....	42.2	19.5	16.6	38.3	19.4
Mountain.....	19.6	25.6	28.5	22.7	25.1	29.0	20.4	27.4	27.7
Pacific.....	.....	32.6	35.2	.....	33.6	34.8	.....	33.0	36.1
Average.....	25.8	35.5	25.1	25.6	34.5	26.4	25.0	33.5	25.9

<sup>1</sup> Excludes blast-furnace gas, which would lower cost slightly.

Source: National Coal Association. Steam-Electric Plant Factors. Annually, 1958 through 1963.

**Electricity Costs.**—The cost of electricity by region and principal rate class is shown in table 32. Comparisons of regional rates are often useful when making decisions concerning plant location or the use of alternative energy sources.

The index of major input expenses (table 33) indicates changes in operating cost and does not reflect the actual cost of producing these fuels as capital costs are omitted. The constant decline of input expenses for bituminous coal has occurred during a period of increasing wages. However, the wage increases were more than offset by productivity advances, thus reducing unit labor cost.

**Relative Labor Cost.**—The indexes of relative labor cost (table 34) further illustrate productivity gains realized in the bituminous coal industry.

**Machinery Prices.**—Table 35 shows wholesale price indexes of selected machinery and equipment used in the mineral-energy resource industry. All indexes show increases for 1964.

TABLE 32.—Cost of electrical energy per kilowatt-hour

(Cents)

Region	1958			1959			1960		
	Total	Residential <sup>1</sup>	Commercial and industrial	Total	Residential <sup>1</sup>	Commercial and industrial	Total	Residential <sup>1</sup>	Commercial and industrial
New England.....	2.6	3.3	2.2	2.6	3.2	2.1	2.5	3.2	2.1
Middle Atlantic.....	2.1	3.0	1.7	2.1	3.0	1.7	2.0	2.9	1.7
East North Central.....	1.7	2.6	1.4	1.7	2.6	1.4	1.7	2.7	1.4
West North Central.....	2.4	3.0	1.9	2.3	2.9	1.9	2.2	2.8	1.8
South Atlantic.....	1.8	2.5	1.5	1.8	2.4	1.5	1.8	2.4	1.5
East South Central.....	.8	1.6	.6	.8	1.6	.6	.8	1.5	.7
West South Central.....	1.8	2.8	1.4	1.8	2.8	1.4	1.8	2.7	1.4
Mountain.....	1.6	2.3	1.2	1.6	2.3	1.3	1.5	2.3	1.2
Pacific.....	1.4	1.9	1.1	1.4	1.8	1.1	1.4	1.8	1.1
Total.....	1.7	2.5	1.3	1.7	2.5	1.3	1.7	2.4	1.3
	1961 <sup>2</sup>			1962			1963		
New England.....	2.5	3.1	2.1	2.5	3.1	2.1	2.5	3.1	2.1
Middle Atlantic.....	2.0	2.9	1.7	2.0	2.9	1.6	2.0	2.8	1.6
East North Central.....	1.7	2.6	1.4	1.7	2.6	1.4	1.7	2.6	1.4
West North Central.....	2.2	2.8	1.5	2.2	2.7	1.8	2.2	2.7	1.8
South Atlantic.....	1.8	2.3	1.5	1.7	2.3	1.4	1.7	2.2	1.4
East South Central.....	.9	1.5	.7	.9	1.5	.7	.9	1.4	.7
West South Central.....	1.8	2.7	1.5	1.8	2.6	1.4	1.7	2.5	1.4
Mountain.....	1.5	2.4	1.2	1.5	2.3	1.2	1.5	2.3	1.3
Pacific.....	1.4	1.9	1.1	1.4	1.9	1.1	1.3	1.8	1.1
Total <sup>3</sup> .....	1.7	2.4	1.4	1.7	2.4	1.4	1.6	2.4	1.3

<sup>1</sup> Includes rural.<sup>2</sup> Beginning with 1961 rural included in all 3 classes.<sup>3</sup> Includes Alaska and Hawaii for 1960-63.

Source: Edison Electric Institute, Statistical Year Book of the Electric Utility Industry, 1958-63.

**TABLE 33.—Index of major input expenses for bituminous coal and crude petroleum and natural gas mining <sup>1</sup>**

(1957-59=100)

Year	Bituminous coal	Crude petroleum and natural gas	Year	Bituminous coal	Crude petroleum and natural gas
1960.....	96	100	1963.....	86	99
1961.....	91	100	1964.....	84	99
1962.....	88	99			

<sup>r</sup> Revised.<sup>1</sup> Index constructed by author using weights derived from 1958 Census of Mineral Industries and using data from U.S. Department of Labor, Bureau of Labor Statistics, Wholesale Price Index, annual and monthly releases.**TABLE 34.—Indexes of relative labor cost, bituminous coal and petroleum mining**

(1957-59=100)

Year	Index of labor costs per unit of output <sup>1</sup>		Index of value of product per man-period <sup>2</sup>		Index of labor costs per dollar of product <sup>3</sup>	
	Bituminous coal	Petroleum	Bituminous coal	Petroleum	Bituminous coal	Petroleum
1960.....	94	100	108	103	98	103
1961.....	86	100	114	108	92	103
1962.....	82	98	118	114	89	102
1963.....	79	98	120	119	88	101
1964.....	75	98	132	121	84	102

<sup>1</sup> Bituminous index based upon net tons per man per day (see "Coal" chapter, this volume) and index of average earnings derived from Bureau of Labor Statistics data on hourly earnings; petroleum index based on barrels per year (see "Petroleum" section, this volume) and Bureau of Employment Security data on total wages in petroleum production.<sup>2</sup> Bituminous index based on net tons per man per day and mine values of production; petroleum index based on average employment and total value of production.<sup>3</sup> Bituminous index based on index of value per man per day and index of average earnings; petroleum index based on total value of production and total wages.**TABLE 35.—Wholesale price indexes of selected machinery and equipment items**

(1957-59=100)

Year	Oilfield machinery and tools	Mining machinery and equipment	Power cranes, draglines, shovels, etc.	Construction machinery and equipment	Specialized construction machinery
1960.....	100.3	106.4	105.1	105.8	106.9
1961.....	101.8	107.8	105.4	107.5	107.8
1962.....	103.2	108.4	106.1	107.8	107.4
1963.....	102.6	109.1	108.8	109.6	108.1
1964.....	104.4	110.8	111.8	112.4	108.5
	Portable air compressors	Scrapers and graders	Contractor's air tools, handheld	Mixers, pavers, spreaders, etc.	Tractors other than farm
1960.....	105.4	104.7	108.2	106.7	106.4
1961.....	114.1	104.4	113.5	108.4	108.0
1962.....	113.7	105.3	113.5	110.3	108.5
1963.....	115.1	108.5	113.5	112.1	110.8
1964.....	117.6	110.8	(?)	116.3	114.7

<sup>1</sup> Series discontinued January 1964.

Source: Bureau of Labor Statistics, 1962 Statistical Supplement, Monthly Labor Review, p. 79, and Wholesale Prices and Price Indexes, January 1965.

## INCOME AND INVESTMENT

National income for selected mineral industries, including wages and salaries paid and profits generated in these industries, is shown in table 36. During 1964, income increased in all major mining industries including the energy resource industries. However, the rate of increase in income from crude petroleum and natural gas expanded at a slower rate than in 1963. Petroleum refining and related industries in the manufacturing sector also showed considerably less growth in income than in the previous year. National income generated in the mining industry expanded at a slower rate than income for all industries in 1964.

Current expenditures in new plant and equipment by selected industries are shown in table 37. Expenditures for mining increased 14.4 percent. In manufacturing, expenditures in the petroleum and coal component increased 15 percent. This was somewhat lower than expenditures in primary iron and steel which increased 36 percent with chemicals, up 22 percent. Decisions to invest in new plant and equipment in the energy resource industries reflect the continuing decline in excess capacity in many of these industries, the growth of technology, and the expansion of the economy.

**TABLE 36.—National income by industrial origin in selected industries**

Industry	1962 (millions)	1963 (millions)	Change from 1962 (percent)	1964 (millions)	Change from 1963 (percent)
All industries.....	\$457, 687	\$481, 110	+5.1	\$514, 389	+6.9
Mining.....	5, 653	5, 971	+5.6	6, 233	+4.4
Metal mining.....	758	807	+6.5	882	+9.3
Coal mining.....	1, 141	1, 211	+6.1	1, 274	+5.2
Crude petroleum and natural gas.....	2, 811	2, 928	+4.2	2, 981	+1.8
Nonmetallic mining and quarrying.....	943	1, 025	+8.7	1, 096	+6.9
Manufacturing.....	136, 988	143, 817	+5.0	154, 662	+7.5
Petroleum refining and related industries.....	4, 489	4, 805	+7.0	4, 814	+0.2

Source: U.S. Department of Commerce, Office of Business Economics, Survey of Current Business, August 1965.

**TABLE 37.—Expenditures on new plant and equipment by firms in mining and selected mineral manufacturing industries**

(Billion dollars)

	1962	1963	1964
Mining <sup>1</sup> .....	1.08	1.04	1.19
Selected manufacturing:			
Primary iron and steel.....	1.10	1.24	1.69
Primary nonferrous metals.....	.31	.41	.48
Stone, clay, and glass products.....	.58	.61	.68
Chemical and allied products.....	1.56	1.61	1.97
Petroleum and coal products.....	2.88	2.92	3.36
All manufacturing.....	14.68	15.69	18.58

<sup>1</sup> Including fuels.

Source: U.S. Department of Commerce, Office of Business Economics, Survey of Current Business, March 1964, p. 13, and June 1965, p. 6.

Direct private investment by U.S. companies in foreign petroleum industries, remained the largest portion of total U.S. foreign investment and continued to increase in 1964. As shown in table 38, the book value of private U.S. foreign investment in petroleum industry at the end of 1964 was \$14.4 billion and about one-third of total direct investment by private U.S. sources in foreign industries. An important factor in the increase in U.S. petroleum investment abroad was the continuing reinvestment abroad of undistributed profits of U.S. subsidiaries and the rising market value of foreign securities held.

Total direct foreign investment in the United States in 1964 and the value of the petroleum component is shown in table 39. Petroleum is the only mineral energy resource in which there is substantial foreign investment in the United States. During the year petroleum accounted for 19 percent of the total of such investment.

**TABLE 38.—Direct private investment of U.S. companies in foreign petroleum industries**

(Million dollars; net inflows to the United States (—))

	Petroleum			All industries				
	Book value beginning of year	Net capital out-flows	Undis-tributed earnings of sub-sidiaries	Book value end of year	Book value beginning of year	Net capital out-flows	Undis-tributed earnings of sub-sidiaries	Book value end of year
Canada.....	3,134	30	54	3,228	13,044	250	498	13,820
Latin American Republics, all.....	3,095	4	3	3,142	8,662	156	219	9,085
Other Western Hemisphere.....	541	31	-1	569	1,229	134	34	1,386
Europe.....	2,776	389	-87	3,086	10,340	1,342	410	12,067
Africa.....	702	97	4	830	1,426	135	40	1,629
Middle East.....	1,205	25	8	1,238	1,277	42	11	1,331
Far East.....	714	74	-20	775	1,515	146	47	1,731
Oceania.....	496	30	-1	444	1,460	115	80	1,582
International.....	988	60	-9	1,038	1,733	56	79	1,865
Total.....	13,652	1,739	-49	14,350	40,686	2,376	1,417	44,496

<sup>1</sup> Total does not add due to rounding.

Source: U.S. Department of Commerce, Office of Business Economics. Survey of Current Business, September 1965.

**TABLE 39.—Value of foreign direct investments in the United States**

(Millions of dollars)

Industry	1960	1961	1962	1963	1964
Total.....	6,910	7,392	7,612	7,944	8,363
Petroleum.....	1,238	1,325	1,419	1,513	1,612

Source: U.S. Department of Commerce, Office of Business Economics. Survey of Current Business, September 1965.

## GOVERNMENT ACTIVITIES

Several established programs of the Bureau of Mines were related to conservation and development of mineral energy resources and related products. The central objective of these programs is to provide an adequate supply of energy resources for the maintenance of U.S. affluence and industrial power, to assure continued prosperity

and economic growth, and to meet the requirements of national security. One of the principal Bureau activities is continuous analysis and evaluation of total energy economy and its components. The Bureau of Mines periodically publishes studies and reports showing energy balances at the national level and supply and demand relationships of energy resources by source and end-use sectors. Accelerated energy consumption has intensified the need to maintain an adequate energy base for the economy and to provide adequate supplies of energy at constant or lower costs to meet the evolving needs of the energy consuming markets. With the objective of effecting further efficiencies in the energy economy, the Bureau periodically conducts energy resource investigations which include development of fundamental engineering and economic data, surveys of mining operations, and market research and analysis. The Bureau also appraises and analyzes the cost and price structures of the energy industries and makes projections of the future United States demand for total energy and its components. In the international area, the Bureau provides a constant flow of information on foreign energy resources and industries including international trade. During 1964 mineral energy resource studies were prepared about various phases of the United States coal, natural gas and petroleum industries, their markets and trade.

Energy problems, including those encountered and evaluated under the mineral resource development program, are frequently the subject of investigation and analysis under the Bureau program for minerals research. This program encompasses virtually all of the major minerals including sources of energy. The central objective of the minerals research program is to assist in development and conservation of national resources through the advance of science and technology. The program is directed toward avoidance of waste in energy resource industries, stimulation of productivity, savings in production costs, and introduction of new materials and processes. Bureau scientists and engineers are particularly concerned with advancement of new concepts for extraction and use of petroleum, natural gas, shale oil, and coal, as well as new discovery, secondary recovery, and expansion of reserves of these resources.

Recent profitable research contributions in the field of energy resources include Bureau of Mines findings which led to the planning of a secondary oil recovery program for the Utah Oil and Gas Commission that is expected to yield 100 million barrels of additional oil for a 25-year period in the greater Aneth field. Pressure maintenance processes advanced by the Bureau are widely applied and these are expected to produce significant additional quantities of oil from reservoirs. Data from Bureau research on gas compressibility, vapor-liquid equilibria, and other properties of gas and reservoir liquids are contributing to increased recovery of gas from high-pressure fields. An offshoot of Bureau research on liquid fuels from coal was development of the Oxo process for economic production of industrial alcohols widely used in detergents and plastics. The Bureau is also working to further new concepts of energy transfer such as the coal-fired turbine, magnetohydrodynamics, and the economic production of shale oil from oil shale. Through these and other mineral resource development and research activities, the Bureau makes a continuing

contribution to the needs of Government, industry, and the general public.

National expenditures for research and development activities in selected industries are shown in table 40. Whereas research and development for chemicals and allied products remained the major area for such expenditures in 1963, expenditures for petroleum and refining were significant, accounting for 2.2 percent of industrial funds in 1963. With both chemical and petroleum, private funds were considerably in excess of Federal funds expended during the year. For all industries, however, Federal expenditures considerably exceeded private.

TABLE 40.—Research and development activity

	Funds expended (million dollars)					
	Total		Company		Federal	
	1962	1963	1962	1963	1962	1963
Petroleum refining and extraction.....	305	315	285	295	20	20
Percent of all industries.....	2.6	2.3	5.7	5.5	0.3	0.2
Chemicals and allied products.....	1,184	1,253	924	989	260	264
Percent of all industries.....	10.3	9.8	18.4	18.4	4.0	3.6
All industries.....	11,544	12,723	5,020	5,378	6,524	7,345

Source: National Science Foundation, Reviews of Data on Science Resources, v. I, No. 1, December 1964.

## INTERNATIONAL

There were no significant shifts in United States trade in the major mineral energy resources during 1964. The combined value of coal and coke exports to Europe (table 41), was slightly below the 1963 level. In the petroleum trade, value of crude petroleum imports into the United States increased slightly during the year, particularly from sources in Asia. The value of refined products imported showed nominal gains from the principal supplying areas. South America remained the source of mineral energy resources imports, which consisted principally of crude petroleum and petroleum products. The major market for U.S. exports of energy resources in 1964 was Europe with coal, coke and petroleum products predominating in shipments. The value of U.S. imports of energy resources increased to \$2 billion in 1964 (table 42). During the year, 57 percent of the value of these imports was crude petroleum, while refined products accounted for 36 percent of the total. The value of total exports of energy resources declined 11 percent during the year to \$991 million. Petroleum products and coal and coke exports predominate in export shipments. However, the value of petroleum products exported decreased \$26 million below the 1963 level.

**TABLE 41.—Regional distribution of U.S. imports and exports of selected mineral energy resources and related products**

(Thousands)

SITC <sup>1</sup> No.	Group	North America	South America	Europe	Asia	Africa	Oceania	Soviet bloc
321	Coal, coke, etc.:							
	Imports .....	\$14,384	\$1	\$1,602	\$4			\$242
	Exports .....	136,277	21,440	240,005	66,515	\$240	\$102	9,000
331	Petroleum, crude, etc.:							
	Imports .....	310,523	539,473	2,409	260,363	35,301		
	Exports .....	22		1,314	2,470			
332	Petroleum products:							
	Imports .....	377,437	333,689	3,376	9,594	721	( <sup>2</sup> )	286
	Exports .....	72,360	40,061	126,182	129,694	27,308	18,084	1,339
341	Gas, natural, manufactured:							
	Imports .....	106,042	532	107	21			
	Exports .....	18,277	77	356	174	21	175	1
	Total selected mineral fuels:							
	Imports .....	808,386	873,695	7,494	269,962	36,022	( <sup>2</sup> )	528
	Exports .....	226,936	61,578	367,857	198,853	27,569	18,361	10,340
521	Mineral tar and crude chemicals from coal, petroleum, natural gas:							
	Imports .....	1,112		7,314	158		58	85
	Exports .....	8,856	2,709	40,188	14,950	1,165	1,608	91
	Grand total:							
	Imports .....	809,498	873,695	14,808	270,140	36,022	58	613
	Exports .....	235,792	64,287	408,045	213,803	28,734	19,969	10,431

<sup>1</sup> Standard International Trade Classification.<sup>2</sup> Less than ½ unit.<sup>3</sup> Plus \$10,023,000 special category shipped to all countries.

Source: U.S. Department of Commerce, Bureau of the Census, U.S. Exports 1964, FT-420.

**TABLE 42.—Value of imports and exports, mineral energy resources, and products**

(Thousands)

SITC <sup>1</sup> No.	Group	Imports for consumption			Exports of domestic merchandise		
		1962	1963	1964	1962	1963	1964
321	Coal, coke, etc. ....	\$4,187	\$6,301	\$16,233	\$388,710	\$482,058	\$473,579
331	Petroleum, crude, etc. ....	1,071,550	1,065,107	1,143,069	5,110	4,616	3,806
332	Petroleum products .....	656,342	707,535	725,103	411,434	441,008	415,028
341	Gas, natural and manu- factured .....	91,901	103,753	106,702	15,402	17,853	19,081
	Total: mineral fuels, lubricants, and related products .....	1,824,080	1,882,696	1,996,107	820,656	945,535	911,494
521	Tar, crude chemicals .....	46,757	34,977	8,727	67,501	65,438	79,590
	Grand total .....	1,870,837	1,917,673	2,004,834	888,157	1,010,973	991,084

<sup>1</sup> Standard International Trade Classification.

Source: U.S. Department of Commerce, Bureau of the Census. U.S. Exports 1964, FT-420 and U.S. Imports for Consumption 1964, FT-125.



Table 43 contrasts U.S. production of the major energy resources in 1964 with world production. While U.S. production of crude petroleum increased this was a smaller portion of the world production than in 1963. Commercial gas production and consumption in the United States during the year was a high proportion of the world total. However, no data for world production and consumption are available for 1964. No significant changes were made in 1964 in the ratio of United States to world production of bituminous coal and of anthracite production and consumption.

TABLE 43.—World production, U.S. production and consumption, selected mineral energy resources

Commodity	1963*				
	World production selected mineral energy resources	U.S. production		U.S. apparent consumption	
		Amount	Percent of world production	Amount	Percent of world production
Crude petroleum.....thousand barrels...	9,537,420	2,752,723	29	3,170,652	33
Natural gas.....million cubic feet...	NA	14,341,255	NA	14,640,480	NA
Bituminous and lignite thousand short tons...	2,725,170	458,928	17	409,225	15
Anthracite.....do.....	201,500	18,267	9	14,200	7
	1964				
Crude petroleum.....thousand barrels...	10,327,591	2,805,125	27	3,241,632	31
Natural gas.....million cubic feet...	NA	15,118,174	NA	15,536,373	NA
Bituminous and lignite thousand short tons...	2,830,258	486,998	17	431,116	15
Anthracite.....do.....	205,700	17,184	8	14,400	7

\* Revised.

NA Not available.

# Employment and Injuries in the Fuel Industries

By Forrest T. Moyer <sup>1</sup>



## Contents

	<i>Page</i>		<i>Page</i>
Introduction .....	35	Peat .....	39
Coal .....	35	Native asphalt .....	39
Coke .....	37	Conclusion .....	40
Oil and gas .....	38		

## INTRODUCTION

**I**NJURY experience and related employment information are presented in the chapter for the coal-mining, coking, oil and gas, peat, and native asphalt industries in the United States for 1964. No attempt has been made to combine these data and present injury-frequency rates reflecting the mineral-fuel industries because the hazards of the separate industries are not comparable. All rates in the text are calculated separately on data before rounding, hence component rates may not add to the total rates shown in the tables. Tabulations showing the trend of injuries and employment for all mineral industries are presented in Volume III.

## COAL

Injury experience of the coal mining industry was improved in 1964, as measured by the declines of 1 and 14 percent, respectively, in the frequency and severity rates. Although the total number of injuries increased in 1964, a slightly greater proportional increase in man-hours worked caused the frequency rate to drop to 44.65 per million man-hours. The injury-severity rate in 1964 was 7,832 days lost per million man-hours of exposure. Employment and injury data for 1964 are based on final data for anthracite mines and preliminary data for bituminous coal and lignite mines. Fatality experience improved significantly with a record low number of 240 deaths in 1964. This total was 44 less than in 1963. The Nation's coal mines during 1964 were free of major disasters (a single accident resulting in the death of five men or more) for the first time since 1956. The

<sup>1</sup> Chief, Branch of Accident Analysis, Division of Accident Prevention and Health.

number of nonfatal injuries was 3 percent above the 1963 total. Employment continued to decline but was only slightly lower than in 1963. The decline in employment was compensated by an increase of 7 in the average number of days worked, with the result that total man-hours of worktime showed a 3 percent gain. Employees averaged 7.87 hours of work per day during 1964.

**Bituminous Coal Mines.**—Preliminary data for bituminous coal and lignite mines in 1964 indicated a 2-percent increase in the number of injuries (fatal and nonfatal). However, an accompanying 4-percent increase in man-hours resulted in a better frequency rate of occurrence per million man-hours, 2 percent lower than in 1963. The severity rate of injuries improved 13 percent over the 1963 rate.

The number of fatal injuries showed a sharp decrease of 14 percent in 1964. The frequency and severity rates of 0.90 and 5,376, respectively, were both 17 percent better than the corresponding 1963 rates of 1.09 and 6,513. Of the 216 fatalities, 187 occurred underground, 13 on the surface, 15 at strip mines, and 1 at an auger mine. Three types of accident caused 89 percent of the overall death total. Falls of roof, face, or rib killed 114 men (53 percent); haulage accidents took 53 lives (24 percent); and machinery accounted for 25 fatalities (12 percent). The remaining fatalities resulted from a variety of causes such as electricity, explosions, explosives, and others. The Bureau of Mines estimated that 10,090 nonfatal lost-time injuries occurred in 1964, 252 more than in 1963. The average number of men working decreased slightly in 1964; days active increased by 8 to a total of 212 days; and worktime increased nearly 9 million man-hours.

TABLE 1.—Employment and injury experience at coal mines in the United States, 1960-64

Industry and year	Average men working daily <sup>1</sup>	Average active mine days <sup>2</sup>	Man-days worked (thousand)	Man-hours worked (thousand)	Number of injuries		Injury rates per million man-hours	
					Fatal	Non-fatal	Frequency	Severity
<b>Bituminous coal mines:<sup>3</sup></b>								
1960.....	170,628	190	32,417	257,075	290	10,501	41.98	9,270
1961.....	151,776	194	29,453	232,871	275	9,902	43.70	9,778
1962.....	147,276	196	28,863	228,287	263	9,783	44.01	9,712
1963.....	143,628	204	29,289	232,136	252	9,838	43.47	8,834
1964 <sup>4</sup> .....	143,300	212	30,404	241,060	216	10,090	42.75	7,678
<b>Anthracite mines:</b>								
1960.....	19,051	176	3,360	24,452	35	1,401	58.73	10,485
1961.....	15,792	196	3,098	22,424	19	1,295	58.60	7,702
1962.....	14,010	204	2,853	20,680	26	1,161	57.40	9,421
1963.....	13,498	216	2,912	21,048	32	1,295	63.05	12,367
1964.....	13,144	214	2,812	20,368	24	1,342	67.07	9,650
<b>Total coal mines:<sup>4</sup></b>								
1960.....	189,679	189	35,778	281,528	325	11,902	43.43	9,376
1961.....	167,568	194	32,551	255,296	294	11,197	45.01	9,596
1962.....	161,236	197	31,716	248,946	289	10,944	45.12	9,688
1963.....	157,126	205	32,200	253,185	284	11,133	45.09	9,128
1964 <sup>4</sup> .....	156,444	212	33,216	261,428	240	11,432	44.65	7,832

<sup>2</sup> Preliminary.

<sup>1</sup> Average number of men at work each day mine was active. Because absenteeism and labor turnover were considered, this number is lower than number of men available for work, as measured by a count of names on payroll.

<sup>3</sup> Average in which operating time of each mine is weighted by average number of workers in mines.

<sup>4</sup> Includes lignite.

<sup>5</sup> Data may not add to total shown because of rounding.

**Anthracite Mines.**—The rate of occurrence of injuries in anthracite mining increased to 67.07 per million man-hours, 6 percent above the 1963 rate. On the other hand, the severity rate was 22 percent better than in 1963, owing principally to the sharp drop in the number of fatal injuries in 1964.

The fatality-frequency rate (1.18) improved 22 percent compared with that of 1963; however, the nonfatal rate (65.89) was 7 percent higher than the corresponding rate for 1963. Of the 24 deaths reported, 22 occurred underground and 2 at preparation plants. Falls of roof, face, or rib claimed nine lives; haulage, five; explosions, explosives, and miscellaneous causes, three each; and an inrush of water, one. Nonfatal injuries totaled 1,342 in 1964, and records show that 917 occurred underground, 167 at strip mines, 15 at culm banks, 2 at dredges, 179 at preparation plants, and 62 at surface operations.

Employment continued to decline with 3-percent fewer men working than in 1963. Employees worked 3-percent fewer man-hours and averaged 1,550 hours for the year, 9 hours less than in 1963. Anthracite mines were active 214 days, 2 less than in 1963.

## COKE

The overall injury-frequency rate of the coking industry in 1964 was 11 percent better than in 1963. Only one fatality was reported in 1964, compared with seven in the preceding year. The number of nonfatal disabilities declined 4 percent from the 1963 figure. The injury-severity rate of the industry, available for the first time in 1964, was 795 days lost per million man-hours of work.

Operating activity of the industry was higher, and the average number of men working daily advanced to 13,447, 3 percent greater than in 1963. The total man-hours of worktime also increased 5 percent in 1964, and the plants were active an average of 357 days, 5 more than in 1963. Employees averaged 2,857 hours during the year and worked an 8-hour shift.

**Slot Ovens.**—Injuries (fatal and nonfatal) at slot ovens dropped 16 percent in number and 19 percent in frequency of occurrence per million man-hours of worktime. Employment increased 3 percent in 1964, and total man-hours gained 4 percent. Slot oven workers had an 8-hour shift and produced 1.7 tons of coke per man-hour. There was no work stoppage in 1964, and the plants were active 6 days more than in 1963.

**Beehive Ovens.**—No fatalities occurred at beehive ovens in 1964 for the second consecutive year. Nonfatal injuries increased 74 percent in number and 33 percent in frequency of occurrence over those of 1963. Employment and man-hours increased 23 and 31 percent, respectively, and employees averaged 1,744 hours for the year while working a 7.9-hour shift.

TABLE 2.—Employment and injury experience at coke ovens in the United States, 1960-64<sup>1</sup>

Industry and year	Average men working daily <sup>2</sup>	Average active mine days <sup>3</sup>	Man-days worked (thousand)	Man-hours worked (thousand)	Number of injuries		Injury rates per million man-hours	
					Fatal	Non-fatal	Frequency	Severity
<b>Slot ovens:</b>								
1960.....	15,779	360	5,673	45,353	3	177	3.97	NA
1961.....	13,106	359	4,707	37,661	3	167	4.51	NA
1962.....	12,723	363	4,623	36,969	9	237	6.65	NA
1963.....	12,696	356	4,524	36,192	7	190	5.44	NA
1964.....	13,021	362	4,713	37,675	1	164	4.38	703
<b>Behive ovens:</b>								
1960.....	684	139	95	712	-----	46	64.57	NA
1961.....	428	196	84	645	-----	26	40.33	NA
1962.....	357	191	68	533	2	15	31.89	NA
1963.....	347	209	73	567	-----	23	40.57	NA
1964.....	426	220	94	743	-----	40	53.83	5,457
<b>All ovens:<sup>4</sup></b>								
1960.....	16,463	350 <sup>5</sup>	5,768	46,066	3	223	4.91	NA
1961.....	13,534	354 <sup>5</sup>	4,791 <sup>5</sup>	38,306	3	193	5.12	NA
1962.....	13,080	359 <sup>5</sup>	4,691 <sup>5</sup>	37,502	11	252	7.01	NA
1963.....	13,043	352 <sup>5</sup>	4,596 <sup>5</sup>	36,759	7	213	5.98	NA
1964.....	13,447	357 <sup>5</sup>	4,807 <sup>5</sup>	38,418	1	204	5.34	795

NA Not available.

<sup>1</sup> All data are final.<sup>2</sup> Average number of men at work each day oven was active. Because absenteeism and labor turnover are taken into consideration, this number is lower than the number of men available for work, as measured by a count of names on payroll.<sup>3</sup> Average in which operating time of each plant is weighted by average number of workers in the plant.<sup>4</sup> Man-days and man-hours of employment have been rounded to the nearest thousand and will not necessarily add to published totals.

## OIL AND GAS

Injury experience for the oil and gas industries in 1964 was not as favorable as in 1963. The frequency rate of 9.51 injuries per million man-hours was 1 percent above that of 1963, and the severity rate of 1,172 days lost per million man-hours showed an increase of 13 percent. Although the total number of injuries was 6 percent lower than the 1963 record, a greater proportional decrease of 7 percent in man-hours caused the frequency and severity rates to rise. Also contributing to the increased severity rate were increases in fatal and permanent total injuries.

Disabling injuries included 109 fatalities and 10 permanent total, 433 permanent partial, and 8,108 temporary total disabilities. For permanent partial and temporary total disabilities the average time loss was 41 days, a decline of 4 days. However, the average severity of all injuries in 1964 was 123 days, compared with 110 days in 1963.

Seven segments of the industries improved their injury experience; the five that did not were exploration, production, pipeline gas, research and engineering, and miscellaneous. Severity rates of injuries dropped in the following six areas: drilling, natural gasoline, pipeline oil, pipeline gas, marine transportation (ocean and coastwise), and refining. The remaining six helped account for the 132-day rise in the severity rate of all injuries. Reduced rates occurred in both frequency and severity in the drilling, natural gasoline, pipeline oil, marine transportation (ocean and coastwise), and refining areas.

**TABLE 3.—Employment and injury experience of the oil industry (all activities) and the natural gas industry (excluding distribution activities) in the United States, 1960-64**

Year	Average men working daily	Man-hours worked (thousand)	Number of injuries <sup>1</sup>		Injury rates per million man-hours	
			Fatal	Nonfatal	Frequency	Severity
1960.....	511, 107	1, 063, 332	82	9, 110	8. 64	812
1961.....	452, 721	951, 743	111	8, 697	9. 25	1, 077
1962.....	469, 256	984, 172	121	9, 336	9. 61	1, 124
1963.....	461, 021	974, 877	93	9, 125	9. 46	1, 040
1964.....	427, 697	910, 525	109	8, 551	9. 51	1, 172

<sup>1</sup> Fatal and permanent total injuries combined for 1960 through 1962. Permanent total injuries included in the nonfatal injury total thereafter.

**PEAT**

There were no fatalities reported in the extraction and processing of peat in 1964; the last fatality occurred in 1959. However, the number of nonfatal injuries more than doubled to a total of 24, occurring at the rate of 21.39 per million man-hours of exposure. The 4 injuries that occurred in the extraction of peat resulted in a frequency rate of 8.40, while 20 injuries in the processing of peat occurred at a rate of 30.97.

Of the 24 nonfatal injuries, 2 were permanent partial disabilities, one from a haulage accident and the other from machinery. Handling material accidents were the ranking cause and accounted for seven injuries. Slips or falls of persons and machinery accidents each caused six injuries, and three resulted from haulage accidents. Miscellaneous causes accounted for the remaining injuries. The average number of men totaled 781, 16 percent greater than in 1963. This gain in employment, coupled with a larger number of active days, resulted in a 17-percent increase in total man-hours worked in the industry.

**TABLE 4.—Employment and injury experience in the peat industry in the United States, 1960-64**

Year	Average men working daily	Man-hours worked (thousand)	Number of injuries		Injury rates per million man-hours	
			Fatal	Nonfatal	Frequency	Severity
1960.....	576	866	-----	24	27. 72	715
1961.....	765	1, 038	-----	17	16. 38	747
1962.....	683	977	-----	19	19. 46	300
1963.....	674	957	-----	11	11. 49	510
1964.....	781	1, 122	-----	24	21. 39	1, 851

**NATIVE ASPHALT**

The rate of occurrence of injuries in the native asphalt operations during 1964 was improved slightly to 41.97 per million man-hours. However, the injury-severity rate of 16,701 days lost per million man-hours was appreciably worse than in 1963.

Two fatalities occurred in 1964, one resulting from a fall of person in the mill and the other from a handling material accident in an open pit mine. The fatalities had a frequency rate of 2.62 per million man-hours of exposure, compared with a rate of 2.29 in 1963 when two fatalities were reported. A total of 30 nonfatal injuries occurred at the frequency rate of 39.34 per million man-hours, a 2-percent decrease from the 1963 figure. The severity rate for nonfatal injuries was 963 days lost per million man-hours, a 17-percent increase over the 1963 rate of 823 days. Seventeen nonfatal injuries were reported in processing plant, 8 in underground, and 5 at surface operations. The leading causes of the nonfatal injuries reported for 1964 follow: nine disabilities resulting from slips or falls; 7 from machinery; and 6 each from haulage and handling material accidents. The average number of men employed in 1964 dropped 12 percent to 369, compared with 417 employed in 1963. Man-hours of worktime also decreased 13 percent from the 1963 figure.

**TABLE 5.—Employment and injury experience at bituminous limestone, bituminous sandstone, and gilsonite mines and mills in the United States, 1960-64**

Year	Average men working daily	Average active days	Man-days worked (thousand)	Man-hours worked (thousand)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1960.....	445	264	117	948	1	38	41.16	7,119
1961.....	383	256	98	792	1	30	39.17	8,766
1962.....	358	279	100	800	-----	13	16.25	146
1963.....	417	260	108	873	2	35	42.41	14,576
1964.....	369	256	94	762	2	30	41.97	16,701

## CONCLUSION

Although man-hours of exposure to work hazards increased in coal mining and the coking of coal, the frequency rate of disabling injuries declined in 1964 in these two industries. The rate of occurrence of injuries improved also in the native asphalt industry, but worsened in the oil and gas and peat industries. Coal mines and coke ovens were active more days than in 1963, while mines in the native asphalt industry were worked 4 fewer days in 1964.

# Coal—Bituminous and Lignite

By W. H. Young<sup>1</sup> and R. L. Anderson<sup>2</sup>



## Contents

	<i>Page</i>		<i>Page</i>
General summary .....	41	Domestic production—Continued	
Scope of report .....	42	Treatment for allaying dust.....	112
Reserves .....	44	Thermal drying.....	115
Thickness of bituminous coal and lignite seams.....	46	Production by States and counties.....	117
Domestic production.....	48	Transportation.....	130
Production by months and weeks.....	53	Consumption.....	134
Summary by States.....	59	Distribution.....	137
Number and size of mines.....	62	Relative rate of growth of mineral fuels and waterpower.....	147
Employment and productivity..	65	Stocks.....	147
Underground mining.....	67	Prices.....	149
Strip mining.....	79	Lignite.....	151
Auger mining.....	93	Foreign trade.....	152
Mechanical loading.....	97	World production.....	155
Mechanical cleaning.....	104	Economic and technical developments.....	158
Water usage.....	110		
Mechanical crushing.....	111		

## GENERAL SUMMARY

**P**RODUCTION of bituminous coal and lignite increased substantially in 1964. There were upward trends also in consumption, average value, exports, mechanization, and productivity. However, a significant decline in employment continued.

**Production.**—The output of bituminous coal and lignite in the United States in 1964—487 million tons—was 6 percent greater than the 459 million tons produced in 1963. The gain was attributed largely to expanded consumption by the electric utilities, greater use at coke ovens, and an increase in exports.

The major seasonal fluctuation in production, as in the past, resulted from the miners' vacation period of 12 days in midsummer. According to the Bureau of Labor Statistics, U.S. Department of Labor, time lost because of strikes totaled 340,000 man-days in 1964, compared with 234,000 man-days in 1963.

**Trend of Employment.**—Employment decreased 9 percent compared with 1963, due largely to increasing mechanization.

<sup>1</sup> Assistant chief, Section of Fuels, Division of Statistics.

<sup>2</sup> Mining engineer, Division of Bituminous Coal.



**Index to Capacity.**—As it is impossible for all mines to operate every working day in the year, an estimate of 280 days for calculating potential capacity was suggested some years ago by the coal committee of the American Institute of Mining, Metallurgical and Petroleum Engineers. The average output per day worked in 1964 was 2.2 million tons, which, if applied to 280 days, gives an annual potential output of 606 million tons, compared with the actual production of 487 million tons. This figure is not a measure of practical productive capacity of the industry because availability of railroad coal cars and other factors bearing on the ability of the industry to produce are not reflected in this computation.

**Mechanization.**—Coal output that was loaded mechanically at underground mines in the United States—87 percent—was 1 percent greater than in the previous year.

**Mechanical Cleaning.**—Approximately 64 percent of the bituminous coal and lignite mined in the United States in 1964 was mechanically cleaned. The growth of mechanical cleaning closely paralleled that of mechanical mining, partly because more refuse was loaded with the coal. Moreover, the bituminous coal and lignite industry has attempted to meet the consumer demand for cleaner coal. A large part of the remaining 36 percent was handpicked and screened into various sizes at tipples where no mechanical cleaning facilities existed.

**Consumption.**—Consumption of bituminous coal and lignite in the United States increased 5 percent, principally in electric utilities and at coke ovens. The remaining principal types of consumers used slightly more coal than in the previous year.

**Trends of Fuel Efficiency.**—For the fourth time in as many years, the fuel efficiency of electric power utilities failed to establish a new record; it remained at 0.86 pound per kilowatt-hour, the same as in 1962, 1962, and 1963.

**Competition with Oil and Gas.**—Although consumption of energy has increased steadily since 1920, the proportion supplied by bituminous coal and lignite has decreased consistently as a result of serious competition from oil and gas, with the exception of a slight increase in 1964. Of total energy consumed in 1964, bituminous coal and lignite furnished 22 percent; anthracite, 1 percent; oil, 40 percent; gas, 33 percent; and waterpower, 4 percent.

Electric utilities consumed 6.6 percent more bituminous coal, 8 percent more gas, and 8 percent more fuel oil in 1964.

**Stocks.**—The reserve supply of bituminous coal and lignite in the hands of industrial consumers and retail coalyards was 75 million tons at the end of the year or 8 percent greater than for the previous year. Days supply increased from 54 to 56 days. Stocks on the upper lake docks decreased 348,106 tons from January 1 to December 31, 1964.

**Exports.**—Exports totaled 48 million tons, increasing 2 percent over those of 1963; 34 million tons was shipped overseas and 14 million tons was shipped to Canada.

### SCOPE OF REPORT

These data include all coal produced in the United States except Pennsylvania anthracite, Texas lignite, and bituminous coal and lignite from mines that produced less than 1,000 tons per year.

Throughout the chapter all tonnage figures show net tons of marketable coal and exclude washery and other refuse. "Tons" refers to net or short tons of 2,000 pounds.

Statistics are final and are based upon detailed annual reports of production and mine operation furnished by producers. All but a small percentage of the output was covered by the reports submitted. For production not directly reported (chiefly that of small mines), accurate data were obtained from the records of the various State mine departments (which have statutory authority to require such reports) or in a few instances, from railroad carloadings. Thus, complete coverage of all mines producing 1,000 tons a year or more is reported. Inclusion of many small mines that produce less than 1,000 tons per year was not attempted.

From 1955 to date the annual production form did not request information on employment. These figures for men working daily, days worked, man-days worked, and tons per man per day were obtained from the Accident Analysis Branch of the Bureau of Mines.

Statistical procedures are also detailed in the following sections: Production by months and weeks, number and size of mines, mechanical cleaning, production by States and counties, consumption, and stocks.

TABLE 1.—Salient statistics of the bituminous coal and lignite industry in the United States

Item	1963	1964	Change from 1963 (percent)
Production..... net tons.....	458,928,175	486,997,952	+6.1
Consumption..... do.....	409,225,000	431,116,000	+5.3
Stocks at end of year:			
Industrial consumers and retail yards..... do.....	70,083,000	75,342,000	+7.5
Stocks on upper lake docks..... do.....	2,945,665	2,597,559	-11.8
Imports and exports: <sup>1</sup>			
Imports..... do.....	267,352	293,059	+9.6
Exports..... do.....	47,078,435	47,969,423	+1.9
Price indicators, average per net ton:			
Cost of coking coal at merchant coke ovens.....	\$9.35	\$9.85	+5.3
Retail price <sup>2</sup> .....	\$17.46	NA	-----
Railroad freight charge <sup>3</sup> .....	\$3.21	NA	-----
Value f.o.b. mines (sold in open market).....	\$4.12	\$4.11	-.2
Value f.o.b. mines.....	\$4.39	\$4.45	+1.4
Equipment sold:			
Mobile loading machines.....	89	111	+24.7
Continuous mining machines.....	137	150	+9.5
Augers.....	36	26	-27.8
Shuttle cars.....	196	311	+58.7
Conveyors:			
Gathering and haulage.....	199	204	+2.5
Room or transfer.....	81	70	-13.6
Method of mining:			
Hand loaded underground..... net tons.....	43,015,565	40,707,408	-5.4
Mechanically loaded underground..... do.....	259,240,835	281,100,506	+8.4
Percentage of total underground production mechanically loaded.....	85.8	87.4	+1.9
Mined by stripping..... net tons.....	144,140,677	151,858,979	+5.4
Mined at sugar mines..... do.....	12,531,098	13,331,059	+6.4
Mechanically cleaned..... do.....	289,462,405	310,202,742	+7.2
Number of mines.....	7,940	7,630	-3.9
Average number of days worked <sup>4</sup> .....	205	225	+9.8
Average number of men working daily <sup>4</sup> .....	141,646	128,698	-9.1
Production per man per day <sup>4</sup> .....	15.83	18.84	+6.4
Fuel efficiency indicator: Pounds of coal per kilowatt-hour at electric power plants <sup>5</sup> .....	0.86	0.86	-----

NA Not available.

<sup>1</sup> Bureau of the Census.

<sup>2</sup> Bureau of Labor Statistics, U.S. Department of Labor.

<sup>3</sup> Interstate Commerce Commission.

<sup>4</sup> Accident Analysis Branch, Bureau of Mines.

<sup>5</sup> Federal Power Commission.

## RESERVES

TABLE 2.—Coal reserves of the United States, January 1, 1960, by States

(Million short tons)

State	Date of publication of estimate	Estimated original reserves				Total	Reserves depleted to Jan. 1, 1960		Remaining reserves, Jan. 1, 1960	Recoverable reserves, Jan. 1, 1960, assuming 50 percent recovery
		Bituminous coal	Subbituminous coal	Lignite	Anthracite and semi-anthracite		Production <sup>1</sup>	Production plus loss in mining <sup>2</sup>		
ALABAMA <sup>a</sup>	(7)	<sup>6</sup> 13,754		20		<sup>6</sup> 13,774	<sup>6</sup> 23	<sup>6</sup> 46	13,728	6,864
ALASKA	(7)	21,401	<sup>8</sup> 71,136	(8)	2,101	94,638	13	26	94,612	47,306
ARKANSAS	1960	1,816		350		2,622	99	198	2,424	1,212
COLORADO	1959	63,203	18,492			81,785	506	1,012	80,773	40,387
GEORGIA	1953	100				100	12	24	76	88
ILLINOIS	1953	137,329				<sup>10</sup> 137,329	<sup>10</sup> 474	<sup>10</sup> 948	136,381	68,190
INDIANA	1953	37,293				37,293	1,148	2,296	34,997	17,499
Iowa <sup>11</sup>	1909	29,180				29,180	357	714	28,445	14,223
KANSAS	B-1951	<sup>9</sup> 20,774		(12)		<sup>9</sup> 20,774	<sup>10</sup> 13	<sup>10</sup> 26	20,748	10,374
KENTUCKY	L-1952	72,318				72,318	2,646	5,292	67,026	33,513
MARYLAND	(4)	<sup>9</sup> 1,200				<sup>9</sup> 1,200	<sup>10</sup> 6	<sup>10</sup> 12	1,188	594
MICHIGAN	1950	297				297	46	92	205	102
Missouri	1913	79,362				79,362	287	574	78,788	39,394
MONTANA	1949	2,363	132,151	87,533		222,047	171	342	221,705	110,853
NEW MEXICO	1950	10,948	50,801		6	61,755	125	260	61,505	30,753
NORTH CAROLINA	1955	112				112	1	2	110	55
NORTH DAKOTA	1953			350,910		350,910	96	192	350,718	175,359
OHIO	1960	46,488				46,488	2,052	4,104	42,384	21,192
OKLAHOMA	1957	3,673		(12)		3,673	180	360	3,313	1,656
OREGON	1955	20	180			200	3	6	194	97
PENNSYLVANIA	B-1928	75,093			22,805	97,898	13,508	27,016	70,882	35,441
	A-1945									
SOUTH DAKOTA	1952			2,033		2,033	1	2	2,031	1,015
TENNESSEE	1959	<sup>18</sup> 1,912				<sup>18</sup> 1,912	<sup>14</sup> 6	<sup>14</sup> 12	1,900	950
TEXAS <sup>11</sup>	B-1909	8,000		7,070		15,070	95	190	14,880	7,440
	L-1955									
UTAH	(7)	28,222	156			28,378	260	520	27,858	13,929
VIRGINIA	1952	11,696			355	12,051	782	1,564	10,487	5,244
Washington	1929	11,413	<sup>9</sup> 52,442	(8)	23	63,878	149	298	63,580	31,790
WEST VIRGINIA	1940	116,618				116,618	6,369	12,738	103,880	61,940
WYOMING	1950	13,235	<sup>8</sup> 108,319	(8)		121,554	402	804	120,750	60,375
Other States	<sup>17</sup>	4,065		<sup>18</sup> 50		4,735	7	14	4,721	2,360
Total		808,420	437,742	447,966	25,836	1,719,964	<sup>19</sup> 29,837	59,674	1,660,290	830,145

<sup>1</sup> Production, 1800 through 1885, from "The first century and a quarter of American coal industry," by H. N. Eavenson, privately printed, Pittsburgh, 1942; production, 1886 through 1923, from U.S. Geological Survey Mineral Resources, annual volumes; production, 1924 through 1957, from Bureau of Mines, Minerals Yearbook, annual volumes, augmented for some States by records of State mine inspectors; production, 1958, from Bureau of Mines, Mineral Market Summary 2974, Sept. 9, 1959; production, 1959, from Bureau of Mines weekly coal reports and partly estimated.

<sup>2</sup> Assuming past losses equal past production.

<sup>3</sup> Reserve estimates of States in capital letters supersede earlier estimates of M. R. Campbell.

<sup>4</sup> New estimate from report in preparation or in press.

<sup>5</sup> Remaining reserves, Jan. 1, 1958.

<sup>6</sup> Production 1958 and 1959 only.

<sup>7</sup> New estimate presented for first time in this report.

<sup>8</sup> Small reserves and production of lignite included under subbituminous coal.

<sup>9</sup> Remaining reserves, Jan. 1, 1950

<sup>10</sup> Production 1950 through 1959.

<sup>11</sup> Reserve estimates of States in lowercase letters were prepared by or under the direction of M. R. Campbell before 1928.

<sup>12</sup> Small reserves of lignite in beds generally less than 30 inches thick.

<sup>13</sup> Remaining reserves, Jan. 1, 1959.

<sup>14</sup> Estimated production 1959 only.

<sup>15</sup> New estimate of lignite reserves; Campbell estimate of bituminous coal reserves.

<sup>16</sup> ARIZONA, CALIFORNIA, Idaho, Nebraska, and Nevada.

<sup>17</sup> ARIZONA, CALIFORNIA, and Idaho.

<sup>18</sup> CALIFORNIA, Idaho, Louisiana, and Nevada.

<sup>19</sup> Less than total recorded production of about 34.8 billion tons. See footnotes 5, 6, 9, 10, 13, and 14.

Source: Averitt, Paul. Coal Reserves of the United States—A Progress Report January 1, 1960. Geol. Survey Bull. 1136, 1961, pp. 10-11.

## THICKNESS OF BITUMINOUS COAL AND LIGNITE SEAMS

The Bureau of Mines compiled and published detailed data on thickness of seams for coal mines in 1960.<sup>3</sup> Because of the importance of seam thickness in mining, these data for 1960 follow.

**TABLE 3.—Number and production of bituminous coal and lignite mines in the United States 1960 classified by thickness of seams mined**

Item	Less than 2 feet	2 to 3 feet	3 to 4 feet	4 to 5 feet	5 to 6 feet	6 to 7 feet	7 to 8 feet	8 feet and over	Total
<b>Number of mines:</b>									
Underground.....	35	1,811	2,178	990	449	266	132	128	5,989
Strip.....	140	510	418	222	106	52	22	60	1,530
Auger.....	3	71	129	94	40	8	-----	1	346
<b>Total.....</b>	<b>178</b>	<b>2,392</b>	<b>2,725</b>	<b>1,306</b>	<b>595</b>	<b>326</b>	<b>154</b>	<b>189</b>	<b>7,865</b>
<b>Percentage of mines:</b>									
Underground.....	0.6	30.2	36.4	16.5	7.5	4.5	2.2	2.1	100.0
Strip.....	9.2	33.3	27.3	14.5	6.9	3.4	1.5	3.9	100.0
Auger.....	.9	20.4	37.3	27.2	11.6	2.3	-----	.3	100.0
<b>Total.....</b>	<b>2.3</b>	<b>30.4</b>	<b>34.6</b>	<b>16.6</b>	<b>7.6</b>	<b>4.1</b>	<b>2.0</b>	<b>2.4</b>	<b>100.0</b>
<b>Production (thousand tons):</b>									
Underground.....	231	20,851	65,322	49,633	53,928	39,833	29,665	25,425	284,888
Strip.....	5,660	19,503	32,934	30,456	17,692	7,126	3,546	5,713	122,630
Auger.....	44	939	2,781	2,965	971	235	-----	59	7,994
<b>Total.....</b>	<b>5,935</b>	<b>41,293</b>	<b>101,037</b>	<b>83,054</b>	<b>72,591</b>	<b>47,194</b>	<b>33,211</b>	<b>31,197</b>	<b>415,512</b>
<b>Percentage of production:</b>									
Underground.....	0.1	7.3	22.9	17.4	19.0	14.0	10.4	8.9	100.0
Strip.....	4.6	15.9	26.9	24.8	14.4	5.8	2.9	4.7	100.0
Auger.....	.5	11.7	35.0	37.1	12.1	2.9	-----	.7	100.0
<b>Total.....</b>	<b>1.4</b>	<b>9.9</b>	<b>24.3</b>	<b>20.0</b>	<b>17.5</b>	<b>11.4</b>	<b>8.0</b>	<b>7.5</b>	<b>100.0</b>

<sup>3</sup> Young, W. H., and R. L. Anderson. Thickness of Bituminous Coal and Lignite Seams Mined in 1960. BuMines Inf. Circ. 8118, 1962, 19 pp.

**TABLE 4.—Number of mines, production, output per man per day, and average thickness of seams mined, at underground, strip, and auger bituminous coal and lignite mines in the United States, 1960, by States**

State	Underground mines				Strip mines				Auger mines				Total, all mines			
	Number of mines	Production (net tons)	Average output per man per day (tons)	Average thickness of seams mined (feet)	Number of mines	Production (net tons)	Average output per man per day (tons)	Average thickness of seams mined (feet)	Number of mines	Production (net tons)	Average output per man per day (tons)	Average thickness of seams mined (feet)	Number of mines	Production (net tons)	Average output per man per day (tons)	Average thickness of seams mined (feet)
Alabama.....	135	10,365,340	7.80	4.1	39	2,558,414	14.96	2.8	3	86,893	26.32	2.7	177	13,010,647	8.66	3.8
Alaska.....	2	66,982	6.01	20.9	6	655,489	15.43	34.6					8	722,471	13.47	34.3
Arizona.....	2	5,526	2.02	5.5									2	5,526	2.02	5.5
Arkansas.....	10	112,774	4.24	2.6	10	296,425	13.38	1.8					20	409,199	8.39	2.0
Colorado.....	87	2,914,437	8.06	7.6	7	692,849	28.46	8.4					94	3,607,286	9.34	7.8
Georgia.....	2	4,215	1.84	1.5									2	4,215	1.84	1.5
Illinois.....	59	23,306,901	17.38	7.5	69	22,670,535	30.04	5.0					128	45,977,436	21.94	6.3
Indiana.....	34	4,752,902	11.96	5.8	47	10,784,937	29.50	4.6					81	15,537,839	20.36	5.0
Iowa.....	19	200,100	4.51	4.9	25	867,924	18.15	4.5					44	1,068,024	11.68	4.6
Kansas.....	2	3,584	2.41	2.1	11	884,690	17.11	1.5					13	888,274	16.70	1.5
Kentucky.....	1,630	44,468,474	10.61	4.3	129	19,672,192	36.16	4.9	105	2,705,826	30.30	4.1	1,864	66,846,492	13.86	4.5
Maryland.....	48	280,198	4.37	3.2	37	487,636	15.51	4.3					85	747,834	8.22	3.9
Missouri.....	10	88,273	3.06	3.6	23	2,801,937	11.83	2.2					33	2,890,210	10.88	2.2
Montana (bituminous and lignite).....	14	115,993	6.17	6.6	5	197,430	37.34	16.6					19	313,423	13.01	12.9
New Mexico.....	18	249,762	6.32	6.3	1	45,000	45.00	3.0					19	294,762	7.27	5.8
North Dakota (lignite).....	1	2,403	7.30	9.0	31	2,522,552	37.07	11.0					32	2,524,955	36.93	11.0
Ohio.....	149	9,206,400	10.95	4.9	265	23,883,289	23.59	3.7	56	867,083	42.45	3.8	470	33,956,772	18.13	4.0
Oklahoma.....	11	247,568	3.10	3.4	15	1,093,965	16.34	1.7					26	1,341,533	9.14	2.0
Pennsylvania.....	680	44,070,560	9.04	5.5	553	20,875,533	17.03	3.2	49	479,172	18.53	3.6	1,282	65,425,265	10.68	4.8
South Dakota (lignite).....					1	20,448	10.10	4.5					1	20,448	10.10	4.5
Tennessee.....	332	3,938,626	6.70	4.2	71	1,763,913	20.97	2.9	12	227,911	25.93	3.7	415	5,930,450	8.71	3.8
Utah.....	45	41,954,693	10.71	10.8									45	4,954,693	10.71	10.8
Virginia.....	1,201	25,819,830	9.44	5.6	35	1,370,864	28.77	4.1	32	647,201	33.04	3.5	1,268	27,837,895	9.92	5.5
Washington.....	9	211,968	6.30	7.8	1	16,177	9.77	2.9					10	228,145	8.46	7.5
West Virginia.....	1,479	109,209,989	11.78	5.1	140	6,764,001	13.65	4.9	89	2,980,287	34.30	4.6	1,708	118,944,277	12.07	5.1
Wyoming.....	10	310,812	7.60	7.5	9	1,713,384	39.20	45.9					19	2,024,196	23.93	40.0
Total.....	5,989	284,888,310	10.64	5.4	1,530	122,629,664	22.93	5.1	346	7,994,373	31.36	4.2	7,865	415,512,347	12.83	5.3

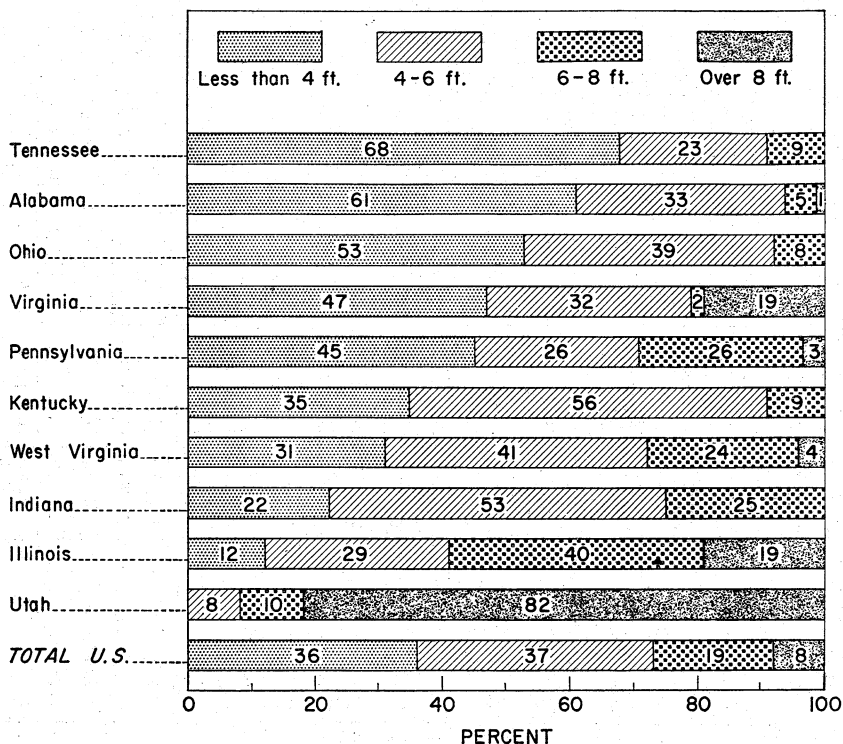


FIGURE 1.—Percentage of bituminous coal and lignite produced in the 10 leading coal-producing States and total United States, 1960, by thickness of seams mined.

## DOMESTIC PRODUCTION

TABLE 5.—Growth of the bituminous coal and lignite mining industry in the United States

Year	Production (net tons)	Value of production		Number of mines	Capacity at 280 days (million tons)	Foreign trade <sup>1</sup>	
		Total	Average per ton			Exports (net tons)	Imports (net tons)
1890	111,302,322	\$110,420,801	\$.99	(?)	137	1,272,396	1,047,416
1891	117,901,238	117,188,400	.99	(?)	148	1,651,694	1,181,677
1892	126,866,567	125,124,381	.99	(?)	162	1,904,556	1,491,800
1893	128,385,231	122,751,618	.96	(?)	174	1,986,383	1,234,499
1894	118,820,405	107,653,501	.91	(?)	196	2,439,720	1,286,268
1895	135,118,193	115,779,771	.86	2,555	196	2,659,987	1,411,323
1896	137,640,276	114,891,515	.83	2,599	202	2,515,838	1,393,095
1897	147,617,519	119,595,224	.81	2,454	213	2,670,157	1,442,534
1898	166,593,623	132,608,713	.80	2,862	221	3,004,304	1,426,108
1899	193,323,187	167,952,104	.87	3,245	230	3,897,994	1,406,838
1900	212,316,112	220,930,313	1.04	(?)	255	6,060,688	1,911,925
1901	225,828,149	236,422,049	1.05	(?)	281	6,455,085	2,214,507
1902	260,216,844	290,858,433	1.12	(?)	316	6,048,777	2,174,393
1903	282,749,348	351,687,933	1.24	(?)	350	5,835,561	4,043,519
1904	278,659,689	305,397,001	1.10	4,650	386	7,206,879	2,179,882

See footnotes at end of table.

TABLE 5.—Growth of the bituminous coal and lignite mining industry in the United States—Continued

Year	Production (net tons)	Value of production		Number of mines	Capacity at 280 days (million tons)	Foreign trade <sup>1</sup>	
		Total	Average per ton			Exports (net tons)	Imports (net tons)
1905.....	315,062,785	334,658,294	1.06	5,060	417	7,512,723	1,704,810
1906.....	342,874,867	381,162,115	1.11	4,430	451	8,014,263	2,039,169
1907.....	394,759,112	451,214,842	1.14	4,550	473	9,869,812	1,892,653
1908.....	332,573,944	374,135,268	1.12	4,730	482	11,071,152	2,219,243
1909.....	379,744,257	405,486,777	1.07	5,775	510	10,101,131	1,375,201
1910.....	417,111,142	469,281,719	1.12	5,818	538	11,663,052	1,819,766
1911.....	405,907,059	451,375,819	1.11	5,887	538	13,259,791	1,972,555
1912.....	450,104,982	517,983,445	1.15	5,747	566	16,475,029	1,456,333
1913.....	478,435,297	565,234,952	1.18	5,776	577	18,013,073	1,767,656
1914.....	422,703,970	493,309,244	1.17	5,592	608	17,589,562	1,520,962
1915.....	442,624,426	502,037,688	1.13	5,502	610	18,776,640	1,703,785
1916.....	502,519,682	665,116,077	1.32	5,726	613	21,254,627	1,713,837
1917.....	551,790,563	1,249,272,837	2.26	6,939	636	23,839,568	1,448,453
1918.....	579,386,520	1,491,809,940	2.58	8,319	650	22,350,730	1,457,073
1919.....	465,860,058	1,160,616,013	2.49	8,994	669	20,113,536	1,011,550
1920.....	568,666,683	2,129,933,000	3.75	8,921	725	38,517,084	1,244,990
1921.....	416,921,950	1,199,983,600	2.89	8,038	781	23,131,166	1,257,539
1922.....	422,208,099	1,274,820,000	3.02	9,299	832	12,413,085	5,059,999
1923.....	504,604,602	1,514,621,000	2.68	9,331	885	21,453,579	1,882,306
1924.....	483,636,538	1,062,626,000	2.20	7,536	792	17,100,347	417,226
1925.....	520,052,741	1,060,402,000	2.04	7,144	748	17,461,560	601,737
1926.....	573,386,985	1,183,412,000	2.06	7,177	747	35,271,937	485,666
1927.....	517,768,352	1,029,657,000	1.99	7,011	759	18,011,744	549,843
1928.....	500,744,970	933,774,000	1.86	6,450	691	16,164,485	546,526
1929.....	534,988,593	952,781,000	1.78	6,037	679	17,429,298	495,219
1930.....	467,526,299	795,483,000	1.70	5,891	700	15,877,407	240,886
1931.....	382,089,396	583,893,000	1.54	5,642	669	12,126,299	206,303
1932.....	309,709,872	406,677,000	1.31	5,427	594	8,814,047	180,909
1933.....	333,630,633	445,783,000	1.34	5,555	559	9,036,947	197,429
1934.....	359,368,022	623,383,000	1.75	6,238	565	10,868,552	179,661
1935.....	372,373,122	658,063,000	1.77	6,315	582	9,742,430	201,871
1936.....	439,087,903	770,955,000	1.76	6,875	618	10,654,959	271,798
1937.....	445,831,449	864,042,000	1.94	6,548	646	13,144,678	257,036
1938.....	348,844,764	678,653,000	1.95	5,777	602	10,490,269	241,305
1939.....	394,855,325	728,348,366	1.84	5,820	621	11,590,478	355,115
1940.....	460,771,500	879,327,227	1.91	6,324	639	16,465,928	371,571
1941.....	514,149,245	1,125,362,836	2.19	6,822	666	20,740,471	390,049
1942.....	582,692,937	1,373,960,608	2.36	6,972	683	22,043,305	498,103
1943.....	590,177,069	1,584,644,477	2.69	6,620	626	25,836,208	757,634
1944.....	619,576,240	1,810,900,542	2.92	6,928	624	26,032,348	633,689
1945.....	577,617,327	1,768,204,320	3.06	7,033	620	27,956,192	467,473
1946.....	533,922,068	1,835,539,476	3.44	7,333	699	41,197,378	434,680
1947.....	630,623,722	2,622,634,046	4.16	8,700	755	68,666,963	290,141
1948.....	599,518,229	2,993,267,021	4.99	9,079	774	45,930,133	291,337
1949.....	437,869,036	2,136,870,571	4.88	8,559	781	27,842,056	314,980
1950.....	516,311,053	2,500,373,779	4.84	9,429	790	25,468,403	346,706
1951.....	533,664,732	2,626,030,137	4.92	8,009	736	56,721,547	292,373
1952.....	466,840,782	2,289,180,401	4.90	7,275	703	47,643,150	262,268
1953.....	457,290,449	2,247,943,799	4.92	6,671	670	33,760,263	226,900
1954.....	391,706,300	1,769,619,723	4.52	6,130	603	31,040,564	188,799
1955.....	464,633,408	2,092,382,737	4.50	7,856	620	51,277,256	337,145
1956.....	500,874,077	2,412,004,151	4.82	8,520	655	68,552,629	355,701
1957.....	492,703,916	2,504,406,042	5.08	8,539	680	76,445,529	366,506
1958.....	410,445,547	1,996,281,274	4.86	8,264	625	50,293,382	306,940
1959.....	412,027,502	1,965,606,901	4.77	7,719	614	37,253,431	374,713
1960.....	415,512,347	1,950,425,049	4.69	7,865	609	36,541,075	260,495
1961.....	402,976,802	1,844,562,662	4.58	7,648	585	34,969,825	164,289
1962.....	422,149,325	1,891,554,474	4.48	7,740	594	38,413,424	232,424
1963.....	458,928,175	2,013,309,368	4.39	7,940	627	47,078,435	267,352
1964.....	486,997,952	2,165,581,847	4.45	7,630	606	47,969,423	293,059

See footnotes at end of table.



TABLE 5.—Growth of the bituminous coal and lignite mining industry in the United States—Continued

Year	Men employed	Average number of days worked	Average days lost per man on strike	Net tons per man—		Percentage of underground production—		Percentage of total production—	
				Per day	Per year	Cut by machines †	Mechanically loaded	Mechanically cleaned ‡	Mined by stripping
1890.....	192, 204	226	(?)	2.56	579	(?)	(?)	(?)	(?)
1891.....	205, 803	223	(?)	2.57	573	5.3	(?)	(?)	(?)
1892.....	212, 893	219	(?)	2.72	596	(?)	(?)	(?)	(?)
1893.....	230, 365	204	(?)	2.73	557	(?)	(?)	(?)	(?)
1894.....	244, 603	171	(?)	2.84	486	(?)	(?)	(?)	(?)
1895.....	239, 962	194	(?)	2.90	563	(?)	(?)	(?)	(?)
1896.....	244, 171	192	(?)	2.94	564	11.9	(?)	(?)	(?)
1897.....	247, 817	196	(?)	3.04	596	15.3	(?)	(?)	(?)
1898.....	255, 717	211	(?)	3.09	651	19.5	(?)	(?)	(?)
1899.....	271, 027	234	46	3.05	713	22.7	(?)	(?)	(?)
1900.....	304, 375	234	43	2.98	697	24.9	(?)	(?)	(?)
1901.....	340, 235	225	35	2.94	694	25.6	(?)	(?)	(?)
1902.....	370, 056	230	44	3.06	703	26.8	(?)	(?)	(?)
1903.....	415, 777	225	28	3.02	680	27.6	(?)	(?)	(?)
1904.....	437, 832	202	44	3.15	637	28.2	(?)	(?)	(?)
1905.....	460, 629	211	23	3.24	684	32.8	(?)	(?)	(?)
1906.....	478, 425	213	63	3.36	717	34.7	(?)	2.7	(?)
1907.....	513, 258	234	14	3.29	709	35.1	(?)	2.9	(?)
1908.....	516, 264	193	38	3.34	644	37.0	(?)	3.6	(?)
1909.....	543, 152	209	29	3.34	699	37.5	(?)	3.8	(?)
1910.....	555, 533	217	89	3.46	751	41.7	(?)	3.8	(?)
1911.....	549, 775	211	27	3.50	738	43.9	(?)	(?)	(?)
1912.....	548, 032	223	35	3.68	820	46.8	(?)	3.9	(?)
1913.....	571, 882	232	36	3.61	837	50.7	(?)	4.6	(?)
1914.....	583, 506	195	80	3.71	724	51.8	(?)	4.8	0.3
1915.....	557, 456	203	61	3.91	794	55.3	(?)	4.7	.6
1916.....	561, 102	230	26	3.90	896	56.9	(?)	4.6	.8
1917.....	603, 143	243	17	3.77	915	58.1	(?)	4.6	1.0
1918.....	615, 305	249	7	3.78	942	56.7	(?)	3.8	1.4
1919.....	621, 998	195	37	3.84	749	60.0	(?)	3.6	1.2
1920.....	639, 547	220	22	4.00	881	60.7	(?)	3.3	1.5
1921.....	663, 754	149	23	4.20	627	66.4	(?)	3.4	1.2
1922.....	687, 958	142	117	4.28	609	64.8	(?)	(?)	2.4
1923.....	704, 793	179	20	4.47	801	68.3	0.3	3.8	2.1
1924.....	619, 604	171	73	4.56	781	71.5	.7	(?)	2.8
1925.....	588, 493	195	30	4.52	884	72.9	1.2	(?)	3.2
1926.....	593, 647	215	24	4.50	966	73.8	1.9	(?)	3.0
1927.....	593, 918	191	153	4.55	872	74.9	3.3	5.3	3.6
1928.....	522, 150	203	83	4.73	959	76.9	4.5	5.7	4.0
1929.....	502, 993	219	11	4.85	1,064	78.4	7.4	6.9	3.8

See footnotes at end of table.

TABLE 5.—Growth of the bituminous coal and lignite mining industry in the United States—Continued

Year	Men employed	Average number of days worked	Average days lost per man on strike	Net tons per man—		Percentage of underground production—		Percentage of total production—	
				Per day	Per year	Cut by machines †	Mechanically loaded	Mechanically cleaned ‡	Mined by stripping §
1930.....	493,202	187	43	5.06	948	81.0	10.5	8.3	4.3
1931.....	460,213	160	35	5.30	849	82.2	13.1	9.5	5.0
1932.....	406,380	146	120	5.22	762	84.1	12.3	9.8	6.3
1933.....	418,703	167	30	4.78	797	84.7	12.0	10.4	5.5
1934.....	468,011	178	15	4.40	785	84.1	12.2	11.1	5.8
1935.....	462,403	179	47	4.50	805	84.2	13.5	12.2	6.4
1936.....	477,204	199	21	4.62	920	84.8	16.3	13.9	6.4
1937.....	491,864	193	19	4.69	906	(?)	20.2	14.0	7.1
1938.....	441,333	162	13	4.89	790	87.5	26.7	18.2	8.7
1939.....	421,738	178	36	5.25	936	88.9	31.0	20.1	9.6
1940.....	439,075	202	8	5.19	1,049	87.4	35.4	22.2	9.2
1941.....	456,981	216	27	5.20	1,125	89.0	40.7	22.9	10.7
1942.....	461,991	246	7	5.12	1,261	89.7	45.2	24.4	11.5
1943.....	416,007	264	15	5.38	1,419	90.3	48.9	24.7	13.5
1944.....	393,347	278	5	5.67	1,575	90.5	52.9	25.6	16.3
1945.....	383,100	261	9	5.78	1,508	90.8	56.1	25.6	19.0
1946.....	396,434	214	23	6.30	1,347	90.8	58.4	26.0	21.1
1947.....	419,182	234	5	6.42	1,504	90.0	60.7	27.7	22.1
1948.....	441,631	217	16	6.26	1,358	90.7	64.3	30.2	23.3
1949.....	433,698	157	15	6.43	1,010	91.4	67.0	35.1	24.2
1950.....	415,532	183	56	6.77	1,239	91.8	69.4	38.5	23.9
1951.....	372,897	203	4	7.04	1,429	93.4	73.1	45.0	22.0
1952.....	335,217	186	6	7.47	1,389	92.8	75.6	48.7	23.3
1953.....	293,106	191	3	8.17	1,560	92.3	79.6	52.9	23.1
1954.....	227,397	182	4	9.47	1,724	88.8	84.0	59.4	25.1
1955.....	225,093	210	4	9.84	2,064	88.1	84.6	58.7	24.8
1956.....	228,163	214	4	10.28	2,195	84.6	84.0	58.4	25.4
1957.....	228,635	203	3	10.59	2,155	80.9	84.8	61.7	25.2
1958.....	197,402	184	3	11.33	2,079	75.3	84.9	63.1	28.3
1959.....	179,636	188	24	12.22	2,294	72.1	86.0	65.5	29.4
1960.....	169,400	191	4	12.83	2,453	67.8	86.3	65.7	29.5
1961.....	150,474	193	4	13.87	2,678	64.7	86.3	65.7	30.3
1962.....	143,822	199	6	14.72	2,935	63.3	85.7	64.3	30.9
1963.....	141,646	205	6	15.33	3,240	61.0	85.8	63.1	31.4
1964.....	128,698	225	6	16.84	3,784	57.4	87.4	63.7	31.2

† Figures for 1890-1914 represent fiscal year ended June 30. ‡ Data not available.  
 § Percentages for 1890-1913 are of total production, as a separation of underground and strip production is not available for these years. Exclusive of continuous mining which began in 1948.  
 ¶ Percentages for 1906-26 are exclusive of coal cleaned at central washeries operated by consumers.  
 § Bureau of Labor Statistics, U.S. Department of Labor.  
 ¶ Average number of men working daily.

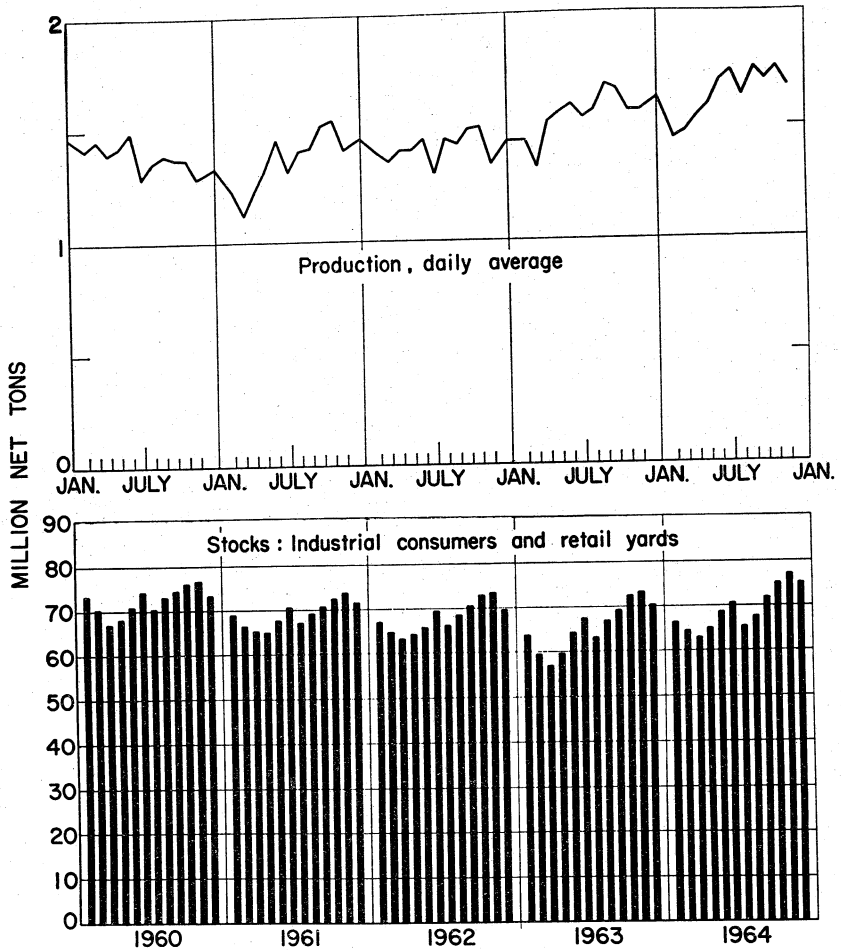


FIGURE 2.—Trends of production and stocks of bituminous coal and lignite in the United States, 1960-64.

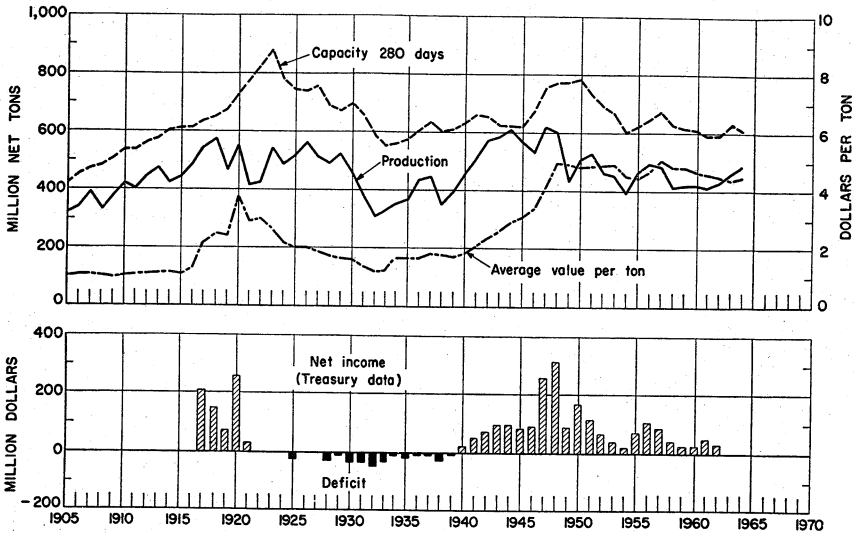


FIGURE 3.—Trends of bituminous coal and lignite production, realization, mine capacity, and net income or deficit in the United States, 1905-64.

### PRODUCTION BY MONTHS AND WEEKS

The figures on monthly and weekly production are estimates based upon railroad carloadings of coal reported daily and weekly by all important carriers, shipments on the Allegheny and Monongahela Rivers reported by the U.S. Army Engineers, direct reports from mining companies, and monthly production statements compiled by certain local operators associations and State mine departments. In computing the estimates, allowance is made for commercial truck shipments, local sales, colliery fuel, and small truck mines producing over 1,000 tons a year.

Preliminary estimates are made currently and published in the Weekly Coal Reports. These preliminary estimates have proved very reliable and for many years have been within approximately 1 percent of the final figure of total production, based upon complete coverage of all mines producing over 1,000 tons a year. The preliminary estimates are later revised to agree with the final total production based on the canvass. Thus, the monthly and weekly estimates of production, summarized in tables 6 to 9, represent final figures and vary slightly from the preliminary figures of production published in the Weekly Coal Reports.

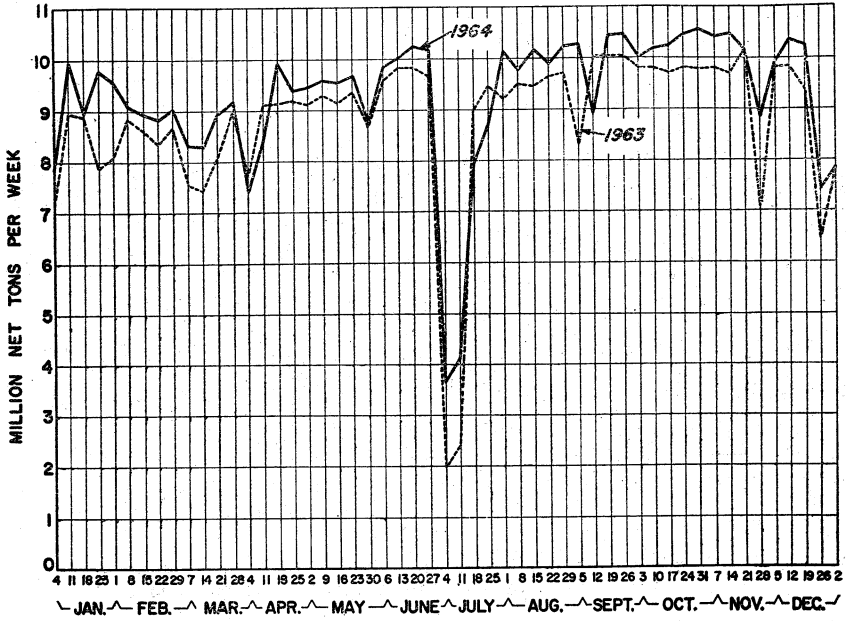


FIGURE 4.—Production of bituminous coal and lignite in the United States, 1963-64, by weeks.

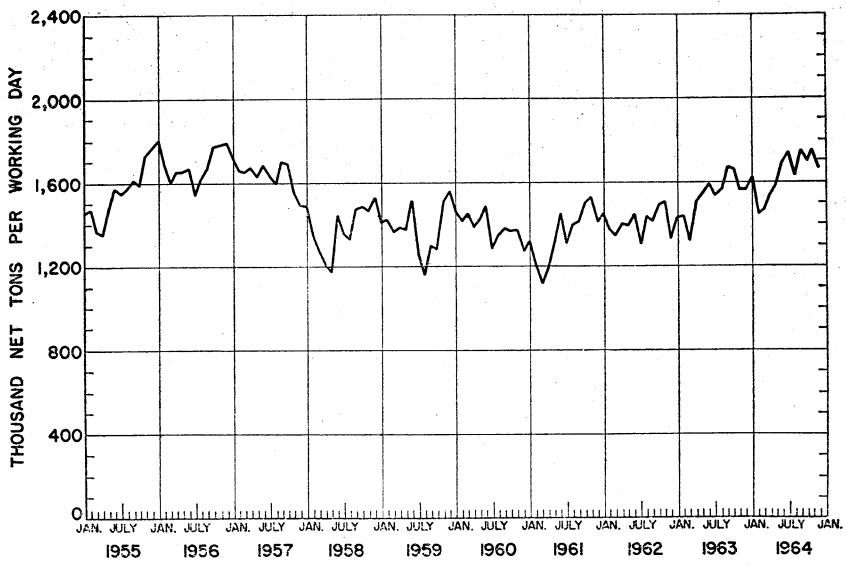


FIGURE 5.—Average production of bituminous coal and lignite in the United States, per working day in each month, 1955-64.

TABLE 6.—Production of bituminous coal and lignite in the United States, with estimates by months

Month	Production (thousand net tons)		Maximum number of working days		Average production per working day (thousand net tons)	
	1963	1964	1963	1964	1963	1964
January.....	37,301	42,152	26	26	1,435	1,621
February.....	34,493	36,153	24	25	1,437	1,446
March.....	34,086	38,217	26	26	1,311	1,470
April.....	38,579	39,005	25.4	25.4	1,519	1,536
May.....	41,556	39,730	26.6	25	1,562	1,589
June.....	39,458	42,068	24.7	24.8	1,597	1,696
July.....	28,070	32,349	18.3	18.6	1,534	1,739
August.....	42,299	42,409	27	26	1,567	1,631
September.....	40,320	43,752	24	25	1,680	1,750
October.....	44,876	45,922	27	27	1,662	1,701
November.....	38,820	41,877	24.9	23.9	1,559	1,752
December.....	39,070	43,364	25	26	1,563	1,668
Total.....	458,928	486,998	298.9	298.7	1,535	1,630

TABLE 7.—Production of bituminous coal and lignite in the United States, 1964, by States, with estimates by months

(Thousand net tons)

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
Alabama.....	1,258	1,211	1,337	1,244	1,002	1,311	862	1,260	1,186	1,258	1,212	1,294	14,435
Alaska.....	84	75	76	60	39	48	45	58	49	61	69	81	745
Arkansas.....	24	20	20	20	19	21	14	18	15	14	13	14	212
Colorado.....	449	361	314	282	296	332	217	310	367	427	442	558	4,355
Georgia.....	1	1	1	1	1	1	1	1	1	1	1	1	4
Illinois.....	4,042	4,263	4,596	4,438	4,338	4,564	3,217	4,732	4,844	5,245	4,708	5,141	55,023
Indiana.....	1,612	1,324	1,341	1,195	1,139	1,185	825	1,132	1,213	1,413	1,228	1,468	15,075
Iowa.....	97	67	39	82	60	76	82	77	83	66	104	140	973
Kansas.....	91	92	102	90	107	85	73	139	147	142	87	108	1,263
Kentucky:													
Eastern.....	3,861	2,975	3,348	3,712	3,670	3,866	3,194	3,992	4,171	4,366	3,920	3,816	44,891
Western.....	3,457	2,894	2,796	2,923	3,170	3,241	2,525	3,402	3,531	3,558	3,063	3,296	37,856
Total Kentucky.....	7,318	5,869	6,144	6,635	6,840	7,107	5,719	7,394	7,702	7,924	6,983	7,112	82,747
Maryland.....	87	95	92	93	78	87	94	103	93	102	100	112	1,136
Missouri.....	363	272	218	195	246	303	227	270	266	268	305	321	3,254
Montana:													
Bituminous.....	4	3	4	3	4	4	4	4	3	4	4	5	46
Lignite.....	25	18	23	21	24	29	26	23	18	29	28	36	300
Total Montana.....	29	21	27	24	28	33	30	27	21	33	32	41	346
New Mexico.....	244	236	282	277	247	271	125	242	264	283	250	248	2,969
North Dakota (lignite).....	308	232	221	168	146	138	175	161	198	248	263	379	2,637
Ohio.....	2,727	2,319	2,467	2,985	3,263	3,664	3,091	3,353	3,565	3,566	3,449	2,861	37,310
Oklahoma.....	87	68	79	95	88	101	85	77	84	88	75	101	1,028
Pennsylvania.....	6,518	6,114	5,996	5,849	6,229	6,388	5,091	6,608	6,786	7,231	6,733	6,988	76,531
South Dakota (lignite).....	3	2	2	1	1	1	1	1	1	1	1	2	13
Tennessee.....	515	445	528	495	512	526	487	537	500	511	458	476	5,990
Utah.....	465	417	439	367	388	364	200	356	426	403	414	481	4,720
Virginia.....	2,823	2,365	2,642	2,544	2,661	2,805	2,339	2,736	2,752	2,830	2,539	2,718	31,654
Washington.....	10	8	5	4	4	3	2	3	4	5	7	13	68
West Virginia.....	11,670	10,016	11,112	11,679	11,848	12,507	9,172	12,635	12,942	13,470	12,082	12,276	141,409
Wyoming.....	427	260	237	183	152	149	177	181	245	333	327	430	3,101
Total.....	42,152	36,153	38,217	39,005	39,730	42,068	32,349	42,409	43,752	45,922	41,877	43,364	486,998

TABLE 8.—Production of bituminous coal and lignite in the United States, 1964, by districts, with estimates by months

(Thousand net tons)

District	January	February	March	April	May	June	July	August	September	October	November	December	Total
1. Eastern Pennsylvania.....	3,224	3,030	2,979	2,916	3,085	3,173	2,553	3,293	3,369	3,589	3,345	3,476	38,032
2. Western Pennsylvania.....	3,476	3,260	3,197	3,119	3,322	3,406	2,715	3,524	3,618	3,856	3,590	3,726	40,809
3. Northern West Virginia.....	3,556	3,055	3,322	3,500	3,778	3,928	3,111	3,988	4,072	4,231	3,819	3,843	44,203
4. Ohio.....	2,727	2,319	2,467	2,985	3,263	3,664	3,091	3,353	3,565	3,596	3,449	2,861	37,310
5. Michigan.....													
6. Panhandle.....	427	368	400	421	455	472	374	480	490	509	459	462	5,317
7. Southern Numbered 1.....	3,271	2,799	3,128	3,270	3,224	3,430	2,441	3,446	3,530	3,674	3,285	3,368	38,866
8. Southern Numbered 2.....	11,409	9,402	10,479	11,040	11,024	11,657	9,078	11,765	12,058	12,541	11,236	11,409	133,098
9. West Kentucky.....	3,487	2,894	2,796	2,923	3,170	3,241	2,625	3,402	3,531	3,558	3,063	3,296	37,856
10. Illinois.....	4,942	4,263	4,596	4,438	4,338	4,564	3,217	4,732	4,844	5,245	4,703	5,141	55,023
11. Indiana.....	1,612	1,324	1,341	1,195	1,139	1,185	825	1,132	1,213	1,413	1,228	1,468	15,075
12. Iowa.....	97	67	39	82	60	76	82	77	83	66	104	140	973
13. Southeastern.....	1,370	1,308	1,451	1,350	1,112	1,424	967	1,375	1,293	1,368	1,310	1,397	15,725
14. Arkansas-Oklahoma.....	61	49	53	60	56	64	50	51	51	51	45	57	648
15. Southwestern.....	504	403	366	340	404	446	349	453	461	461	435	487	5,109
16. Northern Colorado.....	113	78	61	38	33	37	14	41	59	87	83	122	766
17. Southern Colorado.....	369	315	291	281	296	332	220	302	344	378	393	470	3,991
18. New Mexico.....	211	204	244	240	214	234	108	209	228	245	216	214	2,567
19. Wyoming.....	427	260	237	183	152	149	177	181	245	333	327	430	3,101
20. Utah.....	465	417	439	367	388	364	200	356	426	403	414	481	4,720
21. North-South Dakota.....	311	234	223	169	146	138	175	161	198	249	265	381	2,650
22. Montana.....	29	21	27	24	28	33	30	27	21	33	32	41	346
23. Washington.....	94	83	81	64	43	51	47	61	53	66	76	94	813
Total.....	42,152	36,153	38,217	39,005	39,730	42,068	32,349	42,409	43,752	45,922	41,877	43,364	486,998



TABLE 9.—Production of bituminous coal and lignite in the United States, with estimates by weeks

1963				1964			
Week ended—	Production (thousand net tons)	Maximum number of work- ing days	Average production per working day (thousand net tons)	Week ended—	Production (thousand net tons)	Maximum number of work- ing days	Average production per working day (thousand net tons)
Jan. 5.....	15,632	14	1,120	Jan. 4.....	14,260	13	1,170
Jan. 12.....	8,941	6	1,490	Jan. 11.....	9,942	6	1,657
Jan. 19.....	8,836	6	1,473	Jan. 18.....	8,956	6	1,493
Jan. 26.....	7,852	6	1,309	Jan. 25.....	9,771	6	1,629
Feb. 2.....	8,125	6	1,354	Feb. 1.....	9,550	6	1,592
Feb. 9.....	8,855	6	1,476	Feb. 8.....	9,073	6	1,512
Feb. 16.....	8,553	6	1,426	Feb. 15.....	8,918	6	1,486
Feb. 23.....	8,297	6	1,363	Feb. 22.....	8,821	6	1,470
Mar. 2.....	8,709	6	1,452	Feb. 29.....	9,014	6	1,502
Mar. 9.....	7,648	6	1,258	Mar. 7.....	8,328	6	1,388
Mar. 16.....	7,431	6	1,230	Mar. 14.....	8,307	6	1,385
Mar. 23.....	8,116	6	1,353	Mar. 21.....	8,950	6	1,492
Mar. 30.....	8,985	6	1,498	Mar. 28.....	9,199	6	1,533
Apr. 6.....	7,716	5.4	1,420	Apr. 4.....	7,412	5.4	1,373
Apr. 13.....	9,123	6	1,521	Apr. 11.....	8,390	6	1,393
Apr. 20.....	9,119	6	1,520	Apr. 18.....	9,944	6	1,657
Apr. 27.....	9,191	6	1,532	Apr. 25.....	9,359	6	1,565
May 4.....	9,097	6	1,516	May 2.....	9,461	6	1,577
May 11.....	9,308	6	1,551	May 9.....	9,588	6	1,598
May 18.....	9,127	6	1,521	May 16.....	9,551	6	1,592
May 25.....	9,853	6	1,559	May 23.....	9,667	6	1,611
June 1.....	8,609	5.6	1,537	May 30.....	8,766	5	1,753
June 8.....	9,550	6	1,592	June 6.....	9,847	6	1,641
June 15.....	9,858	6	1,643	June 13.....	10,009	6	1,668
June 22.....	9,871	6	1,645	June 20.....	10,247	6	1,708
June 29.....	9,671	5.7	1,697	June 27.....	10,174	5.9	1,724
July 6.....	1,958	1	1,958	July 4.....	3,658	1.9	1,925
July 13.....	2,431	2.3	1,057	July 11.....	4,108	2.2	1,867
July 20.....	8,947	6	1,491	July 18.....	7,957	4.4	1,808
July 27.....	9,475	6	1,579	July 25.....	8,689	6	1,448
Aug. 3.....	9,214	6	1,536	Aug. 1.....	10,155	6	1,693
Aug. 10.....	9,521	6	1,587	Aug. 8.....	9,766	6	1,628
Aug. 17.....	9,465	6	1,578	Aug. 15.....	10,178	6	1,696
Aug. 24.....	9,625	6	1,604	Aug. 22.....	9,882	6	1,647
Aug. 31.....	9,733	6	1,622	Aug. 29.....	10,238	6	1,706
Sept. 7.....	8,231	5	1,646	Sept. 5.....	10,269	6	1,712
Sept. 14.....	10,055	6	1,676	Sept. 12.....	8,927	5	1,785
Sept. 21.....	10,042	6	1,674	Sept. 19.....	10,445	6	1,741
Sept. 28.....	10,037	6	1,673	Sept. 26.....	10,468	6	1,745
Oct. 5.....	9,812	6	1,635	Oct. 3.....	10,013	6	1,669
Oct. 12.....	9,819	6	1,637	Oct. 10.....	10,183	6	1,697
Oct. 19.....	9,710	6	1,618	Oct. 17.....	10,248	6	1,708
Oct. 26.....	9,812	6	1,635	Oct. 24.....	10,470	6	1,745
Nov. 2.....	9,770	6	1,628	Oct. 31.....	10,569	6	1,762
Nov. 9.....	9,808	6	1,635	Nov. 7.....	10,422	6	1,737
Nov. 16.....	9,705	5.9	1,645	Nov. 14.....	10,495	5.9	1,779
Nov. 23.....	10,167	6	1,695	Nov. 21.....	10,146	6	1,691
Nov. 30.....	7,048	5	1,410	Nov. 28.....	8,846	5	1,769
Dec. 7.....	9,854	6	1,642	Dec. 5.....	9,924	6	1,654
Dec. 14.....	9,852	6	1,642	Dec. 12.....	10,370	6	1,728
Dec. 21.....	9,325	6	1,554	Dec. 19.....	10,248	6	1,708
Dec. 28.....	6,449	5	1,290	Dec. 26.....	7,435	5	1,487
Jan. 4.....	13,590	12	1,170	Jan. 2.....	17,355	14	1,270
Total.....	458,928	298.9	1,535	Total.....	486,998	298.7	1,630

<sup>1</sup> Figures represent output and number of working days in that part of week included in calendar year shown. Total production for the week ending January 5, 1963, was 7,100,000 net tons and for the week ending January 2, 1965, was 7,850,000 net tons.

<sup>2</sup> Average daily output for the entire week and not for working days in the calendar year shown.

## SUMMARY BY STATES

**TABLE 10.—Bituminous coal and lignite produced in the United States, by States, with production of maximum year and cumulative production from earliest record to end of 1964**

(Thousand net tons)

State	Maximum production		Production, by years										Total production from earliest record to end of 1964
	Year	Quantity	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	
Alabama.....	1926	21,001	13,088	12,663	13,260	11,182	11,947	13,011	12,915	12,880	12,359	14,435	1,012,234
Arkansas.....	1907	2,670	578	590	2,608	364	441	409	395	256	221	212	99,751
Colorado.....	1917	12,483	3,568	3,502	3,594	2,974	3,294	3,607	3,678	3,379	3,690	4,355	525,222
Illinois.....	1918	89,291	45,932	48,102	46,993	43,912	45,466	45,977	45,246	48,487	51,736	55,023	3,862,419
Indiana.....	1918	30,679	16,149	17,089	15,841	15,022	14,804	15,538	15,106	15,709	15,100	15,075	1,225,691
Iowa.....	1917	8,966	1,258	1,358	1,312	1,179	1,180	1,068	927	1,130	1,213	973	356,818
Kansas.....	1918	7,562	742	884	749	823	772	888	664	915	1,169	1,263	284,122
Kentucky.....	1947	84,241	69,020	74,555	74,667	66,312	62,810	66,847	63,032	69,212	77,350	82,747	3,003,931
Maryland.....	1907	5,533	512	669	748	838	842	748	757	821	1,162	1,136	270,835
Missouri.....	1917	5,671	3,232	3,283	2,976	2,592	2,748	2,890	2,938	2,896	3,174	3,254	301,545
Montana.....	1944	4,844	1,247	846	413	305	345	313	371	382	343	346	172,473
New Mexico.....	1918	4,023	201	158	137	117	148	295	412	677	1,945	2,969	131,406
North Dakota.....	1950	3,261	3,102	2,815	2,561	2,314	2,413	2,525	2,726	2,733	2,399	2,637	106,137
Ohio.....	1920	45,878	37,870	38,934	36,862	32,028	35,112	33,957	32,226	34,125	36,790	37,310	2,232,021
Oklahoma.....	1920	4,849	2,164	2,007	2,195	1,630	1,525	1,342	1,031	1,048	1,008	1,028	184,931
Pennsylvania.....	1918	178,551	85,713	90,287	85,365	67,771	65,347	65,425	62,652	65,515	71,501	76,531	8,570,254
Tennessee.....	1956	8,848	7,053	8,848	7,955	6,785	5,913	5,931	5,860	6,213	6,121	5,990	418,613
Utah.....	1947	7,429	6,296	6,522	6,858	5,328	4,545	4,955	5,159	4,297	4,360	4,720	281,404
Virginia.....	1964	31,654	23,508	28,063	29,506	26,826	29,769	27,838	30,332	29,474	30,531	31,654	937,776
Washington.....	1918	4,082	610	473	360	252	242	228	191	235	190	68	149,182
West Virginia.....	1947	176,157	139,168	155,891	156,842	119,468	119,692	118,944	113,071	118,490	132,568	141,409	6,976,535
Wyoming.....	1945	9,847	2,927	2,553	2,117	1,629	1,977	2,024	2,529	2,569	3,124	3,101	414,953
Other States <sup>1</sup> .....			695	782	885	795	696	752	759	897	874	762	188,814
<b>Total.....</b>	<b>1947</b>	<b>630,624</b>	<b>464,633</b>	<b>500,874</b>	<b>492,704</b>	<b>410,446</b>	<b>412,028</b>	<b>415,512</b>	<b>402,977</b>	<b>422,149</b>	<b>458,928</b>	<b>486,998</b>	<b>31,697,067</b>

<sup>1</sup> Production, if any, in Alaska, Arizona, California, Georgia, Idaho, Michigan, North Carolina, Oregon, South Dakota, Texas, and North Dakota in 1954 included in "Other States."

TABLE 11.—Number of mines, production, value, men working daily, days active, man-days, and output per man per day at bituminous coal and lignite mines in the United States, 1964, by States

State	Production (net tons)					Average value per ton <sup>3</sup>	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day
	Number of active mines	Shipped by rail or water <sup>1</sup>	Shipped by truck	Used at mine <sup>2</sup>	Total					
Alabama.....	175	11,883,501	1,900,475	651,478	14,435,454	\$6.83	5,421	219	1,187,345	12.16
Alaska.....	5	725,862	12,003	7,077	744,942	6.72	177	267	47,208	15.78
Arkansas.....	11	210,335	1,980	-----	212,315	7.08	107	189	20,245	10.49
Colorado.....	82	3,389,394	870,097	95,754	4,355,245	5.38	1,713	191	327,636	13.29
Georgia.....	1	3,900	-----	-----	3,900	3.82	13	111	1,444	2.70
Illinois.....	102	49,639,963	5,280,203	102,436	55,022,602	3.79	8,172	248	2,028,357	27.13
Indiana.....	60	11,109,793	2,543,966	1,420,872	15,074,631	3.80	2,568	216	555,016	27.16
Iowa.....	34	664,466	307,805	943	973,214	3.54	351	214	75,171	12.95
Kansas.....	7	960,232	299,324	3,853	1,263,409	4.55	248	248	61,424	20.57
Kentucky.....	2,002	68,177,805	14,507,708	61,658	82,747,171	3.75	22,590	199	4,496,735	18.40
Maryland.....	67	619,573	516,245	13	1,135,836	3.97	316	236	74,503	15.25
Missouri.....	20	1,777,112	438,343	1,037,975	3,253,430	4.08	466	236	110,156	29.53
Montana:										
Bituminous.....	9	4,125	41,547	234	45,906	7.40	61	123	7,532	6.09
Lignite.....	4	293,117	6,819	5	299,941	1.95	29	198	5,747	52.19
Total Montana.....	13	297,242	48,366	239	345,847	2.68	90	148	13,279	26.04
New Mexico.....	11	835,038	2,134,032	402	2,969,472	3.29	307	219	67,217	44.18
North Dakota (lignite).....	29	2,013,298	336,261	287,192	2,636,751	2.15	280	199	55,799	47.25
Ohio.....	420	22,607,438	10,802,625	3,900,314	37,310,377	3.69	8,421	239	2,013,972	18.53
Oklahoma.....	16	997,991	30,005	-----	1,027,996	5.32	247	225	55,570	18.50
Pennsylvania.....	1,123	60,634,342	14,328,401	1,568,015	76,530,758	5.07	23,349	227	5,304,866	14.43
South Dakota (lignite).....	1	-----	12,700	300	13,000	4.85	8	163	1,300	10.00
Tennessee.....	253	4,102,596	1,884,204	3,605	5,990,405	3.79	3,032	195	590,120	10.15
Utah.....	35	4,207,483	484,380	27,980	4,719,843	7.03	1,679	201	337,576	13.98
Virginia.....	1,398	27,332,367	4,104,078	217,039	31,653,484	3.89	9,358	233	2,177,216	14.54
Washington.....	5	18,696	49,362	-----	68,058	8.45	76	162	12,296	5.53
West Virginia.....	1,743	134,929,125	3,579,536	2,899,837	141,408,498	4.90	39,308	235	9,234,723	15.31
Wyoming.....	17	1,691,612	1,056,392	453,246	3,101,314	3.15	401	170	68,154	45.60
Total.....	7,630	408,725,328	65,532,391	12,740,233	486,997,952	4.45	128,698	225	28,917,328	16.84

<sup>1</sup> Includes coal loaded at mine directly into railroad cars or river barges, hauled by trucks to railroad sidings, and hauled by trucks to waterways.

<sup>2</sup> Includes coal used at mine for power and heat, made into beehive coke at mine, used by mine employees, used for all other purposes at mine, and transported from mine to point of use by conveyor, tram, or pipeline.

<sup>3</sup> Value received or charged for coal, f.o.b. mine. Includes a value, estimated by producer, for coal not sold.

**TABLE 12.—Number of mines, production, value, men working daily, days active, man-days, and output per man per day at bituminous coal and lignite mines in the United States, 1964, by districts**

District	Production (net tons)					Average value per ton <sup>3</sup>	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day
	Number of active mines	Shipped by rail or water <sup>1</sup>	Shipped by truck	Used at mine <sup>2</sup>	Total					
1. Eastern Pennsylvania.....	851	30,023,618	7,084,869	923,158	38,031,645	\$4.36	12,085	223	2,699,675	14.09
2. Western Pennsylvania.....	358	32,332,218	7,831,522	644,939	40,808,679	5.68	12,078	230	2,781,585	14.67
3. Northern West Virginia.....	511	43,060,747	1,097,733	44,570	44,203,050	4.62	11,290	235	2,654,201	16.65
4. Ohio.....	420	22,607,438	10,802,625	3,900,314	37,310,377	3.69	8,421	239	2,013,972	18.53
5. Michigan.....	20	2,325,096	450,007	2,541,648	5,316,751	4.35	1,130	247	278,940	19.06
6. Panhandle.....	815	37,263,568	1,431,630	171,103	38,866,301	5.82	12,463	237	2,955,366	13.15
7. Southern Numbered 1.....	3,866	116,820,589	15,860,582	416,838	133,098,000	4.22	43,731	213	9,802,864	14.31
8. Southern Numbered 2.....	99	33,025,444	4,822,479	7,896	37,855,819	3.29	4,551	242	1,099,369	34.43
9. West Kentucky.....	102	49,639,963	5,280,203	102,436	55,022,602	3.79	8,172	248	2,028,357	27.13
10. Illinois.....	60	11,109,793	2,543,966	1,420,872	15,074,631	3.80	2,568	216	655,016	27.16
11. Indiana.....	34	664,466	307,805	943	973,214	3.54	351	214	75,171	12.95
12. Iowa.....	252	12,828,029	2,245,725	651,498	15,725,252	6.61	6,059	214	1,294,952	12.14
13. Southeastern.....	17	643,297	4,773	648,070	7.20	214	194	41,535	15.60	
14. Arkansas-Oklahoma.....	37	3,302,373	704,879	1,041,828	5,109,080	4.18	854	241	205,860	24.82
15. Southwestern.....	7	517,019	242,857	6,712	766,588	4.13	309	194	59,868	12.80
16. Northern Colorado.....	78	3,269,547	631,903	89,444	3,990,894	5.99	1,535	191	293,454	13.60
17. Southern Colorado.....	8	437,866	2,129,369	2,567,235	2.38	176	236	41,531	61.81	
18. New Mexico.....	17	1,591,076	1,036,392	453,246	3,101,314	3.15	401	170	68,154	45.50
19. Wyoming.....	35	4,207,483	484,380	27,980	4,719,843	7.03	1,679	201	337,676	13.98
20. Utah.....	30	2,013,298	348,961	287,492	2,649,751	2.16	288	198	57,099	46.41
21. North-South Dakota.....	13	297,242	48,366	239	345,847	2.68	90	148	13,279	26.04
22. Montana.....	10	744,558	61,365	7,077	813,000	6.87	253	235	59,504	13.66
23. Washington.....	10	744,558	61,365	7,077	813,000	6.87	253	235	59,504	13.66
Total.....	7,630	408,725,328	65,532,391	12,740,233	486,997,952	4.45	128,698	225	28,917,323	16.84

<sup>1</sup> Includes coal loaded at mine directly into railroad cars or river barges, hauled by trucks to railroad sidings, and hauled by trucks to waterways.

<sup>2</sup> Includes coal used at mine for power and heat, made into beehive coke at mine, used by mine employees, used for all other purposes at mine, and transported from mine to point of use by conveyor, tram, or pipeline.

<sup>3</sup> Value received or charged for coal, f.o.b. mine. Includes a value, estimated by producer, for coal not sold.

### NUMBER AND SIZE OF MINES

The unit in the statistical record is the mine, and operating companies are requested to make a separate report for each mine because its location is definitely known and can be related to a specific district or county; its identity can be followed through successive changes of ownership; and it is the natural operating unit from the standpoint of cost, mechanical equipment, mining practice, and output per man per day. See figure 6.

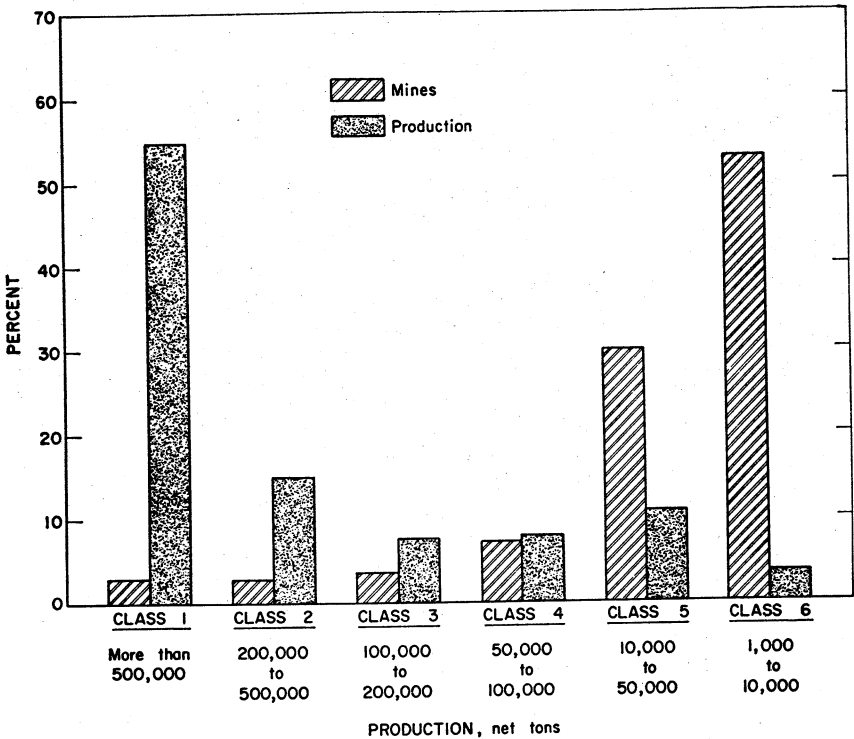


FIGURE 6.—Percentage of number of mines and of production of bituminous coal and lignite mines in the United States, 1964, by size of output.

TABLE 13.—Number and production of bituminous coal and lignite mines in the United States, 1964, by States and size of output

State	Class 1—500,000 tons and over				Class 2—200,000 to 500,000 tons				Class 3—100,000 to 200,000 tons			
	Mines		Production		Mines		Production		Mines		Production	
	Number	Percentage	Net tons	Percentage	Number	Percentage	Net tons	Percentage	Number	Percentage	Net tons	Percentage
Alabama.....	6	3.4	6,907,844	47.9	12	6.9	3,887,847	26.9	9	5.1	1,229,560	8.5
Alaska.....					2	40.0	700,477	94.0				
Arkansas.....												
Colorado.....	2	2.4	1,285,982	29.5	4	4.9	1,373,770	31.6	4	4.9	505,088	11.6
Georgia.....												
Illinois.....	34	33.3	47,240,673	85.8	14	13.7	5,150,533	9.4	11	10.8	1,574,154	2.9
Indiana.....	12	20.0	11,595,737	76.9	7	11.7	2,584,386	17.2				
Iowa.....									3	8.8	384,885	39.6
Kansas.....	1	14.3	899,416	71.2	1	14.3	230,851	18.3	1	14.3	105,793	8.4
Kentucky.....	31	1.5	41,549,675	50.2	26	1.3	8,544,307	10.3	43	2.1	5,977,225	7.2
Maryland.....					1	1.5	209,498	18.4	1	1.5	109,989	9.7
Missouri.....	4	20.0	2,786,329	85.6					1	5.0	188,816	5.8
Montana (bituminous and lignite).....					1	7.7	294,082	85.0				
New Mexico.....	1	9.1	2,116,069	71.3	2	18.2	824,033	27.7				
North Dakota (lignite).....	1	3.5	895,285	33.9	4	13.8	1,218,055	46.2	2	6.9	257,248	9.8
Ohio.....	19	4.5	20,556,502	55.1	16	3.8	3,979,447	10.7	35	8.3	4,811,790	12.9
Oklahoma.....					2	12.5	539,817	52.5	1	6.2	151,294	14.7
Pennsylvania.....	37	3.3	37,771,441	49.4	36	3.2	12,367,107	16.2	63	5.6	8,444,287	11.0
South Dakota (lignite).....												
Tennessee.....	1	.4	552,341	9.2	3	1.2	966,375	16.2	7	2.8	922,197	15.4
Utah.....	3	8.6	1,847,019	39.1	3	8.6	1,129,912	23.9	6	17.1	841,673	17.8
Virginia.....	4	.3	7,120,919	22.5	11	.8	4,001,820	12.6	15	1.1	2,170,213	6.9
Washington.....												
West Virginia.....	81	4.6	83,238,019	58.9	71	4.1	24,296,778	17.2	66	3.8	9,580,318	6.8
Wyoming.....	1	5.9	999,279	32.2	4	23.5	1,594,041	51.4	2	11.8	285,110	9.2
Total.....	238	3.1	267,362,530	54.9	220	2.9	73,893,136	15.2	270	3.5	37,539,620	7.7

COAL—BITUMINOUS AND LIGNITE

TABLE 13.—Number and production of bituminous coal and lignite mines in the United States, 1964, by States and size of output—  
Continued

State	Class 4—50,000 to 100,000 tons				Class 5—10,000 to 50,000 tons				Class 6—less than 10,000 tons				Total		
	Mines		Production		Mines		Production		Mines		Production		Mines	Production (net tons)	
	Number	Percentage	Net tons	Percentage	Number	Percentage	Net tons	Percentage	Number	Percentage	Net tons	Percentage		Total	Average per mine
Alabama.....	12	6.9	807,153	5.6	49	28.0	1,174,953	8.1	87	49.7	428,097	3.0	175	14,435,454	82,488
Alaska.....					1	20.0	36,734	4.9	2	40.0	7,781	1.1	5	744,942	148,988
Arkansas.....	1	9.1	86,880	40.9	5	45.5	113,016	53.2	5	45.4	12,419	5.9	11	212,315	19,301
Colorado.....	8	9.7	590,555	13.6	19	23.2	406,498	9.3	45	54.9	193,352	4.4	82	4,355,245	53,113
Georgia.....									1	100.0	3,900	100.0	1	3,900	3,900
Illinois.....	7	6.9	492,294	9	21	20.6	508,320	9	15	14.7	56,628	.1	102	55,022,602	539,437
Indiana.....	8	13.3	554,766	3.7	10	16.7	217,312	1.4	23	38.3	122,430	.8	60	15,074,631	251,244
Iowa.....	4	11.8	253,354	26.0	11	32.3	265,542	27.3	16	47.1	69,433	7.1	34	973,214	28,624
Kansas.....					1	14.3	15,334	1.2	3	42.8	12,015	.9	7	1,263,409	180,487
Kentucky.....	130	6.5	8,736,152	10.6	612	30.6	13,158,477	15.9	1,160	58.0	4,781,335	5.8	2,002	32,747,171	41,332
Maryland.....	2	3.0	150,942	13.3	18	26.9	487,110	42.9	45	67.1	178,317	15.7	67	1,135,836	16,953
Missouri.....	1	5.0	96,000	3.0	6	30.0	160,818	4.9	8	40.0	21,467	.7	20	3,253,430	162,672
Montana (bituminous and lignite).....					1	7.7	10,065	2.9	11	84.6	41,700	12.1	13	345,847	26,604
New Mexico.....									8	72.7	29,370	1.0	11	2,969,472	269,952
North Dakota (lignite).....	1	3.4	77,899	2.9	5	17.2	107,193	4.1	16	55.2	81,071	3.1	29	2,636,751	90,922
Ohio.....	55	13.1	3,839,562	10.3	138	32.9	3,396,132	9.1	157	37.4	726,944	1.9	420	37,310,377	88,834
Oklahoma.....	3	18.8	250,790	24.4	2	12.5	58,888	5.7	8	50.0	27,217	2.7	16	1,027,996	64,250
Pennsylvania.....	106	9.4	7,354,853	9.6	348	31.0	8,528,120	11.1	533	47.5	2,064,950	2.7	1,123	76,530,758	68,148
South Dakota (lignite).....					1	100.0	13,000	100.0					1	13,000	13,000
Tennessee.....	16	6.3	1,081,067	18.2	82	32.4	1,882,703	31.4	144	56.9	575,722	9.6	253	5,990,405	23,677
Utah.....	8	22.8	608,557	12.9	10	28.6	281,543	6.0	5	14.3	11,139	.3	35	4,719,843	134,853
Virginia.....	78	5.6	5,057,220	16.0	387	27.6	9,147,572	28.9	903	64.6	4,155,740	13.1	1,398	31,653,484	22,642
Washington.....					2	40.0	48,618	71.4	3	60.0	19,440	28.6	5	68,058	13,612
West Virginia.....	111	6.4	7,779,353	5.5	567	32.5	12,631,653	8.9	847	48.6	3,832,377	2.7	1,743	141,408,498	81,129
Wyoming.....	2	11.8	157,621	5.1	3	17.6	45,158	1.5	5	29.4	20,105	.6	17	3,101,314	182,430
Total.....	553	7.3	37,985,008	7.8	2,299	30.1	52,694,759	10.8	4,050	53.1	17,522,899	3.6	7,630	486,997,952	63,827

**EMPLOYMENT AND PRODUCTIVITY**

The bituminous coal and lignite industry has become highly mechanized in recent years. Mechanization has strongly affected production per man per day and the number of employees. In the past 20 years productivity has increased 197 percent and the number of employees has declined 67 percent. See figure 7.

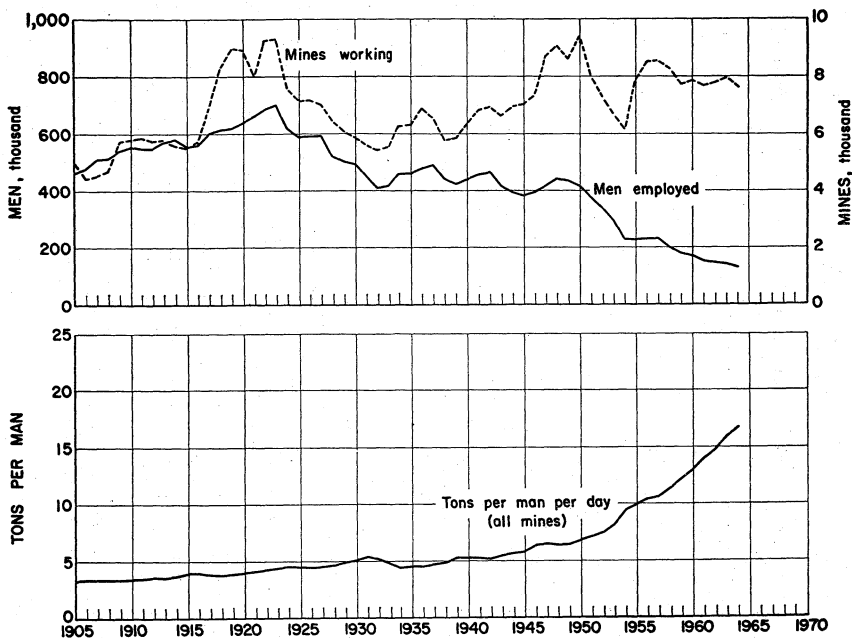


FIGURE 7.—Trends of employment, mechanization, and output per man at bituminous coal and lignite mines in the United States, 1905-64.



TABLE 14.—Production and average output per man per day at bituminous coal and lignite mines in the United States, 1964, by States and by underground, strip, and auger mining

State	Production (net tons)				Percentage of total production				Average tons per man per day			
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total
Alabama	10,461,982	3,878,014	95,488	14,435,484	72.5	28.9	0.6	100.0	10.13	26.33	14.02	12.16
Alaska		744,942		744,942	100.0			100.0		15.78		15.78
Arkansas	73,884	138,431		212,315	34.8	65.2		100.0	5.59	19.71		10.49
Colorado	3,409,338	945,907		4,355,245	78.3	21.7		100.0	11.23	39.54		13.29
Georgia	3,900			3,900	100.0			100.0	2.70			2.70
Illinois	25,034,476	29,988,126		55,022,602	45.5	54.5		100.0	21.14	35.53		27.13
Indiana	3,452,977	11,621,654		15,074,631	22.9	77.1		100.0	14.80	36.12		27.16
Iowa	169,593	803,621		973,214	17.4	82.6		100.0	6.79	16.01		12.95
Kansas		1,263,409		1,263,409	100.0			100.0		20.57		20.57
Kentucky	49,782,846	28,304,868	4,659,457	82,747,171	60.2	34.2	5.6	100.0	12.99	50.32	45.32	18.40
Maryland	385,525	750,311		1,135,836	33.9	66.1		100.0	8.32	26.59		15.25
Missouri	32,687	3,220,743		3,253,430	1.0	99.0		100.0	3.87	31.67		29.53
Montana:												
Bituminous	44,541	1,365		45,906	97.0	3.0		100.0	6.09	6.26		6.09
Lignite	5,859	294,082		299,941	2.0	98.0		100.0	3.21	75.00		52.19
Total Montana	50,400	295,447		345,847	14.6	85.4		100.0	5.51	71.38		26.04
New Mexico	418,300	2,551,172		2,969,472	14.1	85.9		100.0	12.50	75.56		44.18
North Dakota (lignite)	1,867	2,634,884		2,636,751	.1	99.9		100.0	5.01	47.54		47.25
Ohio	10,744,862	24,815,302	1,750,213	37,310,377	28.8	68.5	4.7	100.0	13.38	21.12	49.41	18.53
Oklahoma	10,743	1,017,253		1,027,996	1.0	99.0		100.0	3.20	19.48		18.50
Oklahoma	51,976,150	23,505,457	1,049,151	76,530,758	87.9	30.7	1.4	100.0	12.72	19.90	28.05	14.43
Pennsylvania		13,000		13,000	100.0			100.0		10.00		10.00
South Dakota (lignite)	3,684,147	2,071,994	254,264	5,990,405	61.2	34.6	4.2	100.0	7.18	28.83	32.88	10.15
Tennessee	4,719,843			4,719,843	100.0			100.0	13.98			13.98
Utah	28,064,802	2,450,755	1,137,927	31,653,484	88.7	7.7	3.6	100.0	13.47	34.78	50.56	14.54
Virginia	68,058			68,058	100.0			100.0	5.53			5.53
Washington	129,156,067	7,867,872	4,384,559	141,408,498	91.3	5.6	3.1	100.0	14.60	27.03	43.81	15.31
West Virginia	125,497	2,975,817		3,101,314	4.0	96.0		100.0	7.74	57.30		45.50
Wyoming												
Total	321,807,914	151,858,979	13,331,059	486,997,952	66.1	31.2	2.7	100.0	13.74	29.29	42.63	16.84

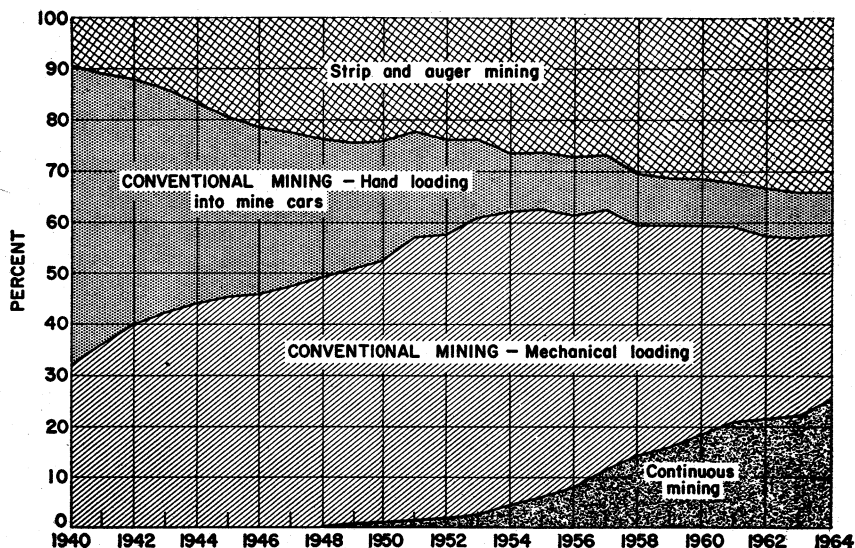


FIGURE 8.—Percentage of total production of bituminous coal and lignite in the United States, 1940-64, by type of mining and loading.

### UNDERGROUND MINING

Two-thirds of the output of bituminous coal and lignite is mined underground. The major tasks underground are cutting, drilling shotholes, loading, and haulage. Loading is discussed later in the section on mechanical loading. For many years, most of the underground production has been cut by machine; however, as the percentage of production by continuous-mining machines increases, the percentage cut by machines will decrease. The use of power drills for shotholes increased rapidly from less than 50 percent of the underground production in 1940 to a maximum of 84 percent in 1953. The use of continuous-mining machines decreased the tonnage powder-drilled for shotholes to 60 percent of the underground output. Trolley locomotives are the principal method of underground haulage; however, in recent years the use of conveyor haulage has increased steadily.

Mines producing 58 percent of the underground output reported 94,315 rail mine cars and 3,607 miles of rail track, while mines producing 5 percent used rubber-tired mine cars. Mines not reporting type of haulage produced 9 percent, and mines employing 100 percent conveyor haulage furnished 26 percent of the underground production, and shuttle buggies furnished 2 percent.

The largest number of mine cars (28 percent) were 4- to 5-ton capacity. However, 14 percent of all rail mine cars were large, 10 tons and over, hauling the largest amount (33 percent) of the tonnage handled by rail mine cars. In contrast, the most frequent size of rubber-tired mine cars was 2-ton capacity; cars of this size hauled 44 percent of the tonnage handled by rubber-tired mine cars.

A recent development in underground haulage is the introduction of a medium-sized rubber-tired mine car that is used in conjunction

with a rubber-tired tractor to transport the coal from the loading machine to the main haulageway. Practically all of the rubber-tired haulage equipment, exclusive of shuttle cars, is located in small mines in Virginia, eastern Kentucky, and southern West Virginia. Another innovation, particularly for small mines, has been the introduction of the shuttle buggy. This is a self-powered rubber-tired mine car which is hand-loaded. The largest number of these shuttle buggies is used in eastern Kentucky and West Virginia.

**TABLE 15.—Number of mines, production, value, men working daily, days active, man-days, and output per man per day at underground bituminous coal and lignite mines in the United States, 1964, by States**

State	Number of active mines	Production (net tons)	Average value per ton, f.o.b. mines	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day
Alabama.....	120	10,461,952	\$7.62	4,555	227	1,033,270	10.13
Arkansas.....	5	73,884	7.30	58	228	13,222	5.59
Colorado.....	73	3,409,338	5.92	1,599	190	303,712	11.23
Georgia.....	1	3,900	3.82	13	111	1,444	2.70
Illinois.....	45	25,034,476	3.76	5,096	232	1,184,429	21.14
Indiana.....	23	3,452,977	4.09	1,323	176	233,240	14.80
Iowa.....	13	169,593	4.09	164	152	24,964	6.79
Kentucky.....	1,760	49,782,846	4.19	19,233	199	3,831,455	12.99
Maryland.....	35	385,525	4.24	201	230	46,283	8.32
Missouri.....	4	32,687	4.76	49	173	8,455	3.87
Montana:							
Bituminous.....	8	44,541	7.57	57	128	7,314	6.09
Lignite.....	3	5,859	4.57	13	140	1,826	3.21
Total Montana ..	11	50,400	7.22	70	131	9,140	5.51
New Mexico.....	8	418,300	8.89	181	185	33,454	12.50
North Dakota (lignite) ..	1	1,867	4.62	5	75	373	5.01
Ohio.....	111	10,744,862	4.26	3,809	211	803,307	13.38
Oklahoma.....	4	10,743	7.43	29	116	3,357	3.20
Pennsylvania.....	537	51,976,150	5.75	17,941	228	4,086,158	12.72
Tennessee.....	199	3,664,147	3.98	2,586	197	510,508	7.18
Utah.....	35	4,719,843	7.03	1,679	201	337,576	13.98
Virginia.....	1,298	28,064,802	4.01	8,874	235	2,084,238	13.47
Washington.....	5	68,058	8.45	76	162	12,296	5.53
West Virginia.....	1,452	129,156,067	5.02	37,280	237	8,843,614	14.60
Wyoming.....	6	125,497	6.11	147	110	16,217	7.74
Total.....	5,746	321,807,914	4.92	104,968	223	23,420,712	13.74

TABLE 16.—Underground production of bituminous coal and lignite in the United States, 1964, by States and mining methods

State	Cut by hand and shot from solid		Cut by machines				Mined by continuous-mining machines		Total underground (net tons)
	Net tons	Percentage of total underground	Net tons	Percentage of total underground	Number of coal-cutting machines	Average output per machine (net tons)	Net tons	Percentage of total underground	
Alabama.....	148,071	1.4	10,313,881	98.6	156	66,115			10,461,952
Arkansas.....			73,884	100.0	9	8,209			73,884
Colorado.....	175,069	5.1	1,411,432	41.4	127	11,114	1,822,837	53.5	3,409,338
Georgia.....	3,900	100.0							3,900
Illinois.....			16,022,510	64.0	95	168,658	9,011,966	36.0	25,034,476
Indiana.....			3,229,709	93.5	53	60,938	223,268	6.5	3,452,977
Iowa.....	15,130	8.9	184,463	91.1	18	13,046			169,593
Kansas.....									
Kentucky.....	4,213,768	8.5	39,323,511	79.0	1,282	30,674	6,245,567	12.5	49,782,846
Maryland.....	91,834	23.8	191,480	49.7	23	8,325	102,211	26.5	385,525
Missouri.....	1,000	3.1	31,687	96.9	4	7,922			32,687
Montana:									
Bituminous.....			44,541	100.0	13	3,426			44,541
Lignite.....	1,379	23.5	4,480	76.5	2	2,240			5,859
Total Montana.....	1,379	2.7	49,021	97.3	15	3,268			50,400
New Mexico.....	11,766	2.1	8,960	2.8	4	2,240	397,574	95.1	418,300
North Dakota (lignite).....	1,867	100.0							1,867
Ohio.....	27,990	.3	6,197,635	57.7	163	38,022	4,519,237	42.0	10,744,862
Oklahoma.....	3,829	35.6	6,914	64.4	3	3,581			10,743
Pennsylvania.....	447,426	.9	12,696,797	24.4	588	21,693	38,831,927	74.7	51,976,150
Tennessee.....	311,268	8.5	2,972,127	81.1	149	19,947	380,752	10.4	3,664,147
Utah.....	33,531	.7	1,935,091	41.0	57	33,949	2,751,221	58.3	4,719,843
Virginia.....	4,120,663	14.7	20,620,157	73.5	961	21,457	3,323,982	11.8	28,064,802
Washington.....	68,058	100.0							68,058
West Virginia.....	2,665,624	2.1	69,423,945	53.7	1,595	43,526	57,066,498	44.2	129,156,067
Wyoming.....			125,497	100.0	23	5,456			125,497
Total.....	12,342,173	3.8	184,788,701	57.4	5,320	34,735	124,677,040	38.8	321,807,914

COAL—BITUMINOUS AND LIGNITE

TABLE 17.—Summary of drilling operations at underground bituminous coal and lignite mines in the United States

Year	Number of mines using power drills	Number of power drills <sup>1</sup>					Production (thousand net tons)				Production, percent		
		Electric	Face or coal	Compressed air	Roof or rock	Total	Where shot holes are power-drilled	Where shot holes are hand-drilled	Where no shot-holes are required (continuous mining)	Total	Where shot holes are power-drilled	Where shot holes are hand-drilled	Where no shot-holes are required (continuous mining)
1936	599	3,968		1,302		5,270	111,950	299,012		410,962	27.2	72.8	
1937	NA	NA		NA		NA	NA	NA		413,780	NA	NA	
1938	1,061	5,071		1,465		6,536	122,581	195,557		318,138	38.5	61.5	
1939	NA	NA		NA		NA	NA	NA		357,133	NA	NA	
1940	1,172	6,613		1,378		7,991	197,083	220,521		417,604	47.2	52.8	
1941	1,266	7,697		1,602		9,199	237,213	221,865		459,078	51.7	48.3	
1942	1,364	8,482		1,664		10,046	281,530	233,960		515,490	54.6	45.4	
1943	1,376	8,930		1,630		10,560	299,805	210,687		510,492	58.7	41.3	
1944	1,501	9,755		1,903		11,658	324,116	194,562		518,678	62.5	37.5	
1945	1,504	10,267		1,855		12,122	302,786	164,844		467,630	64.7	35.3	
1946	1,702	10,968		1,884		12,852	278,734	142,224		420,958	66.2	33.8	
1947	2,522	12,940		1,449		14,389	351,866	189,363		491,229	71.6	28.4	
1948	2,798	13,970		1,312		15,282	336,873	122,689	450	460,012	73.2	26.7	0.1
1949	2,923	14,087		1,411		15,498	251,329	77,894	2,600	331,823	75.7	23.5	0.8
1950	3,112	14,277		1,282		15,559	286,661	101,333	4,850	392,844	73.0	25.8	1.2
1951	3,027	14,231		1,345		15,576	324,645	85,136	6,061	415,842	78.0	20.5	1.5
1952	2,830	13,468		1,292		14,760	284,048	64,162	8,215	356,425	79.7	18.0	2.3
1953	2,486	12,054		1,053		13,107	293,161	44,560	11,830	349,551	85.9	12.7	3.4
1954	2,137	10,782		885		11,667	233,557	39,219	16,336	289,112	80.7	13.6	5.7
1955	2,003	9,533		476		10,009	285,348	30,657	27,460	343,465	83.1	8.9	8.0
1956	4,033	(1)	11,021	(1)	2,443	13,464	306,675	19,192	39,907	365,774	83.8	5.3	10.9
1957	4,152	(1)	10,938	(1)	2,981	13,919	294,186	12,680	53,783	360,640	81.6	3.5	14.9
1958	4,410	(1)	9,691	(1)	2,947	12,638	216,226	14,285	56,373	286,884	75.1	5.0	19.8
1959	3,979	(1)	8,524	(1)	2,814	11,338	207,043	10,599	65,792	283,434	73.1	3.7	23.2
1960	4,294	(1)	8,265	(1)	2,840	11,105	194,956	12,004	77,928	284,888	68.4	4.2	27.4
1961	4,333	(1)	7,837	(1)	3,153	10,990	181,741	6,704	84,321	272,766	66.6	2.5	30.9
1962	4,660	(1)	7,744	(1)	3,121	10,865	187,324	3,768	90,174	281,266	66.6	1.4	32.0
1963	4,868	(1)	7,496	(1)	2,913	10,409	193,036	4,870	104,350	302,256	63.9	1.6	34.5
1964	4,734	(1)	7,185	(1)	2,847	10,032	193,044	4,087	124,677	321,808	60.0	1.3	38.7

NA Not available.

<sup>1</sup> Total number of power drills before 1956 are not strictly comparable with the figures for 1956 to date. Data were collected by "type" of drills before 1956 and by "use" of

drills 1956 to date. Most of the "electric," drills were used in coal and most of the "compressed air" drills were used in rock. "Face or coal" drills include hand-held, post mounted, and mobile drills. "Roof or rock" drills include rotary and percussion drills.

TABLE 18.—Use of power drills in underground bituminous coal and lignite mines in the United States, 1964, by States

State	Number of power drills							Production where shotholes are power-drilled (net tons)			
	Number of mines using power drills	Face or coal drills		Roof or rock drills				Handheld and post-mounted drills	Mobile drills	Total	Percentage of total underground
		Handheld and post-mounted	Mobile	Roof bolting		Other uses					
				Rotary	Percussion	Rotary	Percussion				
Alabama.....	85	174	19	47	53	3	21	8,379,482	2,013,301	10,392,783	99.3
Arkansas.....	3	7		1		3		68,777		68,777	93.1
Colorado.....	62	152	14	6	25		3	1,363,670	489,999	1,853,669	54.4
Georgia.....											
Illinois.....	45	21	108	130		2	1	247,662	15,774,848	16,022,510	64.0
Indiana.....	23	27	25	37			1	635,248	2,594,461	3,229,709	93.5
Iowa.....	9	11	2	4				39,697	114,306	154,003	90.8
Kentucky.....	1,326	1,679	147	248	123	4	26	24,095,020	18,317,987	42,413,007	85.2
Maryland.....	16	26				2		192,980		192,980	50.1
Missouri.....	1	1						27,415		27,415	83.9
Montana:											
Bituminous.....	8	12		1				44,541		44,541	100.0
Lignite.....	3	6						5,859		5,859	100.0
Total Montana.....	11	18		1				50,400		50,400	100.0
New Mexico.....	7	11		2	8			19,254		19,254	4.6
North Dakota (lignite).....	1	1						1,867		1,867	100.0
Ohio.....	103	120	53	92	4			895,855	5,304,677	6,200,532	57.7
Oklahoma.....	2	3						6,914		6,914	64.4
Pennsylvania.....	346	528	54	296	241	32	97	5,807,720	6,744,987	12,552,707	24.2
Tennessee.....	108	170	1	4	5	7	2	2,747,013	62,200	2,809,213	76.7
Utah.....	31	34	53	7	77	1	40	691,594	1,589,689	2,281,283	48.3
Virginia.....	1,264	1,331	15	52	68	8	13	19,244,889	3,875,550	23,120,439	82.4
Washington.....	5	18						68,058		68,058	100.0
West Virginia.....	1,281	2,160	184	697	292	14	44	47,264,808	24,194,107	71,458,915	55.3
Wyoming.....	5	17	1	3				118,073	431	118,504	94.4
Total.....	4,734	6,509	676	1,627	896	76	248	111,966,996	81,076,543	193,043,539	60.0

TABLE 19.—Number of underground bituminous coal and lignite mines and number of haulage units in use in the United States, in selected years<sup>1</sup>

Year	Under-ground mines	Locomotives				Rope-haulage units			Shuttle cars			Gathering and haulage conveyors	Animals
		Trolley	Battery	Other types	Total	Portable	Stationary	Total	Cable reel	Battery	Total		
1924...	7,352	<sup>2</sup> 12,765	1,515	443	14,723	NA	NA	649	NA	NA	NA	NA	36,352
1946...	5,888	14,110	1,011	110	15,231	4,084	1,009	5,093	NA	NA	NA	457	10,185
1948...	7,108	14,617	904	74	15,595	3,886	1,044	4,930	NA	NA	NA	755	10,834
1949...	6,798	14,090	928	59	15,077	3,904	1,073	4,977	2,144	623	2,767	860	10,313
1950...	7,559	13,822	949	62	14,833	4,225	1,037	5,262	2,782	512	3,294	1,013	10,033
1951...	6,225	13,327	900	51	14,278	3,875	916	4,791	3,191	567	3,758	1,094	7,478
1952...	5,632	12,545	812	41	13,398	3,584	852	4,436	3,382	462	3,844	1,066	6,555
1953...	5,034	11,311	678	45	12,034	2,833	727	3,565	3,797	425	4,222	1,042	5,354
1954...	4,653	10,155	762	38	10,955	1,926	781	2,707	4,400	431	4,831	1,081	5,409
1955...	6,035	9,538	658	40	10,236	1,327	577	1,904	4,375	239	4,614	1,002	6,440
1956...	6,542	9,445	861	102	10,408	1,420	575	1,995	4,757	257	5,014	1,114	6,097
1957...	6,512	8,997	898	138	10,033	1,214	616	1,830	5,129	257	5,386	1,233	5,054
1958...	6,319	8,057	920	138	9,115	926	538	1,464	4,871	259	5,130	1,235	4,678
1959...	5,815	7,263	949	137	8,349	900	504	1,404	4,795	255	5,050	1,416	4,063
1960...	5,989	6,922	946	173	8,041	892	510	1,402	4,722	236	4,958	1,566	3,503
1961...	5,843	6,362	583	162	7,107	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	4,687	182	4,869	1,635	( <sup>3</sup> )
1962...	5,946	5,874	461	123	6,458	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	4,746	212	4,958	1,786	( <sup>3</sup> )
1963...	6,129	5,273	484	113	5,870	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	4,952	175	5,127	1,998	( <sup>3</sup> )
1964...	5,746	4,974	423	50	5,447	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	4,933	115	5,048	2,150	( <sup>3</sup> )

NA Not available.

<sup>1</sup> Exclusive of lignite and Virginia semianthracite mines in 1946, 1948, and 1949.<sup>2</sup> Includes combination trolley and battery locomotives.<sup>3</sup> Canvass discontinued.

TABLE 20.—Haulage units and length of rail track in use in bituminous coal and lignite underground mines in the United States, 1964, by States

State	Locomotives			Tractor, rubber-tired	Mine cars <sup>1</sup>		Shuttle cars		Shuttle buggies <sup>1</sup>	Gathering and haulage conveyors <sup>1</sup>		Rail track reported (miles)		
	Trolley	Battery	All others		Rail	Rubber-tired	Cable reel	Battery		Units	Miles	Main line	All other	Total
Alabama.....	137			26	3,179		173			65	27.7	75.3	50.6	125.9
Arkansas.....		1			45							1.0		1.0
Colorado.....	74	33			2,727		108	11	1	25	7.5	20.9	11.6	32.5
Illinois.....	117	24		8	2,838		281	3		146	61.2	52.2	27.2	79.4
Indiana.....	72	3	1		1,281		68	2	1	19	4.9	37.2	26.1	63.3
Iowa.....	6	1			571		7					10.8	1.3	12.1
Kentucky.....	810	114	5	458	8,718	1,478	724	42	674	199	58.1	228.5	101.7	330.2
Maryland.....	5	5		2	192		2		9	8	1.6	7.1	3.4	10.5
Missouri.....		1			36							1.5	.2	1.7
Montana:														
Bituminous.....	7	1			138		4					2.8		2.8
Lignite.....			1		23							1.0		1.0
Total Montana.....	7	1	1		161		4					3.8		3.8
New Mexico.....	9	1			149		10			1	.3	7.6	1.8	9.4
Ohio.....	205	19	6	4	3,348	17	149			60	14.1	106.0	45.2	151.2
Oklahoma.....					17							1.0	.2	1.2
Pennsylvania.....	1,351	91	20	104	26,236	179	970	12	32	477	132.6	657.7	333.6	991.3
Tennessee.....	96	1		15	868	59	54		41	1	.3	25.3	10.3	35.6
Utah.....	103	3		6	2,799	1	156		2	63	12.8	99.2	32.0	131.2
Virginia.....	350	47	1	664	3,928	3,337	210		44	93	38.4	157.8	52.8	210.6
Washington.....	3				52		2					1.6		1.6
West Virginia.....	1,629	74	16	414	37,118	1,610	2,008	37	721	990	292.3	957.3	455.0	1,412.3
Wyoming.....		4			52		7		1	3	.9		2.0	2.0
Total.....	4,974	423	50	1,701	94,315	6,695	4,933	115	1,526	2,150	650.7	2,451.8	1,155.0	3,606.8

<sup>1</sup> See table 21 for percentage of tonnage not reported.



TABLE 21.—Method of haulage at bituminous coal and lignite underground mines in the United States, 1964, by States

State	Production (net tons) from mines						Percentage of total underground production from mines					
	Reporting rail mine cars	Reporting rubber-tired mine cars	Reporting shuttle buggies	With conveyor haulage only	Not reporting type of haulage	Total	Reporting rail mine cars	Reporting rubber-tired mine cars	Reporting shuttle buggies	With conveyor haulage only	Not reporting type of haulage	Total
Alabama.....	5,599,857			3,838,675	1,023,420	10,461,952	53.5			36.7	9.8	100.0
Arkansas.....	44,107				29,777	73,884	59.7				40.3	100.0
Colorado.....	1,668,915		13,155	1,540,416	186,852	3,409,358	48.9		0.4	45.2	5.5	100.0
Illinois.....	8,265,822			16,327,068	441,586	25,034,476	33.0			65.2	1.8	100.0
Indiana.....	2,006,973			1,418,838	27,166	3,452,977	58.1			41.1	.8	100.0
Iowa.....	169,593					169,593	100.0					100.0
Kentucky.....	18,482,329	6,274,629	2,523,124	11,391,236	11,111,528	49,782,846	37.1	12.6	5.1	22.9	22.3	100.0
Maryland.....	75,197	50,370	28,818	150,942	80,198	385,525	19.5	13.1	7.5	39.1	20.8	100.0
Missouri.....	27,415				5,272	32,687	83.9				16.1	100.0
Montana:												
Bituminous.....	44,541					44,541	100.0					100.0
Lignite.....	3,383				2,476	5,859	57.7				42.3	100.0
Total Montana.....	47,924				2,476	50,400	95.1				4.9	100.0
New Mexico.....	412,165				6,135	418,300	98.5				1.5	100.0
Ohio.....	9,835,326	24,919		787,853	116,764	10,744,862	91.5	.2		7.2	1.1	100.0
Oklahoma.....	5,325				5,418	10,743	49.6				50.4	100.0
Pennsylvania.....	40,970,037	214,112	161,241	10,160,212	470,548	51,976,150	78.8	.4	.3	19.6	.9	100.0
Tennessee.....	1,553,916	88,714	154,468	30,000	1,837,049	3,664,147	42.4	2.4	4.2	.8	50.2	100.0
Utah.....	3,837,966	10,555		637,737	233,585	4,719,843	81.3	.2		13.5	5.0	100.0
Virginia.....	5,887,676	6,772,272	46,107	6,504,753	8,853,994	28,064,802	21.0	24.1	.2	23.2	31.5	100.0
Washington.....	59,067				8,991	68,058	86.8				13.2	100.0
West Virginia.....	88,909,363	4,264,250	2,650,508	29,846,472	3,485,474	129,158,067	68.8	3.3	2.1	23.1	2.7	100.0
Wyoming.....	16,398		2,331	106,768	125,497	144,263	13.1		1.8		85.1	100.0
Other States <sup>1</sup> .....					5,767	5,767					100.0	100.0
Total.....	187,875,371	17,699,821	5,579,752	82,614,202	28,038,768	321,807,914	58.4	5.5	1.7	25.7	8.7	100.0

<sup>1</sup> Includes Georgia and North Dakota (lignite).

TABLE 22.—Rail mine cars used at bituminous coal and lignite underground mines in the United States, 1964, by States <sup>1</sup>

State	Capacity						Total
	1 ton	2 tons	3 tons	4-5 tons	6-9 tons	10 tons and over	
NUMBER REPORTED							
Alabama.....	100	19	1	1,809	1,210	40	3,179
Arkansas.....	36	9					45
Colorado.....	50	2,083	180	339	15	60	2,727
Illinois.....	575	1,149	85	175	719	135	2,838
Indiana.....	22	169	390	560	140		1,281
Iowa.....	403	148	20				571
Kentucky.....	257	1,743	1,189	3,719	421	1,389	8,718
Maryland.....	127	61	4				192
Missouri.....	36						36
Montana:							
Bituminous.....		72	50	16			138
Lignite.....	23						23
Total Montana.....	23	72	50	16			161
New Mexico.....	44	11				94	149
Ohio.....	380	297	70	641	766	1,194	3,348
Oklahoma.....		4	8		5		17
Pennsylvania.....	3,153	3,963	5,586	2,110	9,057	2,367	26,236
Tennessee.....	244	121	18	485			868
Utah.....		21	304	1,531	943		2,799
Virginia.....	418	299	1,255	1,482	174	300	3,928
Washington.....	25			27			52
West Virginia.....	281	2,463	8,819	13,430	4,706	7,419	37,118
Wyoming.....				52			52
Total.....	6,174	12,632	17,979	26,376	18,156	12,998	94,315
PERCENTAGE OF TOTAL							
Alabama.....	3.1	0.6	0.1	56.9	38.1	1.2	100.0
Arkansas.....	80.0	20.0					100.0
Colorado.....	1.8	76.4	6.6	12.4	.6	2.2	100.0
Illinois.....	20.3	40.5	3.0	6.2	25.3	4.7	100.0
Indiana.....	1.7	13.2	30.5	43.7	10.9		100.0
Iowa.....	70.6	25.9	3.5				100.0
Kentucky.....	3.0	20.0	13.6	42.7	4.8	15.9	100.0
Maryland.....	66.1	31.8	2.1				100.0
Missouri.....	100.0						100.0
Montana:							
Bituminous.....		52.2	36.2	11.6			100.0
Lignite.....	100.0						100.0
Total Montana.....	14.3	44.7	31.1	9.9			100.0
New Mexico.....	29.5	7.4				63.1	100.0
Ohio.....	11.3	8.9	2.1	19.1	22.9	35.7	100.0
Oklahoma.....		23.5	47.1		29.4		100.0
Pennsylvania.....	12.0	15.1	21.3	8.1	34.5	9.0	100.0
Tennessee.....	28.1	13.9	2.1	55.9			100.0
Utah.....		.7	10.9	54.7	33.7		100.0
Virginia.....	10.7	7.6	32.0	37.7	4.4	7.6	100.0
Washington.....	48.1			51.9			100.0
West Virginia.....	.8	6.6	23.7	36.2	12.7	20.0	100.0
Wyoming.....				100.0			100.0
Total.....	6.5	13.4	19.1	28.0	19.2	13.8	100.0

<sup>1</sup> See table 21 for percentage of tonnage not reported.

TABLE 23.—Rail mine car haulage at bituminous coal and lignite underground mines in the United States, 1964, by States<sup>1</sup>

State	Production, by size of mine car reported						Total
	1 ton	2 tons	3 tons	4-5 tons	6-9 tons	10 tons and over	
NET TONS							
Alabama.....	56,970	27,211	12,202	2,328,088	2,998,533	176,853	5,599,857
Arkansas.....	39,000	5,107					44,107
Colorado.....	32,570	905,687	19,256	384,107	16,930	310,365	1,668,915
Illinois.....	193,060	547,088	164,176	1,105,995	3,959,417	2,296,086	8,265,822
Indiana.....	14,459	183,481	629,965	803,335	375,733		2,006,973
Iowa.....	40,798	79,072	49,723				169,693
Kentucky.....	179,814	2,472,963	1,849,936	5,941,055	2,423,702	6,614,859	18,482,329
Maryland.....	63,436	8,104	3,657				75,197
Missouri.....	27,415						27,415
Montana:							
Bituminous.....		22,071	12,405	10,065			44,541
Lignite.....	3,383						3,383
Total Montana.....	3,383	22,071	12,405	10,065			47,924
New Mexico.....	12,780	1,811				397,574	412,165
Ohio.....	163,779	154,942	132,506	1,685,831	2,274,779	5,423,489	9,835,326
Oklahoma.....		1,496	2,793		1,036		5,325
Pennsylvania.....	1,093,863	1,874,839	5,076,943	2,898,527	21,547,615	8,478,250	40,970,037
Tennessee.....	110,282	77,552	44,144	1,321,938			1,553,916
Utah.....		17,338	177,905	2,234,346	1,408,377		3,837,966
Virginia.....	104,518	355,772	2,003,953	1,384,336	644,301	1,394,796	5,887,676
Washington.....	3,153			55,914			59,067
West Virginia.....	203,543	2,410,724	11,058,116	23,810,529	14,168,527	37,257,924	88,909,363
Wyoming.....				16,398			16,398
Total.....	2,342,823	9,145,258	21,237,680	43,980,464	49,818,950	61,350,196	187,875,371
PERCENTAGE OF TOTAL							
Alabama.....	1.0	0.5	0.2	41.6	53.5	3.2	100.0
Arkansas.....	88.4	11.6					100.0
Colorado.....	2.0	54.3	1.1	23.0	1.0	18.6	100.0
Illinois.....	2.3	6.6	2.0	13.4	47.9	27.8	100.0
Indiana.....	.7	9.2	31.4	40.0	18.7		100.0
Iowa.....	24.1	46.6	29.3				100.0
Kentucky.....	1.0	13.4	10.0	32.1	13.1	30.4	100.0
Maryland.....	84.3	10.8	4.9				100.0
Missouri.....	100.0						100.0
Montana:							
Bituminous.....		49.5	27.9	22.6			100.0
Lignite.....	100.0						100.0
Total Montana.....	7.1	46.0	25.9	21.0			100.0
New Mexico.....	3.1	.4				96.5	100.0
Ohio.....	1.7	1.6	1.4	17.1	23.1	55.1	100.0
Oklahoma.....		28.1	52.5		19.4		100.0
Pennsylvania.....	2.6	4.6	12.4	7.1	52.6	20.7	100.0
Tennessee.....	7.1	5.0	2.8	85.1			100.0
Utah.....		.5	4.6	58.2	36.7		100.0
Virginia.....	1.8	6.0	34.0	23.5	11.0	23.7	100.0
Washington.....	5.3			94.7			100.0
West Virginia.....	.2	2.7	12.5	26.8	15.9	41.9	100.0
Wyoming.....				100.0			100.0
Total.....	1.3	4.9	11.3	23.4	26.5	32.6	100.0

<sup>1</sup> See table 21 for percentage of tonnage not reported.

TABLE 24.—Rubber-tired mine cars used at bituminous coal and lignite underground mines in the United States, 1964, by States <sup>1</sup>

State	Capacity						Total
	1 ton	2 tons	3 tons	4-5 tons	6-9 tons	10 tons and over	
NUMBER REPORTED							
Kentucky.....	635	493	234	109	2	5	1,478
Maryland.....		14					14
Ohio.....	2	15					17
Pennsylvania.....	46	93	36		4		179
Tennessee.....	8	51					59
Utah.....				1			1
Virginia.....	941	1,891	332	147	15	11	3,337
West Virginia.....	254	1,062	203	71	20		1,610
Total.....	1,886	3,619	805	328	41	16	6,695
PERCENTAGE OF TOTAL							
Kentucky.....	43.0	33.4	15.8	7.4	0.1	0.3	100.0
Maryland.....		100.0					100.0
Ohio.....	11.8	88.2					100.0
Pennsylvania.....	25.7	52.0	20.1		2.2		100.0
Tennessee.....	13.6	86.4					100.0
Utah.....				100.0			100.0
Virginia.....	28.2	56.7	10.0	4.4	.4	.3	100.0
West Virginia.....	15.8	66.0	12.6	4.4	1.2		100.0
Total.....	28.2	54.1	12.0	4.9	.6	.2	100.0

<sup>1</sup> See table 21 for percentage of tonnage not reported.

TABLE 25.—Rubber-tired mine car haulage at bituminous coal and lignite underground mines in the United States, 1964, by States <sup>1</sup>

State	Production, by size of mine car reported						Total
	1 ton	2 tons	3 tons	4-5 tons	6-9 tons	10 tons and over	
NET TONS							
Kentucky.....	2,667,617	1,577,767	1,068,823	911,138	30,546	18,733	6,274,629
Maryland.....		50,370					50,370
Ohio.....	1,417	23,502					24,919
Pennsylvania.....	63,248	77,873	67,612		5,379		214,112
Tennessee.....	6,269	82,445					88,714
Utah.....				10,555			10,555
Virginia.....	1,783,382	3,538,935	863,571	502,733	52,670	30,981	6,772,272
West Virginia.....	979,330	2,402,848	682,566	88,833	110,673		4,264,250
Total.....	5,501,263	7,753,740	2,682,577	1,513,259	199,268	49,714	17,699,821
PERCENTAGE OF TOTAL							
Kentucky.....	42.5	25.2	17.0	14.5	0.5	0.3	100.0
Maryland.....		100.0					100.0
Ohio.....	5.7	94.3					100.0
Pennsylvania.....	29.5	36.4	31.6		2.5		100.0
Tennessee.....	7.1	92.9					100.0
Utah.....				100.0			100.0
Virginia.....	26.3	52.3	12.7	7.4	.8	.5	100.0
West Virginia.....	23.0	56.3	16.0	2.1	2.6		100.0
Total.....	31.1	43.8	15.2	8.5	1.1	.3	100.0

<sup>1</sup> See table 21 for percentage of tonnage not reported.

**TABLE 26.—Number and production of underground bituminous coal and lignite mines using gathering and haulage conveyors, and number and length of units in use in the United States <sup>1</sup>**

Year	Number of mines		Production (net tons)		Number of units in use		Average length (feet)		Total length (miles)	
	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964
1945	117		40,189,857		359		1,438		97.6	
1946	161		46,022,710		457		1,484		128.5	
1947	199		70,690,920		594		1,470		165.3	
1948	270		81,821,361		755		1,460		208.8	
1949	314		69,947,713		860		1,514		246.7	
1950	374		92,413,644		1,013		1,538		294.9	
1951	372		99,643,003		1,094		1,568		325.0	
1952	358		92,168,992		1,066		1,526		308.2	
1953	322		100,155,249		1,042		1,541		303.9	
1954	291		83,211,284		1,081		1,626		32.9	
1955	314		97,677,313		1,002		1,682		319.6	
1956	314		126,717,518		1,114		1,656		349.4	
1957	362		136,914,192		1,233		1,672		390.4	
1958	366		115,419,740		1,235		1,711		400.3	
1959	371		126,654,911		1,416		1,723		462.1	
1960	396		137,053,564		1,566		1,673		499.2	
1961	414		140,938,297		1,635		1,655		512.6	
1962	430		153,251,478		1,786		1,659		561.2	
1963	494		173,999,774		1,998		1,656		626.9	
1964	503		194,389,009		2,150		1,598		650.7	

<sup>1</sup> Includes all gathering and haulage conveyors with capacity over 500 feet, except main-slope conveyors. Excludes lignite and Virginia semianthracite mines in 1945-49.

**TABLE 27.—Number and production of underground bituminous coal and lignite mines using gathering and haulage conveyors, and number and length of units in use in the United States, by States <sup>1</sup>**

State	Number of mines		Production (net tons)		Number of units in use		Average length (feet)		Total length (miles)	
	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964
	Alabama	7	7	5,470,917	5,827,668	69	65	2,073	2,247	27.1
Colorado	6	7	1,352,627	1,850,781	21	25	1,412	1,594	5.6	7.5
Illinois	16	17	22,258,377	23,094,950	141	146	2,242	2,213	59.9	61.2
Indiana	6	6	3,325,843	2,649,773	28	19	1,218	1,363	6.5	4.9
Kentucky	46	43	20,444,585	19,884,177	197	199	1,814	1,489	67.7	56.1
Maryland	2	2	135,236	150,942	3	8	1,540	1,050	.9	1.6
New Mexico	1	1	293,371	397,574	1	1	1,500	1,500	.3	.3
Ohio	16	15	8,035,426	8,194,296	56	60	1,218	1,242	12.9	14.1
Pennsylvania	75	94	24,889,177	31,813,034	403	477	1,599	1,468	122.0	132.6
Tennessee	5	1	204,449	30,000	7	1	1,333	1,500	1.8	.3
Utah	19	20	3,653,148	4,080,070	51	63	1,067	1,072	10.3	12.8
Virginia	16	12	8,885,724	8,363,077	97	93	2,210	2,178	40.6	38.4
West Virginia	278	277	75,012,690	88,036,269	921	990	1,550	1,559	270.4	292.3
Wyoming	1	1	38,204	16,398	3	3	1,500	1,500	.9	.9
Total	494	503	173,999,774	194,389,009	1,998	2,150	1,656	1,598	626.9	650.7

<sup>1</sup> Includes all mines using belt conveyors, 500 feet long or more for transporting coal underground. Excludes main-slope conveyors.

### STRIP MINING

Strip mines have two substantial advantages over underground mines: (1) The output per man per day in strip mines is more than double that in underground mines, and (2) the average value of strip coal, f.o.b. mines, is about one-third less than the average value of coal from underground mines. See figures 9 and 10.

The rapid growth of strip mining was made possible by the development of larger and improved stripping and drilling equipment and trucks.

An increase in the average capacity of trucks used in strip mines has reduced the number required. The average hauling distance from strip mines to tipples or ramps is approximately 5 miles.

The average thickness of overburden at all bituminous coal and lignite strip mines in the United States was 46 feet in 1960, the latest year for which figures are available. Several strip mines handled an average of more than 70 feet of overburden in 1960, and a few handled more than 80 feet.

TABLE 28.—Growth of strip mining at bituminous coal and lignite mines in the United States, compared with underground and auger mining

Year	Production (thousand net tons)				Percentage of total mined by stripping	Average tons per man per day				Average value per ton f.o.b. mine				Number of strip mines	Number of power shovels and draglines
	Underground mines	Strip mines <sup>1</sup>	Auger mines	Total		Underground mines	Strip mines <sup>1</sup>	Auger mines	Total	Underground mines	Strip mines <sup>1</sup>	Auger mines	Total		
1914.....	421,423	1,281	-----	422,704	0.3	3.71	5.06	-----	3.71	NA	NA	-----	\$1.17	<sup>2</sup> 35	48
1915.....	439,792	2,832	-----	442,624	.6	3.90	5.81	-----	3.91	\$1.13	\$1.18	-----	1.13	<sup>2</sup> 60	87
1916.....	498,587	3,933	-----	502,520	.8	3.88	6.67	-----	3.90	1.32	1.51	-----	1.32	<sup>2</sup> 79	111
1917.....	546,001	5,790	-----	551,791	1.0	3.75	6.52	-----	3.77	2.26	2.34	-----	2.26	<sup>2</sup> 126	182
1918.....	571,098	8,288	-----	579,386	1.4	3.76	6.81	-----	3.78	2.58	2.54	-----	2.58	<sup>2</sup> 165	276
1919.....	460,225	5,635	-----	465,860	1.2	3.82	6.21	-----	3.84	2.49	2.33	-----	2.49	<sup>2</sup> 168	287
1920.....	559,807	8,860	-----	568,667	1.5	3.97	7.20	-----	4.00	3.74	4.12	-----	3.75	<sup>2</sup> 174	312
1921.....	410,865	5,057	-----	415,922	1.2	4.18	8.28	-----	4.20	2.89	2.87	-----	2.89	<sup>2</sup> 155	279
1922.....	412,059	10,209	-----	422,268	2.4	4.24	8.09	-----	4.24	3.02	3.07	-----	3.02	272	379
1923.....	552,625	11,940	-----	564,565	2.1	4.43	9.32	-----	4.47	2.69	2.31	-----	2.68	263	442
1924.....	470,080	13,607	-----	483,687	2.8	4.50	9.91	-----	4.56	2.20	2.00	-----	2.20	234	420
1925.....	503,182	16,871	-----	520,053	3.2	4.45	11.18	-----	4.52	2.05	1.84	-----	2.04	227	389
1926.....	556,444	16,923	-----	573,367	3.0	4.42	11.13	-----	4.50	2.07	1.89	-----	2.06	237	410
1927.....	499,385	18,378	-----	517,763	3.6	4.47	11.06	-----	4.55	1.99	1.90	-----	1.99	255	455
1928.....	480,956	19,789	-----	500,745	4.0	4.61	13.02	-----	4.73	1.87	1.69	-----	1.86	250	415
1929.....	514,721	20,268	-----	534,989	3.8	4.73	14.08	-----	4.85	1.79	1.57	-----	1.78	200	411
1930.....	447,684	19,842	-----	467,526	4.3	4.93	16.21	-----	5.06	1.71	1.54	-----	1.70	218	341
1931.....	363,157	18,932	-----	382,089	5.0	5.12	17.68	-----	5.30	1.54	1.51	-----	1.54	235	314
1932.....	290,069	19,641	-----	309,710	6.3	4.99	16.95	-----	5.22	1.31	1.32	-----	1.31	255	332
1933.....	315,360	18,270	-----	333,630	5.5	4.60	13.59	-----	4.78	1.34	1.33	-----	1.34	289	389
1934.....	338,578	20,790	-----	359,368	5.8	4.23	13.28	-----	4.40	1.76	1.49	-----	1.75	344	458
1935.....	348,726	23,647	-----	372,373	6.4	4.32	12.01	-----	4.50	1.79	1.47	-----	1.77	368	507
1936.....	410,962	28,126	-----	439,088	6.4	4.42	13.91	-----	4.62	1.77	1.49	-----	1.76	381	562
1937.....	413,780	31,751	-----	445,531	7.1	NA	NA	-----	4.69	NA	NA	-----	1.94	449	NA
1938.....	318,138	30,407	-----	348,545	8.7	4.60	15.00	-----	4.89	NA	NA	-----	1.95	465	737
1939.....	357,133	37,722	-----	394,855	9.6	4.92	14.68	-----	5.25	1.88	1.49	-----	1.84	537	914
1940.....	417,604	43,167	-----	460,771	9.4	4.86	15.63	-----	5.19	1.94	1.56	-----	1.91	638	1,071
1941.....	459,078	55,071	-----	514,149	10.7	4.83	15.59	-----	5.20	2.23	1.79	-----	2.19	769	1,321
1942.....	515,490	67,203	-----	582,693	11.5	4.74	15.52	-----	5.12	2.41	1.90	-----	2.36	834	1,438
1943.....	510,492	79,685	-----	590,177	13.5	4.89	15.15	-----	5.38	2.75	2.28	-----	2.69	1,004	1,899
1944.....	518,678	100,898	-----	619,576	16.3	5.04	15.89	-----	5.67	3.01	2.48	-----	2.92	1,240	2,312

1945	467,630	109,987		577,617	19.0	5.04	15.46		5.78	3.16	2.65		3.06	1,370	2,439
1946	420,958	112,964		533,922	21.1	5.43	15.73		6.30	3.59	2.87		3.44	1,445	2,744
1947	491,229	139,395		630,624	22.1	5.49	15.93		6.42	4.35	3.47		4.16	1,750	3,254
1948	460,012	139,506		599,518	23.3	5.31	15.28		6.26	5.26	4.11		4.99	1,971	3,712
1949	331,823	106,045		437,868	24.2	5.42	15.33		6.43	5.18	3.94		4.88	1,761	3,576
1950	392,844	123,467		516,311	23.9	5.75	15.66		6.77	5.15	3.87		4.84	1,870	3,877
1951	415,842	117,618	205	533,665	22.0	6.08	16.02		7.04	5.21	3.88		4.92	1,784	3,810
1952	356,425	108,910	1,506	466,841	23.3	6.37	16.77	20.07	7.47	5.24	3.81	\$4.31	4.90	1,643	3,527
1953	349,551	105,448	2,291	457,290	23.1	7.01	17.62	25.30	8.17	5.27	3.75	4.15	4.92	1,554	3,390
1954	289,112	98,134	4,460	391,706	25.1	7.99	19.64	24.12	9.47	4.87	3.52	3.41	4.52	1,329	3,409
1955	343,465	115,093	6,075	464,633	24.8	8.28	21.12	22.22	9.84	4.86	3.48	3.60	4.50	1,617	3,265
1956	365,774	127,055	8,045	500,874	25.4	8.62	21.18	24.85	10.28	5.20	3.74	4.17	4.82	1,728	3,705
1957	360,649	124,109	7,946	492,704	25.2	8.91	21.64	26.19	10.59	5.52	3.89	4.12	5.08	1,756	3,723
1958	286,884	116,242	7,320	410,446	28.3	9.38	21.54	28.15	11.33	5.33	3.80	3.60	4.86	1,646	3,515
1959	283,434	120,953	7,641	412,028	29.4	10.08	22.65	28.77	12.22	5.23	3.76	3.83	4.77	1,594	3,417
1960	284,888	122,630	7,994	415,512	29.5	10.64	22.93	31.36	12.83	5.14	3.74	3.37	4.69	1,530	3,313
1961	272,786	121,979	8,232	402,977	30.3	11.41	25.00	30.61	13.87	5.02	3.67	3.24	4.58	1,477	3,204
1962	281,286	130,300	10,583	422,149	30.9	11.97	26.76	34.61	14.72	4.91	3.64	3.33	4.48	1,429	3,185
1963	302,256	144,141	12,531	458,928	31.4	12.78	28.69	38.87	15.83	4.82	3.57	3.25	4.39	1,431	3,254
1964	321,808	151,859	13,331	486,998	31.2	13.74	29.29	42.63	16.84	4.92	3.55	3.35	4.45	1,455	3,192

NA. Not available.

<sup>1</sup> Includes power strip pits proper and excludes horse stripping operations and mines combining stripping and underground in the same operation for the period 1914-42. The years 1943-64 include data on all strip mines.

<sup>2</sup> Exclusive of horse stripping operations.



**TABLE 29.—Number and production of bituminous coal and lignite strip mines and units of stripping and loading equipment in use in the United States**

Year	Number of strip mines	Production (thousand net tons)	Number of power shovels and dragline excavators											Number of carry-all scrapers	Number of bulldozers		
			By type of power					By capacity of dipper or bucket, cubic yards				By type of machine				Total	
			Electric	Diesel-electric	Diesel	Gasoline	Steam	Less than 3	3-5	6-12	More than 12	Power shovels	Dragline excavators				
1932	255	19,641	1 105	(2)	* 61	(0)	166	NA	NA	NA	NA	NA	NA	NA	332	NA	NA
1933	289	18,270	1 117	(2)	* 103	(0)	189	NA	NA	NA	NA	NA	NA	NA	389	NA	NA
1934	344	20,790	1 121	(2)	* 149	(0)	188	NA	NA	NA	NA	NA	NA	NA	458	NA	NA
1935	368	23,647	1 139	(2)	* 194	(0)	174	NA	NA	NA	NA	NA	NA	NA	507	NA	NA
1936	381	28,126	1 151	(2)	* 223	(0)	188	NA	NA	NA	NA	NA	NA	NA	562	NA	NA
1937	449	31,751	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1938	465	30,407	1 155	(2)	* 440	(0)	142	NA	NA	NA	NA	NA	NA	NA	737	NA	NA
1939	537	37,722	1 184	(2)	* 524	(0)	206	NA	NA	NA	NA	NA	NA	NA	914	NA	NA
1940	638	43,167	1 194	(2)	* 697	(0)	180	NA	NA	NA	NA	NA	NA	NA	1,071	NA	NA
1941	769	55,071	1 210	(2)	* 911	(0)	200	1,009	153	95	64	NA	NA	NA	1,321	NA	NA
1942	834	67,203	1 219	(2)	* 1,020	(0)	199	1,114	159	97	68	NA	NA	NA	1,438	NA	NA
1943	1,004	79,685	1 234	(2)	* 1,433	(0)	172	1,488	173	106	72	NA	NA	NA	1,839	NA	NA
1944	1,240	100,898	1 244	(2)	* 1,902	(0)	166	1,900	225	113	74	NA	NA	NA	2,312	NA	NA
1945	1,370	109,987	1 256	(2)	* 2,042	(0)	141	2,004	243	117	75	NA	NA	NA	2,439	NA	NA
1946	1,445	112,964	1 261	(2)	1,619	753	111	2,256	302	112	74	2,406	338	2,744	2,663	NA	NA
1947	1,760	139,395	1 301	(2)	2,279	591	83	2,685	362	123	84	2,822	432	3,254	275	NA	NA
1948	1,971	139,506	1 337	(2)	2,675	646	54	3,048	446	130	88	3,177	535	3,712	362	NA	NA
1949	1,761	106,045	1 352	(2)	2,646	527	51	2,931	367	168	110	3,011	565	3,576	320	NA	NA
1950	1,870	123,467	1 348	(2)	2,890	607	42	3,182	416	170	109	3,247	630	3,877	286	NA	NA
1951	1,784	117,618	1 346	(2)	2,905	533	26	3,088	420	187	115	3,164	646	3,810	220	NA	NA
1952	1,643	108,910	1 321	(2)	2,642	545	19	2,800	425	183	119	2,892	635	3,527	218	NA	NA
1953	1,054	105,448	1 317	(2)	2,629	446	17	2,692	413	193	111	2,793	616	3,409	244	1,954	1,954
1954	1,329	98,134	1 381	(2)	2,617	374	18	2,450	579	211	120	2,605	785	3,390	269	2,599	2,599
1955	1,617	115,093	1 315	(2)	2,603	337	10	2,381	550	223	111	2,592	673	3,265	187	2,106	2,106
1956	1,728	127,055	285	136	2,914	365	5	2,693	634	249	129	2,899	806	3,705	226	2,381	2,381
1957	1,756	124,109	325	164	2,839	389	6	2,748	566	266	143	2,894	829	3,723	215	2,499	2,499
1958	1,646	116,242	315	273	2,607	315	5	2,507	591	275	142	2,704	811	3,515	173	2,472	2,472
1959	1,594	120,953	309	215	2,579	307	7	2,435	572	267	143	2,607	810	3,417	161	2,443	2,443
1960	1,530	122,630	311	194	2,519	285	4	2,315	588	265	145	2,521	792	3,313	163	2,345	2,345
1961	1,477	121,979	286	210	2,455	253	(0)	2,162	606	299	137	2,412	792	3,204	152	2,341	2,341
1962	1,429	130,300	296	214	2,423	252	(0)	2,111	597	335	142	2,353	832	3,185	146	2,330	2,330
1963	1,431	144,141	304	213	2,503	234	(0)	2,101	627	372	154	2,409	845	3,254	163	2,430	2,430
1964	1,455	151,859	315	146	2,540	191	(0)	2,045	599	381	167	2,352	840	3,192	148	2,441	2,441

NA Not available.

1 Includes diesel-electric shovels.

2 Included with electric shovels.

3 Includes gasoline shovels.

4 Included with diesel shovels.

5 Canvass discontinued.

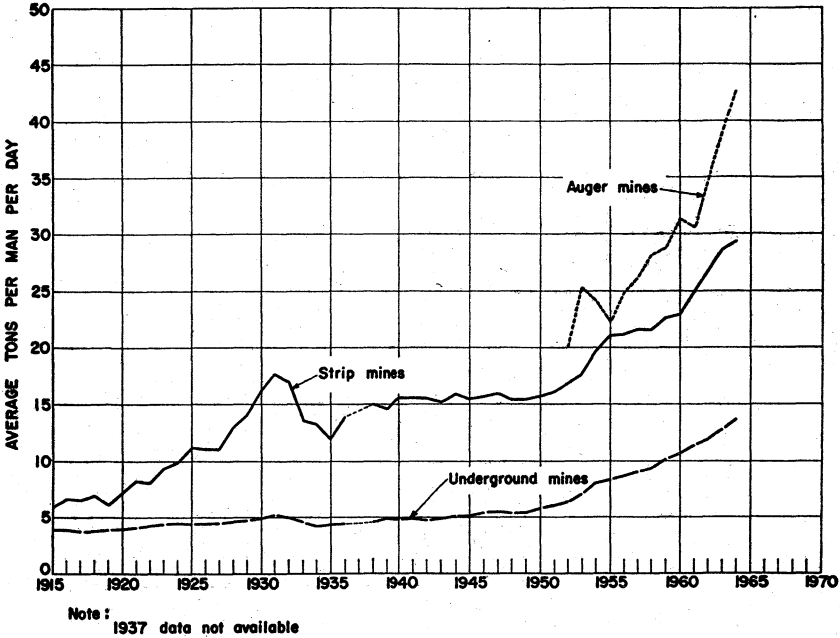


FIGURE 9.—Average tons per man per day at bituminous coal and lignite mines in the United States, 1915-64, by underground, strip and auger mines.

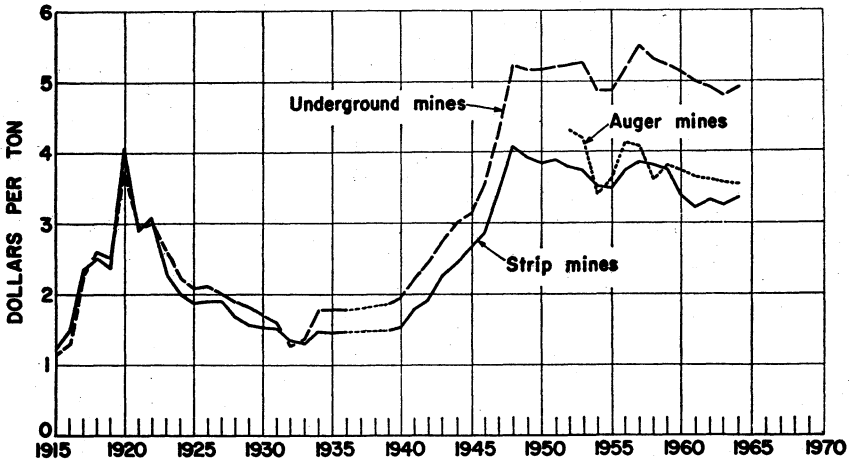


FIGURE 10.—Average value per ton, f.o.b. mines, of bituminous coal and lignite produced in the United States, 1915-64, by underground, strip, and auger mines.

TABLE 30.—Number and production of bituminous coal and lignite strip mines and units of stripping and loading equipment in use in the United States, 1964, by States

State	Number of strip mines	Production (net tons)	Number of power shovels and dragline excavators										Number of carryall scrapers	Number of bulldozers	
			By type of power				By capacity of dipper or bucket, cubic yards				By type of machine				Total
			Electric	Diesel electric	Diesel	Gasoline	Less than 3	3-5	6-12	More than 12	Power shovels	Dragline excavators			
Alabama.....	51	3,878,014	8	2	93	2	65	17	15	8	86	19	105	5	93
Alaska.....	5	744,942			13		6	6	1		11	2	13	4	24
Arkansas.....	6	138,431		4	5		6	1	2		3	6	9		9
Colorado.....	9	945,907	4	1	8		3	6	3		7	6	13	2	14
Illinois.....	57	29,888,126	97	7	66	3	30	34	54	55	107	66	173		121
Indiana.....	37	11,621,654	43	4	36	12	35	22	21	17	55	40	95	4	84
Iowa.....	21	803,021	1	1	35	6	29	11	3		26	17	43	4	34
Kansas.....	7	1,263,409	8	4	6	1	9	2	4	4	11	8	19		8
Kentucky:															
Eastern.....	65	3,129,677		2	93	5	82	12	6		94	6	100	4	72
Western.....	48	25,175,191	43	6	72	4	46	26	30	23	95	30	125	4	118
Total Kentucky.....	113	28,304,868	43	8	165	9	128	38	36	23	189	36	225	8	190
Maryland.....	32	750,311		1	43	10	46	6	2		44	10	54	3	30
Missouri.....	16	3,220,743	13	1	19	7	19	8	6	7	24	16	40	5	38
Montana:															
Bituminous.....	1	1,365				1			1		1		1		1
Lignite.....	1	294,082	1		1			1	1		1	1	2	1	1
Total Montana.....	2	295,447	1		1	1		2	1		2	1	3	1	2
New Mexico.....	3	2,551,172		5	3		1		4	3	6	2	8		7
North Dakota (lignite).....	28	2,634,884	20	2	16	8	23	12	9	2	36	10	46	22	39
Ohio.....	255	24,815,302	44	21	485	37	363	132	65	27	432	155	587	35	486
Oklahoma.....	12	1,017,253	7	4	7		5	7	2	4	10	8	18	1	14
Pennsylvania.....	510	23,505,457	13	61	1,083	84	882	219	127	13	839	402	1,241	19	814
South Dakota (lignite).....	1	13,000			2		1	1			1	1	2	1	1
Tennessee.....	47	2,071,994		6	88		79	7	7	1	89	5	94		67
Virginia.....	44	2,450,755			59		51	9			60		60	4	67
Washington.....															
West Virginia.....	188	7,867,872	2	18	295	8	253	53	16	1	299	24	323	10	279
Wyoming.....	11	2,975,817	6		12	3	11	6	3	1	15	6	21	20	20
Total.....	1,455	151,858,979	315	146	2,540	191	2,045	599	381	167	2,352	840	3,192	148	2,441

TABLE 31.—Bituminous coal lignite strip mines using power drills in bank or overburden in the United States

Year	Number of mines	Production		Number of power drills		
		Quantity (net tons)	Percentage of total	Horizontal	Vertical	Total
1946.....	514	75,375,841	66.7	NA	NA	764
1947.....	598	95,915,346	68.8	NA	NA	875
1948.....	728	98,809,393	72.3	NA	NA	1,195
1949.....	756	78,146,655	73.7	NA	NA	1,256
1950.....	692	87,205,280	70.6	NA	NA	1,201
1951.....	650	85,331,204	72.5	737	388	1,125
1952.....	629	79,252,284	73.0	685	385	1,070
1953.....	603	80,259,365	76.1	639	409	1,048
1954.....	541	70,107,205	71.4	592	391	983
1955.....	564	85,623,050	74.4	582	371	953
1956.....	696	96,278,779	75.8	652	389	1,041
1957.....	722	96,418,089	77.7	640	464	1,104
1958.....	737	91,659,662	78.9	615	464	1,079
1959.....	697	95,716,153	79.1	580	487	1,067
1960.....	714	96,660,466	78.8	551	498	1,049
1961.....	650	92,135,940	75.5	495	449	944
1962.....	636	100,901,554	77.4	456	461	917
1963.....	613	108,424,525	75.2	414	459	873
1964.....	670	119,312,811	78.6	395	504	899

NA Not available.

TABLE 32.—Bituminous coal and lignite strip mines using power drills in bank or overburden in the United States, by States

State	Number of mines		Production				Number of power drills					
			Quantity (net tons)		Percentage of total strip production		Horizontal		Vertical		Total	
	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964
Alabama.....	22	27	1,921,897	2,515,868	68.8	64.9	10	10	18	24	28	34
Alaska.....	5	5	853,398	504,569	100.0	67.7	3	3	5	4	8	7
Arkansas.....	3	5	124,686	132,988	85.7	96.1	2	1	2	4	4	5
Colorado.....	4	5	817,188	921,921	95.4	97.5	4	4	5	5	9	9
Illinois.....	37	37	21,074,807	23,147,270	77.2	77.2	28	23	25	30	53	53
Indiana.....	26	28	10,670,623	11,424,452	97.5	98.3	18	18	19	20	37	38
Iowa.....	17	15	1,050,612	738,919	99.5	91.9	17	15	13	11	30	26
Kansas.....	7	-----	1,162,342	1,263,409	99.6	100.0	10	11	3	3	13	14
Kentucky:												
Eastern.....	21	22	1,100,786	1,203,845	38.7	38.5	11	19	5	9	16	28
Western.....	22	28	19,955,852	24,334,625	87.1	96.7	12	10	33	39	45	49
Total Kentucky.....	43	50	21,056,638	25,538,170	81.8	90.2	23	29	38	48	61	77
Maryland.....	3	7	184,910	408,504	25.1	54.4	1	1	2	3	3	4
Missouri.....	11	12	3,072,054	3,188,185	97.9	99.0	15	12	-----	5	15	17
Montana:												
Bituminous.....	1	1	3,000	1,365	100.0	100.0	1	-----	-----	1	1	1
Lignite.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total Montana.....	1	1	3,000	1,365	1.0	.5	1	-----	-----	1	1	1
New Mexico.....	3	3	1,631,448	2,551,172	100.0	100.0	2	2	2	1	4	3
North Dakota (lignite).....	5	4	727,796	908,801	30.4	34.5	3	1	4	4	7	5
Ohio.....	108	121	18,453,908	19,453,741	75.6	78.4	61	63	102	106	163	169
Oklahoma.....	11	12	936,341	943,804	98.1	92.8	6	6	6	5	12	11
Pennsylvania.....	189	208	13,368,578	14,939,628	54.6	63.6	116	102	129	146	245	248
Tennessee.....	18	18	1,066,938	964,198	42.8	46.5	19	16	7	8	26	24
Virginia.....	12	12	1,447,282	1,543,688	62.9	63.0	10	10	6	8	16	18
West Virginia.....	79	93	5,861,049	5,462,818	78.7	69.4	60	64	65	59	125	123
Wyoming.....	9	7	2,939,030	2,759,341	97.8	92.7	5	4	8	9	13	13
Total.....	613	670	108,424,525	119,312,811	75.2	78.6	414	395	459	504	873	899

TABLE 33.—Method of haulage from bituminous coal and lignite strip mines to tippie or ramp, in the United States <sup>1</sup>

Year	Strip mines reporting method of haulage							Strip mines not reporting method of haulage—production (net tons)	Total strip production (net tons)
	Strip mines using trucks				Strip mines using rail, rail and truck, truck and tram—production (net tons)	Strip production			
	Production (net tons)	Number of trucks	Average capacity per truck (net tons)	Average distance hauled (miles)		Total (net tons)	Percentage of total		
1948.....	97,450,399	7,214	9.4	3.7	6,327,989	103,778,388	74.4	35,727,532	139,505,920
1949.....	73,220,556	6,694	10.1	3.7	5,365,432	78,594,988	74.1	27,450,311	106,045,299
1950.....	88,666,733	6,564	10.3	3.8	4,364,333	93,031,066	75.3	30,435,498	123,466,564
1951.....	87,427,029	6,173	10.6	4.0	2,424,994	89,852,023	76.4	27,765,653	117,617,676
1952.....	88,589,637	5,799	11.3	4.0	2,296,744	90,886,381	83.5	18,023,375	108,909,756
1953.....	84,764,694	5,287	12.2	4.0	2,104,600	86,869,303	82.4	18,579,266	105,448,569
1954.....	73,794,489	4,250	13.2	3.9	1,203,753	74,998,242	76.4	23,136,008	98,134,250
1955.....	94,150,171	4,798	13.3	3.9	2,290,600	96,440,771	83.9	18,651,998	115,092,769
1956.....	103,127,374	5,432	13.3	4.4	1,056,627	104,184,001	82.0	22,871,381	127,055,382
1957.....	104,796,728	5,532	14.0	4.3	164,311	104,961,039	84.6	19,147,499	124,108,538
1958.....	99,223,676	5,151	14.5	4.4	19,241	99,242,917	85.4	16,998,870	116,241,787
1959.....	102,706,819	4,959	15.3	4.6	-----	102,706,819	84.9	18,246,615	120,953,434
1960.....	104,099,974	4,855	15.5	4.8	-----	104,099,974	84.9	18,529,690	122,629,664
1961.....	101,951,989	4,407	16.5	4.4	-----	101,951,989	83.6	20,027,085	121,979,074
1962.....	109,846,339	4,309	17.7	4.9	-----	109,846,339	84.3	20,459,885	130,306,224
1963.....	119,681,295	4,314	18.5	4.7	-----	119,681,295	85.0	24,459,882	144,141,177
1964.....	132,209,971	4,462	19.5	4.7	-----	132,209,971	87.1	19,649,008	151,858,979

<sup>1</sup> Excludes lignite in 1948 and 1949.

TABLE 34.—Method of haulage from bituminous coal and lignite strip mines to tipple or ramp, in the United States, 1964, by States

State	Strip mines reporting method of haulage					Strip mines not reporting method of haulage—production (net tons)	Total strip production (net tons)
	Number of trucks	Average capacity per truck (net tons)	Average distance hauled (miles)	Production			
				Net tons	Percentage of total production		
Alabama.....	112	20.4	3.8	2,420,350	62.4	1,457,664	3,878,014
Alaska.....	15	25.3	2.9	504,569	67.7	240,373	744,942
Arkansas.....	13	9.3	1.3	138,431	100.0	-----	138,431
Colorado.....	24	19.0	1.9	929,607	98.3	15,300	945,907
Illinois.....	351	38.2	4.0	29,696,714	99.0	291,412	29,988,126
Indiana.....	143	32.4	4.1	11,427,797	98.3	193,917	11,621,654
Iowa.....	43	10.6	3.3	712,324	88.6	91,297	803,621
Kansas.....	30	30.9	2.3	1,263,409	100.0	-----	1,263,409
Kentucky.....	353	28.0	3.3	25,131,436	89.0	3,123,432	28,304,868
Maryland.....	26	17.1	4.8	454,295	60.5	296,016	750,311
Missouri.....	64	36.1	3.6	3,189,245	99.0	31,498	3,220,743
Montana:							
Bituminous.....	1	10.0	.2	1,365	100.0	-----	1,365
Lignite.....	4	20.0	1.5	294,082	100.0	-----	294,082
Total Montana.....	5	18.0	1.5	295,447	100.0	-----	295,447
New Mexico.....	23	41.6	3.7	2,551,172	100.0	-----	2,551,172
North Dakota (lignite).....	83	16.9	3.2	2,594,155	98.5	40,729	2,634,884
Ohio.....	780	19.1	6.4	20,416,864	82.3	4,898,438	24,815,302
Oklahoma.....	46	19.6	10.7	1,002,479	98.5	14,774	1,017,253
Pennsylvania.....	1,600	13.7	5.9	18,268,070	77.7	5,237,387	23,505,457
South Dakota (lignite).....	4	6.0	1.0	13,000	100.0	-----	13,000
Tennessee.....	80	15.7	14.0	675,979	32.6	1,396,015	2,071,994
Virginia.....	76	14.1	3.9	1,671,399	68.2	779,356	2,450,755
Washington.....							
West Virginia.....	558	15.5	6.8	5,961,137	75.8	1,906,735	7,867,872
Wyoming.....	28	24.0	6.8	2,842,152	95.5	133,665	2,975,817
Total.....	4,462	19.5	4.7	132,209,971	87.1	19,649,008	151,858,979

TABLE 35.—Stripping operations in the bituminous coal and lignite fields of the United States, 1964, by States and counties

State and county	Number of strip mines	Production (net tons)	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day
Alabama:						
Bibb.....	6	201,422	81	100	3,057	25.00
Etowah.....	2	126,560	32	307	9,872	12.82
Jackson.....	1	135,923	68	100	6,796	20.00
Jefferson.....	9	372,416	109	243	26,394	14.11
Marion.....	1	57,818	39	100	3,855	15.00
St. Clair.....	1	4,000	5	53	267	14.98
Tuscaloosa.....	9	1,055,331	113	259	29,380	35.92
Walker.....	20	1,771,044	343	158	54,967	32.22
Winston.....	2	153,500	31	248	7,675	20.00
Total Alabama.....	51	3,878,014	826	178	147,263	26.33
Alaska.....	5	744,942	177	267	47,208	15.78
Arkansas:						
Franklin.....	1	86,880	15	181	2,709	32.07
Johnson.....	W	W	W	W	W	W
Sebastian.....	W	W	W	W	W	W
Other counties.....	5	51,551	34	127	4,314	11.95
Total Arkansas.....	6	138,431	49	143	7,023	19.71

See footnotes at end of table.

TABLE 35.—Stripping operations in the bituminous coal and lignite fields of the United States, 1964, by States and counties—Continued

State and county	Number of strip mines	Production (net tons)	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day
<b>Colorado:</b>						
El Paso.....	W	W	W	W	W	W
Fremont.....	5	35,010	12	120	1,400	25.00
Montrose.....	W	W	W	W	W	W
Routt.....	W	W	W	W	W	W
Other counties.....	4	910,897	102	221	22,524	40.44
Total Colorado.....	9	945,907	114	210	23,924	39.54
<b>Illinois:</b>						
Adams.....	1	28,109	13	150	2,008	14.00
Bureau.....	W	W	W	W	W	W
Fulton.....	8	7,433,793	738	285	210,232	35.36
Gallatin.....	1	5,115	5	100	512	10.00
Greene.....	1	3,102	6	50	310	10.00
Grundy.....	W	W	W	W	W	W
Jackson.....	W	W	W	W	W	W
Jefferson.....	1	1,159	2	55	110	10.54
Knox.....	W	W	W	W	W	W
Mercer.....	W	W	W	W	W	W
Peoria.....	4	1,103,718	113	292	33,026	33.42
Perry.....	3	4,051,589	354	268	94,885	42.70
Randolph.....	2	1,541,186	126	319	40,208	38.33
St. Clair.....	W	W	W	W	W	W
Saline.....	10	2,535,837	419	251	105,265	24.09
Schuyler.....	W	W	W	W	W	W
Stark.....	W	W	W	W	W	W
Vermilion.....	W	W	W	W	W	W
Wabash.....	1	1,103	2	80	160	6.89
Will.....	W	W	W	W	W	W
Williamson.....	10	2,712,217	312	274	85,397	31.76
Other counties.....	15	10,571,198	986	276	271,815	33.89
Total Illinois.....	57	29,988,126	3,076	274	843,928	35.53
<b>Indiana:</b>						
Clay.....	7	960,267	143	263	37,554	25.57
Daviess.....	1	11,100	11	91	1,004	11.06
Fountain.....	W	W	W	W	W	W
Greene.....	5	1,551,511	219	275	60,300	25.73
Owen.....	W	W	W	W	W	W
Parke.....	1	7,416	12	239	2,863	2.59
Pike.....	W	W	W	W	W	W
Spencer.....	5	67,687	42	135	5,617	12.05
Sullivan.....	1	6,740	6	146	925	7.29
Vigo.....	W	W	W	W	W	W
Warrick.....	9	5,934,640	379	279	105,617	56.19
Other counties.....	8	3,082,293	433	249	107,896	28.57
Total Indiana.....	37	11,621,654	1,245	258	321,776	36.12
<b>Iowa:</b>						
Appanoose.....	2	9,524	14	31	433	21.98
Mahaska.....	5	318,486	94	295	27,840	11.44
Marion.....	7	375,570	51	289	14,728	25.50
Monroe.....	4	26,820	4	186	770	34.85
Van Buren.....	1	16,931	8	145	1,160	14.59
Wapello.....	2	56,290	16	320	5,276	10.67
Total Iowa.....	21	803,621	187	268	50,207	16.01
<b>Kansas:</b>						
Bourbon.....	1	6,258	6	104	626	10.00
Cherokee.....	W	W	W	W	W	W
Crawford.....	W	W	W	W	W	W
Other counties.....	6	1,257,151	242	251	60,798	20.68
Total Kansas.....	7	1,263,409	248	248	61,424	20.57

See footnotes at end of table.



TABLE 35.—Stripping operations in the bituminous coal and lignite fields of the United States, 1964, by States and counties—Continued

State and county	Number of strip mines	Production (net tons)	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day
<b>Kentucky, Eastern:</b>						
Bell.....	18	760,614	123	247	30,291	25.11
Boyd.....	1	27,733	18	100	1,849	15.00
Breathitt.....	2	125,115	42	200	8,341	15.00
Carter.....	1	4,000	13	50	667	6.00
Clay.....	1	22,500	13	150	1,875	12.00
Harlan.....	11	355,873	34	275	9,365	38.00
Jackson.....	2	11,096	15	50	740	15.00
Knott.....	1	152,000	94	65	6,080	25.00
Knox.....	2	8,000	11	50	533	15.00
Laurel.....	3	108,729	41	175	7,249	15.00
Lawrence.....	1	2,100	7	20	140	15.00
Leslie.....	3	146,257	16	150	2,438	60.00
Letcher.....	3	150,296	60	100	6,012	25.00
Morgan.....	2	29,508	13	140	1,844	16.00
Perry.....	3	764,797	31	250	7,648	100.00
Pike.....	6	295,111	18	250	4,540	65.00
Pulaski.....	1	72,142	6	280	1,603	45.00
Wayne.....	1	50,000	44	75	3,333	15.00
Whitley.....	3	43,806	39	75	2,920	15.00
Total Eastern Kentucky.....	65	3,129,677	638	153	97,468	32.11
<b>Kentucky, Western:</b>						
Butler.....	2	140,689	78	40	3,126	45.00
Christian.....	1	13,573	9	101	905	15.00
Daviess.....	3	838,101	78	293	22,799	36.76
Hancock.....	1	1,000	5	20	100	10.00
Hopkins.....	16	3,741,320	380	263	99,902	37.45
McLean.....	1	18,498	9	103	925	20.00
Muhlenberg.....	11	15,806,855	812	311	252,425	62.62
Ohio.....	8	4,113,967	233	318	74,045	55.56
Union.....	1	444,397	44	200	8,888	50.00
Webster.....	4	56,791	8	250	1,895	29.97
Total Western Kentucky.....	48	25,175,191	1,656	281	465,010	54.14
Total Kentucky.....	113	28,304,868	2,294	245	562,478	50.32
<b>Maryland:</b>						
Allegany.....	17	140,733	54	214	11,583	12.15
Garrett.....	15	609,578	61	272	16,637	36.64
Total Maryland.....	32	750,311	115	245	28,220	26.59
<b>Missouri:</b>						
Boone.....	W	W	W	W	W	W
Callaway.....	1	27,957	7	260	1,820	15.36
Clark.....	W	W	W	W	W	W
Dade.....	1	17,000	8	285	2,279	7.46
Henry.....	W	W	W	W	W	W
Macon.....	W	W	W	W	W	W
Putnam.....	2	131,482	29	300	8,765	15.00
St. Clair.....	2	191,090	66	139	9,165	20.85
Vernon.....	2	52,964	35	151	5,296	10.00
Other counties.....	8	2,800,250	272	273	74,376	37.65
Total Missouri.....	16	3,220,743	417	244	101,701	31.67
Montana (bituminous): Big Horn.....	(1)	(1)	(1)	(1)	(1)	(1)
Montana (lignite): Richland.....	(1)	(1)	(1)	(1)	(1)	(1)
Total Montana.....	(1)	(1)	(1)	(1)	(1)	(1)
<b>New Mexico:</b>						
McKinley.....	(1)	(1)	(1)	(1)	(1)	(1)
San Juan.....	(1)	(1)	(1)	(1)	(1)	(1)
Total New Mexico <sup>1</sup> .....	5	2,846,619	146	260	37,902	75.10

See footnotes at end of table.

TABLE 35.—Stripping operations in the bituminous coal and lignite fields of the United States, 1964, by States and counties—Continued

State and county	Number of strip mines	Production (net tons)	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day
<b>North Dakota (lignite):</b>						
Adams.....	1	15,637	4	250	1,117	14.00
Bowman.....	1	139,867	10	213	2,109	66.32
Burke.....	W	W	W	W	W	W
Burleigh.....	1	7,988	4	100	399	20.00
Dunn.....	1	2,809	3	100	312	9.00
Grant.....	4	19,930	7	135	997	20.00
Hettinger.....	1	2,919	1	150	146	20.00
McLean.....	3	47,842	16	64	1,016	47.09
Mercer.....	W	W	W	W	W	W
Morton.....	W	W	W	W	W	W
Oliver.....	W	W	W	W	W	W
Stark.....	3	88,848	15	150	2,221	40.00
Ward.....	W	W	W	W	W	W
Other counties.....	13	2,309,044	215	219	47,109	49.01
<b>Total North Dakota (lignite).....</b>	<b>28</b>	<b>2,634,884</b>	<b>275</b>	<b>202</b>	<b>55,426</b>	<b>47.54</b>
<b>Ohio:</b>						
Athens.....	2	16,876	15	125	1,875	9.00
Belmont.....	20	3,303,635	852	256	218,206	15.14
Carroll.....	9	258,841	50	296	14,927	17.34
Columbiana.....	37	1,342,526	263	293	77,157	17.40
Coshocton.....	8	1,817,441	176	307	54,123	33.58
Gallia.....	7	423,377	92	364	33,495	12.64
Guernsey.....	6	233,594	58	200	11,680	20.00
Harrison.....	11	3,415,780	310	220	68,247	50.05
Hocking.....	5	64,768	32	186	5,986	10.82
Holmes.....	3	202,723	33	312	10,450	19.40
Jackson.....	12	515,290	621	211	131,117	3.93
Jefferson.....	31	3,275,578	428	266	113,933	28.75
Lawrence.....	W	W	W	W	W	W
Mahoning.....	14	789,408	161	329	52,839	14.94
Meigs.....	4	278,541	70	200	13,927	20.00
Morgan.....	4	1,869,058	143	359	51,320	36.42
Muskingum.....	4	42,403	28	150	4,240	10.00
Noble.....	11	2,375,505	168	330	55,296	42.96
Perry.....	W	W	W	W	W	W
Portage.....	1	62,628	17	310	5,362	11.68
Stark.....	12	398,541	83	295	24,616	16.19
Tuscarawas.....	36	2,138,422	512	304	155,522	13.75
Vinton.....	3	133,781	37	291	10,780	12.41
Wayne.....	3	52,062	59	126	7,437	7.00
Other counties.....	12	1,804,524	173	305	52,710	34.23
<b>Total Ohio.....</b>	<b>255</b>	<b>24,815,302</b>	<b>4,381</b>	<b>268</b>	<b>1,175,245</b>	<b>21.12</b>
<b>Oklahoma:</b>						
Craig.....	7	323,092	81	279	22,641	14.27
Haskell.....	W	W	W	W	W	W
Muskogee.....	1	1,350	3	113	338	4.00
Okmulgee.....	1	1,700	2	53	106	16.04
Rogers.....	W	W	W	W	W	W
Other counties.....	3	691,111	132	221	29,128	23.73
<b>Total Oklahoma.....</b>	<b>12</b>	<b>1,017,253</b>	<b>218</b>	<b>240</b>	<b>52,213</b>	<b>19.48</b>
<b>Pennsylvania:</b>						
Allegheny.....	17	865,293	116	230	26,665	32.45
Armstrong.....	47	1,489,743	428	161	68,842	21.64
Beaver.....	12	430,927	86	293	25,215	17.09
Bedford.....	W	W	W	W	W	W
Blair.....	1	4,761	3	176	598	7.96
Bradford.....	W	W	W	W	W	W
Butler.....	33	1,495,691	301	232	69,859	21.41
Cambria.....	20	1,088,975	253	206	52,154	20.88
Cameron.....	W	W	W	W	W	W
Centre.....	13	546,840	138	263	36,287	15.07
Clarion.....	27	3,045,757	646	273	176,463	17.26
Clearfield.....	92	6,087,635	1,357	235	318,894	19.09
Clinton.....	7	479,783	67	281	18,712	25.64
Elk.....	8	298,869	71	227	16,120	18.54
Fayette.....	26	536,176	125	224	27,897	19.22
Greene.....	9	100,344	27	130	3,548	28.23
Huntingdon.....	W	W	W	W	W	W

See footnotes at end of table.

TABLE 35.—Stripping operations in the bituminous coal and lignite fields of the United States, 1964, by States and counties—Continued

State and county	Number of strip mines	Production (net tons)	Average number of men working daily	A average number of days worked	Number of man-days worked	Average tons per man per day
<b>Pennsylvania—Continued</b>						
Indiana.....	26	733, 233	198	189	37, 372	19.62
Jefferson.....	25	1, 097, 055	283	221	62, 653	17.51
Lawrence.....	19	824, 743	150	270	40, 409	20.41
Lycoming.....	W	W	W	W	W	W
McKean.....	1	21, 700	22	100	2, 170	10.00
Mercer.....	11	586, 780	117	313	36, 651	16.01
Somerset.....	49	1, 816, 917	291	200	58, 141	31.25
Tioga.....	5	350, 132	84	225	18, 906	18.52
Venango.....	14	456, 621	69	236	16, 198	28.19
Washington.....	13	686, 698	152	217	32, 935	20.85
Westmoreland.....	25	189, 718	60	196	11, 689	16.23
Other counties.....	10	271, 016	88	261	22, 932	11.82
Total Pennsylvania.....	510	23, 505, 457	5, 132	230	1, 181, 310	19.90
South Dakota (lignite): Dewey.....	1	13, 000	8	163	1, 300	10.00
<b>Tennessee:</b>						
Anderson.....	9	465, 103	72	206	14, 855	31.31
Campbell.....	11	527, 387	85	166	14, 049	37.54
Claiborne.....	4	103, 263	15	233	3, 526	29.29
Grundy.....	W	W	W	W	W	W
Hamilton.....	W	W	W	W	W	W
Marion.....	1	15, 056	13	75	1, 003	15.00
Morgan.....	6	125, 720	16	178	2, 888	43.83
Scott.....	6	228, 071	84	90	7, 602	30.00
Van Buren.....	5	266, 552	37	233	8, 646	30.83
Other counties.....	5	340, 842	68	284	19, 331	17.63
Total Tennessee.....	47	2, 071, 994	390	184	71, 880	28.83
<b>Virginia:</b>						
Buchanan.....	9	610, 674	122	200	24, 427	25.00
Dickenson.....	11	530, 753	53	200	10, 615	50.00
Lee.....	1	1, 024	1	75	68	15.00
Russell.....	1	2, 945	3	75	196	15.00
Tazewell.....	2	34, 334	17	100	1, 717	20.00
Wise.....	20	1, 271, 025	139	240	33, 448	38.00
Total Virginia.....	44	2, 450, 755	335	210	70, 471	34.78
<b>West Virginia:</b>						
Barbour.....	14	679, 102	125	166	20, 812	32.63
Boone.....	5	506, 027	105	214	22, 500	22.49
Brooke.....	6	395, 580	57	302	17, 192	23.01
Fayette.....	8	418, 399	48	254	12, 291	34.04
Gilmer.....	1	5, 252	11	50	525	10.00
Grant.....	W	W	W	W	W	W
Greenbrier.....	1	9, 660	6	100	644	15.00
Hancock.....	1	34, 620	15	150	2, 308	15.00
Harrison.....	30	1, 415, 755	286	225	64, 353	22.00
Kanawha.....	7	259, 509	29	197	5, 748	45.15
Lewis.....	6	118, 707	59	100	5, 935	20.00
Lincoln.....	4	18, 363	15	102	1, 530	12.00
Logan.....	W	W	W	W	W	W
Marion.....	W	W	W	W	W	W
Mason.....	3	135, 165	25	196	4, 988	27.10
McDowell.....	10	785, 719	77	277	21, 368	36.77
Mercer.....	6	223, 771	37	175	6, 393	35.00
Mineral.....	1	26, 085	3	198	594	43.91
Mingo.....	7	28, 433	18	40	710	40.00
Monongalia.....	7	125, 955	19	225	4, 199	30.00
Nicholas.....	8	254, 467	43	202	8, 733	29.14
Freston.....	29	1, 067, 505	169	294	49, 721	21.47
Raleigh.....	7	293, 797	27	243	6, 493	45.25
Randolph.....	7	121, 360	19	193	3, 751	32.35
Taylor.....	5	228, 399	35	75	2, 656	86.00
Tucker.....	5	195, 431	24	200	4, 886	40.00
Upshur.....	2	43, 856	9	75	692	63.40
Webster.....	2	61, 416	37	224	8, 178	7.51
Wyoming.....	6	276, 226	39	200	7, 892	35.00
Other counties.....	6	139, 313	42	141	5, 941	23.45
Total West Virginia.....	188	7, 867, 872	1, 379	211	291, 033	27.03

See footnotes at end of table.

TABLE 35.—Stripping operations in the bituminous coal and lignite fields of the United States, 1964, by States and counties—Continued

State and county	Number of strip mines	Production (net tons)	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day
Wyoming:						
Campbell.....	1	488,846	34	261	8,888	55.00
Carbon.....	4	446,509	77	145	11,163	40.00
Converse.....	W	W	W	W	W	W
Lincoln.....	W	W	W	W	W	W
Sheridan.....	2	431,521	38	252	9,589	45.00
Other counties.....	4	1,608,941	105	212	22,297	72.16
Total Wyoming.....	11	2,975,817	254	204	51,937	57.30
Total United States.....	1,455	151,858,979	21,266	244	5,183,869	29.29

W Withheld to avoid disclosing individual company data; included with "other counties."

<sup>1</sup> To avoid disclosing individual operations Montana and New Mexico are combined.

### AUGER MINING

Augers are generally used in areas where strip mining has become economically impracticable because the overburden is thick. They were used first about 1945, and separate statistics on coal-recovery augers begin with 1951. The rapidly expanded production of coal by stripping during World War II in the mountainous areas of the northern Appalachian region left many miles of high wall containing exposed coal seams. After several years of experimentation, large, efficient augers as much as 84 inches in diameter were developed to recover the coal from these exposed coal seams.

Production at auger mines increased rapidly from 205,000 tons in 1951 to 13 millions tons in 1964. Augers were used to mine coal in seven States in 1964, and sales of augers reported by three manufacturers indicate continued growth of auger mining. A few coal-recovery augers have been sold for underground use; these units and the coal produced by them have been included with coal loaded mechanically underground.

TABLE 36.—Auger mines in the bituminous coal and lignite fields of the United States, 1964, by States and counties

State and county	Number of auger mines	Equipment in use (number of units)				Production (net tons)	Average number of men working daily	Average Number of days worked	Number of man-days worked	Average tons per man per day
		Augers	Power shovels	Power drills	Bull-dozers					
Alabama:										
Jefferson.....	1	1			1	12,348	4	150	617	20.00
Walker.....	3	4			1	83,140	36	171	6,195	31.42
Total Alabama.....	4	5			2	95,488	40	170	6,812	14.02
Kentucky, Eastern:										
Bell.....	11	10			2	522,672	25	280	6,969	75.00
Breathitt.....	1	1			1	26,362	7	150	1,054	25.00
Clay.....	1	1				71,784	14	175	2,393	30.00
Floyd.....	4	4				70,474	23	100	2,349	30.00
Harlan.....	14	14		3	13	440,444	29	275	8,008	55.00
Jackson.....	1	1			1	25,100	6	200	1,255	20.00
Johnson.....	1	1				43,969	18	100	1,759	25.00
Knott.....	2	2			3	230,159	480	30	14,385	16.00
Knox.....	7	7				46,500	4	150	681	80.00
Leslie.....	5	5			1	48,343	24	50	1,209	40.00
Leslie.....	2	2				594,547	125	129	16,139	36.84
Letcher.....	18	18		2	8	4,000	8	25	200	20.00
Martin.....	2	2				1,020,045	147	167	24,568	41.52
Perry.....	18	19	1		16	1,356,625	125	145	18,088	75.00
Pike.....	37	38	2		9	31,920	5	230	1,140	28.00
Pulaski.....	1	1			2	46,122	6	220	1,349	34.18
Whitley.....	2	2								
Total Eastern Kentucky.....	126	127	3	5	56	4,579,066	1,046	97	101,446	45.14
Kentucky, Western:										
Hopkins.....	2	2	2		3	59,672	13	80	1,036	57.60
Ohio.....	1	1				20,719	4	80	320	64.72
Total Western Kentucky.....	3	3	2		3	80,391	17	80	1,356	59.29
Total Kentucky.....	129	130	5	5	59	4,659,457	1,063	97	102,802	45.32
Ohio:										
Athens.....	1	1			1	3,306	3	75	194	17.00
Belmont.....	6	7	1	1	7	74,510	30	147	4,430	16.82
Carroll.....	W	W	W	W	W	W	W	W	W	W
Columbiana.....	10	9			6	166,176	11	214	2,316	71.74
Coshocton.....	W	W	W	W	3	W	W	W	W	W
Gallia.....	3	3	1		3	104,708	7	259	1,740	60.17
Guernsey.....	3	2			1	72,005	25	150	764	95.00
Harrison.....	5	5	1		7	87,399	11	100	1,092	80.00

Hocking.....	W	W	W	W	W	W	W	W	W	W
Jefferson.....	9	9			5	299,666	15	217	3,253	92.11
Meigs.....	2	2			1	99,159	21	120	2,479	40.00
Muskingum.....	W	W	W	W	W	W	W	W	W	W
Noble.....	4	6			6	346,929	64	135	8,673	40.00
Perry.....	W	W	W	W	W	W	W	W	W	W
Stark.....	1	1				8,425	7	90	602	14.00
Tuscarawas.....	3	3			3	42,391	14	75	1,060	40.00
Other counties.....	7	7	1		9	444,939	43	205	8,817	50.46
<b>Total Ohio.....</b>	<b>54</b>	<b>55</b>	<b>5</b>	<b>1</b>	<b>49</b>	<b>1,750,213</b>	<b>231</b>	<b>153</b>	<b>35,420</b>	<b>49.41</b>
<b>Pennsylvania:</b>										
Allegheny.....	W	W	W	W	W	W	W	W	W	W
Armstrong.....	7	5				88,431	22	90	1,957	45.18
Beaver.....	W	W	W	W	W	W	W	W	W	W
Butler.....	14	17			1	153,579	17	185	3,092	49.67
Cambria.....	6	4				31,971	8	92	743	43.02
Centre.....	1	1				9,844	3	40	126	78.33
Clarion.....	4	5			1	45,354	14	156	2,159	21.01
Clearfield.....	17	18	1	4	2	390,424	112	154	17,283	22.59
Elk.....	3	4			1	11,044	2	183	450	24.54
Indiana.....	2	2			1	10,007	5	46	230	43.55
Jefferson.....	8	9			1	101,099	53	104	5,474	18.47
Lawrence.....	2	2			1	9,693	4	100	388	25.00
Venango.....	W	W	W	W	W	W	W	W	W	W
Washington.....	W	W	W	W	W	W	W	W	W	W
Westmoreland.....	1	1				4,450		60	223	20.00
Other counties.....	11	11		3	4	193,255	32	165	5,273	36.65
<b>Total Pennsylvania.....</b>	<b>76</b>	<b>79</b>	<b>1</b>	<b>9</b>	<b>11</b>	<b>1,049,151</b>	<b>276</b>	<b>136</b>	<b>37,398</b>	<b>28.05</b>
<b>Tennessee:</b>										
Anderson.....	1	1			2	12,453	5	68	360	34.63
Campbell.....	1	1			1	36,000	14	100	1,440	25.00
Claborne.....	2	2	1		1	101,795	15	200	2,908	35.00
Morgan.....	1	1				50,919	17	100	1,697	30.00
Scott.....	2	2	2	2		53,097	5	250	1,327	40.00
<b>Total Tennessee.....</b>	<b>7</b>	<b>7</b>	<b>3</b>	<b>2</b>	<b>4</b>	<b>254,264</b>	<b>56</b>	<b>138</b>	<b>7,732</b>	<b>32.88</b>
<b>Virginia:</b>										
Buchanan.....	24	24			26	511,008	51	200	10,220	50.00
Dickenson.....	11	11			10	160,421	40	100	4,011	40.00
Lee.....	W	W	W	W	W	W	W	W	W	W
Russell.....	W	W	W	W	W	W	W	W	W	W
Tazewell.....	2	2			2	6,086	3	50	152	40.00
Wise.....	16	17			12	410,761	34	169	5,726	71.73
Other counties.....	3	3			5	49,651	21	114	2,398	20.71
<b>Total Virginia.....</b>	<b>56</b>	<b>57</b>			<b>55</b>	<b>1,137,927</b>	<b>149</b>	<b>151</b>	<b>22,507</b>	<b>50.56</b>

See footnote at end of table.

TABLE 36.—Auger mines in the bituminous coal and lignite fields of the United States, 1964, by States and counties—Continued

State and county	Number of auger mines	Equipment in use (number of units)				Production (net tons)	Average number of men working daily	Average number of days worked	Number man-days worked	Average tons per man per day
		Augers	Power shovels	Power drills	Bulldozers					
West Virginia:										
Barbour.....	W	W	W	W	W	W	W	W	W	
Boone.....	10	12	4	1	16	1,257,349	114	203	23,130	54.36
Brooke.....	4	4			3	56,720	6	126	748	75.83
Clay.....	1	1	1		1	9,955	10	50	498	20.00
Fayette.....	4	5	1	1	5	272,906	37	204	7,497	36.40
Harrison.....	12	12			10	277,748	30	100	2,991	92.86
Kanawha.....	15	15	5	3	19	1,053,367	193	179	34,469	30.56
Lewis.....	2	1				38,676	13	100	1,289	30.00
Logan.....	6	7			7	401,947	33	144	4,751	84.60
Mason.....	1	1				5,795	2	130	232	25.00
McDowell.....	10	12			5	311,098	34	213	7,281	42.73
Mercer.....	6	6			1	35,456	16	75	1,182	30.00
Mingo.....	7	7			5	184,125	21	196	4,076	45.17
Monongalia.....	W	W	W	W	W	W	W	W	W	W
Nicholas.....	5	6			4	92,947	30	90	2,737	33.96
Preston.....	W	W	W	W	W	W	W	W	W	W
Raleigh.....	7	9	5	3	10	202,299	25	89	2,257	89.62
Randolph.....	W	W	W	W	W	W	W	W	W	W
Webster.....	1	1				1,200	4	20	80	15.00
Wyoming.....	6	7	1		3	60,994	13	190	2,440	25.00
Other counties.....	6	6	1		3	121,977	68	65	4,418	27.61
Total West Virginia.....	103	112	18	8	92	4,384,559	649	154	100,076	43.81
Total United States.....	429	445	32	25	272	13,331,059	2,464	127	312,747	42.63

W Withheld to avoid disclosing individual company data; included with "Other counties."

TABLE 37.—Units of coal-recovery augers sold to bituminous coal and lignite mines for surface use in the United States, as reported by manufacturers, by States

	1960	1961	1962	1963	1964
Alabama.....		1	1		2
Iowa.....			1		
Kentucky.....	8	5	4	16	6
Ohio.....	5	5	2	4	3
Pennsylvania.....	7	4	4	6	4
Tennessee.....	1	1			1
Virginia.....	1		1	1	3
West Virginia.....	3	2	2	9	7
Total.....	25	18	15	36	26

### MECHANICAL LOADING

Prior to 1925 less than 1 percent of the total underground output was mechanically loaded. During the following 10 years (1925-35), as better machines were developed, mechanical loading increased more than 1 percent per year, and in 1935 almost 14 percent of the total underground output was mechanically loaded. Development was rapid in some States but practically nonexistent in others. The percentage of underground production mechanically loaded in 1935 in some States was as follows: Wyoming (90), Illinois (56), Indiana (64), Pennsylvania (7), West Virginia (2), and Kentucky (1). During the next 20 years (1935-55), mechanical loading increased rapidly, averaging a gain of more than 3 percent per year, until it included 85 percent of the underground output in 1955.

Although the increase in mechanical loading has leveled off in the past few years, the type of loading equipment has changed considerably. In the past 10 years, the proportion produced by mobile loading into mine cars decreased from 14 to 2 percent of the total underground production, and mobile loading into shuttle cars decreased from 53 percent in 1954 to 44 percent in 1964; production from continuous-mining machines increased from 6 to 39 percent, all other types of mechanical loading decreased from 11 to 2 percent, and hand loading into mine cars decreased from 16 to 13 percent during the same period.

The most important change in mechanical loading in recent years was the introduction of continuous-mining machines. In 1964, 125 million tons of bituminous coal was produced at 361 mines by continuous-mining machines, whereas in 1963, 104 million tons were produced at 342 mines. In 1964, 219 mines, compared with 193 mines in 1963, used continuous-mining machines exclusively.

Longwall mining began in November 1951, on a 340-foot face in the Pocahontas No. 4 seam in Raleigh County, W. Va. Production from longwall mining to date has not been large, and as a result separate figures begin with 1963 when 816,003 tons were mined by this method. In 1964, longwall mining was practiced in three States (Illinois, Utah, and West Virginia), and a total of 1,450,629 tons was mined by this method.

Sales of mobile loading machines, continuous-mining machines, shuttle cars, and gathering and haulage conveyors increased, whereas sales of room or transfer conveyors and bridge conveyors decreased.



TABLE 38.—Growth of mechanical loading at underground bituminous coal and lignite mines in the United States

Year	Underground production (thousand net tons)						Percentage of underground production		Number of mechanical loading units					
	Mechanically loaded					Hand-loaded into mine cars	Total	Mechanically loaded	Hand-loaded into mine cars	Mobile loading machines used in conventional mining	Duck-bills and scrapers <sup>1</sup>	Hand-loaded conveyors and pit-car loaders <sup>1</sup>	Con- tinuous mining machines	Mobile loading machine used in conjunction with continuous mining
	Conventional mining			Con- tinuous mining	Total									
	Mobile loading machines	Duck- bills and scrapers <sup>1</sup>	Hand- loaded conveyors and pit-car loaders <sup>1</sup>											
1923.....	NA	NA	NA	-----	<sup>2</sup> 1,880	550,745	552,625	0.3	99.7	NA	NA	NA	-----	-----
1924.....	NA	NA	NA	-----	<sup>2</sup> 3,496	466,584	470,080	.7	99.3	NA	NA	NA	-----	-----
1925.....	NA	NA	NA	-----	<sup>2</sup> 6,243	496,939	503,182	1.2	98.8	NA	NA	NA	-----	-----
1926.....	7,786	2,236	523	-----	<sup>2</sup> 10,545	545,899	556,444	1.9	98.1	<sup>295</sup> 160	NA	NA	-----	-----
1927.....	NA	NA	NA	-----	16,500	482,885	499,385	3.3	96.7	NA	NA	NA	-----	-----
1928.....	11,811	2,748	7,000	-----	21,559	459,397	480,956	4.5	95.5	397	212	1,040	-----	-----
1929.....	16,432	2,859	18,571	-----	37,862	476,859	514,721	7.4	92.6	488	225	2,521	-----	-----
1930.....	20,073	3,265	23,644	-----	46,982	400,702	447,684	10.5	89.5	545	290	2,876	-----	-----
1931.....	19,407	3,282	24,873	-----	47,562	315,595	363,157	13.1	86.9	583	311	3,428	-----	-----
1932.....	14,825	2,762	18,230	-----	35,817	254,252	290,069	12.3	87.7	548	287	3,112	-----	-----
1933.....	17,865	2,647	17,309	-----	37,821	277,539	315,360	12.0	88.0	523	225	2,978	-----	-----
1934.....	20,750	3,086	17,597	-----	41,433	297,145	338,578	12.2	87.8	534	276	2,862	-----	-----
1935.....	24,675	3,713	18,789	-----	47,177	301,549	348,726	13.5	86.5	657	257	2,768	-----	-----
1936.....	40,970	4,513	21,494	-----	66,977	343,985	410,962	16.3	83.7	980	340	2,787	-----	-----
1937.....	NA	NA	NA	-----	83,500	330,280	413,780	20.2	79.8	NA	NA	NA	-----	-----
1938.....	57,824	5,279	21,990	-----	85,093	233,045	318,138	26.7	73.3	1,405	463	2,918	-----	-----
1939.....	76,442	7,766	26,504	-----	110,712	246,421	357,133	31.0	69.0	1,673	690	2,707	-----	-----
1940.....	100,962	11,617	35,291	-----	147,870	269,734	417,604	35.4	64.6	1,720	772	2,960	-----	-----
1941.....	126,478	16,208	43,981	-----	186,667	272,411	459,078	40.7	59.3	1,985	897	3,414	-----	-----
1942.....	160,301	22,088	50,514	-----	232,903	282,587	515,490	45.2	54.8	2,301	1,155	3,522	-----	-----
1943.....	179,008	24,266	46,531	-----	249,805	260,687	510,492	48.9	51.1	2,525	1,309	3,512	-----	-----
1944.....	202,875	24,605	46,809	-----	274,189	244,489	518,678	52.9	47.1	2,737	1,418	3,477	-----	-----
1945.....	198,668	22,758	41,086	-----	262,512	205,118	467,630	56.1	43.9	2,950	1,470	3,527	-----	-----
1946.....	186,975	20,595	37,771	-----	245,341	175,617	420,958	58.3	41.7	3,200	1,596	3,563	-----	-----
1947.....	229,836	22,775	45,546	-----	298,157	193,072	491,229	60.7	39.3	3,569	1,598	4,050	-----	-----
1948.....	232,217	20,377	42,762	450	295,806	164,206	460,012	64.3	35.7	<sup>3</sup> 3,965	1,688	4,162	15	NA
1949.....	174,639	14,333	30,804	2,600	222,376	109,447	331,823	67.0	33.0	<sup>3</sup> 4,155	1,529	4,329	50	NA

1950.....	218,126	14,303	35,446	4,850	272,725	120,119	392,844	69.4	30.6	<sup>3</sup> 4,228	1,368	4,446	90	NA
1951.....	246,397	14,010	37,583	6,061	304,051	111,791	415,842	73.1	26.9	<sup>3</sup> 4,302	1,264	3,904	108	NA
1952.....	218,982	10,667	31,130	8,215	268,994	87,431	356,425	75.5	24.5	<sup>3</sup> 4,083	1,068	3,569	152	NA
1953.....	232,585	8,770	25,144	11,830	278,329	71,222	349,551	79.6	20.4	<sup>3</sup> 3,985	878	2,994	219	NA
1954.....	206,546	5,083	15,005	16,336	242,970	46,142	289,112	84.0	16.0	<sup>4</sup> 4,224	681	2,162	325	90
1955.....	243,204	4,510	15,497	27,460	290,671	52,794	343,465	84.6	15.4	<sup>4</sup> 3,679	510	1,925	385	140
1956.....	248,341	3,883	15,271	39,907	307,402	58,372	365,774	84.0	16.0	<sup>4</sup> 3,666	472	1,819	510	188
1957.....	236,720	2,781	12,463	53,783	305,737	54,912	360,649	84.8	15.2	<sup>4</sup> 3,556	375	1,528	614	199
1958.....	178,014	1,560	7,626	56,373	243,573	43,311	286,884	84.9	15.1	<sup>4</sup> 3,212	249	1,290	679	222
1959.....	171,150	1,010	5,779	65,792	243,731	39,703	283,434	86.0	14.0	<sup>4</sup> 2,895	144	1,014	776	226
1960.....	162,109	1,232	4,517	77,928	245,786	39,102	284,888	86.3	13.7	<sup>4</sup> 2,707	159	931	879	245
1961.....	145,134	1,032	4,863	84,321	235,350	37,416	272,766	86.3	13.7	<sup>4</sup> 2,348	130	867	927	235
1962.....	146,962	488	4,296	90,174	240,920	40,346	281,266	85.7	14.3	<sup>4</sup> 2,235	100	825	961	267
1963.....	150,303	457	4,131	104,350	259,241	43,015	302,256	85.8	14.2	<sup>4</sup> 2,186	81	680	1,030	249
1964.....	152,409	313	3,702	124,677	281,101	40,707	321,808	87.4	12.6	<sup>4</sup> 2,159	73	585	1,111	237

NA Not available.

<sup>1</sup> For separate data by type of loading, see Minerals Yearbook 1959, v. 2, p. 86. Cans of pit-car loaders discontinued in 1951.

Exclusive of tonnage "Handled by conveyors."

<sup>3</sup> Includes mobile loading machines used in conjunction with continuous mining.

<sup>4</sup> Mobile loading machines used in conjunction with continuous mining shown separately in last column of this table.

**TABLE 39.**—Bituminous coal and lignite mechanically loaded underground in the United States, by type of loading equipment

Type of loading equipment	1963		1964	
	Net tons	Percentage of tons	Net tons	Percentage of tons
<b>Mobile machines:</b>				
Direct into mine cars.....	5,813,032	2.2	7,093,848	2.5
Onto conveyors.....	1,926,174	.7	2,770,863	1.0
Into shuttle cars.....	142,563,644	55.0	142,544,548	50.7
<b>Continuous-mining machines:</b>				
Onto conveyors.....	19,897,393	7.7	17,322,123	6.2
Into shuttle cars.....	84,452,963	32.6	107,354,917	38.2
<b>Scrapers and conveyors equipped with duck-bills or other self-loading heads.....</b>	<b>457,083</b>	<b>.2</b>	<b>312,595</b>	<b>.1</b>
<b>Hand-loaded conveyors.....</b>	<b>4,130,546</b>	<b>1.6</b>	<b>3,701,612</b>	<b>1.3</b>
<b>Total mechanically loaded.....</b>	<b>259,240,835</b>	<b>100.0</b>	<b>281,100,506</b>	<b>100.0</b>

**TABLE 40.—Comparative changes in underground mechanical loading of bituminous coal and lignite by principal types of loading devices in the United States, by States**

State	Loading machines <sup>1</sup> (net tons)		Continuous-mining machines (net tons)		Hand-loaded conveyors (net tons)		Total mechanically loaded (net tons)		Total production at mines using mechanical loading devices (net tons)		Handled by each class (percent)					
	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964	Loading machines <sup>1</sup>		Continuous- mining machines		Hand- loaded conveyors	
											1963	1964	1963	1964	1963	1964
Alabama	8,394,704	9,445,506	163,446	-----	291,013	274,823	8,849,163	9,720,329	8,849,163	9,720,822	94.9	97.2	1.8	-----	3.3	2.8
Arkansas	-----	-----	-----	-----	75,218	73,884	75,218	73,884	75,218	73,884	-----	-----	-----	-----	100.0	100.0
Colorado	1,099,281	1,341,872	1,533,734	1,822,837	151,649	197,892	2,784,694	3,362,601	2,797,904	3,363,656	39.5	39.9	55.1	54.2	5.4	5.9
Illinois	15,624,088	16,001,259	8,793,343	9,011,966	-----	-----	24,417,431	25,013,225	24,417,431	25,013,225	64.0	64.0	36.0	36.0	-----	-----
Indiana	3,639,838	3,205,040	484,276	223,268	-----	-----	4,124,114	3,428,308	4,124,114	3,428,308	88.3	93.5	11.7	6.5	-----	-----
Iowa	99,661	123,359	-----	-----	-----	-----	99,661	123,359	99,661	123,359	100.0	100.0	-----	-----	-----	-----
Kentucky	27,779,913	29,139,050	4,344,908	6,245,567	253,416	198,042	32,378,237	35,582,659	32,577,181	35,809,788	85.8	81.9	13.4	17.5	8	6
Maryland	63,427	70,855	71,809	102,211	33,303	12,270	168,539	185,336	179,434	220,691	37.6	38.2	42.6	55.2	19.8	6.6
Montana	47,410	39,388	-----	-----	1,488	1,572	48,898	40,960	48,898	41,560	97.0	96.2	-----	-----	3.0	3.8
New Mexico	-----	-----	293,371	397,574	2,052	1,472	295,423	399,046	295,423	399,046	-----	-----	99.3	99.6	7	4
Ohio	5,783,286	5,683,120	4,059,193	4,519,237	80,791	59,357	9,923,270	10,261,714	9,925,684	10,332,730	58.3	55.4	40.9	44.0	8	6
Oklahoma	-----	-----	42,126	-----	8,566	6,914	50,692	6,914	50,692	6,914	-----	-----	83.1	77.1	16.9	100.0
Pennsylvania	10,620,143	10,673,662	32,785,676	38,831,927	1,005,223	846,245	44,411,042	50,351,834	44,549,379	50,437,033	23.9	21.2	73.8	77.1	2.3	1.7
Tennessee	1,851,560	1,863,974	312,115	380,752	158,094	162,747	2,321,769	2,407,473	2,339,269	2,410,473	79.8	77.4	13.4	15.8	6.8	6.8
Utah	2,190,904	1,967,536	2,166,236	2,751,221	-----	-----	4,357,140	4,718,757	4,357,140	4,719,843	50.3	41.7	49.7	58.3	-----	-----
Virginia	10,861,818	12,071,260	2,188,025	3,323,982	172,229	117,401	13,222,072	15,512,643	13,473,874	16,309,413	82.2	77.8	16.5	21.4	1.3	8
Washington	51,634	42,125	97,967	-----	33,267	25,933	182,868	68,058	182,868	68,058	28.2	61.9	53.6	-----	18.2	38.1
West Virginia	62,563,665	60,942,161	47,014,131	57,066,498	1,835,309	1,709,281	111,413,105	119,717,940	111,814,895	120,064,380	56.2	50.9	42.2	47.7	1.6	1.4
Wyoming	88,601	111,687	-----	-----	28,928	13,779	117,529	125,466	117,529	125,497	75.4	89.0	-----	-----	24.6	11.0
Total	150,759,933	152,721,854	104,350,356	124,677,040	4,130,546	3,701,612	259,240,835	281,100,506	260,275,757	282,677,680	58.1	54.3	40.3	44.4	1.6	1.3

<sup>1</sup> Includes mobile loading machines, scrapers, and conveyors equipped with duckbills or other self-loading heads.

TABLE 41.—Number of bituminous coal and lignite underground mines using mechanical loading devices and number of units in use in the United States, by States

State	Number of mines										Number of loading devices							
	Using loading machines only <sup>1</sup>		Using continuous mining machines only		Using hand-loaded conveyors only		Using more than one type of mechanical loading		Total		Loading machines				Continuous mining machines		Hand-loaded conveyors (number of units)	
											Mobile <sup>2</sup>		Scrapers and duckbills or other self-loading conveyors					
	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964
Alabama.....	14	16			9	4	2	1	25	21	83	85	4	4	2		56	49
Arkansas.....					6	5			6	5							16	15
Colorado.....	35	34	7	8	9	9	7	6	58	57	68	68	19	15	26	26	34	35
Illinois.....	32	33	4	6			3	2	39	41	96	104	5	5	41	43		
Indiana.....	16	16					2	2	18	18	60	53			9	6		
Iowa.....	2	3							2	3	3	5						
Kentucky.....	179	248	8	16	18	13	15	12	220	289	411	466	4	6	53	64	40	22
Maryland.....	1	2	1	2	3	3			5	7	2	4		1	2	6	6	
Montana.....	9	6			1	1			10	7	9	6	9	7		1	1	
New Mexico.....			1	1	1	1			2	2	4	4		4	4	1	1	
Ohio.....	17	18	4	4	7	7	5	5	33	34	73	69		2	41	45	15	14
Oklahoma.....			1	2	2	2			3	2				1		2	2	
Pennsylvania.....	60	61	65	72	89	75	20	25	234	233	277	270	13	12	337	372	196	169
Tennessee.....	17	17	4	3	18	20	1		40	40	32	34			7	7	25	30
Utah.....	24	24	4	4			7	7	35	35	100	93	3	3	37	42		
Virginia.....	79	125	6	6	4	4	8	6	97	141	149	197	1		23	31	20	9
Washington.....	3	3			2	2	1		6	5	3	3			3		16	4
West Virginia.....	290	300	87	97	74	67	89	87	540	551	1,062	930	8	4	445	469	229	205
Wyoming.....	3	4			1	1	1	1	5	6	3	5	15	15			23	23
Total.....	781	910	192	219	244	214	161	154	1,378	1,497	2,435	2,396	81	73	1,030	1,111	680	585

<sup>1</sup> Includes mobile loading machines, scrapers, and conveyors equipped with duckbills or other self-loading heads.

<sup>2</sup> Includes mobile loading machines used in conjunction with continuous mining.

23  
42  
75  
509

TABLE 42.—Production at bituminous coal and lignite underground mines in the United States, by States and methods of loading

State	Hand loaded (net tons)		Mechanically loaded (net tons)		Total underground production (net tons)		Underground output hand loaded (percent)		Underground output mechanically loaded (percent)	
	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964
Alabama.....	616,357	741,623	8,849,163	9,720,329	9,465,520	10,461,952	6.5	7.1	93.5	92.9
Arkansas.....			75,218	73,884	75,218	73,884			100.0	100.0
Colorado.....	49,265	46,737	2,784,664	3,362,601	2,833,929	3,409,333	1.7	1.4	98.3	98.6
Georgia.....	4,550	3,900			4,550	3,900	100.0	100.0		
Illinois.....	31,575	21,261	24,417,431	25,013,225	24,449,006	25,034,476	.1	.1	99.9	99.9
Indiana.....	36,082	24,669	4,124,114	3,428,308	4,160,196	3,452,977	.9	.7	99.1	99.3
Iowa.....	57,177	46,234	99,661	123,359	156,838	169,593	36.5	27.3	63.5	72.7
Kansas.....	1,715				1,715		100.0			
Kentucky.....	15,090,971	14,200,187	32,378,237	35,582,659	47,478,208	49,782,846	31.8	28.5	68.2	71.5
Maryland.....	256,970	200,189	168,539	185,336	425,509	385,525	60.4	51.9	39.6	48.1
Missouri.....	30,634	32,687			30,634	32,687	100.0	100.0		
Montana:										
Bituminous.....	2,890	3,581	47,576	40,960	50,466	44,541	5.7	8.0	94.3	92.0
Lignite.....	3,846	5,859	1,322		5,168	5,859	74.4	100.0	25.6	
Total Montana.....	6,736	9,440	48,898	40,960	55,634	50,400	12.1	18.7	87.9	81.3
New Mexico.....	17,979	19,254	295,423	399,046	313,402	418,300	5.7	4.6	94.3	95.4
North Dakota (lignite).....	1,880	1,867			1,880	1,867	100.0	100.0		
Ohio.....	565,318	483,143	9,923,270	10,261,714	10,488,588	10,744,862	5.4	4.5	94.6	95.5
Oklahoma.....	2,668	3,829	50,692	6,914	53,360	10,743	5.0	35.6	95.0	64.4
Pennsylvania.....	1,691,388	1,624,316	44,411,042	50,351,834	46,102,430	51,976,150	3.7	3.1	96.3	96.9
Tennessee.....	1,057,711	1,256,674	2,321,769	2,407,473	3,379,480	3,664,147	31.3	34.3	68.7	65.7
Utah.....	2,391	1,086	4,357,140	4,718,757	4,359,531	4,719,843	.1		99.9	100.0
Virginia.....	13,570,958	12,552,159	13,222,072	15,512,643	26,793,030	28,064,802	50.7	44.7	49.3	55.3
Washington.....			182,868	68,058	182,868	68,058			100.0	100.0
West Virginia.....	9,914,240	9,438,127	111,413,105	119,717,940	121,327,345	129,156,067	8.2	7.3	91.8	92.7
Wyoming.....		31	117,529	125,466	117,529	125,497			100.0	100.0
Total.....	43,015,565	40,707,408	269,240,835	281,100,506	302,256,400	321,807,914	14.2	12.6	85.8	87.4

**TABLE 43.—Units of mechanical loading equipment sold to bituminous coal and lignite mines for underground use in the United States, as reported by manufacturers**

Type of equipment	1960	1961	1962	1963	1964	Change from 1963 (percent)
Mobile loading machines.....	110	84	113	89	111	+24.7
Continuous mining machines.....	128	115	149	137	150	+9.5
Conveyors <sup>1</sup> .....	47	66	58	81	70	-13.6
Number of manufacturers reporting.....	18	15	15	15	16	-----

<sup>1</sup> Includes hand-loaded conveyors and those equipped with duckbills or other self-loading heads.

**TABLE 44.—Units of mechanical loading equipment sold for use in bituminous coal and lignite mines in the United States, as reported by manufacturers, by States**

State	Mobile loading machines		Continuous mining machines		Room conveyors <sup>1</sup>	
	1963	1964	1963	1964	1963	1964
Alabama.....	8	5				
Colorado.....	1	4		1		
Illinois.....	3	6	3	3	1	
Indiana.....		2	1			
Kentucky.....						2
Maryland.....	24	24	11	15	3	2
Ohio.....				4		
Pennsylvania.....		1	4	8	1	
Tennessee.....	9	17	32	36	26	42
Utah.....	3		4	1	3	
Virginia.....		1	2	1		
West Virginia.....	5	4	12	15	11	4
Total.....	36	47	68	69	36	20
Total.....	89	111	137	150	81	70

<sup>1</sup> Includes hand-loaded conveyors and those equipped with duckbills or other self-loading heads.

**TABLE 45.—Units of conveying equipment sold for use in bituminous coal and lignite mines in the United States, as reported by manufacturers, by States**

State	Bridge conveyors		Shuttle cars		Gathering and haulage conveyors <sup>1</sup>	
	1963	1964	1963	1964	1963	1964
Alabama.....			12	7	2	
Colorado.....			1	1	2	
Illinois.....			8	15	5	
Indiana.....				3	3	
Kentucky.....	5	2	41	62	22	29
Maryland.....		1				
Ohio.....	1			6	3	3
Pennsylvania.....	18	21	28	53	48	56
Tennessee.....	5		4	1	4	
Utah.....			3		1	
Virginia.....	9	4		20	9	18
West Virginia.....	16	14	99	143	100	98
Total.....	54	42	196	311	199	204

<sup>1</sup> Includes all gathering and haulage conveyors with a capacity over 500 feet, except main-slope conveyors.

## MECHANICAL CLEANING

Mechanical cleaning means cleaning raw coal with mechanical devices that separate out impurities, usually by differences in specific gravity, and does not include coal that is only screened. Mechanical devices are divided into two general classes—wet and

pneumatic. About 93 percent of the coal cleaned in 1964 was cleaned by wet methods.

All coal mechanically cleaned in 1964 has been classified into seven types. The percentages of total production cleaned were as follows: Jigs, 47; dense-medium processes, 27; concentrating tables, 13; pneumatic cleaning, 7; and classifiers, launders, and flotation each about 2 percent. Magnetite and sand were most commonly used as mediums in cleaning bituminous coal by the dense-medium processes. Magnetite was used in cleaning 51 million tons, and sand was used in cleaning 30 million tons.

Although mechanical cleaning by froth flotation has been in use at bituminous coal mines in the United States since 1930, it was not until 1960 that the tonnage cleaned by this method was large enough to be listed separately. Bituminous coal cleaned by froth flotation increased from 1,826,000 tons in 1960 to 5,123,000 tons in 1964.

TABLE 46.—Growth of mechanical cleaning at bituminous coal and lignite mines in the United States

Year	Total production (thousand tons)	Mechanical cleaning					Percentage of total production mechanically cleaned
		Number of cleaning plants	Raw coal (thousand tons)	Cleaned coal (thousand tons)	Refuse (thousand tons)	Percentage of refuse to raw coal	
1927	517,763	NA	NA	27,692	NA	NA	5.3
1928	500,745	236	NA	28,783	NA	NA	5.7
1929	534,989	280	40,241	36,799	3,442	8.6	6.9
1930	467,526	297	42,645	38,800	3,845	9.0	8.3
1931	382,089	312	39,529	36,172	3,357	8.5	9.5
1932	309,710	309	32,903	30,279	2,625	8.0	9.8
1933	333,630	290	37,682	34,558	3,124	8.3	10.4
1934	359,368	293	43,556	39,827	3,729	8.6	11.1
1935	372,373	320	49,473	45,261	4,112	8.3	12.2
1936	439,088	342	67,162	61,095	6,067	9.0	13.9
1937	445,531	NA	NA	65,000	NA	NA	14.6
1938	348,545	374	71,207	63,455	7,752	10.9	18.2
1939	394,855	366	88,895	79,429	9,466	10.6	20.1
1940	460,771	387	115,692	102,270	13,422	11.6	22.2
1941	514,149	417	133,379	117,540	15,839	11.9	22.9
1942	582,693	438	162,598	142,187	20,411	12.6	24.4
1943	590,177	432	167,310	145,576	21,734	13.0	24.7
1944	619,576	439	182,071	158,727	23,344	12.8	25.6
1945	577,617	439	172,899	147,886	25,013	14.5	25.6
1946	533,922	445	163,633	138,670	24,963	15.3	26.0
1947	630,624	461	206,620	174,436	32,184	15.6	27.7
1948	599,518	502	215,217	189,880	34,337	16.0	30.2
1949	437,868	571	184,691	153,652	31,039	16.8	35.1
1950	516,311	612	238,391	198,699	39,692	16.7	38.5
1951	533,665	631	289,838	240,010	49,828	17.2	45.0
1952	466,841	625	274,246	227,265	46,981	17.1	48.7
1953	457,290	611	285,654	241,759	53,895	18.2	52.9
1954	391,706	613	287,005	232,764	54,240	18.9	59.4
1955	464,633	575	335,458	272,715	62,743	18.7	58.7
1956	500,874	583	359,378	292,365	67,013	18.6	58.4
1957	492,704	593	376,546	304,027	72,519	19.3	61.7
1958	410,446	573	320,898	259,035	61,863	19.3	63.1
1959	412,028	555	337,138	269,787	67,351	20.0	66.5
1960	415,512	535	337,686	273,169	65,517	19.3	65.7
1961	402,977	503	328,200	264,711	63,489	19.3	64.3
1962	422,149	508	339,408	271,633	67,775	20.0	64.3
1963	458,928	499	362,141	289,462	72,679	20.1	63.1
1964	486,998	495	388,134	310,203	77,931	20.1	63.7

NA Not available.



TABLE 47.—Mechanical cleaning at bituminous coal and lignite mines in the United States, 1964, by States

State	Total production (net tons)	Mechanical cleaning					Percent- age of total produc- tion mechani- cally cleaned
		Number of clean- ing plants	Raw coal (net tons)	Cleaned (net tons)	Refuse (net tons)	Percent- age of refuse to raw coal	
Alabama.....	14, 435, 454	27	17, 563, 922	11, 646, 246	5, 917, 676	33.7	80.7
Alaska.....	744, 942	4	743, 109	422, 936	320, 173	43.1	56.8
Arkansas.....	212, 315	1	(1)	(1)	(1)	(1)	(1)
Colorado.....	4, 355, 245	4	1, 796, 348	1, 448, 157	348, 191	19.4	33.3
Illinois.....	55, 022, 602	56	59, 179, 231	47, 973, 098	11, 206, 133	18.9	87.2
Indiana.....	15, 074, 631	15	14, 063, 835	11, 597, 770	2, 489, 065	17.7	76.9
Kansas.....	1, 263, 409	3	1, 932, 637	1, 244, 022	688, 615	35.6	98.5
Kentucky.....	82, 747, 171	63	51, 057, 410	42, 107, 116	8, 950, 294	17.5	50.9
Missouri.....	3, 253, 430	6	2, 735, 185	1, 988, 250	746, 935	27.3	61.1
Montana (bituminous).....	45, 906	1	(1)	(1)	(1)	(1)	(1)
New Mexico.....	2, 969, 472	1	704, 043	397, 574	306, 469	43.5	13.4
Ohio.....	37, 310, 377	22	17, 786, 362	14, 201, 262	3, 585, 100	20.2	38.1
Oklahoma.....	1, 027, 996	1	216, 770	214, 497	2, 32, 273	14.9	14.3
Pennsylvania.....	76, 530, 758	97	65, 830, 441	52, 196, 058	13, 634, 383	20.8	68.2
Utah.....	4, 719, 843	8	3, 769, 068	3, 192, 444	576, 624	15.3	67.6
Virginia.....	31, 653, 484	28	15, 812, 104	13, 270, 316	2, 541, 788	16.1	41.9
Washington.....	68, 058	2	98, 663	64, 905	33, 758	34.2	95.4
West Virginia.....	141, 408, 498	154	134, 705, 088	108, 203, 720	26, 501, 368	19.7	76.5
Wyoming.....	3, 101, 314	2	66, 544	63, 871	2, 673	4.0	2.1
Other States <sup>3</sup> .....	11, 053, 047						
Total.....	486, 997, 952	495	388, 133, 760	310, 202, 742	77, 931, 018	20.1	63.7

<sup>1</sup> Included in Oklahoma.<sup>2</sup> Includes Arkansas and Montana (bituminous).<sup>3</sup> Includes Georgia, Iowa, Maryland, Tennessee, and lignite from Montana, North Dakota, and South Dakota.

TABLE 48.—Mechanical cleaning of bituminous coal and lignite in the United States, by types of equipment

Year	Wet methods							Pneumatic methods	Grand total
	Jigs	Concentrating tables	Classifiers	Launders	Dense-medium processes	Unclassified <sup>1</sup>	Total		
CLEAN COAL (THOUSAND NET TONS)									
1938	27,615	984	4,521	10,681	4,450	4,936	53,187	10,268	63,455
1939	37,056	1,402	5,917	12,809	4,683	5,867	67,734	11,695	79,429
1940	47,064	2,330	7,762	16,269	6,692	7,173	87,290	14,980	102,270
1941	53,287	2,510	8,177	16,954	9,344	10,106	100,378	17,162	117,540
1942	66,876	3,138	10,529	18,658	12,495	10,304	122,000	20,187	142,187
1943	66,092	2,929	11,854	17,424	13,388	12,688	124,375	21,201	145,576
1944	74,175	2,753	14,780	19,686	12,869	13,400	138,663	20,064	158,727
1945	68,609	2,594	14,203	18,980	12,875	13,209	130,470	17,416	147,886
1946	64,702	1,447	13,883	16,021	14,173	11,833	122,059	16,611	138,670
1947	85,931	2,980	14,648	17,902	17,702	16,920	156,083	18,353	174,436
1948	87,506	4,360	18,304	16,788	20,638	17,068	164,664	16,216	180,880
1949	72,423	4,040	14,865	11,238	17,821	20,321	140,708	12,944	153,652
1950	94,161	4,693	18,059	11,630	28,948	25,679	183,170	15,529	198,699
1951	101,746	5,811	23,174	10,362	33,840	46,497	221,430	16,611	240,010
1952	97,336	3,723	19,296	11,738	31,321	45,205	208,619	18,646	227,265
1953	101,001	4,002	18,312	11,988	36,805	50,386	222,494	19,265	241,759
1954	99,913	6,606	16,115	12,156	43,104	36,143	214,037	18,727	232,764
1955	114,538	7,443	17,656	11,400	49,332	52,051	252,420	20,295	272,715
1956	124,858	9,535	15,064	10,223	56,937	51,437	268,054	24,311	292,365
1957	133,844	14,389	14,282	8,306	63,678	44,760	279,529	24,768	304,027
1958	115,321	18,142	8,793	6,768	52,735	38,394	240,153	18,882	259,035
1959	126,836	27,453	8,935	7,305	66,951	14,058	251,538	18,249	269,787
1960	136,633	30,741	11,012	7,561	66,251	2,832	255,030	18,139	273,169
1961	133,360	30,158	9,263	6,529	65,148	2,562	247,020	17,691	264,711
1962	136,879	31,859	5,681	5,986	68,565	3,959	252,929	18,704	271,633
1963	142,540	37,492	5,558	5,221	74,177	4,539	269,527	19,935	289,462
1964	145,918	40,878	6,725	6,000	84,159	5,123	288,803	21,400	310,203
PERCENTAGE CLEANED									
1938	43.5	1.6	7.1	16.8	7.0	7.8	83.8	16.2	100.0
1939	46.6	1.8	7.5	16.1	5.9	7.4	85.3	14.7	100.0
1940	46.0	2.3	7.6	15.9	6.5	7.0	85.3	14.7	100.0
1941	45.3	2.2	7.0	14.4	7.9	8.6	85.4	14.6	100.0
1942	47.0	2.2	7.4	13.1	8.8	7.3	85.8	14.2	100.0
1943	45.4	2.0	8.1	12.0	9.2	8.7	85.4	14.6	100.0
1944	46.7	1.8	9.3	12.4	8.8	8.4	87.4	12.6	100.0
1945	46.4	1.8	9.6	12.8	8.7	8.9	88.2	11.8	100.0
1946	46.7	1.0	10.0	11.6	10.2	8.5	88.0	12.0	100.0
1947	49.3	1.7	8.4	10.3	10.1	9.7	89.5	10.5	100.0
1948	48.4	2.4	10.1	9.3	11.4	9.4	91.0	9.0	100.0
1949	47.1	2.6	9.7	7.3	11.6	13.3	91.6	8.4	100.0
1950	47.4	2.4	9.1	5.8	14.6	12.9	92.2	7.8	100.0
1951	42.4	2.4	9.7	4.3	14.1	19.4	92.3	7.7	100.0
1952	42.8	1.6	8.5	5.2	13.8	19.9	91.8	8.2	100.0
1953	41.8	1.6	7.6	4.9	15.2	20.9	92.0	8.0	100.0
1954	42.8	3.0	5.7	3.9	21.8	17.9	95.1	4.9	100.0
1955	42.0	2.7	6.5	4.2	18.1	19.1	92.6	7.4	100.0
1956	42.7	3.3	5.1	3.5	19.5	17.6	91.7	8.3	100.0
1957	44.0	4.8	4.7	2.7	21.0	14.7	91.9	8.1	100.0
1958	44.5	7.0	3.4	2.6	20.4	14.8	92.7	7.3	100.0
1959	47.0	10.2	3.3	2.7	24.8	5.2	93.2	6.8	100.0
1960	50.0	11.3	4.0	2.8	24.3	1.0	93.4	6.6	100.0
1961	50.4	11.4	3.5	2.4	24.6	1.0	93.3	6.7	100.0
1962	50.4	11.7	2.1	2.2	25.2	1.5	93.1	6.9	100.0
1963	49.2	13.0	1.9	1.8	25.6	1.6	93.1	6.9	100.0
1964	47.0	13.2	2.2	1.9	27.1	1.7	93.1	6.9	100.0

<sup>1</sup> Of the total unclassified tonnage in 1960, 1,826,000 net tons was cleaned by flotation. In 1961-64, all of the tonnage under "Unclassified" was cleaned by flotation.

TABLE 49.—Mechanical cleaning at bituminous coal and lignite mines in the United States, by underground, strip, and auger mining

Year	Total production (net tons)	Cleaned		Total production (net tons)	Cleaned	
		Net tons	Percent		Net tons	Percent
	Underground mines			Strip mines		
1953.....	349,550,972	194,934,599	55.8	105,448,569	46,202,508	43.8
1954.....	289,112,031	184,372,053	63.8	98,134,250	47,772,295	48.7
1955.....	343,465,239	217,199,126	63.2	115,092,769	54,423,341	47.3
1956.....	365,774,042	232,231,914	63.5	127,055,382	58,271,513	45.9
1957.....	360,649,141	242,981,446	67.4	124,108,538	59,317,324	47.8
1958.....	286,884,244	198,710,828	69.3	116,241,787	58,932,257	50.7
1959.....	283,433,655	203,829,017	71.9	120,953,334	64,417,972	53.3
1960.....	284,888,310	205,804,076	72.2	122,629,664	66,356,125	54.1
1961.....	272,765,985	199,359,507	73.1	121,979,084	64,500,929	52.9
1962.....	281,266,368	200,662,784	71.3	130,300,224	69,489,985	53.3
1963.....	302,256,400	215,717,996	71.4	144,140,677	72,032,483	50.0
1964.....	321,807,914	231,997,577	72.1	151,858,979	76,339,834	50.3
	Auger mines			Total, all mines		
1953.....	2,290,908	621,470	27.1	457,290,449	241,758,577	52.9
1954.....	4,460,019	619,675	13.9	391,706,300	232,764,023	59.4
1955.....	6,075,400	1,093,017	18.0	464,633,408	272,715,484	58.7
1956.....	8,044,652	1,861,957	23.1	500,874,077	292,365,384	58.4
1957.....	7,946,237	1,728,424	21.8	493,703,916	304,027,194	61.7
1958.....	7,319,516	1,391,766	19.0	410,445,547	259,034,851	63.1
1959.....	7,640,513	1,539,698	20.2	412,027,502	269,786,687	65.5
1960.....	7,994,373	1,008,493	12.6	415,512,347	273,168,694	65.7
1961.....	8,231,733	850,506	10.3	402,976,802	264,710,942	65.7
1962.....	10,582,733	1,479,830	14.0	422,149,325	271,632,599	64.3
1963.....	12,531,098	1,711,926	13.7	458,928,175	289,462,405	63.1
1964.....	13,331,059	1,865,331	14.0	486,997,952	310,202,742	63.7

TABLE 50.—Mechanical cleaning at bituminous coal and lignite mines in the United States, 1964, by States and by underground, strip, and auger mining

State	Underground mines			Strip mines			Auger mines			Total, all mines		
	Total production (net tons)	Cleaned		Total production (net tons)	Cleaned		Total production (net tons)	Cleaned		Total production (net tons)	Cleaned	
		Net tons	Percent		Net tons	Percent		Net tons	Percent		Net tons	Percent
Alabama.....	10,461,952	9,891,765	94.5	3,878,014	1,671,341	43.1	95,488	83,140	87.1	14,435,454	11,646,246	80.7
Alaska.....				744,942	422,936	56.8				744,942	422,936	56.8
Arkansas.....	73,884	(1)	(1)	138,431	(1)	(1)				212,315	(1)	(1)
Colorado.....	3,409,338	1,441,394	42.3	945,907	6,763	.7				4,355,245	1,448,157	33.3
Illinois.....	25,034,476	20,600,206	82.3	20,988,126	27,372,892	91.3				55,022,602	47,973,098	87.2
Indiana.....	3,452,977	2,804,296	81.2	11,621,654	8,793,474	75.7				15,074,631	11,597,770	76.9
Kansas.....				1,263,409	1,244,022	98.5				1,263,409	1,244,022	98.5
Kentucky.....	49,782,846	24,538,011	49.4	28,304,868	17,409,202	61.5	4,659,457	109,903	2.4	82,747,171	42,107,116	50.9
Missouri.....	32,687			3,220,743	1,988,250	61.7				3,253,430	1,988,250	61.1
Montana (bituminous).....	44,641	(1)	(1)	1,365	(1)	(1)				45,906	(1)	(1)
New Mexico.....	418,300	397,574	95.0	2,551,172						2,969,472	397,574	13.4
Ohio.....	10,744,862	6,559,253	61.0	24,815,302	7,268,199	29.3	1,750,213	373,810	21.4	37,310,377	14,201,262	38.1
Oklahoma.....	10,743	<sup>2</sup> 7,203	<sup>2</sup> 5.6	1,017,253	<sup>2</sup> 177,294	<sup>2</sup> 15.3				1,027,996	<sup>2</sup> 184,497	<sup>2</sup> 14.3
Pennsylvania.....	51,976,150	43,637,730	84.0	23,505,457	8,232,294	35.0	1,049,151	326,034	31.1	76,530,758	52,196,058	68.2
Utah.....	4,719,843	3,192,444	67.6							4,719,843	3,192,444	67.6
Virginia.....	28,064,802	12,500,466	44.5	2,450,755	597,807	24.4	1,137,927	172,543	15.2	31,653,484	13,270,816	41.9
Washington.....	68,058	64,905	95.4							68,058	64,905	95.4
West Virginia.....	129,156,067	106,248,459	82.3	7,867,872	1,155,360	14.7	4,384,559	799,901	18.2	141,408,498	108,203,720	76.5
Wyoming.....	125,497	63,871	50.9	2,975,817						3,101,314	63,871	2.1
Other States <sup>3</sup> .....	4,230,891			6,567,892			254,264			11,053,047		
Total.....	321,807,914	231,997,577	72.1	151,858,979	76,339,834	50.3	13,331,059	1,865,331	14.0	486,997,952	310,202,742	63.7

<sup>1</sup> Included in Oklahoma.

<sup>2</sup> Includes Arkansas and Montana (bituminous).

<sup>3</sup> Includes Georgia, Iowa, Maryland, Tennessee, and lignite from Montana, North Dakota, and South Dakota.

## WATER USAGE

The Bureau of Mines collected detailed statistics on water at coal preparation plants for the first time in the year 1962. Table 51 gives the water usage and water disposal by States. The principal States, named in order of importance were West Virginia, Illinois, Pennsylvania, Kentucky and Alabama. By far the major portion of the water used was recirculated.

The method of treatment of the water is shown in table 52. Practically none of the new water used at coal preparation plants was treated. The major portion of the recirculated was clarified by thickeners and settling ponds. A small amount was filtered.

The most significant thing about the water at coal preparation plants is that almost all of the water—98 percent—was from self-operated systems. Also, almost no saline water and only an insignificant amount of sewage effluent were used.

TABLE 51.—Water usage at bituminous coal and lignite preparation plants in the United States, 1962, by States  
(Million gallons)

State	Water usage			Water disposal	
	New water	Recirculated water	Total	Consumed	Discharged
Alabama.....	2,330	7,363	9,693	352	1,978
Alaska.....	1,344	132	1,476	3	1,340
California.....	18	18	36	10	8
Colorado.....	5	15	20	1	4
Illinois.....	5,304	22,409	27,713	427	4,877
Indiana.....	1,190	8,685	9,875	142	1,048
Kansas.....	147	1,715	1,862	101	46
Kentucky.....	8,096	14,623	22,719	535	7,561
Missouri.....	226	1,067	1,293	109	116
Montana.....	2	20	22	-----	2
New Mexico.....	41	300	341	4	38
Ohio.....	645	7,091	7,736	290	355
Oklahoma.....	26	132	158	11	15
Pennsylvania.....	2,682	23,483	26,165	768	1,914
Tennessee.....	1	-----	1	-----	1
Utah.....	995	1,399	2,394	626	369
Virginia.....	1,693	8,010	9,603	278	1,316
Washington.....	18	25	43	4	14
West Virginia.....	7,169	42,024	49,193	2,028	5,141
Wyoming.....	1	-----	1	-----	1
Total.....	31,833	138,511	170,344	5,689	26,144

TABLE 52.—Water treatment at bituminous coal and lignite preparation plants, 1962, by method of treatment

Method of treatment	Type of Water					
	New water		Recirculated water		Waste water	
	Million gallons	Percent	Million gallons	Percent	Million gallons	Percent
None.....	24,688	82	1,978	1	4,179	22
Settle.....	1,489	5	116,309	82	12,284	64
Filter.....	696	2	7,840	5	1,808	9
Aerate.....	128	1	2,150	2	10	( <sup>1</sup> )
Soften.....	261	1	3,607	3	-----	-----
Control of pH.....	2,209	7	3,304	3	585	3
Precipitate.....	339	1	3,244	2	221	1
Bactericide.....	186	1	3,120	2	25	( <sup>1</sup> )
Other.....	9	( <sup>1</sup> )	520	( <sup>1</sup> )	141	1

<sup>1</sup> Less than 1 percent.

**MECHANICAL CRUSHING**

**TABLE 53.—Mechanical crushing of bituminous coal and lignite at mines in the United States<sup>1</sup>**

Year	Number of mines crushing coal	Coal crushed (net tons)	Percentage of total production crushed	Year	Number of mines crushing coal	Coal crushed (net tons)	Percentage of total production crushed
1940.....	716	35,251,061	7.7	1954.....	982	122,288,369	31.2
1944.....	814	66,460,564	10.8	1955.....	1,225	161,470,318	34.8
1945.....	830	70,936,898	12.3	1956.....	1,370	172,389,802	34.4
1946.....	851	66,663,732	12.5	1957.....	1,452	173,098,257	35.0
1947.....	904	88,985,858	14.1	1958.....	1,359	146,749,108	35.8
1948.....	995	91,564,311	15.3	1959.....	1,393	151,225,633	36.7
1949.....	1,120	77,327,691	17.7	1960.....	1,348	160,875,418	38.7
1950.....	1,210	101,594,731	19.7	1961.....	1,217	146,765,297	36.4
1951.....	1,374	118,663,712	22.2	1962.....	1,202	159,654,414	37.8
1952.....	1,325	108,102,158	23.2	1963.....	1,288	183,006,848	39.9
1953.....	1,239	116,493,415	25.5	1964.....	1,293	209,119,640	42.9

<sup>1</sup> Data not available for 1941-43. Lignite and Virginia semianthracite mines are not included in 1940-49.

**TABLE 54.—Mechanical crushing of bituminous coal and lignite at mines in the United States, by States**

State	Number of mines crushing coal		Coal crushed (net tons)		Percentage of total production crushed	
	1963	1964	1963	1964	1963	1964
Alabama.....	40	20	4,952,341	6,271,769	40.1	43.4
Alaska.....	4	3	581,476	471,206	68.1	63.3
Arkansas.....	7	7	169,916	186,719	77.0	87.9
Colorado.....	39	45	1,401,598	1,939,561	38.0	44.5
Illinois.....	74	76	22,050,617	27,131,051	42.6	49.3
Indiana.....	29	30	8,421,531	10,433,882	55.8	69.2
Iowa.....	21	21	965,370	777,349	79.6	79.9
Kansas.....	4	2	762,486	903,243	65.2	71.5
Kentucky.....	156	119	25,058,206	28,769,974	32.4	34.8
Maryland.....	12	10	273,025	225,153	23.5	19.8
Missouri.....	10	9	1,410,377	3,153,109	44.4	96.9
Montana:						
Bituminous.....	8	6	18,466	16,799	34.5	36.6
Lignite.....	1	1	284,364	293,117	98.2	97.7
Total Montana.....	9	7	302,830	309,916	88.3	89.6
New Mexico.....	4	4	1,916,819	2,945,102	98.6	99.2
North Dakota (lignite).....	15	14	1,767,238	2,041,288	73.7	77.4
Ohio.....	115	131	13,345,764	18,222,543	36.3	48.8
Oklahoma.....	6	8	701,469	763,261	69.6	74.2
Pennsylvania.....	280	312	39,421,652	38,750,879	55.1	50.6
South Dakota (lignite).....	1	1	6,780	5,200	40.9	40.0
Tennessee.....	26	17	2,284,432	1,552,276	37.3	25.9
Utah.....	34	34	3,157,277	3,419,829	72.4	72.5
Virginia.....	48	40	11,515,637	11,276,995	37.7	35.6
Washington.....	5	4	20,129	7,084	10.6	10.4
West Virginia.....	338	365	39,508,385	46,601,370	29.8	33.0
Wyoming.....	11	14	3,011,493	2,960,881	96.4	95.5
Total.....	1,288	1,293	183,006,848	209,119,640	39.9	42.9

## TREATMENT FOR ALLAYING DUST

TABLE 55.—Treatment of bituminous coal and lignite at mines for allaying dust in the United States <sup>1</sup>

Year	Grand total production (net tons)	Percentage of total production treated	Net tons treated with				
			Calcium chloride	Oil	Calcium chloride and oil	All other materials	Total
1940	460,771,500	7.7	2,633,291	25,767,651	4,428,113	2,807,728	35,636,783
1941	514,149,245	7.7	3,957,459	29,258,462	2,482,899	3,844,476	39,543,296
1942	582,692,937	6.0	10,132,809	11,302,020	6,544,658	7,148,064	35,127,551
1943	590,177,069	4.5	15,049,176	1,720,176	1,947,219	7,966,484	26,683,055
1944	619,576,240	5.0	7,276,702	13,188,883	4,744,580	5,562,565	30,772,730
1945	577,617,327	5.8	5,115,090	18,875,674	4,647,872	4,910,602	33,549,238
1946	533,922,068	6.9	4,957,622	24,310,109	3,193,070	4,572,360	37,033,161
1947	630,623,722	8.2	5,822,483	34,667,571	5,571,953	5,732,101	51,794,108
1948	599,518,229	8.4	6,275,121	34,466,534	4,177,987	5,462,054	50,381,696
1949	437,868,036	9.5	3,670,120	30,448,670	4,380,961	3,275,151	41,774,902
1950	516,311,053	10.5	4,643,186	41,688,159	4,278,212	3,724,314	54,333,871
1951	533,664,732	11.0	4,694,938	46,142,726	4,587,940	3,172,205	53,597,809
1952	466,840,732	11.0	4,954,080	41,409,886	3,432,199	1,772,111	51,568,276
1953	457,290,449	10.7	3,362,552	40,671,431	2,769,833	2,154,985	48,958,801
1954	391,706,300	14.4	2,959,979	47,782,165	3,366,955	2,255,872	56,364,971
1955	464,633,408	13.5	3,160,729	51,157,769	5,696,447	2,513,752	62,528,697
1956	500,874,077	12.9	5,500,522	52,008,545	4,912,374	2,309,732	64,731,173
1957	492,703,916	12.5	4,112,934	52,051,076	3,809,132	1,852,051	61,825,193
1958	410,445,547	13.0	3,359,434	42,922,129	4,122,397	2,862,670	53,266,630
1959	412,027,502	13.3	2,716,638	45,139,888	3,419,852	3,403,320	54,679,698
1960	415,512,347	13.9	4,576,176	46,241,261	4,333,350	2,469,508	57,620,295
1961	402,976,802	12.3	3,616,536	39,130,370	3,448,677	3,885,980	49,581,563
1962	422,149,325	11.8	3,128,468	39,822,318	3,025,489	4,047,823	50,024,098
1963	458,928,175	11.1	2,405,209	40,834,323	2,674,714	5,254,795	51,169,046
1964	486,997,952	10.7	1,413,348	39,578,713	2,641,817	8,680,431	52,314,309

Year	Number of mines treating with					Percentage of tonnage treated with				
	Calcium chloride	Oil	Calcium chloride and oil	All other materials	Total <sup>2</sup>	Calcium chloride	Oil	Calcium chloride and oil	All other materials	Total
1940	51	486	22	62	614	7.4	72.3	12.4	7.9	100.0
1941	67	564	15	58	668	10.0	74.0	6.3	9.7	100.0
1942	167	334	73	117	603	28.8	32.2	18.6	20.4	100.0
1943	212	67	28	101	393	56.4	6.4	7.3	29.9	100.0
1944	145	192	47	83	434	23.6	42.9	15.4	18.1	100.0
1945	105	296	43	67	487	15.2	56.3	13.9	14.6	100.0
1946	79	380	41	51	546	13.4	65.6	8.6	12.4	100.0
1947	67	384	58	45	546	11.2	66.9	10.8	11.1	100.0
1948	63	474	43	46	629	12.5	68.4	8.3	10.8	100.0
1949	91	586	62	34	769	8.8	72.9	10.5	7.8	100.0
1950	106	688	32	45	838	8.5	76.7	7.9	6.9	100.0
1951	98	764	40	27	898	8.0	78.8	7.8	5.4	100.0
1952	101	723	30	20	865	9.6	80.3	6.7	3.4	100.0
1953	81	681	28	26	785	6.8	83.1	5.7	4.4	100.0
1954	83	614	29	29	737	5.2	84.8	6.0	4.0	100.0
1955	63	650	33	28	757	5.1	81.8	9.1	4.0	100.0
1956	73	642	35	30	763	8.5	80.3	7.6	3.6	100.0
1957	71	665	31	34	785	6.6	84.2	6.2	3.0	100.0
1958	60	596	36	33	720	6.3	80.6	7.7	5.4	100.0
1959	54	615	44	37	743	5.0	82.6	6.2	6.2	100.0
1960	64	635	56	26	748	7.9	80.3	7.5	4.3	100.0
1961	48	544	32	32	643	7.3	78.9	7.0	6.8	100.0
1962	36	534	32	44	638	6.3	79.6	6.0	8.1	100.0
1963	32	579	24	35	661	4.7	79.8	5.2	10.3	100.0
1964	19	505	29	41	603	2.7	75.7	5.0	16.6	100.0

<sup>1</sup> All items except "Grand total production" exclude lignite and semianthracite, 1940-49. Data for 1940-45 include all mines with an average daily production of 50 tons and all mines with rail or river connections regardless of size. Data for 1946-64 include all mines producing 1,000 or more tons. The figures are reasonably comparable for all years.

<sup>2</sup> Because some mines used more than one method of treatment, this total is not the sum of the individual items.



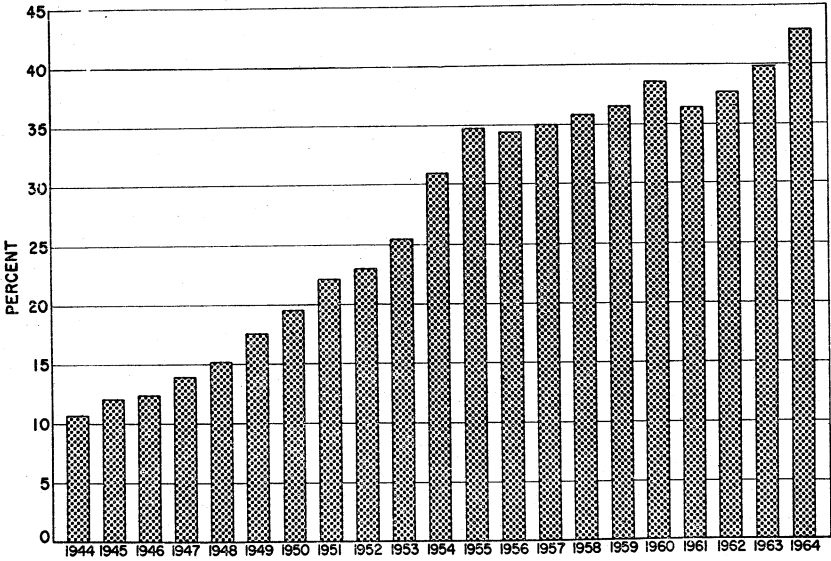


FIGURE 11.—Percentage of total production of bituminous coal and lignite crushed at mines in the United States, 1944-64.

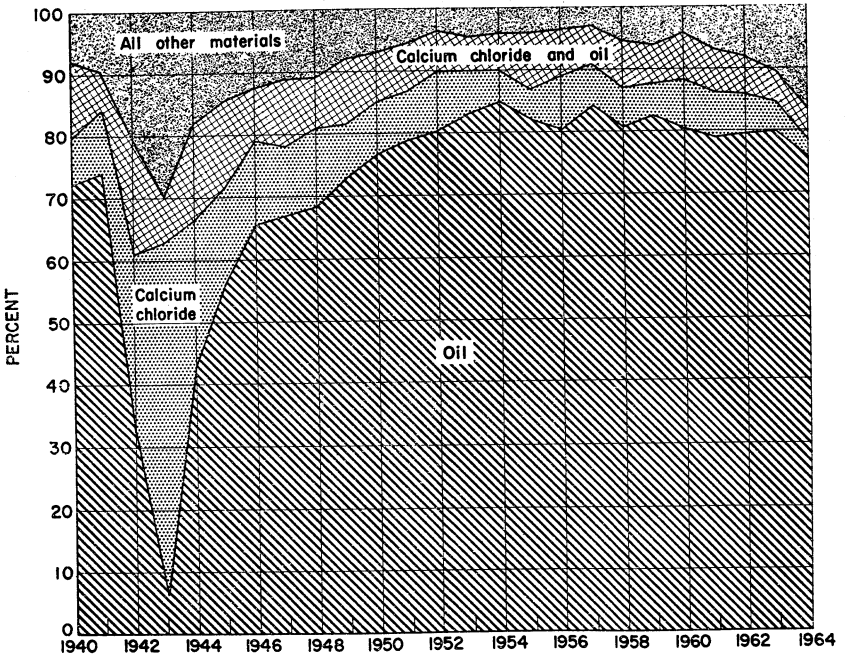


FIGURE 12.—Percentage of total bituminous coal and lignite treated for allaying dust at mines in the United States, 1940-64, by type of agent used.

TABLE 56.—Treatment of bituminous coal and lignite at mines for allaying dust in the United States, by States

State	Number of mines treating coal		Coal treated (net tons)		Percentage of total production treated	
	1963	1964	1963	1964	1963	1964
Alabama.....	10	3	104, 817	57, 935	0.8	0.4
Arkansas.....	1	1	2, 000	-----	9	-----
Colorado.....	34	37	381, 688	216, 911	10.3	5.0
Illinois.....	66	63	4, 667, 196	4, 874, 180	9.0	8.9
Indiana.....	21	19	845, 337	1, 285, 781	5.6	8.5
Iowa.....	5	4	11, 242	7, 969	9	8
Kansas.....	3	3	61, 445	38, 053	5.3	3.0
Kentucky.....	102	78	8, 692, 444	7, 540, 336	11.2	9.1
Maryland.....	1	1	10, 000	9, 000	9	8
Missouri.....	4	4	43, 643	34, 914	1.4	1.1
Montana:						
Bituminous.....	8	6	21, 474	19, 434	40.2	42.3
Lignite.....	-----	-----	-----	-----	-----	-----
Total Montana.....	8	6	21, 474	19, 434	6.3	5.6
New Mexico.....	3	3	1, 612, 948	2, 543, 176	82.9	85.6
North Dakota (lignite).....	19	17	521, 017	462, 654	21.7	17.5
Ohio.....	37	35	4, 298, 301	4, 654, 481	11.7	12.5
Oklahoma.....	2	3	38, 600	26, 000	3.8	2.5
Pennsylvania.....	81	89	5, 440, 680	7, 229, 421	7.6	9.4
South Dakota (lignite).....	1	1	6, 780	5, 200	40.9	40.0
Tennessee.....	1	1	400	20, 000	-----	3
Utah.....	31	28	1, 746, 087	1, 001, 697	40.1	21.2
Virginia.....	27	25	3, 379, 875	2, 356, 665	11.1	7.4
Washington.....	1	-----	600	-----	3	-----
West Virginia.....	194	173	19, 065, 391	19, 711, 692	14.4	13.9
Wyoming.....	9	10	217, 181	218, 810	7.0	7.1
Total.....	661	603	51, 169, 046	52, 314, 309	11.1	10.7

## THERMAL DRYING

Because most of the bituminous coal and lignite produced in the United States is either sprayed with water underground to reduce the dust in mining, cleaned by wet methods, or subjected to wet screening in the tippie, the problem of removing surface moisture is vital. The moisture must be removed for any or all of the following reasons: (1) To avoid freezing difficulties and to facilitate handling the coal during shipment and transfer to the firebox; (2) to reduce the heat wasted in evaporation of surface moisture on the coal, thus increasing efficiency in burning; (3) to decrease transportation costs; (4) to improve the coal so that it may be used for specific purposes, such as producing coke and briquets; and (5) to facilitate drycleaning.

Removal of surface water from fine coal usually presents an individual problem at each preparation plant. Fine coal has a greater surface area per unit weight than coarse coal; therefore, its capacity for retaining moisture is proportionately greater. Removing water from coarse coal is relatively easy, but the problem is greater with coal that is 10 mesh or finer.<sup>4</sup>

The two components of the total moisture content of wetwashed coal are inherent moisture and surface moisture. Inherent moisture is present in the coal in the bed. Surface moisture is attached to the surface of the coal particles or retained in cracks and fissures other than capillary openings in the coal substance.

There are two principal methods of removing surface moisture

<sup>4</sup> Lyons, Orville R. Dewatering and Thermal Drying. Ch. in Coal Preparation. AIME, 2d. ed., 1950 pp. 648-715.

from coal; mechanical dewatering, and thermal drying. Thermal drying is generally used on coals that cannot be readily dried by mechanical means such as screens, centrifuges, filters, thickeners, cyclones, and others.

The annual reports of bituminous coal and lignite producers to the Bureau of Mines for 1957 included, for the first time, data on thermal drying. These and succeeding reports have included data on thermal drying only at the preparation plant, and have not included thermal drying at powerplants or other industrial plants.

Thermal driers have been divided into seven groups: (1) Continuous-carrier, (2) fluidized bed, (3) multilouvre, (4) rotary, (5) screen, (6) suspension or flash, and (7) vertical tray and cascade.

Each type of thermal drier has been designed to handle a definite range of sizes of coal. The size of coal thermally dried in 1964 ranged from 100 mesh by 0-inch to 1.5 by 0.5 inch. The size most commonly reported was 0.25 by 0-inch coal.

Nineteen percent of the bituminous coal mechanically cleaned in 1964 was thermally dried.

Bituminous coal and lignite thermally dried amounted to 59 million tons, or 12 percent of the total production in the United States.

**TABLE 57.—Thermal drying of bituminous coal and lignite in the United States, by type of drying equipment**

Type of drier	Number of thermal drying units		Thermally dried (net tons)		Percentage of total	
	1963	1964	1963	1964	1963	1964
Continuous carrier.....	4	4	739,165	866,350	1.5	1.5
Fluidized-bed.....	38	49	14,857,074	22,473,004	29.4	38.3
Multilouvre.....	44	42	9,469,847	9,943,032	18.7	16.9
Rotary.....	11	9	2,549,294	1,959,496	5.0	3.3
Screen.....	53	52	8,760,509	8,792,615	17.3	15.0
Suspension or flash.....	49	49	8,131,081	9,154,519	16.1	15.6
Vertical tray and cascade.....	54	50	6,048,360	5,507,522	12.0	9.4
Total.....	253	255	50,555,330	58,701,538	100.0	100.0

**TABLE 58.—Comparison of thermal drying of bituminous coal and lignite with mechanical cleaning at mines in the United States, by States**

State	Cleaning plants, number				Production mechanically cleaned (net tons)		Thermally dried (net tons)		Percentage of cleaned coal thermally dried	
	Total		With thermal drying		1963	1964	1963	1964	1963	1964
	1963	1964	1963	1964						
Illinois.....	53	56	23	26	45,786,182	47,973,098	8,709,766	10,188,039	19.0	21.2
Indiana.....	15	15	10	11	11,153,201	11,597,770	2,977,990	3,549,268	26.7	30.6
Kentucky.....	73	63	7	6	41,919,493	42,107,116	2,200,392	1,918,723	5.2	4.6
North Dakota (lignite).....							290,000	150,484		
Ohio.....	20	22	6	8	13,432,566	14,201,262	2,460,475	3,060,169	18.3	21.5
Pennsylvania.....	89	97	15	15	45,132,123	52,196,058	4,765,130	6,927,992	10.6	13.3
Utah.....	7	8	4	4	2,914,094	3,192,444	1,668,009	1,211,752	57.2	38.0
Virginia.....	29	28	3	4	12,958,882	13,270,816	3,356,801	3,327,882	25.9	25.1
Washington.....	3	2	1		186,833	64,905	129,816		69.5	
West Virginia.....	153	154	53	54	100,181,839	108,203,720	23,996,951	28,367,229	24.0	26.2
Other States.....	57	50			15,797,192	17,395,553				
Total.....	499	495	122	128	289,462,405	310,202,742	50,555,330	58,701,538	17.4	18.9

<sup>1</sup> Excludes North Dakota.

TABLE 59.—Thermal drying of bituminous coal and lignite at mines in the United States, by States

State	Number of thermal drying units		Grand total production (net tons)		Thermally dried (net tons)		Percentage of total production thermally dried	
	1963	1964	1963	1964	1963	1964	1963	1964
Illinois.....	53	56	51,736,316	55,022,602	8,709,766	10,188,039	16.8	18.5
Indiana.....	28	29	15,099,679	15,074,631	2,977,990	3,549,268	19.7	23.5
Kentucky.....	10	9	77,350,451	82,747,171	2,200,392	1,918,723	2.8	2.3
North Dakota (lignite).....	4	3	2,398,988	2,636,751	290,000	150,484	12.1	5.7
Ohio.....	18	19	36,789,830	37,310,377	2,460,475	3,060,169	6.7	11.2
Pennsylvania.....	22	23	71,500,953	76,530,758	4,765,130	6,927,992	6.7	9.1
Utah.....	4	4	4,359,531	4,719,843	1,668,009	1,211,752	38.3	25.7
Virginia.....	17	16	30,530,995	31,653,484	3,356,801	3,327,882	11.0	10.5
Washington.....	1	---	190,225	68,058	129,816	---	68.2	---
West Virginia.....	96	96	132,567,763	141,408,498	23,996,951	28,367,229	18.1	20.1
Other States.....	---	---	36,403,444	39,825,779	---	---	---	---
Total.....	253	255	458,928,175	486,997,952	50,555,330	58,701,538	11.0	12.1

PRODUCTION BY STATES AND COUNTIES

Detailed production and employment statistics are shown in table 60 for each coal-producing county in the United States from which three or more operators submitted reports. Statistics on counties with less than three reporting producers have been combined with data for "Other counties" to avoid disclosing individual figures, except when the Bureau has been granted permission to publish statistics separately. Production of mines on the border between two States has been credited to the State in which the coal was mined rather than to the State where the tipples was. If the coal was mined in both States, the tonnage was apportioned accordingly.

Bituminous coal and lignite were mined in 25 States and 303 counties. As soft coal is the source of a large part of the economic activity in many counties, the key items pertaining to the industry are published by counties, and are useful in analyzing potential markets. These key items are method of shipping the coal, value, number of men working daily, days worked, and tons per man per day.

The most striking fact illustrated by the following table is the wide variation among several counties in the same State, not only in production but also in average value and average tons per man per day. The differences in average value are due to quality of coal, method of mining, method of transportation, or market conditions. The differences in output per man per day are caused mostly by physical conditions, mining methods, and extent of mechanization.

TABLE 60.—Production, value, men working daily, days active, man-days, and output per man per day at bituminous coal and lignite mines in the United States, 1964, by States and counties

County	Production (net tons)				Average value per ton <sup>3</sup>	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day <sup>4</sup>
	Shipped by rail or water <sup>1</sup>	Shipped by truck	Used at mine <sup>2</sup>	Total					
<b>ALABAMA</b>									
Bibb.....	19,363	210,710	-----	230,073	\$4.15	105	122	12,832	17.93
Blount.....	-----	2,596	-----	2,596	5.49	5	104	519	5.00
Cullman.....	-----	8,452	-----	8,452	7.56	21	101	2,113	4.00
Etowah.....	126,560	-----	-----	126,560	5.31	32	307	9,872	12.32
Jackson.....	88,454	75,355	-----	163,809	4.73	124	100	12,373	13.24
Jefferson.....	7,014,020	441,081	215	7,455,316	7.52	3,174	234	743,379	10.05
Marion.....	61,418	268,470	-----	319,888	4.44	476	192	91,212	3.51
St. Clair.....	-----	4,000	-----	4,000	2.50	5	53	267	14.98
Shelby.....	625,519	61,360	-----	686,879	8.33	235	252	59,163	11.61
Tuscaloosa.....	929,020	172,468	-----	1,101,488	4.35	124	262	32,457	33.94
Walker.....	2,959,147	572,483	651,263	4,182,893	6.53	1,089	198	215,483	19.41
Winston.....	60,000	93,500	-----	153,500	4.95	31	248	7,675	20.00
Total Alabama.....	11,883,501	1,900,475	651,478	14,435,454	6.83	5,421	219	1,187,345	12.16
<b>ALASKA</b>									
Total Alaska.....	725,862	12,003	7,077	744,942	6.72	177	267	47,208	15.78
<b>ARKANSAS</b>									
Franklin.....	86,880	-----	-----	86,880	6.77	15	181	2,709	32.07
Johnson.....	112,905	1,980	-----	114,885	7.32	67	209	14,020	8.19
Sebastian.....	10,550	-----	-----	10,550	6.98	25	141	3,516	3.00
Total Arkansas.....	210,335	1,980	-----	212,315	7.08	107	189	20,245	10.49

COLORADO

Delta.....	28,864	33,064	648	62,576	5.08	32	160	5,087	12.30
El Paso.....	W	W	W	W	W	W	W	W	W
Fremont.....	14,777	277,917	10	292,704	3.78	280	85	23,886	12.25
Garfield.....	W	8,234	W	8,234	7.47	14	147	2,059	4.00
Gunnison.....	407,489	49,924	5,572	462,985	5.94	192	202	38,776	11.94
Huerfano.....	2,154	47,767	W	49,921	6.10	51	205	10,422	4.79
La Plata.....	W	26,780	W	26,780	4.25	23	166	3,826	7.00
Las Animas.....	776,281	23,955	1,248	801,484	6.40	410	233	95,528	8.39
Mesa.....	W	W	W	W	W	W	W	W	W
Moffat.....	W	W	W	W	W	W	W	W	W
Montrose.....	W	W	W	W	W	W	W	W	W
Pitkin.....	W	W	W	W	W	W	W	W	W
Rio Blanco.....	W	W	W	W	W	W	W	W	W
Routt.....	W	W	W	W	W	W	W	W	W
Weid.....	517,019	241,716	6,712	765,447	4.12	308	194	59,754	12.81
Other counties.....	1,642,810	160,740	81,564	1,885,114	5.56	403	219	88,298	21.35
Total Colorado.....	3,389,394	870,097	95,754	4,355,245	5.38	1,713	191	327,636	13.29

GEORGIA

Walker.....		3,900		3,900	3.82	13	111	1,444	2.70
-------------	--	-------	--	-------	------	----	-----	-------	------

ILLINOIS

Adams.....		27,928	181	28,109	6.94	13	150	2,008	14.00
Bureau.....	W	W	W	W	W	W	W	W	W
Christian.....	W	W	W	W	W	W	W	W	W
Douglas.....	W	W	W	W	W	W	W	W	W
Franklin.....	W	W	W	W	W	W	W	W	W
Fulton.....	6,904,725	521,016	8,052	7,433,793	3.91	738	285	210,232	35.36
Gallatin.....	48,607	9,625	W	58,232	3.25	35	205	7,168	8.12
Greene.....	W	3,096	6	3,102	5.67	6	50	510	10.00
Grundy.....	W	W	W	W	W	W	W	W	W
Henry.....	W	W	W	W	W	W	W	W	W
Jackson.....	W	W	W	W	W	W	W	W	W
Jefferson.....	W	W	W	W	W	W	W	W	W
Knox.....	W	W	W	W	W	W	W	W	W
Logan.....	W	21,859	40	21,899	4.98	23	156	3,596	6.09
Macoupin.....	295,443	77,702	792	373,937	3.78	156	203	81,743	11.78
Madison.....	1,143	124,111	1,568	126,822	4.20	106	100	10,569	12.00
Menard.....	W	W	W	W	W	W	W	W	W
Mercer.....	W	W	W	W	W	W	W	W	W
Montgomery.....	W	W	W	W	W	W	W	W	W

See footnotes at end of table.

TABLE 60.—Production, value, men working daily, days active, man-days, and output per man per day at bituminous coal and lignite mines in the United States, 1964, by States and counties—Continued

County	Production (net tons)				Average value per ton <sup>3</sup>	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day <sup>4</sup>
	Shipped by rail or water <sup>1</sup>	Shipped by truck	Used at mine <sup>2</sup>	Total					
ILLINOIS—Continued									
Peoria.....	824,064	293,425	198	1,117,687	\$4.86	124	279	34,597	32.31
Perry.....	W	W	W	W	W	W	W	W	W
Randolph.....	W	W	W	W	W	W	W	W	W
St. Clair.....	4,232,063	1,538,121	280	5,770,464	3.55	465	267	124,225	46.45
Saline.....	3,797,093	224,012	6,506	4,027,611	3.73	786	233	183,083	22.00
Sangamon.....	W	79,176	110	79,286	4.41	63	113	7,104	11.16
Schuyler.....	W	W	W	W	W	W	W	W	W
Stark.....	W	W	W	W	W	W	W	W	W
Vermillion.....	W	W	W	W	W	W	W	W	W
Wabash.....	W	1,103	W	1,103	4.10	2	80	160	6.89
Washington.....	W	W	W	W	W	W	W	W	W
Will.....	W	W	W	W	W	W	W	W	W
Williamson.....	5,942,579	460,230	15,849	6,418,658	3.83	1,222	241	294,800	21.77
Other counties.....	27,594,246	1,898,799	68,854	29,561,899	3.75	4,433	252	1,118,762	26.42
Total Illinois.....	49,639,963	5,280,203	102,436	55,022,602	3.79	8,172	248	2,028,357	27.13
INDIANA									
Clay.....	432,718	525,247	2,302	960,267	3.87	143	263	37,554	25.57
Daviess.....	W	11,100	W	11,100	5.00	11	91	1,004	11.06
Dubois.....	W	10,500	W	10,500	3.50	4	175	700	15.00
Fountain.....	W	W	W	W	W	W	W	W	W
Gibson.....	445,654	87,660	18,390	551,704	4.26	291	182	53,048	10.40
Greene.....	1,465,718	81,003	5,991	1,552,712	3.89	226	270	60,986	25.46
Knox.....	W	64,899	W	64,899	3.25	54	150	8,112	8.00
Owen.....	W	W	W	W	W	W	W	W	W
Parke.....	W	7,416	W	7,416	5.93	12	239	2,863	2.59
Fike.....	2,148,171	118,087	2,207	2,268,465	3.76	347	237	82,083	27.64
Spencer.....	17,706	49,981	2,758	70,445	4.65	45	138	6,230	11.31
Sullivan.....	676,013	194,053	1,074,646	1,944,712	4.10	484	217	105,173	18.49
Vermillion.....	W	10,210	W	10,210	6.00	31	58	1,801	5.67
Vigo.....	293,548	238,397	310,050	841,995	4.10	302	132	39,824	21.14
Warrick.....	5,306,641	1,045,987	4,503	6,357,131	3.56	549	250	137,312	46.30
Other counties.....	323,624	99,426	25	423,075	4.30	69	266	18,326	23.09
Total Indiana.....	11,109,793	2,543,966	1,420,872	15,074,631	3.80	2,568	216	555,016	27.16

IOWA

Appanoose.....	11,299	27,555	728	39,582	5.40	110	101	11,130	3.56
Lucas.....	36,755	12,968		49,723	4.10	17	276	4,691	10.60
Mahaska.....	268,059	49,327	200	318,486	3.40	94	295	27,840	11.44
Marion.....	327,067	69,720		397,687	3.44	74	252	18,615	21.36
Monroe.....	19,486	75,028		94,515	3.21	32	202	6,459	14.63
Van Buren.....		16,916	15	16,931	4.79	8	145	1,160	14.59
Wapello.....		56,290		56,290	3.43	16	320	5,276	10.67
<b>Total Iowa.....</b>	<b>664,466</b>	<b>307,805</b>	<b>943</b>	<b>973,214</b>	<b>3.54</b>	<b>351</b>	<b>214</b>	<b>75,171</b>	<b>12.95</b>

KANSAS

Bourbon.....	3,827	2,431		6,258	4.00	6	104	626	10.00
Cherokee.....	W	W	W	W	W	W	W	W	W
Crawford.....	W	W	W	W	W	W	W	W	W
Other counties.....	956,405	296,893	3,853	1,257,151	4.55	242	251	60,798	20.68
<b>Total Kansas.....</b>	<b>960,232</b>	<b>299,324</b>	<b>3,853</b>	<b>1,263,409</b>	<b>4.55</b>	<b>248</b>	<b>248</b>	<b>61,424</b>	<b>20.57</b>

KENTUCKY

<b>Eastern Kentucky:</b>									
Bell.....	1,638,377	428,793	450	2,067,620	3.41	1,140	130	148,355	13.94
Boyd.....		40,299	865	41,164	3.76	96	196	7,055	5.83
Breathitt.....	106,563	153,601		260,164	3.71	230	100	22,981	11.32
Carter.....		27,006		27,006	3.99	35	135	4,739	5.70
Clay.....	761,268	723,522		1,484,790	3.94	892	191	170,898	8.71
Clinton.....		13,801		13,801	4.20	14	152	2,123	6.50
Elliott.....		13,752	100	13,852	4.59	21	173	3,636	3.81
Floyd.....	3,855,155	816,610	7,740	4,679,505	5.43	1,812	214	387,076	12.09
Harlan.....	5,116,776	519,993	5,087	5,641,856	5.05	2,020	212	428,360	13.17
Jackson.....		44,631		44,631	4.92	77	62	4,807	9.28
Johnson.....	141,740	119,846		261,586	3.23	166	181	30,095	8.69
Knott.....	1,824,061	234,601		2,058,662	3.04	1,628	99	161,704	12.73
Knox.....	69,628	197,310		266,938	3.49	330	121	40,454	6.60
Laurel.....	117,107	19,544		136,651	3.83	136	89	12,080	11.31
Lawrence.....		8,789		8,789	3.31	20	74	1,478	5.95
Lee.....	5,126	55,979		61,105	4.00	87	170	14,831	4.12
Leslie.....	1,205,270	599,679	1,582	1,806,531	4.13	858	203	173,861	10.39
Letcher.....	4,716,334	846,692	10,764	5,573,790	4.35	1,730	224	386,875	14.41
McCreary.....	415,717	49,992		465,709	3.50	192	219	42,108	11.06
Magoffin.....	38,825	56,980		95,805	3.32	140	88	12,330	7.77
Martin.....	178,176	18,350		196,526	4.17	81	161	13,035	15.08
Morgan.....		36,687		36,687	4.65	33	103	3,405	10.77

See footnotes at end of table.



TABLE 60.—Production, value, men working daily, days active, man-days, and output per man per day at bituminous coal and lignite mines in the United States, 1964, by States and counties—Continued

County	Production (net tons)				Average value per ton <sup>3</sup>	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day <sup>4</sup>
	Shipped by rail or water <sup>1</sup>	Shipped by truck	Used at mine <sup>2</sup>	Total					
KENTUCKY—Continued									
Eastern Kentucky—Continued									
Owsley.....		9,000	200	9,200	\$3.00	12	153	1,840	5.00
Perry.....	3,175,791	766,223	2,104	3,944,118	2.86	1,246	184	228,692	17.25
Pike.....	11,227,190	3,588,987	24,870	14,836,047	4.03	4,505	215	969,097	15.31
Pulaski.....	104,062	64,150		168,212	3.32	59	188	11,074	14.29
Rockcastle.....		1,100		1,100	4.20	6	48	275	4.00
Wayne.....	50,000	2,500		52,500	2.84	50	79	3,958	13.28
Whitley.....	405,195	233,068		638,263	3.12	463	235	108,714	5.87
Wolfe.....		8,744		8,744	4.20	20	97	1,930	4.53
Total Eastern Kentucky.....	35,152,361	9,685,229	53,762	44,891,352	4.13	18,039	188	3,397,366	13.21
Western Kentucky:									
Butler.....		187,038		187,038	4.20	136	108	14,713	12.71
Christian.....	13,573			13,573	5.06	9	101	905	15.00
Daviess.....	425,869	450,732		876,601	2.61	104	256	26,649	32.89
Hancock.....		1,000		1,000	3.24	5	20	100	10.00
Henderson.....	12,616	137,199	5,412	155,227	2.60	55	217	11,922	13.02
Hopkins.....	9,949,667	312,711	915	10,263,283	3.35	1,849	221	408,227	25.14
McLean.....		18,498		18,498	2.83	9	108	923	20.00
Muhlenberg.....	13,996,958	3,636,777	951	17,634,686	3.19	1,334	268	357,292	49.36
Ohio.....	4,527,952	39,285		4,567,237	3.23	293	298	86,424	53.04
Union.....	4,056,662	10,411	618	4,067,691	3.72	738	257	189,421	21.47
Webster.....	42,187	28,828		70,985	2.60	19	147	2,791	25.43
Total Western Kentucky.....	33,025,444	4,822,479	7,896	37,855,819	3.29	4,551	242	1,099,369	34.43
Total Kentucky.....	68,177,805	14,507,708	61,658	82,747,171	3.75	22,590	199	4,496,735	18.40
MARYLAND									
Allegany.....	95,801	155,510	18	251,329	4.49	115	231	26,589	9.45
Garrett.....	523,772	360,735		884,507	3.82	201	238	47,914	18.46
Total Maryland.....	619,573	516,245	18	1,135,836	3.97	316	236	74,503	15.25

MISSOURI

Adair.....		26,915	500	27,415	4.83	28	228	6,346	4.32
Boone.....	W	W	W	W	W	W	W	W	W
Callaway.....		27,957		27,957	4.96	7	260	1,820	15.36
Clark.....	W	W	W	W	W	W	W	W	W
Dade.....		17,000		17,000	4.74	8	285	2,279	7.46
Henry.....	W	W	W	W	W	W	W	W	W
Macon.....	W	W	W	W	W	W	W	W	W
Putman.....	37,500	99,254		136,754	3.73	50	217	10,874	12.58
St. Clair.....	W	W	W	W	W	W	W	W	W
Vernon.....	48,015	4,939	10	52,964	3.84	35	151	5,296	10.00
Other counties.....	1,691,597	262,278	1,037,465	2,991,340	4.09	338	247	83,541	35.81
<b>Total Missouri.....</b>	<b>1,777,112</b>	<b>438,343</b>	<b>1,037,975</b>	<b>3,253,430</b>	<b>4.08</b>	<b>466</b>	<b>236</b>	<b>110,156</b>	<b>29.53</b>

MONTANA

<b>Bituminous coal:</b>									
Big Horn.....	W	W	W	W	W	W	W	W	W
Blaine.....		2,941	40	2,981	9.00	8	150	1,232	2.42
Carbon.....	W	W	W	W	W	W	W	W	W
Musselshell.....		31,385	110	31,495	7.20	29	140	4,069	7.74
Other counties.....	4,125	7,221	84	11,430	7.55	24	93	2,231	5.12
<b>Total bituminous coal.....</b>	<b>4,125</b>	<b>41,547</b>	<b>234</b>	<b>45,906</b>	<b>7.40</b>	<b>61</b>	<b>123</b>	<b>7,532</b>	<b>6.09</b>
<b>Lignite:</b>									
Custer.....	W	W	W	W	W	W	W	W	W
Powder River.....		1,374	5	1,379	4.98	2	240	480	2.87
Richland.....	W	W	W	W	W	W	W	W	W
Sheridan.....		2,476		2,476	4.00	4	170	678	3.65
Other counties.....	293,117	2,969		296,086	1.92	23	200	4,589	64.52
<b>Total lignite.....</b>	<b>293,117</b>	<b>6,819</b>	<b>5</b>	<b>299,941</b>	<b>1.95</b>	<b>29</b>	<b>198</b>	<b>5,747</b>	<b>52.19</b>
<b>Total Montana.....</b>	<b>297,242</b>	<b>48,366</b>	<b>239</b>	<b>345,847</b>	<b>2.68</b>	<b>90</b>	<b>148</b>	<b>13,279</b>	<b>26.04</b>

NEW MEXICO

Colfax.....	397,172	4,663	402	402,237	9.09	131	196	25,686	15.66
McKinley.....	W	W	W	W	W	W	W	W	W
Rio Arriba.....	W	W	W	W	W	W	W	W	W
Sandoval.....	W	W	W	W	W	W	W	W	W
San Juan.....	W	W	W	W	W	W	W	W	W
Other counties.....	437,866	2,129,369		2,567,235	2.38	176	236	41,531	61.81
<b>Total New Mexico.....</b>	<b>835,038</b>	<b>2,134,032</b>	<b>402</b>	<b>2,969,472</b>	<b>3.29</b>	<b>307</b>	<b>219</b>	<b>67,217</b>	<b>44.18</b>

See footnotes at end of table.

TABLE 60.—Production, value, men working daily, days active, man-days, and output per man per day at bituminous coal and lignite mines in the United States, 1964, by States and counties—Continued

County	Production (net tons)				Average value per ton <sup>3</sup>	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day <sup>4</sup>
	Shipped by rail or water <sup>1</sup>	Shipped by truck	Used at mine <sup>2</sup>	Total					
NORTH DAKOTA (LIGNITE)									
Adams.....	7,626	8,011	-----	15,637	\$3.33	4	250	1,117	14.00
Bowman.....	139,867	-----	-----	139,867	1.89	10	213	2,109	66.32
Burke.....	W	W	W	W	W	W	W	W	W
Burleigh.....	-----	7,988	-----	7,988	3.34	4	100	399	20.00
Dunn.....	-----	2,609	200	2,809	3.00	3	100	312	9.00
Grant.....	-----	19,930	-----	19,930	2.99	7	135	997	20.00
Hettinger.....	-----	2,919	-----	2,919	3.16	1	150	146	20.00
McLean.....	6,568	41,274	-----	47,842	3.37	16	64	1,016	47.09
Mercer.....	W	W	W	W	W	W	W	W	W
Morton.....	W	W	W	W	W	W	W	W	W
Oliver.....	W	W	W	W	W	W	W	W	W
Stark.....	-----	88,848	-----	88,848	1.66	15	150	2,221	40.00
Ward.....	W	W	W	W	W	W	W	W	W
Williams.....	-----	1,867	-----	1,867	4.62	5	75	373	5.01
Other counties.....	1,859,237	162,815	286,992	2,309,044	2.13	215	219	47,109	49.01
Total North Dakota.....	2,013,298	336,261	287,192	2,636,751	2.15	280	199	65,799	47.25
OHIO									
Athens.....	63,056	83,785	-----	146,841	3.93	89	220	19,563	7.51
Belmont.....	7,675,595	158,026	1,017	7,834,638	4.04	2,097	236	494,705	15.84
Carrroll.....	119,376	149,984	5,329	271,689	3.37	62	261	16,163	16.81
Columbiana.....	264,435	1,263,815	-----	1,528,250	3.17	295	283	83,383	18.33
Coshocton.....	621,417	511,867	1,168,927	2,302,211	4.12	267	286	76,314	30.17
Gallia.....	569,104	45,570	-----	614,674	3.02	154	309	47,605	12.91
Guernsey.....	258,869	49,453	-----	308,322	3.35	91	174	15,814	19.50
Harrison.....	6,970,330	671,430	20,987	7,662,747	4.08	2,036	206	419,177	18.28
Hooking.....	-----	78,502	100	78,602	3.81	45	172	7,751	10.14
Holmes.....	129,134	75,886	-----	205,020	3.04	36	812	11,216	18.28
Jackson.....	11,524	551,859	100	563,483	3.45	657	210	138,002	4.08
Jefferson.....	2,807,982	1,500,127	239	4,308,348	3.61	712	250	177,773	24.24
Lawrence.....	W	W	W	W	W	W	W	W	W
Mahoning.....	17,420	770,318	1,670	789,408	3.67	161	329	52,839	14.94
Meigs.....	2,250	402,700	778	405,728	2.82	147	150	22,012	18.43

Morgan		14,841	1,855,233	1,870,074	2.99	147	350	51,574	36.26
Muskingum		116,087		116,087	4.27	82	187	15,352	7.56
Noble	1,205,792	710,200	806,442	2,722,434	2.99	232	276	63,969	42.56
Perry	W	W	W	W	W	W	W	W	W
Portage		62,628		62,628	3.49	17	310	5,362	11.68
Stark		404,051	2,915	406,966	3.19	90	280	25,218	16.14
Tuscarawas	312,126	2,135,441	21,577	2,469,144	3.36	644	279	179,484	13.76
Vinton	10,389	149,579		159,968	3.78	76	228	17,327	9.23
Wayne		52,062		52,062	2.76	59	126	7,437	7.00
Other counties	1,568,639	847,414	15,000	2,431,053	3.71	225	293	65,932	36.87
Total Ohio	22,607,438	10,802,625	3,900,314	37,310,377	3.69	8,421	239	2,013,972	18.53

OKLAHOMA

Craig	299,771	23,321		323,092	3.11	81	279	22,641	14.27
Haskell	W	W	W	W	W	W	W	W	W
Le Flore	7,950	2,793		10,743	7.43	29	117	3,357	3.20
Muskogee		1,350		1,350	5.30	3	113	338	4.00
Okmulgee		1,700		1,700	5.29	2	53	106	16.04
Rogers	W	W	W	W	W	W	W	W	W
Other counties	690,270	841		691,111	6.33	132	221	29,128	23.73
Total Oklahoma	997,991	30,005		1,027,996	5.32	247	225	55,570	18.50

PENNSYLVANIA

Allegheny	3,373,834	1,342,845	115,815	4,832,494	5.42	1,325	224	297,102	16.27
Armstrong	2,382,048	1,670,175	267,931	4,320,154	4.23	1,173	197	230,495	18.74
Beaver	16,629	477,734		494,363	3.41	131	263	34,402	14.37
Bedford		284,630		284,630	3.49	108	263	28,358	10.04
Blair	1,250	9,984		11,234	4.77	19	152	2,885	3.89
Bradford	W	W	W	W	W	W	W	W	W
Butler	897,716	928,659	338	1,826,713	3.69	422	221	93,161	19.61
Cambria	7,786,428	689,713	265,129	8,741,270	5.51	3,522	234	825,749	10.59
Cameron	W	W	W	W	W	W	W	W	W
Centre	353,358	242,358	5,227	600,943	3.66	188	247	46,518	12.92
Clarion	2,293,332	873,700	7,466	3,174,498	3.48	697	268	186,526	17.02
Clearfield	6,073,594	1,211,911	2,666	7,288,171	3.66	1,980	221	437,435	16.66
Clinton	362,056	117,223	2,733	482,012	3.52	73	263	19,207	25.10
Elk	103,197	336,902	280	440,379	3.47	156	220	34,320	12.83
Fayette	1,440,413	362,987	30,444	1,833,844	5.76	990	242	239,934	7.64
Greene	11,440,997	138,120	9,225	11,588,342	6.18	3,615	231	836,012	13.86
Huntingdon		67,614		67,614	3.31	31	165	5,117	13.21
Indiana	4,516,965	664,935	327,572	5,509,472	4.48	1,690	218	367,673	14.98
Jefferson	1,743,422	139,714	8,212	1,891,348	3.53	547	210	114,650	16.50
Lawrence		840,880		840,880	3.01	162	263	42,638	19.72

See footnotes at end of table.

TABLE 60.—Production, value, men working daily, days active, man-days, and output per man per day at bituminous coal and lignite mines in the United States, 1964, by States and counties—Continued

County	Production (net tons)				Average value per ton <sup>3</sup>	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day <sup>4</sup>
	Shipped by rail or water <sup>1</sup>	Shipped by truck	Used at mine <sup>2</sup>	Total					
PENNSYLVANIA—Continued									
Lycoming.....	W	W	W	W	W	W	W	W	W
McKean.....		21,700		21,700	\$3.60	22	100	2,170	10.00
Mercer.....	240,276	346,375	129	586,780	3.87	117	313	36,651	16.01
Somerset.....	2,572,519	685,206	10,485	3,168,210	4.48	989	188	185,862	17.05
Tioga.....	W	W	W	W	W	W	W	W	W
Venango.....	285,161	205,883	15	491,059	4.08	79	222	17,503	28.06
Washington.....	11,477,525	1,012,428	69,923	13,459,876	6.32	3,941	232	915,434	14.70
Westmoreland.....	3,225,076	411,112	444,425	4,080,613	5.14	1,221	220	268,732	15.18
Other counties.....	43,546	445,613		494,159	4.27	151	240	36,232	13.62
Total Pennsylvania.....	60,634,342	14,328,401	1,568,015	76,530,758	5.07	23,349	227	5,304,866	14.43
SOUTH DAKOTA (LIGNITE)									
Dewey.....		12,700	300	13,000	4.85	8	163	1,300	10.00
TENNESSEE									
Anderson.....	1,045,260	737,087	43	1,782,390	3.86	506	202	102,378	17.41
Bledsoe.....	3,769	5,950		9,719	3.31	10	200	1,944	5.00
Campbell.....	697,592	310,118	350	1,008,060	3.43	281	161	45,293	22.26
Clairborne.....	324,738	39,451		364,189	3.55	154	195	30,009	12.14
Cumberland.....	10,800	5,835		16,635	3.15	29	98	2,878	5.78
Fentress.....	41,328	9,000		50,328	3.75	126	100	12,582	4.00
Grundy.....	288,537	43,887		332,424	3.92	66	285	18,931	17.56
Hamilton.....		29,618		29,618	3.86	88	97	8,523	3.48
Marion.....	476,864	61,380		538,244	4.64	246	188	46,261	11.63
Morgan.....	37,657	325,203	3,192	366,052	3.52	824	243	199,836	1.83
Overton.....	33,166	5,257		38,423	3.11	29	175	5,042	7.62
Putnam.....	439,049	38,727		477,776	3.73	118	217	25,563	18.69
Rhea.....		24,400		24,400	3.90	54	100	5,422	4.50
Scott.....	528,478	72,176		600,654	3.79	340	176	60,376	10.17
Sequatchie.....		67,121	20	67,141	3.42	98	127	12,480	5.38
Van Buren.....	175,358	108,994		284,352	3.70	63	200	12,602	22.56
Total Tennessee.....	4,102,596	1,884,204	3,605	5,990,405	3.79	3,032	195	590,120	10.15

UTAH

Carbon.....	3,552,634	180,205	19,515	3,752,354	7.43	1,325	195	258,427	14.52
Emery.....	654,849	184,275	8,397	847,521	5.53	312	220	68,681	12.34
Iron.....		53,747		53,747	4.65		266	5,842	9.20
Kane.....		1,855	28	1,883	5.34	1	269	269	7.00
Sevier.....		47,000		47,000	6.08	9	209	1,880	25.00
Summit.....		17,298	40	17,338	4.68	10	247	2,477	7.00
<b>Total Utah.....</b>	<b>4,207,483</b>	<b>484,380</b>	<b>27,980</b>	<b>4,719,843</b>	<b>7.03</b>	<b>1,679</b>	<b>201</b>	<b>337,576</b>	<b>13.98</b>

VIRGINIA

Buchanan.....	12,093,784	2,406,383	1,438	14,501,605	3.96	5,156	242	1,245,500	11.64
Dickenson.....	7,586,205	142,276		7,728,481	3.69	1,534	229	351,823	21.97
Lee.....	412,877	57,601	812	471,290	3.88	454	178	80,715	5.84
Montgomery.....		7,846		7,846	3.65	20	98	1,962	4.00
Russell.....	1,554,067	345,511		1,899,578	3.85	529	241	127,624	14.88
Scott.....		4,300		4,300	3.91	19	75	1,433	3.00
Tazewell.....	196,919	39,668		236,587	3.33	161	226	36,466	6.49
Wise.....	5,488,515	1,100,493	214,789	6,803,797	4.01	1,485	223	331,693	20.51
<b>Total Virginia.....</b>	<b>27,332,367</b>	<b>4,104,078</b>	<b>217,039</b>	<b>31,653,484</b>	<b>3.89</b>	<b>9,358</b>	<b>233</b>	<b>2,177,216</b>	<b>14.54</b>

WASHINGTON

King.....	W	W	W	W	W	W	W	W	W
Lewis.....	W	W	W	W	W	W	W	W	W
Thurston.....		8,991		8,991	7.00	6	250	1,499	6.00
Other counties.....	18,696	40,371		59,067	8.67	70	154	10,797	5.47
<b>Total Washington.....</b>	<b>18,696</b>	<b>49,362</b>		<b>68,058</b>	<b>8.45</b>	<b>76</b>	<b>162</b>	<b>12,296</b>	<b>5.53</b>

WEST VIRGINIA

Barbour.....	2,313,381	14,090	169	2,327,634	4.34	630	221	139,539	16.68
Boone.....	8,429,331	154,607	9,558	8,593,496	4.47	1,821	241	438,166	19.61
Braxton.....	70,429	3,501		73,930	4.39	84	63	5,815	13.91
Brooks.....	159,407	350,633	519,971	1,030,011	3.32	231	266	61,344	16.79
Clay.....	65,666	7,145		72,811	4.13	70	135	9,477	7.68
Fayette.....	5,336,698	388,429	13,233	5,738,360	4.51	2,171	228	495,477	11.58
Gilmer.....	W	W	W	W	W	W	W	W	W
Grant.....	W	W	W	W	W	W	W	W	W
Greenbrier.....	897,069	47,258	215	944,542	4.31	388	215	83,231	11.35
Hancock.....		34,620		34,620	2.66	15	150	2,308	15.00
Harrison.....	8,171,624	114,379	561	8,286,564	4.15	1,791	228	408,071	20.31

See footnotes at end of table.

TABLE 60.—Production, value, men working daily, days active, man-days, and output per man per day at bituminous coal and lignite mines in the United States, 1964, by States and counties—Continued

County	Production (net tons)				Average value per ton <sup>3</sup>	Average number of men working daily	Average number of days worked	Number of man-days worked	Average tons per man per day <sup>4</sup>
	Shipped by rail or water <sup>1</sup>	Shipped by truck	Used at mine <sup>2</sup>	Total					
WEST VIRGINIA—Continued									
Kanawha.....	10,812,522	186,121	3,174	11,001,817	\$4.47	2,534	226	571,992	16.62
Lewis.....	109,016	48,367	12,376	169,759	3.42	83	124	10,318	16.45
Lincoln.....	18,363	.....	.....	18,363	2.45	15	102	1,530	12.00
Logan.....	15,863,623	14,973	7,031	15,885,627	4.52	4,545	235	1,069,516	14.85
Marion.....	11,688,993	51,851	26,969	11,767,813	5.18	2,675	245	654,468	17.98
Marshall.....	W	W	W	W	W	W	W	W	W
Mason.....	301,467	156,136	268	457,871	3.36	167	225	37,525	12.20
McDowell.....	16,976,466	221,185	112,297	17,309,945	6.16	4,644	244	1,134,592	15.26
Mercer.....	1,425,051	34,085	2,658	1,462,394	5.98	404	229	92,604	15.79
Mineral.....	70,881	2,439	58	73,378	3.99	32	232	7,409	9.90
Mingo.....	5,165,408	339,088	104,099	5,608,545	5.05	1,478	229	338,696	16.56
Monongalia.....	8,386,735	141,088	.....	8,527,833	4.86	1,341	291	390,570	21.83
Nicholas.....	7,798,672	54,937	2,800	7,856,418	4.81	2,285	243	555,601	14.14
Ohio.....	W	W	W	W	W	W	W	W	W
Pocahontas.....	W	W	W	W	W	W	W	W	W
Preston.....	2,992,619	541,525	162	3,534,306	3.70	1,358	231	313,657	11.27
Putnam.....	.....	4,880	.....	4,880	4.56	3	190	569	8.58
Raleigh.....	7,413,773	210,770	32,776	7,657,319	5.59	2,892	228	659,179	11.62
Randolph.....	948,389	102,678	.....	1,051,067	3.69	649	207	134,578	7.81
Taylor.....	425,290	4,450	10	429,750	3.22	152	143	21,687	19.82
Tucker.....	245,276	.....	.....	245,276	3.44	48	223	10,716	22.89
Upshur.....	407,672	14,449	48	422,169	4.01	215	133	28,653	14.73
Wayne.....	18,025	12,364	.....	30,389	4.56	76	100	7,597	4.00
Webster.....	808,355	13,251	3,658	825,264	4.24	370	196	72,454	11.39
Wyoming.....	13,278,310	175,617	26,060	13,479,987	5.40	4,406	244	1,077,115	12.51
Other counties.....	4,330,614	134,060	2,021,683	6,486,357	4.48	1,735	228	400,769	16.18
Total West Virginia.....	134,929,125	3,579,536	2,899,837	141,408,498	4.90	39,308	235	9,234,723	15.31

WYOMING

Campbell.....	468,544	20,302		488,846	1.35	34	261	8,888	55.00
Carbon.....	446,504		5	446,509	3.85	77	145	11,163	40.00
Converse.....	W	W	W	W	W	W	W	W	W
Hot Springs.....	3,946	7,842		11,788	8.29	16	147	2,358	5.00
Lincoln.....	W	W	W	W	W	W	W	W	W
Sheridan.....	412,761	18,760		431,521	3.32	38	252	9,589	45.00
Sweetwater.....	W	W	W	W	W	W	W	W	W
Other counties.....	259,921	1,009,488	453,241	1,722,650	3.40	236	153	36,156	47.64
Total Wyoming.....	1,591,676	1,056,392	453,246	3,101,314	3.15	401	170	68,154	45.50

UNITED STATES

Total United States.....	408,725,328	65,532,391	12,740,233	486,997,952	4.45	128,698	225	28,917,328	16.84
--------------------------	-------------	------------	------------	-------------	------	---------	-----	------------	-------

W Withheld to avoid disclosing individual company data; included with "other counties."

<sup>1</sup> Includes coal loaded at mine directly into railroad cars or river barges, hauled by trucks to railroad sidings, and hauled by trucks to waterways.

<sup>2</sup> Includes coal used at mine for power and heat, made into beehive coke at mine, used by mine employees, used for all other purposes at mine, and transported from mine to point of use by conveyor, tram, or pipeline.

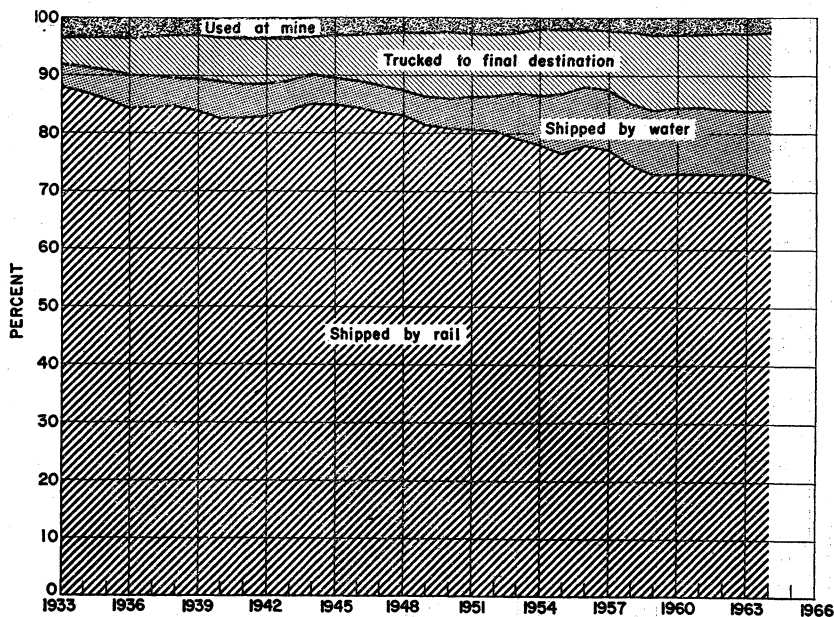
<sup>3</sup> Value received or charged for coal f.o.b. mine. Includes a value for coal not sold but used by producers, such as mine fuel and coal coked, as estimated by producers at average prices that might have been received if such coal had been sold commercially.

<sup>4</sup> In certain counties the average tons per man per day is large because of auger mining, strip mining, or mechanical loading underground.



## TRANSPORTATION

Within recent years, methods of shipping bituminous coal and lignite from the mines have changed radically; shipments by rail have declined, and shipments by water and truck have increased. Usually, shipments by water or truck (particularly for short distances) cost less than rail freight rates. See figure 13.



Note: 1937 data not available

FIGURE 13.—Percentage of total production of bituminous coal and lignite, 1933-64, by method of shipment from mines, and percentage used at mines.

TABLE 61.—Bituminous coal and lignite shipped from mines, by method of shipment, and that used at mines in the United States

Year	Method of shipment from mines			Used at mine <sup>1</sup>	Total production
	Shipped by rail and trucked to rail	Shipped by water and trucked to water	Trucked to final destination		
THOUSAND NET TONS					
1933	293,258	13,021	15,463	11,888	333,630
1934	313,304	15,128	18,739	12,197	359,368
1935	319,742	18,327	21,960	12,344	372,373
1936	370,763	24,868	27,929	15,528	439,088
1937	NA	NA	NA	NA	445,531
1938	295,336	16,903	25,592	10,714	348,545
1939	331,190	22,229	29,534	11,902	394,855
1940	380,388	29,493	35,540	15,350	460,771
1941	425,184	30,240	40,056	18,669	514,149
1942	482,814	34,018	45,154	20,707	582,693
1943	495,863	30,188	42,433	21,693	590,177
1944	527,136	31,518	40,123	20,799	619,576
1945	490,472	27,548	41,477	18,120	577,617

See footnotes at end of table.

TABLE 61.—Bituminous coal and lignite shipped from mines, by method of shipment, and that used at mines in the United States—Continued

Year	Method of shipment from mines			Used at mine <sup>1</sup>	Total production
	Shipped by rail and trucked to rail	Shipped by water and trucked to water	Trucked to final destination		
THOUSAND NET TONS					
1946	450,615	24,642	42,731	15,934	533,922
1947	527,282	29,802	55,859	17,680	630,624
1948	498,194	26,735	58,260	16,329	599,518
1949	350,602	21,829	47,786	11,651	437,868
1950	417,225	27,583	58,286	13,217	516,311
1951	430,387	29,984	58,132	15,162	533,665
1952	375,911	27,746	50,231	12,953	466,841
1953	362,133	35,648	47,102	12,407	457,290
1954	305,918	32,912	44,689	8,187	391,706
1955	355,924	47,476	51,607	9,626	464,633
1956	390,015	50,732	49,768	10,359	500,874
1957	380,471	51,171	50,334	10,728	492,704
1958	305,642	43,899	50,605	10,300	410,446
1959	300,763	45,954	52,564	12,747	412,028
1960	303,865	46,784	52,699	12,164	415,512
1961	293,546	46,348	51,044	12,039	402,977
1962	307,328	48,106	54,853	11,862	422,149
1963	333,989	50,664	60,901	13,374	458,928
1964	349,377	59,349	65,532	12,740	486,998
PERCENTAGE OF TOTAL					
1933	87.9	3.9	4.6	3.6	100.0
1934	87.2	4.2	5.2	3.4	100.0
1935	85.9	4.9	5.9	3.3	100.0
1936	84.4	5.7	6.4	3.5	100.0
1937	NA	NA	NA	NA	100.0
1938	84.7	4.9	7.3	3.1	100.0
1939	83.9	5.6	7.5	3.0	100.0
1940	82.6	6.4	7.7	3.3	100.0
1941	82.7	5.9	7.8	3.6	100.0
1942	82.9	5.8	7.7	3.6	100.0
1943	84.0	5.1	7.2	3.7	100.0
1944	85.1	5.1	6.5	3.3	100.0
1945	84.9	4.8	7.2	3.1	100.0
1946	84.4	4.6	8.0	3.0	100.0
1947	83.6	4.7	8.9	2.8	100.0
1948	83.1	4.5	9.7	2.7	100.0
1949	81.4	5.0	10.9	2.7	100.0
1950	80.8	5.3	11.3	2.6	100.0
1951	80.7	5.6	10.9	2.8	100.0
1952	80.5	5.9	10.8	2.8	100.0
1953	79.2	7.8	10.3	2.7	100.0
1954	78.1	8.4	11.4	2.1	100.0
1955	76.6	10.2	11.1	2.1	100.0
1956	77.9	10.1	9.9	2.1	100.0
1957	77.2	10.4	10.2	2.2	100.0
1958	74.5	10.7	12.3	2.5	100.0
1959	73.0	11.1	12.8	3.1	100.0
1960	73.1	11.3	12.7	2.9	100.0
1961	72.9	11.5	12.6	3.0	100.0
1962	72.8	11.4	13.0	2.8	100.0
1963	72.8	11.0	13.3	2.9	100.0
1964	71.7	12.2	13.5	2.6	100.0

NA Not available.

<sup>1</sup> Includes coal used at mine for power and heat, made into beehive coke at mine, used by mine employees, used for all other purposes at mine, and transported from mine to point of use by conveyor, tram, or pipeline.

TABLE 62.—Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, 1964, as reported by mine operators

Route	State	By State (net tons)	Total for route (net tons)
<b>RAILROAD</b>			
Alaska.....	Alaska.....	725,862	725,862
Atchison, Topeka & Santa Fe.....	Colorado.....	14,777	1,051,341
	Illinois.....	204,289	
	New Mexico.....	832,275	
	Illinois.....	400,088	
Baltimore & Ohio.....	Ohio.....	4,397,844	37,150,433
	Pennsylvania.....	3,771,558	
	West Virginia.....	28,580,993	
Bessemer & Lake Erie.....	Pennsylvania.....	1,413,542	1,413,542
Cambria & Indiana.....	do.....	2,677,606	2,677,606
Carbon County.....	Utah.....	1,187,394	1,187,394
	Kentucky.....	11,067,754	
Chesapeake & Ohio.....	Ohio.....	21,913	47,883,912
	Virginia.....	171,159	
	West Virginia.....	36,623,086	
Cheswick & Harmar.....	Pennsylvania.....	410,520	410,520
	Illinois.....	8,230,476	
Chicago, Burlington & Quincy.....	Iowa.....	281,818	9,916,511
	Missouri.....	518,966	
	Wyoming.....	885,251	
	Illinois.....	2,244,950	
Chicago & Eastern Illinois.....	Indiana.....	454,816	2,699,766
Chicago & Illinois Midland.....	Illinois.....	5,284,978	5,284,978
Chicago, Milwaukee, St. Paul & Pacific.....	Indiana.....	1,936,995	2,084,488
Chicago & North Western.....	North Dakota (lignite).....	147,493	
Chicago, Rock Island & Pacific.....	Illinois.....	2,000,636	2,000,636
	do.....	1,146,928	
	Iowa.....	309,097	
Clinchfield.....	Missouri.....	3,500	3,480,890
	Kentucky.....	210,696	
	Virginia.....	3,270,194	
Colorado & Wyoming.....	Colorado.....	776,281	776,281
Denver & Rio Grande Western.....	do.....	2,081,317	4,446,837
	New Mexico.....	2,763	
	Utah.....	2,362,757	
Erie-Lackawanna.....	Ohio.....	235,887	284,433
Great Northern.....	Pennsylvania.....	48,546	
Gulf, Mobile & Ohio.....	North Dakota (lignite).....	450,146	450,146
	Illinois.....	1,603,962	
Illinois Central.....	do.....	13,277,800	25,745,717
	Indiana.....	33,798	
	Kentucky.....	12,434,119	
	Illinois.....	295,443	
Illinois Terminal.....	Illinois.....	295,443	295,443
Interstate.....	Virginia.....	3,604,410	3,604,410
Kansas City Southern.....	Oklahoma.....	153,826	153,826
Kentucky & Tennessee.....	Kentucky.....	403,317	403,317
Lake Erie, Franklin & Clarion.....	Pennsylvania.....	379,133	379,133
	Alabama.....	1,898,106	
Louisville & Nashville.....	Kentucky.....	23,037,992	25,564,382
	Tennessee.....	626,284	
	Alabama.....	887,261	
Mary Lee.....	Oklahoma.....	273,718	273,718
Midland Valley.....	Illinois.....	741,377	741,377
Missouri-Illinois.....	Kansas.....	630,320	1,371,969
	Missouri.....	728,346	
	Oklahoma.....	13,303	
	Arkansas.....	201,692	
Missouri Pacific.....	Illinois.....	4,286,594	4,656,129
	Missouri.....	48,015	
	Oklahoma.....	119,888	
Monon.....	Indiana.....	210,649	210,649
Monongahela.....	Pennsylvania.....	938,582	7,387,384
Montour.....	West Virginia.....	6,448,822	
New York Central (includes coal shipped over Kanawha & Michigan, Kelley's Creek, Toledo & Ohio Central, and Zanesville & Western).....	Pennsylvania.....	1,524,054	1,524,054
	Illinois.....	5,686,807	
	Indiana.....	5,904,662	
New York, Chicago & St. Louis.....	Ohio.....	3,061,469	24,393,383
	Pennsylvania.....	5,003,889	
	West Virginia.....	4,736,556	
	Ohio.....	5,172,858	
Norfolk & Western.....	Kentucky.....	5,491,449	67,157,102
	Ohio.....	799,500	
	Virginia.....	19,856,006	
Northern Pacific.....	West Virginia.....	41,010,147	1,449,835
	Montana (bit. & lig.).....	297,242	
	North Dakota (lignite).....	1,152,593	

See footnotes at end of table.

TABLE 62.—Bituminous coal and lignite loaded for shipment by railroads and waterways in the United States, 1964, as reported by mine operators—Continued

Route	State	By State (net tons)	Total for route (net tons)
RAILROAD—continued			
Pacific Coast.....	Washington.....	18,696	18,696
	Indiana.....	677,393	
Pennsylvania.....	Ohio.....	4,081,534	26,016,556
		Pennsylvania.....	
Pittsburg & Shawmut.....	West Virginia.....	20,500	
Pittsburgh & Lake Erie.....	Pennsylvania.....	2,053,208	
Pittsburgh & West Virginia.....	do.....	1,167,730	2,053,208
	Ohio.....	945,554	1,167,730
St. Louis-San Francisco.....	Alabama.....	529,047	1,304,858
	Arkansas.....	8,643	
	Kansas.....	329,912	
	Oklahoma.....	437,256	
Soo Line.....	North Dakota (lignite).....	263,066	263,066
	Alabama.....	3,058,555	
Southern.....	Indiana.....	97,706	6,038,926
	Kentucky.....	728,931	
	Tennessee.....	1,723,136	
	Virginia.....	430,598	
Southern Iowa.....	Iowa.....	8,510	8,510
	Tennessee.....	765,206	
Tennessee Central.....	do.....	527,162	765,206
Tennessee Coal, Iron and Railroad Co.....	Alabama.....	2,213,023	527,162
Toledo, Peoria & Western.....	Illinois.....	543,202	2,213,023
Union Pacific.....	Colorado.....	517,019	1,223,444
	Wyoming.....	706,425	
Utah.....	Utah.....	657,332	657,332
Wabash.....	Iowa.....	65,041	543,326
	Missouri.....	478,285	
Western Allegheny.....	Pennsylvania.....	83,519	83,519
	Maryland.....	619,573	
Western Maryland.....	Pennsylvania.....	204,118	5,473,679
	West Virginia.....	4,649,988	
Woodward Iron Company.....	Alabama.....	1,106,552	1,106,552
Youngstown & Southern.....	Ohio.....	45,511	62,140
	Pennsylvania.....	16,629	
Total railroad shipments.....		349,376,699	349,376,699
WATERWAY			
Allegheny River.....	Pennsylvania.....	1,609,345	1,609,345
Black Warrior River.....	Alabama.....	2,102,503	2,102,503
Conemaugh River.....	Pennsylvania.....	223,746	223,746
Green River.....	Kentucky.....	10,354,576	10,354,576
Guyandot River.....	West Virginia.....	14,363	14,363
Illinois River.....	Illinois.....	3,245,151	3,245,151
Kanawha River.....	West Virginia.....	5,350,062	5,350,062
Kentucky River.....	Kentucky.....	4,707	4,707
Monongahela River.....	Pennsylvania.....	17,871,508	24,417,052
	West Virginia.....	6,545,544	
	Illinois.....	447,392	
	Indiana.....	1,793,774	
Ohio River.....	Kentucky.....	4,444,264	11,479,862
	Ohio.....	3,845,368	
	West Virginia.....	949,064	
	Alabama.....	88,454	
Tennessee River.....	Tennessee.....	458,808	547,262
Total waterway shipments.....		59,348,629	59,348,629
Total loaded at mines for shipment by railroads and waterways.....		408,725,328	408,725,328
Shipped by truck from mine to final destination.....		65,532,391	65,532,391
Used at mine <sup>1</sup> .....		12,740,233	12,740,233
Total production, 1964.....		486,997,952	486,997,952

<sup>1</sup> Includes coal used at mine for power and heat, made into beehive coke at mine, used by mine employees, used for all other purposes at mine, and transported from mine to point of use by conveyor, tram, or pipeline.

## CONSUMPTION

The statistics on consumption of bituminous coal and lignite, by major consumer classes, are based upon complete coverage of all consumers in each class except "Other manufacturing and mining industries" and "Retail deliveries to other consumers." The figures for both categories are based upon a monthly sample approximating 35 percent coverage. A new benchmark representing complete coverage for "Other manufacturing and mining industries" was established for 1954, based upon data from the Census of Manufactures and the Census of Mineral Industries. The new benchmark for "Retail deliveries to other consumers" for 1954 represents the residual tonnage not otherwise accounted for, and includes some coal shipped by truck from mine to final destination.

Data for each month are determined by matching plants reporting for the latest month with identical plants reporting the preceding month, calculating the percentage change from the previous month,

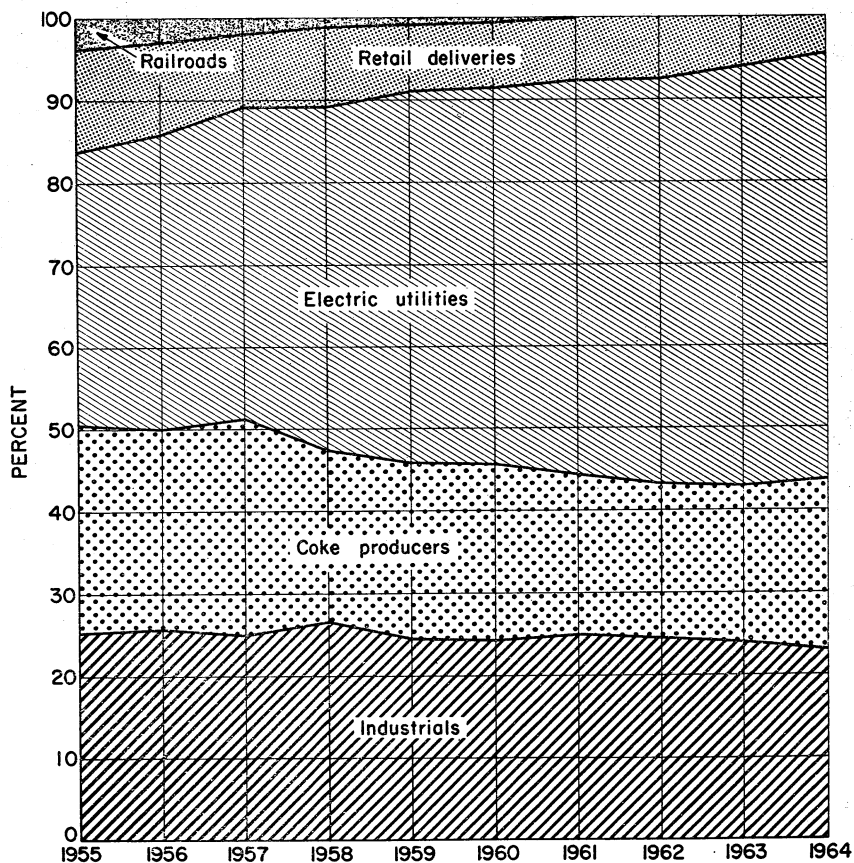


FIGURE 14.—Percentage of total consumption of bituminous coal and lignite, by consumer class, and retail deliveries in the United States, 1955-64

and applying this percentage change to the published figure for the previous month. The results have been reasonably reliable over a period of years. A detailed analysis of the establishment of the new benchmarks and the revisions in "Cement mills," "Steel and rolling mills," and "Bunker, foreign, and lake vessels," is given in Bureau of Mines Weekly Coal Report 2113, March 14, 1958. The total of the classes approximates total consumption and is a much more reliable figure than calculated consumption based on production, imports, exports, and changes in stocks, because certain significant items of stocks are not included in yearend stocks. See figure 14.

TABLE 63.—Consumption of bituminous coal and lignite, by consumer class, with retail deliveries in the United States  
(Thousand net tons)

Year and month	Electric power utilities <sup>1</sup>	Bunker, lake vessel and foreign <sup>2</sup>	Rail-roads (class I) <sup>3</sup>	Manufacturing and mining industries					Retail deliveries to other consumers <sup>6</sup>	Total of classes shown <sup>7</sup>
				Beehive coke plants	Oven coke plants	Steel and rolling mills <sup>4</sup>	Cement mills	Other manufacturing and mining industries <sup>5</sup>		
1933	27,088	2,298	72,548	1,408	38,681	14,129	2,760	81,377	77,396	317,685
1934	29,707	2,423	76,037	1,635	44,343	15,391	3,457	87,314	83,507	343,814
1935	30,936	2,683	77,109	1,469	49,046	16,585	3,456	94,598	80,444	356,326
1936	38,104	3,052	86,391	2,698	63,244	19,019	4,711	111,030	80,044	408,293
1937	41,045	3,433	88,080	4,927	69,575	18,148	5,182	124,056	76,331	430,777
1938	36,440	2,310	73,921	1,360	45,266	11,877	4,413	94,196	66,498	336,281
1939	42,304	2,764	79,072	2,293	61,216	13,843	5,194	100,637	68,770	376,998
1940	49,126	2,939	85,130	4,803	76,583	14,169	5,559	107,864	84,687	430,910
1941	59,858	3,304	97,384	10,529	82,609	15,384	6,735	121,580	94,402	492,115
1942	63,472	3,226	115,410	12,876	87,974	14,722	7,462	132,767	102,141	540,050
1943	74,036	3,042	130,233	12,441	90,019	15,864	5,842	142,149	120,121	593,797
1944	76,656	3,069	132,049	10,858	94,438	15,152	3,767	131,498	122,112	589,599
1945	71,603	3,192	125,120	8,135	87,214	14,241	4,203	126,562	119,297	559,567
1946	68,743	2,632	110,166	7,167	76,121	12,151	6,990	117,732	98,684	500,386
1947	86,009	3,037	94,338	10,475	94,325	14,195	7,919	123,932	96,657	545,891
1948	95,620	2,552	94,338	10,322	96,954	14,193	8,546	110,960	86,794	519,909
1949	80,610	2,056	68,123	5,854	85,882	10,529	7,966	96,629	88,389	445,538
1950	88,262	2,042	60,969	9,088	94,757	10,877	7,923	95,862	84,422	454,202
1951	101,898	2,220	54,005	11,418	102,030	11,260	8,507	103,188	74,378	468,904
1952	103,309	1,839	37,962	6,912	90,702	9,632	7,903	93,637	66,861	418,757
1953	112,283	1,839	27,735	8,226	104,648	8,764	5,167	95,160	69,976	426,798
1954	115,235	1,244	17,370	8,980	84,411	6,933	7,924	77,115	51,798	363,060
1955	140,550	1,499	15,473	2,869	104,508	7,353	8,529	89,611	53,020	423,412
1956	154,983	1,470	12,308	4,943	101,870	7,189	9,026	93,302	48,667	432,853
1957	157,398	1,364	8,401	3,473	104,547	6,938	8,633	87,202	35,712	413,668
1958	152,928	955	3,725	1,017	75,563	7,268	8,256	81,372	35,619	366,703
1959	165,788	969	2,600	1,827	77,354	6,674	8,510	73,396	29,138	366,256
1960	173,882	945	2,101	1,640	79,375	7,373	8,216	76,487	30,405	380,429
1961	179,629	770	( <sup>8</sup> )	1,496	72,385	7,495	7,615	77,280	27,735	374,405
1962	190,833	687	( <sup>8</sup> )	1,339	72,923	7,319	7,719	78,768	28,188	387,774
1963:										
January	19,684	1	( <sup>8</sup> )	110	6,029	848	579	7,911	4,710	39,872
February	17,624		( <sup>8</sup> )	112	5,637	786	516	7,254	3,928	35,867
March	17,073	1	( <sup>8</sup> )	110	6,603	743	599	7,435	2,302	34,866
April	15,378	34	( <sup>8</sup> )	144	6,763	605	617	6,729	1,011	31,281
May	15,717	99	( <sup>8</sup> )	168	7,139	574	711	6,635	793	31,873
June	16,191	81	( <sup>8</sup> )	160	6,771	511	750	6,217	703	31,384
July	17,053	72	( <sup>8</sup> )	142	6,398	469	735	5,204	841	31,610
August	17,649	85	( <sup>8</sup> )	134	5,976	447	740	6,200	1,153	32,468
September	16,566	89	( <sup>8</sup> )	134	5,905	479	716	6,171	1,536	31,596
October	17,593	98	( <sup>8</sup> )	139	6,233	518	701	7,023	1,511	33,816
November	17,783	85	( <sup>8</sup> )	128	6,108	597	719	7,053	1,905	34,383
December	20,727	25	( <sup>8</sup> )	132	6,458	824	755	8,180	3,118	40,219
Total	209,038	670	( <sup>8</sup> )	1,613	76,020	7,401	8,138	82,797	23,548	409,225

See footnotes at end of table.

TABLE 63.—Consumption of bituminous coal and lignite, by consumer class, with retail deliveries in the United States—Continued

(Thousand net tons)

Year and month	Electric power utilities <sup>1</sup>	Bunker, lake vessel and foreign <sup>2</sup>	Railroads (class I) <sup>3</sup>	Manufacturing and mining industries					Retail deliveries to other consumers <sup>6</sup>	Total of classes shown <sup>7</sup>
				Beehive coke plants	Oven coke plants	Steel and rolling mills <sup>4</sup>	Cement mills	Other manufacturing and mining industries <sup>5</sup>		
1964:										
January.....	20,389	1	( <sup>8</sup> )	140	6,657	817	617	8,188	2,968	39,777
February....	18,732	1	( <sup>8</sup> )	135	6,412	776	619	7,590	2,496	36,761
March.....	18,465	5	( <sup>8</sup> )	154	6,868	764	683	7,636	1,872	36,447
April.....	16,666	56	( <sup>8</sup> )	151	6,901	654	686	6,918	1,030	33,062
May.....	16,757	103	( <sup>8</sup> )	155	7,389	542	726	6,517	518	32,707
June.....	17,997	91	( <sup>8</sup> )	133	7,221	488	721	6,009	562	33,222
July.....	19,794	79	( <sup>8</sup> )	114	7,337	474	758	5,558	655	33,769
August.....	18,685	88	( <sup>8</sup> )	156	7,308	462	775	6,080	1,066	34,620
September..	18,013	92	( <sup>8</sup> )	182	7,311	479	732	6,171	1,501	34,481
October.....	18,682	94	( <sup>8</sup> )	210	7,777	567	766	7,152	2,190	37,438
November...	18,678	80	( <sup>8</sup> )	233	7,646	623	782	7,080	1,851	36,973
December...	21,174	21	( <sup>8</sup> )	262	7,905	748	814	8,029	2,906	41,859
Total....	223,032	711	( <sup>8</sup> )	2,025	86,732	7,394	8,679	82,928	19,615	431,116

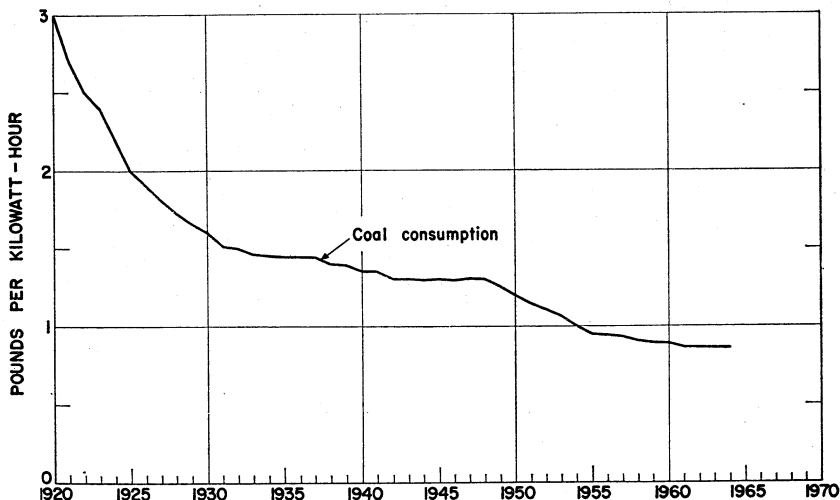
<sup>1</sup> Federal Power Commission.<sup>2</sup> Bureau of the Census, U.S. Department of Commerce, Ore and Coal Exchange.<sup>3</sup> Association of American Railroads. Represents consumption of bituminous coal and lignite for all uses, including locomotive, powerhouse, shop, and station fuel.<sup>4</sup> Estimates based upon reports collected from a selected list of representative steel and rolling mills.<sup>5</sup> Estimates based upon reports collected from a selected list of representative manufacturing plants.<sup>6</sup> Estimates based upon reports collected from a selected list of representative retailers. Includes some coal shipped by truck from mine to final destination.<sup>7</sup> The total classes shown approximates total consumption. The calculation of consumption from production, imports, exports, and changes in stocks is not as accurate as the "Total of classes shown" because certain significant items of stocks are not included in year-end stocks. These items are: Stocks on Lake and Tidewater docks, stocks at other intermediate storage piles between mine and consumer, and coal in transit.<sup>8</sup> Canvass discontinued.

FIGURE 15.—Trend in fuel economy at electric-utility powerplants in the United States, 1920-64.

TABLE 64.—Fuel economy in consumption of coal at electric-utility powerplants in the United States

Year	Coal consumed per kilowatt-hour (pounds)	Index numbers based on 1919 as 100	Year	Coal consumed per kilowatt-hour (pounds)	Index numbers based on 1919 as 100	Year	Coal consumed per kilowatt-hour (pounds)	Index numbers based on 1919 as 100
1919	3.20	100.0	1935	1.44	45.0	1951	1.14	35.6
1920	3.00	93.8	1936	1.44	45.0	1952	1.10	34.4
1921	2.70	84.4	1937	1.44	45.0	1953	1.06	33.1
1922	2.50	78.1	1938	1.40	43.8	1954	.99	30.9
1923	2.40	75.0	1939	1.38	43.1	1955	.95	29.7
1924	2.20	68.8	1940	1.34	41.9	1956	.94	29.4
1925	2.00	62.5	1941	1.34	41.9	1957	.93	29.1
1926	1.90	59.4	1942	1.30	40.6	1958	.90	28.1
1927	1.82	56.9	1943	1.30	40.6	1959	.89	27.8
1928	1.73	54.1	1944	1.29	40.3	1960	.88	27.5
1929	1.66	51.9	1945	1.30	40.6	1961	.86	26.9
1930	1.60	50.0	1946	1.29	40.3	1962	.86	26.9
1931	1.52	47.5	1947	1.31	40.9	1963	.86	26.9
1932	1.49	46.6	1948	1.30	40.6	1964	.86	26.9
1933	1.46	45.6	1949	1.24	38.8			
1934	1.45	45.3	1950	1.19	37.2			

### DISTRIBUTION OF BITUMINOUS COAL AND LIGNITE

Tables 65, 66, and 67 summarize the distribution of bituminous coal and lignite in 1964 for types of consumer use by methods of transportation, by coal-producing districts of origin, by geographic divisions, and by States of destination. This shows the participation of the bituminous coal and lignite industry in various energy markets of the Nation, both locally and nationally, and also provides benchmarks for special studies and analyses of the many factors that influence coal production and its utilization in the highly competitive energy market.



TABLE 65.—Distribution of bituminous coal and lignite, 1964, by method of movement and consumer use

(Thousand net tons)

Shipments	Electric utilities	Coke and gas plants	Retail dealers	All others	Railroad fuel	Used at mines and sales to employees
Total shipments to all destinations in the United States, Canada, and Mexico, by all methods of movements and consumer use, and overseas exports.....	229,392	95,631	22,911	100,249	1,437	1,956
Shipments to all destinations in the United States, Canada, and Mexico by specific method of movement and consumer use:						
Method of movement:						
All-rail.....	112,646	44,627	14,903	62,240	-----	-----
River and ex-river.....	50,598	28,301	762	6,378	-----	-----
Great Lakes <sup>1</sup> .....	20,209	15,066	3,265	12,842	-----	-----
Tidewater <sup>2</sup> .....	15,577	6,209	101	1,886	-----	-----
Truck.....	18,958	957	3,880	16,758	-----	-----
Tramway, conveyor, and private railroad.....	11,404	471	-----	145	-----	-----
Method of movement and/or consumer uses unknown.....	-----	-----	-----	-----	1,437	1,956
Total.....	229,392	95,631	22,911	100,249	1,437	1,956
	Canadian Great Lakes commercial docks <sup>3</sup>	U.S. Great Lakes dock storage <sup>3</sup>	U.S. tidewater dock storage <sup>3</sup>	Overseas exports <sup>4</sup>	Net change in mine inventory	Total
Total shipments to all destinations in the United States, Canada, and Mexico, by all methods of movements and consumer use, and overseas exports.....	836	-327	9	33,733	-362	485,465
Shipments to all destinations in the United States, Canada, and Mexico by specific method of movement and consumer use:						
Method of movement:						
All-rail.....	-----	-----	-----	-----	-----	234,416
River and ex-river.....	-----	-----	-----	-----	-----	86,039
Great Lakes <sup>1</sup> .....	-----	-----	-----	-----	-----	51,882
Tidewater <sup>2</sup> .....	-----	-----	-----	-----	-----	23,773
Truck.....	-----	-----	-----	-----	-----	40,553
Tramway, conveyor, and private railroad.....	-----	-----	-----	-----	-----	12,020
Method of movement and/or consumer uses unknown.....	836	-327	9	33,733	-362	37,282
Total.....	836	-327	9	33,733	-362	485,465

<sup>1</sup> Excludes shipments to Canadian Great Lakes commercial docks and U.S. dock storage for which consumer uses are not available; however, includes vessel fuel, the destinations of which are not available.

<sup>2</sup> Excludes overseas exports and U.S. tidewater dock storage for which consumer uses are not available, however, includes bunker fuel, the destinations of which are not available.

<sup>3</sup> Consumer use unknown.

<sup>4</sup> Excludes Canada; consumer use unknown.

TABLE 66.—Distribution of bituminous coal and lignite, 1964, by district of origin and consumer use

(Thousand net tons)

District of origin <sup>1</sup>	Electric utilities	Coke and gas plants	Retail dealers	All others	Railroad fuel	Used at mines and sales to employees
1.....	22,790	3,518	493	8,139	186	610
2.....	9,424	25,176	605	7,633	16	33
3 and 6.....	28,879	8,684	731	8,108	101	18
4.....	23,659	-----	1,913	11,877	240	60
7.....	1,040	17,675	1,973	3,191	90	546
8.....	45,250	27,770	9,166	30,773	221	561
9.....	32,113	74	1,974	4,299	63	1
10.....	34,989	1,313	2,984	15,656	279	44
11.....	9,348	-----	667	5,045	128	15
12.....	747	-----	4	261	-----	-----
13.....	7,971	6,190	208	854	1	1
14.....	611	-----	2	64	-----	-----
15 <sup>2</sup> .....	3,950	45	188	1,021	5	-----
16.....	535	-----	65	171	-----	6
17.....	1,113	2,251	345	268	-----	2
18.....	2,542	-----	11	48	-----	-----
19.....	2,234	-----	176	658	53	4
20.....	463	2,324	930	1,023	5	27
21.....	1,697	-----	389	645	39	22
22 and 23.....	648	-----	87	510	5	6
Total.....	229,392	95,631	22,911	100,249	1,437	1,956

District of origin <sup>1</sup>	Canadian Great Lakes commercial docks <sup>3</sup>	U.S. Great Lakes dock storage <sup>3</sup>	U.S. tidewater dock storage <sup>3</sup>	Overseas exports <sup>4</sup>	Net change in mine inventory	Total
1.....	19	-18	-2	1,773	57	37,565
2.....	-----	14	-----	-----	-157	42,744
3 and 6.....	77	46	3	1,600	87	48,424
4.....	130	-52	-----	-----	-27	37,800
7.....	112	-37	1	14,401	-114	38,878
8.....	498	-232	7	15,869	-185	129,703
9.....	-----	-5	-----	-----	-138	38,386
10.....	-----	-43	-----	-----	-4	55,218
11.....	-----	-----	-----	-----	44	15,247
12.....	-----	-----	-----	-----	-----	1,012
13.....	-----	-----	-----	-----	104	15,329
14.....	-----	-----	-----	-----	-----	677
15 <sup>2</sup> .....	-----	-----	-----	-----	9	5,218
16.....	-----	-----	-----	-----	-3	774
17.....	-----	-----	-----	-----	-1	3,978
18.....	-----	-----	-----	-----	-15	2,586
19.....	-----	-----	-----	-----	-----	3,125
20.....	-----	-----	-----	-----	-20	4,752
21.....	-----	-----	-----	-----	1	2,793
22 and 23.....	-----	-----	-----	-----	-----	1,256
Total.....	836	-327	9	33,733	-362	485,465

<sup>1</sup> Producing districts are defined in: Bureau of Mines. Bituminous Coal and Lignite Distribution Calendar Year 1964. Mineral Industry Survey, March, 1965, 21 pp.

<sup>2</sup> Excludes Texas.

<sup>3</sup> Consumer use unknown.

<sup>4</sup> Excludes Canada; consumer use unknown.

TABLE 67.—Distribution of bituminous coal and lignite, 1964, by destination and consumer use

(Thousand net tons)

Destination	Total	Electric utilities	Coke and gas plants	Retail dealers	All others
New England:					
Massachusetts.....	4,160	3,426	-----	160	574
Connecticut.....	4,767	3,985	476	26	280
Maine, New Hampshire, Vermont, and Rhode Island.....	1,080	789	-----	60	231
Middle Atlantic:					
New York.....	25,932	12,880	5,724	307	7,021
New Jersey.....	7,526	5,729	350	26	1,421
Pennsylvania.....	56,692	19,836	26,030	812	10,014
East North Central:					
Ohio.....	51,092	23,769	10,462	2,503	14,358
Indiana.....	35,885	17,019	11,856	1,361	5,649
Illinois.....	41,466	22,995	3,309	4,809	10,353
Michigan.....	30,936	14,690	5,309	1,771	9,166
Wisconsin.....	13,928	6,663	417	2,076	4,772
West North Central:					
Minnesota.....	7,077	3,849	1,031	581	1,616
Iowa.....	4,849	2,319	-----	548	1,982
Missouri.....	8,154	5,418	158	457	2,121
North Dakota and South Dakota.....	2,191	1,304	-----	481	406
Nebraska and Kansas.....	1,647	925	-----	112	610
South Atlantic:					
Delaware and Maryland.....	12,317	5,776	5,022	354	1,165
District of Columbia.....	3,638	374	-----	136	2,128
Virginia.....	13,787	7,824	126	1,078	4,759
West Virginia.....	18,205	7,627	5,096	258	5,224
North Carolina.....	11,595	8,487	-----	746	2,362
South Carolina.....	4,401	2,601	-----	302	1,498
Georgia and Florida.....	6,923	6,032	-----	285	606
East South Central:					
Kentucky.....	16,148	11,181	1,866	645	2,456
Tennessee.....	14,075	11,070	153	738	2,114
Alabama and Mississippi.....	19,626	12,000	6,458	166	1,002
West South Central:					
Arkansas, Louisiana, Oklahoma, and Texas.....	1,099	18	866	31	184
Mountain:					
Colorado.....	3,877	1,932	1,105	333	507
Utah.....	2,706	410	1,690	232	374
Montana and Idaho.....	1,190	294	-----	478	418
Wyoming.....	1,936	1,762	-----	50	124
New Mexico.....	2,169	2,116	-----	18	35
Arizona and Nevada.....	577	456	-----	54	67
Pacific:					
Washington and Oregon.....	774	-----	-----	278	496
California.....	2,015	-----	1,976	8	31
Alaska.....	842	354	-----	44	444
Canada <sup>2</sup> .....	13,228	3,175	5,547	552	3,954
Mexico.....	54	-----	-----	-----	54
Destinations not revealable.....	1,496	307	604	35	550
Destinations and/or consumer uses not available:					
Great Lakes movement:					
Canadian commercial docks.....	386	-----	-----	-----	-----
Vessel fuel.....	1,106	-----	-----	-----	-----
U. S. dock storage.....	-327	-----	-----	-----	-----
Tidewater movement:					
Overseas exports (except Canada).....	33,733	-----	-----	-----	-----
Bunker fuel.....	174	-----	-----	-----	-----
U. S. dock storage.....	91	-----	-----	-----	-----
Railroad fuel:					
U. S. companies.....	1,321	-----	-----	-----	-----
Canadian companies.....	116	-----	-----	-----	-----
Coal used at mines and sales to employees.....	1,956	-----	-----	-----	-----
Net change in mine inventory.....	-362	-----	-----	-----	-----
Total.....	485,465	-----	-----	-----	-----

<sup>1</sup> Excludes vessel fuel and bunker fuel, the destinations of which are not available.<sup>2</sup> A considerable block of tonnage is included under "Destinations not revealable."<sup>3</sup> Excludes shipments to Canadian Great Lakes commercial docks and Canadian railroad companies.

Table 68 shows, on a comparative basis, the total tons shipped to all types of consumers from 1959 through 1964, and what percentage of total shipments during each year moved to each geographic region and State. From these data one can readily determine the size of the total market, the relative position of regional and State markets in relation to the whole, and the trend of shipments to these markets from year to year. The regional and State data reported in this table exclude shipments for United States railroad fuel, vessel fuel, bunker fuel, coal used at mines and sales to employees, overseas exports, and net change in mine inventory, because the ultimate destinations of these tonnages are not available. This information, where available, is shown in totals at the end of the table.

Table 69 shows the quantitative changes in total tons shipped, expressed in indexes, that took place throughout the country, by geographic division, State of destination, and consumer use, for the years 1957 and 1960 through 1964. The year 1957 is used as the base year, representing 100. For example, the total shipments of bituminous coal and lignite in the United States in 1957 amounted to 493,895,000 tons. This sum represents 100. Total shipments in 1960 represented only 84.3 percent of the 1957 level, while in 1961 total shipments compared with 1957 figures amounted to 81.6 percent. In 1964 they represented 98.3 percent.

To indicate the size of the bituminous coal and lignite market, quantitatively, in each geographic division, State, and consumer use category, the 1957 total tons shipped are shown in the table in lieu of the index numbers of 100 which each tonnage figure represents (except those otherwise noted).

These distribution data are based on reports submitted to the Bureau of Mines voluntarily by producers, sales agents, distributors, and wholesalers who normally produce or sell 100,000 tons or more annually. The unprecedented cooperation of these respondents resulted in their reporting about 94 percent of all coal produced or shipped. To account for total industry shipments, estimates for the remaining shipments are included, based on data from coal trade and other reliable coal statistical reporting agencies.

Details of the bituminous coal and lignite distribution for 1964 are presented in a Bureau of Mines report.<sup>5</sup>

<sup>5</sup> Bureau of Mines. Bituminous Coal and Lignite Distribution Calendar Year 1964. Mineral Industry Surveys, March 1965, 21 pp.

TABLE 68.—Total bituminous coal and lignite shipments and percent of grand total shipments, 1959–64, by geographic division and State of destination

Geographic division and State of destination	Thousand tons						Percent of total					
	1959	1960	1961	1962	1963	1964	1959	1960	1961	1962	1963	1964
Total.....	412,245	416,119	403,262	424,627	456,137	485,465	100.0	100.0	100.0	100.0	100.0	100.0
New England.....	11,150	9,313	9,674	9,997	10,017	10,007	2.7	2.2	2.4	2.4	2.2	2.0
Massachusetts.....	4,924	4,031	4,014	4,342	4,346	4,160	1.2	1.0	1.0	1.0	1.0	.8
Connecticut.....	3,850	3,758	3,956	4,047	4,341	4,767	.9	.9	1.0	1.0	.9	1.0
Maine, New Hampshire, Vermont, and Rhode Island.....	2,376	1,524	1,704	1,608	1,330	1,080	.6	.3	.4	.4	.3	.3
Middle Atlantic.....	75,082	76,173	72,076	76,107	79,492	90,150	18.2	18.3	17.9	17.9	17.4	18.6
New York.....	22,974	22,980	21,092	21,737	22,417	25,932	5.6	5.5	5.2	5.1	4.9	5.3
New Jersey.....	6,087	5,910	6,455	6,901	6,874	7,526	1.5	1.4	1.6	1.6	1.5	1.6
Pennsylvania.....	46,021	47,283	44,529	47,469	50,201	56,092	11.1	11.4	11.1	11.2	11.0	11.7
East North Central.....	161,242	158,125	151,278	159,391	164,423	173,307	39.1	38.0	37.5	37.5	36.0	35.7
Ohio.....	150,271	149,624	144,998	148,324	149,157	151,092	36.4	35.8	35.2	35.2	34.4	34.4
Indiana.....	31,000	32,283	31,894	31,824	33,124	35,885	7.5	7.8	7.9	7.5	7.2	7.4
Illinois.....	39,720	38,705	37,479	39,259	39,086	41,466	9.6	9.3	9.3	9.2	8.6	8.5
Michigan.....	27,231	25,076	24,327	27,255	29,888	30,986	6.6	6.0	6.0	6.4	6.5	6.4
Wisconsin.....	13,220	12,437	12,580	12,729	13,168	13,928	3.2	3.0	3.1	3.0	2.9	2.9
West North Central.....	21,023	22,571	20,920	22,520	23,242	23,918	5.1	5.4	5.2	5.3	5.1	4.9
Minnesota.....	5,378	6,376	5,831	5,768	6,143	7,077	1.3	1.5	1.5	1.4	1.3	1.4
Iowa.....	5,062	4,946	4,439	5,047	5,271	4,849	1.2	1.2	1.1	1.2	1.2	1.0
Missouri.....	6,944	7,279	6,847	7,685	7,896	8,154	1.7	1.7	1.7	1.8	1.7	1.7
North Dakota and South Dakota.....	2,434	2,453	2,425	2,425	2,113	2,191	.6	.6	.6	.5	.5	.5
Nebraska and Kansas.....	1,205	1,513	1,313	1,630	1,810	1,647	.3	.4	.3	.4	.4	.3
South Atlantic.....	50,682	52,547	55,316	57,891	63,816	67,866	12.3	12.6	13.7	13.6	14.0	14.0
Delaware and Maryland.....	3,122	9,031	9,351	9,884	10,968	12,317	2.0	2.2	2.3	2.3	2.4	2.6
District of Columbia.....	1,105	1,002	968	813	718	638	.3	.2	.2	.2	.2	.1
Virginia.....	11,147	11,685	12,343	12,823	13,323	13,787	2.7	2.8	3.1	3.0	2.9	2.8
West Virginia.....	14,143	13,778	14,661	15,272	16,742	18,205	3.4	3.3	3.6	3.6	3.7	3.8
North Carolina.....	8,946	8,667	9,295	9,980	11,187	11,595	2.2	2.1	2.3	2.4	2.4	2.4
South Carolina.....	3,444	3,591	3,800	3,921	4,442	4,401	.8	.9	1.0	.9	1.0	.9
Georgia and Florida.....	3,775	4,793	4,898	5,198	6,436	6,923	.9	1.1	1.2	1.2	1.4	1.4
East South Central.....	38,907	41,556	40,771	42,709	47,418	49,849	9.4	10.0	10.1	10.0	10.4	10.3
Kentucky.....	11,301	11,270	11,340	11,873	15,453	16,148	2.7	2.7	2.8	2.8	3.4	3.3
Tennessee.....	13,744	14,786	13,588	14,120	14,952	14,075	3.3	3.6	3.4	3.3	3.3	2.9
Alabama and Mississippi.....	13,862	15,500	15,843	16,716	17,013	19,626	3.4	3.7	3.9	3.9	3.7	4.1
West South Central: Arkansas, Louisiana, Oklahoma, and Texas.....	1,387	1,114	802	839	802	1,099	.3	.3	.2	.2	.2	.2
Mountain.....	7,346	8,536	8,932	8,898	10,823	12,455	1.8	2.1	2.2	2.1	2.4	2.6
Colorado.....	2,781	2,887	3,242	3,340	3,752	3,877	.7	.7	.8	.8	.8	.8
Utah.....	2,508	3,377	3,046	2,417	2,334	2,706	.6	.8	.8	.6	.5	.6
Montana and Idaho.....	941	952	1,045	1,108	1,066	1,190	.3	.2	.3	.3	.3	.3
Wyoming.....	894	1,006	1,328	1,438	1,977	1,936	.2	.3	.3	.3	.4	.4
New Mexico.....	113	171	138	107	1,132	2,169	(3)	.1	(3)	(3)	.3	.4
Arizona and Nevada.....	109	143	133	488	562	577	(3)	(3)	(3)	.1	.1	.1

Pacific.....	2,394	2,271	3,162	2,390	2,518	2,789	.6	.6	.8	.6	.6	.6
Washington and Oregon.....	897	963	992	964	828	774	.2	.3	.3	.2	.2	.2
California.....	1,497	1,318	2,170	1,426	1,690	2,015	.4	.3	.5	.4	.4	.4
Alaska.....	685	720	710	893	855	842	.2	.2	.2	.2	.2	.2
Canada <sup>1</sup> .....	12,381	11,413	11,168	11,702	13,724	14,180	3.0	2.7	2.8	2.8	3.0	2.9
Mexico.....	54	57	55	53	48	54	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
Destinations not revealable.....		1,380	1,148	1,105	1,350	1,496		.3	.3	.2	.3	.3
U.S. railroad fuel.....	2,513	2,124	1,782	1,602	1,452	1,321	.6	.5	.4	.4	.3	.3
U.S. Great Lakes dock storage.....	304	363	-718	-29	70	-327	.1	.1	.2	( <sup>2</sup> )	( <sup>2</sup> )	.1
U.S. tidewater dock storage.....	26		19		6	9	( <sup>2</sup> )		( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	.2
Vessel fuel.....	1,544	1,419	1,083	1,183	1,090	1,106	.4	.3	.3	.3	.2	.2
Bunker fuel.....	17	4	3	12	18	17	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
Overseas exports.....	24,835	24,818	23,780	27,041	33,317	33,733	6.0	6.0	5.9	6.4	7.3	7.0
Coal used at mines and sales to employees.....	1,907	1,676	1,866	1,272	1,753	1,956	.5	.4	.3	.3	.4	.4
Net change in mine inventory.....	-1,234	-61	-63	-949	-97	-362	-.3	( <sup>2</sup> )	( <sup>2</sup> )	-.2	( <sup>2</sup> )	-.1

<sup>1</sup> District 9 shipments via river and ex-river to Ohio electric utilities included with Indiana.

<sup>2</sup> District 10 shipments via river and ex-river to Alabama and Mississippi electric utilities included with Tennessee.

<sup>3</sup> Less than one-tenth of one percent.

<sup>4</sup> Includes shipments to Canadian Great Lakes commercial docks and Canadian railroad companies.

TABLE 69.—The changing levels of bituminous coal and lignite markets—indexes of physical volumes shipped to markets, 1957 and 1960–64, by geographic division, State of destination, and consumer use.

Geographic division, State of destination, and consumer use	1957 (thousand tons)	Index 1957=100 (except where noted)				
		1960	1961	1962	1963	1964
Total.....	493,895	84.3	81.6	86.0	92.4	98.3
Electric utilities.....	160,754	108.4	110.1	120.4	131.5	142.7
Coke and gas plants.....	112,901	76.3	69.8	68.6	73.3	84.7
Retail dealers.....	39,230	82.0	74.7	73.0	66.3	58.4
All others (includes vessel and bunker fuel).....	108,711	85.4	83.4	87.6	90.8	92.2
Railroad fuel (U.S. and Canada).....	9,581	23.5	19.6	18.0	16.1	15.0
Canadian Great Lake commercial docks (consumer use not available).....	2,785	61.6	43.6	26.1	21.3	30.0
U.S. Great Lakes dock storage (consumer use not available) <sup>1</sup> .....	NA	119.4	-236.2	-109.5	23.0	-207.6
U.S. tidewater dock storage (consumer use not available) <sup>2</sup> .....	NA	.0	73.1	-----	23.1	34.6
Coal used at mines and sales to employees.....	3,125	53.6	43.7	40.7	56.1	62.6
Net change in mine inventory.....	1,142	-105.3	-105.5	-183.1	-108.5	-131.7
Overseas exports (excludes Canada—consumer use not available).....	55,666	44.6	42.7	48.6	59.9	60.6
New England.....	11,909	78.2	81.2	83.9	84.1	84.0
Electric utilities.....	6,012	99.8	111.8	120.2	129.2	136.4
Coke and gas plants.....	1,845	42.4	35.3	35.3	35.1	35.4
Retail dealers.....	1,279	48.7	35.4	35.2	23.5	19.2
All others.....	3,273	64.8	61.8	57.0	45.1	33.2
Massachusetts.....	5,354	75.3	75.0	81.1	81.2	77.7
Electric utilities.....	2,575	94.0	103.8	119.1	133.3	133.0
Coke and gas plants.....	751	14.2	.0	.0	.0	.0
Retail dealers.....	755	55.2	36.7	38.3	21.5	21.2
All others.....	1,273	85.4	83.7	77.5	59.0	45.1
Connecticut.....	4,105	91.5	96.4	98.6	105.7	116.1
Electric utilities.....	2,567	110.2	121.1	127.2	136.0	155.2
Coke and gas plants.....	594	77.8	80.0	75.3	79.5	80.1
Retail dealers.....	139	61.9	44.6	46.8	34.5	18.7
All others.....	805	47.3	38.5	33.5	41.0	34.8
Maine, New Hampshire, Vermont, and Rhode Island.....	2,450	62.2	69.6	65.6	54.3	44.1
Electric utilities.....	870	86.3	108.3	102.6	97.2	90.7
Retail dealers.....	385	31.2	29.6	24.9	23.4	15.6
All others.....	1,195	54.6	54.2	51.0	33.0	19.3
Middle Atlantic.....	92,596	82.3	77.8	82.2	85.8	97.4
Electric utilities.....	31,662	96.7	97.2	104.5	108.3	121.4
Coke and gas plants.....	38,448	70.0	61.8	62.5	68.0	83.5
Retail dealers.....	2,498	71.3	65.7	61.6	54.3	45.8
All others.....	19,988	84.4	79.6	87.2	88.5	92.3
New York.....	26,753	85.9	78.8	81.3	83.8	96.9
Electric utilities.....	12,335	93.5	85.3	88.8	91.1	104.4
Coke and gas plants.....	5,693	75.6	66.4	70.2	70.6	100.5
Retail dealers.....	769	56.0	56.6	60.7	48.5	39.9
All others.....	7,956	84.4	79.8	79.5	85.3	88.2
New Jersey.....	7,814	75.6	82.6	88.3	88.0	96.3
Electric utilities.....	4,284	84.9	100.9	108.6	115.1	133.7
Coke and gas plants.....	1,249	59.7	45.1	35.2	31.8	28.0
Retail dealers.....	130	51.5	51.5	37.7	44.6	20.0
All others.....	2,151	68.0	69.8	81.9	69.2	66.1
Pennsylvania.....	58,029	81.5	76.7	81.8	86.5	97.7
Electric utilities.....	15,043	102.7	105.8	116.3	120.6	131.9
Coke and gas plants.....	31,506	69.4	61.6	62.2	68.9	82.6
Retail dealers.....	1,599	80.2	71.2	64.0	57.9	50.8
All others.....	9,881	88.0	81.5	94.6	95.3	101.3
East North Central.....	170,697	92.6	88.6	93.4	96.3	101.5
Electric utilities.....	66,436	104.7	102.7	112.5	118.8	128.1
Coke and gas plants.....	38,757	79.2	70.0	68.4	71.5	80.9
Retail dealers.....	21,321	82.1	76.0	74.8	66.7	58.7
All others.....	44,183	91.3	90.0	95.5	98.6	100.3
Ohio.....	55,612	89.2	80.9	86.9	88.4	91.9
Electric utilities.....	20,193	105.9	100.2	108.5	113.9	117.7
Coke and gas plants.....	15,661	75.9	58.3	60.5	57.9	66.8
Retail dealers.....	5,077	68.4	57.4	61.1	51.7	49.3
All others.....	14,681	87.9	86.6	94.1	98.6	97.8
Indiana.....	34,938	92.4	91.3	91.1	94.8	102.7
Electric utilities.....	12,853	106.8	106.8	115.2	119.5	132.4
Coke and gas plants.....	13,736	80.3	78.3	69.9	77.9	86.3
Retail dealers.....	2,796	78.0	72.6	69.0	62.2	48.7
All others.....	5,553	96.5	96.9	99.0	96.0	101.7
Illinois.....	42,718	90.6	87.7	91.9	91.5	97.1
Electric utilities.....	18,584	103.0	103.2	109.7	112.6	123.7
Coke and gas plants.....	3,925	75.1	70.7	73.2	71.3	84.3
Retail dealers.....	8,623	76.2	66.1	67.3	61.3	55.8
All others.....	11,586	86.8	84.8	88.1	87.0	89.4

See footnotes at end of table.

TABLE 69.—The changing levels of bituminous coal and lignite markets—indexes of physical volumes shipped to markets, 1957 and 1960-64, by geographic division, State of destination, and consumer use—Continued

Geographic division, State of destination, and consumer use	1957 (thousand tons)	Index 1957=100 (except where noted)				
		1960	1961	1962	1963	1964
<b>East North Central—Continued</b>						
Michigan	26,255	95.5	92.7	103.8	113.8	117.8
Electric utilities	9,839	103.6	101.6	124.8	138.0	149.3
Coke and gas plants	4,877	92.6	84.5	87.1	98.7	108.9
Retail dealers	3,368	73.0	74.6	70.0	64.0	52.6
All others	8,171	96.8	94.2	102.5	114.3	112.2
Wisconsin	11,174	111.3	112.6	113.9	117.8	124.6
Electric utilities	4,967	103.7	101.6	108.1	122.6	134.1
Coke and gas plants	558	60.9	62.4	52.9	60.9	74.7
Retail dealers	1,457	194.2	209.0	189.8	166.0	142.5
All others	4,192	98.3	98.8	102.5	103.1	113.8
West North Central	20,824	108.4	100.5	108.1	111.6	114.9
Electric utilities	8,278	127.3	123.9	147.6	159.2	166.9
Coke and gas plants	1,518	62.3	39.0	50.6	51.1	78.3
Retail dealers	4,079	101.1	89.5	79.9	63.8	53.4
All others	6,949	100.2	92.4	90.3	96.2	96.9
Minnesota	5,832	119.6	110.5	111.9	115.2	132.7
Electric utilities	1,810	162.9	154.5	169.0	176.7	212.7
Coke and gas plants	1,206	60.6	43.2	52.4	55.0	85.5
Retail dealers	553	176.1	178.7	131.5	122.1	105.1
All others	1,769	97.7	90.0	76.7	91.1	91.7
Iowa	4,878	101.4	91.0	103.5	108.1	99.4
Electric utilities	1,846	111.6	100.6	127.1	137.3	125.6
Retail dealers	1,254	74.9	63.2	63.9	56.9	43.7
All others	1,778	109.5	100.7	106.8	113.7	111.5
Missouri	6,862	106.1	99.8	112.0	115.1	118.1
Electric utilities	2,605	138.1	142.2	176.2	200.2	208.0
Coke and gas plants	312	68.6	22.8	43.6	36.2	50.6
Retail dealers	1,495	81.8	68.3	61.7	36.2	30.6
All others	2,450	91.6	83.7	83.1	82.8	86.6
North Dakota and South Dakota	2,416	101.5	100.4	98.9	87.5	90.7
Electric utilities	1,378	91.1	99.3	103.7	89.5	94.6
Retail dealers	517	135.4	126.5	118.6	101.4	93.0
All others	521	95.4	77.2	66.8	68.3	77.9
Nebraska and Kansas	1,336	113.6	98.7	122.0	136.2	123.3
Electric utilities	639	106.3	82.6	124.3	156.2	144.8
Retail dealers	260	111.2	75.4	75.8	56.9	43.1
All others	437	125.9	135.9	146.2	154.0	139.6
South Atlantic	52,560	100.0	105.2	110.1	121.4	129.1
Electric utilities	22,251	122.1	134.0	143.6	161.7	174.0
Coke and gas plants	11,321	74.6	73.4	73.5	79.6	90.5
Retail dealers	4,765	77.9	66.3	70.0	67.2	66.3
All others	14,223	93.0	98.6	100.5	109.9	110.7
Delaware and Maryland	10,358	87.2	90.3	95.4	105.9	118.9
Electric utilities	3,000	125.4	137.6	144.2	167.3	192.5
Coke and gas plants	5,414	76.6	76.3	82.6	81.5	92.8
Retail dealers	420	55.0	51.0	56.9	80.2	84.3
All others	1,524	58.4	57.6	55.6	78.9	76.4
District of Columbia	1,097	91.3	88.2	74.1	65.5	58.2
Electric utilities	609	70.1	67.7	52.5	59.1	61.4
Retail dealers	188	73.4	77.1	78.7	80.3	72.3
All others	300	145.7	137.0	115.0	69.0	42.7
Virginia	10,553	110.7	117.0	121.5	126.2	130.6
Electric utilities	4,435	138.2	151.2	162.2	166.9	176.4
Coke and gas plants	165	101.8	46.7	19.4	30.3	76.4
Retail dealers	1,756	75.5	64.5	62.6	59.3	61.4
All others	4,197	96.7	105.5	107.1	115.1	113.4
West Virginia	15,771	87.4	93.0	96.8	106.2	115.4
Electric utilities	6,290	94.8	103.2	111.2	114.2	121.3
Coke and gas plants	5,742	71.8	71.4	66.4	79.2	88.7
Retail dealers	302	83.1	82.8	112.9	94.0	85.4
All others	3,437	100.0	111.1	119.9	137.5	152.0
North Carolina	8,716	99.4	106.6	114.5	128.4	133.0
Electric utilities	4,953	108.1	123.0	135.4	160.0	171.4
Retail dealers	1,248	82.3	66.8	70.6	63.9	59.8
All others	2,515	90.9	94.2	95.1	98.0	93.9
South Carolina	3,050	117.7	124.6	128.6	145.6	144.3
Electric utilities	856	192.5	222.8	236.8	289.0	303.9
Retail dealers	321	107.5	84.1	90.0	91.0	94.1
All others	1,873	85.3	86.7	85.7	89.5	80.0
Georgia and Florida	3,015	159.0	162.5	172.4	213.5	229.6
Electric utilities	2,108	184.1	193.8	207.8	266.4	286.1
Coke and gas plants	530	74.5	59.4	63.4	56.4	53.8
Retail dealers	377	137.1	132.1	127.9	138.2	160.7

See footnotes at end of table.



TABLE 69.—The changing levels of bituminous coal and lignite markets—indexes of physical volumes shipped to markets, 1957 and 1960-64, by geographic division, State of destination, and consumer use—Continued

Geographic division, State of destination, and consumer use	1957 (thousand tons)	Index 1957=100 (except where noted)				
		1960	1961	1962	1963	1964
East South Central	43,283	96.0	94.2	36.5	109.6	115.2
Electric utilities	23,572	112.6	115.0	122.4	137.6	145.3
Coke and gas plants	10,380	80.8	69.8	70.3	73.6	81.7
Retail dealers	2,494	78.5	74.7	72.6	80.2	62.1
All others	6,837	68.3	66.6	69.3	78.1	81.5
Kentucky	11,167	100.9	101.5	106.3	138.4	144.6
Electric utilities	6,758	107.6	108.1	117.8	154.4	165.4
Coke and gas plants	1,683	87.6	91.0	83.8	111.5	110.9
Retail dealers	834	83.8	99.6	77.2	95.3	77.3
All others	1,892	96.3	88.3	98.4	123.9	129.8
Tennessee	15,104	97.9	90.0	93.5	99.0	93.2
Electric utilities	9,876	119.2	107.2	112.8	119.4	112.1
Coke and gas plants	258	73.6	89.9	96.5	84.5	59.3
Retail dealers	1,206	81.0	69.4	71.6	72.1	61.2
All others	3,764	49.0	51.4	49.5	55.0	56.2
Alabama and Mississippi	17,012	91.9	93.1	98.3	100.0	115.4
Electric utilities	6,938	107.9	133.0	140.7	147.1	173.0
Coke and gas plants	8,439	79.7	64.9	66.8	65.7	76.5
Retail dealers	454	62.3	43.0	66.5	73.8	36.6
All others	1,181	85.0	80.0	85.8	78.6	84.8
West South Central: Arkansas, Louisiana, Oklahoma, and Texas	1,868	59.6	42.9	44.9	42.9	58.8
Electric utilities	65	0	0	0	100.0	75.0
Coke and gas plants	1,050	67.3	49.0	61.5	58.7	82.5
Retail dealers	161	44.1	28.0	28.6	23.0	19.3
All others	592	56.8	41.0	24.8	22.3	31.1
Mountain	8,779	97.2	101.7	101.4	123.3	141.9
Electric utilities	1,437	193.5	237.1	263.6	405.8	485.0
Coke and gas plants	3,772	80.9	76.5	60.9	65.3	74.1
Retail dealers	1,350	86.4	82.7	88.4	83.1	86.3
All others	2,220	69.3	68.6	73.0	63.2	68.7
Colorado	3,264	88.4	99.3	102.3	115.0	118.8
Electric utilities	687	177.1	205.1	227.4	264.3	281.2
Coke and gas plants	1,324	64.6	75.4	70.4	85.6	83.5
Retail dealers	326	81.3	85.9	100.0	87.7	102.1
All others	927	59.3	59.9	56.1	55.7	54.7
Utah	3,748	90.1	81.3	64.5	62.3	72.2
Electric utilities	367	137.6	150.4	124.0	118.8	111.7
Coke and gas plants	2,445	89.7	77.1	55.8	54.4	69.0
Retail dealers	334	76.9	75.1	81.7	73.1	69.5
All others	599	70.1	59.3	54.1	53.9	62.4
Montana and Idaho	923	103.1	113.2	120.0	115.5	128.9
Electric utilities	1	105.6	149.2	164.8	160.3	164.2
Retail dealers	593	87.5	80.6	80.9	80.8	80.6
All others	329	74.2	91.2	101.2	91.2	127.1
Wyoming	607	165.7	218.8	236.9	325.7	318.9
Electric utilities	340	245.6	336.2	326.8	520.3	518.2
Retail dealers	61	96.7	91.8	98.4	86.9	82.0
All others	206	54.4	62.6	129.6	75.2	60.2
New Mexico	92	15.1	12.2	9.5	100.0	191.6
Electric utilities	37	2.7	3.0	2.8	100.0	195.0
Retail dealers	12	358.3	291.7	250.0	183.3	150.0
All others	43	230.2	162.8	109.3	58.1	81.4
Arizona and Nevada	145	98.6	91.7	336.6	387.6	397.9
Electric utilities	5	1.5	.9	100.0	131.0	136.1
Retail dealers	24	100.0	70.8	100.0	158.3	225.0
All others	116	98.3	97.4	111.2	73.3	57.8
Pacific	3,142	72.3	100.6	76.1	80.1	88.8
Electric utilities	4	0	0	0	0	0
Coke and gas plants	1,708	75.3	124.2	80.9	96.8	115.7
Retail dealers	377	95.0	106.9	77.7	72.4	75.9
All others	1,053	59.5	60.6	68.0	56.2	50.0
Washington and Oregon	1,324	72.0	74.9	72.8	62.5	58.5
Electric utilities	3	0	0	0	0	0
Retail dealers	367	95.6	108.2	78.2	73.3	75.7
All others	954	63.1	62.4	71.0	58.6	52.0
California	1,818	72.5	119.4	78.4	93.0	110.8
Electric utilities	1	0	0	0	0	0
Coke and gas plants	1,708	75.3	124.2	80.9	96.8	115.7
Retail dealers	10	70.0	60.0	60.0	40.0	80.0
All others	99	25.3	43.4	39.4	33.3	31.3
Alaska	828	86.9	85.6	107.7	103.1	101.6
Electric utilities	470	87.7	43.8	61.5	71.5	75.3
Retail dealers	49	134.7	134.7	155.1	108.2	89.8
All others	310	78.1	141.3	170.3	150.3	143.2

See footnotes at end of table.

**TABLE 69.—The changing levels of bituminous coal and lignite markets—indexes of physical volumes shipped to markets, 1957 and 1960–64, by geographic division, State of destination, and consumer use—Continued**

Geographic division, State of destination, and consumer use	1957 (thousand tons)	Index 1957=100 (except where noted)				
		1960	1961	1962	1963	1964
Canada <sup>9</sup> .....	17,878	63.8	62.5	65.5	76.8	80.8
Electric utilities.....	567	30.7	21.5	206.2	437.9	560.0
Coke and gas plants.....	4,602	102.5	114.2	109.6	122.8	120.5
Retail dealers.....	857	81.3	75.5	74.6	94.6	64.4
All others.....	7,183	55.5	53.4	55.7	57.0	55.0
Canadian Great Lakes Commercial docks (consumer use not available).....	2,785	61.6	43.6	26.1	21.3	30.0
Canadian railroad companies.....	1,884	6.7	5.0	6.5	4.9	6.2
Mexico <sup>10</sup> .....	NA	100.0	96.5	93.0	84.2	94.7
All others <sup>10</sup> .....	NA	100.0	96.5	93.0	84.2	94.7
Destinations not revealable <sup>11</sup> .....		100.0	83.2	80.1	97.8	108.4
Electric utilities <sup>11</sup> .....		100.0	74.6	42.1	34.2	61.8
Coke and gas plants <sup>11</sup> .....		100.0	141.2	172.7	161.0	161.5
Retail dealers <sup>11</sup> .....		100.0	69.7	52.3	32.3	35.4
All others <sup>11</sup> .....		100.0	43.9	53.2	133.2	134.1
Destinations not available.....						
Great Lakes vessel fuel <sup>12</sup> .....	1,859	76.3	58.3	63.6	58.6	59.5
Tidewater bunker fuel <sup>12</sup> .....	41	9.8	7.3	29.3	43.9	41.5
Railroad fuel, United States companies <sup>13</sup> .....	7,697	27.6	23.2	22.4	18.9	17.2

NA Not available.

<sup>1</sup> For Great Lakes dock storage the annual base period is 1959=100. The 1959 annual tonnage was 304 tons.

<sup>2</sup> For tidewater dock storage the annual base period is 1959=100. The 1959 annual tonnage was 26 tons.

<sup>3</sup> District 15 shipments to Illinois included with Iowa.

<sup>4</sup> A considerable block of tonnage is included under "Destinations not revealable."

<sup>5</sup> For electric utilities in Arkansas, Louisiana, Oklahoma, and Texas the annual base period is 1963=100. The 1963 tonnage shipped to electric utilities was 24,000 tons.

<sup>6</sup> For electric utilities in Montana and Idaho the annual base period is 1959=100. The 1959 tonnage shipped to electric utilities was 179,000 tons.

<sup>7</sup> For total shipments and electric utilities to New Mexico the annual base period is 1963=100. Total shipments to New Mexico were 1,132,000 tons and for electric utilities 1,085,000 tons.

<sup>8</sup> For electric utilities in Arizona and Nevada the annual base period is 1962=100. The 1962 annual tonnage shipped to electric utilities was 335,000 tons.

<sup>9</sup> Includes shipments to Canadian Great Lakes commercial docks and Canadian railroad companies.

<sup>10</sup> Since tonnages for Mexico were first published in 1960, yearly indexes are based on 1960=100. In thousands of tons, 1960 tons were total 57, all others 57.

<sup>11</sup> Since "Destinations not revealable" were first published during 1960, the calendar year indexes are based on 1960=100. In thousands of tons these figures are as follows: Calendar year 1960 total not revealable 1,380, electric utilities 497, coke and gas plants 374, retail dealers 99, all others 410.

<sup>12</sup> Included in summary at beginning of table in all others.

<sup>13</sup> Included in summary at beginning of table in railroad fuel.

## RELATIVE RATE OF GROWTH OF MINERAL FUELS AND WATERPOWER

Information on the trends in consumption of the various energy fuels and waterpower is presented in the Review of Mineral-Fuel Industries, 1964 Minerals Yearbook, volume 2.

### STOCKS

The figures on stocks are based on complete coverage for all categories except "Other manufacturing and mining industries" and "Retail dealer stocks." Stocks for these two categories are based on samples, and the statistical procedure followed is that for calculating total consumption.

TABLE 70.—Stocks of bituminous coal and lignite in the hands of commercial consumers and in retail dealers' yards in the United States

Date	Total stocks (net tons)	Days' supply at current rate of consumption on date of stocktaking						Retail dealers	Total
		Electric power utilities	Manufacturing and mining industries						
			Oven coke plants	Steel and rolling mills	Cement mills	Other manu- facturing and mining industries			
1963:									
Jan. 31.....	63,804,000	71	38	15	49	39	3	50	
Feb. 28.....	59,473,000	66	36	15	45	36	2	46	
Mar. 31.....	56,959,000	72	31	17	40	38	4	51	
Apr. 30.....	59,764,000	81	30	21	38	44	9	57	
May 31.....	64,551,000	89	33	22	38	47	13	63	
June 30.....	67,638,000	87	36	27	40	52	20	65	
July 31.....	63,318,000	81	31	28	43	54	18	62	
Aug. 31.....	67,002,000	82	36	32	43	55	14	64	
Sept. 30.....	69,388,000	89	37	28	45	53	11	66	
Oct. 31.....	72,708,000	91	39	29	50	48	12	67	
Nov. 30.....	73,383,000	88	40	23	48	46	10	64	
Dec. 31.....	70,083,000	74	39	17	47	40	5	54	
1964:									
Jan. 31.....	66,536,000	71	36	18	55	39	5	52	
Feb. 29.....	64,430,000	70	36	17	47	37	4	51	
Mar. 31.....	63,041,000	73	37	16	40	38	4	54	
Apr. 30.....	65,043,000	81	37	19	40	43	7	59	
May 31.....	68,419,000	89	37	23	41	49	19	65	
June 30.....	70,700,000	82	39	25	40	51	19	64	
July 31.....	65,616,000	77	32	26	39	53	18	60	
Aug. 31.....	67,682,000	80	34	27	39	48	12	61	
Sept. 30.....	71,892,000	85	35	26	41	49	9	63	
Oct. 31.....	75,163,000	89	37	24	43	44	6	62	
Nov. 30.....	77,283,000	88	39	21	45	45	7	63	
Dec. 31.....	75,342,000	77	40	20	42	41	4	56	

## PRICES

TABLE 71.—Average value per ton, f.o.b. mines, of bituminous coal and lignite produced in the United States, by States

State	1963				1964			
	Under-ground	Strip	Auger	Total	Under-ground	Strip	Auger	Total
Alabama.....	\$7.89	\$5.67	\$7.74	\$7.38	\$7.62	\$4.69	\$6.90	\$6.83
Alaska.....		6.93		6.93		6.72		6.72
Arkansas.....	7.17	6.64		6.82	7.30	6.96		7.08
Colorado.....	6.66	3.50		5.93	5.92	3.43		5.38
Georgia.....	3.63			3.63	3.82			3.82
Illinois.....	3.77	3.83		3.80	3.76	3.81		3.79
Indiana.....	4.07	3.67		3.78	4.09	3.71		3.80
Iowa.....	4.22	3.39		3.50	4.09	3.43		3.54
Kansas.....	4.54	4.54		4.54		4.55		4.55
Kentucky.....	4.27	3.14	2.99	3.82	4.19	3.11	2.88	3.75
Maryland.....	4.10	3.51		3.73	4.24	3.83		3.97
Missouri.....	5.41	4.15	3.15	4.16	4.76	4.08		4.08
Montana:								
Bituminous.....	7.64	5.25		7.51	7.57	1.90		7.40
Lignite.....	4.64	1.90		1.95	4.57	1.90		1.95
Total Montana.....	7.36	1.94		2.82	7.22	1.90		2.68
New Mexico.....	6.02	2.29		2.89	8.89	2.37		3.29
North Dakota (lignite).....	4.60	2.19		2.19	4.62	2.14		2.15
Ohio.....	4.28	3.49	3.20	3.70	4.26	3.48	3.23	3.69
Oklahoma.....	11.77	5.28		5.63	7.43	5.30		5.32
Pennsylvania.....	5.62	3.58	3.57	4.90	5.75	3.62	3.80	5.07
South Dakota (lignite).....		3.74		3.74		4.85		4.85
Tennessee.....	3.81	3.60	3.35	3.71	3.98	3.50	3.33	3.79
Utah.....	5.22			5.22	7.03			7.03
Virginia.....	4.12	2.85	2.89	3.96	4.01	2.85	3.21	3.89
Washington.....	7.28	6.62		7.26	8.45			8.45
West Virginia.....	4.90	3.57	3.50	4.79	5.02	3.72	3.75	4.90
Wyoming.....	6.17	3.06		3.18	6.11	3.03		3.15
Total.....	4.82	3.57	3.25	4.39	4.92	3.55	3.35	4.45

**TABLE 72.—Production and average value per ton, f.o.b. mines, of bituminous coal and lignite sold in open market and not sold in open market, 1964, by States**

State	Production				Average value per ton, f.o.b. mines			
	Sold in open market		Not sold in open market		Total (net tons)	Sold in open market	Not sold in open market	Total
	Net tons	Percentage of total	Net tons	Percentage of total				
Alabama	6,553,020	45.4	7,882,434	54.6	14,435,454	\$5.71	\$7.82	\$6.83
Alaska	744,942	100.0			744,942	6.72		6.72
Arkansas	212,315	100.0			212,315	7.08		7.08
Colorado	3,262,155	74.9	1,093,090	25.1	4,355,245	5.04	6.39	5.38
Georgia	3,900	100.0			3,900	3.82		3.82
Illinois	55,022,602	100.0			55,022,602	3.79		3.79
Indiana	15,071,873	99.9	2,758	.1	15,074,631	3.80	4.08	3.80
Iowa	973,214	100.0			973,214	3.54		3.54
Kansas	1,263,409	100.0			1,263,409	4.55		4.55
Kentucky	76,079,363	91.9	6,667,808	8.1	82,747,171	3.55	5.99	3.75
Maryland	1,135,836	100.0			1,135,836	3.97		3.97
Missouri	3,253,430	100.0			3,253,430	4.08		4.08
Montana:								
Bituminous	45,906	100.0			45,906	7.40		7.40
Lignite	299,941	100.0			299,941	1.95		1.95
Total Montana	345,847	100.0			345,847	2.68		2.68
New Mexico	2,593,451	87.3	375,991	12.7	2,969,472	2.40	9.41	3.29
North Dakota (lignite)	2,558,852	97.0	77,899	3.0	2,636,751	2.17	1.40	2.15
Ohio	31,918,655	85.5	5,391,722	14.5	37,310,377	3.78	3.19	3.69
Oklahoma	1,027,996	100.0			1,027,996	5.32		5.32
Pennsylvania	46,701,758	61.0	29,829,000	39.0	76,530,758	4.16	6.50	5.07
South Dakota (lignite)	13,000	100.0			13,000	4.85		4.85
Tennessee	5,942,035	99.2	43,370	.8	5,990,405	3.79	3.53	3.79
Utah	2,310,752	49.0	2,409,091	51.0	4,719,843	4.62	9.34	7.03
Virginia	31,459,520	99.3	213,964	.7	31,653,484	3.89	4.42	3.89
Washington	68,058	100.0			68,058	8.45		8.45
West Virginia	122,313,617	86.5	19,094,881	13.5	141,408,498	4.73	6.03	4.90
Wyoming	1,565,597	50.5	1,535,717	49.5	3,101,314	3.66	2.63	3.15
<b>Total</b>	<b>412,375,227</b>	<b>84.7</b>	<b>74,622,725</b>	<b>15.3</b>	<b>486,997,952</b>	<b>4.11</b>	<b>6.24</b>	<b>4.45</b>

LIGNITE

TABLE 73.—Summary of operations at lignite mines in the United States, 1964, by States <sup>1</sup>

Item	Montana	North Dakota	South Dakota	Total
<b>UNDERGROUND MINES</b>				
Number of mines.....	3	1		4
Shot from solid..... net tons.....	1,379	1,867		3,246
Cut by machines..... do.....	4,480			4,480
Total production.....	5,859	1,867		7,726
Number of cutting machines.....	2			2
Average output per machine..... net tons.....	2,240			2,240
Underground production cut by machine..... percent.....	76.5			76.5
Average value per ton.....	\$4.57	\$4.62		\$4.58
Average number of men working daily.....	13	5		18
Average number of days worked.....	140	75		122
Number of man-days worked.....	1,826	373		2,199
Average tons per man per day.....	3.21	5.01		3.51
<b>STRIP MINES</b>				
Number of strip mines.....	1	28	1	30
Production..... net tons.....	294,082	2,634,884	13,000	2,941,966
Average value per ton.....	\$1.90	\$2.14	\$4.85	\$2.13
Number of shovels and draglines.....	2	46	2	50
Average number of men working daily.....	16	275	8	299
Average number of days worked.....	245	202	163	203
Number of man-days worked.....	3,921	55,426	1,300	60,647
Average tons per man per day.....	75.00	47.54	10.00	48.51
<b>TOTAL, ALL LIGNITE MINES</b>				
Number of mines.....	4	29	1	34
Production (net tons):				
Shipped by rail <sup>2</sup> .....	293,117	2,013,298		2,306,415
Shipped by truck.....	6,819	336,261	12,700	355,780
Used at mines <sup>3</sup> .....	5	287,192	300	287,497
Total.....	299,941	2,636,751	13,000	2,949,692
Average value per ton.....	\$1.95	\$2.15	\$4.85	\$2.14
Average number of men working daily.....	29	280	8	317
Average number of days worked.....	198	199	163	198
Number of man-days worked.....	5,747	55,799	1,300	62,846
Average tons per man per day.....	52.19	47.25	10.00	36.70

<sup>1</sup> Exclusive of Texas (lignite).

<sup>2</sup> Includes coal loaded at mines directly into railroad cars and hauled by trucks to railroad sidings.

<sup>3</sup> Includes coal used at mine for power and heat, made into beehive coke at mine, used by mine employees, used for all other purposes at mine, and transported from mine to point of use by conveyor or tram.

## FOREIGN TRADE

Imports of bituminous coal and lignite are very small. Exports have been an important item of foreign trade for many years, particularly since the close of World War II. See figure 16.

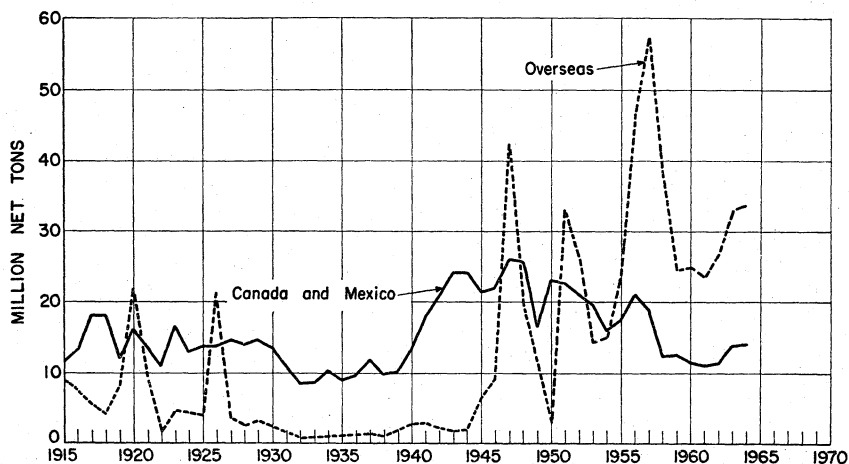


FIGURE 16.—Exports of bituminous coal and lignite from the United States to Canada and Mexico and overseas, 1915-64.

TABLE 74.—Bituminous coal<sup>1</sup> imported for consumption in the United States, by countries and customs districts  
(Net tons)

Country and customs district	1962	1963	1964
<b>Country:</b>			
North America:			
Canada.....	232,417	r 267,315	292,982
Mexico.....			51
Europe:			
Germany, West.....		r 34	
United Kingdom.....		3	
Asia: Japan.....	7		26
Total.....	232,424	r 267,352	293,059
<b>Customs district:</b>			
Alaska.....	20	10	10
Buffalo.....	783	r 51	61
Dakota.....		r 782	212
Duluth and Superior.....	2,214		
Hawaii.....			76
Laredo.....			51
Los Angeles.....		3	
Maine and New Hampshire.....	224,199	r 262,720	276,471
Massachusetts.....	7		
Montana and Idaho.....	5,196	r 3,752	14,112
New Orleans.....		34	
Ohio.....			65
St. Lawrence.....	5		
Washington.....			2,001
Total.....	232,424	r 267,352	293,059

r Revised.

<sup>1</sup> Includes slack, culm, and lignite.

Source: Bureau of the Census.

TABLE 75.—Exports of bituminous coal, by country groups  
(Thousand net tons)

Year	Canada (including New- foundland) and Mexico	Overseas (all other countries)							Total over- seas	Grand total
		West Indies and Central America <sup>1</sup>	Mique- lon, Bermu- da, and Green- land	South Amer- ica	Europe	Asia	Africa	Oceania		
1955-59 (average)	16,232	35	3	1,899	34,310	4,107	178	-----	40,532	56,764
1960	11,696	18	2	2,178	16,936	5,654	57	-----	24,845	36,541
1961	11,223	3	3	1,786	15,275	6,617	63	( <sup>2</sup> )	23,747	34,970
1962	11,461	10	5	2,159	18,284	6,467	27	-----	26,952	38,413
1963	13,809	6	5	1,933	25,218	6,064	43	-----	33,269	47,078
1964	14,237	2	3	2,099	25,096	6,515	17	-----	33,732	47,969

<sup>1</sup> Includes Panama.

<sup>2</sup> Less than 1/4 unit.

Source: Bureau of the Census.



TABLE 76.—Bituminous coal exported from the United States, by countries<sup>1</sup>  
(Net tons)

Country	1961	1962	1963	1964
<b>North America:</b>				
Canada.....	11,169,056	11,409,746	13,762,082	14,183,051
<b>Central America:</b>				
Costa Rica.....	147	50	685	135
Guatemala.....	229	3,208	406	-----
Honduras.....	450	439	255	450
Panama.....	72	123	2,938	62
Other.....	116	183	-----	28
Mexico.....	53,992	51,056	47,036	53,453
Miquelon.....	2,813	4,759	5,004	3,415
<b>West Indies:</b>				
<b>British:</b>				
Bahamas.....	-----	3,042	-----	-----
Bermuda.....	-----	-----	404	-----
Jamaica.....	25	68	-----	30
Trinidad and Tobago.....	466	1,795	444	878
Dominican Republic.....	355	-----	-----	89
French.....	906	623	985	326
Netherlands Antilles.....	-----	521	28	-----
<b>Total.....</b>	<b>11,228,627</b>	<b>11,475,613</b>	<b>13,820,227</b>	<b>14,241,917</b>
<b>South America:</b>				
Argentina.....	576,990	670,727	531,390	765,133
Brazil.....	978,700	1,316,150	1,155,806	1,101,308
Chile.....	177,999	114,126	180,193	183,783
Uruguay.....	33,972	57,779	47,684	47,333
Venezuela.....	16,970	-----	18,151	83
Other.....	1,337	438	-----	1,849
<b>Total.....</b>	<b>1,785,968</b>	<b>2,159,220</b>	<b>1,933,224</b>	<b>2,099,489</b>
<b>Europe:</b>				
Austria.....	322,707	251,949	44,790	30,979
Belgium-Luxembourg.....	904,907	1,083,949	2,107,443	2,184,827
Czechoslovakia.....	39,617	13,761	76,718	-----
Denmark.....	80,022	37,570	43,785	17,505
France.....	643,729	710,080	2,002,294	1,923,835
<b>Germany:</b>				
East.....	-----	-----	-----	267,921
West.....	4,203,520	4,812,249	5,508,144	5,161,464
Greece.....	-----	57,554	70,563	35,181
Ireland.....	195,255	241,011	404,269	325,290
Italy.....	4,728,556	5,837,218	7,611,833	7,859,796
Netherlands.....	2,447,480	3,186,593	4,170,478	3,989,995
Norway.....	50,918	17,453	13,386	93,116
Portugal.....	67,046	125,398	229,095	162,941
Spain.....	227,574	766,095	1,405,748	1,406,607
Sweden.....	820,136	725,715	874,763	990,733
Switzerland.....	70,494	-----	86,995	21,601
Yugoslavia.....	420,444	414,514	404,220	472,224
Other.....	51,970	2,501	103,247	151,850
<b>Total.....</b>	<b>15,274,375</b>	<b>18,283,610</b>	<b>25,217,771</b>	<b>25,095,865</b>
<b>Asia:</b>				
Indonesia.....	1,079	-----	11,107	-----
Japan.....	6,610,166	6,465,395	6,052,859	6,514,724
Other.....	6,200	1,763	336	68
<b>Total.....</b>	<b>6,617,445</b>	<b>6,467,158</b>	<b>6,064,302</b>	<b>6,514,792</b>
<b>Africa:</b>				
Libya.....	45,432	16,408	10,405	51
United Arab Republic (Egypt).....	17,815	11,362	11,233	12,259
Other.....	55	-----	21,273	5,050
<b>Total.....</b>	<b>63,302</b>	<b>27,770</b>	<b>42,911</b>	<b>17,360</b>
<b>Oceania: Australia.....</b>	<b>108</b>	-----	-----	-----
<b>Grand total.....</b>	<b>34,969,825</b>	<b>38,413,371</b>	<b>47,073,435</b>	<b>47,969,423</b>

<sup>1</sup> Amounts stated do not include fuel or bunker coal loaded on vessels engaged in foreign trade, which aggregated 275,017 tons in 1961, 213,161 tons in 1962, 223,142 tons in 1963, and 252,785 tons in 1964.

Source: Bureau of the Census.

**TABLE 77.—Bituminous coal exported from the United States, by customs districts**  
(Net tons)

Customs district	1961	1962	1963	1964
<b>North Atlantic:</b>				
Maine and New Hampshire.....	2,459	3,224	1,934	810
Massachusetts.....		187		
New York.....	5,448	23,300	2,645	155
Philadelphia.....	14,900	41,048	215,845	68,382
Rhode Island.....				2,617
<b>South Atlantic:</b>				
Maryland.....	1,160,824	2,119,628	3,477,457	3,257,925
Virginia.....	22,644,561	24,883,469	29,675,818	30,531,995
<b>Gulf Coast:</b>				
Galveston.....	1,092	316	1,455	3,879
Mobile.....	30,086		127	484
New Orleans.....	1,277	1,151	12,304	767
<b>Mexican border:</b>				
Arizona.....		61	56	
El Paso.....	55,353	49,022	36,303	48,636
Laredo.....	417	1,841	3,215	4,406
<b>Pacific Coast:</b>				
Los Angeles.....				1,260
San Francisco.....	81	30	236	
Washington.....	820	1,186		500
<b>Northern border:</b>				
Buffalo.....	148,542	150,701	160,215	126,300
Chicago.....	33,079	10,821	41,056	16,388
Dakota.....	9,544	7,721	7,101	3,997
Duluth and Superior.....	6,516	22,482	2,510	5,100
Indiana.....	4,822	4,777		
Michigan.....	271,739	259,223	184,224	135,102
Minnesota.....			212	
Montana and Idaho.....	1,921	2,282	2,095	2,310
Ohio.....	9,061,261	9,096,160	10,338,842	11,941,491
Rochester.....	1,207,334	1,493,491	2,758,490	1,607,481
St. Lawrence.....	298,277	240,901	148,613	209,438
Vermont.....	141	235	7,462	
Wisconsin.....	42			
<b>Miscellaneous:</b>				
Alaska.....		84		
Kentucky.....		30		
Connecticut.....			220	
St. Louis.....	9,289			
<b>Total.....</b>	<b>34,969,825</b>	<b>38,413,371</b>	<b>47,078,435</b>	<b>47,969,423</b>

Source: Bureau of the Census.

**TABLE 78.—Shipments of bituminous coal to possessions and other areas administered by the United States**  
(Net tons)

Territory	1962	1963	1964
Guam.....	3	12	89
Puerto Rico.....	2,264	1,979	1,710
Virgin Islands.....	11	18	5

Source: Bureau of the Census.

### WORLD PRODUCTION

The United States supplied 504 million tons of bituminous coal, anthracite, and lignite, or 17 percent of the world output, in 1964.

World coal output increased 4 percent, principally in the United States and Europe.

TABLE 79.—World production of bituminous coal, anthracite, and lignite by countries<sup>1</sup>

(Thousand short tons)

Country	1960	1961	1962	1963	1964 <sup>2</sup>
<b>North America:</b>					
Canada:					
Bituminous.....	8,840	8,189	8,028	8,702	9,325
Lignite.....	2,171	2,209	2,256	1,874	1,994
Greenland: Bituminous.....	31	35	29	44	26
Mexico: Bituminous.....	1,958	2,004	2,087	2,283	2,357
United States:					
Anthracite (Pennsylvania).....	18,817	17,446	16,894	18,267	17,184
Bituminous.....	412,766	399,959	419,094	456,223	484,048
Lignite.....	2,746	3,018	3,055	2,705	2,950
Total.....	447,329	432,860	451,443	490,098	517,884
<b>South America:</b>					
Argentina: Bituminous.....	309	379	315	228	366
Brazil: Bituminous (including lignite).....	2,568	2,635	2,765	2,834	3,578
Chile: Bituminous (mined).....	1,621	1,944	2,045	1,895	1,972
Colombia: Bituminous.....	2,866	3,086	3,307	3,527	3,307
Peru: Bituminous and anthracite.....	179	184	180	144	161
Venezuela: Bituminous.....	39	34	30	46	42
Total.....	7,582	8,262	8,642	8,674	9,426
<b>Europe:</b>					
Albania: Lignite.....	320	319	342	• 331	• 331
Austria:					
Bituminous.....	146	117	109	115	114
Lignite.....	6,584	6,240	6,296	6,672	6,350
Belgium: Bituminous and anthracite.....	24,763	23,739	23,398	23,609	23,485
Bulgaria:					
Bituminous and anthracite.....	628	651	701	725	670
Lignite.....	18,273	19,890	22,669	22,349	26,147
Czechoslovakia:					
Bituminous.....	28,896	28,917	29,927	31,191	31,087
Lignite.....	64,378	71,984	76,594	80,803	83,340
Denmark: Lignite.....	2,545	2,384	2,232	2,204	• 2,094
France:					
Bituminous and anthracite.....	61,692	57,715	57,728	52,649	58,455
Lignite.....	2,512	3,203	3,177	2,724	2,470
Germany:					
Bituminous and anthracite:					
East.....	2,999	2,944	2,838	2,737	• 2,756
West (including Saar).....	157,911	158,309	156,417	156,656	156,750
Lignite:					
East.....	248,532	261,166	272,262	280,428	283,073
West.....	105,974	107,140	111,610	117,569	122,296
Pech coal: West.....	2,021	1,943	1,942	2,029	2,060
Greece: Lignite.....	2,747	2,760	2,971	3,836	4,193
Hungary:					
Bituminous.....	3,138	3,385	3,685	4,091	4,547
Lignite.....	26,098	27,672	27,901	29,404	30,229
Ireland: Bituminous and anthracite.....	229	222	229	230	255
Italy:					
Bituminous and anthracite.....	812	818	763	645	520
Lignite.....	875	1,681	1,958	1,506	1,324
Netherlands:					
Bituminous and anthracite.....	13,777	13,912	12,757	12,686	12,655
Lignite.....	4				
Poland:					
Bituminous.....	115,123	117,513	120,818	124,726	129,360
Lignite.....	10,281	11,396	12,226	16,914	22,355
Portugal:					
Anthracite.....	480	518	446	459	489
Lignite.....	172	174	169	157	112
Rumania:					
Bituminous and anthracite <sup>3</sup> .....	4,939	5,404	5,863	6,234	• 7,301
Lignite.....	4,059	4,190	4,707	5,084	• 4,960
Spain:					
Bituminous and anthracite.....	15,193	15,207	13,994	14,229	13,346
Lignite.....	1,942	2,303	2,743	2,856	2,838
Svalbard (Spitzbergen): Bituminous:					
Controlled by Norway.....	445	407	489	433	488
Controlled by U.S.S.R.....	529	439	405	408	• 661
Sweden: Bituminous.....	277	220	163	110	91
U.S.S.R.: <sup>4</sup>					
Bituminous and anthracite.....	413,284	415,592	425,933	435,555	451,952
Lignite.....	152,406	147,176	144,403	150,565	158,733
United Kingdom: Bituminous and anthracite.....	216,838	213,320	221,129	219,291	216,863

See footnotes at end of table.

TABLE 79.—World production of bituminous coal, anthracite, and lignite by countries<sup>1</sup>—Continued  
(Thousand short tons)

Country	1960	1961	1962	1963	1964 <sup>2</sup>
Yugoslavia:					
Bituminous.....	1,414	1,447	1,310	1,418	1,444
Lignite.....	23,623	25,089	25,910	28,810	31,139
Total <sup>4</sup> .....	1,736,859	1,757,506	1,799,214	1,842,438	1,897,333
Asia:					
Afghanistan: Bituminous.....	51	76	• 74	108	125
Burma: Bituminous.....	1	2	3	• 6	• 9
China: Bituminous, anthracite, and lignite.....	460,000	275,000	275,000	300,000	• 320,000
India:					
Bituminous.....	57,974	61,801	67,649	72,652	68,810
Lignite.....	52	71	233	1,093	1,729
Indonesia: Bituminous.....	725	619	519	651	491
Iran: Bituminous <sup>4</sup> .....	254	220	220	• 220	• 220
Japan:					
Bituminous and anthracite.....	56,292	60,058	59,965	56,810	55,517
Lignite.....	1,552	1,443	1,225	1,007	761
Korea:					
North: Anthracite, bituminous, and lignite.....	11,707	12,996	14,550	15,472	17,081
South: Anthracite.....	5,897	6,486	8,206	9,763	10,604
Malaya: Bituminous.....	8				
Mongolia, Outer: Lignite and bituminous.....	682	826	948	931	• 780
Pakistan: Bituminous and lignite.....	916	1,015	1,097	1,370	1,328
Philippines: Bituminous.....	163	168	180	173	127
Taiwan: Bituminous.....	4,367	4,670	5,020	5,301	5,541
Thailand: Lignite.....	164	119	149	151	114
Turkey (mined):					
Bituminous.....	6,952	7,035	7,156	7,494	7,868
Lignite.....	3,760	4,159	4,668	5,501	6,367
Viet-Nam:					
North: Anthracite.....	2,860	3,099	3,823	3,714	• 4,000
South: Anthracite.....	30	63	78	115	164
Total <sup>4</sup> .....	614,407	439,926	450,763	482,532	501,646
Africa:					
Algeria: Bituminous and anthracite.....	131	86	58	44	39
Congo, Republic of the (Léopoldville): Bituminous.....	180	80	84	101	110
Malagasy, Republic of: Bituminous.....		2		2	( <sup>5</sup> )
Morocco: Anthracite.....	454	452	408	445	441
Mozambique: Bituminous.....	298	354	328	312	270
Nigeria: Bituminous.....	629	669	699	636	770
Rhodesia (formerly Southern): Bituminous.....	3,923	3,387	3,115	3,020	3,355
South Africa, Republic of: Bituminous and anthracite (marketable).....	42,079	43,613	45,498	46,798	49,513
Swaziland: Anthracite and bituminous.....	13	1			( <sup>5</sup> )
Tanzania: Bituminous.....	2	2	3	2	1
Total.....	47,709	48,646	50,193	51,360	54,499
Oceania:					
Australia:					
Bituminous.....	25,277	26,886	27,406	27,832	30,638
Lignite.....	16,763	18,232	19,191	20,666	21,311
New Zealand:					
Bituminous and anthracite.....	3,194	3,101	2,689	2,889	3,046
Lignite.....	180	175	166	181	170
Total.....	45,414	48,394	49,452	51,568	55,170
Lignite (total of items shown above) (estimate).....	699,395	725,019	750,061	786,321	818,165
Bituminous and anthracite (by subtraction).....	2,199,905	2,010,575	2,059,646	2,140,349	2,217,793
World total, all grades (estimate).....	2,899,300	2,735,594	2,809,707	2,926,670	3,035,958

<sup>1</sup> Estimate. <sup>2</sup> Preliminary.

<sup>3</sup> This table incorporates some revisions.

<sup>4</sup> Revised according to the new standard of the United Nations "International Classification of Hard Coals by Type."

<sup>5</sup> Includes a preponderant share of low-grade bituminous.

<sup>6</sup> Output from U.S.S.R. in Asia (including Sakhalin) included with U.S.S.R. in Europe.

<sup>7</sup> Year ended March 20 of year following that stated.

<sup>8</sup> Less than ½ unit.

## ECONOMIC AND TECHNICAL DEVELOPMENTS

For the bituminous coal industry, 1964 was a rewarding year. The increase in coal production for the third consecutive year was brought about by several factors. In addition to the increased demand for coal-generated electrical energy, there were continuing technical achievements in mining, preparation and transportation. The overall confidence of the industry is reflected in the fact that approximately \$800 million was spent for improving and building new mining facilities and equipment, and for operating and maintenance supplies. Thus, the vigor of the industry was further demonstrated by the addition of still more efficient equipment for recovering coal at both underground and surface mines. An example of the better competitive status of coal as an energy source is the fact that coal has made further inroads in market areas, such as Florida, that were once the exclusive domain of other fuels. Industry leaders are devoting considerable effort to finding solutions to the dual problems of air and water pollution. Strip mine operators placed greater emphasis during the year on reclaiming mined surface areas.

In underground mining, two new types of continuous miners were introduced and several improvements were made in existing types of miners. One of the new miners was a two-arm rotary drum machine which can drive 18-foot places in 36- to 58-inch seams. This machine occupies about one-third of the entry width, thus allowing considerable room for ventilation and roof control. The second newly introduced miner has an oscillating ripper designed for use in 50- to 120-inch seams. This miner can cut a 10-foot place in a single downward pass. A crawler-mounted continuous miner was introduced for use in seams as low as 30 inches, which was a needed complement to low coal equipment. With these and other improvements, high production rates become more common than previously. Tonnages produced heretofore on peak shifts became average due to greatly reduced maintenance requirements. Continued success with the remote-control push button miner in Ohio confirms the practicality of this system, as a result of which additional installations may be forthcoming. New face haulage equipment was introduced, which, when used with modern mining machines, holds promise of increasing productivity even further. One of the new haulage systems, called a mobile bridge conveyor, can move more than 450 tons per hour from the face with increased safety for the workers. Battery-powered rubber-tired haulage units gained wider acceptance. These units permit high recovery rates when used in conjunction with newer models of low seam mining equipment.

High interest was shown in longwall mining. Excellent experience in West Virginia, Pennsylvania, and Utah has proved that longwall mining is practical in the United States, at least in some areas. Operators indicate that when longwall methods were used under proper conditions, recovery increased over conventional mining methods, and roof support costs were lower. One mine reported a savings up to 34 cents per ton. Equipment manufacturers offered a wide range of longwall equipment. Successes with this mining technique during the year indicate that additional longwall mining units will be used in the future.

The increasing size of mining equipment requires that higher electrical voltages be made available at the working face. Considerable progress was made toward getting permissible face voltage restrictions revised. The newly developed procedure for using a high-current silicon dioxide for frame grounding gained considerable acceptance. This grounding procedure eliminates the need for the three conductor system, thereby effecting considerable economy. Increasing interest was shown in using diesel-powered shuttle cars where no trailing cables are required. The successful application of diesel cars in eastern Kentucky, where maintenance supply costs were reported much lower than for electric cars, may be indicative of a trend to widespread use of diesel cars in coal mines.

The initial progress made with using computers to evaluate mining operations made the industry aware of the potential importance of this technique. This work was started in 1962 by Virginia Polytechnic Institute under contract with the Office of Coal Research. A mine in Alabama used the computer program developed by V.P.I. Very favorable results were obtained. Probably as a result of this program, several mine operators are using time and motion studies to gain information regarding face and haulage cycles. This development, while slow in coming, should contribute greatly to increased productivity and lower costs.

In surface mining, as in the past several years, the emphasis was on larger and more efficient earth moving equipment. Active shovel capacity reached a new high when a 140 cubic yard shovel went into operation in southern Illinois. This machine's power requirements are equal to that of an average town of 15,000 inhabitants, and is capable of moving 210 tons of overburden in 45 to 55 seconds. This record will be short lived, however. A 200 cubic yard shovel which has been under construction for more than a year is expected to go into operation in the near future. A second 85 cubic yard dragline began moving overburden. A 3,500 hp. wheel-excavator capable of handling 2,800 cubic yards of overburden per hour is nearly completed and is scheduled to start uncovering lignite in North Dakota. This excavating wheel will be the largest in the lignite fields of the United States. A self-propelled stacker capable of moving 350 cubic yards per hour to a point nearly 100 feet away and 35 feet high went into operation. This stacker has performed at rates as high as 475 cubic yards per hour.

In addition to the large earth-moving equipment, economies in surface mining also have been achieved by less spectacular means. A specially designed 5 cubic yard, fast cycle, shovel went into operation. This shovel, designed to remove partings in a multiple-bedded stripping area, compares favorably in performance with large draglines, yet has a much lower initial cost. Larger sized rotary drills were employed to prepare holes for explosives used to loosen the overburden for the large earth-moving equipment. The larger drill holes permit a greater explosive charge to be used, which in turn permits more overburden to be loosened with each charge. Trucks used to haul coal from surface mines have been getting larger; 120-ton capacity trucks already have been accepted. A new coal-hauling truck with a capacity of 240 tons has been designed and construction is nearly completed. This truck has dual controls so that it may be driven from either end. In spite of its great length, 96 feet, it has a turning

radius of approximately 42 feet. In addition to land reclamation projects, strip mine operators sought to improve public relations by reducing noise and vibrations near populated areas. Major reclamation efforts were devoted to reforestation and planning recreational facilities.

Chief developments in coal preparation were the introduction of better designed equipment with superior performance and greater economy. Automation achieves better quality control with less manpower and at a lower overall cost. There was increased use of froth flotation and thermal drying equipment, the chief purpose being for water clarification as well as coal recovery.

The revolution in coal transportation is well under way. In overland transportation there was a significant extension of the unit train concept. It is estimated that approximately 100 million tons of coal were moved by unit trains in 1964. The trend to the use of larger hopper cars in unit trains continued. One company is reported to have requested that a 240-ton capacity, all aluminum hopper car be designed and tested. A new 4,320 hp. diesel-powered towboat is being designed for hauling coal barges on the Mississippi River. Just south of New Orleans, a river-to-ocean shipping transfer station is under construction. This transfer station will be used primarily as an aid in getting midwestern coal to Florida markets. In connection with this, the longest dry cargo barge ever built made its maiden voyage, hauling 17,000 tons of midwestern coal from the new transfer station to Tampa, Fla., for use in an electric utility plant. The barge returned to New Orleans laden with phosphate rock. This closed-circuit operation lowers the delivered cost of both the coal and phosphate rock. In ocean transportation the use of supercolliers is increasing. One supercollier bound for Japan, loaded at Hampton Roads, Va., with 56,200 tons of high-grade metallurgical coal, set a new record for coal tonnage. The multimillion dollar port facilities at Hampton Roads, Va., had an outstanding year of operation. During 1964, approximately 26 million tons of coal flowed through these facilities. Of this amount, nearly 21 million tons were destined for overseas ports. France announced late in the year that she would construct a large supercollier capable of hauling more than 80,000 tons of coal. Other coal importing nations have expressed an interest in supercolliers of this class. Thus there is reason to believe that the trend to larger supercolliers will continue. The net result of the technical improvements in both overland and ocean transportation was that transportation rates were lowered considerably. With the use of unit trains and long-term coal contracts, freight rates were lowered by as much as \$1.75 to \$2 per ton in some instances. Large supercolliers plying the trade routes loaded with coal have caused ocean freight rates to be lowered by as much as \$2 a ton on coal going to Japan and \$1 a ton on coal going to Europe.

Electric utilities have become coal's biggest market. Twenty-four steam electric generating units presently under construction or scheduled for service by the end of 1968 will burn coal. Many of these units will be mine-mouth generating facilities. Extra high-voltage networks are planned as an integral part of some of the generating stations now under construction. Meanwhile, electric rate reductions

were put into effect as a result of the savings brought about by the lower delivered price of coal.

Strong research programs carried out by the coal industry as well as by Federal and State governments were responsible for several significant developments. Three processes were developed for removing  $\text{SO}_2$  from stack gases. One of these processes recovers elemental sulfur, whereas the other two convert the  $\text{SO}_2$  to sulfuric acid. A moisture meter was developed which provides continuous measurement of the moisture content of coal. This may prove quite useful in automatically controlled preparation plants. Coal-burning gas turbines were one step closer to reality after a testing program indicated that specially designed rotor and stator blades resisted erosion considerably better than the blades formerly used. An experimental blast furnace was put into operation designed for the highest pressures used for iron making in this country. This furnace will help determine the value of coal as an auxiliary fuel in blast furnaces. The use of coal as a water purifier either before or after it is burned was found promising. A durable, lightweight brick was made from a mixture of fly ash, sand, and sodium silicate which is not only attractive but can be produced economically. The bricks produced met or surpassed A.S.T.M. standards established for clay bricks. As the result of a research contract, the first packaged boiler went into operation. Several more of these units are expected to be in service shortly. A one cylinder diesel engine running on pulverized coal was demonstrated. The engine was first started on oil, then powdered coal was introduced and the oil flow was stopped. The engine continued to run on pulverized coal. A direct titration method of determining the sulfur content of coal was developed which results in a savings of analysis time and labor.





# Coal—Pennsylvania Anthracite

By J. A. Vaughan<sup>1</sup> and Mariam I. Cooke<sup>2</sup>



## Contents

	<i>Page</i>		<i>Page</i>
General summary.....	163	Distribution.....	195
Scope of report.....	169	Consumption.....	199
Acknowledgments.....	170	Stocks.....	200
Production, mining methods, and equipment.....	170	Foreign trade.....	201
Prices and value of sales.....	188	World production.....	203
Employment.....	193	Technology.....	203

## GENERAL SUMMARY

**P**RODUCTION of Pennsylvania anthracite totaled 17.2 million short, or net, tons in 1964, a decrease of 6 percent from 1963. Of this total, 34 percent was produced at underground mines, 42 percent at strip pits, 20 percent from culm and silt banks, and 4 percent from river dredging. When compared with tonnages produced in 1963, underground production declined 12 percent, strip pits 4 percent, dredging operations increased 2 percent, and culm and silt banks remained about the same—increasing less than 1 percent.

Total value of the 1964 output was \$148.6 million, 3 percent less than in 1963. Production of pea and larger sizes declined 10 percent from 1963 and the buckwheat No. 1 and smaller category, 3 percent. Although the pea and larger sizes amounted to only 39 percent of the year's output (41 percent in 1963), they accounted for relatively more of the industry's total revenue than in 1963 because of the higher prices received. The average value for pea and larger was \$12.38 per net ton f.o.b. preparation plant, a gain of \$0.73, or 6 percent, while the average for the buckwheats was \$6.34, a gain of \$0.09 per ton, or 1 percent. Except for the "Other" category, each size commanded higher prices. As a result, the average value for all sizes increased to \$8.70—\$0.25 more than in 1963.

Apparent consumption of anthracite in the United States during 1964 was estimated at 14.4 million tons, a gain of 2 percent. Although use data are incomplete for anthracite, the slight increase in apparent consumption indicated an increased demand for the smaller industrial sizes.

<sup>1</sup> Mineral specialist (coal).  
<sup>2</sup> Statistical officer.

Exports of anthracite totaled 1.6 million tons, a decrease of 53 percent from the 3.6 million tons shipped to foreign countries in 1963. The greater part of the decrease was attributable to the trade with Western Europe, which dropped 66 percent. However, a more accurate measurement of the importance of exports to the industry can be obtained by adding the quantity shipped for use by the U.S. Armed Forces in West Germany to the tonnage reported by the Bureau of the Census. This computation indicates that approximately 2,736,000 tons were actually exported, or about 16 percent of the total 1964 production.

Although production declined 6 percent, the average number of men working daily at anthracite operations in 1964 fell only 3 percent to a total of 13,144. Anthracite operations were active on an average of 214 days, a decrease of 2 days from 1963. However, owing to the reduction in the number of days worked and men working, actual worktime declined to 2,812,000 man-days, or 3 percent below 1963. The productivity rate also declined—from 6.27 tons per man-day in 1963 to 6.11 tons in 1964.

A new wage contract between the producing companies and the United Mine Workers of America became effective September 1, 1964. The package agreement included wage increases, a larger payment for lunch periods, a \$25 increase in vacation pay (to a total of \$185), and three paid holidays: May 30 (Memorial Day), Thanksgiving Day, and Christmas. April 1 (8-hour day) also will be an idle day. A new seniority clause and other provisions affecting mine safety and the Anthracite Health and Welfare Fund were also embodied in the new agreement.

The overall injury rate in the industry increased to 67.07 per million man-hours, compared with 63.05 in 1963. A total of 24 men lost their lives at anthracite operations (32 in 1963), at a frequency rate of 1.18 per million man-hours (1.52 in 1963). Nonfatal injuries totaled 1,342 during the year, compared with 1,295 in 1963; the rate increased from 61.53 in 1963 to 67.07 in 1964.

Table 1 includes salient annual statistics for 1960-64; monthly developments in the industry in 1964 are shown in table 2. Table 3 shows selected historical data for 1930-64.

TABLE 1.—Salient statistics of the Pennsylvania anthracite industry, 1960-64

	1960	1961	1962	1963	1964
<b>Production:</b>					
Preparation plants.....net tons..	18,003,730	16,655,847	16,015,366	17,415,365	16,335,700
Dredges.....do.....	711,713	745,498	726,666	691,370	704,748
Used at collieries for power and heat.....net tons..	101,998	45,094	151,614	160,649	143,803
Total production.....do.....	18,817,441	17,446,439	16,893,646	18,267,384	17,184,251
Value of production.....	\$147,116,250	\$140,337,541	\$134,093,374	\$153,503,442	\$148,647,575
Average sales realization per net ton on preparation plant shipments (excludes dredge coal)					
Pea and larger.....	\$10.42	\$10.80	\$10.90	\$11.65	\$12.38
Buckwheat No. 1 and smaller.....	\$6.27	\$6.32	\$6.14	\$6.43	\$6.56
All sizes.....	\$8.01	\$8.26	\$7.99	\$8.64	\$8.93
Percentage of total preparation plant shipments (excludes dredge coal)					
Pea and larger.....	42.0	43.4	43.1	42.4	40.8
Buckwheat No. 1 and smaller.....	58.0	56.6	56.9	57.6	59.2
Producers' stocks at end of year <sup>1</sup>					
net tons..	199,356	232,520	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
Exports <sup>3</sup> .....do.....	1,440,400	1,435,335	1,801,724	* 3,357,340	1,575,097
Imports <sup>3</sup> .....do.....	1,476	792	7,583	* 4,625	NA
Consumption (apparent).....do.....	17,600,000	15,900,000	14,300,000	* 14,100,000	14,400,000
Average number of days worked.....	176	196	204	216	214
Average number of men working daily.....	19,051	15,792	14,010	13,498	13,144
Output per man per day.....net tons..	5.60	5.63	5.92	6.27	6.11
Output per man per year.....do.....	986	1,103	1,208	1,354	1,308
Quantity cut by machines.....do.....	225,520	236,166	277,537	240,427	417,080
Quantity mined by stripping.....do.....	7,112,288	7,246,646	6,822,207	7,467,842	7,177,188
Quantity loaded by machines underground.....net tons..	4,044,392	3,377,778	3,065,364	3,665,962	3,455,034
<b>Distribution:</b>					
Receipts in New England <sup>5</sup> .....do.....	697,353	634,435	495,390	422,012	331,780
Exports to Canada <sup>6</sup> .....do.....	1,204,414	965,576	892,488	794,535	636,867
Loaded into vessels at Lake Erie <sup>6</sup>					
net tons..	244,468	221,435	196,440	191,609	216,590
Receipts at Duluth-Superior <sup>7</sup>					
do.....	65,713	33,474	26,516	* 32,615	47,649

\* Revised. NA Not available.

<sup>1</sup> Anthracite Committee.

<sup>2</sup> This series discontinued.

<sup>3</sup> U.S. Department of Commerce, 1961-64 export data does not include shipments to U.S. military forces. See NOTE, tables 2 and 34.

<sup>4</sup> Import data discontinued with August 1963.

<sup>5</sup> Commonwealth of Massachusetts, Division on the Necessaries of Life.

<sup>6</sup> Ore and Coal Exchange, Cleveland, Ohio.

<sup>7</sup> Lake Superior Area Office, Corps of Engineers, U.S. Army, Duluth, Minn.

TABLE 2.—Statistical summary of monthly developments

(Net tons, except as

	January	February	March	April	May	June
Production (including mine fuel, local sales, and dredge coal).....	1,668,000	1,520,000	1,211,000	1,454,000	1,636,000	1,816,000
Shipments (breakers and washeries only, all sizes):						
By rail <sup>1</sup> .....	717,743	652,738	527,701	673,088	778,745	919,424
By truck <sup>2</sup> .....	873,834	785,719	627,555	656,380	599,853	624,000
Carloadings <sup>3</sup> .....	14,048	12,254	11,084	13,226	14,891	17,442
Distribution:						
Lake Erie loadings <sup>4</sup> .....				19,904	18,969	19,229
Lake Ontario loadings <sup>4</sup> .....						4,365
Receipts at Duluth-Superior <sup>5</sup> .....					2,527	10,007
Upper Lake dock trade: <sup>6</sup>						
Receipts:						
Lake Superior.....					142	5,079
Lake Michigan.....	655	516	816	5,605	2,179	489
Deliveries (reloadings):						
Lake Superior.....	2,375	1,379	198	124	243	4,935
Lake Michigan.....	2,039	1,337	967	634	587	903
New England receipts: By						
rail <sup>7</sup> .....	32,030	31,553	14,531	18,549	39,540	47,910
Exports <sup>8</sup> .....	247,735	148,716	86,001	84,332	151,043	170,608
Imports <sup>9</sup> .....	NA	NA	NA	NA	NA	NA
Industrial consumption and stocks by:						
Electric utilities: <sup>11</sup>						
Consumption.....	182,991	182,831	173,803	187,092	195,660	186,092
Stocks.....	1,271,503	1,205,142	1,182,893	1,200,791	1,180,782	1,176,057
Coke plants:						
Used for carbonizing.....	42,389	39,080	42,236	41,297	41,309	39,587
Stocks.....	82,485	67,204	42,178	36,583	42,782	58,768
Stocks on Upper Lake docks: <sup>6</sup>						
Lake Superior.....	4,211	2,764	2,568	2,540	2,283	2,254
Lake Michigan.....	6,654	5,818	5,667	9,916	11,508	11,094
Stocks in retail dealer yards: <sup>12</sup>						
Chestnut and larger.....	237,000	222,000	192,000	259,000	336,000	396,000
Pea.....	36,000	32,000	24,000	31,000	35,000	44,000
Buckwheat No. 1 and rice.....	176,000	153,000	119,000	130,000	173,000	245,000
Total.....	449,000	407,000	335,000	420,000	544,000	685,000
Retail dealer deliveries: <sup>12</sup>						
Chestnut and larger.....	247,000	214,000	148,000	92,000	73,000	103,000
Pea.....	65,000	60,000	44,000	35,000	27,000	28,000
Buckwheat No. 1 and rice.....	139,000	110,000	93,000	68,000	68,000	109,000
Total.....	451,000	384,000	285,000	195,000	168,000	240,000
Wholesale price indexes (1957-59=100): <sup>13</sup> F.o.b. mines:						
Chestnut.....	100.9	100.9	100.9	91.9	91.9	91.9
Pea.....	101.3	101.3	101.3	93.2	93.2	93.2
Buckwheat No. 1.....	100.0	100.0	100.0	91.1	91.1	91.1
Buckwheat No. 3.....	108.9	108.9	108.9	104.8	104.8	104.8

\* Revised. NA Not available.

<sup>1</sup> Furnished by the initial carriers.<sup>2</sup> Pennsylvania Department of Mines and Mineral Industries.<sup>3</sup> Association of American Railroads.<sup>4</sup> Ore and Coal Exchange, Cleveland, Ohio.<sup>5</sup> Lake Superior Area Office, Corps of Engineers, U.S. Army, Duluth, Minn.<sup>6</sup> Data supplied by Upper Lake Docks Coal Bureau, Inc., and direct reports to the Bureau of Mines.

NOTE.—According to the Association of American Railroads, 2,005,763 net tons of anthracite was exported West Germany, and 396,710 to Netherlands, including shipments for the use of U.S. military forces in West period in 1963.

in the Pennsylvania anthracite industry in 1964

otherwise indicated)

July	August	September	October	November	December	Year 1964	Change from 1963 (percent)	Year 1963
1,182,000	1,306,000	1,300,000	1,337,000	1,340,000	1,414,000	17,184,000	-5.9	18,267,000
636,453	841,875	756,673	743,534	659,923	616,856	8,524,753	-19.6	10,599,400
446,671	591,221	631,814	627,051	587,023	810,736	7,861,857	-1.4	7,970,106
13,682	16,141	14,685	13,811	12,666	12,141	166,021	-17.2	200,540
28,661	18,204	28,752	42,217	40,654	-----	216,590	+13.0	191,609
2,524	784	-----	-----	-----	-----	5,149	-79.0	24,480
-----	2,448	10,086	17,500	2,557	-----	47,649	+46.1	32,615
2,524	2,448	2,471	4,643	7,289	-----	24,596	+32.2	18,605
110	1,102	466	289	450	414	13,091	-38.7	21,360
2,365	2,423	2,544	5,967	5,028	2,121	29,700	+21.5	24,446
1,143	1,199	1,034	1,679	1,299	1,538	14,359	-37.0	22,792
26,222	21,867	23,710	26,787	24,099	24,982	331,780	-21.4	422,012
157,859	141,705	127,955	120,433	77,793	60,867	1,575,097	-53.1	3,357,340
NA	NA	NA	NA	NA	NA	NA	NA	10 4,625
201,429	193,236	194,159	186,771	165,446	189,809	2,239,319	+4.7	2,139,286
1,155,752	1,193,441	1,234,194	1,278,347	1,289,658	1,247,238	1,247,238	-3.6	1,294,129
42,799	35,351	41,551	43,351	41,685	41,683	492,318	+9.3	450,509
60,035	67,531	82,882	103,198	132,546	129,342	129,342	+13.8	113,620
2,372	2,397	2,399	1,084	3,253	1,132	1,132	-82.8	6,586
10,061	9,964	9,396	8,006	7,157	6,033	6,033	-23.7	7,911
407,000	408,000	395,000	360,000	338,000	306,000	306,000	+8.1	283,000
47,000	46,000	45,000	42,000	39,000	37,000	37,000	-7.5	40,000
232,000	254,000	265,000	262,000	260,000	243,000	243,000	+14.1	213,000
686,000	708,000	705,000	664,000	637,000	586,000	586,000	+9.3	536,000
100,000	121,000	147,000	213,000	165,000	231,000	1,854,000	-11.2	2,088,000
16,000	19,000	22,000	34,000	26,000	45,000	421,000	-21.7	538,000
126,000	77,000	56,000	59,000	56,000	98,000	1,059,000	-25.9	1,429,000
242,000	217,000	225,000	306,000	247,000	374,000	3,334,000	-17.8	4,055,000
95.4	95.4	95.4	98.9	98.9	98.9	96.8	+4.1	93.0
97.5	97.5	97.5	99.7	99.7	99.7	97.9	+2.7	95.3
92.9	92.9	92.9	95.2	95.2	95.2	94.8	+1.6	94.3
107.6	107.6	107.6	109.4	109.4	109.4	107.7	+1.1	107.6

<sup>7</sup> Furnished by Commonwealth of Massachusetts, Division on the Necessaries of Life.  
<sup>8</sup> U.S. Department of Commerce. Export data does not include shipments to U.S. military forces.  
<sup>9</sup> U.S. Department of Commerce. Beginning with the month of September, 1963 anthracite import data are included with bituminous coal.  
<sup>10</sup> January-August total.  
<sup>11</sup> Federal Power Commission.  
<sup>12</sup> Estimated from reports submitted by a selected list of retail dealers located outside the producing region.  
<sup>13</sup> Bureau of Labor Statistics. Based on data obtained from authorized trade publications.

to Europe during 1964 compared with 3,210,156 tons for 1963. Of this total, 965,479 tons was consigned to Germany. This compares with 860,800 tons to West Germany and 847,598 tons to Netherlands for the same

TABLE 3.—Trends in the Pennsylvania anthracite industry

	Production (net tons)	Value of production	Average value per net ton	Exports <sup>1</sup> (net tons)	Imports <sup>1</sup> (net tons)	Apparent consumption <sup>2</sup> (net tons)	Average number of em- ployees	Average number of days worked	Average tons per man per day	Average tons per man per year	Quantity cut by machines (net tons)	Quantity produced by strip- ping (net tons)	Quantity loaded me- chanically under- ground (net tons)
1930.....	69,384,837	\$354,574,191	\$5.11	2,551,659	674,812	67,628,000	150,804	208	2.21	460	1,410,123	2,536,288	4,467,750
1931.....	59,645,657	296,354,586	4.97	1,778,308	637,951	58,408,000	139,431	181	2.37	428	1,587,265	3,813,237	4,384,780
1932.....	49,855,221	222,375,129	4.46	1,303,355	607,097	50,500,000	121,243	162	2.54	411	1,674,223	3,980,973	5,433,340
1933.....	49,541,344	206,718,405	4.17	1,034,562	456,252	49,600,000	104,633	182	2.60	473	1,645,249	4,932,069	6,557,207
1934.....	57,168,291	244,152,245	4.27	1,297,610	478,118	55,500,000	109,050	207	2.53	524	1,981,088	5,798,138	9,284,486
1935.....	52,158,783	210,130,565	4.03	1,608,549	571,439	51,100,000	103,269	189	2.68	505	1,848,095	5,187,072	9,279,057
1936.....	54,579,535	227,003,538	4.16	1,678,024	614,639	53,200,000	102,081	192	2.79	535	2,162,744	6,203,267	10,883,837
1937.....	51,856,433	197,598,849	3.81	1,914,173	395,737	50,400,000	99,085	189	2.77	528	1,984,512	5,696,018	10,151,699
1938.....	46,099,027	180,600,167	3.92	1,905,911	362,895	45,200,000	96,417	171	2.79	478	1,588,407	5,095,341	11,773,833
1939.....	51,487,377	187,175,324	3.64	2,590,000	298,153	49,700,000	93,138	183	3.02	553	1,831,834	5,486,479	11,328,000
1940.....	51,484,640	205,489,814	3.99	2,667,632	135,436	49,000,000	91,313	186	3.04	592	1,816,483	6,352,700	13,441,987
1941.....	56,368,267	240,275,126	4.26	3,380,189	74,669	52,700,000	88,054	203	4.29	617	1,855,422	7,316,574	14,741,459
1942.....	60,327,729	271,673,380	4.50	4,438,588	140,115	56,500,000	82,121	239	4.78	751	1,624,883	8,989,387	14,745,793
1943.....	60,643,620	306,816,018	5.06	4,138,680	166,020	57,100,000	79,153	270	4.78	815	1,336,082	10,953,030	14,975,146
1944.....	63,701,363	354,582,884	5.57	4,185,933	11,847	59,400,000	77,591	292	4.79	815	1,210,171	10,056,325	13,927,955
1945.....	54,933,909	323,944,435	5.90	3,691,247	149	51,600,000	72,842	269	4.79	770	1,232,828	12,858,930	15,619,162
1946.....	60,506,873	413,417,070	6.83	6,497,245	9,556	53,900,000	78,145	271	4.84	720	1,209,983	12,603,545	16,054,011
1947.....	57,190,009	413,019,486	7.22	8,509,995	10,350	48,200,000	78,600	259	4.78	745	1,016,757	13,352,874	15,742,368
1948.....	57,139,948	467,051,800	8.17	6,675,914	945	50,200,000	76,215	195	4.87	560	557,599	10,376,808	11,858,588
1949.....	42,701,724	358,008,451	8.38	4,942,670	-----	37,700,000	75,377	211	4.83	497	611,734	11,833,934	12,335,050
1950.....	44,076,703	392,398,006	8.90	3,891,669	18,289	39,900,000	78,624	208	2.97	618	496,085	11,135,990	10,847,787
1951.....	42,669,997	405,817,963	9.51	5,955,635	26,812	37,000,000	68,995	208	3.06	615	386,128	10,696,705	10,834,464
1952.....	40,582,558	379,714,076	9.36	4,692,060	29,370	35,300,000	65,923	201	3.28	535	318,699	8,606,482	6,838,769
1953.....	30,949,152	299,139,687	9.67	2,724,270	31,443	28,000,000	57,862	163	4.02	659	381,424	7,939,680	6,978,035
1954.....	29,083,477	247,870,023	8.52	2,851,239	5,531	26,900,000	43,996	164	3.96	780	393,932	7,703,907	6,660,939
1955.....	26,204,554	206,096,662	7.86	3,152,813	170	23,600,000	33,523	197	4.25	918	400,402	8,354,280	7,308,110
1956.....	28,900,220	236,785,062	8.19	5,244,949	46	24,000,000	30,525	196	4.18	819	292,307	7,543,157	6,657,479
1957.....	25,338,321	227,753,802	8.99	4,531,785	1,138	20,800,000	26,540	183	4.36	798	184,028	6,877,761	5,332,043
1958.....	21,171,142	187,898,316	8.88	2,279,559	4,363	19,000,000	26,540	173	5.12	886	260,502	7,096,343	4,700,542
1959.....	20,649,286	172,319,913	8.35	1,787,558	2,693	18,800,000	23,294	176	5.12	896	255,520	7,112,288	4,044,592
1960.....	18,817,441	147,116,250	7.82	1,440,400	1,476	17,600,000	19,051	176	5.63	926	260,502	7,246,646	3,877,778
1961.....	17,446,439	140,337,541	8.04	1,435,335	792	15,900,000	15,792	196	5.92	1,208	277,537	6,822,207	3,665,364
1962.....	16,893,646	134,093,874	7.94	1,501,724	7,583	15,000,000	14,010	204	6.27	1,354	240,427	7,467,842	3,665,962
1963.....	18,267,384	153,503,442	8.40	3,357,340	4,625	14,100,000	13,498	216	6.11	1,308	417,080	7,177,188	3,455,034
1964.....	17,184,251	148,647,575	8.65	1,575,097	NA	14,400,000	13,144	214					

\* Estimated. \* Revised. NA Not available.

<sup>1</sup> U.S. Department of Commerce. Export data for 1961-64 does not include shipments to U.S. military forces. See NOTE, tables 2 and 34.

<sup>2</sup> After 1961 the figures of consumption take no account of producers' stocks, there being no data available for this item.

<sup>3</sup> Includes some bootleg coal purchased by authorized operators and prepared at their breakers.

<sup>4</sup> Output per man calculated on authorized tonnages only; bootleg purchases excluded.

\* Figures for 1951 and subsequent years are not strictly comparable with previous years. See Production and Employment sections, Coal—Pennsylvania Anthracite, Minerals

Yearbook, 1951.

\* For period January–August. Beginning with September, anthracite import data is included with bituminous.

## SCOPE OF REPORT

Data in this chapter refer only to anthracite, or hard coal, produced in the northeastern part of the Commonwealth of Pennsylvania. Production of anthracite, or semianthracitic coals of Arkansas, Colorado, New Mexico, Virginia, and Washington is included with bituminous coal and lignite in the Bituminous Coal and Lignite chapter of the Bureau of Mines Minerals Yearbook. The anthracite producing region is divided geologically into four fields: The Northern, Eastern Middle, Western Middle, and Southern. The area is also grouped by coaltrade usage into three regions: The Wyoming, which is coextensive with the Northern field; the Lehigh, which includes the Eastern Middle field and that portion of the Southern lying east of Tamaqua; and the Schuylkill, which encompasses all of the Western Middle field and that part of the Southern field west of Tamaqua.

Bureau statistics on production, value, and transportation methods are compiled almost entirely from reports submitted voluntarily by operators of preparation plants and dredges. Estimates are prepared on unreported tonnage from data published by the Pennsylvania Department of Mines and Mineral Industries and other sources. Questionnaires are also sent to operators of underground mines not equipped with preparation facilities and to contractors engaged either in strip mining or in reclaiming culm and silt banks. From these reports information is obtained on run-of-mine production, names of plants to which the raw coal is shipped for preparation, types of mining equipment used, and the counties, fields, and regions in which the run-of-mine production originated. These reports are used also to eliminate duplicate reporting and to obtain the widest possible coverage.

Beginning with calendar year 1961, Bureau production data have been presented by carrier method (rail and truck), rather than as shipments to points inside (local sales) and outside the producing region. Also, since 1956, statistics on employment in the Pennsylvania anthracite industry have been compiled from the Bureau of Mines questionnaire, Mine Injuries and Employment-Pennsylvania Anthracite, to lessen the reporting burden of respondents. Bureau employment data include production, development, maintenance, supervisory, shop, and technical personnel, plus partners or firm members who perform duties directly related to coal production. Sales and office workers and others not connected with production are excluded.

Summarized distribution data appearing in table 28 are collected by the Bureau from producers, wholesalers, and dock operators by coal year (April 1–March 31) rather than calendar year because the former conforms more closely to the actual heating season. The complete report presents detailed information on shipments by sizes and method of movement to selected markets in the United States and Canada. Copies may be obtained by writing to the Bureau of Mines, U.S. Department of the Interior, Washington, D.C., 20240, or to the Publications Distribution Section, 4800 Forbes Avenue, Pittsburgh, Pa., 15213.



## ACKNOWLEDGMENTS

Because Bureau of Mines canvasses of the Pennsylvania anthracite industry are restricted to such subjects as production by sizes, carrier method, employment, f.o.b. preparation-plant value, injuries, mining equipment, distribution, sources of production, and retail-dealer stocks and deliveries, the authors have made free use of relevant data from numerous sources. Although care has been taken to acknowledge each individual source by footnote reference, the Bureau would like to express its thanks to the Pennsylvania Department of Mines and Mineral Industries, the Association of American Railroads, Commonwealth of Massachusetts, Upper Lake Docks Coal Bureau, Inc., the Ore and Coal Exchange, and the Anthracite Institute for their continued cooperation. However, as it would have been patently impossible to prepare this chapter without cooperation from the industry, the Bureau also extends its sincere appreciation to hundreds of producers who voluntarily submitted annual reports on their operations.

## PRODUCTION, MINING METHODS, AND EQUIPMENT

Production of Pennsylvania anthracite totaled 17.2 million short tons in 1964, a decrease of 1.1 million tons, or 6 percent, from that of 1963. Despite this decrease, production from culm and silt banks showed a minor gain (less than 1 percent), and the quantity of coal recovered from rivers and their tributaries increased 2 percent. Thus, all of the decrease was attributable to production from underground mines and strip pits. Underground production dropped to 34 percent of total production, compared with 37 percent in 1963; strip pits accounted for 42 percent (41 percent in 1963); culm banks, 20 percent (18 percent in 1963); and river coal 4 percent (the same as in 1963).

Each of the three producing regions showed losses in 1964. In the Lehigh region, total production was 13 percent below that of 1963, with decreases of 16 percent in production from underground mines, 4 percent at strip pits, and 28 percent from culm banks. In the Schuylkill region, where production was more stable (decreasing only 0.2 percent from 1963), the loss of 14 percent at underground operations was about offset by gains in production of 2, 9, and 14 percent

for dredges, strip pits, and culm and silt banks, respectively. The Wyoming region recorded a gain of 27 percent in output from culm and silt banks, but had losses of 10 and 22 percent, respectively, in production from underground mines and stripping operations. The Schuylkill region contributed 51 percent of the total production, an increase of 3 percentage points over 1963; the Wyoming production dropped 2 points from 32 to 30 percent; and the output from the Lehigh dropped from 20 to 19 percent.

Northumberland County was the only major anthracite producing county to show an increase in production (6 percent). Output decreased 11 percent in Luzerne County, 11 percent in Schuylkill County, and 4 percent in Lackawanna County. Production data by counties, regions, and fields are shown in tables 4, 7, 8, and 9. Figure 1 shows trends in anthracite shipments, by regions, for 1940-64.

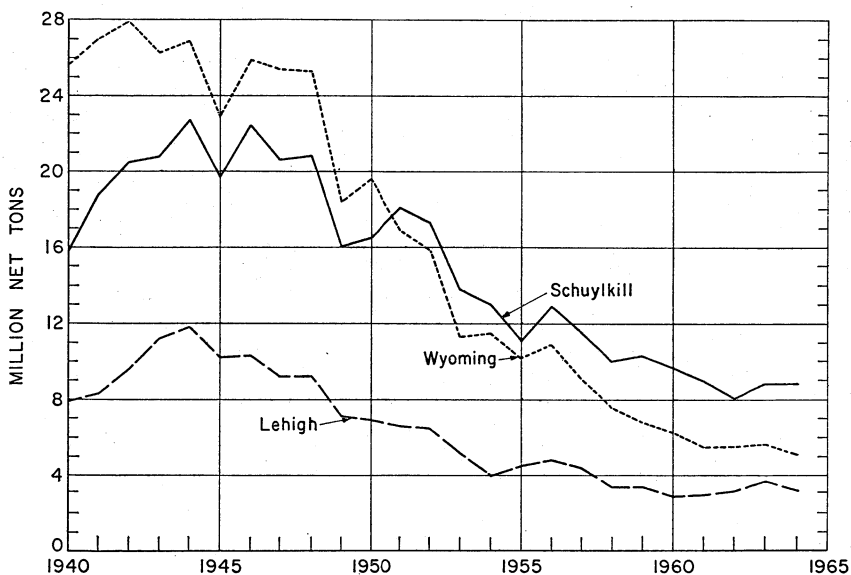


FIGURE 1.—Pennsylvania anthracite shipped from the Lehigh, Schuylkill, and Wyoming regions, 1940-64.

TABLE 4.—Commercial production of Pennsylvania anthracite in 1964, by regions and sizes

Size	From preparation plants								
	Lehigh region			Schuylkill region			Wyoming region <sup>1</sup>		
	Rail	Truck	Total	Rail	Truck	Total	Rail	Truck	Total
Net tons:									
Lump <sup>2</sup> and broken.....				252	241	493	1,001	70	1,071
Egg.....	94,946	8,977	103,923	68,548	3,389	71,937	223,087	6,299	234,386
Stove.....	281,267	95,281	376,548	461,551	451,561	913,112	604,442	166,683	771,125
Chestnut.....	188,012	260,353	448,365	469,618	677,668	1,147,276	473,349	401,858	880,207
Pea.....	73,019	253,525	326,544	285,005	447,765	733,370	203,690	450,324	654,014
Total pea and larger.....	637,244	618,136	1,255,380	1,285,574	1,580,614	2,866,188	1,515,569	1,025,234	2,540,803
Buckwheat No. 1.....	108,437	223,316	331,753	427,827	481,652	909,479	277,022	426,510	703,532
Buckwheat No. 2 (rice).....	82,485	251,823	334,308	239,328	515,776	749,104	163,094	299,759	467,853
Buckwheat No. 3 (barley).....	144,413	203,551	347,964	326,689	619,505	946,194	327,063	196,803	523,866
Buckwheat No. 4.....	152,272	62,239	214,511	315,102	218,154	533,256	95,082	15,223	111,305
Buckwheat No. 5.....	342,144	43,255	385,399	766,846	311,374	1,078,220	123,491	33,271	156,762
Other <sup>3</sup> .....	145,293	164,520	309,813	500,415	495,540	995,955		574,055	574,055
Total buckwheat No. 1 and smaller.....	975,044	948,704	1,923,748	2,570,207	2,642,001	5,212,208	991,752	1,545,621	2,537,373
Grand total.....	1,612,288	1,566,840	3,179,128	3,855,781	4,222,615	8,078,396	2,507,321	2,570,855	5,078,176
Value:									
Lump <sup>2</sup> and broken.....				\$3,467	\$3,318	\$6,785	\$12,432	\$869	\$13,301
Egg.....	\$1,239,957	\$115,654	\$1,355,611	885,721	43,765	929,486	2,942,819	81,560	3,024,379
Stove.....	3,767,494	1,281,808	5,049,302	5,930,903	5,569,209	11,500,112	7,896,551	2,173,491	10,070,042
Chestnut.....	2,505,145	3,522,469	6,027,614	6,033,703	8,325,886	14,359,589	6,284,080	5,320,116	11,604,196
Pea.....	784,621	2,827,217	3,611,838	2,977,092	4,489,961	7,467,053	2,275,674	5,195,330	7,471,004
Total pea and larger.....	8,297,217	7,747,148	16,044,365	15,830,886	18,432,139	34,263,025	19,411,556	12,771,366	32,182,922
Buckwheat No. 1.....	1,028,029	2,184,823	3,212,852	4,142,188	4,427,395	8,569,583	2,705,010	4,358,760	7,063,770
Buckwheat No. 2 (rice).....	805,560	2,537,873	3,343,433	2,081,472	4,049,471	6,730,943	1,617,950	2,932,876	4,550,826
Buckwheat No. 3 (barley).....	1,052,074	1,465,800	2,507,874	2,249,104	4,254,564	6,503,668	2,258,594	1,373,138	3,631,732
Buckwheat No. 4.....	794,529	349,479	1,144,008	1,607,295	1,048,507	2,655,802	500,681	80,128	580,809
Buckwheat No. 5.....	1,779,613	214,483	1,994,096	3,680,432	1,193,774	4,774,206	607,549	168,214	775,763
Other <sup>3</sup> .....	491,921	487,774	979,695	1,613,712	1,746,446	3,360,158		1,072,803	1,072,803
Total buckwheat No. 1 and smaller.....	5,951,726	7,230,232	13,181,958	15,274,203	17,320,157	32,594,360	7,689,784	9,985,919	17,675,703
Grand total.....	14,248,943	14,977,380	29,226,323	31,105,089	35,752,296	66,857,385	27,101,340	22,757,285	49,858,625

Average value per ton:

Lump <sup>2</sup> and broken.....				\$13.76	\$13.77	\$13.76	\$12.42	\$12.41	\$12.42
Egg.....	\$13.06	\$12.88	\$13.04	12.92	12.91	12.92	12.90	12.95	12.90
Stove.....	13.39	13.45	13.41	12.85	12.33	12.59	13.06	13.04	13.06
Chestnut.....	13.32	13.53	13.44	12.85	12.29	12.52	13.14	13.24	13.18
Pea.....	10.75	11.15	11.06	10.42	10.03	10.18	11.17	11.54	11.42
<b>Total pea and larger.....</b>	<b>13.02</b>	<b>12.53</b>	<b>12.78</b>	<b>12.31</b>	<b>11.66</b>	<b>11.95</b>	<b>12.81</b>	<b>12.46</b>	<b>12.67</b>
Buckwheat No. 1.....	9.48	9.78	9.68	9.68	9.19	9.42	9.76	10.22	10.04
Buckwheat No. 2 (rice).....	9.77	10.08	10.00	8.92	9.01	8.99	9.63	9.78	9.73
Buckwheat No. 3 (barley).....	7.29	7.15	7.21	6.88	6.87	6.87	6.91	6.98	6.93
Buckwheat No. 4.....	5.22	5.62	5.33	5.10	4.81	4.98	5.21	5.26	5.22
Buckwheat No. 5.....	5.20	4.96	5.17	4.67	3.83	4.43	4.92	5.06	4.95
Other <sup>3</sup> .....	3.39	2.96	3.16	3.22	3.52	3.37	-----	1.87	1.87
<b>Total buckwheat No. 1 and smaller.....</b>	<b>6.10</b>	<b>7.62</b>	<b>6.85</b>	<b>5.94</b>	<b>6.56</b>	<b>6.25</b>	<b>7.75</b>	<b>6.46</b>	<b>6.97</b>
<b>Grand total.....</b>	<b>8.84</b>	<b>9.56</b>	<b>9.19</b>	<b>8.07</b>	<b>8.47</b>	<b>8.28</b>	<b>10.81</b>	<b>8.85</b>	<b>9.82</b>

See footnotes at end of table.

TABLE 4.—Commercial production of Pennsylvania anthracite in 1964, by regions and sizes—Continued

Size	Total preparation plants			From river dredging			Total		
	Rail	Truck	Total	Rail	Truck	Total	Rail	Truck	Total
<b>Net tons:</b>									
Lump <sup>a</sup> and broken.....	1,253	311	1,564	-----	-----	-----	1,253	311	1,564
Egg.....	391,581	18,665	410,246	-----	-----	-----	391,581	18,665	410,246
Stove.....	1,347,260	713,525	2,060,785	-----	-----	-----	1,347,260	713,525	2,060,785
Chestnut.....	1,135,979	1,339,869	2,475,848	-----	-----	-----	1,135,979	1,339,869	2,475,848
Pea.....	562,314	1,151,614	1,713,928	-----	-----	-----	562,314	1,151,614	1,713,928
<b>Total pea and larger.....</b>	<b>3,438,387</b>	<b>3,223,984</b>	<b>6,662,371</b>	-----	-----	-----	<b>3,438,387</b>	<b>3,223,984</b>	<b>6,662,371</b>
Buckwheat No. 1.....	813,286	1,131,478	1,944,764	-----	58	58	813,286	1,131,536	1,944,822
Buckwheat No. 2 (rice).....	483,907	1,067,358	1,551,265	-----	212	212	483,907	1,067,570	1,551,477
Buckwheat No. 3 (barley).....	798,165	1,019,859	1,818,024	-----	104	104	798,165	1,019,963	1,818,128
Buckwheat No. 4.....	563,456	295,616	859,072	-----	27,800	27,800	563,456	323,416	886,872
Buckwheat No. 5.....	1,232,481	387,900	1,620,381	15,500	28,509	44,009	1,247,981	410,409	1,664,390
Other <sup>a</sup> .....	645,708	1,234,115	1,879,823	545,733	86,832	632,565	1,191,441	1,320,947	2,512,388
<b>Total buckwheat No. 1 and smaller.....</b>	<b>4,537,003</b>	<b>5,136,326</b>	<b>9,673,329</b>	<b>561,233</b>	<b>143,515</b>	<b>704,748</b>	<b>5,098,236</b>	<b>5,279,841</b>	<b>10,378,077</b>
<b>Grand total.....</b>	<b>7,975,390</b>	<b>8,360,310</b>	<b>16,335,700</b>	<b>561,233</b>	<b>143,515</b>	<b>704,748</b>	<b>8,536,623</b>	<b>8,503,825</b>	<b>17,040,448</b>
<b>Value:</b>									
Lump <sup>a</sup> and broken.....	\$15,899	\$4,187	\$20,086	-----	-----	-----	\$15,899	\$4,187	\$20,086
Egg.....	5,068,497	240,979	5,309,476	-----	-----	-----	5,068,497	240,979	5,309,476
Stove.....	17,594,948	9,024,508	26,619,456	-----	-----	-----	17,594,948	9,024,508	26,619,456
Chestnut.....	14,822,928	17,168,471	31,991,399	-----	-----	-----	14,822,928	17,168,471	31,991,399
Pea.....	6,037,387	12,512,508	18,549,895	-----	-----	-----	6,037,387	12,512,508	18,549,895
<b>Total pea and larger.....</b>	<b>43,539,659</b>	<b>38,950,653</b>	<b>82,490,312</b>	-----	-----	-----	<b>43,539,659</b>	<b>38,950,653</b>	<b>82,490,312</b>
Buckwheat No. 1.....	7,875,227	10,970,978	18,846,205	-----	\$406	\$406	7,875,227	10,971,384	18,846,611
Buckwheat No. 2 (rice).....	4,504,982	10,120,220	14,625,202	-----	1,696	1,696	4,504,982	10,121,916	14,626,898
Buckwheat No. 3 (barley).....	5,559,772	7,083,502	12,643,274	-----	780	780	5,559,772	7,084,282	12,644,054
Buckwheat No. 4.....	2,902,505	1,478,114	4,380,619	-----	104,233	104,233	2,902,505	1,582,347	4,484,852
Buckwheat No. 5.....	5,967,594	1,576,471	7,544,065	\$56,000	100,668	156,668	6,023,594	1,677,139	7,700,733
Other <sup>a</sup> .....	2,105,633	3,307,023	5,412,656	1,814,642	279,268	2,093,910	3,920,275	3,586,291	7,506,566
<b>Total buckwheat No. 1 and smaller.....</b>	<b>28,915,713</b>	<b>34,536,308</b>	<b>63,452,021</b>	<b>1,870,642</b>	<b>487,051</b>	<b>2,357,693</b>	<b>30,786,355</b>	<b>35,023,359</b>	<b>65,809,714</b>
<b>Grand total.....</b>	<b>72,455,372</b>	<b>73,486,961</b>	<b>145,942,333</b>	<b>1,870,642</b>	<b>487,051</b>	<b>2,357,693</b>	<b>74,326,014</b>	<b>73,974,012</b>	<b>148,300,026</b>

Average value per ton:									
Lump <sup>1</sup> and broken.....	\$12.69	\$13.46	\$12.84				\$12.69	\$13.46	\$12.84
Egg.....	12.94	12.91	12.94				12.94	12.91	12.94
Stove.....	13.06	12.65	12.92				13.06	12.65	12.92
Chestnut.....	13.05	12.81	12.92				13.05	12.81	12.92
Pea.....	10.74	10.87	10.82				10.74	10.87	10.82
<b>Total pea and larger.....</b>	<b>12.66</b>	<b>12.08</b>	<b>12.38</b>				<b>12.66</b>	<b>12.08</b>	<b>12.38</b>
Buckwheat No. 1.....	9.68	9.70	9.69		\$7.00	\$7.00	9.68	9.70	9.69
Buckwheat No. 2 (rice).....	9.31	9.48	9.43		8.00	8.00	9.31	9.48	9.43
Buckwheat No. 3 (barley).....	6.97	6.95	6.95		7.50	7.50	6.97	6.95	6.95
Buckwheat No. 4.....	5.15	5.00	5.10		3.75	3.75	5.15	4.89	5.06
Buckwheat No. 5.....	4.84	4.06	4.66	\$3.61	3.53	3.56	4.83	4.03	4.63
Other <sup>2</sup> .....	3.26	2.68	2.88	3.33	3.22	3.31	3.29	2.71	2.99
<b>Total buckwheat No. 1 and smaller...</b>	<b>6.37</b>	<b>6.72</b>	<b>6.56</b>	<b>3.33</b>	<b>3.39</b>	<b>3.35</b>	<b>6.04</b>	<b>6.63</b>	<b>6.34</b>
<b>Grand total.....</b>	<b>9.08</b>	<b>8.79</b>	<b>8.93</b>	<b>3.33</b>	<b>3.39</b>	<b>3.35</b>	<b>8.71</b>	<b>8.70</b>	<b>8.70</b>

<sup>1</sup> Includes Sullivan County.

<sup>2</sup> Quantity of lump included is insignificant.

<sup>3</sup> Includes various mixtures of buckwheat Nos. 2 to 5 and coal of relatively low dollar value.

TABLE 5.—Sizes of Pennsylvania anthracite prepared at plants in 1964, by regions, in percent of total

(Excludes dredge coal)

Size	Lehigh region			Schuylkill region		
	Shipped by rail	Shipped by truck	Total	Shipped by rail	Shipped by truck	Total
Lump <sup>1</sup> and broken.....				( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
Egg.....	5.9	0.6	3.3	1.8	0.1	0.9
Stove.....	17.4	6.1	11.8	11.9	10.7	11.3
Chestnut.....	11.7	16.6	14.1	12.2	16.0	14.2
Pea.....	4.5	16.2	10.3	7.4	10.6	9.1
Total pea and larger.....	39.5	39.5	39.5	33.3	37.4	35.5
Buckwheat No. 1.....	6.7	14.2	10.4	11.1	11.4	11.3
Buckwheat No. 2 (rice).....	5.1	16.1	10.5	6.0	12.2	9.3
Buckwheat No. 3 (barley).....	9.0	13.0	11.0	8.5	14.7	11.7
Buckwheat No. 4.....	9.5	4.0	6.8	8.2	5.2	6.6
Buckwheat No. 5.....	21.2	2.7	12.1	19.9	7.4	13.3
Other <sup>3</sup> .....	9.0	10.5	9.7	13.0	11.7	12.3
Total buckwheat No. 1 and smaller.....	60.5	60.5	60.5	66.7	62.6	64.5
	Wyoming region <sup>4</sup>			Total		
Lump <sup>1</sup> and broken.....	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
Egg.....	9.1	0.3	4.6	4.9	0.2	2.5
Stove.....	24.1	6.5	15.2	16.9	8.6	12.6
Chestnut.....	19.1	15.6	17.3	14.2	16.0	15.2
Pea.....	8.1	17.5	12.9	7.1	13.8	10.5
Total pea and larger.....	60.4	39.9	50.0	43.1	38.6	40.8
Buckwheat No. 1.....	11.1	16.6	13.9	10.2	13.5	11.9
Buckwheat No. 2 (rice).....	6.7	11.7	9.2	6.1	12.8	9.5
Buckwheat No. 3 (barley).....	13.1	7.6	10.3	10.0	12.2	11.1
Buckwheat No. 4.....	3.8	.6	2.2	7.1	3.5	5.3
Buckwheat No. 5.....	4.9	1.3	3.1	15.4	4.6	9.9
Other <sup>3</sup> .....		22.3	11.3	8.1	14.8	11.5
Total buckwheat No. 1 and smaller.....	39.6	60.1	50.0	56.9	61.4	59.2

<sup>1</sup> Quantity of lump included is insignificant.<sup>2</sup> Less than 0.05 percent.<sup>3</sup> Includes various mixtures of buckwheat Nos. 2 to 5 and coal of relatively low value.<sup>4</sup> Includes Sullivan County.

TABLE 6.—Sizes of Pennsylvania anthracite prepared at plants, by regions in percent of total

(Excludes dredge coal)

Size	Lehigh region					Schuylkill region				
	1960	1961	1962	1963	1964	1960	1961	1962	1963	1964
Lump <sup>1</sup> and broken		( <sup>2</sup> )				0.1	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
Egg	0.9	1.8	3.1	2.3	3.3	.5	0.6	0.9	1.1	0.9
Stove	11.5	11.6	10.7	9.7	11.8	11.8	12.0	12.2	11.9	11.3
Chestnut	15.4	15.9	12.5	11.7	14.1	15.3	15.8	15.4	15.0	14.2
Pea	11.1	11.2	10.8	10.1	10.3	10.1	10.3	10.7	10.3	9.1
Total pea and larger	38.9	40.5	37.1	33.8	39.5	37.8	38.7	39.2	38.3	35.5
Buckwheat No. 1	10.8	12.3	11.0	9.3	10.4	12.1	11.7	12.4	12.3	11.3
Buckwheat No. 2 (rice)	8.6	8.9	8.6	8.7	10.5	9.5	9.2	9.5	9.7	9.3
Buckwheat No. 3 (barley)	9.0	10.2	8.8	9.8	11.0	13.2	12.0	11.1	11.2	11.7
Buckwheat No. 4	7.3	9.0	6.8	7.8	6.8	7.3	7.2	7.2	6.8	6.6
Buckwheat No. 5	10.9	11.1	10.6	16.8	12.1	11.6	10.8	12.7	12.8	13.3
Other <sup>3</sup>	14.5	8.0	17.1	13.8	9.7	8.5	10.4	7.9	8.9	12.3
Total buckwheat No. 1 and smaller	61.1	59.5	62.9	66.2	60.5	62.2	61.3	60.8	61.7	64.5
	Wyoming region <sup>4</sup>					Total				
Lump <sup>1</sup> and broken	0.1	0.1	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	0.1	0.1	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
Egg	.7	1.9	4.4	4.9	4.6	.6	1.2	2.5	2.6	2.5
Stove	14.7	15.3	15.8	16.7	15.2	12.8	13.0	13.2	13.0	12.6
Chestnut	19.8	20.2	17.7	18.5	17.3	16.9	17.3	15.6	15.4	15.2
Pea	14.0	14.5	13.8	13.9	12.9	11.6	11.8	11.8	11.4	10.5
Total pea and larger	49.3	52.0	51.7	54.0	50.0	42.0	43.4	43.1	42.4	40.8
Buckwheat No. 1	16.0	15.1	15.1	15.1	13.9	13.3	12.9	13.1	12.6	11.9
Buckwheat No. 2 (rice)	9.2	9.4	9.1	9.3	9.2	9.2	9.2	9.2	9.3	9.5
Buckwheat No. 3 (barley)	10.9	11.3	10.5	10.9	10.3	11.8	11.5	10.5	10.8	11.1
Buckwheat No. 4	2.2	3.0	2.3	2.4	2.2	5.5	6.1	5.4	5.6	5.3
Buckwheat No. 5	3.3	4.3	4.8	4.0	3.1	8.6	8.7	9.5	10.8	9.9
Other <sup>3</sup>	9.1	4.9	6.5	4.3	11.3	9.6	8.2	9.2	8.5	11.5
Total buckwheat No. 1 and smaller	50.7	48.0	48.3	46.0	50.0	58.0	56.6	56.9	57.6	59.2

<sup>1</sup> Quantity of lump included is insignificant.

<sup>2</sup> Less than 0.05 percent.

<sup>3</sup> Includes various mixtures of buckwheat Nos. 2 to 5 and coal of relatively low value.

<sup>4</sup> Includes Sullivan County.



TABLE 7.—Production of Pennsylvania anthracite in 1964, by regions

Region	Production							
	Rail shipments		Truck shipments		Colliery fuel		Total	
	Net tons	Value <sup>1</sup>	Net tons	Value <sup>1</sup>	Net tons	Value	Net tons	Value <sup>1</sup>
Lehigh: Preparation plants.....	1,612,288	\$14,248,943	1,566,840	\$14,977,380	7,703	\$69,905	3,186,831	\$29,296,228
Schuylkill:								
Preparation plants.....	3,855,781	31,105,089	4,222,615	35,752,296	7,985	68,081	8,086,381	66,925,466
Dredges.....	561,233	1,870,642	143,515	487,051	500	1,500	705,248	2,359,193
Total, Schuylkill.....	4,417,014	32,975,731	4,366,130	36,239,347	8,485	69,581	8,791,629	69,284,659
Wyoming: Preparation plants <sup>2</sup> .....	2,507,321	27,101,340	2,570,855	22,757,285	127,615	208,063	5,205,791	50,066,688
Total:								
Preparation plants.....	7,975,390	72,455,372	8,360,310	73,486,961	143,303	346,049	16,479,003	146,288,382
Dredges.....	561,233	1,870,642	143,515	487,051	500	1,500	705,248	2,359,193
Grand total.....	8,536,623	74,326,014	8,503,825	73,974,012	143,803	347,549	17,184,251	148,647,575

<sup>1</sup> Value given for shipments is that at which coal left possession of producing company; does not include selling expenses.

<sup>2</sup> Includes Sullivan County.

TABLE 8.—Pennsylvania anthracite produced, 1960-64, by fields, in net tons

Field	1960	1961	1962	1963	1964
Eastern Middle: Breakers and washeries.....	2,121,500	2,002,163	2,257,038	2,657,499	2,188,777
Western Middle:					
Breakers and washeries.....	5,104,897	4,673,983	3,723,273	4,270,454	4,492,491
Dredges.....	71,828	58,287	41,105	36,095	33,667
Total.....	5,176,725	4,732,270	3,764,378	4,306,549	4,526,158
Southern:					
Breakers and washeries.....	4,530,628	4,486,037	4,515,339	4,857,977	4,591,944
Dredges.....	640,335	687,561	685,946	655,635	671,581
Total.....	5,170,963	5,173,598	5,201,285	5,513,612	5,263,525
Northern: Breakers and washeries <sup>1</sup> .....	6,348,253	5,538,408	5,670,945	5,789,724	5,205,791
Total:					
Breakers and washeries.....	18,105,278	16,700,591	16,166,595	17,575,654	16,479,003
Dredges.....	712,163	745,843	727,051	691,730	705,248
Grand total.....	18,817,441	17,446,439	16,893,646	18,267,384	17,184,251

<sup>1</sup> Includes Sullivan County.

TABLE 9.—Production of Pennsylvania anthracite in 1964, by counties

County	Production							
	Rail shipments		Truck shipments		Colliery fuel		Total	
	Net tons	Value <sup>1</sup>	Net tons	Value <sup>1</sup>	Net tons	Value	Net tons	Value <sup>1</sup>
Berks, Lancaster, and Snyder.....	545,333	\$1,812,642	106,752	\$346,868	-----	-----	652,085	\$2,159,510
Carbon.....	428,677	4,158,687	72,770	269,527	-----	-----	501,447	4,428,214
Columbia.....	703,668	6,714,750	119,256	865,975	183	\$1,279	823,107	7,582,004
Dauphin.....	206,520	872,443	48,803	234,672	-----	-----	255,323	1,107,115
Lackawanna.....	511,465	5,371,903	407,661	3,908,400	1,073	9,307	920,199	9,289,610
Lebanon.....	21,446	160,973	9,404	50,930	-----	-----	30,850	211,903
Luzerne.....	2,933,618	29,657,697	2,968,108	26,867,364	133,940	266,441	6,035,666	56,791,502
Northumberland.....	878,238	6,143,304	1,267,337	10,367,150	815	4,210	2,146,390	16,514,664
Schuylkill.....	2,307,305	19,430,366	3,486,380	30,967,708	7,792	66,312	5,801,477	50,464,386
Sullivan.....	-----	-----	15,932	82,377	-----	-----	15,932	82,377
Wayne.....	353	3,249	1,422	13,041	-----	-----	1,775	16,290
Total.....	8,536,623	74,326,014	8,503,825	73,974,012	143,803	347,549	17,184,251	148,647,575

<sup>1</sup> Value given for shipments is that at which coal left possession of producing company; does not include selling expenses.

**Underground Mines.**—Production from underground mines decreased sharply in 1964, after having remained relatively stable for several years. The decrease (826,000 tons) was largely attributable to declines in the shipment of fresh-mined large sizes to European markets, exclusive of anthracite shipped to the U.S. Armed Forces in West Germany. There was little change in the proportion of tonnage contributed by each region. Of total underground production, the Lehigh region remained the same as 1963, 1 percent; the Schuylkill region dropped to 53 percent (54 percent in 1963); and the Wyoming rose to 46 percent (45 percent in 1963). In the Lehigh region production from underground mines decreased 16,000 tons, or 16 percent; in the Schuylkill region, 500,000 tons or 14 percent; and in the Wyoming region, 310,000 tons, or 10 percent. Detailed data on production by source, fields, and regions are shown in tables 10 and 11. Figures 2 and 3 show trends in production by source.

TABLE 10.—Pennsylvania anthracite produced in 1964, classified as fresh-mined, culm-bank, and river coal, by fields, in net tons

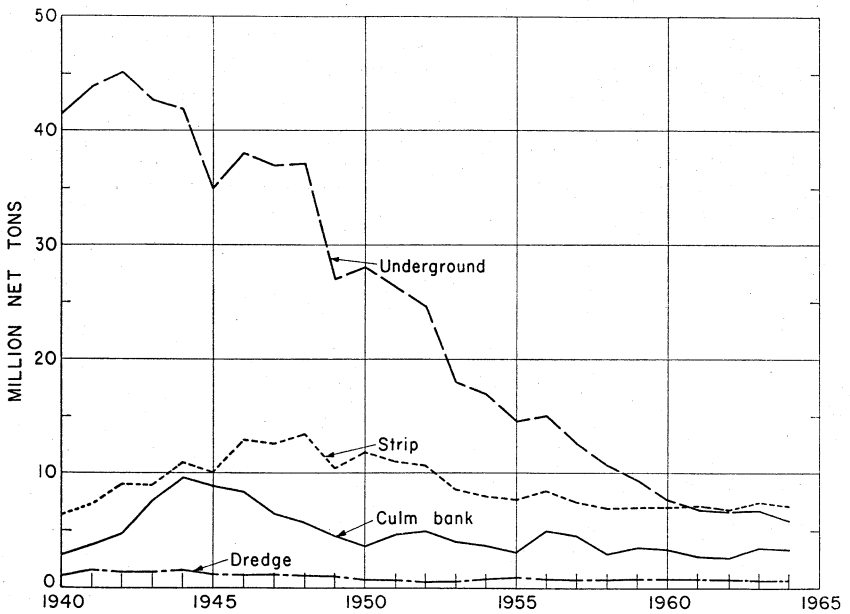
Field	Fresh-mined coal				From culm banks	From river dredging	Total
	Underground mines			Strip pits			
	Mechanically loaded	Hand loaded	Total				
Eastern Middle.....	38,100	14,144	52,244	1,407,288	729,245	-----	2,188,777
Western Middle.....	366,547	810,520	1,177,067	2,235,016	1,080,408	33,667	4,526,153
Southern.....	424,700	1,559,426	1,984,126	1,901,455	706,363	671,581	5,263,525
Northern <sup>1</sup> .....	2,625,687	49,702	2,675,389	1,633,429	896,973	-----	5,205,791
Total.....	3,455,034	2,433,792	5,888,826	7,177,188	3,412,989	705,248	17,184,251

<sup>1</sup> Includes Sullivan County.

**TABLE 11.—Pennsylvania anthracite produced in 1964, classified as fresh-mined, culm-bank, and river coal, by regions, in net tons**

Region	Fresh-mined coal				From culm banks	From river dredging	Total
	Underground mines			Strip pits			
	Mechanically loaded	Hand loaded	Total				
Lehigh.....	38,100	42,843	80,943	2,170,162	935,726	-----	3,186,831
Schuylkill.....	791,247	2,341,247	3,132,494	3,373,597	1,580,290	705,248	8,791,629
Wyoming <sup>1</sup> .....	2,625,687	49,702	2,675,389	1,633,429	896,973	-----	5,205,791
<b>Total.....</b>	<b>3,455,034</b>	<b>2,433,792</b>	<b>5,888,826</b>	<b>7,177,188</b>	<b>3,412,989</b>	<b>705,248</b>	<b>17,184,251</b>

<sup>1</sup> Includes Sullivan County.



**FIGURE 2.—Production of Pennsylvania anthracite, by sources, 1940–64.**

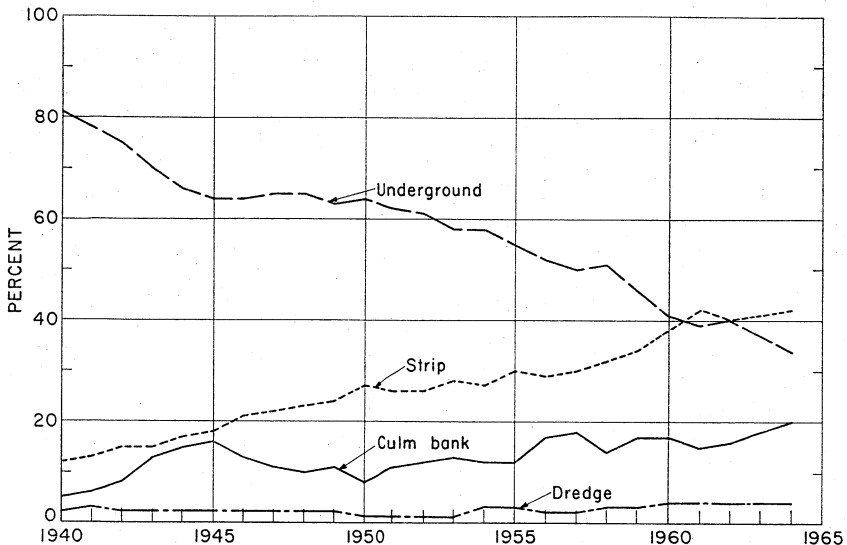


FIGURE 3.—Production of Pennsylvania anthracite, by sources, 1940-64, in percent of total.

**Strip Pits.**—Production at stripping operations declined 4 percent in 1964. In the Schuylkill region, output from strip pits increased 9 percent. In the Lehigh and Wyoming regions, however, strip-pit production decreased 4 and 22 percent, respectively. Of the total produced by stripping, 47 percent was produced in the Schuylkill region (42 percent in 1963); 30 percent in the Lehigh (the same as the previous year); and 23 percent in the Wyoming region (28 percent in 1963). Of the total fresh-mined coal (strip plus underground) produced in the Lehigh region in 1964, 96 percent originated at strip pits, in Schuylkill, 52 percent of the total was strip coal; 38 percent of the Wyoming coal was from strip pits. Comparable figures in 1963 were 96, 46, and 41 percent, respectively. Table 12 shows detailed data on strip-pit production for selected years in the period 1915-64. Figure 4 shows regional production of strip coal for 1940-64.

TABLE 12.—Production of Pennsylvania anthracite from strip pits

	Mined by stripping (net tons)	Percent of fresh-mined total	Number of men employed	Average number of days worked
1915.....	1,121,603	NA	NA	NA
1920.....	2,054,441	2.5	NA	NA
1925.....	1,578,478	2.7	NA	NA
1930.....	2,536,288	3.8	NA	NA
1957.....	7,543,157	37.4	4,546	207
1958.....	6,877,761	39.1	4,418	196
1959.....	7,096,343	43.0	3,775	200
1960.....	7,112,288	48.0	3,470	195
1961.....	7,246,646	51.6	3,194	207
1962.....	6,822,207	50.6	3,008	206
1963.....	7,467,842	52.7	3,025	224
<b>1964:</b>				
Lehigh region.....	2,170,162	96.4	974	209
Schuylkill region.....	3,373,597	51.9	1,393	205
Wyoming region <sup>1</sup> .....	1,633,429	37.9	708	250
<b>Total.....</b>	<b>7,177,188</b>	<b>54.9</b>	<b>3,075</b>	<b>217</b>

NA Not available.

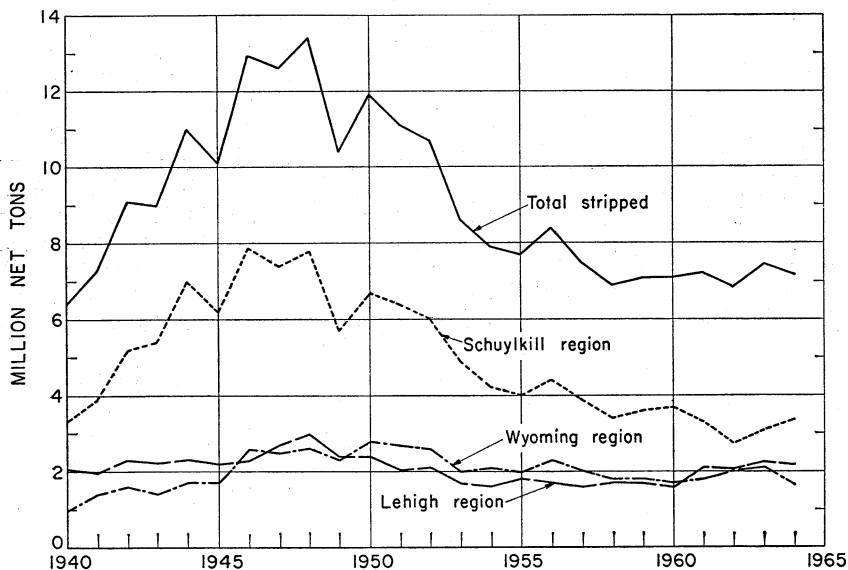
<sup>1</sup> Includes Sullivan County.

FIGURE 4.—Pennsylvania anthracite mined from strip pits, by regions, 1940-64.

**Culm Banks.**—Because of a stable market for the small sizes, anthracite reclaimed from culm and silt banks remained virtually the same. However, as some banks were depleted during the year and operations were shifted to other sites, the percentages contributed by the individual regions showed marked changes. In 1963, the Lehigh region contributed 38 percent of total culm-bank production compared with 28 percent in 1964, a decline of 28 percent. On the other hand, the Schuylkill region increased production by 14 percent and the Wyoming by 27 percent. The Wyoming region's share

rose from 21 to 26 percent of the total reclaimed from banks and the Schuylkill region accounted for 46 percent (41 percent in 1963). The production of Pennsylvania anthracite from culm banks is shown in tables 10, 11, and 13.

**TABLE 13.—Production of Pennsylvania anthracite from culm banks, by regions, in net tons**

	Lehigh	Schuylkill	Wyoming	Sullivan County	Total
1935	192,790	1,748,960	760,718		2,702,468
1936	136,058	2,532,116	525,798		3,193,972
1937	101,239	2,178,482	442,878		2,722,599
1938	53,037	1,941,896	345,511		2,340,444
1939	64,180	2,159,548	360,086		2,583,814
1940	192,878	2,109,557	480,603		2,783,038
1941	326,755	2,881,049	449,062		3,656,866
1942	745,934	3,529,757	459,373		4,735,064
1943	1,944,047	4,577,917	1,041,841	19,893	7,583,698
1944	2,125,317	5,787,036	1,673,994	13,833	9,600,180
1945	2,086,864	4,936,907	1,728,440	34,448	8,786,659
1946	1,875,590	4,752,141	1,780,874	22,487	8,431,092
1947	1,044,501	3,947,016	1,409,217	2,912	6,403,646
1948	796,114	3,729,542	1,098,123		5,623,779
1949	694,763	2,778,131	956,250		4,429,144
1950	366,069	2,533,535	565,829	1,877	3,467,310
1951	566,613	3,578,795	484,792		4,630,200
1952	791,445	3,407,974	566,097		4,765,516
1953	714,646	2,792,323	504,031		4,011,000
1954	797,761	2,320,006	447,715		3,565,482
1955	862,539	1,934,492	416,015		3,213,046
1956	1,493,381	2,750,838	530,580		4,774,799
1957	1,457,869	2,479,241	584,300		4,521,410
1958	605,741	1,742,356	550,756	3,900	2,902,753
1959	831,254	1,905,465	684,135	(1)	3,420,854
1960	825,825	1,563,746	907,441		3,297,012
1961	656,528	1,377,204	635,627		2,669,359
1962	974,650	949,710	747,106		2,671,466
1963	1,297,590	1,389,314	706,162		3,393,066
1964	935,726	1,580,290	896,973		3,412,989

<sup>1</sup> Sullivan County included in Wyoming region.

**Dredge Coal.**—In 1964, the production of dredge coal totaled 705,000 net tons, an increase of 2 percent over 1963. As the preponderant part of the river coal produced is "captive" tonnage (coal used by the producer) it is not nearly so responsive to fluctuations in the general market as are the small sizes produced from other sources. Tables 14 and 15 contain data on recovery of anthracite from rivers and their tributaries.

**TABLE 14.—Pennsylvania anthracite produced by dredges in 1964, by rivers (Including tributaries)**

River	Production (net tons)	Value	
		Total	Average
Schuylkill	97,957	\$324,143	\$3.31
Susquehanna	607,291	2,035,050	3.35
Total	705,248	2,359,193	3.35

TABLE 15.—Pennsylvania anthracite produced by dredges, by rivers  
(Including tributaries)

	Lehigh River (net tons)	Schuylkill River (net tons)	Susquehanna River (net tons)	Total (net tons)	Total value	Average value per ton
1940.....	178,947	(1)	863,997	942,944	\$1,097,000	\$1.16
1941.....	47,838	396,522	1,073,203	1,517,563	1,839,784	1.21
1942.....	9,385	268,919	1,006,729	1,285,033	1,478,719	1.15
1943.....	37,452	342,815	954,470	1,334,737	1,972,777	1.48
1944.....	40,894	494,371	837,472	1,372,737	2,084,431	1.52
1945.....	41,409	366,161	797,656	1,205,226	1,924,148	1.60
1946.....	37,441	247,757	847,196	1,132,394	2,091,324	1.85
1947.....	46,478	153,102	1,015,126	1,219,706	2,480,068	2.03
1948.....	54,284	67,871	865,849	988,004	2,291,752	2.32
1949.....	22,131	52,012	790,979	865,122	2,131,096	2.46
1950.....	21,877	34,222	563,465	619,564	1,677,508	2.71
1951.....	25,344	27,454	508,770	561,568	1,576,576	2.81
1952.....	17,402	30,407	324,245	372,054	1,109,778	2.98
1953.....	31,391	20,643	386,147	438,181	1,449,149	3.31
1954.....	16,015	.....	709,892	725,907	1,810,026	2.49
1955.....	29,935	60,256	698,652	788,843	1,844,835	2.34
1956.....	44,262	5,540	666,485	716,287	1,273,415	1.78
1957.....	30,650	10,167	616,884	657,701	1,143,152	1.74
1958.....	30,763	10,230	650,800	691,793	1,324,943	1.92
1959.....	13,312	13,213	690,094	716,619	2,310,895	3.22
1960.....	22,700	23,624	665,839	712,163	2,257,367	3.17
1961.....	2,975	122,880	619,993	745,848	2,355,314	3.16
1962.....	.....	98,076	628,975	727,051	2,475,987	3.41
1963.....	.....	83,768	607,962	691,730	2,469,101	3.57
1964.....	.....	97,957	607,291	705,248	2,359,193	3.35

<sup>1</sup>Schuylkill included with Lehigh in 1940.

**Weekly and Monthly Data.**—The Bureau publishes a series of weekly reports containing estimates of weekly and monthly production of Pennsylvania anthracite, as well as a record of daily and weekly carloadings. Estimates of production are derived primarily from factors based on carloading data furnished by the Association of American Railroads. Secondary factors are those for colliery fuel, river coal, and truck shipments. The weekly and monthly estimates have been adjusted to the production total for 1964 and are presented in tables

TABLE 16.—Estimated production of Pennsylvania anthracite, in 1964 <sup>1</sup>

Week ended—	Thousand net tons	Week ended—	Thousand net tons	Week ended—	Thousand net tons
Jan. 4.....	153	May 16.....	390	Sept. 26.....	317
11.....	429	23.....	391	Oct. 3.....	326
18.....	218	30.....	376	10.....	322
25.....	437	June 6.....	458	17.....	306
Feb. 1.....	447	13.....	460	24.....	298
8.....	463	20.....	400	31.....	277
15.....	382	27.....	421	Nov. 7.....	333
22.....	310	July 4.....	164	14.....	316
29.....	349	11.....	115	21.....	334
Mar. 7.....	288	18.....	319	28.....	288
14.....	259	25.....	350	Dec. 5.....	337
21.....	267	Aug. 1.....	327	12.....	356
28.....	293	8.....	311	19.....	333
Apr. 4.....	251	15.....	339	26.....	239
11.....	277	22.....	287	31.....	* 218
18.....	363	29.....	297	Total.....	17,184
25.....	395	Sept. 5.....	285		
May 2.....	350	12.....	239		
9.....	401	19.....	323		

<sup>1</sup> Estimated from weekly carloadings as reported by the Association of American Railroads and other factors; adjusted to annual production from Bureau of Mines canvass.

\* Figures represent output of working days in that part of week included in calendar year 1964. Revised total for week of January 4, 1964 was 201,000 net tons. Preliminary production for week of January 2, 1965 was 218,000 tons.

TABLE 17.—Estimated monthly production of Pennsylvania anthracite, in thousand net tons<sup>1</sup>

Month	1956	1957	1958	1959	1960	1961	1962	1963	1964
January.....	2,743	2,625	2,161	2,318	1,701	1,767	1,810	1,799	1,668
February.....	2,360	2,072	1,753	1,645	1,643	1,721	1,522	1,529	1,520
March.....	2,052	1,798	1,476	1,593	1,749	1,438	1,513	1,489	1,211
April.....	2,258	2,037	1,545	1,588	1,281	1,173	1,257	1,195	1,454
May.....	1,947	2,294	1,612	1,466	1,313	1,418	1,319	1,524	1,636
June.....	2,470	2,551	1,963	1,777	1,496	1,344	1,339	1,455	1,816
July.....	1,890	1,478	1,377	1,206	1,186	1,178	906	1,124	1,182
August.....	2,729	2,294	1,750	1,600	1,704	1,533	1,328	1,606	1,906
September.....	2,509	2,173	2,050	1,823	1,580	1,394	1,193	1,574	1,900
October.....	2,971	2,262	1,966	1,805	1,678	1,603	1,528	1,822	1,937
November.....	2,629	1,928	1,559	1,863	1,692	1,501	1,664	1,615	1,940
December.....	2,342	1,826	1,959	1,965	1,794	1,376	1,515	1,535	1,414
Total.....	28,900	25,338	21,171	20,649	18,817	17,446	16,894	18,267	17,184

<sup>1</sup> Production is estimated from weekly carloadings, as reported by the Association of American Railroads, and includes mine fuel, coal sold locally, and dredge coal.

16 and 17. The weekly anthracite report also contains supplementary monthly tables on rail and truck shipments, consumption, retail-dealer stocks and deliveries, imports, exports, and other related subjects. Requests to be placed on the mailing list for this publication should be addressed to the Bureau of Mines.

**Mechanical Loading.**—With the drop in total production and 12 percent in underground mining, mechanical loading decreased 6 percent and hand loading decreased 20 percent. As a result, anthracite loaded mechanically was 59 percent of the total underground production in 1964, compared with 55 percent in 1963. The Northern field was primarily responsible for the drop as the increase in the Western Middle field more than offset small decreases in the other two fields. Figure 5 shows trends in mechanical loading, hand loading, and

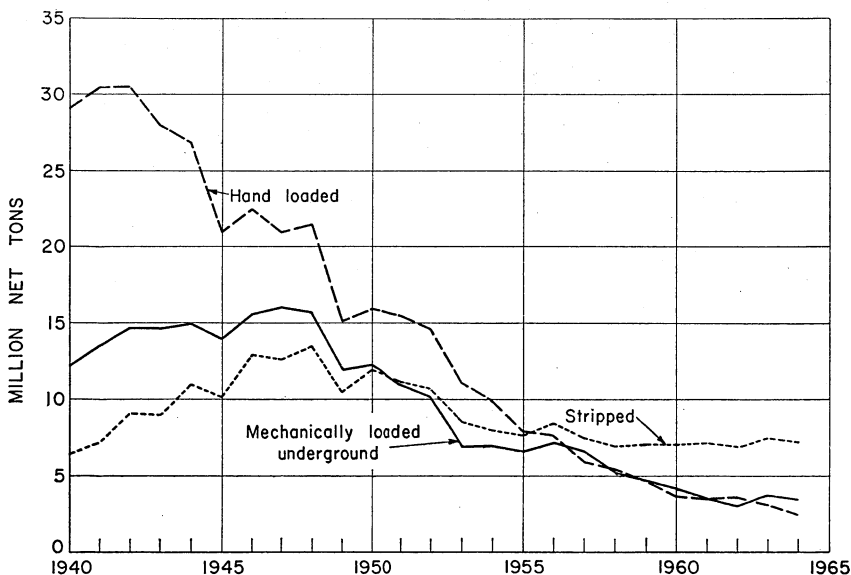


FIGURE 5.—Pennsylvania anthracite mechanically loaded, hand loaded, and stripped, 1940-64.



stripping for 1940-64. Tables 18 and 19 present data on the tonnages loaded mechanically and the number and types of equipment used.

**TABLE 18.—Pennsylvania anthracite loaded mechanically underground, by fields, in net tons**

Field	Scraper loaders <sup>1</sup>		Pit-car loaders		Hand-loaded face conveyors, all types <sup>2</sup>		Total mechanically loaded	
	1963	1964	1963	1964	1963	1964	1963	1964
Northern.....	1,013,878	1,060,916	110,342	68,601	1,732,058	1,496,170	2,856,278	2,625,687
Eastern Middle.....		3,546	1,047	369	48,863	34,185	49,910	38,100
Western Middle.....	51,716	22,715	1,500	1,800	267,329	342,032	320,545	366,547
Southern.....	101,574	155,672	16,000	7,500	321,655	261,528	439,229	424,700
Total.....	1,167,168	1,242,849	128,889	78,270	2,369,905	2,133,915	3,665,962	3,455,034

<sup>1</sup> Includes mobile loaders.

<sup>2</sup> Shaker chutes, including those equipped with duckbills.

**TABLE 19.—Pennsylvania anthracite loaded mechanically underground, in net tons**

Year	Scraper loaders		Mobile loaders		Conveyors <sup>1</sup> and pit-car loaders		Total loaded mechanically	
	Number of units	Net tons loaded	Number of units	Net tons loaded	Number of units	Net tons loaded	Number of units	Net tons loaded
1960.....	114	525,482	45	691,942	754	2,826,968	913	4,044,392
1961.....	132	595,572	27	387,417	616	2,394,789	775	3,377,778
1962.....	128	541,241	34	296,259	536	2,227,864	698	3,065,364
1963.....	147	862,252	30	304,916	512	2,498,794	689	3,665,962
1964.....	139	750,293	31	492,556	495	2,212,185	665	3,455,034

<sup>1</sup> Includes duckbills and other self-loading conveyors.

TABLE 20.—Trends in mechanical loading, hand loading, and stripping of Pennsylvania anthracite

(Mechanical loading includes coal handled on pit-car loaders and hand-loaded face conveyors)

Year	Fresh-mined coal							Total
	Underground				Strip pits		Total	
	Mechanical loading (net tons)	Percent of total, underground	Hand loading (net tons)	Percent of total, underground	Total (net tons)	Net tons		
1927	1,223,281	3.0	71,434,537	97.0	73,657,818	2,153,156	2.8	75,810,974
1928	2,351,074	3.4	67,373,788	96.6	69,724,862	2,422,924	3.4	72,147,786
1929	3,470,158	5.0	66,493,690	95.0	69,963,848	1,911,766	2.7	71,875,614
1930	4,467,760	6.9	60,458,344	93.1	64,926,094	2,536,288	3.8	67,462,382
1931	4,384,730	8.2	49,074,722	91.8	53,459,502	3,813,237	6.7	57,272,739
1932	5,433,340	12.4	38,400,820	87.6	43,834,160	3,980,973	8.3	47,815,133
1933	6,557,267	16.0	34,474,844	84.0	41,032,111	4,932,069	10.7	45,964,180
1934	9,284,486	19.1	39,290,255	80.9	48,574,741	5,798,138	10.7	54,372,879
1935	9,279,057	21.2	34,503,819	78.8	43,782,876	5,187,072	10.6	48,969,948
1936	10,827,946	24.2	33,898,560	75.8	44,726,506	6,203,267	12.2	50,929,773
1937	10,683,837	25.1	31,882,514	74.9	42,566,351	5,696,018	11.8	48,262,369
1938	10,151,669	26.6	27,990,628	73.4	38,142,297	5,095,341	11.8	43,237,638
1939	11,773,833	27.7	30,797,715	72.3	42,571,548	5,486,479	11.4	48,058,027
1940	12,326,000	29.7	29,190,837	70.3	41,516,837	6,352,700	13.3	47,869,537
1941	13,441,987	30.6	30,435,277	69.4	43,877,264	7,316,574	14.3	51,193,838
1942	14,741,459	32.6	30,495,240	67.4	45,236,699	9,070,933	16.7	54,307,632
1943	14,745,793	34.5	27,990,005	65.5	42,735,798	8,989,387	17.4	51,725,185
1944	14,975,146	35.8	26,800,270	64.2	41,775,416	10,953,030	20.8	52,728,446
1945	13,927,955	39.9	20,957,744	60.1	34,885,699	10,056,325	22.4	44,942,024
1946	15,619,162	41.0	22,465,295	59.0	38,084,457	12,858,930	25.2	50,943,387
1947	16,054,011	43.4	20,909,101	56.6	36,963,112	12,603,545	25.4	49,566,657
1948	15,742,368	42.3	21,432,923	57.7	37,175,291	13,352,874	26.4	50,528,165
1949	11,858,088	43.9	15,172,562	56.1	27,030,650	10,376,808	27.7	37,407,458
1950	12,335,650	43.8	15,820,245	56.2	28,155,895	11,833,934	29.6	39,989,829
1951	10,847,787	41.2	15,494,452	58.8	26,342,239	11,135,990	29.7	37,478,229
1952	10,034,464	40.5	14,713,819	59.5	24,748,283	10,696,705	30.2	35,444,988
1953	6,838,769	38.2	11,054,720	61.8	17,893,489	8,606,482	32.5	26,499,971
1954	6,978,035	41.4	9,874,373	58.6	16,852,408	7,939,680	32.0	24,792,088
1955	6,660,939	45.9	7,837,819	54.1	14,498,758	7,703,907	34.7	22,202,665
1956	7,308,110	48.5	7,746,794	51.5	15,054,904	8,354,230	35.7	23,409,134
1957	6,657,479	52.8	5,958,574	47.2	12,616,053	7,543,157	37.4	20,159,210
1958	5,332,043	49.8	5,366,792	50.2	10,698,835	6,877,761	39.1	17,576,596
1959	4,700,542	49.9	4,714,928	50.1	9,415,470	7,096,343	43.0	16,511,813
1960	4,044,392	52.6	3,651,536	47.4	7,695,928	7,112,288	48.0	14,808,266
1961	3,777,778	49.8	3,406,808	50.2	6,784,586	7,246,646	51.6	14,031,232
1962	3,065,364	45.9	3,607,558	54.1	6,672,922	6,822,207	50.6	13,495,129
1963	3,665,962	54.6	3,048,784	45.4	6,714,746	7,467,842	52.7	14,182,588
1964	3,455,034	58.7	2,433,792	41.3	5,888,826	7,177,188	54.9	13,066,014

<sup>1</sup> As reported by Commonwealth of Pennsylvania, Department of Mines.

**Cutting Machines.**—Six cutting machines were used in 1964, one less than in 1963. However, the total undercut before shooting rose from 240,000 tons in 1963 to 417,000 tons in 1964, all of which was produced in the Wyoming region.

**Power Equipment.**—Although strip mining decreased 4 percent from 1963, and the recovery of coal from culm banks remained virtually the same, the number of power units reported increased by 27. In 1964, 121 shovels and 231 draglines were reported used in strip mining—3 more shovels and 26 more draglines than in 1963. In bank operations, 28 shovels and 26 draglines were reported used—an increase of 2 shovels and 1 dragline. Six shovels and 7 draglines were employed during the year for both stripping and culm bank recovery. Data on power shovels and draglines utilized by the anthracite industry in 1962–64 are shown in table 21.

**TABLE 21.—Power shovels and draglines used in recovering coal from culm banks and in stripping Pennsylvania anthracite, by types of power**

Type of power	1962			1963			1964		
	Number of power shovels	Number of draglines	Total	Number of power shovels	Number of draglines	Total	Number of power shovels	Number of draglines	Total
Gasoline.....	8	6	14	24	11	35	28	8	36
Electric.....	39	59	98	27	50	77	27	68	95
Diesel.....	91	177	268	94	182	276	97	184	281
Diesel-electric.....	5	6	11	1	3	4	3	4	7
Total.....	143	248	391	146	246	392	155	264	419

### PRICES AND VALUE OF SALES

Based on total production, including colliery fuel and dredge coal, the average value of Pennsylvania anthracite in 1964 was \$8.65 per short ton, a gain of 3 percent over that for 1963. Total value of the year's output dropped to \$148,648,000, or a decline of 3 percent. Prices of the larger sizes were steadier during the year than those of the smaller coals; shipments of the pea and larger size group declined 10 percent but dropped only 4 percent in total value, while shipments of the buckwheat No. 1 and smaller size category declined 3 percent and dropped 2 percent in total value.

Among the individual sizes, the industry reported average increases of \$0.74 for lump and broken (average value in 1963, \$12.10 per ton), \$0.91 for egg (\$12.03 in 1963), \$0.73 for stove (\$12.19 in 1963), \$0.68 for chestnut (\$12.24 in 1963), \$0.67 for pea (\$10.15 in 1963). As a result, the average per-ton value for the pea and larger group of sizes increased from \$11.65 to \$12.38. Average value of the buckwheat No. 1 and smaller size group was \$6.34, an increase of \$0.09 over the 1963 level. The largest increase (\$0.63) was for buckwheat No. 1, followed by buckwheat No. 2 (rice) (\$0.43), buckwheat No. 3 (barley) (\$0.31), buckwheat No. 4 (\$0.20), and buckwheat No. 5 (\$0.22). The "Other" was the only size classification showing a decrease (\$0.06). All of the foregoing individual size values exclude dredge coal.

As is customary in the Pennsylvania anthracite industry, spring discount prices were announced in late March and early April 1964. On egg, stove, and chestnut the spring prices represented a cut of \$1.25-\$1.50 per net ton; on pea, \$0.75-\$1.00; buckwheat No. 1 and No. 2 (rice), \$1.00 and \$0.25 on buckwheat No. 3 (barley).

During July new prices were announced and by the end of the month, the prices quoted in Saward's Journal were higher, ranging from \$0.50-\$1.00 on egg and stove; \$0.50-\$0.85 on chestnut; \$0.50-\$0.60 on pea; \$0.40 on buckwheat No. 1; \$0.25-\$0.50 on buckwheat No. 2 (rice) and \$0.25 on buckwheat No. 3 (barley). After the announcement of a new wage agreement in early September, prices again rose; but, in most instances, the prices were the same or lower than those quoted in December 1963. By the end of December 1964, wholesale prices quoted in Saward's Journal were as follows: Egg and stove at \$15.00 to \$15.50; chestnut, \$14.50-\$15.25; pea, \$11.85-\$12.50; buckwheat No. 1, \$10.40-\$10.50; buckwheat No. 2 (rice), \$10.50 and buckwheat No. 3 (barley) \$8.50-\$8.75. These prices reflected little change from those quoted in December 1963.

Average values, f.o.b. preparation plants are presented by regions in tables 23, 24, and 25. Trends in shipments and value, by size groups, are shown in figure 6.

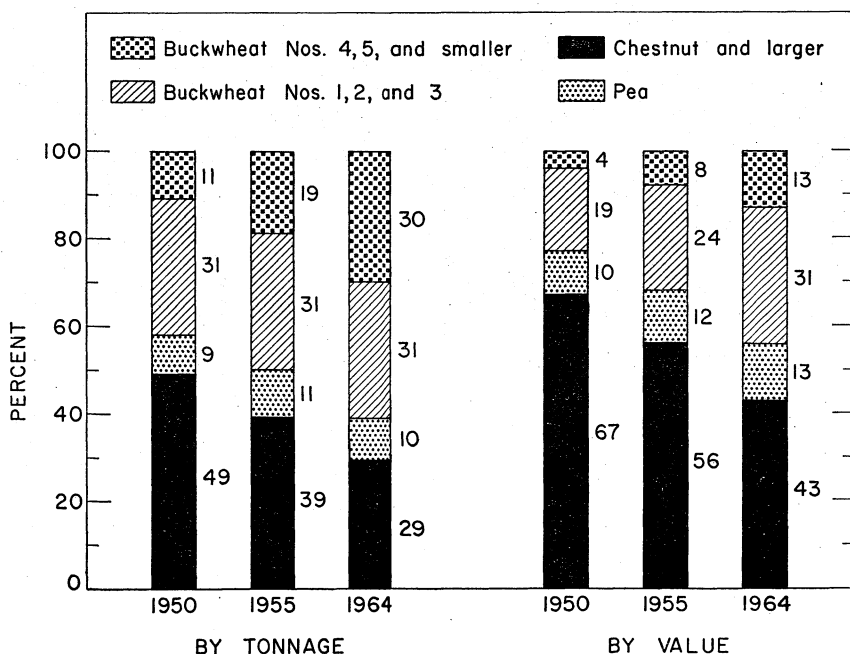


FIGURE 6. —Shipments of Pennsylvania anthracite, 1950, 1955, and 1964, by size groups, in percent of total tonnage and total value.

TABLE 22.—Standard anthracite specifications approved and adopted by the Anthracite Committee, effective July 23, 1947

Size	Round test mesh (inches)	Percent					
		Over- size maxi- mum	Undersize		Maximum impurities <sup>1</sup>		
			Maxi- mum	Mini- mum	Slate	Bone	Ash <sup>2</sup>
Broken.....	Through 4 $\frac{1}{2}$ .....				1 $\frac{1}{2}$	2	11
Egg.....	Over 3 $\frac{1}{4}$ to 3.....	5	15	7 $\frac{1}{2}$	1 $\frac{1}{2}$	2	11
	Through 3 $\frac{1}{4}$ to 3.....						
Stove.....	Over 2 $\frac{1}{16}$ .....	7 $\frac{1}{2}$	15	7 $\frac{1}{2}$	2	3	11
	Through 2 $\frac{1}{16}$ .....						
Chestnut.....	Over 1 $\frac{5}{8}$ .....	7 $\frac{1}{2}$	15	7 $\frac{1}{2}$	3	4	11
	Through 1 $\frac{5}{8}$ .....						
Pea.....	Over 1 $\frac{3}{16}$ .....	10	15	7 $\frac{1}{2}$	4	5	12
	Through 1 $\frac{3}{16}$ .....						
Buckwheat No. 1.....	Over $\frac{9}{16}$ .....	10	15	7 $\frac{1}{2}$			13
	Through $\frac{9}{16}$ .....						
Buckwheat No. 2 (rice).....	Over $\frac{5}{16}$ .....	10	15	7 $\frac{1}{2}$			13
	Through $\frac{5}{16}$ .....						
Buckwheat No. 3 (barley).....	Over $\frac{3}{16}$ .....	10	17	7 $\frac{1}{2}$			15
	Through $\frac{3}{16}$ .....						
Buckwheat No. 4.....	Over $\frac{3}{32}$ .....	20	20	10			15
	Through $\frac{3}{32}$ .....						
Buckwheat No. 5.....	Over $\frac{3}{64}$ .....	30	30	10			16
	Through $\frac{3}{64}$ .....			No limit			

<sup>1</sup> When slate content in sizes from broken to chestnut, inclusive, is less than above standards, bone content may be increased by 1 $\frac{1}{2}$  times the decrease in slate content under the allowable limits, but slate content specified above shall not be exceeded in any event.

A tolerance of 1 percent is allowed on maximum percentage of undersize and maximum percentage of ash content.

Maximum percentage of undersize is applicable only to anthracite as it is produced at preparation plant. Slate is defined as any material that has less than 40 percent fixed carbon.

Bone is defined as any material that has 40 percent or more, but less than 75 percent, fixed carbon.

<sup>2</sup> Ash determinations are on a dry basis.

**TABLE 23.—Average sales realization per net ton of Pennsylvania anthracite at preparation plants in 1964, by regions and sizes**

(Excludes dredge coal)

Size	Lehigh region			Schuylkill region		
	Shipped by rail	Shipped by truck	Total	Shipped by rail	Shipped by truck	Total
Lump <sup>1</sup> and broken.....				\$13.76	\$13.77	\$13.76
Egg.....	\$13.06	\$12.88	\$13.04	12.92	12.91	12.92
Stove.....	13.39	13.45	13.41	12.85	12.33	12.59
Chestnut.....	13.32	13.53	13.44	12.85	12.29	12.52
Pea.....	10.75	11.15	11.06	10.42	10.03	10.18
Total pea and larger.....	13.02	12.53	12.78	12.31	11.66	11.95
Buckwheat No. 1.....	9.48	9.78	9.63	9.68	9.19	9.42
Buckwheat No. 2 (rice).....	9.77	10.08	10.00	8.92	9.01	8.99
Buckwheat No. 3 (barley).....	7.29	7.15	7.21	6.88	6.87	6.87
Buckwheat No. 4.....	5.22	5.62	5.33	5.10	4.81	4.98
Buckwheat No. 5.....	5.20	4.96	5.17	4.67	3.83	4.43
Other <sup>2</sup> .....	3.39	2.96	3.16	3.22	3.52	3.37
Total buckwheat No. 1 and smaller.....	6.10	7.62	6.85	5.94	6.56	6.25
Total all sizes.....	8.84	9.56	9.19	8.07	8.47	8.28
	Wyoming region <sup>3</sup>			Total		
Lump <sup>1</sup> and broken.....	\$12.42	\$12.41	\$12.42	\$12.69	\$13.46	\$12.84
Egg.....	12.90	12.95	12.90	12.94	12.91	12.94
Stove.....	13.06	13.04	13.06	13.06	12.65	12.92
Chestnut.....	13.14	13.24	13.18	13.05	12.81	12.92
Pea.....	11.17	11.54	11.42	10.74	10.87	10.82
Total pea and larger.....	12.81	12.46	12.67	12.66	12.08	12.38
Buckwheat No. 1.....	9.76	10.22	10.04	9.68	9.70	9.69
Buckwheat No. 2 (rice).....	9.63	9.78	9.73	9.31	9.48	9.43
Buckwheat No. 3 (barley).....	6.91	6.98	6.93	6.97	6.95	6.95
Buckwheat No. 4.....	5.21	5.26	5.22	5.15	5.00	5.10
Buckwheat No. 5.....	4.92	5.06	4.95	4.84	4.06	4.66
Other <sup>2</sup> .....		1.87	1.87	3.26	2.68	2.88
Total buckwheat No. 1 and smaller.....	7.75	6.46	6.97	6.37	6.72	6.56
Total all sizes.....	10.81	8.85	9.82	9.08	8.79	8.93

<sup>1</sup> Quantity of lump included is insignificant.

<sup>2</sup> Includes various mixtures of buckwheat Nos. 2 to 5 and coal of relatively low dollar value.

<sup>3</sup> Includes Sullivan County.

TABLE 24.—Average sales realization per net ton of Pennsylvania anthracite at preparation plants, by regions and sizes

(Excludes dredge coal)

Size	Lehigh region					Schuylkill region				
	1960	1961	1962	1963	1964	1960	1961	1962	1963	1964
Lump <sup>1</sup> and broken		\$11.29				\$10.62	\$10.96	\$11.34	\$12.62	\$13.76
Egg	\$10.23	10.79	\$11.02	\$11.75	\$13.04	10.23	10.39	11.01	11.81	12.92
Stove	10.59	11.14	11.46	12.28	13.41	10.39	10.69	10.93	11.92	12.59
Chestnut	10.98	11.52	11.77	12.39	13.44	10.56	10.80	10.97	11.86	12.52
Pea	9.44	9.22	9.36	9.89	11.06	8.59	8.66	8.80	9.63	10.18
Total pea and larger	10.41	10.75	10.92	11.57	12.78	9.97	10.19	10.36	11.28	11.95
Buckwheat No. 1	8.75	8.24	8.03	8.76	9.68	8.14	7.99	8.09	8.78	9.42
Buckwheat No. 2 (rice)	9.29	8.99	8.80	9.25	10.00	7.99	7.94	7.99	8.63	8.99
Buckwheat No. 3 (barley)	7.25	6.89	6.68	6.74	7.21	6.76	6.62	6.54	6.67	6.87
Buckwheat No. 4	5.05	4.88	4.94	4.97	5.33	4.88	4.76	4.58	4.70	4.98
Buckwheat No. 5	4.89	4.70	4.94	4.86	5.17	4.23	4.21	4.16	4.12	4.43
Other <sup>2</sup>	1.77	1.86	2.02	3.00	3.16	2.90	2.99	3.45	3.25	3.37
Total buckwheat No. 1 and smaller	5.82	6.10	5.45	5.89	6.85	6.00	5.82	5.95	6.16	6.25
Total all sizes	7.60	7.98	7.48	7.81	9.19	7.50	7.51	7.68	8.12	8.28
	Wyoming region <sup>3</sup>					Total				
Lump <sup>1</sup> and broken	\$11.20	\$11.50	\$11.06	\$11.72	\$12.42	\$10.87	\$11.29	\$11.18	\$12.10	\$12.84
Egg	10.42	11.08	11.21	12.19	12.90	10.31	10.84	11.13	12.03	12.94
Stove	10.74	11.57	11.59	12.42	13.06	10.56	11.10	11.29	12.19	12.92
Chestnut	11.23	11.96	11.98	12.62	13.18	10.89	11.36	11.49	12.24	12.92
Pea	10.64	10.87	10.60	10.83	11.42	9.57	9.65	9.63	10.15	10.82
Total pea and larger	10.90	11.51	11.42	12.06	12.67	10.42	10.80	10.90	11.65	12.38
Buckwheat No. 1	8.92	9.34	8.86	9.51	10.04	8.54	8.55	8.39	9.06	9.69
Buckwheat No. 2 (rice)	9.09	9.24	8.95	9.41	9.73	8.56	8.55	8.47	9.00	9.43
Buckwheat No. 3 (barley)	7.16	7.15	6.77	6.53	6.93	6.95	6.83	6.64	6.64	6.95
Buckwheat No. 4	5.19	5.15	5.30	5.60	5.22	4.95	4.85	4.78	4.90	5.10
Buckwheat No. 5	4.78	4.90	4.61	4.77	4.95	4.43	4.43	4.41	4.44	4.66
Other <sup>2</sup>	2.54	2.18	2.22	1.92	1.87	2.52	2.64	2.62	2.94	2.88
Total buckwheat No. 1 and smaller	7.00	7.41	6.94	7.46	6.97	6.27	6.32	6.14	6.43	6.56
Total all sizes	8.92	9.54	9.26	9.94	9.82	8.01	8.26	8.19	8.64	8.93

<sup>1</sup> Quantity of lump included is insignificant.<sup>2</sup> Includes various mixtures of buckwheat Nos. 2 to 5 and coal of relatively low dollar value.<sup>3</sup> Includes Sullivan County.TABLE 25.—Average value per net ton of Pennsylvania anthracite from all sources, by regions<sup>1</sup>

Region	1963				1964			
	Shipped by rail	Shipped by truck	Colliery fuel	Total	Shipped by rail	Shipped by truck	Colliery fuel	Total
Lehigh	\$7.24	\$8.43	\$5.57	\$7.80	\$8.84	\$9.56	\$9.08	\$9.19
Schuylkill	7.18	8.33	7.58	7.76	7.47	8.30	8.20	7.88
Wyoming <sup>2</sup>	10.24	9.58	2.52	9.77	10.81	8.85	1.63	9.62
Total	8.20	8.72	3.05	8.40	8.71	8.70	2.42	8.65

<sup>1</sup> Value given for shipments is that at which coal left possession of producing company and does not include selling expenses.<sup>2</sup> Includes Sullivan County.

## EMPLOYMENT

Employment at anthracite operations continued to decline in 1964. Reports submitted to the Bureau on mine injuries and employment indicated that the average number of men working daily was 13,144, 3 percent less than in 1963.

Of the total number of men working daily in 1964, 40 percent were employed at underground mines; 14 percent in surface work at underground operations (including general shops); 23 percent at strip pits; 18 percent at preparation plants; 4 percent at culm banks; and, 1 percent on dredges. Notwithstanding the decrease of 12 percent in underground production, the average number of men working at deep mines (underground and surface) decreased only 5 percent. Employment at preparation plants decreased 2 percent and on river dredges 4 percent.

The average number of men working daily at strip pits and culm banks each increased 2 percent, despite the drop in production of 4 percent at strip pits and the increase of less than 1 percent at culm banks.

Of the total labor force, 50 percent was employed in the Schuylkill region, 36 percent in the Wyoming, and 14 percent in the Lehigh region. Employment declined in each of the regions as follows: Lehigh, 8 percent; Schuylkill, 2 percent; and Wyoming, 1 percent. The four major producing counties, Luzerne, Schuylkill, Northumberland, and Lackawanna provided work for 92 percent of the total labor force; employment was down 2 percent in both Luzerne and Northumberland Counties, 7 percent in Schuylkill, but up 2 percent in Lackawanna County.

Anthracite operations were active an average of 214 days in 1964—2 less than in 1963. In the Wyoming region, operations were active an average of 230 days; in the Schuylkill region, 208 days; in the Lehigh region, 194 days. The reduced labor force worked a total of 2,812,000 man-days. The productivity rate was 6.11 tons per man-day, down from the record high of 6.27 tons set in 1963. Details on the number of men employed, days worked, man-days of labor, and productivity rates are presented in table 26. The labor force is shown by counties in table 27.



**TABLE 26.—Men employed, days worked, man-days of labor, and output per man per day at operations producing Pennsylvania anthracite in 1964**

(Includes operations of strip contractors)

	Lehigh region	Schuylkill region	Wyoming region †	Total	
				1964	1963
<b>Average number of men working daily:</b>					
Underground.....	84	2,757	2,352	5,193	5,449
In strip pits.....	974	1,393	708	3,075	3,025
At culm banks.....	206	215	153	574	563
At preparation plants.....	534	1,262	617	2,413	2,473
Other surface.....	85	862	834	1,781	1,876
<b>Total excluding dredge operations.....</b>	<b>1,883</b>	<b>6,489</b>	<b>4,664</b>	<b>13,036</b>	<b>13,386</b>
Dredge operations.....		108		108	112
<b>Total.....</b>	<b>1,883</b>	<b>6,597</b>	<b>4,664</b>	<b>13,144</b>	<b>13,498</b>
<b>Average number of days active:</b>					
All operations except dredges.....	194	208	230	214	216
Dredge operations.....		245		245	231
<b>Average, all operations.....</b>	<b>194</b>	<b>208</b>	<b>230</b>	<b>214</b>	<b>216</b>
<b>Man days of labor:</b>					
All operations except dredges.....	365,590	1,346,503	1,073,310	2,785,403	2,885,954
Dredge operations.....		26,451		26,451	25,835
<b>Total, all operations.....</b>	<b>365,590</b>	<b>1,372,954</b>	<b>1,073,310</b>	<b>2,811,854</b>	<b>2,911,789</b>
<b>Average tons per man-day:</b>					
All operations except dredges.....	8.72	6.01	4.85	5.92	6.09
Dredge operations.....		26.66		26.66	26.77
<b>Average all operations.....</b>	<b>8.72</b>	<b>6.53</b>	<b>4.85</b>	<b>6.11</b>	<b>6.27</b>

† Includes Sullivan County.

**TABLE 27.—Men employed at operations producing Pennsylvania anthracite, by counties**

(Includes operations of strip contractors)

County	1963	1964	County	1963	1964
Berks, Lancaster, Lebanon, and Snyder.....	99	96	Northumberland.....	1,912	1,881
Carbon.....	343	258	Schuylkill.....	4,873	4,537
Columbia.....	307	456	Sullivan.....	11	20
Dauphin.....	181	179	Wayne.....	2	5
Lackawanna.....	1,086	1,107	<b>Total.....</b>	<b>13,498</b>	<b>13,144</b>
Luzerne.....	4,684	4,605			

## DISTRIBUTION

Reports submitted voluntarily to the Bureau of Mines by producers, wholesalers, and exporting firms, showed that 15,705,000 net tons of Pennsylvania anthracite was shipped during the 1963-64 coal year (April 1-March 31). Where possible, high-ash coal of low-dollar value, used largely as colliery fuel or for generation of electricity, was eliminated from the statistics. Of the total shipped to market during the year, about 75 percent was destined to points in the United States, 4 percent to Canada, and the remainder to overseas countries. Compared with 1962-63 coal-year, total shipments were up about 3 percent, with declines of 8 percent in the United States and 17 percent in exports to Canada. However, exports abroad doubled—rising from 1,666,000 tons in the 1962-63 coal year to 3,340,000 tons—as the result of continued shipments to U.S. Armed Forces in West Germany and sharply increased demand in Western Europe.

By size, shipments of pea and larger declined less than 1 percent, but buckwheat No. 1 and smaller sizes, as a group, rose 6 percent. In the United States demand for pea and larger sizes was 14 percent below 1962-63 coal-year levels, and in Canada, 20 percent lower. These losses were balanced by the increase of 75 percent in overseas exports of these sizes. The distribution pattern for the smaller sizes differed markedly, however, as shipments of buckwheat No. 1 and smaller registered a gain of 156 percent in overseas markets, while dropping 4 percent in the United States and 9 percent in Canada. Despite the sharp gain in exports of the smaller sizes, of greater importance to the producing industry was the fact that 60 percent of European imports consisted of the higher-priced large sizes. West Germany led all European countries with 908,000 tons (including coal shipped to U.S. Armed Forces), followed by France, Netherlands, Belgium-Luxembourg, and Italy in that order.

Because of the 14 percent increase in rail traffic (due entirely to increased exports) and the 9 percent decrease in reported truck shipments, rail shipments accounted for 58 percent of the coal-year total, compared with 53 percent in the 1962-63 year. Truck shipments fell from 47 percent to 42 percent in 1963-64. Data on the distribution of anthracite during the coal year 1963-64 are presented in table 28.

According to data released by the Pennsylvania Department of Mines and Mineral Industries, both rail and truck shipments declined in calendar year 1964—by 7 percent and slightly more than 1 percent, respectively. Rail shipments to the New England States, New York, New Jersey, and Delaware all decreased, whereas shipments to the other States increased from 7 percent for the "Other States" category to 175 percent for Indiana. The decline in exports to Canada amounted to 134,000 tons, and exports to other countries were off 510,000 tons, chiefly because of the decrease to European countries. Shipments by truck to markets in the producing region remained virtually the same whereas those in Pennsylvania markets outside the producing region increased 4 percent. The District of Columbia

TABLE 28.—Distribution of Pennsylvania anthracite, April 1, 1963 to March 31, 1964, by States, Provinces, and countries of destination in net tons

Destinations	Pea and larger						Buckwheat No. 1 and smaller					Total all sizes	Percent of total
	Broken	Egg	Stove	Chestnut	Pea	Total	Buckwheat No. 1	Buckwheat No. 2 (rice)	Buckwheat No. 3 (barley)	Other	Total		
<b>United States:</b>													
<b>New England States:</b>													
Connecticut.....		983	22,285	27,282	1,629	52,179	3,225	5,719	6,265	90	15,299	67,478	0.4
Maine.....		1,674	20,313	19,505	433	41,925	3,924	7,849		1	11,774	53,699	.4
Massachusetts.....		11,045	111,650	66,499	7,537	196,781	28,664	29,665	6,130	290	64,749	261,480	1.7
New Hampshire.....		1,227	13,147	10,552	770	25,696	2,790	6,743		334	9,867	35,563	.2
Rhode Island.....		288	6,249	5,097	338	12,572	3,986	927	14	121	5,048	17,620	.1
Vermont.....		2,934	19,080	15,421	2,960	40,395	11,718	16,109			27,827	68,222	.4
<b>Total.....</b>		<b>18,151</b>	<b>192,724</b>	<b>144,956</b>	<b>13,667</b>	<b>369,498</b>	<b>54,307</b>	<b>67,012</b>	<b>12,409</b>	<b>836</b>	<b>134,564</b>	<b>504,062</b>	<b>3.2</b>
<b>Middle Atlantic States:</b>													
New Jersey.....	572	3,511	130,634	283,994	73,860	492,571	107,501	146,089	207,083	283,106	743,779	1,236,350	7.9
New York.....		25,736	343,380	321,064	449,925	1,140,105	400,235	213,783	266,472	284,211	1,164,651	2,304,756	14.7
Pennsylvania.....	742	31,957	484,313	1,049,797	876,023	2,442,832	1,002,052	926,771	1,123,085	1,041,665	4,093,573	6,536,405	41.6
<b>Total.....</b>	<b>1,314</b>	<b>61,204</b>	<b>958,327</b>	<b>1,654,855</b>	<b>1,399,808</b>	<b>4,075,508</b>	<b>1,509,788</b>	<b>1,286,593</b>	<b>1,596,640</b>	<b>1,608,982</b>	<b>6,002,003</b>	<b>10,077,511</b>	<b>64.2</b>
<b>South Atlantic States:<sup>2</sup></b>													
Delaware.....		5,177	10,884	27,595	598	44,254	978	2,838	2,018	570	6,404	50,658	.3
District of Columbia.....		337	11,293	9,959	699	22,288	4,157	572		1,054	6,354	28,642	.2
Maryland.....		666	47,026	41,021	3,797	92,510	19,280	2,631	1,200	238,038	261,149	353,659	2.2
Virginia.....		54	5,610	3,948	1,623	11,235	1,828	191	31	540	2,590	13,825	.1
<b>Total.....</b>		<b>6,234</b>	<b>74,813</b>	<b>82,523</b>	<b>6,717</b>	<b>170,287</b>	<b>26,243</b>	<b>6,232</b>	<b>3,820</b>	<b>240,202</b>	<b>276,497</b>	<b>446,784</b>	<b>2.8</b>
<b>Lake States:<sup>3</sup></b>													
Illinois.....	42	17	1,578	3,814	246	5,697	27,439	10,682	3,415	24,395	65,931	71,628	.5
Michigan.....		45	3,593	2,574	378	6,590	9,171	4,736	29	77,650	91,586	98,176	.6
Minnesota.....			279	566	217	1,062	504	30	49	8,313	8,896	9,958	.1
Ohio.....		75	135	1,742	197	2,149	38,532	6,881	16,311	120,237	181,961	184,110	1.2
Wisconsin.....			11,314	12,977	703	24,994	972	1,163	22	11,368	13,525	38,519	.2
<b>Total.....</b>	<b>42</b>	<b>137</b>	<b>16,899</b>	<b>21,673</b>	<b>1,741</b>	<b>40,492</b>	<b>76,618</b>	<b>23,492</b>	<b>19,826</b>	<b>241,963</b>	<b>361,899</b>	<b>402,391</b>	<b>2.6</b>
<b>Other States.....</b>		<b>1,861</b>	<b>502</b>	<b>7,656</b>	<b>9,776</b>	<b>19,795</b>	<b>41,275</b>	<b>8,683</b>	<b>20,583</b>	<b>183,999</b>	<b>254,540</b>	<b>274,335</b>	<b>1.7</b>
<b>Total United States.....</b>	<b>1,366</b>	<b>87,587</b>	<b>1,243,265</b>	<b>1,911,663</b>	<b>1,431,709</b>	<b>4,675,580</b>	<b>1,708,231</b>	<b>1,392,012</b>	<b>1,653,278</b>	<b>2,275,982</b>	<b>7,029,503</b>	<b>11,705,083</b>	<b>74.5</b>

Canada:														
Ontario.....		6,707	151,519	148,126	41,207	347,559	51,869	20,060		2,740	75,341	422,900		2.7
Quebec.....		1,536	39,922	30,686	1,650	73,794	38,332	10,860		11,915	149,788	223,582		1.4
Other Provinces.....		636	3,577	3,393	3	7,609	4	966		3,424	5,885	13,494		.1
Total Canada.....		8,879	195,018	182,205	42,860	428,962	90,205	31,886		16,146	231,014	659,976		4.2
Other countries.....	156	386,303	768,557	465,755	380,819	2,001,680	341,419	102,464		174,199	1,338,474	3,340,154		21.3
Grand total.....	1,512	482,859	2,206,840	2,559,623	1,855,388	7,106,222	2,139,855	1,526,362		1,920,254	3,012,520	8,598,991		100.0

<sup>1</sup> Includes "Local Sales."

<sup>2</sup> Shipments to other States in the South Atlantic area are included in "Other States."

<sup>3</sup> Shipments to Indiana are included in "Other States."

was the only other trucking market showing an increase. Truck data for 1964 by months are shown in table 29, rail and truck shipments for the period 1960-64 are shown in tables 30 and 31.

TABLE 29.—Truck shipments of Pennsylvania anthracite in 1964, by months, and by States of destination, in net tons <sup>1</sup>

Destination	January	February	March	April	May	June	July
<b>Pennsylvania:</b>							
Within region.....	381, 213	339, 871	279, 957	268, 162	226, 939	242, 382	180, 494
Outside region.....	329, 393	298, 583	253, 469	280, 191	261, 952	263, 352	194, 339
New York.....	83, 089	79, 103	49, 768	57, 763	54, 306	59, 683	42, 122
New Jersey.....	58, 534	48, 563	32, 538	42, 449	46, 876	48, 692	24, 858
Delaware.....	6, 258	4, 170	2, 047	1, 799	3, 632	2, 786	168
Maryland.....	12, 171	10, 635	5, 790	4, 853	4, 424	4, 187	2, 872
District of Columbia.....	288	1, 012	928	126	86	159	198
Other States.....	2, 888	3, 782	2, 458	1, 037	1, 938	2, 779	1, 620
<b>Total: 1964.....</b>	<b>873, 834</b>	<b>785, 719</b>	<b>627, 555</b>	<b>656, 380</b>	<b>599, 853</b>	<b>624, 000</b>	<b>446, 671</b>
1963.....	1, 006, 651	904, 393	727, 823	508, 102	574, 556	548, 756	428, 887
	August	September	October	November	December	Total	Percent of total trucked
<b>Pennsylvania:</b>							
Within region.....	225, 348	225, 146	251, 699	262, 592	347, 530	3, 231, 333	41. 1
Outside region.....	268, 911	305, 674	264, 555	235, 216	328, 586	3, 284, 221	41. 8
New York.....	55, 170	49, 100	54, 520	43, 302	64, 061	691, 987	8. 8
New Jersey.....	31, 472	38, 898	41, 901	33, 735	52, 705	500, 921	6. 4
Delaware.....	895	1, 957	2, 549	2, 696	4, 462	34, 019	. 4
Maryland.....	4, 500	6, 714	7, 147	5, 998	8, 956	78, 227	1. 0
District of Columbia.....	326	148	353	455	1, 000	5, 079	. 1
Other States.....	4, 599	4, 177	4, 327	3, 029	3, 436	36, 070	. 4
<b>Total: 1964.....</b>	<b>591, 221</b>	<b>631, 814</b>	<b>627, 051</b>	<b>587, 023</b>	<b>810, 736</b>	<b>7, 861, 857</b>	<b>100. 0</b>
1963.....	527, 612	613, 110	676, 370	659, 477	794, 369	7, 970, 106	100. 0

<sup>1</sup> Compiled from reports of Pennsylvania Department of Mines and Mineral Industries; does not include dredge coal.

TABLE 30.—Rail shipments of Pennsylvania anthracite, by destinations, in net tons <sup>1</sup>

Destination	1960	1961	1962	1963	1964
New England States.....	712, 780	602, 262	465, 535	407, 194	381, 880
New York.....	2, 458, 043	2, 267, 861	1, 939, 004	1, 515, 786	1, 317, 443
New Jersey.....	988, 852	826, 323	858, 587	675, 159	640, 969
Pennsylvania.....	2, 236, 964	2, 275, 481	2, 309, 182	2, 001, 932	2, 209, 434
Delaware.....	48, 586	42, 194	21, 373	16, 630	12, 002
Maryland.....	167, 355	255, 658	182, 222	207, 904	230, 209
District of Columbia.....	22, 024	19, 561	15, 983	14, 982	19, 008
Virginia.....	17, 524	14, 158	18, 876	10, 613	12, 373
Ohio.....	165, 903	174, 620	165, 211	138, 546	162, 154
Indiana.....	44, 763	46, 650	29, 754	26, 306	72, 358
Illinois.....	91, 640	76, 348	75, 435	77, 548	102, 438
Wisconsin.....	60, 737	59, 815	41, 322	24, 562	29, 408
Minnesota.....	13, 032	8, 636	6, 304	8, 394	21, 492
Michigan.....	50, 835	55, 218	43, 028	35, 377	50, 964
Other States.....	154, 586	121, 119	190, 028	217, 351	231, 842
<b>Total United States.....</b>	<b>7, 233, 624</b>	<b>6, 845, 904</b>	<b>6, 361, 844</b>	<b>5, 378, 284</b>	<b>5, 493, 474</b>
Canada.....	1, 067, 181	890, 058	713, 336	647, 437	513, 061
Other foreign countries.....	68, 875	82, 636	516, 376	1, 963, 671	1, 443, 751
<b>Grand total.....</b>	<b>8, 369, 680</b>	<b>7, 818, 598</b>	<b>7, 591, 556</b>	<b>7, 979, 392</b>	<b>7, 450, 286</b>

<sup>1</sup> Compiled from reports of Pennsylvania Department of Mines and Mineral Industries; does not include dredge coal.

**TABLE 31.—Truck shipments of Pennsylvania anthracite, by destinations, in net tons <sup>1</sup>**

Destination	1960	1961	1962	1963	1964
Pennsylvania:					
Within region.....	3,826,445	3,744,781	3,471,725	3,227,838	3,231,333
Outside region.....	2,900,414	2,891,607	2,915,220	3,155,875	3,284,221
New York.....	1,217,342	1,194,765	844,447	870,186	691,987
New Jersey.....	548,678	641,329	591,905	547,333	500,921
Delaware.....	48,221	45,310	43,863	37,465	34,019
Maryland.....	103,381	92,837	92,249	89,995	78,227
District of Columbia.....	6,232	5,753	6,573	4,443	5,079
Other States.....	17,703	26,169	32,214	36,971	36,070
Total.....	8,668,416	8,642,551	7,998,196	7,970,106	7,861,857

<sup>1</sup> Compiled from reports of Pennsylvania Department of Mines and Mineral Industries; does not include dredge coal.

The tonnage of anthracite moving over Lake Erie docks increased from 192,000 net tons in 1963 to 217,000 tons in 1964, but decreased 19,000 tons over Lake Ontario docks. Receipts were about 15,000 tons greater at Duluth-Superior. At Upper-Lake docks, receipts were 6,000 tons higher on Lake Superior, but declined about 8,000 tons at Lake Michigan. The exdock movement to inland points increased on Lake Superior but decreased on Lake Michigan. Detailed data on the Lake-dock trade in Pennsylvania anthracite are shown in table 2.

## CONSUMPTION

Apparent consumption of Pennsylvania anthracite in the United States in 1964, calculated as production minus exports (including coal shipped to West Germany for the use of U.S. Armed Forces), totaled 14.4 million net tons—a gain of 2 percent. This is the first year since 1956 to show an increase in consumption. Although use data on anthracite are incomplete, the larger part of the gain apparently was attributable to increased demand for the smaller industrial sizes. Demand by the major European countries for imports of American anthracite declined drastically (see table 34). Exports to Canada again showed a decrease (20 percent), and deliveries by United States retail dealers outside the producing region were approximately 18 percent below the 1963 volume.

Consumption of Pennsylvania anthracite at electric-utility plants increased, as the total for 1964 (2,239,000 tons) represented a gain of 5 percent. Data for the iron and steel industry are incomplete as no data are available for miscellaneous purposes. However, anthracite used for coke making increased about 41,000 tons, and that used for sintering and pelletizing, 248,000 tons. Consumption at cement plants dropped about 31,000 tons, and the amount used as colliery fuel also decreased (17,000 tons).

Consumption of Pennsylvania anthracite by public utility and coke plants is shown, by months, in table 2. Apparent consumption of anthracite, heating and range oil and natural gas is shown in table 32 for the individual States comprising the primary anthracite marketing area. Historical data on retail-dealer deliveries, and consumption for certain industrial purposes are presented in table 33.

**TABLE 32.—Apparent consumption of anthracite, heating and range oil, and natural gas, in the principal anthracite markets**

(Thousand net tons)

Fuel	New England	New York	New Jersey	Pennsylvania	Delaware	Maryland	District of Columbia	Total	Percent of total fuels
<b>Anthracite (all users):<sup>1</sup></b>									
1961.....	602	2 3,463	2 1,468	8,912	88	348	25	14,906	10.5
1962.....	466	2 2,783	2 1,451	8,696	65	274	23	13,758	9.3
1963.....	407	2 2,386	2 1,223	8,386	54	298	19	12,773	8.6
1964.....	381	2 2,009	2 1,142	8,725	46	309	24	12,636	8.5
<b>Oil (heating and range):<sup>3</sup></b>									
1961.....	32,087	30,285	11,581	11,018	873	4,224	1,015	91,083	64.0
1962.....	32,891	32,294	12,076	12,433	1,003	4,442	1,092	96,231	64.8
1963.....	31,783	32,154	12,829	12,519	1,148	4,506	1,167	96,106	64.4
1964.....	31,432	30,988	12,851	12,484	934	4,692	1,498	94,879	63.7
<b>Natural gas:<sup>4</sup></b>									
1961.....	3,927	12,834	4,155	12,240	206	2,887	(0)	36,249	25.5
1962.....	4,298	13,590	4,551	12,685	228	3,086	(0)	38,438	25.9
1963.....	4,611	14,290	4,897	12,992	249	3,218	(0)	40,257	27.0
1964.....	4,850	14,499	5,303	13,080	262	3,397	(0)	41,391	27.8
<b>Total:</b>									
1961.....	36,616	46,582	17,204	32,170	1,167	7,459	1,040	142,238	100.0
1962.....	37,655	48,667	18,078	33,814	1,296	7,802	1,115	148,427	100.0
1963.....	36,801	48,830	18,949	33,897	1,451	8,022	1,186	149,136	100.0
1964.....	36,663	47,496	19,296	34,289	1,242	8,398	1,522	148,906	100.0

<sup>1</sup> Pennsylvania Department of Mines and Mineral Industries.<sup>2</sup> Part of the anthracite shown as shipped to New Jersey is reshipped to New York.<sup>3</sup> Converted to coal equivalent upon the basis of 4 barrels of fuel oil equaling 1 ton of coal.<sup>4</sup> Converted to coal equivalent upon the basis of 24,190 cubic feet of natural gas equaling 1 ton of coal.<sup>5</sup> District of Columbia included with Maryland.<sup>6</sup> Natural gas for the District of Columbia included with Maryland.**TABLE 33.—Retail dealer deliveries and consumption of Pennsylvania anthracite in the United States, 1955-64, by selected consumer categories**

(Thousand net tons)

Year	Retail dealer deliveries <sup>1</sup>	Colliery fuel	Railroads <sup>2</sup>	Electric utilities <sup>3</sup>	Briquet plants	Cement plants	Iron and steel industry		
							Coke making	Sintering and pelletizing <sup>4</sup>	Other <sup>5</sup>
1955.....	13,019	419	457	3,209	264	199	366	385	443
1956.....	13,018	342	409	3,296	228	244	377	564	625
1957.....	10,670	279	361	3,363	156	221	389	868	698
1958.....	9,386	195	335	2,786	120	183	255	685	686
1959.....	7,562	129	292	2,629	43	159	369	780	683
1960.....	6,775	102	248	2,751	31	152	370	754	720
1961.....	5,070	45	NA	2,509	28	153	320	588	685
1962.....	4,767	152	NA	2,297	(0)	188	420	560	609
1963.....	4,055	161	NA	2,155	(0)	184	451	766	670
1964.....	3,334	144	NA	2,239	(0)	153	492	1,014	NA

NA Not available.

<sup>1</sup> Estimated from reports submitted by a selected list of retail dealers. Does not include local sales.<sup>2</sup> Association of American Railroads.<sup>3</sup> Federal Power Commission.<sup>4</sup> Annual Statistical Report, American Iron and Steel Institute.<sup>5</sup> Annual Statistical Report, American Iron and Steel Institute. Contains a small but not exactly determined amount of anthracite used for sintering.<sup>6</sup> Concealed to avoid disclosure of individual company data.

## STOCKS

Data on producer stocks were discontinued with October 1962, at which time only 124,000 tons were in ground storage at the mines. For many decades, the anthracite industry traditionally stored mil-

lions of tons of prepared coal in the producing region to satisfy a demand that normally far exceeded production during the winter months. However, with the long-term decline for its product and increased costs of storing coal, the industry has so reduced its mine-storage capacity that today it apparently lacks the flexibility to meet sudden, unexpected demand for large tonnages—particularly of a single size, or a narrow range of sizes.

Retail dealers, either in anticipation of increased exports or fear of a recurrence of the severe winter of 1962-63 increased their stocks over 1963. These increases ranged from 10,000 tons in January to 128,000 tons in June. The only months registering a slight decrease were March and November. Yearend stocks were 50,000 tons higher than 1963.

Public utilities again decreased their stocks but increased consumption by 100,000 tons. At the close of the year the utilities reported stocks at 1,247,000 tons, 4 percent below the 1963 year-end figure. Coke plants increased their stocks by 14 percent. Stocks on the Upper Lake Docks decreased drastically, with stocks at Lake Michigan docks down by 83 percent and at Lake Superior by 24 percent.

## FOREIGN TRADE

Data released by the Bureau of the Census, U.S. Department of Commerce, indicate that 1,575,000 net tons of Pennsylvania anthracite was exported in 1964, a decrease of 53 percent from 1963. The entire loss was attributable to substantial decreases in Western Europe and Canada, minor gains in Asia were offset by declines in exports to South America, Africa, and Oceania.

Census export data in table 34 show that 862,000 tons of anthracite were shipped to Europe in 1964, a decrease of 66 percent from the 1963 figure. However, this does not fully reflect the total movement of anthracite to the Continent, because the Bureau of the Census does not include in its figures coal shipped abroad for the use of U.S. Armed Forces. According to data furnished to the Bureau of Mines by the Association of American Railroads, almost 965,500 tons were dumped at tidewater piers for shipment to West Germany, and 396,700 tons were consigned to Netherlands. Of this amount, approximately 1,160,000 tons were intended for the use of U.S. Armed Forces in Germany. A more accurate measure of the importance of the export trade to the industry can be obtained, therefore, by adding this military tonnage to the Census data. Such an addition would show that about 2,022,000 tons were shipped to Europe. Also, the figure for total exports would approximate 2,736,000 tons.

Although no size data are available by calendar years, trade sources indicated the major part of exports in 1964 consisted of the larger sizes, thus helping the industry to absorb further losses in space-heating markets of the United States and Canada.

As indicated in footnote 9 to table 2, the Bureau of the Census discontinued issuing separate data on imports of anthracite beginning with September 1963. Since that date, the small quantities imported into the country have been combined with bituminous coal.



TABLE 34.—Anthracite exported from the United States, by countries and customs districts

(Net tons)

Country	1963	1964	Customs district	1963	1964
<b>North America:</b>			<b>North Atlantic:</b>		
Canada.....	794,585	636,867	Maine and New Hampshire.....	128	50
Canal Zone.....	27		New York.....	7,175	4,011
Costa Rica.....	48		Philadelphia.....	2,672,468	1,095,655
Dominican Republic.....		76	<b>South Atlantic:</b>		
Haiti.....	60	37	Maryland.....	9,159	712
Honduras.....	13		Virginia.....	1,476	533
Jamaica.....	122	46	<b>Gulf Coast:</b>		
Mexico.....	7,319	7,712	Florida.....	48	
Trinidad and Tobago.....	158	69	Galveston.....	2,750	3,313
<b>Total.....</b>	<b>802,332</b>	<b>644,807</b>	Mobile.....	788	
			New Orleans.....	1,826	1,375
			Sabine.....	481	
<b>South America:</b>			<b>Mexican border:</b>		
Argentina.....		4,424	Arizona.....	146	
Brazil.....	5,336	1,701	Laredo.....	6,510	7,347
Chile.....	529	387	<b>Northern border:</b>		
Colombia.....	54	341	Buffalo.....	459,945	328,511
Peru.....	1,193	32	Duluth and Superior.....	1,167	2,077
Surinam.....	38	36	Michigan.....	672	1,950
Venezuela.....	8,094	6,722	Ohio.....	1,688	3,073
<b>Total.....</b>	<b>15,244</b>	<b>13,643</b>	Rochester.....	22,545	5,501
			St. Lawrence.....	166,317	119,849
			Vermont.....	1,524	870
<b>Europe:</b>			<b>Pacific Coast:</b>		
Belgium-Luxembourg.....	543,874	140,486	Washington.....	527	270
Denmark.....	50	54	<b>Total.....</b>	<b>3,357,340</b>	<b>1,575,097</b>
France.....	723,964	291,796			
Germany, West.....	52,163	679			
Italy.....	259,946	208,313			
Netherlands.....	829,118	201,071			
Spain.....	93,791	19,183			
Sweden.....	96				
United Kingdom.....	334	439			
Yugoslavia.....	155				
<b>Total.....</b>	<b>2,503,491</b>	<b>862,021</b>			
<b>Asia:</b>					
India.....	3,269	2,268			
Indonesia.....		77			
Iran.....	275	39			
Israel.....	10,867	8,385			
Japan.....	3,714	11,351			
Korea, Republic.....		47			
Pakistan.....		49			
Philippines.....	277	120			
Saudi Arabi.....		30			
Viet-Nam.....	14,583	29,385			
<b>Total.....</b>	<b>32,985</b>	<b>51,751</b>			
<b>Africa:</b>					
Kenya.....		565			
Rhodesia and Malawi.....		43			
Tunisia.....	792				
<b>Total.....</b>	<b>792</b>	<b>608</b>			
<b>Oceania:</b>					
Australia.....	2,433	2,267			
New Zealand.....	63				
<b>Total.....</b>	<b>2,496</b>	<b>2,267</b>			
<b>Grand total.....</b>	<b>3,357,340</b>	<b>1,575,097</b>			

r Revised.

Source: Bureau of the Census.

NOTE.—According to the Association of American Railroads, 2,005,763 net tons of anthracite was exported to Europe in 1964, compared with 3,210,156 tons in 1963. Of this total, 965,479 tons was consigned to West Germany and 396,710 to Netherlands, including shipments for the use of U.S. military forces in West Germany. This compares with 860,800 tons to West Germany and 847,598 tons to Netherlands for the same period in 1963.

## WORLD PRODUCTION

World production of anthracite totaled 205.7 million tons in 1964 according to estimates and data reported by several sources, an increase of approximately 2 percent over the revised figure for 1963. In Europe, relatively small tonnage increases were reported for Belgium and the United Kingdom; however, the estimated increase of 1.2 million tons in West Germany placed the total for the Continent well above the 1963 output. Elsewhere, the most significant increases occurred in North and South Korea, with the latter almost doubling its production since 1960 with U.S. aid. Production in the United States decreased by more than 1 million tons. In the U.S.S.R., the largest anthracite-producing country in the world, output was estimated at 85 million tons in 1964, a gain of less than 1 percent. World production of anthracite for the 5-year period, 1960-64, is shown in table 35.

TABLE 35.—World production of anthracite, by countries <sup>1</sup>

(Thousand short tons)

Country	1960	1961	1962	1963	1964 <sup>2</sup>
Belgium.....	8,815	8,210	8,406	8,562	8,710
Bulgaria.....	177	210	217	239	• 220
China *.....	24,800	22,000	22,000	22,000	23,100
France.....	13,683	12,849	12,942	11,998	• 11,400
Germany:					
East *.....	275	275	275	275	275
West.....	13,257	13,803	14,351	14,969	16,217
Ireland.....	143	129	146	144	160
Italy.....	22	26	18	15	10
Japan.....	1,987	2,088	2,065	1,982	1,884
Korea:					
North *.....	7,500	8,300	9,900	10,700	12,300
South.....	5,897	6,486	8,206	9,764	10,605
Morocco.....	454	452	408	445	441
Netherlands *.....	4,400	4,400	4,400	4,300	4,300
New Zealand.....	1	( <sup>2</sup> )	1	( <sup>2</sup> )	( <sup>2</sup> )
Peru.....	34	23	24	23	34
Portugal.....	480	518	446	459	489
Rumania *.....	17	17	17	17	17
South Africa, Republic of.....	709	1,429	1,224	1,270	1,449
Spain.....	2,771	2,863	2,913	3,057	2,918
Switzerland *.....	11	11	11	11	11
U.S.S.R.....	85,995	85,405	84,175	84,530	• 85,000
United Kingdom.....	4,026	3,973	4,371	4,658	5,150
United States (Pennsylvania).....	18,817	17,446	16,894	18,267	17,184
Vietnam:					
North.....	2,860	3,118	3,823	3,715	• 3,700
South.....	30	63	78	115	164
World total (estimate) <sup>1</sup> .....	197,200	194,100	197,300	201,500	205,700

\* Estimate. <sup>2</sup> Preliminary.<sup>1</sup> This table incorporates revisions of data published in previous anthracite chapters. Data do not add to totals shown because of rounding where estimated figures are included in the detail.<sup>2</sup> Less than one half unit.

NOTE.—An undetermined amount of semianthracite is included in the figures for some countries.

## TECHNOLOGY

**Mining.**—Four of eight blocks were completed of a designed, half-replication experiment, with seven factors involved, in the operation of the Bureau's hydraulic miner. Data are evaluated as the blocks are completed. Factors considered are: Line pressure, water volume at the face, depth of round, number of mast set-ups, rate of nozzle

travel, cutting pattern, and angle of jet impact. The effect of water infusion on the jet-cutting operation was investigated, but the tests proved negative under the conditions encountered.

Electro-mechanical equipment to automate movements of the hydraulic miner and jet-cutting, together with a depth-sensing device, was developed and installed by an outside concern. A malfunction was encountered in the jet-depth probe, which is being corrected. The automating equipment is undergoing permissibility tests at the Bureau's Pittsburgh testing station.

Tests with the Bureau-designed prototype hydraulic-hoisting system<sup>3</sup> were concluded with the completion of over 3,000 trial runs. The plant is being maintained in operating condition for demonstration purposes.

**Preparation.**—Investigations on the applicability of dense-media (magnetite) washing processes to the beneficiation of fine-sized anthracites were extended using blended and separate feeds of buckwheat No. 1, rice, and barley sizes. The data obtained show that separate washing of the three sizes resulted in maximum recovery of theoretical yields at high efficiencies. It was also found that as the size was decreased, misplaced material in the product and refuse increased, ash content rose, and efficiency fell. Test runs were made at 1.85, 1.80, and 1.70 sp. gr. Results are being evaluated.

Laboratory investigations on the preparation of low-ash anthracite during the first half of 1964 were confined to test runs with low-, medium, and high-volatile buckwheat No. 1 size anthracite. Original ash in the test samples varied from 7.3 percent in low-volatile samples to 9.0 percent in medium-volatile coal. With separating media varying from 1.36 to 1.55 sp. gr., the end product recovered varied from 16.5 percent, at 1.8 percent ash, for the high-volatile material to 18 percent, at 3.1 percent ash, for the medium-volatile samples. The low-volatile sample, however, yielded only a 5-percent recovery (2.5 percent ash) at 1.55 sp. gr.

A project was initiated to investigate the washability characteristics of Pennsylvania anthracite, and to systematically sample and assay the major anthracite beds to obtain the basic data needed to improve preparation plant design and processing methods. Work began with analyses of five samples from the Bottom Red Ash bed in the Northern field.

Research on developing a device for dewatering fine-sized anthracite was centered around an inverted conical spray chamber utilizing an upward-flowing air current to carry off the atomized moisture at varying air velocities and temperatures. Fluctuations observed in the reduction of moisture content and recovery will undergo further study.

**Properties.**—Research on the surface properties of anthracite continued with investigations on the use of nitrogen compared with carbon dioxide as low-temperature adsorbates in determining surface areas. The major portion of the work comprised running samples of Northern and Southern field anthracites which were unirradiated or vacuum irradiated, and exposed to  $10^6$  rads gamma irradiation in air. Calculations using the four different forms of the BET equation

<sup>3</sup> Dierks, H. A., and H. B. Link. Development of a Lock-Hopper Feeder for Hydraulic Hoisting of Coal. BuMines Rept. of Inv. 6347, 1964, 27 pp.

showed that by all forms of the equation, the specific surface of each anthracite exposed to  $10^6$  rads gamma radiation in air had increased over the unirradiated or vacuum irradiated samples. Studies to date indicate that carbon dioxide appears to be a valid agent for determining the specific surface of coals. Plans include further studies with nitrogen to obtain data for comparison.

Research was concluded on the electrical resistivity of anthracite. A definite relationship was established between moisture and volatile content of the samples tested and their electrical conductivity. A report on this investigation is being prepared for publication. Studies on the effect of gamma radiation upon the physical properties of anthracite<sup>4</sup> were also concluded with research on the reactions with chlorine, following those with flourine. In the presence of radiation at  $400^\circ\text{C}$ ., the volatile matter in the residue increased 350 percent compared to 270 percent without radiation.

The possibility of converting anthracite by chemical treatment into a form suitable for use in carbon products requiring ultrafine particles was also studied with concentrated nitric acid as the oxidizing agent. Further work is planned to study the effect of alkali concentration on the dispersion of the acid-insoluble residue and the nature of the residue dispersed with 0.1 normal sodium hydroxide.

**Utilization.**—Bureau studies to promote the use of anthracite as a metallurgical fuel<sup>5</sup> were extended during the year to investigate the possible use of calcined hollow-core briquets as a blast furnace fuel. If successful, the fuel will be tested in the Bureau's experimental blast furnace at Bruceton, Pa. The initial objective was to develop the forming and calcining process to produce briquets with a tumbler stability approximating the 45 percent obtained in previous pilot plant production. Experiments were conducted with a screw feed compactor on the feed system, and the product compared with briquets made with a paddle-feeder installation. The briquets made with the compactor showed an increase of 30 percent in tumbler stability, using both direct and indirect firing. A series of experiments were made to determine the feasibility of crushing and reprocessing approximately 175 tons of inferior quality raw briquets, with an addition to the coal-tar pitch content. The results indicated an average tumbler stability increase from 44.8 to 52.4 percent by adding 1 percent coal-tar pitch. The use of steam injection to improve heating and mixing was attempted, but failed to show any improvement in the quality of the finished briquets. The process was improved by increasing the operating temperatures of the pug mill. The operating temperature was increased about  $30^\circ\text{F}$ . by installing a separate steam line operating at 195 psi and cooling the mix to about  $170^\circ\text{F}$ . before pressing. The briquets consisted of 8 percent coal tar pitch, 10 percent bituminous coal, and 82 percent anthracite. Forming pressure was 3,000 psi; soaking period was 90 minutes at  $1,750^\circ\text{F}$ . Test runs were made with buckwheat No. 5 as received, buckwheat No. 5 crushed to minus  $\frac{1}{32}$  inch, and buckwheat No. 6. A substantial increase in briquet strength was noted when the buckwheat No. 5 was crushed. However, only a small increase was noted

<sup>4</sup> Husack, Ralph, G. A. Brady, and J. W. Eckerd. Effect of Gamma Radiation on Anthracite. BuMines Rept. of Inv. 6391, 1964, 28 pp.

<sup>5</sup> Eckerd, J. W., R. E. McKeever, W. S. Sanner, and P. L. Woolf. Anthracite Metallurgical Briquets as Blast Furnace Fuel. BuMines Rept. of Inv. 6383, 1964, 16 pp.

over the stability of briquets made with buckwheat No. 6, indicating that a separate crushing operation would not be warranted in a plant setup. Improvements in processing techniques during the experimental runs achieved an ASTM tumbler stability of 56 percent for reprocessed briquets and 59.5 percent for new briquets. Processing variations will be studied to improve manufacturing techniques.

Pressure-drop studies were concluded in the simulated metallurgical blast furnace. Ten tests were run on shaft packings of pellets and sinter (furnished by a cooperating steel company) with furnace coke or anthracite briquets, ore pellets without fuel, and calcined anthracite briquets. The slopes of the basic trends for the burdens tested are being studied as a function of the permeability characteristics.

The basic trend of a pellet-pillow briquet burden in standard layers was found to be nearly parallel to the trend of the same burden with the components mixed. The average pressure drops of the mixed burdens were 24 percent higher than the layered burden at 3 feet per second, and 19 percent higher at 10 feet per second. The use of pillow briquets instead of coke in layered sinter burdens increased the average pressure drop per foot of bed depth by 44 to 48 percent.

The basic pressure-drop trends, with increasing superficial air velocity, of hollow-core, pillow-, and bolster-shaped briquets were nearly parallel, but showed substantial differences in pressure drops. The pressure drops with pillow briquets were from 10 to 13 percent higher than those of the hollow-core briquets at velocities of 4 through 13 feet per second. The bolster briquets had pressure drops from 18 to 21 percent lower than the hollow-core briquets through the same range of air velocities. A summary of each run and an evaluation of results are being prepared.

The Bureau's experimental program on hydrogasification of anthracite was continued with the design and construction of a miniscale hydrogasification plant. A plastic-fluidization reactor was also constructed to investigate the fluidizing characteristics associated with the proposed process. The plant was pressure-tested in several runs, first with nitrogen, then with hydrogen at temperatures from 800° F. to 1,000° F., and pressures from 300 to 800 psi. Procedures were devised for the analysis of the gases produced. Experiments completed to date to form methane indicate that very little reaction between anthracite and hydrogen occurs at 800° F. Tests are planned for 1,000° F. at 300 psi.

**Acid Mine Water.**—The study of acid mine water was conducted in three phases: (1) an investigation of the mechanics of water-contaminant formation to obtain a better understanding of the mechanical and physical processes involved in the production of acid mine water; (2) analyses of mine water samples to identify significant properties, and (3), investigations to develop methods of treating mine water to abate stream contamination. Analytical procedures were established for determining the chief constituents in mine water, except for sodium and potassium. Tests with sulfuric mine refuse and crystalline pyrite indicated that the sulfuric refuse produces acid at twice the rate of the pyrite. The effect of temperature and water on acid production was also studied. A significant reduction in the total acidity, total iron, and manganese was accomplished in samples run by demineralization achieved by exchanging the cations and anions in the water for hydrogen and hydroxide ions,

respectively, in the resin. Visible water discharges from abandoned mines throughout the region were estimated.

**Mine Water Control.**—The mine water and surface subsidence control program authorized by Public Law 162, Act of July 15, 1955, was amended October 15, 1962 (Public Law 87-818) to extend the original authority to permit sealing and filling openings in abandoned anthracite mines in the interest of public health and safety. Projects completed in cooperation with the Commonwealth of Pennsylvania to protect active mines and anthracite reserves from inundation included the construction of a surface-drainage system in the Southern field and the installation of a deep-well pumping station in an abandoned underground mine in the Northern field. Also, work was started on three mine-void backfilling Public Health and Safety projects in the Northern field. These projects are designed to protect the inhabitants and surface structures in heavily populated parts of Scranton, Wilkes-Barre, and Plymouth from the hazards of subsidence. The combined project areas total 106 acres and include over 600 dwellings and business establishments, 4 churches, and 4 schools—with an estimated total value of \$12.3 million. The total contract cost of the three projects is \$1,800,000 (of which the Federal Government will pay one-half), including the purchase of two mine-refuse crushing and screening plants to prepare backfill material. Both plants are mobile and will be used on further projects of this type. The use of the waste-piles, which were donated by private owners to the local municipalities, not only eliminates them as unsightly fire hazards but makes the sites available for more useful purposes.

**Microfilming.**—The program, initiated in 1962 by the Bureau to place on film all available data relating to abandoned anthracite mines, showed satisfactory progress during the year. Maps, cross-sections, and other relevant data relating to over 100 mines were recorded. The work involved about 2,900 maps and 7,600 photographic frames, including those of the map folios compiled in conjunction with the Bureau's study undertaken for the U.S. Army Corps of Engineers. The value of the program was evidenced when the microfilmed records were used to furnish copies of a group of mine maps that were destroyed by fire after having been microfilmed and to obtain subsurface data requested by two communities interested in determining surface stability in selected areas. A Bureau Information Circular is being prepared for publication on the first phase of the microfilming program.

**Other Research Activities.**—Supported by the Pennsylvania Coal Research Board, the Mineral Industries Experiment Station, College of Mineral Industries, the Pennsylvania State University continued research into the properties of anthracite,<sup>6,7</sup> combustion processes<sup>8</sup> and on developing new uses<sup>9</sup> in an effort to expand markets and promote the economic well-being of the industry. Studies are also being conducted of acid mine drainage, mining costs, and treatment of refuse piles.

<sup>6</sup> Walker, Philip L., and Satyendra Prosad Nandi. The Unsteady State Diffusion of Gases from Coals. Coal Res. Board of the Commonwealth of Pennsylvania, Special Res. Rept. 42, February 1964, 137 pp.

<sup>7</sup> Campbell, John A. L., and S. C. Sun. The Electrokinetic Behavior of Anthracite Coals and Lithotypes. Coal Res. Board of the Commonwealth of Pennsylvania, Special Res. Rept. 44, May 1964, 139 pp.

<sup>8</sup> Marshall, W. F., Jr., and H. B. Palmer. The Effect of Concentration and Particle Size on the Burning Velocity of Laminar Coal Dust Flames. Coal Res. Board of the Commonwealth of Pennsylvania, Special Res. Rept. 43, March 1964, 54 pp.

<sup>9</sup> Utley, Ronald W., H. L. Lovell and T. S. Spicer. The Utilization of Coal Refuse for the Manufacture of Lightweight Aggregate. Coal Res. Board of the Commonwealth of Pennsylvania, Special Res. Rept. 46, September 1964, 98 pp.



# Coke and Coal Chemicals

By J. A. DeCarlo<sup>1</sup> and E. T. Sheridan<sup>2</sup>



## Contents

	<i>Page</i>		<i>Page</i>
General summary.....	209	Coke ovens.....	237
Scope of report.....	215	Slot ovens.....	237
Oven and beehive coke and breeze.....	216	Beehive ovens.....	239
Monthly and average daily production.....	216	Coking coal.....	240
Production by merchant and furnace plants.....	218	Quantity and value of coal carbonized.....	241
Production by State.....	219	Preparation of coking coal.....	243
Screenings or breeze.....	220	Washed and unwashed.....	243
Disposal.....	222	Blending.....	246
Consumption and sales.....	222	Sources.....	246
Geographic distribution.....	224	Captive coal.....	247
Stocks of coke and breeze.....	228	Stocks.....	249
Value and price.....	230	Technology.....	254
Foreign trade.....	231	Coal chemicals.....	254
Imports.....	231	General review.....	259
Exports.....	232	Coke-oven gas.....	260
World production.....	233	Coke-oven ammonia.....	263
Hard coke.....	233	Crude coal tar and derivatives.....	263
Soft coke.....	234	Crude light oil and derivatives.....	266

## GENERAL SUMMARY

**T**HE COKE industry kept pace with the general upswing in industrial activity in 1964, and total coke output increased 14 percent. Both oven and beehive plants operated at increased rates throughout most of the year. Production was greater in the second half of the year, particularly in the last quarter; output for December reached 5.7 million tons, the highest monthly production since April 1960. During the year, the monthly production index (1957-59=100) of oven-coke plants, which produced 98 percent of the total coke, rose 20.7 points—from 89.6 in December 1963 to 110.3 in December 1964. In the first 6 months, the index averaged 95.9, compared with an average of 105.2 recorded during the second half, and an overall average of 100.6 for the entire year. Furnace plants registered a 14-percent increase in production for the year, and merchant plants a 13-percent increase. The index, however, was influenced by the out-

<sup>1</sup> Supervisory chemical engineer.

<sup>2</sup> Mineral specialist.



put of the furnace plants, which produced 90 percent of the total coke. The beehive segment of the industry was particularly active, and annual production reached 1.2 million tons, the highest output of beehive coke since 1957. As with oven-coke production, beehive output was highest in the last quarter of the year, with production in December nearly double that of December 1963. There was no construction of new ovens, and the increased output was accomplished by the reactivation of ovens that had been idle for several years.

Demand for coke was high, and apparent consumption was about one-half million tons greater than production. In addition, exports exceeded imports by 420,000 tons, resulting in a net decrease of nearly 1 million tons in producers' stocks. On hand at the end of December was 2 million tons of oven and beehive coke, equivalent to 10.7 days' production at the December rate of operation.

Ninety-one percent of the coke distributed in the United States was shipped to blast furnaces. Although blast-furnace shipments increased 15 percent, and were nearly 7.5 million tons greater than in 1963, blast-furnace fuel rates continued to decline, and less coke was required to produce each ton of pig iron and ferroalloys. According to data published by the American Iron and Steel Institute, the average annual coke rate of all blast furnaces operating in 1964 was only 1,323.6 pounds, compared with 1,350.5 pounds in 1963, and 1,634.4 pounds in 1957-59. Although the decline in 1964 represented a saving of 26.9 pounds of coke for each ton of pig iron and ferroalloys produced, this decrease was substantially less than the annual decreases registered in the past 5 years because a number of idle blast furnaces, not equipped with fuel injection systems, pressure tops, and other coke-saving devices, were pressed into service to meet the rising demand for pig iron and ferroalloys.

The remaining 9 percent of the coke distributed by producers in the United States was sold principally to foundries and miscellaneous industrial plants as industrial fuel. A small quantity was sold also for residential heating, but this market has been declining steadily, and is expected soon to be nonexistent. Shipments to foundries and to other industrial plants increased 11 percent and 16 percent, respectively. Both categories were influenced by the large demand for industrial materials in 1964, particularly castings, nonferrous metals, and industrial chemicals.

Production of breeze or coke screenings increased 8 percent. This was substantially less than the 14-percent gain in coke production because of lower breeze yields, particularly at beehive plants where the yield was about one-half that recorded in 1963. Unsuitable for most metallurgical applications because of its size and ash content, breeze is used by producers for sintering iron ores and for steam raising. About one-fourth of the production in 1964 was sold, mainly for use as a reductant in electric furnaces that smelt phosphate rock to produce elemental phosphorus. Sales of breeze were 13 percent higher than in 1963.

The delivered cost of coal to oven-coke plants continued to decline, and the average value of all coals carbonized at oven-coke plants was \$0.21 per ton less than in 1963. The decrease was attributed to lower freight rates and a \$0.01 per ton decrease in the average f.o.b. plant value of all bituminous coal produced. The average value per short ton of coal carbonized at oven-coke plants in 1964 ranged from \$7.66 at plants in West Virginia to \$12.59 at plants in California, Colorado, and Utah.

Production of all basic coal-chemical materials increased in 1964, with tar, light oil, ammonia, and coke-oven gas showing increases ranging between 10 and 14 percent over that of 1963. All increases were attributed to the larger quantity of coal carbonized, as the yield of all products declined because of higher operating rates, with the exception of light oil which remained at about the same level. The increased ammonia supply resulted in production increases of 10 percent for ammonium sulfate, 11 percent for ammonia liquor, and 19 percent for diammonium and monoammonium phosphate. Although production of crude tar and light oil were substantially higher than in 1963, output of some tar and light-oil derivatives did not increase proportionately because a few plants discontinued their processing operations. This was due to a number of economic factors, and to the inability of some plants to produce light-oil derivatives of high purity.

Prices of coke-oven products were firm throughout the year. According to trade journals, except for a \$1.50-per-ton increase in the f.o.b. price of oven-foundry coke in several areas, prices of oven-foundry, beehive-furnace, and beehive-foundry coke remained at the 1963 level. Prices in 1964, f.o.b. plant, ranged from \$14.75 to \$15.25 in Pennsylvania to \$16.25 in Virginia for beehive-furnace coke; \$18.00 to \$18.50 in Pennsylvania for beehive-foundry coke; and \$31 at Swedeland, Pa., to \$34.50 at St. Louis, Mo., for over-foundry coke. The prices of coal chemicals remained the same, except ammonium sulfate, which increased from \$30 to \$32 to \$34 per ton during the year.

Foreign trade in coke was relatively small, with exports of 524,000 tons and imports of about 100,000 tons. Canada was the principal market for both exports and imports.

Foreign trade in basic coal chemicals was insignificant also, except for exports of coal-tar pitch, which increased nearly 2.5 times, and totaled 222,000 tons. Approximately two-thirds of this quantity was shipped to France for use as a binder for coal briquetting. Only a part of the pitch exports, however, was produced at coke plants, as tar-refining plants also exported some pitch.

The total value of all coals carbonized was \$820 million, and the total value of all carbonization products used and sold was \$1,420 million. The latter value was 73 percent more than the value of the coals, while the value of coke and breeze, the principal products, represented 80 percent of the value of products recovered.

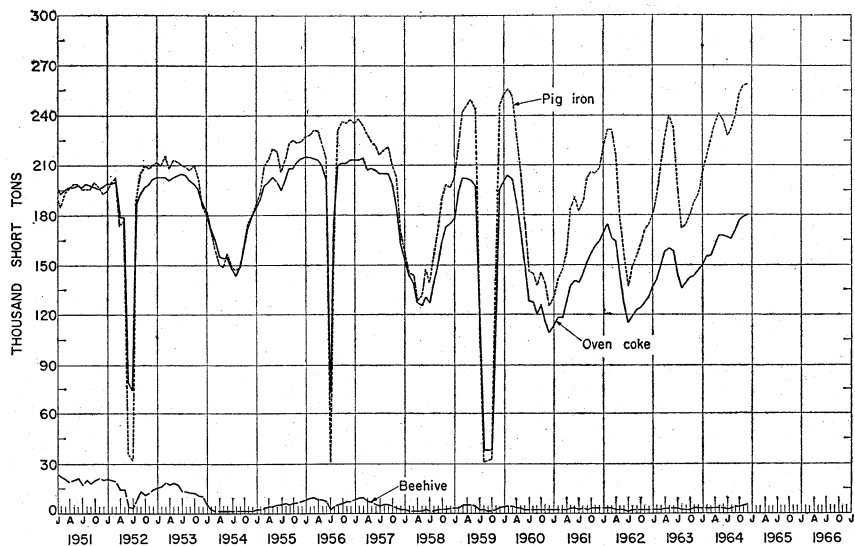


FIGURE 1.—Average daily production of oven and beehive coke and pig iron in the United States, by month.

TABLE 1.—Salient coke statistics

	1957-59 (average)	1962	1963	1964
<b>United States:</b>				
<b>Production:</b>				
Oven coke.....short tons..	60,551,900	51,098,420	53,307,609	60,908,391
Beehive coke.....do.....	1,254,232	811,872	970,698	1,236,287
Total.....do.....	61,806,132	51,910,292	54,278,307	62,144,678
Imports.....do.....	120,908	141,883	152,595	103,286
Exports.....do.....	558,428	364,032	451,241	523,695
Producers' stocks, Dec. 31.....do.....	1 4,682,436	3,906,811	2,884,931	1,971,892
Consumption, apparent.....do.....	60,585,947	51,823,205	55,001,541	62,637,308
<b>Ovens:</b>				
Slot in existence, Dec. 31.....	1 15,993	14,561	14,586	14,639
Beehive in existence, Dec. 31.....	1 7,448	4,979	4,907	5,071
<b>Value of coal-chemical materials used or sold.....</b>				
	\$330,902,284	\$264,739,789	\$254,220,290	\$290,952,399
<b>Value of coke and breeze produced.....</b>				
	1,143,589,918	963,211,681	977,060,009	1,128,925,328
<b>Total value of all products.....</b>				
	1,474,492,202	1,227,951,470	1,231,280,299	1,419,877,727
<b>World production:</b>				
Hard coke.....thousand short tons..	287,855	301,012	307,795	326,602
Gashouse and low-temperature coke.....do.....	51,130	50,310	49,960	48,630

\* Revised.

1 1959.

TABLE 2.—Statistical summary of the coke industry in the United States in 1964

	Slot ovens	Beehive ovens	Total
<b>Coke produced:</b>			
At merchant plants:			
Short tons.....	6,335,528	(1)	(1)
Value.....	\$139,299,997	(1)	(1)
At furnace plants: <sup>2</sup>			
Short tons.....	54,572,863	(1)	(1)
Value.....	\$944,576,184	(1)	(1)
<b>Total:</b>			
Short tons.....	60,908,391	1,236,287	62,144,678
Value.....	\$1,083,876,181	\$18,592,081	\$1,102,468,262
<b>Breeze produced:</b>			
Short tons.....	3,902,047	22,383	3,924,430
Value.....	\$26,411,679	\$44,956	\$26,456,635
<b>Coal carbonized:</b>			
Bituminous:			
Short tons.....	86,732,161	2,025,415	88,757,576
Value.....	\$804,155,920	\$10,766,852	\$814,922,772
Average per ton.....	\$9.27	\$5.32	\$9.18
Anthracite:			
Short tons.....	492,318	-----	492,318
Value.....	\$5,266,953	-----	\$5,266,953
Average per ton.....	\$10.70	-----	\$10.70
<b>Total:</b>			
Short tons.....	87,224,479	2,025,415	89,249,894
Value.....	\$809,422,873	\$10,766,852	\$820,189,725
Average per ton.....	\$9.28	\$5.32	\$9.19
<b>Average yield in percent of total coal carbonized:</b>			
Coke.....	69.83	61.04	69.63
Breeze (at plants actually recovering).....	4.47	3.84	4.47
<b>Coke used by producing companies:</b>			
In blast furnaces:			
Short tons.....	52,840,688	(3)	52,840,688
Value.....	\$914,103,967	(3)	\$914,103,967
In foundries:			
Short tons.....	334,163	-----	334,163
Value.....	\$10,485,581	-----	\$10,485,581
For other industrial uses: <sup>4</sup>			
Short tons.....	676,815	-----	676,815
Value.....	\$12,042,455	-----	\$12,042,455
<b>Breeze used by producing companies:</b>			
In steam plants:			
Short tons.....	632,391	-----	632,391
Value.....	\$3,956,378	-----	\$3,956,378
In agglomerating plants:			
Short tons.....	1,763,660	-----	1,763,660
Value.....	\$11,562,902	-----	\$11,562,902
For other industrial uses:			
Short tons.....	434,015	-----	434,015
Value.....	\$2,629,429	-----	\$2,629,429
<b>Coke sold (commercial sales):</b>			
To blast furnaces:			
Short tons.....	3,459,794	698,734	4,158,528
Value.....	\$53,780,793	\$10,168,092	\$63,948,885
Average per ton.....	\$15.54	\$14.55	\$15.38
To foundries:			
Short tons.....	2,697,531	43,639	2,741,170
Value.....	\$82,084,643	\$765,228	\$82,849,871
Average per ton.....	\$30.43	\$17.54	\$30.22
To other industrial plants: <sup>5</sup>			
Short tons.....	1,456,528	486,122	1,942,650
Value.....	\$23,004,280	\$7,620,856	\$30,625,136
Average per ton.....	\$15.79	\$15.68	\$15.76
For residential heating:			
Short tons.....	239,812	11,139	250,951
Value.....	\$3,905,145	\$87,260	\$3,992,405
Average per ton.....	\$16.28	\$7.83	\$15.91
<b>Breeze sold (commercial sales):</b>			
Short tons.....	1,093,052	22,638	1,115,690
Value.....	\$8,259,236	\$45,387	\$8,304,623
Average per ton.....	\$7.56	\$2.00	\$7.44

See footnotes at end of table.

TABLE 2.—Statistical summary of the coke industry in the United States in 1964—Continued

	Slot ovens	Beehive ovens	Total
<b>Coal-chemical materials produced:</b>			
Crude tar:			
Gallons.....	762,917,505	-----	762,917,505
Gallons per ton of coal.....	8.75	-----	8.75
Ammonia: <sup>6</sup>			
Short tons.....	793,908	-----	793,908
Pounds per ton of coal.....	18.49	-----	18.49
Crude light oil:			
Gallons.....	248,668,967	-----	248,668,967
Gallons per ton of coal.....	2.92	-----	2.92
Gas:			
Thousand cubic feet.....	904,697,479	-----	904,697,479
Thousand cubic feet per ton of coal.....	10.37	-----	10.37
Percent burned in coking process.....	34.73	-----	34.73
Percent surplus used or sold.....	64.35	-----	64.35
Percent wasted.....	.92	-----	.92
<b>Value of coal-chemical materials used or sold:</b>			
Crude tar and derivatives:			
Used.....	\$33,231,123	-----	\$33,231,123
Sold.....	\$61,468,029	-----	\$61,468,029
Ammonia products <sup>7</sup> .....	\$23,982,158	-----	\$23,982,158
Crude light oil and derivatives <sup>8</sup> .....	\$40,003,625	-----	\$40,003,625
Surplus gas.....	\$132,267,464	-----	\$132,267,464

<sup>1</sup> Not separately recorded.

<sup>2</sup> Plants associated with iron-blast furnaces (refer to definition in "Scope of Report").

<sup>3</sup> Included with "Sales" to avoid disclosing individual company data.

<sup>4</sup> Includes coke for producer- and water-gas manufacture.

<sup>5</sup> Includes coke sold to water-gas plants.

<sup>6</sup> In terms of sulfate equivalent.

<sup>7</sup> Includes ammonium sulfate, ammonia liquor (NH<sub>3</sub> content), and diammonium and monoammonium phosphate.

<sup>8</sup> Includes intermediate light oil.

TABLE 3.—Summary of oven-coke operations in the United States in 1964, by State

State	In existence Dec. 31 <sup>1</sup>		Coal carbonized (short tons)	Yield of coke from coal (percent)	Coke produced (short tons)	Value of coke at ovens	
	Plants	Ovens				Total	Per ton
Alabama.....	7	1,516	6,365,139	73.67	4,689,108	\$85,549,979	\$18.24
California, Colorado, Utah.....	3	773	4,687,274	62.64	2,935,921	65,314,900	22.25
Connecticut, Maryland, New Jersey, New York.....	6	1,802	11,043,820	69.61	7,687,284	126,783,218	16.49
Illinois.....	6	568	3,366,792	68.27	2,298,576	43,382,598	18.87
Indiana.....	5	2,218	11,742,407	69.58	8,170,323	156,463,275	19.15
Kentucky, Missouri, Tennessee, Texas.....	5	438	2,897,135	71.07	2,058,916	37,178,811	18.06
Michigan.....	4	778	5,305,865	73.65	3,907,944	66,885,423	17.12
Minnesota and Wisconsin.....	3	380	1,205,977	77.35	932,804	18,419,554	19.75
Ohio.....	12	1,836	10,352,914	69.97	7,243,587	128,850,524	17.79
Pennsylvania.....	12	3,662	25,313,522	69.51	17,594,174	299,388,143	17.02
West Virginia.....	3	668	4,943,634	68.57	3,369,754	55,659,751	16.42
Total 1964.....	66	14,639	87,224,479	69.83	60,908,391	1,082,876,181	17.80
At merchant plants.....	17	1,894	8,822,552	71.81	6,335,528	139,299,997	21.99
At furnace plants.....	49	12,745	78,401,927	69.61	54,572,863	944,576,184	17.31
Total 1963.....	66	14,586	76,470,038	69.71	53,307,609	936,962,187	17.58

<sup>1</sup> Excludes plants retired permanently during year.

TABLE 4.—Summary of beehive-coke operations in the United States in 1964, by State

State	In existence Dec. 31 <sup>1</sup>		Coal carbonized (short tons)	Yield of coke from coal (percent)	Coke produced (short tons)	Value of coke at ovens	
	Plants	Ovens				Total	Per ton
Pennsylvania.....	18	3,800	914,405	61.44	561,777	\$7,571,657	\$13.48
Kentucky, Virginia, West Virginia.....	8	1,271	1,111,010	60.71	674,510	11,020,424	16.34
Total:							
1964.....	26	5,071	2,025,415	61.04	1,236,287	18,592,081	15.04
1963.....	26	4,907	1,612,581	60.20	970,698	14,929,656	15.38

<sup>1</sup> Excludes plants retired permanently during year.

### SCOPE OF REPORT

This chapter covers high-temperature oven and beehive coke and related products. All data, except where noted, were supplied by coke-producing companies in the United States. Only products made in high-temperature slot and beehive ovens were included; products made by other carbonization processes (coal-gas retorts, low-temperature coal carbonization, and carbonization of residues from the refining of coal tar and petroleum) were specifically excluded. Approximately 16.8 million tons of petroleum coke was produced in 1964.

In addition to coke produced in high-temperature slot and beehive ovens, six companies produced 200,000 tons of coke and char in unconventional carbonizing units. One manufactured a low-temperature coke known as Disco by a continuous process. Another producer carbonized lignite in a Lurgi gasifier and manufactured briquets from the char. Three plants produced high-temperature coke with traveling-grate stokers. One plant produced high-temperature chemical coke in an experimental rotary-hearth carbonizer.

Of the 66 oven-coke plants surveyed by the Bureau of Mines in 1964, 63 were active all year, 2 were idle all year, and 1 was active part of the year, but later was closed permanently. Of the 27 beehive plants surveyed, only 11 operated the entire year, 8 were active part of the year, and the remainder were idle.

The terms "merchant" and "furnace" in this chapter apply only to oven-coke plants. Furnace plants are owned by, or are financially affiliated with, iron and steel companies that produce coke mainly for use in their blast furnaces. Merchant plants include those that manufacture metallurgical, industrial, and residential-heating grades of coke for sale on the open market; those associated with chemical companies or gas utilities; and those affiliated with local iron works that consume only a small part of their output in affiliated blast furnaces.

The term "coke" in this chapter refers only to the large sizes (usually plus one-half inch) from which the smaller sizes, called breeze, have been screened. "Metallurgical coke" refers to grades used for smelting and casting ferrous metals in blast furnaces and foundries.

## OVEN AND BEEHIVE COKE AND BREEZE

### MONTHLY AND AVERAGE DAILY PRODUCTION

Coke is used primarily as fuel for industrial applications, and production is governed mainly by industrial activity rather than by seasonal variations. The steady rise in industrial activity in the latter part of 1964 induced corresponding increases in coke production; for example, the average daily production of oven coke in December was the highest since April 1960, and beehive production in December was nearly double the average daily output in January.

Table 5 summarizes monthly and average daily production of oven and beehive coke in 1964 and shows comparable data for two preceding years and for the 1957-59 bench-mark period.

Preliminary data on average daily and monthly production are published regularly by the Bureau of Mines in Mineral Industry Survey, Coke and Coal Chemicals, Monthly. This publication may be obtained free of charge by writing to the Bureau of Mines Publications Distribution Section, 4800 Forbes Ave., Pittsburgh, Pa., 15213.

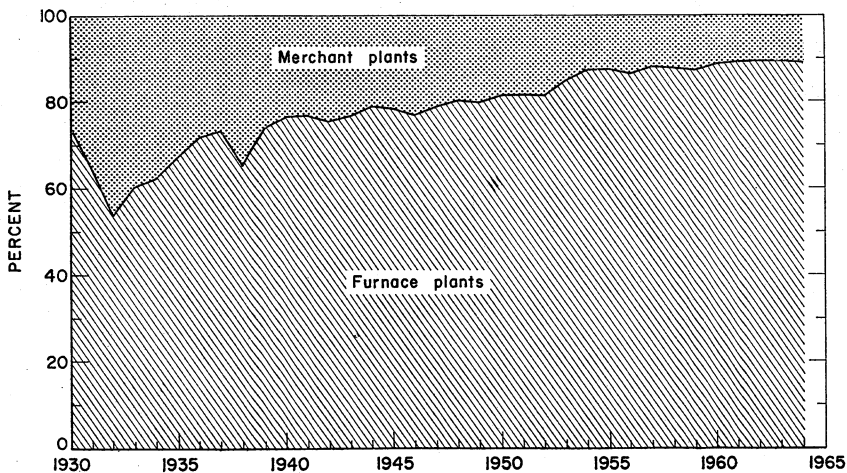


FIGURE 2.—Production of oven coke in the United States, by type of plant.

TABLE 5.—Production of oven and beehive coke in the United States, by month<sup>1</sup>  
(Short tons)

Month	1957-59 (average)		1962		1963		1964	
	Total	Daily average	Total	Daily average	Total	Daily average	Total	Daily average
<b>Oven coke:</b>								
January	5,630,000	181,600	5,273,400	170,100	4,244,600	136,900	4,660,100	150,300
February	5,159,400	184,300	4,866,900	173,800	3,953,800	141,200	4,485,000	154,700
March	5,744,700	185,300	5,154,100	166,300	4,627,500	149,300	4,820,300	155,500
April	5,378,300	179,300	4,926,300	164,200	4,740,300	158,000	4,853,900	161,800
May	5,532,400	178,500	4,451,800	143,600	4,963,400	160,100	5,191,500	167,500
June	5,352,800	178,400	3,786,800	126,200	4,734,100	157,800	5,036,500	167,900
July	4,603,300	148,500	3,550,400	114,500	4,466,500	144,100	5,163,400	166,500
August	4,151,700	133,900	3,690,900	119,100	4,200,400	135,500	5,138,200	165,800
September	4,121,500	137,400	3,691,300	123,100	4,157,200	138,600	5,141,000	171,300
October	4,340,000	140,000	3,850,900	124,200	4,390,600	141,600	5,476,100	176,600
November	5,002,600	166,800	3,822,600	127,400	4,289,900	143,000	5,373,300	179,100
December	5,535,200	178,500	4,033,000	130,100	4,540,200	146,500	5,569,100	179,600
<b>Total</b>	<b>60,551,900</b>	<b>165,900</b>	<b>51,098,400</b>	<b>140,000</b>	<b>53,307,600</b>	<b>146,000</b>	<b>60,908,400</b>	<b>166,400</b>
<b>Beehive coke:</b>								
January	132,200	4,300	102,200	3,300	66,400	2,200	86,100	2,800
February	127,900	4,500	93,900	3,400	67,100	2,400	82,100	2,800
March	150,300	4,900	97,600	3,100	66,900	2,100	93,100	3,000
April	138,900	4,600	70,400	2,400	87,600	2,900	92,500	3,100
May	118,700	3,800	59,000	1,900	102,000	3,300	93,900	3,000
June	107,900	3,600	54,100	1,800	96,200	3,200	81,400	2,700
July	80,000	2,600	43,800	1,400	84,200	2,700	69,800	2,300
August	82,600	2,700	50,400	1,600	79,500	2,600	94,300	3,000
September	78,600	2,600	51,900	1,700	79,000	2,600	113,200	3,800
October	75,300	2,400	63,900	2,100	82,600	2,700	126,800	4,100
November	76,100	2,500	65,900	2,200	77,600	2,600	142,300	4,800
December	85,700	2,800	58,800	1,900	81,600	2,600	160,800	5,200
<b>Total</b>	<b>1,254,200</b>	<b>3,400</b>	<b>811,900</b>	<b>2,200</b>	<b>970,700</b>	<b>2,700</b>	<b>1,236,300</b>	<b>3,400</b>
<b>Total:</b>								
January	5,762,200	185,900	5,375,600	173,400	4,311,000	139,100	4,746,200	153,100
February	5,287,300	188,800	4,960,800	177,200	4,020,900	143,600	4,567,100	157,500
March	5,895,000	190,200	5,251,700	169,400	4,694,400	151,400	4,913,400	158,500
April	5,517,200	183,900	4,996,700	166,600	4,827,900	160,900	4,946,400	164,900
May	5,651,100	182,300	4,510,800	145,500	5,065,400	163,400	5,285,400	170,500
June	5,460,700	182,000	3,840,900	128,000	4,830,300	161,000	5,117,900	170,600
July	4,683,300	151,100	3,594,200	115,900	4,550,700	146,800	5,233,200	168,800
August	4,234,800	136,600	3,741,300	120,700	4,279,900	138,100	5,232,500	168,800
September	4,200,100	140,000	3,743,200	124,800	4,236,200	141,200	5,254,200	175,100
October	4,415,300	142,400	3,914,800	126,300	4,473,200	144,300	5,602,900	180,700
November	5,073,700	169,300	3,888,500	129,600	4,366,600	145,600	5,515,600	183,900
December	5,620,900	181,300	4,091,800	132,000	4,621,800	149,100	5,729,900	184,800
<b>Total</b>	<b>61,806,100</b>	<b>169,300</b>	<b>51,910,300</b>	<b>142,200</b>	<b>54,278,300</b>	<b>148,700</b>	<b>62,144,700</b>	<b>169,800</b>

<sup>1</sup> Daily average calculated by dividing monthly production by number of days in month.



### PRODUCTION BY MERCHANT AND FURNACE PLANTS

The classification of oven-coke plants according to type of ownership (merchant or furnace plants) was initiated in 1920 and is maintained by the Bureau of Mines to delineate trends in production for each segment of the industry.

As shown in figure 2, a tremendous change in the pattern of production has occurred since the early 1930's when merchant operators produced about one-fourth of the total coke output, as opposed to only 10 percent in 1964. Drastic reductions in the use of coke for residential heating and gas manufacture, markets formerly supplied largely by merchant plants, resulted in the steady decline in production from these plants. Contributing also to the decline in merchant output was the expansion program in coking capacity, started by the steel companies during the World War II era, to meet their own normal blast-furnace coke needs. Previously, most of the iron-producing companies built oven-coke capacity sufficient for only about 80 percent of normal requisites and, in periods of heavy demand, additional blast-furnace coke requirements were obtained from merchant oven- and beehive-coke plants. Although blast-furnace coke consumption in 1964 was the highest since 1957, only 6 percent was obtained from merchant oven- and beehive-coke plants.

Production of oven coke by merchant and furnace plants in 1964 is shown in tables 6 and 7.

TABLE 6.—Production of oven coke in the United States, by type of plant  
(Short tons)

Month	1957-59 (average)		1962		1963		1964	
	Merchant plants	Furnace plants	Merchant plants	Furnace plants	Merchant plants	Furnace plants	Merchant plants	Furnace plants
<b>Production:</b>								
January.....	705,700	4,924,300	512,600	4,760,800	488,400	3,756,200	515,000	4,145,100
February.....	641,100	4,513,300	490,300	4,376,600	455,700	3,498,100	507,000	3,978,000
March.....	681,400	5,063,300	523,500	4,630,600	497,900	4,129,600	541,200	4,279,100
April.....	612,900	4,765,400	485,200	4,441,100	433,100	4,257,200	523,300	4,325,600
May.....	609,800	4,922,600	454,400	3,997,400	478,400	4,435,000	544,100	4,647,400
June.....	575,800	4,777,000	405,700	3,331,100	468,500	4,265,600	520,700	4,515,800
July.....	569,100	4,034,200	378,000	3,172,400	436,800	4,029,700	524,500	4,638,900
August.....	573,200	3,578,500	415,100	3,275,800	451,300	3,749,100	494,900	4,643,300
September.....	572,900	3,548,600	412,200	3,279,100	435,600	3,721,600	514,600	4,626,400
October.....	586,000	3,754,000	433,600	3,417,300	475,600	3,915,000	532,600	4,943,500
November.....	582,700	4,419,900	444,300	3,378,300	452,600	3,836,400	546,000	4,827,300
December.....	649,000	4,886,200	483,500	3,549,500	502,800	4,037,400	566,600	5,002,500
<b>Total.....</b>	<b>7,359,600</b>	<b>53,192,300</b>	<b>5,438,400</b>	<b>45,660,000</b>	<b>5,628,700</b>	<b>47,680,900</b>	<b>6,335,500</b>	<b>54,572,900</b>
<b>Daily average:</b>								
January.....	22,800	158,800	16,500	153,600	15,700	121,200	16,600	133,700
February.....	22,900	161,400	17,500	156,300	16,300	124,900	17,600	137,200
March.....	22,000	163,300	16,900	149,400	16,100	133,200	17,500	138,000
April.....	20,400	158,900	16,200	148,000	16,100	141,900	17,600	144,200
May.....	19,700	158,800	14,700	128,900	15,400	144,700	17,600	149,900
June.....	19,200	159,200	13,500	112,700	15,600	142,200	17,400	150,500
July.....	18,400	130,100	12,200	102,300	14,100	130,000	16,900	149,600
August.....	18,500	115,400	13,400	105,700	14,600	120,900	16,000	149,800
September.....	19,100	118,300	13,800	109,300	14,500	124,100	17,100	154,200
October.....	18,900	121,100	14,000	110,200	15,300	126,300	17,200	159,400
November.....	19,400	147,400	14,800	112,600	15,100	127,900	18,200	160,900
December.....	20,900	157,600	15,600	114,500	16,200	130,300	18,300	161,300
<b>Average for year...</b>	<b>20,200</b>	<b>145,700</b>	<b>14,900</b>	<b>125,100</b>	<b>15,400</b>	<b>130,600</b>	<b>17,300</b>	<b>149,100</b>

TABLE 7.—Production of oven coke and number of plants in the United States, by type of plant

Year	Number of active plants <sup>1</sup>		Coke produced (short tons)		Percent of production	
	Merchant plants	Furnace plants	Merchant plants	Furnace plants	Merchant plants	Furnace plants
1929.....	41	46	12, 187, 439	41, 224, 387	22.8	77.2
1939.....	39	45	11, 070, 506	31, 811, 807	25.8	74.2
1949.....	31	55	12, 112, 922	48, 109, 559	20.1	79.9
1957-59 (average).....	<sup>2</sup> 21	<sup>2</sup> 54	7, 359, 600	53, 192, 300	12.2	87.8
1961.....	18	52	5, 490, 047	45, 340, 362	10.8	89.2
1962.....	17	49	5, 438, 368	45, 660, 052	10.6	89.4
1963.....	17	47	5, 626, 701	47, 680, 908	10.6	89.4
1964.....	17	47	6, 335, 528	54, 572, 863	10.4	89.6

<sup>1</sup> Includes plants operating any part of year.<sup>2</sup> Dec. 31, 1959.

## PRODUCTION BY STATE

The number of States in which coke is produced seldom changes; only one State, Massachusetts, has been removed from the list of producing States in the last decade. In the early years of the coke industry, when beehive ovens were the principal suppliers of metallurgical fuel, production was limited to States producing coking coal. The expanding transportation system plus the adoption of slot ovens for the production of metallurgical coke and gas at the turn of the century resulted in the construction of slot ovens near large steel- and gas-consuming centers far distant from coking-coal fields. The principal producing States, however, always have been those in which heavy industry is concentrated, such as Pennsylvania, Ohio, Indiana, Illinois, New York, and Alabama.

Detailed statistics on the production of coke by State are given in table 8.

TABLE 8.—Production of coke in the United States, by State

State	(Short tons)				
	1957-59 (average)	1961	1962	1963	1964
Oven coke:					
Alabama.....	5, 024, 645	3, 949, 927	4, 109, 628	4, 281, 587	4, 689, 108
California, Colorado, Utah.....	2, 701, 547	3, 017, 217	2, 406, 276	2, 408, 363	2, 935, 921
Connecticut, Maryland, New Jersey, New York.....	1, 782, 854	6, 234, 321	6, 499, 514	6, 354, 716	7, 687, 284
Illinois.....	2, 291, 276	1, 841, 273	1, 917, 391	1, 871, 204	2, 286, 576
Indiana.....	8, 148, 294	7, 666, 870	7, 027, 014	7, 541, 430	8, 170, 322
Kentucky, Missouri, Tennessee, Texas.....	2, 097, 415	1, 730, 069	1, 772, 084	2, 010, 349	2, 058, 916
Michigan.....	3, 166, 295	2, 958, 342	3, 164, 917	3, 460, 027	3, 907, 944
Minnesota and Wisconsin.....	1, 058, 305	713, 769	757, 032	786, 923	932, 804
Ohio.....	8, 871, 503	6, 703, 475	6, 848, 812	6, 339, 546	7, 243, 587
Pennsylvania.....	15, 935, 874	13, 320, 866	13, 985, 742	15, 245, 046	17, 594, 174
West Virginia.....	3, 434, 892	2, 694, 280	2, 610, 010	3, 008, 418	3, 389, 754
Total.....	60, 551, 900	50, 830, 409	51, 098, 420	53, 307, 609	60, 908, 391
Beehive coke:					
Pennsylvania.....	895, 358	453, 989	384, 839	383, 979	561, 777
Kentucky, Virginia, West Virginia.....	<sup>2</sup> 358, 874	426, 789	427, 033	<sup>2</sup> 586, 719	674, 510
Total.....	1, 254, 232	880, 778	811, 872	970, 698	1, 236, 287
Grand total.....	61, 806, 132	51, 711, 187	51, 910, 292	54, 278, 307	62, 144, 678

<sup>1</sup> Includes Massachusetts.<sup>2</sup> Includes Utah.<sup>3</sup> Excludes West Virginia.

### SCREENINGS OR BREEZE

The screening of the run-of-oven coke is a universal practice at oven-coke plants. The small coke which drops through  $\frac{1}{2}$ -inch or, in some instances,  $\frac{5}{8}$ -inch screens is called screenings, or breeze. This material, which generally has a higher ash and moisture content than the larger sizes, has become an important industrial fuel. Roughly 5 percent of the dry weight of coal carbonized in slot ovens is recovered as coke screenings or breeze. The yield of coke breeze ranged between 10.89 and 2.43 percent, and averaged 4.47 percent in 1964. The recovery of breeze is practiced less widely at beehive-coke plants, and only about one-half of the active plants recovered this material in 1964. At most of the beehive-coke plants, breeze is considered a waste material and is hauled away from the plant and deposited in waste banks or ash dumps. However, at beehive plants actually recovering this fuel, a yield of 3.84 percent was reported in 1964.

Roughly three-fourths of the breeze recovered at oven-coke plants is used by the producing companies on or near the premises. Until the early 1950's, the bulk of the breeze used by producing companies was utilized in steam plants, and the balance was used for miscellaneous heating purposes. In the past decade, the expansion of iron-ore agglomerating facilities at blast-furnace operations has increased coke-breeze requirements tremendously; in 1964, almost one-half of the total production at oven-coke plants was used by the producing companies in sintering operations, and only one-sixth was used for steam raising. In addition, about 10 percent of the output was used by producing companies for miscellaneous purposes at steel works; for example, for lining ingot molds, carbon runners on pig-iron ladles, soaking pits, and as a carburizing agent in steel furnaces.

Sales of breeze in 1964 increased 13 percent over those of 1963, and the average price per ton increased 4 percent. The largest market for breeze is for smelting phosphate rock in the manufacture of elemental phosphorous. Approximately 1.5 tons of coke breeze is required to produce 1 ton of elemental phosphorus and, on this basis, it is estimated that 750,000 tons of coke breeze was charged into electric furnaces to smelt phosphate rock. Other uses for breeze are in mineral-wool production, as aggregate in cement burial-vault manufacture, and for other industrial applications.

Table 9 shows production and disposal of coke breeze by State in 1964. Table 10 shows the quantities of breeze used by the producers according to major uses, the quantities sold, and the average value per ton for 1964 and selected prior years.

TABLE 9.—Breeze recovered at coke plants in the United States in 1964, by State

State	Yield per ton of coal <sup>1</sup> (percent)	Produced		Used by producers—						Sold		On hand Dec. 31 (short tons)
		Short tons	Value	In steam plants		In agglomerating plants		For other industrial use		Short tons	Value	
				Short tons	Value	Short tons	Value	Short tons	Value			
Oven coke:												
Alabama.....	5.35	340,757	\$2,867,248	( <sup>2</sup> )	( <sup>2</sup> )	96,481	\$648,767	34,228	\$235,123	186,720	\$1,811,800	69,329
California, Colorado, Utah.....	5.30	248,365	1,789,375			190,078	1,259,692	20,391	131,238	( <sup>2</sup> )	( <sup>2</sup> )	21,826
Connecticut, Maryland, New Jersey, New York.....	4.75	524,089	3,141,173	342,028	\$2,096,088	( <sup>2</sup> )	( <sup>2</sup> )	52,560	290,690	3,270	31,729	147,331
Illinois.....	5.21	176,273	1,421,137	19,731	128,698	101,886	866,622	17,289	136,439	27,725	218,900	96,185
Indiana.....	5.01	588,703	3,476,134	53,866	317,945	580,052	3,475,362	25,441	154,731	84,138	462,306	435,709
Kentucky, Missouri, Tennessee, Texas.....	5.93	171,816	1,574,443	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	133,988	1,191,170	15,115
Michigan.....	4.39	233,051	1,751,661	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	91,687	678,154	4,167
Minnesota and Wisconsin.....	5.33	64,227	384,967			( <sup>2</sup> )	( <sup>2</sup> )	50,349	256,424	( <sup>2</sup> )	( <sup>2</sup> )	57,528
Ohio.....	4.55	470,954	3,074,573	54,207	345,334	44,431	210,210	69,676	358,798	347,958	2,371,776	73,738
Pennsylvania.....	3.41	862,846	5,591,902	110,863	757,212	396,123	2,613,821	109,010	694,648	122,135	722,451	246,329
West Virginia.....	4.49	221,966	1,340,066	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	32,909	201,677	( <sup>2</sup> )	( <sup>2</sup> )	5,314
Undistributed.....				51,696	311,103	354,609	2,488,428	22,162	169,661	95,451	770,950	
Total 1964.....	4.47	3,902,047	26,411,679	632,391	3,956,378	1,763,660	11,562,902	434,015	2,629,429	1,093,052	8,259,236	\$ 1,112,571
At merchant plants.....	5.93	523,443	4,190,473	127,402	1,013,600			45,352	241,321		2,846,742	139,562
At furnace plants.....	4.31	3,378,604	22,221,206	504,989	2,942,778	1,763,660	11,562,902	388,663	2,388,108	748,948	5,412,494	973,009
Total 1963.....	4.72	3,608,806	25,107,301	609,518	3,847,353	1,794,566	12,553,467	388,499	2,455,041	954,223	7,000,292	\$ 1,133,642
Beehive coke:												
Pennsylvania.....	4.13	17,460	32,647							17,665	32,953	
Kentucky and Virginia.....	3.08	4,923	12,309							4,973	12,434	30
Total:												
1964.....	3.84	22,383	44,956							22,638	45,387	30
1963.....	6.38	29,606	60,865							30,206	62,010	80

<sup>1</sup> Calculated by dividing production by coal carbonized at plants actually recovering breeze.

<sup>2</sup> Included with "Undistributed" to avoid disclosing individual company data.

<sup>3</sup> Includes some breeze resulting from the screening of coke at blast furnaces.

TABLE 10.—Oven- and beehive-coke breeze used and sold in the United States, by use

(Short tons)

Year	Used by producers—			Sold	Average value per ton
	In steam plants	In agglomerating plants	For other industrial use		
1947-49 (average).....	3,450,905	* 300,000	1,489,055	1,142,589	\$3.79
1957-59 (average).....	1,612,547	796,390	447,171	1,042,308	7.22
1961.....	619,458	1,518,930	506,746	807,798	8.30
1962.....	720,466	1,471,530	594,997	816,356	7.71
1963.....	609,518	1,794,566	388,499	984,429	7.17
1964.....	632,391	1,763,660	434,015	1,115,690	7.44

\* Estimate.

† Includes 77,795 tons used to make producer or water gas.

## DISPOSAL

## CONSUMPTION AND SALES

The apparent consumption of coke in the United States in 1964, allowing for imports, exports, and change in producers' stocks, increased 14 percent over that of 1963, and was 3 percent above the 1957-59 period, but 20 percent less than the record established in 1951. Several economic and technologic factors were responsible for the large drop in coke consumption. Most of the decline, however, may be attributed to two factors—the substitution of other fuels (fuel oil and natural gas) for coke, and lower blast-furnace coke rates. For example, an average of 8 million tons of coke was used to manufacture producer and water gas and for residential heating in the 1947-49 period compared with only 318,489 tons in 1964. Because of the loss of these markets, only 9 percent of the apparent coke consumption in the United States in 1964 was used for purposes other than the smelting of iron ore in blast furnaces.

In the past decade, blast furnaces have consistently used nearly 90 percent of the coke produced. For this reason, changes in coke rates are important. In 1964, the amount of coke consumed per ton of pig iron and ferroalloys produced in blast furnaces dropped to 1,323.6 pounds. This decrease (2 percent from 1963 and 19 percent from the 1957-59 average) was attributed mainly to improved burdens (coke and iron ore) and advanced operating techniques, such as higher blast temperatures, fuel injection, and oxygen enrichment of the blast. Further improvements in blast-furnace fuel efficiency may be expected in the future, as older furnaces are replaced by modern furnaces with improved equipment and controls. The steady decline in coke rates directly affected coal and coke operations, as blast-furnace coke requirements in 1964 were 23.6 million tons lower (equivalent to 34 million tons of bituminous coal) than requirements would have been if furnaces were operated at 1951 coke rates.

Tables 13 and 14 summarize, by major end use, the disposal of oven and beehive coke in 1964. Furnace oven-coke producers use the bulk of their coke in integrated and affiliated blast furnaces, whereas merchant oven-coke producers and beehive-coke producers sell most of

their output to blast-furnace installations, foundries, and to miscellaneous other industrial plants. Only a small fraction of the coke production, largely by merchant oven-coke plants, was marketed for residential heating, as combined sales from furnace oven-coke plants and beehive plants amounted to less than 10,000 tons. In 1964, furnace oven-coke producers used and sold 55,148,198 tons, of which 96 percent was used in company-operated blast furnaces, 1 percent was used for various other purposes, and only 3 percent was marketed or could be considered merchant sales. The distribution pattern was quite different with merchant oven-coke producers, who sold 93 percent and used only 7 percent of the total disposal. Most of the blast-furnace installations without coke-supporting facilities, as well as gray-iron foundries, nonferrous smelters, and chemical companies that use coke as a raw material, are supplied by merchant oven-coke producers. In 1964, merchant producers of oven coke sold 6,125,643 tons which was distributed as follows: 43 percent to blast-furnace operators; 41 percent to iron foundries; 12 percent for other industrial purposes; and 4 percent was sold for residential heating.

In recent years there has been a marked change in the distribution pattern of beehive coke. Until the late 1950's, virtually all beehive coke was produced for use as blast-furnace fuel. Some blast-furnace installations with integrated slot ovens, which depended on beehive coke when demand was high, were made self-sufficient by the sharp decline in coke rates. However, the increase in requirements for

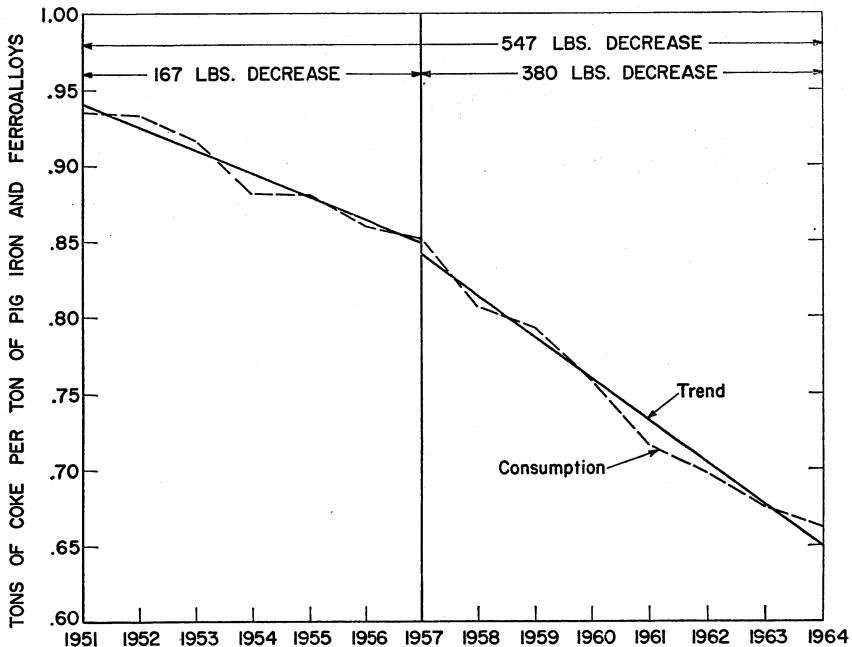


FIGURE 3.—Coke consumption per short ton of pig iron and ferroalloys produced in blast furnaces in the United States.

chemical coke, or coke used in the production of elemental phosphorus and calcium carbide, has resulted in the shipment of beehive coke to such plants. Thus, in 1964, 44 percent of the beehive coke used and sold was distributed for various industrial purposes (including foundries) and residential heating, and 56 percent went to blast-furnace plants.

TABLE 11.—Apparent consumption of coke in the United States

(Short tons)

Year	Total production	Imports	Exports	Net change in stocks	Apparent U.S. consumption <sup>1</sup>	Consumption			
						In iron furnaces <sup>2</sup>		All other purposes	
						Quantity	Percent	Quantity	Percent
1937-39 (average)	43,065,975	187,838	534,393	+290,011	42,429,409	28,009,630	66.0	14,419,779	34.0
1947-49 (average)	70,648,402	181,000	696,699	+280,230	69,852,473	55,877,463	80.0	13,975,010	20.0
1957-59 (average)	61,806,132	120,908	558,428	+782,665	60,585,947	54,140,391	89.4	6,445,556	10.6
1961.....	51,711,187	126,518	445,232	-696,215	52,088,688	46,771,105	89.8	5,317,583	10.2
1962.....	51,910,292	141,883	364,032	-135,062	51,823,205	46,244,675	89.2	5,578,530	10.8
1963.....	54,278,307	152,595	451,241	-1,021,880	55,001,541	48,871,568	88.9	6,129,973	11.1
1964.....	62,144,678	103,286	523,695	-913,039	62,637,308	57,063,389	91.1	5,573,919	8.9

<sup>1</sup> Production plus imports minus exports, plus or minus net change in stocks.

<sup>2</sup> American Iron and Steel Institute; figures include coke consumed in manufacturing ferroalloys.

TABLE 12.—Coke and coking coal consumed per short ton of pig iron and ferroalloys produced in the United States

Year	Coke per short ton of pig iron and ferroalloys <sup>1</sup> (pounds)	Yield of coke from coal (percent)	Coking coal per short ton of pig iron and ferroalloys (pounds calculated)	Year	Coke per short ton of pig iron and ferroalloys <sup>1</sup> (pounds)	Yield of coke from coal (percent)	Coking coal per short ton of pig iron and ferroalloys (pounds calculated)
1913.....	2,172.6	66.9	2,347.5	1957-59 (average).....	1,634.4	70.0	2,334.9
1918.....	2,120.7	66.4	3,193.8				
1929.....	1,838.0	69.0	2,663.8				
1939.....	1,778.0	69.8	2,547.3				
1949.....	1,895.8	69.6	2,723.9				
				1961.....	1,432.6	69.7	2,055.4
				1962.....	1,395.2	69.5	2,007.5
				1963.....	1,350.5	69.5	1,943.2
				1964.....	1,323.6	69.6	1,901.7

<sup>1</sup> American Iron and Steel Institute; consumption per ton of pig iron only, excluding furnaces making ferroalloys, was 2,172.6 pounds in 1913, 2,120.7 in 1918, 1,813.3 in 1929, 1,760.0 in 1939, 1,870.4 in 1949, 1,617.0 in 1957-59 (average), 1,415.0 in 1961, 1,379.0 in 1962, 1,338.1 in 1963, and 1,310.0 in 1964.

#### GEOGRAPHIC DISTRIBUTION

Total distribution of coke, exclusive of breeze, in 1964, increased 14 percent over 1963 and was the highest since 1957. The principal factor in this increase was the 15-percent gain in shipments to blast-furnace plants which utilized 91 percent of the national total. Most of the blast-furnace installations are integrated with coke ovens, and blast-furnace coke generally moves only short distances, usually by conveyor belt or company railroad within the producing establishments. Usually, about 88 percent of the coke destined to blast-furnace plants in a State is produced within the same State. Of the

TABLE 13.—Oven coke produced in the United States, used by producers, and sold in 1964, by State

State	Produced		Used by producing companies				Commercial sales	
			In blast furnaces		For other purposes <sup>1</sup>		To blast-furnace plants	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama.....	4,689,108	\$85,549,979	3,660,027	\$61,548,702	342,670	\$7,200,313	(2)	(2)
California, Colorado, Utah.....	2,935,921	65,314,900	2,786,366	62,656,832	21,670	422,386	(2)	(2)
Connecticut, Maryland, New Jersey, New York.....	7,687,284	126,783,218	6,275,216	99,424,880	81,462	1,471,841	776,068	\$12,753,818
Illinois.....	2,298,876	43,382,698	2,217,211	40,669,286	75,100	2,616,727	(2)	(2)
Indiana.....	8,170,823	156,463,275	7,792,406	144,910,161	12,464	233,581	(2)	(2)
Kentucky, Missouri, Tennessee, Texas.....	2,058,916	37,178,811	690,586	12,691,315	(2)	(2)	(2)	(2)
Michigan.....	3,907,944	66,885,423	(2)	(2)	258,401	5,509,177	(2)	(2)
Minnesota and Wisconsin.....	932,804	18,419,554	(2)	(2)	(2)	(2)	(2)	(2)
Ohio.....	7,243,687	128,850,524	6,083,856	104,906,546	136,207	2,937,636	477,298	7,543,620
Pennsylvania.....	17,694,174	299,888,148	16,771,789	285,292,234	19,129	320,716	529,976	8,040,442
West Virginia.....	3,889,754	55,659,751	3,061,197	51,186,423	(2)	(2)	(2)	(2)
Undistributed.....			3,502,034	50,817,588	63,975	1,815,659	1,676,452	25,442,913
Total 1964.....	60,908,391	1,083,876,181	52,840,688	914,103,967	1,010,978	22,528,036	3,459,794	53,780,793
At merchant plants.....	6,335,528	139,299,997			431,490	9,106,558	2,646,226	41,832,192
At furnace plants.....	54,572,863	944,576,184	52,840,688	914,103,967	579,488	13,421,478	813,568	11,948,601
Total 1963.....	53,307,609	936,962,187	46,879,469	799,712,515	708,026	15,677,060	2,279,411	35,096,469
Commercial sales—Continued								
	To foundries		To other industrial plants <sup>2</sup>		For residential heating		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Alabama.....	507,696	\$14,907,758	331,846	\$5,263,774	(2)	(2)	958,503	\$21,841,482
California, Colorado, Utah.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Connecticut, Maryland, New Jersey, New York.....	310,435	9,155,489	119,670	2,229,614	95,386	\$1,724,363	1,301,559	25,863,284
Illinois.....	(2)	(2)	(2)	(2)	(2)	(2)	30,464	474,843
Indiana.....	(2)	(2)	101,295	1,787,243	9,551	130,357	584,590	15,245,933
Kentucky, Missouri, Tennessee, Texas.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Michigan.....	(2)	(2)	160,714	2,448,721	(2)	(2)	586,677	15,535,938
Minnesota and Wisconsin.....	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Ohio.....	357,551	10,890,430	(2)	(2)	(2)	(2)	1,028,474	21,297,028
Pennsylvania.....	195,277	5,506,984	218,189	2,860,787	92,450	1,394,044	1,035,892	17,802,257
West Virginia.....	(2)	(2)	(2)	(2)	(2)	(2)	330,646	4,503,605
Undistributed.....	1,326,572	41,623,982	534,814	8,409,141	42,425	656,381	1,996,860	40,210,491
Total 1964.....	2,697,531	82,084,643	1,456,528	23,004,280	239,812	3,905,145	7,853,665	162,774,861
At merchant plants.....	2,506,403	76,655,696	737,509	12,864,270	235,505	3,829,129	6,125,643	135,181,287
At furnace plants.....	191,128	5,428,947	719,019	10,140,010	4,307	76,016	1,728,022	27,593,574
Total 1963.....	2,511,183	75,890,475	1,286,760	20,133,197	515,843	7,875,290	6,593,197	139,004,421

<sup>1</sup> Comprises 334,163 tons valued at \$10,485,581 used in foundries; 676,815 tons valued at \$12,042,455 for other purposes.

<sup>2</sup> Included with "Undistributed" to avoid disclosing individual company data.

<sup>3</sup> Includes small amount to water-gas plants.



TABLE 14.—Beehive coke produced in the United States, used by producers, and sold in 1964, by State

State	Produced		Used by producing companies—				Commercial sales	
			In blast furnaces		For other purposes		To blast-furnace-plants	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Pennsylvania.....	561, 777	\$7, 571, 657	( <sup>1</sup> )	( <sup>1</sup> )	-----	-----	420, 103	\$5, 854, 808
Kentucky, Virginia, West Virginia.....	674, 510	11, 020, 424	-----	-----	-----	-----	278, 631	4, 313, 284
Total:								
1964.....	1, 236, 287	18, 592, 081	( <sup>1</sup> )	( <sup>1</sup> )	-----	-----	698, 734	10, 168, 092
1963.....	970, 698	14, 929, 656	( <sup>1</sup> )	( <sup>1</sup> )	-----	-----	442, 940	6, 493, 931
Commercial sales—Continued								
	To foundries		To other industrial plants		For residential heating		Total	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Pennsylvania.....	28, 545	\$532, 280	115, 975	\$1, 226, 026	( <sup>2</sup> )	( <sup>2</sup> )	564, 623	\$7, 613, 114
Kentucky, Virginia, West Virginia.....	15, 094	232, 948	381, 286	6, 482, 090	( <sup>2</sup> )	( <sup>2</sup> )	675, 011	11, 028, 322
Total:								
1964.....	43, 639	765, 228	497, 261	7, 708, 116	( <sup>2</sup> )	( <sup>2</sup> )	1, 239, 634	18, 641, 436
1963.....	( <sup>1</sup> )	( <sup>1</sup> )	526, 486	8, 410, 012	( <sup>2</sup> )	( <sup>2</sup> )	969, 425	14, 903, 943

<sup>1</sup> Combined with coke sold "to blast-furnace plants" to avoid disclosing individual company data.

<sup>2</sup> Combined with coke sold "to other industrial plants" to avoid disclosing individual company data.

17 blast-furnace-coke-consuming States, Pennsylvania, Ohio, and Indiana consumed 56 percent of the total shipments of blast-furnace coke.

Unlike blast-furnace coke which is produced within the consuming States, foundry-coke shipments are widespread and many involve long-distance rail hauls. The principal consumers of foundry coke are the automotive, farm machinery, machine tool, heavy machinery, railroad, and electrical equipment industries. These industries are concentrated in such cities as Detroit, Flint, Chicago, Cleveland, Birmingham, Pittsburgh, Buffalo, and Milwaukee, and account for the large tonnages of foundry coke consumed in the States where these cities are located. A major factor in the 12-percent increase in foundry-coke shipments over those of 1963 was the increase in castings required for the automotive industry.

Coke utilized for miscellaneous industrial applications is included in shipments to other industrial plants. This classification includes shipments to nonferrous smelters, alkali plants (lime burning), chemical manufacturers (calcium carbide and elemental phosphorus), and a variety of other industrial plants. The total shipments for these uses represented 4 percent of the total distribution. The use of coke for residential heating continued to decline and amounted to less than 1 percent of the total.

Table 15 summarizes the distribution of oven and beehive coke by major end uses and final destination. Shipments in certain States have been grouped under the designation of "Undistributed" to avoid the disclosure of individual company data. Also, the small shipments to producer-gas and water-gas plants are no longer considered a major end use, and are included with shipments to other industrial plants.

TABLE 15.—Distribution of oven and beehive coke and breeze in 1964<sup>1</sup>

(Short tons)

Consuming State	Coke					Breeze
	To blast-furnace plants	To foundries	To other industrial plants	For residential heating	Total	
Alabama	3,700,501	193,968	280,605	9,663	4,184,737	214,090
Alaska			(2)		(2)	
Arizona		(2)	(2)		1,457	
Arkansas		1,475	2,458		3,933	(2)
California	(2)	58,704	(2)		1,357,903	79,520
Colorado	(2)	14,305	35,902	(2)	630,002	(2)
Connecticut		(2)	49,169	(2)	91,573	47,966
Delaware			1,825		1,825	1,086
District of Columbia						(2)
Florida		(2)	33,387	(2)	38,218	39,639
Georgia		12,454	(2)	(2)	16,689	950
Idaho		194	112,444		112,638	(2)
Illinois	3,982,658	266,562	98,494	5,732	4,353,446	222,307
Indiana	7,344,734	144,060	79,593	8,852	7,577,239	683,212
Iowa		80,025	11,027	371	91,423	(2)
Kansas		(2)	(2)		9,661	1,963
Kentucky	(2)	38,373	237,682	(2)	1,227,579	43,722
Louisiana		(2)	52,541	(2)	60,915	1,120
Maine		(2)	(2)	(2)		
Maryland	(2)	(2)	20,643		3,653,810	(2)
Massachusetts		(2)	(2)	(2)		
Michigan	(2)	747,517	256,093	(2)	5,172,617	243,025
Minnesota	(2)	21,353	15,318	(2)	411,088	42,994
Mississippi		(2)	(2)		(2)	(2)
Missouri		26,841	(2)	(2)	50,841	1,585
Montana		227	22,691		22,918	43,514
Nebraska		4,747	11,773		16,520	(2)
Nevada		(2)			(2)	
New Hampshire		(2)		(2)	(2)	
New Jersey		141,800	(2)	(2)	226,082	47,916
New Mexico			(2)	(2)	(2)	(2)
New York	3,151,772	103,129	74,053	9,331	3,338,285	256,977
North Carolina		22,428	(2)	(2)	43,971	20,869
North Dakota		(2)			(2)	
Ohio	9,820,994	351,196	258,563	5,104	10,435,857	399,597
Oklahoma		(2)	(2)		4,806	6,657
Oregon		4,464	26,664		31,128	(2)
Pennsylvania	14,620,838	168,863	194,797	41,890	15,026,388	727,246
Rhode Island		(2)	(2)		(2)	
South Carolina		(2)	25,610	(2)	36,075	11,695
South Dakota		(2)	(2)	(2)		(2)
Tennessee	(2)	33,868	217,030	(2)	316,736	132,049
Texas	(2)	84,154	47,024	(2)	878,062	76,222
Utah	(2)	(2)	27,820		996,669	(2)
Vermont		2,862	(2)	(2)	3,576	
Virginia	(2)	62,613	69,842	(2)	167,446	2,448
Washington		4,183	4,585		8,768	(2)
West Virginia	(2)	8,718	46,430	(2)	1,675,527	260,320
Wisconsin		151,947	1,378	6,646	159,971	(2)
Wyoming			4,830		4,830	140
Undistributed	14,298,561	161,472	176,195	82,657	108,063	315,866
Total	56,920,058	2,962,502	2,496,466	170,246	62,549,272	3,924,695
Exported	79,158	112,831	122,999	80,705	395,693	21,061
Grand total	56,999,216	3,075,333	2,619,465	250,951	62,944,965	3,945,756

<sup>1</sup> Based upon reports from producers showing destination and principal end use of coke used and sold. Does not include imported coke, which totaled 103,286 tons in 1964.

<sup>2</sup> Included with "Undistributed" to avoid disclosing individual company data.

## STOCKS OF COKE AND BREEZE

Producers' stocks of coke which usually decline during periods of high industrial activity, decreased 32 percent during 1964. As a rule, producers endeavor to keep stocks to a minimum by adjusting production to demand. This procedure, however, can be followed only to a certain point because of the nature of the refractory material in slot ovens. Such ovens cannot be stopped and started intermittently without serious damage to this material, and, for this reason, the producing companies are reluctant to shut down ovens.

Demand for coke began to decline in 1958, following the record production in 1957, and producers' stocks rose steadily. They reached an alltime peak in November 1959 when they totaled more than 5.1 million tons. For the next 3 years they varied between 3.6 and 4.8 million tons, and since the beginning of 1963 there has been a gradual decline at both merchant and furnace oven-coke plants.

Although stocks at merchant plants dropped 72 percent between January 1963 and December 1964, reserves at the close of 1964 were equal to 14.3 days' production. Stocks at furnace plants at the close of 1964 were equal to 10.6 days' production and consisted mainly of blast-furnace coke. Stocks of coke breeze at oven-coke plants varied only slightly from those of the preceding year. Beehive-coke-plant operators rarely stock coke, and only an insignificant amount was in reserve at the end of the year.

Detailed data on producers' stocks of coke and breeze are shown in table 16.

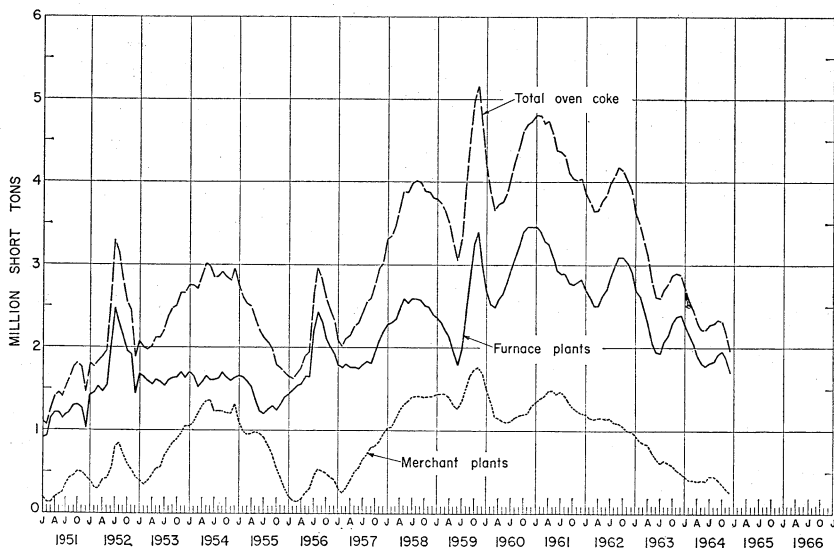


FIGURE 4.—Producers' stocks of oven coke in the United States, by month.

TABLE 16.—Producers' stocks of coke and breeze in the United States on Dec. 31, 1964, by State

(Short tons)

State	Coke				Breeze
	Blast furnace	Foundry	Residential heating and other	Total	
Oven coke:					
Alabama.....	316,960	10,526	44,167	371,653	69,329
California, Colorado, Utah.....	217,314			217,314	21,826
Connecticut, Maryland, New Jersey, New York.....	331,372	19,871	24,825	376,068	147,331
Illinois.....	49,925	1,912	1,790	53,627	36,185
Indiana.....	194,324	16,918	1,514	212,756	435,709
Kentucky, Missouri, Tennessee, Texas.....	33,262	18,932	10,074	62,268	15,115
Michigan.....	52,727	1,766	14,667	69,160	4,167
Minnesota and Wisconsin.....	72,295	28,676	39,295	140,266	57,528
Ohio.....	182,498	3,427	14,559	200,484	73,738
Pennsylvania.....	212,045	13,768	8,441	234,254	246,329
West Virginia.....	32,716			32,716	5,314
Total 1964.....	1,695,438	115,796	159,332	1,970,566	1,112,571
At merchant plants.....	38,440	99,963	123,684	262,087	139,562
At furnace plants.....	1,656,998	15,833	35,648	1,708,479	973,009
Total 1963.....	2,390,983	139,410	348,428	2,878,821	1,133,642
Beehive coke:					
Pennsylvania.....	892			892	
Kentucky, Virginia, West Virginia.....	118		316	434	30
Total:					
1964.....	1,010		316	1,326	30
1963.....	4,834		1,276	6,110	80

TABLE 17.—Producers' month-end stocks of oven coke in the United States

(Short tons)

Month	At merchant plants		At furnace plants		Total	
	1963	1964	1963	1964	1963	1964
January.....	937,903	447,093	2,688,158	2,264,672	3,626,061	2,711,765
February.....	871,464	410,554	2,620,780	2,146,261	3,492,244	2,556,815
March.....	845,617	410,499	2,472,069	2,048,118	3,317,686	2,458,617
April.....	829,026	392,241	2,280,177	1,910,015	3,109,203	2,302,256
May.....	732,717	405,581	2,047,941	1,812,872	2,780,658	2,218,453
June.....	660,119	395,908	1,947,240	1,788,316	2,607,359	2,184,224
July.....	663,048	451,203	1,932,980	1,825,530	2,596,028	2,276,733
August.....	638,097	451,172	2,070,619	1,842,343	2,708,716	2,293,515
September.....	610,767	417,106	2,166,067	1,922,885	2,776,834	2,339,991
October.....	570,494	351,404	2,300,830	1,970,993	2,871,294	2,322,397
November.....	523,270	304,193	2,375,864	1,890,459	2,899,134	2,194,652
December.....	484,692	262,087	2,394,129	1,708,479	2,878,821	1,970,566

## VALUE AND PRICE

The average values and prices of oven and beehive coke produced and sold, as reported by the producing companies, are shown in tables 18 and 19. The average values at plants of oven and beehive coke produced are based on reports from the producing companies that showed receipts, f.o.b. plant, for commercial sales of coke, and the prevailing market value assigned by the producers for coke consumed by the producing companies.

The average value of oven and beehive coke produced rose slightly over the 1963 figure, but was well below the 1957-59 average. The average receipts of oven and beehive coke from commercial sales declined from 1963, but were 4 percent above the 1957-59 average. Generally, coke prices follow delivered coal costs, but other factors, such as demand and labor costs, were responsible for the slightly higher selling prices for the various grades of coke in 1964. The only grade of oven coke that was higher than the 1957-59 average was that sold to foundries. Prices of beehive coke sold to furnace plants and for residential heating have declined below the 1957-59 average, whereas increases were registered on sales to foundries and other industrial plants. The large variance in prices between blast furnace and foundry is due to a number of factors, such as lower yields of coke from coking-coal admixtures because of higher proportions of low-volatile coals; longer coking cycles which reduce productivity; and larger minimum sizes. The difference in prices of oven and beehive-foundry coke is due largely to transportation charges on coal and/or coke.

TABLE 18.—Average value per short ton of coke produced in the United States and average receipts per short ton from coke sold (commercial sales)

Year	Value per ton produced			Receipts per ton sold		
	Oven coke	Beehive coke	Total	Oven coke	Beehive coke	Total
1957-59 (average).....	\$18.14	\$14.70	\$18.07	\$20.06	\$14.67	\$19.29
1961.....	17.80	15.08	17.76	21.14	15.13	20.55
1962.....	18.14	14.96	18.09	21.19	14.95	20.62
1963.....	17.58	15.38	17.54	21.08	15.48	20.53
1964.....	17.80	15.04	17.74	20.73	15.00	20.04

TABLE 19.—Average receipts per short ton of coke sold (commercial sales) in the United States, by use

Year	Oven coke				Beehive coke			
	To blast-furnace plants	To foundries	To other industrial plants <sup>1</sup>	For residential heating	To blast-furnace plants	To foundries	To other industrial plants <sup>1</sup>	For residential heating
1957-59 (average)....	\$15.85	\$29.39	\$15.87	\$17.15	\$14.84	\$16.72	\$14.04	\$11.64
1961.....	15.98	30.07	16.67	17.12	15.94	16.02	14.95	16.87
1962.....	15.98	30.25	16.37	14.10	14.35	14.15	15.05	15.63
1963.....	15.40	30.22	15.65	15.27	14.06	14.75	15.99	9.35
1964.....	15.54	30.43	15.79	16.23	14.34	17.54	15.68	7.83

<sup>1</sup> Includes water-gas plants.

## FOREIGN TRADE

## IMPORTS

Although imports of coke are important to certain local areas, such as the northwestern part of the United States, they are not a significant factor in the overall supply. For many years the total quantity of coke imported has amounted to less than one day's production. The 1964 total was the lowest since 1946, principally because of the virtual termination of imports through the Michigan Customs District.

More than one-half of the coke imported in 1964 and prior years has entered the United States through the Montana-Idaho Customs District. This coke is used mainly in nonferrous smelters and originates in the Canadian Province of British Columbia. Imports from countries other than Canada are usually small, and in 1964 were insignificant. In some instances in past years, special-purpose carbons from some countries have been classified as coke and included under imports of coke.

Statistics on coke imports in 1964 and two prior years are given in table 20.

TABLE 20.—Coke imported for consumption in the United States, by country and by customs district

	1962		1963		1964	
	Short tons	Value	Short tons	Value	Short tons	Value
Country or area:						
North America:						
Canada.....	132,076	\$1,663,693	142,952	\$1,731,011	101,375	\$1,329,897
Dominican Republic.....			5	419		
Netherlands Antilles.....	73	787	100	1,071		
Total.....	132,149	1,664,480	143,057	1,732,501	101,375	1,329,897
South America: British Guiana.....					40	608
Europe:						
Belgium-Luxembourg.....	720	21,029	220	6,365	220	7,296
Germany, West.....	69	18,297	782	81,322	1,651	170,806
Netherlands.....			1,792	112,917		
United Kingdom.....	8,939	151,361	6,744	113,942		
Yugoslavia.....	6	173				
Total.....	9,734	190,860	9,538	314,546	1,871	178,102
Grand total.....	141,883	1,855,340	152,595	2,047,047	103,286	1,508,607
Customs District:						
Buffalo.....	2,264	20,023	20,896	144,132	25,781	174,588
Hawaii.....	759	22,413	220	6,365	220	7,296
Maine and New Hampshire.....	106	1,687	96	1,508	89	1,391
Maryland.....			100	1,071		
Michigan.....	45,519	394,972	39,097	344,347	57	960
Minnesota.....	102	879				
Montana and Idaho.....	65,597	992,862	66,420	988,659	59,811	906,638
New Orleans.....	3,698	78,993	9,266	298,725	1,333	139,886
New York.....	79	960				
Puerto Rico.....			5	419		
Sabine.....			52	9,456	318	30,920
St. Lawrence.....	304	9,491	363	11,830	292	10,226
San Francisco.....	547	4,626				
South Carolina.....	5,271	89,281				
Vermont.....	35	585	76	1,258	47	777
Washington.....	17,602	238,568	16,004	239,277	15,338	235,865
Total.....	141,883	1,855,340	152,595	2,047,047	103,286	1,508,607

Source: Bureau of the Census.

## EXPORTS

The United States has always been a net exporter of coke. In 1964, this country exported over five times the quantity of coke imported, with an overall value over 6.5 times greater. Increased shipments to Canada and South America were the principal factors in the 16-percent gain in exports over 1963. Canada is by far the principal market for American coke, receiving 86 percent of the total export shipments in 1964. Shipments to European countries virtually ceased in 1964; less than 500 tons was distributed to three countries compared with nearly 47,000 tons sent to seven countries in 1963. Exports to Africa and Australia were small, and, of the five countries in Asia importing American coke, only the Philippines and Japan received more than 1,000 tons.

Exports of coke for 1962-64, by country and by customs district, are shown in table 21.

TABLE 21.—Coke exported from the United States, by country and by customs district

Country or area:	1962		1963		1964	
	Short tons	Value	Short tons	Value	Short tons	Value
<b>North America:</b>						
Canada.....	311,177	\$6,052,007	344,456	\$6,502,346	449,759	\$8,268,152
Mexico.....	9,878	267,297	13,633	331,863	19,116	537,208
Panama.....	306	9,131	584	10,532	411	8,574
<b>West Indies:</b>						
Trinidad and Tobago.....	113	2,573	59	1,299	173	5,712
Other West Indies.....	291	6,946	30	1,300	90	2,758
Other North America.....	220	5,205	38	1,671		
<b>Total.....</b>	<b>321,985</b>	<b>6,343,159</b>	<b>358,800</b>	<b>6,849,011</b>	<b>469,549</b>	<b>8,822,404</b>
<b>South America:</b>						
Argentina.....					10,098	288,480
Bolivia.....			131	2,360		
Brazil.....	9,923	274,066	5,730	159,424	7,637	323,270
Chile.....	249	7,330	900	22,743	146	6,464
Colombia.....	251	4,983	98	2,025		
Ecuador.....	175	3,289	243	5,682	213	4,811
Paru.....			74	3,138	7,221	93,318
Venezuela.....	263	7,833	24,879	265,603	19,962	277,838
<b>Total.....</b>	<b>10,861</b>	<b>297,501</b>	<b>32,055</b>	<b>460,975</b>	<b>45,277</b>	<b>994,181</b>
<b>Europe:</b>						
Denmark.....	325	6,792				
France.....					37	696
Germany, West.....	14,862	167,686	446	5,700		
Greece.....			131	1,160		
Italy.....	15	396	15,233	201,836	243	5,789
Norway.....			7,388	96,712		
Portugal.....	10,766	158,000	10,039	189,424		
United Kingdom.....	424	8,330	632	10,146	139	3,264
Yugoslavia.....			13,100	136,900		
<b>Total.....</b>	<b>26,392</b>	<b>341,204</b>	<b>46,969</b>	<b>641,878</b>	<b>419</b>	<b>9,749</b>
<b>Asia:</b>						
India.....	1,386	27,307	708	15,101	193	7,485
Iran.....			16	714		
Japan.....	1,142	31,039	12,365	341,643	6,762	195,334
Nansei and Nanpo Islands.....					16	368
Philippines.....	2,190	80,358	300	7,699	1,189	34,093
Saudi Arabia.....					6	256
Taiwan.....	61	899				
<b>Total.....</b>	<b>4,779</b>	<b>139,603</b>	<b>13,389</b>	<b>365,157</b>	<b>8,166</b>	<b>237,536</b>

See footnote at end of table.

TABLE 21.—Coke exported from the United States, by country and by customs district—Continued

	1962		1963		1964	
	Short tons	Value	Short tons	Value	Short tons	Value
Country or area—Continued						
Africa:						
Congo (Léopoldville).....			28	\$986		
Kenya.....					41	\$965
Total.....			28	986	41	965
Oceania: Australia.....	15	\$570			243	27,762
Grand total.....	364,032	7,122,037	451,241	8,318,007	523,695	10,092,597
Customs District:						
Buffalo.....	69,242	1,514,987	88,627	1,905,554	148,097	3,151,149
Chicago.....	81,681	1,208,950	104,193	1,536,822	105,163	1,524,049
Dakota.....	8,308	248,334	7,431	234,470	9,023	256,981
Duluth and Superior.....	3,029	79,701	3,191	74,545	2,441	64,855
Laredo.....	8,908	240,493	12,152	293,974	17,992	500,172
Maryland.....	100	4,338			298	10,705
Massachusetts.....	65	1,750				
Michigan.....	138,856	2,755,363	122,373	2,385,340	168,081	2,868,388
Mobile.....	11,245	170,735	1,204	31,035	15,377	238,204
Montana and Idaho.....			441	10,930		
New Orleans.....	724	20,313	1,011	441		21,009
New York.....	9,243	266,340	42,034	505,322	17,309	507,062
Ohio.....	2,334	47,894	6,522	56,890		
Oregon.....	1,136	30,939	12,290	339,780	6,965	221,921
Philadelphia.....	19,408	290,898	35,447	568,332	13,358	276,750
Sabine.....	551	9,250				
St. Lawrence.....	4,010	69,339	8,552	190,439	13,130	273,320
San Diego.....	858	22,151	1,332	32,544	960	30,416
Vermont.....	96	1,469	490	8,820		
Virginia.....	113	2,573	69	1,299	58	1,123
Washington.....	3,787	129,075	3,295	102,912	4,003	133,849
Other districts.....	338	7,145	597	14,806	574	12,644
Total.....	364,032	7,122,037	451,241	8,318,007	523,695	10,092,597

Source: Bureau of the Census.

## WORLD PRODUCTION

World production of hard or metallurgical coke in 1964 was estimated at 327 million tons, an increase of 6 percent over the estimated output for 1963. This increase was attributed to a more-or-less general rise in coke production throughout the world, as all continents, though not all countries, had larger outputs than in the previous year.

Europe led the world in production with nearly two-thirds of the total output. European production increased 4 percent, mainly because of substantial production increases in the U.S.S.R., West Germany, and the United Kingdom. Although there were 18 coke-producing countries in Europe, the three countries mentioned accounted for two-thirds of Europe's total.

Output of coke and breeze in the Soviet Union, currently the world's largest producer, reached 75 million tons, more than one-third of the European total, and nearly one-fourth of the world total. This record Soviet output was 6 percent higher than the 1963 figure and was 20 percent above that of 1960. It was, however, nearly 10 million tons less than the record output of coke and breeze established in the United States in 1951. The substantial increases in production in the U.S.S.R. are attributed to the all-out Soviet effort in recent years to increase the productive capacity of heavy industries which, basically,



are geared to the production of iron and steel. Although table 22 shows that production in the U.S.S.R. in 1964 exceeded that of the United States by 12.5 million tons, the actual difference in output between the two countries was only 8.5 million tons, as breeze production was not included in the U.S. figure.

The United States, with 19 percent of the world total, ranked second in output, while West Germany, with 15 percent, ranked third. Both countries registered production increases in 1964, principally because of increased demands for blast-furnace coke. United States output increased nearly 8 million tons, or 14 percent, compared with an increase of 1.6 million tons, or 4 percent, in West Germany.

Other ranking coke-producing countries, in order, were the United Kingdom, China, France, Poland, Japan, and Czechoslovakia. Production trends in these countries differ somewhat, with output in the United Kingdom and France declining slightly or remaining at about the same level over the past 5 years, while Japan, Poland, and Czechoslovakia had sizable production increases. The largest increases were recorded in Japan, where production has increased 51 percent since 1960, and 15 percent over 1963, an average of 10.2 percent per year during the past 5 years. Estimated production in China has remained at the same level since 1961. Data on China, however, cannot be considered too reliable because very little information has been published on China's industrial activity.

In addition to the high-temperature metallurgical coke produced in conventional slot- and beehive-coke ovens, nearly 50 million tons of other coke was produced by carbonizing a wide variety of coals, both coking and noncoking, at high, medium, and low temperatures in vertical and horizontal retorts, or in types of carbonizing equipment other than conventional coke ovens. This coke, which is commonly referred to as soft coke, and is not suitable for most metallurgical applications, is used principally for domestic heating, chemical processing, and the production of producer and water gas. When produced as char, the material generally is briquetted and then used for domestic fuel.

Europe produced four-fifths of the world's soft coke, and Asia supplied most of the remainder. The leading European producers were East Germany and the United Kingdom, with a combined output equal to 43 percent of the world total and 53 percent of Europe's production. East Germany's output of soft coke was principally lignite in the form of carbonized briquets. Production in the United Kingdom consisted principally of carbonized briquets or semicoke produced in retorts from bituminous coal. Both countries used these fuels principally for domestic heating. Other countries with relatively large outputs of soft coke were West Germany, Japan, Czechoslovakia, India, and Poland. Only a few hundred thousand tons was produced in the United States.

Table 23 shows production of gashouse, low-, and medium-temperature coke.

TABLE 22.—World production of oven and beehive coke (excluding breeze), by country<sup>1</sup>

(Thousand short tons)

Country	1960	1961	1962	1963	1964 <sup>2</sup>
<b>North America:</b>					
Canada <sup>2</sup> .....	3,873	3,900	4,022	4,281	4,343
Mexico.....	481	785	854	995	1,014
United States.....	57,229	51,711	51,910	54,278	62,145
Total.....	61,583	56,396	56,786	59,554	67,502
<b>South America:</b>					
Argentina <sup>2</sup> .....	280	440	550	660	720
Brazil.....	776	771	794	740	788
Chile.....	258	224	260	274	271
Colombia.....	463	358	397	441	463
Peru.....	33	40	44	44	31
Total.....	1,810	1,833	2,045	2,159	2,273
<b>Europe:</b>					
Austria.....	2,255	1,965	1,824	1,801	1,771
Belgium.....	8,295	7,948	7,981	7,941	8,155
Bulgaria.....	22	22	9	141	140
Czechoslovakia.....	9,323	9,410	9,844	10,250	10,385
Finland.....	11	* 20	* 20	* 11	* 11
France <sup>3</sup> .....	15,030	14,859	14,902	14,842	15,367
Germany:					
East <sup>4</sup> .....	1,111	1,135	1,136	1,149	1,149
West <sup>5</sup> .....	49,252	48,992	47,504	46,069	47,691
Hungary.....	550	658	721	728	733
Italy.....	4,095	4,296	4,769	5,065	5,153
Netherlands <sup>6</sup> .....	4,979	5,020	4,711	4,707	4,976
Poland.....	12,437	13,170	13,859	14,549	14,359
Rumania.....	904	1,036	1,233	1,258	1,263
Spain.....	2,837	2,876	3,018	3,034	2,821
Sweden.....	148	293	379	378	410
U.S.S.R. <sup>7</sup> .....	61,986	64,600	67,163	70,408	74,600
United Kingdom.....	21,094	19,968	17,430	17,408	18,982
Yugoslavia.....	1,194	1,211	1,220	1,202	1,297
Total.....	195,523	197,479	197,673	200,941	209,263
<b>Asia:</b>					
China <sup>2</sup> .....	27,600	16,500	16,500	16,500	16,500
India.....	5,267	8,264	7,769	8,102	8,069
Iran <sup>7</sup> .....	22	22	14	* 22	* 22
Japan.....	9,424	12,030	12,729	12,398	14,256
Korea, North <sup>2</sup> .....	900	990	1,200	1,300	1,500
Turkey.....	583	580	565	907	947
Total.....	43,800	38,386	38,777	39,229	41,294
<b>Africa:</b>					
Rhodesia (formerly Southern).....	161	212	112	* 116	143
South Africa, Republic of.....	2,364	2,420	2,429	2,520	2,636
Total.....	2,525	2,632	2,541	2,636	2,779
<b>Oceania:</b>					
Australia.....	2,949	3,038	3,106	3,192	3,407
New Caledonia <sup>2</sup> .....	77	77	77	77	77
New Zealand.....	7	7	7	7	7
Total.....	3,033	3,122	3,190	3,276	3,491
<b>World total.....</b>	<b>308,274</b>	<b>299,848</b>	<b>301,012</b>	<b>307,795</b>	<b>326,602</b>

\* Estimate. <sup>2</sup> Preliminary.<sup>1</sup> Includes revisions of data published previously.<sup>2</sup> Includes breeze and a negligible amount of gashouse coke.<sup>3</sup> Includes breeze.<sup>4</sup> High-temperature coke from lignite.<sup>5</sup> 1963 data.<sup>6</sup> Includes electrode coke but excludes an estimated 100,000 tons of low-temperature coke.<sup>7</sup> Year ended March 20 of year following that stated.

TABLE 23.—World production of gashouse, low-, and medium-temperature coke (excluding breeze), by country<sup>1</sup>

(Thousand short tons)

Country <sup>2</sup>	1960	1961	1962	1963	1964 <sup>p</sup>
North America: United States.....	W	W	164	160	203
Total <sup>e 2</sup> .....	230	130	275	270	315
South America:					
Argentina <sup>e</sup> .....	66	66	66	66	66
Brazil.....	*280	314	*310	*310	*310
Chile.....	*94	*94	*94	109	91
Uruguay.....	35	25	25	23	23
Total.....	475	499	495	508	490
Europe:					
Austria.....	289	280	347	378	358
Czechoslovakia:					
Gashouse.....	686	565	571	497	336
Lignite.....	2,399	2,375	2,327	2,330	*2,315
Denmark.....	439	446	461	453	*460
Finland.....	152	*130	*145	*170	*150
France:					
Gashouse.....	766	474	272	152	67
Low-temperature.....	328	306	297	299	326
Germany:					
East:					
Gashouse <sup>3</sup> .....	3,534	3,400	3,441	3,596	*3,595
Lignite.....	7,376	7,314	7,308	7,194	*7,195
West:					
Gashouse.....	5,754	5,454	5,467	5,390	5,415
Lignite.....	664	662	661	661	657
Low-temperature.....	80	98	114	111	94
Greece.....	25	25	24	23	*15
Hungary.....	547	534	559	535	*520
Ireland (Eire).....	106	103	97	*110	*115
Italy.....	899	862	855	793	650
Luxembourg.....	41	40	40	40	*30
Netherlands <sup>5</sup> .....	322	257	220	195	121
Norway <sup>6</sup> .....	52	50	50	40	50
Poland:					
Gashouse.....	1,077	1,122	1,194	1,273	*1,275
Low-temperature.....	*220	*220	276	280	*280
Portugal.....	43	44	34	28	11
Spain.....	273	279	256	219	186
Sweden.....	659	661	642	628	584
Switzerland.....	534	529	547	375	375
United Kingdom.....	11,050	10,975	10,886	10,938	9,900
Yugoslavia.....	22	19	20	19	21
Total <sup>e 2</sup> .....	41,700	40,600	41,000	40,600	39,000
Asia:					
Ceylon <sup>e</sup> .....	13	13	11	9	6
Hong Kong <sup>5</sup> .....	20	10	19	17	14
India:					
Gashouse.....	141	140	138	*130	*75
Low-temperature.....	2,002	1,989	2,313	2,525	2,436
Japan:					
Gashouse.....	4,101	4,185	3,807	3,719	4,102
Low-temperature <sup>e</sup> .....	83	83	83	83	77
Malaya <sup>e</sup> .....	22	22	22	22	22
Taiwan <sup>6</sup> .....	212	206	254	257	271
Turkey:					
Gashouse.....	110	133	168	186	191
Low-temperature.....	93	91	93	87	87
Total <sup>e 2</sup> .....	7,300	7,315	7,350	7,475	7,720

See footnotes at end of table.

TABLE 23.—World production of gashouse, low-, and medium-temperature coke (excluding breeze), by country<sup>1</sup>—Continued

Country <sup>2</sup>	1960	1961	1962	1963	1964 <sup>p</sup>
<b>Africa:</b>					
Algeria.....	103	68	77	66	*45
South Africa, Republic of.....	67	111	122	139	148
United Arab Republic (Egypt) <sup>e</sup> .....	33	33	39	39	39
Total.....	203	212	238	244	232
<b>Oceania:</b>					
Australia <sup>7</sup> .....	850	856	853	773	*785
New Zealand <sup>8</sup> .....	80	86	97	86	88
Total.....	930	942	950	864	873
World total <sup>2</sup> .....	50,840	49,700	50,310	49,960	48,630

\* Estimate. <sup>p</sup> Preliminary. W Withheld to avoid disclosing individual company data.

<sup>1</sup> Gashouse coke unless otherwise specified. Includes revisions of data published previously. Data do not add to totals shown, owing to rounding.

<sup>2</sup> Production data for China, Mexico, Rumania, and the U.S.S.R. not available; estimates included in the totals. A negligible amount is produced in Canada.

<sup>3</sup> Includes high-temperature coke.

<sup>4</sup> 1963 data.

<sup>5</sup> Includes breeze.

<sup>6</sup> Includes other cokes.

<sup>7</sup> Year ended June 30 of year stated.

<sup>8</sup> Year ended March 31 of year following that stated.

## COKE OVENS

### SLOT OVENS

A slight gain in the number of slot ovens occurred in 1964 as a result of the completion of 165 new ovens at three furnace-coke plants. A total of 112 ovens was abandoned at three furnace plants, and at year's end there were 14,639 slot ovens at 66 plants compared with 14,586 for the same number of plants in 1963. For the second consecutive year, there was comparatively little construction work in the oven-coke industry. Two possible reasons for this were the reduced operating rates during the early 1960's, which extended the useful life of some of the older batteries, and improvements in the fuel efficiency of blast furnaces, which reduced blast-furnace coke requirements and the need for additional coke capacity.

The durability of slot ovens is indicated by the fact that more than one-fifth of the ovens were over 35 years old at the end of 1964. The majority of these ovens, however, were Semet-Solvay ovens whose construction was quite different from ovens built in recent years. These old ovens, which were built on 5-foot centers, are essentially individual units that have withstood the stresses of continuous service. Most of the modernization and construction of new ovens in recent years has been at furnace plants. Consequently, nearly 69 percent of the ovens in existence at merchant plants were more than 35 years old, whereas the proportion of this age group at furnace plants was 13 percent.

Although many kinds of slot ovens have been built since the first battery of Semet-Solvay ovens in the United States was erected at

Syracuse, N.Y., in 1893, all but two batteries built in the past two decades have been either Koppers or Wilputte. At the end of 1964, 69 percent were Koppers-Becker, including old-type Koppers; 31 percent were Wilputte, including Semet-Solvay; and less than 1 percent were other types.

TABLE 24.—Slot ovens completed and abandoned in the United States in 1964, by State

State	Plants in existence Dec. 31 <sup>1</sup>	Ovens			
		New	Abandoned during year <sup>2</sup>	In existence Dec. 31	Under construction Dec. 31
Alabama.....	7			1,516	
California.....	1			315	
Colorado.....	1			206	
Connecticut.....	1			70	
Illinois.....	6			568	
Indiana.....	5			2,218	
Kentucky.....	1			196	
Maryland.....	1			757	
Michigan.....	4	45		778	
Minnesota.....	2			180	
Missouri.....	1			58	
New Jersey.....	1			120	
New York.....	3	50		855	
Ohio.....	12	70	54	1,836	
Pennsylvania.....	12		58	3,662	
Tennessee.....	1			44	
Texas.....	2			140	
Utah.....	1			252	
West Virginia.....	3			668	
Wisconsin.....	1			200	
Total 1964.....	66	165	112	14,639	
At merchant plants.....	17			1,894	
At furnace plants.....	49	165	112	12,745	
Total 1963.....	66	85	61	14,586	50

<sup>1</sup> Excludes plants retired permanently during year.

<sup>2</sup> Includes ovens dismantled for rebuilding.

TABLE 25.—Number of slot ovens in the United States on Dec. 31, 1964, by State and kind

State	Koppers	Koppers-Becker	Semet-Solvay	Wilputte	All others	Total
Alabama.....	510	633	180	130	163	1,516
California.....		315				315
Colorado.....	60	146				206
Connecticut.....		70				70
Illinois.....		238		330		568
Indiana.....	340	1,166	60	652		2,218
Kentucky.....		757	120	76		196
Maryland.....		268				757
Michigan.....		115	362	148		778
Minnesota.....	65					180
Missouri.....	18				240	58
New Jersey.....	55	65				120
New York.....	135	236	120	364		855
Ohio.....	667	586	122	461		1,836
Pennsylvania.....	903	1,546	88	1,125		3,662
Tennessee.....		140	24	20		44
Texas.....		252				140
Utah.....		514				252
West Virginia.....	154					668
Wisconsin.....	100		100			200
Total 1964.....	3,007	7,047	1,176	3,306	103	14,639
At merchant plants.....	398	469	624	363	40	1,894
At furnace plants.....	2,609	6,578	552	2,943	63	12,745
Total 1963.....	3,065	6,882	1,230	3,306	103	14,586

<sup>1</sup> Otto. <sup>2</sup> Simon-Carves.

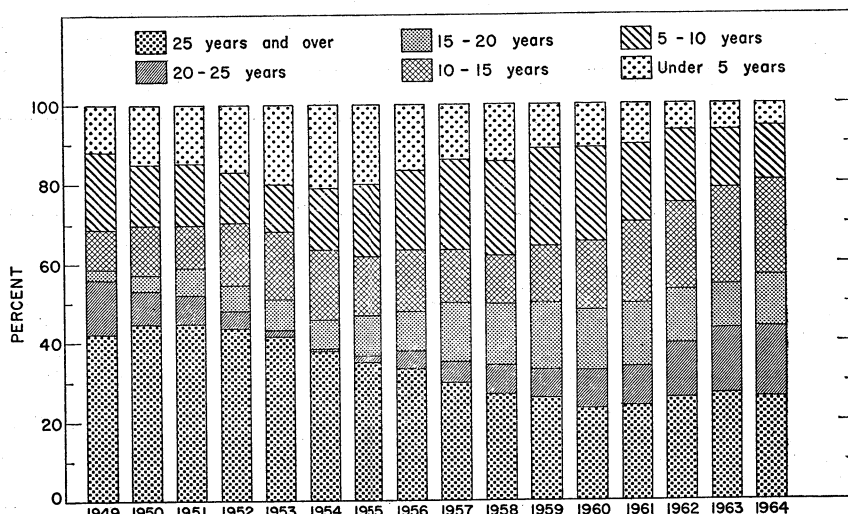


FIGURE 5.—Age of slot ovens in the United States.

TABLE 26.—Age of slot ovens in the United States on Dec. 31 1964<sup>1</sup>

Age	At merchant plants		At furnace plants		Total	
	Number of ovens	Percent of total	Number of ovens	Percent of total	Number of ovens	Percent of total
Under 5 years.....	78	4.1	798	6.3	876	6.0
From 5 to 10 years.....			1,980	15.5	1,980	13.5
From 10 to 15 years.....	214	11.3	3,308	25.9	3,523	24.1
From 15 to 20 years.....	55	2.9	1,856	14.6	1,911	13.0
From 20 to 25 years.....	216	11.4	2,342	18.4	2,558	17.5
From 25 to 30 years.....	35	1.9	792	6.2	827	5.7
From 30 to 35 years.....			111	.9	498	3.4
From 35 to 40 years.....	387	20.4	1,557	12.2	2,466	16.8
40 years and over.....	909	48.0				
Total.....	1,894	100.0	12,745	100.0	14,639	100.0

<sup>1</sup> Age dates from first entry into operation or from last date of rebuilding.

### BEEHIVE OVENS

Table 27 shows the number of plants and beehive-coke ovens in existence at the close of 1964 as reported by the owners or operators. This figure, however, does not represent the total number of ovens capable of producing coke. Ovens reported abandoned and plants closed have been removed from the list of active ovens. Many of these ovens could be reactivated with a minimum of repairs if there were a demand for metallurgical coke, and if coking coal were available.

The increase demand for metallurgical coke in 1964 resulted in the reactivation of several beehive plants that had been idle for several years, and the average number of beehive ovens active at the end of the year was nearly double the number active in January. The sharp increase in demand for beehive coke in the latter months of 1964 is evident in table 28 which shows the average number of ovens active in each month.

TABLE 27.—Beehive ovens completed and abandoned in the United States in 1964, by State

State	Plants in existence Dec. 31	Ovens			
		New or rebuilt	Abandoned during year	In existence Dec. 31	Under construction Dec. 31
Kentucky.....	1			200	
Pennsylvania.....	18	300	136	3,800	
Virginia.....	6			877	
West Virginia.....	1			194	
Total:					
1964.....	26	300	<sup>1</sup> 136	5,071	
1963.....	26	318	<sup>1</sup> 390	4,907	

<sup>1</sup> Idle and not expected to resume production; removed from list of available ovens.

TABLE 28.—Average number of beehive ovens active in the United States in 1964, by month

Month	Number	Month	Number	Month	Number
January.....	1,439	May.....	1,608	September.....	2,054
February.....	1,605	June.....	1,609	October.....	2,259
March.....	1,581	July.....	1,634	November.....	2,674
April.....	1,822	August.....	1,665	December.....	2,795

## COKING COAL

### QUANTITY AND VALUE OF COAL CARBONIZED

Coke ovens carbonized about one-sixth of the bituminous coal produced in 1964 and ranked second to electric utilities in the utilization of coal. Generally, a uniform rate of coal is charged into coke ovens, particularly in slot ovens, because of the continuous operation of the coking process. In 1964, however, the rate of utilization at both oven and beehive plants increased sharply in the latter months of the year. This development resulted in a gain of 14 percent in the quantity of bituminous coal charged into slot ovens, and 26 percent for beehive ovens. The blending of small proportions of anthracite fines with bituminous coal, mainly by producers of foundry coke, resulted in the utilization of nearly 500,000 tons of anthracite fines in the coke industry in 1964.

Coal costs at oven-coke plants continued to decline in 1964, although costs at beehive plants increased slightly. Coal costs are highest at plants farthest from their source of coal, particularly those along the Great Lakes, in the northeast, and on the west coast. Thus, the highest average costs of coal per ton were in California, Colorado, and Utah; in Connecticut, Maryland, New Jersey, and New York; and in Minnesota and Wisconsin. West Virginia oven-coke plant operators had the lowest-cost coal, followed by Alabama, Pennsylvania, and Ohio.

The delivered cost of coal to coke plants is important because coal represents between 65 and 70 percent of the cost of making coke. Transportation is one of the principal items in delivered coal costs. Many of the coke-producing centers in the United States are great distances from the coalfields, and transportation charges in some instances are greater than mine costs of the coking coal. The effect of transportation fees on delivered costs of coal to coke plants is illustrated by a comparison of the average values of delivered coal in Illinois and Indiana. For many years, all coal carbonized in these States was obtained from the Appalachian region, and the average values for both States were about the same. In recent years, however, the proportion of indigenous coal used in Illinois has increased, and in 1964 comprised 26 percent of the total coal carbonized within the State. As a result, the delivered cost of coal in Illinois averaged \$0.79 per ton less than that delivered in Indiana.

Although coal costs in general were lower in 1964 than for the 1957-59 period, there were exceptions. The far western States of California, Colorado, and Utah recorded slight increases in average costs for coal.

Coal costs for beehive-coke plants usually are much lower than for oven-coke plants because the ovens are located at or near their source of supply. Coal costs at beehive plants increased slightly in all producing States.

Table 29 shows the quantity and value of coals of individual States and groups of States.

TABLE 29.—Quantity and value at ovens of coal carbonized in the United States in 1964, by State

State	Coal carbonized			Coal per ton of coke	
	Short tons	Value		Short tons	Value
		Total	Average		
<b>Oven coke:</b>					
Alabama.....	6,365,139	\$49,341,246	\$7.75	1.36	\$10.52
California, Colorado, Utah.....	4,687,274	59,035,799	12.59	1.60	20.11
Connecticut, Maryland, New Jersey, New York.....	11,043,820	124,138,653	11.24	1.44	16.15
Illinois.....	3,366,792	31,092,258	9.23	1.46	13.53
Indiana.....	11,742,407	117,695,546	10.02	1.44	14.41
Kentucky, Missouri, Tennessee, Texas.....	2,897,135	27,091,369	9.35	1.41	13.16
Michigan.....	5,305,865	52,311,516	9.86	1.36	13.39
Minnesota and Wisconsin.....	1,205,977	12,936,896	10.73	1.29	13.87
Ohio.....	10,352,914	93,170,046	9.00	1.43	12.86
Pennsylvania.....	25,313,522	204,726,939	8.09	1.44	11.64
West Virginia.....	4,943,634	37,882,605	7.66	1.46	11.18
<b>Total 1964.....</b>	<b>87,224,479</b>	<b>809,422,873</b>	<b>9.28</b>	<b>1.43</b>	<b>13.29</b>
At merchant plants.....	8,822,552	87,228,299	9.89	1.39	13.77
At furnace plants.....	78,401,927	722,194,574	9.21	1.44	13.23
<b>Total 1963.....</b>	<b>76,470,038</b>	<b>725,812,979</b>	<b>9.49</b>	<b>1.43</b>	<b>13.62</b>
<b>Beehive coke:</b>					
Pennsylvania.....	914,405	5,037,357	5.51	1.63	8.97
Kentucky and Virginia.....	1,111,010	5,729,495	5.16	1.65	8.49
<b>Total:</b>					
1964.....	2,025,415	10,766,852	5.32	1.64	8.71
1963.....	1,612,581	8,287,970	5.14	1.66	8.54



TABLE 30.—Bituminous coal carbonized in coke ovens in the United States, by month

(Short tons)

Month	1957-59 (average)			1963			1964		
	Slot	Beehive	Total	Slot	Beehive	Total	Slot	Beehive	Total
Jan.....	7,974,200	220,300	8,194,500	6,028,800	109,600	6,138,400	6,656,800	139,600	6,796,400
Feb.....	7,312,300	213,300	7,525,600	5,637,200	111,900	5,749,100	6,411,800	135,300	6,547,100
Mar.....	8,125,900	251,200	8,377,100	6,603,300	110,000	6,713,300	6,868,100	154,100	7,022,200
Apr.....	7,619,800	230,500	7,850,300	6,762,900	144,300	6,907,200	6,901,100	150,900	7,052,000
May.....	7,833,800	198,000	8,031,800	7,139,100	167,800	7,306,900	7,888,600	154,600	7,543,200
June.....	7,569,600	150,700	7,720,300	6,770,500	159,600	6,930,100	7,221,000	133,200	7,354,200
July.....	6,531,200	138,300	6,669,500	6,398,400	142,300	6,540,700	7,337,000	114,500	7,451,500
Aug.....	5,892,900	139,900	6,032,800	5,975,700	134,200	6,109,900	7,308,000	155,500	7,463,500
Sept.....	5,849,300	132,400	5,981,700	5,905,000	123,500	6,028,500	7,311,000	182,300	7,493,300
Oct.....	6,152,600	127,100	6,279,700	6,232,600	139,000	6,371,600	7,777,200	210,000	7,987,200
Nov.....	7,116,800	129,300	7,246,100	6,107,800	128,100	6,235,900	7,646,200	233,200	7,879,400
Dec.....	7,842,200	144,300	7,986,500	6,458,200	132,300	6,590,500	7,905,400	262,200	8,167,600
Total.....	85,820,600	2,105,300	87,925,900	76,019,500	1,612,600	77,632,100	86,732,200	2,025,400	88,757,600

TABLE 31.—Anthracite carbonized at oven-coke plants in the United States, by month

(Short tons)

Month	1957-59 (average)	1961	1962	1963	1964
January.....	29,700	25,300	35,100	37,500	42,400
February.....	28,200	23,100	32,100	36,300	39,100
March.....	29,900	23,600	34,300	42,900	42,200
April.....	29,100	25,200	34,600	35,500	41,300
May.....	30,200	27,000	31,500	38,900	41,300
June.....	26,000	26,100	30,300	36,200	39,600
July.....	24,800	25,300	30,600	34,100	42,800
August.....	25,600	26,000	34,600	34,400	35,300
September.....	26,300	27,300	35,000	35,600	41,500
October.....	29,800	28,400	39,600	39,200	43,400
November.....	29,000	30,700	38,700	36,200	41,700
December.....	29,000	32,100	43,100	43,700	41,700
Total.....	337,600	320,100	419,500	450,500	492,300

TABLE 32.—Value of coal and products per short ton of coal carbonized in the United States

Year	Oven coke					Beehive coke	
	Value of coal per ton	Value per ton of coal				Value of coal per ton	Value per ton of coal
		Coke produced	Breeze produced	Coal-chemical materials used or sold <sup>1</sup>	Total		
1957-59 (average).....	\$9.90	\$12.75	\$0.31	\$3.84	\$16.90	\$6.12	\$8.76
1961.....	9.79	12.45	.34	3.84	16.63	6.10	8.88
1962.....	9.85	12.64	.32	3.61	16.57	5.31	9.07
1963.....	9.49	12.25	.33	3.33	15.91	5.14	9.26
1964.....	9.28	12.43	.30	3.34	16.07	5.32	9.18

<sup>1</sup> Includes value of surplus gas used and tar and pitch-of-tar burned.

TABLE 33.—Average value per short ton of coal carbonized at oven-coke plants in the United States, by State

State	1957-59 (average)	1961	1962	1963	1964
Alabama	\$8.13	\$8.36	\$8.35	\$8.29	\$7.75
California, Colorado, Utah	12.24	12.92	12.58	12.86	12.59
Connecticut, Maryland, New Jersey, New York	<sup>1</sup> 11.87	12.01	12.31	11.59	11.24
Illinois	10.65	9.84	9.66	9.35	9.23
Indiana	11.23	11.20	11.22	10.60	10.02
Kentucky, Missouri, Tennessee, Texas	10.60	8.62	9.07	9.06	9.35
Michigan	10.22	10.14	10.05	9.87	9.86
Minnesota and Wisconsin	11.46	11.07	11.13	11.02	10.73
Ohio	9.79	9.11	8.94	8.72	9.00
Pennsylvania	8.50	8.33	8.82	8.45	8.09
West Virginia	7.74	7.80	7.64	7.47	7.66
Average	9.90	9.79	9.85	9.49	9.28
Value of coal per ton of coke	14.08	14.00	14.14	13.62	13.29

<sup>1</sup> Includes Massachusetts.

## PREPARATION OF COKING COAL

### WASHED AND UNWASHED

One of the first steps in preparing coals for coking is mechanical cleaning by pneumatic or wet methods. The method generally used involves a wet process using jigs, concentrating tables, classifiers, launder washers, dense-medium processes, flotation, and other techniques. For this reason, all of the cleaned coal used in the coke industry is classified as washed.

Approximately 95 percent of the coal charged into slot ovens and 89 percent of that going into beehive ovens in 1964 was washed. The steady increase in the proportion of cleaned coal carbonized in recent years was due largely to the mechanization of mining operations. Mechanical mining and loading of coal, although increasing productivity and reducing mining costs, often results in more refuse in the run-of-mine coal, and in some areas necessitates extensive cleaning. All of the bituminous coal mined in Alabama, Colorado, and Utah used in coke ovens was washed before carbonization. Roughly 99 percent of the West Virginia, Pennsylvania, and eastern Kentucky coals was washed. The bulk of the unwashed coals carbonized was high quality coals that originated mainly in Pennsylvania and West Virginia.

Detailed data on the use of washed coals are shown in table 34. Trends in the use of washed coals are indicated in table 35.

### BLENDING

The judicious blending of coking coals is standard operating practice at oven-coke plants. Coal cleaning maintains the uniformity of quality of an individual coal; blending maintains the uniformity of the coking-coal admixtures. The principal objectives of blending coals are as follows: (1) To improve the chemical and physical quality and uniformity of the coke; (2) to control the pressure developed in the oven by the carbonization process; (3) to regulate the yield of products; and (4) to broaden the use of inferior coals. Coke plants generally have four or more mixing or blending bins, depending on the number of different coals blended. The usual practice is to blend major pro-

TABLE 34.—Washed and unwashed coal carbonized in the United States in 1964, by State in which used

State	Bituminous coal			Anthracite	Grand total
	Washed	Unwashed	Total		
<b>Oven coke:</b>					
Alabama.....	6,280,119	46,410	6,326,529	38,610	6,365,139
California, Colorado, Utah.....	4,499,420	187,854	4,687,274	-----	4,687,274
Connecticut, Maryland, New Jersey, New York.....	9,443,092	1,560,494	11,003,586	40,234	11,043,820
Illinois.....	2,997,289	359,458	3,356,747	10,045	3,366,792
Indiana.....	11,232,807	428,483	11,661,290	81,117	11,742,407
Kentucky, Missouri, Tennessee, Texas.....	2,459,934	387,507	2,847,441	49,694	2,897,135
Michigan.....	5,201,294	-----	5,201,294	104,571	5,305,865
Minnesota and Wisconsin.....	1,171,130	-----	1,171,130	34,847	1,205,977
Ohio.....	9,310,923	956,023	10,266,946	85,968	10,352,914
Pennsylvania.....	24,903,224	363,066	25,266,290	47,232	25,313,522
West Virginia.....	4,943,634	-----	4,943,634	-----	4,943,634
Total 1964.....	82,442,866	4,289,295	86,732,161	492,318	87,224,479
At merchant plants.....	8,257,038	147,656	8,404,694	417,858	8,822,552
At furnace plants.....	74,185,828	4,141,639	78,327,467	74,460	78,401,927
Total 1963.....	71,065,392	4,954,137	76,019,529	450,509	76,470,038
<b>Beehive coke:</b>					
Pennsylvania.....	749,222	165,183	914,405	-----	914,405
Kentucky, Virginia, West Virginia.....	1,063,328	47,682	1,111,010	-----	1,111,010
Total:	-----	-----	-----	-----	-----
1964.....	1,812,550	212,865	2,025,415	-----	2,025,415
1963.....	1,423,677	188,904	1,612,581	-----	1,612,581

TABLE 35.—Washed and unwashed bituminous coal carbonized in the United States

Year	Washed coal			Unwashed coal			Total coal carbonized*	Percent of total washed
	In slot ovens	In beehive ovens	Total	In slot ovens	In beehive ovens	Total		
	1957-59 (average).....	66,219,149	1,429,859	67,649,008	19,601,434	675,484		
1961.....	61,700,024	1,184,232	62,884,256	10,685,016	311,874	10,996,890	73,881,146	85.1
1962.....	62,026,666	1,124,809	63,151,475	10,896,661	214,053	11,110,714	74,262,189	85.0
1963.....	71,065,392	1,423,677	72,489,069	4,954,137	188,904	5,143,041	77,632,110	93.4
1964.....	82,442,866	1,812,550	84,255,416	4,289,295	212,865	4,502,160	88,757,576	94.9

portions of high-volatile coal with minor proportions of low-volatile coal. The addition of low-volatile coal improves the physical structure and increases the yield of the coke. Low-volatile coals usually are highly expanding coals, and the proportion that can be added is limited because of possible damage to oven walls when the coke is being discharged from the ovens. In addition to using high- and low-volatile coals, some plants also use medium-volatile coals or other blending materials such as anthracite or coal-tar pitch. In 1964, 61 of the 64 active coke plants used coals of different volatile contents. Of these, 39 (including 7 blending anthracite) used high- and low-volatile coals; 13 (including 10 blending anthracite) used high-, medium-, and low-volatile coals; 6 plants used high- and medium-volatile coals; 3 plants used medium- and low-volatile coals (including 2 blending anthracite); and 3 plants used medium-volatile coals exclusively.

Coking-coal admixtures are selected carefully, and coke-plant operators are reluctant to make frequent changes. This is clearly indicated in the data presented in table 36, which shows that the average volatile content of all bituminous coals carbonized in 1964 (30.4) was only 1 percent higher than the average for the 1957-59 period.

The proportions of high-, medium-, and low-volatile coals used by the coke industry have not varied greatly in the past two decades. There are wide variations, however, in the proportions of the different types used at individual plants. This is shown in table 37, which gives the receipts of coal according to volatile content, by State.

The highest proportion of high-volatile coals was used in West Virginia and the Far Western States. Alabama used the highest proportion of medium-volatile coals, and the Lake States of Minnesota and Wisconsin, the highest percent of low-volatile. Merchant oven-coke plants used a greater percentage of low-volatile coal than furnace plants because a large part of their coke is foundry grade, for which larger proportions of low-volatile coals are used in the blends.

TABLE 36.—Average volatile content of bituminous coal carbonized by oven-coke plants in the United States

Year	High		Medium		Low		Total	
	Short tons	Volatile content (per-cent)	Short tons	Volatile content (per-cent)	Short tons	Volatile content (per-cent)	Short tons	Volatile content (per-cent)
1957-59 (average).....	56,499,763	34.9	11,447,103	26.0	17,873,717	17.7	85,820,583	30.1
1961.....	47,304,877	35.6	10,175,333	25.9	14,904,830	17.6	72,385,040	30.5
1962.....	47,846,051	35.3	10,469,256	26.1	14,608,020	17.6	72,923,327	30.4
1963.....	49,825,740	35.4	10,657,200	26.1	15,536,589	17.4	76,019,529	30.4
1964.....	58,011,780	35.2	11,151,584	25.9	17,568,797	17.5	86,732,161	30.4

TABLE 37.—Coal received by oven-coke plants in the United States in 1964, by consuming State and volatile content <sup>1</sup>

(Short tons)

Consuming State	High-volatile		Medium-volatile		Low-volatile		Total coal receipts
	Quantity	Percent of total	Quantity	Percent of total	Quantity	Percent of total	
Alabama.....	539,831	8.2	5,430,942	82.3	626,351	9.5	6,597,124
California, Colorado, Utah.....	4,124,349	83.1	655,923	13.2	181,649	3.7	4,961,921
Connecticut, Maryland, New Jersey, New York.....	8,194,477	68.0	458,067	3.8	3,403,379	28.2	12,055,923
Illinois.....	2,553,247	74.9	46,486	1.4	809,301	23.7	3,409,034
Indiana.....	6,735,207	37.1	1,992,734	16.9	3,060,978	26.0	11,788,919
Kentucky, Missouri, Tennessee, Texas.....	1,817,250	62.8	436,274	15.1	640,883	22.1	2,894,407
Michigan.....	3,426,266	61.7	488,575	8.8	1,640,765	29.5	5,555,606
Minnesota and Wisconsin.....	640,278	44.5	139,684	9.7	653,092	45.8	1,438,054
Ohio.....	7,963,073	75.7	219,880	2.1	2,335,780	22.2	10,518,742
Pennsylvania.....	19,090,439	73.1	1,631,223	6.2	5,393,868	20.7	26,115,530
West Virginia.....	4,146,355	82.9	524	(?)	854,274	17.1	5,001,153
Total 1964.....	59,230,772	65.6	11,500,321	12.7	19,605,320	21.7	90,336,413
At merchant plants.....	4,486,313	48.7	1,398,053	15.2	3,323,302	36.1	9,207,668
At furnace plants.....	54,744,459	67.5	10,102,268	12.4	16,282,018	20.1	81,128,745
Total 1963.....	50,359,603	65.3	10,796,671	14.0	15,966,943	20.7	77,123,217

<sup>1</sup> Volatile matter on moisture-free basis: High-volatile—over 31 percent; medium-volatile—22-31 percent; and low-volatile—14-22 percent.

<sup>2</sup> Less than 0.1 percent.

## SOURCES

Sources of coals carbonized in the United States are shown in table 38. Although bituminous coal was mined in 23 States in 1964, only 10 States shipped coals to coke plants. Of the coals delivered to coke plants, 89 percent originated in Alabama, eastern Kentucky, Pennsylvania, and West Virginia. Only these few States supply the bituminous coals which have the caking or agglomerating properties necessary for use in coke ovens. All bituminous coal deposits of the Appalachian region possess caking or agglomerating properties, but because some coals in certain areas of the region contain high proportions of ash and sulfur, they are not used as mined in making metallurgical coke. Many of these coals, however, can be upgraded to meet established specifications required in the coke industry through conventional cleaning methods. Consequently, the cleaned coals mined in the Appalachian region are distributed widely, as shown in table 39.

In addition to the coking coals of the Appalachian region, smaller quantities were obtained from fields in Colorado, Illinois, New Mexico, Oklahoma, Utah, and Virginia.

Coking coals are commonly classified in the United States by volatile content. Volatile matter represents that portion of a coal which is converted into volatile products (gases and vapors) when heated above its decomposition temperature in a coke oven. Three types, classified as high-, medium-, and low-volatile, are used to designate bituminous coals. The limits of volatile-matter content designating each type were established by the American Society for Testing and Materials as follows: High-volatile, over 31 percent; medium-volatile, 22-31 percent; and low-volatile, 14-22 percent.

The better quality high- and medium-volatile coals are found in West Virginia, Pennsylvania, eastern Kentucky, and Alabama. Low-volatile coals (pointed out in the preceding section on Blending) are used for improving the physical properties of metallurgical coke, especially its strength, and are obtained largely from West Virginia and central Pennsylvania. In preceding years, some low-volatile coals have been obtained from western Arkansas, but none was obtained from that State in 1964, and only 585,000 tons was received from eastern Oklahoma.

## CAPTIVE COAL

The oven-coke industry purchases less than 40 percent of its coking-coal requirements and obtains the balance from mines owned by the coke-producing companies. This is known as captive coal and ordinarily does not move in commercial channels, but is mined as needed by the coke-producing companies. By owning the coal mines, coke-plant operators have better control of the quality and supply of coking coals. It is evident from the data in table 40 that the optimum proportions of captive coal desired by the coke-oven operators was reached in the mid-1950's. For example, since the 1957-59 period, the proportion of captive coal obtained by oven-coke operators has varied only 1 percent, and was 63 percent in 1964. These data also show that furnace plants use a greater proportion of captive coal than do merchant plants.

## STOCKS

Monthend stocks of bituminous coal and anthracite at oven-coke plants are shown in tables 41 and 42. Adequate stocks of coal are extremely important to operators of slot ovens because these ovens are operated continuously and normally cannot be shut down without serious damage to the refractory materials from which they are constructed.

The quantity of bituminous coking coal on hand at all oven-coke plants at the end of 1964 was 26 percent greater than at the end of 1963. The high operating rate of ovens in 1964, however, substantially increased coal requirements and, at the end of the year, there was 39.5 days' supply of coal on hand, compared with 38.5 days' supply available on December 31, 1963. Stocks were maintained at relatively high levels during 1964, ranging from a low of 31.6 days' supply on hand on July 31 to 39.5 days' supply on December 31. The low level of stocks in July was attributed to the annual shutdown of mining operations in the first 2 weeks of the month to allow for miners' vacations.

TABLE 38.—Origin of coal received by oven-coke plants in the United States in 1964, by producing field and volatile content

(Short tons)

State and field <sup>1</sup> where coal was produced	Volatile content <sup>2</sup>			Total
	High	Medium	Low	
Alabama.....	432,361	5,550,826	-----	5,983,187
Colorado.....	1,509,608	492,176	-----	2,001,784
Illinois.....	1,286,671	-----	-----	1,286,671
Kentucky:				
Elkhorn.....	6,502,959	-----	-----	6,502,959
Harlan.....	2,777,460	-----	-----	2,777,460
Kenova-Thacker.....	46,346	-----	-----	46,346
New Mexico.....	380,303	-----	-----	380,303
Oklahoma.....	314,088	271,134	-----	585,222
Pennsylvania:				
Anthracite.....	-----	-----	500,597	500,597
Bituminous:				
Central Pennsylvania.....	-----	324,560	2,692,530	3,017,090
Connellsville.....	5,482,939	-----	-----	5,482,939
Freeport.....	2,427,945	-----	-----	2,427,945
Pittsburgh.....	14,767,669	-----	-----	14,767,669
Somerset.....	-----	-----	462,821	462,821
Westmoreland.....	220,653	-----	-----	220,653
Utah.....	2,234,438	-----	-----	2,234,438
Virginia:				
Buchanan.....	275,696	548,222	-----	823,918
Pocahontas.....	-----	-----	309,211	309,211
Southwestern.....	1,566,464	986,307	-----	2,552,771
West Virginia:				
Coal River.....	572,044	-----	-----	572,044
Fairmont.....	6,762,548	-----	-----	6,762,548
Kanawha.....	5,957,177	10,590	-----	5,967,767
Kenova-Thacker.....	1,605,555	-----	-----	1,605,555
Logan.....	3,620,882	224,960	-----	3,845,842
New River.....	-----	-----	590,313	590,313
Pocahontas.....	-----	1,875,587	13,248,291	15,123,878
Randolph-Barbour.....	64	-----	-----	64
Tug River.....	-----	-----	4,214	4,214
Webster-Gauley.....	486,902	1,210,327	-----	1,697,229
Winding Gulf.....	-----	5,632	1,797,343	1,802,975
Total.....	59,230,772	11,500,321	19,605,320	90,336,413

<sup>1</sup> As defined by the U.S. Coal Commission of 1922.

<sup>2</sup> Volatile matter on moisture-free basis: High-volatile—over 31 percent; medium-volatile—22-31 percent; and low-volatile—14-22 percent.

TABLE 39.—Origin of coal received by oven-coke plants in the United States in 1964, by State

(Short tons)

Consuming State	Coal produced in—					
	Alabama	Colorado	Illinois	Kentucky	New Mexico	Oklahoma
Alabama.....	5,825,074					
California, Colorado, Utah.....		2,001,784			380,303	131,198
Connecticut, Maryland, New Jersey, New York.....				1,468,007		
Illinois.....			892,291	1,414,881		
Indiana.....			394,380	3,733,450		
Kentucky, Missouri, Tennessee, Texas.....	158,113					454,024
Michigan.....				1,542,135		
Minnesota and Wisconsin.....				188,453		
Ohio.....				539,171		
Pennsylvania.....				440,668		
West Virginia.....						
Total 1964.....	5,983,187	2,001,784	1,286,671	9,326,765	380,303	585,222
At merchant plants.....	575,881		46,555			
At furnace plants.....	5,407,306	2,001,784	1,286,671	9,280,210	380,303	585,222
Total 1963.....	5,131,252	1,571,820	1,261,939	8,326,565	279,003	658,131
	Coal produced in—(Continued)					Total
	Pennsylvania	Tennessee	Utah	Virginia	West Virginia	
Alabama.....	37,988			24,634	709,428	6,597,124
California, Colorado, Utah.....			2,234,438		214,198	4,961,921
Connecticut, Maryland, New Jersey, New York.....	4,023,173			636,710	5,928,033	12,055,923
Illinois.....	10,134			46,486	1,045,242	3,409,034
Indiana.....	84,368			775,512	6,801,209	11,788,919
Kentucky, Missouri, Tennessee, Texas.....	45,001			99,349	2,137,920	2,894,407
Michigan.....	108,038			551,344	3,354,089	5,555,606
Minnesota and Wisconsin.....	34,212			4,742	1,210,647	1,438,054
Ohio.....	4,800,799			227,409	4,951,363	10,518,742
Pennsylvania.....	14,200,308			1,217,984	10,256,570	26,115,530
West Virginia.....	3,535,693			101,730	1,363,730	5,001,153
Total 1964.....	26,879,714		2,234,438	3,685,900	37,972,429	90,336,413
At merchant plants.....	613,627			840,062	7,131,543	9,207,668
At furnace plants.....	26,266,087		2,234,438	2,845,838	30,840,886	81,128,745
Total 1963.....	21,922,653	7,458	2,037,384	3,371,964	32,555,048	77,123,217

TABLE 40.—Quantity and percentage of captive coal received by oven-coke plants in the United States

(Short tons)

Year	At merchant plants			At furnace plants			Total		
	Total coal received	Captive coal		Total coal received	Captive coal		Total coal received	Captive coal	
		Quantity	Percent		Quantity	Percent		Quantity	Percent
1957-59 (average)	10,270,085	4,523,385	44.0	76,660,207	48,941,264	63.8	86,930,292	53,464,649	61.5
1961.....	7,727,607	3,214,284	41.6	66,547,998	42,354,003	63.6	74,275,605	45,568,287	61.4
1962.....	7,337,664	3,361,357	45.8	65,412,231	41,377,978	63.3	72,749,895	44,739,335	61.5
1963.....	8,018,890	3,642,257	45.4	69,104,327	43,502,197	63.0	77,123,217	47,144,454	61.1
1964.....	9,207,668	3,172,241	34.5	81,128,745	53,265,248	65.7	90,336,413	56,437,489	62.5

TABLE 41.—Monthend stocks of bituminous coal at oven-coke plants in the United States

(Short tons)

Month	1960	1961	1962	1963	1964
January.....	11,428,017	10,483,155	9,778,578	7,338,642	7,780,399
February.....	11,241,870	9,788,567	9,407,933	7,232,935	7,899,711
March.....	11,148,141	9,551,136	9,404,688	6,595,093	8,298,576
April.....	11,324,365	9,331,749	9,431,344	6,883,100	8,410,773
May.....	11,916,169	9,851,556	9,668,244	7,647,971	8,840,881
June.....	12,391,359	9,932,172	10,360,167	8,202,228	9,375,431
July.....	10,342,992	8,495,602	8,256,863	6,386,167	7,467,186
August.....	10,742,409	8,936,261	8,276,856	6,918,806	7,969,248
September.....	10,918,346	9,135,237	8,179,859	7,290,283	8,643,158
October.....	11,082,639	9,813,136	8,622,170	7,911,761	9,346,889
November.....	11,203,784	10,452,933	8,849,458	8,054,381	9,872,705
December.....	11,028,816	10,392,751	8,305,379	8,014,046	10,081,035

TABLE 42.—Monthend stocks of anthracite at oven-coke plants in the United States

(Short tons)

Month	1960	1961	1962	1963	1964
January.....	77,724	74,624	85,037	99,088	82,485
February.....	65,831	62,092	72,282	73,173	67,204
March.....	50,517	50,036	58,826	51,011	42,176
April.....	55,222	51,222	51,201	44,880	36,683
May.....	67,100	54,241	52,181	40,473	42,782
June.....	71,499	57,494	52,652	55,515	58,768
July.....	68,800	58,947	61,979	58,471	60,035
August.....	86,143	59,811	71,150	71,982	67,531
September.....	89,366	73,292	88,897	87,493	82,882
October.....	108,090	98,923	101,987	110,091	103,198
November.....	107,542	109,281	122,315	121,476	132,546
December.....	92,848	98,381	115,338	113,620	129,342

Anthracite stocks also increased in conjunction with the higher level of oven operations, and were 14 percent higher on December 31, 1964, than at the end of 1963. These stocks are relatively unimportant, however, as only a small portion of anthracite is used in coking-coal admixtures by producers of foundry coke.

## TECHNOLOGY

The increase of productivity and the reduction of production costs, as well as the development of an improved product, are constant factors of concern to the coke industry. Particularly in recent years, great emphasis has been placed on improvement and automation of certain phases of coke-oven operations, and on innovation in operating techniques.

The technique of preheating coal and charging the hot coal into ovens has been studied throughout the world for many years. However, with the foregoing goals in view, this method was the subject of renewed interest in 1964. For several years, considerable work was devoted to the dry charging of coal at the experimental coke plant at Marienau in France by Cherchar. The Federal Bureau of Mines and the Koppers Co., Inc., in the United States also have conducted laboratory experiments and studies on the preheat treatment of coal



and charging of hot coal. A laboratory study was conducted in Germany on the effect of drying and preheating coking coal. In the Soviet Union, tests on a laboratory scale were conducted at the Moscow Chemical-Technological Institute de Mendeleev.<sup>3</sup> Results of the Soviet tests were in agreement with work done in the previously mentioned countries, and it was found that best results were achieved when coal was heated at a rate of 40° to 70° C per minute. Heating at slower rates (below 10° C per minute) resulted in poorer coking; faster rates (above 90° C per minute) led to an increase in the cracks or fissures. Also, best results in coke structure were found with a final preheat temperature of between 200° and 250° C. At this temperature an increase of 14 to 32 percent was obtained in the bulk density of the charges. The preheating of coal also allowed a more uniform bulk density of the charge throughout oven height. For example, the range of bulk density of a charge containing 3 percent moisture ranged from 690 kg per square meter at the top or surface of the charge, to 832 kg per square meter near the bottom of the oven. For preheated coal, the difference ranged from 860 to 875 kg per square meter from top to bottom of ovens. In addition to increasing bulk density and decreasing coking periods, which increased oven productivity, these tests showed that the structure and properties of coke were improved. The sulfur content of the coal blend and resulting coke decreased as preheating temperatures increased. For example, on unheated coal, all of the sulfur in the coal blend is charged into the oven, and the resulting coke contained 81.6 percent of the original sulfur content. When the same coal was heated to 250° C, only 91.6 percent of the original sulfur remained in the coal blend, and, when carbonized in ovens, only 66.3 percent remained in the coke. Preheating to 350° C resulted in coal blends containing only 74.9 percent of the sulfur while the resulting coke contained only 61.3. The desulfurization of coking coals is important in the U.S.S.R., particularly in the Donets Basin where coking coal has a high sulfur content.

The conclusion drawn from this study was that preheating of coals is an effective method of increasing coke productivity, improving coke structure and properties, and expanding the use of gas and weakly coking coals. Plans were being made to continue tests on a pilot-scale basis. Final conclusion was that if this technique proved technically and economically successful, rising coke requirements can be met with existing capacity.

A series of tests conducted at the Clairton works of the United States Steel Corp. indicate that significant increases in coking rates can be achieved in slot ovens with walls constructed of unusually dense silica brick, or ovens with thinner walls of regular silica brick.<sup>4</sup> Both approaches improve heat transfer rates through the walls, and the coking time for a 21-ton coal charge in each type of oven was reduced from the usual 16.8 hours to as little as 13.9 hours, with net improvements of up to 21 percent in oven productivity. Both types of oven showed a 17-percent shorter coking period for each charge. The dense silica brick used in the experimental ovens were a developmental product of the Harbison-Walker Refractories Co. of Pitts-

<sup>3</sup> Zhitov, B. N., G. N. Makarov, and S. S. Dvorin. The Carbonization of Preheated Coals and Blends. Coke and Chemistry (U.S.S.R.), February 1964, pp. 15-21.

<sup>4</sup> Chemical and Engineering News, v. 42, No. 49, Dec. 7, 1964, pp. 54-56.

burgh, Pa.; the thin-walled test ovens were designed by the Koppers Co.

A significant development in 1964 was the United States Steel Corp.'s decision to expand chemicals recovery and processing facilities at its Clairton, Pa., coke plant.<sup>5</sup> The main facility will be an anhydrous ammonia plant which will produce ammonia from hydrogen extracted from coke-oven gas. Nitrogen for the synthesis will be supplied by a new conventional air separation plant that will produce high-purity oxygen as a byproduct. Recovery of hydrogen and other chemicals will be effected by a new cryogenic technique that involves condensing the components of coke-oven gas in interchangeable regenerators. A primary regenerator plant will separate a mixture of ethylene and heavier volatile constituents from the gas. Hydrogen sulfide, hydrogen cyanide, and some benzene will be separated from this mixture, leaving a fraction rich in ethylene. Crude hydrogen, about 90 percent pure, will be recovered from the coke-oven gas, leaving the primary regenerator. This hydrogen will be further purified in a liquid nitrogen scrubber before it is combined with nitrogen to produce anhydrous ammonia. It is estimated that this plant will have an annual output of more than 400,000 tons of anhydrous ammonia per year.

In conjunction with the process described above, U.S. Steel will use a new method for removing ammonia from the gas stream.<sup>6</sup> This method, in which ammonia is removed by absorption with a weak solution of ammonium phosphate, will avoid the normally used ammonium sulfate route of ammonia recovery and yield a rich ammonium phosphate solution from which ammonia is recovered by distillation. The process, described in U.S. patent No. 3,024,090, is said to recover up to 99.5 percent of the ammonia in the gas and deliver a clean gas, ready for compression and hydrogen recovery.

Bureau of Mines research on coal carbonization during the year was centered upon developing new processes for carbonizing low-grade coals; perfecting techniques for destroying the agglomerating properties of highly-caking coals in order that these coals may be carbonized, hydrogenized, or gasified in processes employing fixed or fluidized beds; upgrading and characterizing the constituents of low-temperature tars; developing a universally acceptable test for coke quality; and providing information on the carbonizing properties of a number of American coals.

The Bureau continued entrainment carbonization investigations with studies aimed at perfecting the entrainment process for continuously carbonizing coals of any rank, both caking and noncaking, into a nonagglomerating char. To overcome the softening and agglomerating problems associated with the use of coking coals in the previously developed equipment, a 4-inch entrainment carbonization plant with a new coal feed system was designed and constructed. Two exploratory runs using Eagle and Sunnyside coals were made in the new plant late in the year, but no conclusive results were obtained, as neither run had reached a balanced operation.

Three techniques for pretreating highly-caking coals to destroy their agglomerating property were investigated. Such coals become plastic

<sup>5</sup> Chemical and Engineering News, v. 42, No. 40, Oct. 5, 1964, p. 25.

<sup>6</sup> Chemical Week, v. 96, No. 9, Feb. 27, 1965, p. 39.

and sticky when heated between 570° and 750° F, and cannot be carbonized, hydrogenated, or gassified effectively in fixed or fluidized beds at elevated temperatures. In treatment in a fluidized bed reactor,<sup>7</sup> a nonagglomerating product was obtained when the coal was exposed to mixtures of steam plus oxygen or air at temperatures of 780° to 810° F for 5 to 10 minutes, and, when the coal was exposed to air at 430° to 450° F for 30 to 40 minutes. Caking coals also were converted to noncaking chars when treated under varying temperatures and lengths of time in fixed beds and free-fall reactors.<sup>8</sup>

An electrically heated, experimental, slot-type coke oven with a special coal handling system was constructed for use in a pilot-plant study to investigate the effects of adding char to coking-coal blends. This study will explore the possibility of substituting char for at least part of the relatively expensive low- and medium-volatile coals that are now commonly used in coking-coal blends. Tangible results from this study would be particularly important to western coke-oven operators who now have to use lower-volatile coals that are relatively unavailable in the West.

Methods used to adjust and control the bulk density of coal blends suitable for coking were investigated.<sup>9</sup> Major attention was directed toward the effects of changing surface moisture and particle size, and adding oil, techniques normally used in industry for controlling bulk density. Blends used in this study, which were obtained from a western coke plant, consisted of a Utah high-volatile base coal (Sunnyside, Carbon Co.) and three low- and medium-volatile coals from Oklahoma. Maximum bulk density was obtained with zero surface moisture. As surface moisture was added, bulk density dropped, reaching a minimum at 6 percent before increasing again with further moisture additions. At constant surface moisture, finer grinding of the blend decreased bulk density. Maximum bulk densities from the addition of oil were obtained by using one-half to one gallon of oil per ton of coal. Generally, the addition of oil decreased the bulk density of low-surface-moisture coal and increased that of high-surface-moisture coal.

In an effort to develop a universally acceptable coke quality test, the Bureau undertook a coke testing program to supply data for a direct correlation between the United States Standard ASTM tumbler test and the proposed International Standard Micum tumbler test.<sup>10</sup> Relative strengths of 18 commercially produced cokes were determined by ASTM and Micum tumblers and ASTM shatter test. Statistical procedures were used to relate the three test methods and to evaluate the effect of the charge weights, top sizes of coke, and types of screens specified by the two standard tumbler procedures.

The survey evaluating the coking properties of American coals was continued, and reports were published on coals from Letcher Co., Ky.,<sup>11</sup>

<sup>7</sup> Forney, A. J., R. F. Kenny, S. J. Gasior, and J. H. Field. Destruction of Caking Properties of Coal by Pretreatment in a Fluidized Bed. *Ind. and Eng. Chem., Product Research and Development*, v. 3 No. 1, March 1964, pp. 48-53.

<sup>8</sup> Gasior, S. F., A. J. Forney, and J. H. Field. Destruction of the Caking Quality of Bituminous Coal in a Fixed Bed. *Ind. and Eng. Chem., Product Research and Development*, v. 3, No. 1, March 1964, pp. 43-47.

<sup>9</sup> Landers, W. S., Manuel Gomez, and D. J. Donaven. Bulk Density Studies on a Commercial Blend of Western Coking Coals. *BuMines Rept. of Inv. 6502*, 1964, 33 pp.

<sup>10</sup> Walters, J. G., G. W. Birge, and D. E. Wolfson. Correlation of ASTM and Micum Test Methods. *BuMines Rept. of Inv. 6482*, 1964, 48 pp.

<sup>11</sup> Birge, G. W., D. E. Wolfson, and J. H. Lynch, Jr. Carbonizing Properties of Letcher County, Ky., Coals. *BuMines Rept. of Inv. 6416*, 1964, 16 pp.

and Buchanan, Dickenson, Russell, Tazewell, and Wise Counties in Virginia.<sup>12</sup> Investigations to determine the coking properties of bituminous coal deposits in northwestern Alaska were continued. These studies provide the metallurgical industries with information on the suitability of various American coals for the manufacture of metallurgical coke.

In a series of tests, the properties of coke produced by the Bureau of Mines in the BM-AGA retort were compared with those of coke produced in commercial ovens.<sup>13</sup> Fifteen of the industrial coke samples were produced in slot ovens, of which 13 were for blast furnace use and 2 were for foundry use; 2 samples were produced in beehive ovens. Although the plastic properties of the coal bends determined by the Giesler, Audibert-Arnu, and Hoffman methods were not correlatable with either the volatile matter of the coal blends or the physical properties of the resultant cokes, a high degree of correlation was obtained between the strength indexes of the pilot-plant and industrial cokes. The apparent gravity of industrial cokes, however, was consistently higher than that of BM-AGA cokes. The study also confirmed previous findings which show that the ash and sulfur content of cokes can be calculated with a high degree of accuracy from the chemical analysis of the coal and the yield of coke.

The Bureau conducted more than 90 carbonization assays on coals in 1964. This test, which is useful for predicting char, tar, and light-oil yields from larger equipment, is used also to provide data to guide the direction of research programs. Fifty-four of the assays were made in conjunction with a study on the effect of storage on carbonization yields.

Work on the characterization of low-temperature tars was continued, and a revised analytical procedure for identifying the constituents of various tars was developed. The procedure, which combines distillation, extraction, and chromatograph techniques, can be performed on standard laboratory equipment by technicians with limited laboratory experience. The procedure gives relatively detailed information on coal-tar constituents of greatest interest in product identification and processing.

The Bureau expanded its studies on the composition of various low-temperature tars to include tars produced by fixed-bed (BM-AGA), fluidized-bed, and entrainment-bed carbonizers. Emphasis was placed on determining the yields of compounds of current commercial interest. Comparisons made of tars produced in each type of carbonizer from Eagle subbituminous coal carbonized at 500° C showed that yields of commercially valuable oils were much higher from the BM-AGA process than from the other two.

The changes that occur in low-temperature tar vapors when they are thermally cracked in a high-temperature, fluidized-coke bed were studied also. This investigation showed that at 600° C the yield of paraffins, acids, aromatics, and olefins in the distillate increased with an increase in the tar vapor concentration in the cracker, but at higher temperatures, only the acids and aromatics increased with increased

<sup>12</sup> Birge, G. W., D. E. Wolfson, and J. H. Lynch, Jr. Carbonizing Properties of Coals from Buchanan, Dickenson, Russell, Tazewell, and Wise Counties, Va. BuMines Rept. of Inv. 6355, 1964, 22 pp.

<sup>13</sup> Wolfson, D.E., G. W. Birge, and J. G. Walters. Comparison of Properties of Coke Produced by BM-AGA and Industrial Methods. BuMines Rept. of Inv. 6354, 1964, 19 pp.

concentration. At 800° C most of the paraffins, naphthenes, and olefins decomposed, while the yield of tar bases remained essentially unchanged by cracking.

Research was continued on several projects directed at converting low-temperature tar into marketable products. Pitch obtained from low-temperature lignite tar was heated and blown with air or oxygen in an attempt to modify it for use as an electrode binder. Although this treatment increased the softening point and carbon-hydrogen ratio of the pitch, both important properties of electrode binder pitch, the values obtained were not comparable with those of commercial bituminous coal-tar pitch.

Yields of carbonization products as affected by coal storage time and conditions were studied under a cooperative agreement between the Bureau of Mines and the Union Carbide Olefins Co. In this investigation, in which coal was stored under varying conditions of particle size, pile size, and storage time, it was found that yields of tar and light oil were fairly sensitive to short periods of storage, with the effects perceptible after three days and continuing to increase for at least seven weeks. However, the overall effect diminished as pile size was increased.

## COAL CHEMICALS

### GENERAL REVIEW

Four basic coal-chemical materials—tar, ammonia, light oil, and gas—are recovered at oven-coke plants from the high-temperature carbonization of coal in slot ovens. Except for ammonia (recovered as an aqueous solution or converted to a salt and sold as produced) these materials are, in most instances, further processed to yield a number of primary chemicals of which the most important are benzene, toluene, xylene, solvent naphtha, naphthalene, crude chemical oil, creosote oil, pitch, and pyridine. Yields of the basic, as well as of the primary chemicals, vary somewhat according to the kind of coals carbonized, operating techniques, and recovery equipment used, but of the products resulting from carbonization, approximately 16 percent (on a weight basis) is recovered as gas and 5 percent as tar, while light oil and ammonia each comprise about 1 percent of the total. In standard units of measure, there were 10,372 cubic feet of gas, 8.75 gallons of tar, 2.92 gallons of light oil, and 18.49 pounds of ammonia (in terms of sulfate equivalent) produced for each ton of coal carbonized in slot ovens in 1964. Table 43 shows production and sales of coal-chemical materials and derivatives at oven-coke plants in 1964.

Figure 6 shows the relative yields of coke and basic coal-chemical materials since 1930. Although yields have varied only slightly from year to year, the figure illustrates that more gas and chemicals were recovered in periods of low industrial activity when there was less de-

mand for coke. This situation prevailed during the 1930's, when operating rates of ovens were low and coking cycles were longer than normal to provide for the maximum recovery of gas and chemicals which were in demand and readily marketable at that time. Yields fell substantially during the World War II period, when producers operated ovens for maximum coke recovery, and, after the war, changes in the supply and demand patterns of coke, gas, and chemicals kept yields below the levels attained in the 1930's. In recent years, yields have varied somewhat because of changes in coal mixes and other factors, but they have not changed appreciably in the past two decades and, in fact, were not much different in 1964 than in the 1920's.

Table 44 shows the heating value and coal equivalent of products other than coke produced at oven-coke plants. Although the quantities vary from year to year, most of the changes were due to differences in the amount of coal carbonized, rather than large fluctuations in yields. In terms of coal equivalent, the products recovered in 1964 were roughly equal to one-fourth of the coal carbonized in slot ovens.

Figure 7, which depicts the relative value of all products recovered from slot ovens, shows that the proportion of the total value supplied by surplus gas and chemical materials has declined steadily since 1930. Most of the decline in surplus coke-oven gas revenues was due to the introduction of natural gas in the residential and industrial heating markets. The reduction in the value of chemicals was largely the result of competition from petrochemicals which in recent years has become increasingly keen because of the development of new methods for producing high-purity, lower-cost products from natural gas and petroleum.

Table 45 shows the average value of coal-chemical materials recovered (used or sold) from each ton of coal carbonized. Compared with 1957-59, both chemicals and gas have declined in value. Most of the decrease, however, was caused by lower returns from the sale of chemicals which declined 19 percent in value since 1957-59. The decrease in the value of chemicals was due principally to sharp reductions in the prices of light-oil derivatives, particularly benzene which represents about three-fourths of the total dollar value of all light-oil products sold, and which has declined in value about \$0.10 per gallon since 1957-59. Surplus gas, which currently represents 45 percent of the total dollar value of chemical materials recovered, declined 5 percent in value during this period, and tar and ammonia products declined 13 percent and 10 percent, respectively.

Table 46 shows the proportions of the cost of coals carbonized that were recovered from the sale of various coal-chemical materials in recent years. Although the proportion recovered has decreased for all materials since 1957-59, the recovery of these products continues to be a major part of coke-plant operations, returning to coke producers in 1964 revenues equivalent to 36 percent of the value of the coals carbonized.

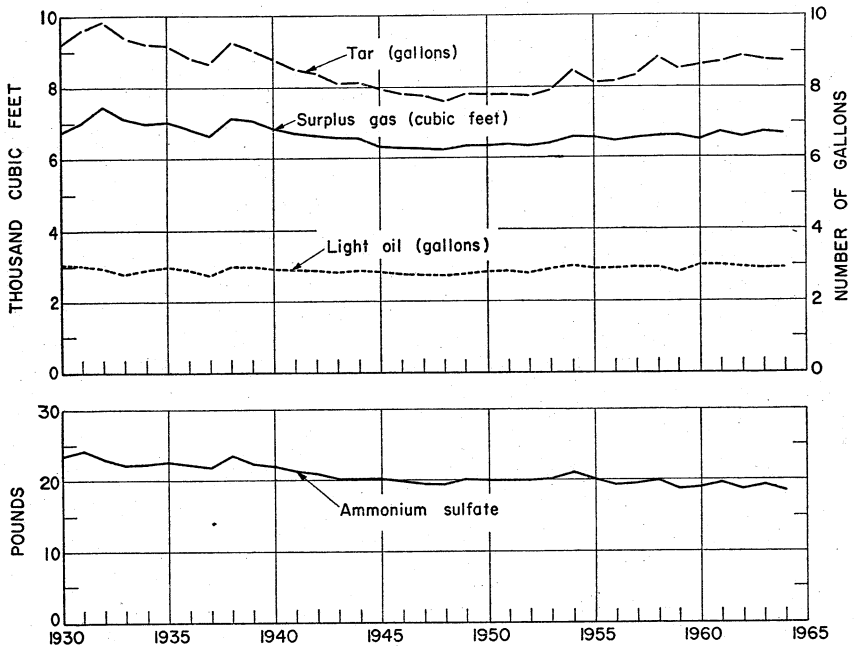


FIGURE 6.—Average yield of principal coal-chemical materials per short ton of coal carbonized in slot ovens in the United States. Yields of light oil and ammonium sulfate equivalent represent average for plants recovering these products.

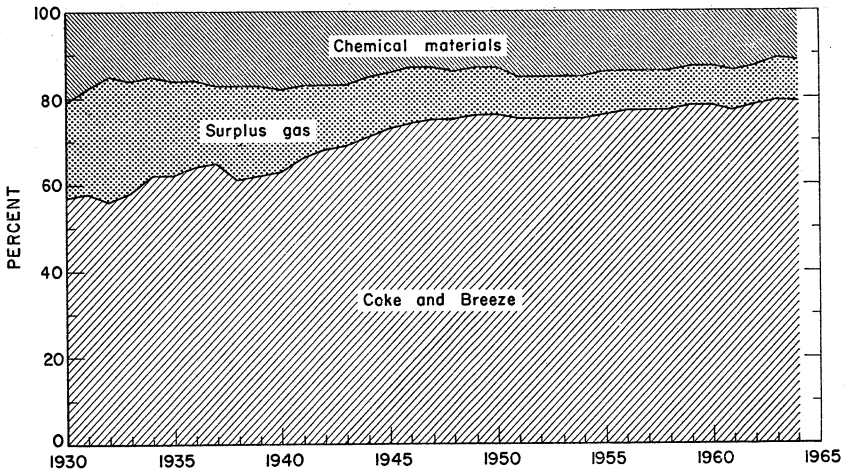


FIGURE 7.—Percentage of total value of coke-oven products from slot ovens supplied by coke and breeze, surplus gas, and chemical materials in the United States.

TABLE 43.—Coal-chemical materials, exclusive of breeze, produced at oven-coke plants in the United States in 1964<sup>1</sup>

Product	Produced	Sold			On hand Dec. 31
		Quantity	Value		
			Total	Average	
Tar, crude.....gallons	762,917,505	<sup>2</sup> 336,084,256	\$34,482,791	\$0.103	39,623,992
Tar derivatives:					
Sodium phenolate or carbolate do	3,236,282	<sup>3</sup> 3,277,166	352,823	.108	189,755
Crude chemical oil (tar acid oil) do	24,892,867	24,144,588	3,748,738	.155	1,601,117
Pitch-of-tar: <sup>4</sup>					
Soft.....short tons	583,230	127,564	4,113,245	32.245	27,726
Hard.....do	503,281	<sup>5</sup> 217,174	7,649,593	35.223	60,478
Other tar derivatives <sup>6</sup>			11,120,839		
Ammonia products:					
Sulfate.....short tons	680,887	<sup>7</sup> 635,633	17,967,085	28.266	158,573
Liquor (NH <sub>3</sub> content).....do	16,202	14,923	1,048,499	70.261	1,854
Diammonium and monoammonium phosphate.....do	50,175	<sup>7</sup> 50,291	4,966,574	98.757	6,460
Total.....do			23,982,158		
Sulfate equivalent of all forms short tons	793,908	743,810			172,225
NH <sub>3</sub> equivalent of all forms do	204,670	191,754			44,400
Gas:					
Used under boilers, etc. thousand cubic feet		74,488,904	13,445,251	.181	
Used in steel or allied plants do					
Distributed through city mains do	<sup>8</sup> 904,697,479	460,270,046	105,179,613	.229	
do do		21,892,599	9,287,932	.424	
Sold for industrial use.....do		25,495,763	4,354,668	.171	
Total.....do	904,697,479	582,147,312	132,267,464	.227	
Crude light oil.....gallons	<sup>9</sup> 248,668,967	53,702,264	6,769,092	.125	7,184,348
Light oil derivatives:					
Benzene:					
Specification grades (excluding Motor grade).....do	118,944,204	119,070,201	25,262,753	.212	9,307,528
Motor grade.....do	863,875	863,875	197,077	.228	9,280
Toluene (all grades).....do	25,520,509	25,529,772	4,728,900	.185	2,158,349
Xylene (all grades).....do	7,119,398	<sup>7</sup> 7,135,350	1,616,517	.227	674,460
Solvent naphtha (crude and refined).....do	4,483,899	4,192,686	838,583	.200	484,979
Other light oil derivatives.....do	8,237,221	4,853,486	426,443	.088	295,551
Total.....do	165,169,106	161,645,370	33,070,273	.205	12,930,147
Intermediate light oil.....do	5,391,899	2,184,839	224,260	.103	281,829
Grand total.....do			257,721,276		

<sup>1</sup> Includes products of tar distillation conducted by coke-oven operators under same corporate name.

<sup>2</sup> Includes 31,936,362 gallons sold to affiliated companies for refining and a small amount exported.

<sup>3</sup> Includes small amount exported.

<sup>4</sup> Soft—water-softening point less than 110° F; medium—from 110° to 160° F; hard—over 160° F. Figures on hard pitch include small amount of medium pitch.

<sup>5</sup> Cresote oil, cresols, cresylic acid, naphthalene, phenol, pyridine, refined tar, tar paint.

<sup>6</sup> Includes gas used for heating ovens and gas wasted.

<sup>7</sup> 192,281,020 gallons refined by coke-oven operators to make derived products shown.



**TABLE 44.—Coal equivalent of the thermal materials except coke, produced at oven-coke plants in the United States**

Year	Materials produced				Estimated equivalent in heating value <sup>1</sup> (billion Btu)					Coal equivalent (thousand short tons)
	Coke breeze (thousand short tons)	Surplus gas (billion cubic feet)	Tar (thousand gallons)	Light oil (thousand gallons)	Coke breeze	Surplus gas	Tar	Light oil	Total	
1913.....	735	64	115, 145	3, 000	14, 700	35, 200	17, 272	390	67, 562	2, 600
1918.....	1, 999	158	263, 299	87, 562	39, 980	85, 900	39, 495	11, 383	177, 758	6, 785
1929.....	4, 853	508	680, 864	200, 594	97, 060	279, 400	102, 130	26, 077	504, 667	19, 262
1939.....	3, 354	434	554, 406	170, 963	67, 080	238, 700	83, 161	22, 225	411, 166	15, 693
1949.....	4, 929	546	672, 407	228, 754	98, 580	300, 300	100, 861	29, 738	529, 479	20, 209
1957-59 (average)....	4, 077	568	732, 173	244, 118	81, 532	312, 400	109, 826	31, 735	535, 493	20, 439
1961.....	3, 337	490	633, 378	214, 003	66, 740	269, 500	95, 007	27, 820	459, 067	17, 522
1962.....	3, 425	484	650, 112	211, 688	68, 500	266, 200	97, 517	27, 519	459, 736	17, 547
1963.....	3, 609	516	671, 876	218, 166	72, 180	283, 800	100, 781	28, 362	485, 123	18, 516
1964.....	3, 902	582	762, 918	248, 669	78, 040	320, 100	114, 438	32, 327	544, 905	20, 798

<sup>1</sup> Breeze, 10,000 Btu per pound; gas, 550 Btu per cubic foot; tar, 150,000 Btu per gallon; and light oil, 130,000 Btu per gallon.

**TABLE 45.—Average value of coal-chemical materials used or sold and of coke and breeze produced per short ton of coal carbonized in the United States**

Product	1957-59 (average)	1961	1962	1963	1964
Ammonia products.....	\$0.307	\$0.317	\$0.286	\$0.270	\$0.275
Light oil and its derivatives.....	.687	.661	.545	.473	.459
Surplus gas used or sold.....	1, 592	1, 572	1, 527	1, 526	1, 516
Tar and its derivatives (including naphthalene):					
Tar burned by producers <sup>1</sup> .....	.427	.328	.404	.336	.381
Sold.....	.828	.964	.848	.719	.705
Total.....	3.841	3.842	3.610	3.324	3.336
Coke produced.....	12.749	12.447	12.640	12.253	12.426
Breeze produced.....	.308	.345	.324	.328	.303
Grand total.....	16.898	16.634	16.574	15.905	16.065

<sup>1</sup> Includes pitch-of-tar.

**TABLE 46.—Percentage of coal costs recovered from the sale of coal-chemical materials in the United States**

Product:	1957-59 (average)	1961	1962	1963	1964
Ammonia products.....	3.1	3.2	2.9	2.8	3.0
Light oil and its derivatives.....	6.9	6.7	5.5	5.0	4.9
Surplus gas used or sold.....	16.1	16.1	15.5	16.1	16.3
Tar and its derivatives used or sold (including naphthalene).....	12.7	13.2	12.7	11.1	11.7
Total.....	38.8	39.2	36.6	35.0	35.9
Value of coal per short ton.....	\$9.90	\$9.79	\$9.85	\$9.49	\$9.28

## COKE-OVEN GAS

The term "coke-oven gas" normally refers to the gas that remains after tar, ammonia, and light oil have been removed from the volatile matter evolved in carbonization. This gas, composed principally of hydrogen and methane, has a relatively high calorific value, and is used as fuel by producers and sold for residential and industrial heating. A few operations further process coke-oven gas and recover hydrogen, which is combined with nitrogen to form synthetic ammonia.

Yields of gas vary, but the quantity of gas produced for each ton of coal carbonized at high temperatures in slot ovens generally ranges between 9,300 and 11,000 cubic feet, with an overall average in the United States of about 10,500 cubic feet. This is a recovery rate of from 14 to 16 percent, by weight, of the coals carbonized. The overall yield in 1964 was 10,372 cubic feet, slightly less than the yield in 1963, owing to the increased rate of operation of ovens. Total gas production increased 13 percent over output in 1963, however, because of the increased amount of coal carbonized.

Tables 47 and 48 show production, disposal according to use, and the distribution of coke-oven gas in 1964. Roughly, one-third of the production was used for heating coke ovens, and the remainder (surplus gas) was used by producers for firing boilers, transferred to steel or allied plants for heating open-hearth and other metallurgical furnaces, and sold for industrial use or distributed through city mains for residential heating and cooking. A small part of the production was wasted because storage facilities at most plants are limited, and some gas was burned in the atmosphere when production exceeded demand.

Table 48 shows also the disposal of surplus gas by furnace and merchant plants. The bulk of the surplus gas produced at furnace plants in 1964 was consumed by producing companies, particularly in steel or allied plants, and only 4 percent of the total was sold. Merchant plants, generally with no affiliated companies to use the excess gas, sold the bulk of their surplus, which was distributed about equally to city mains and industrial plants. This is about the same disposal pattern that has prevailed at both furnace and merchant plants for the past several years, but there has been a significant change over the past few decades in the percentages of surplus gas used by producers and sold, particularly by furnace plants. Whereas furnace plants during the 1930's and 1940's sold a relatively large percentage of their surplus coke-oven gas (15 percent in 1944) to utilities and industrial plants, these plants now consume the major part as fuel because these outlets have been virtually lost to natural gas. Merchant plants continue to market the major part of their production, but the decline in the use of coke-oven gas for residential and industrial heating caused many plants to suspend operations, and the quantity of gas sold by merchant plants in 1964 was only about one-fifth as large as in 1944.

Most slot ovens were heated with coke-oven gas, but some operations used blast-furnace gas, a mixture of coke-oven and blast-furnace gas, or natural gas, for underfiring. Table 49 shows the quantities of the various gases used for heating ovens in 1964. Of the 377 billion cubic feet (coke-oven gas equivalent) consumed, 83 percent was coke-oven gas, 16 percent was blast-furnace gas, and the remainder was natural gas.

The total value of surplus coke-oven gas used or sold in 1964 totaled \$132 million, a 13-percent increase over that of 1963. The increase is attributed to the larger amount of surplus gas used or sold, as the average unit value of this gas remained at virtually the same level.

#### COKE-OVEN AMMONIA

The nitrogen released from coal during high-temperature carbonization is recovered through subsequent processing as ammonia liquor or as a crystallized solid. Ammonia liquor is a weak solution of ammonia (approximately 7 grams per liter of solution), while the solid forms are ammonium sulfate, diammonium phosphate, and monoammonium phosphate.

The recovery of ammonia is a necessary part of oven-plant operations, because some of the ammonia salts not only would corrode the processing equipment, but also contaminate the aromatic hydrocarbons, such as benzene.

Most plants produce ammonium sulfate, and 86 percent of the 204,670 tons of ammonia (equivalent of all forms) produced in 1964 was reacted with sulfuric acid to produce 680,887 tons of this ammonium salt. Eight percent of the ammonia production was recovered as ammonia liquor, and the remainder was reacted with phosphoric acid to produce 50,175 tons of di- and monoammonium phosphate. Of the 59 plants which recovered ammonia in 1964, 46 produced am-

TABLE 47.—Production and disposal of coke-oven gas in the United States in 1964, by State

(Thousand cubic feet)

State	Produced		Used in heating ovens	Surplus used or sold			Wasted
	Total	Per ton of coal coked		Quantity	Value		
					Total	Average	
Alabama.....	61,671,951	9.69	29,235,060	31,416,699	\$4,146,673	\$0.132	1,020,192
California, Colorado, Utah, Connecticut, Maryland, New Jersey, New York.....	120,027,871	10.87	35,286,280	35,994,911	7,359,462	.204	441,989
Illinois.....	34,418,282	10.22	9,924,745	33,703,580	31,476,952	.376	1,038,011
Indiana.....	127,147,789	10.83	36,101,496	23,449,856	4,330,828	.185	1,043,681
Kentucky, Missouri, Tennessee, Texas.....	27,277,565	9.42	14,254,313	90,368,161	17,376,833	.192	678,132
Michigan.....	52,303,602	9.86	9,431,812	12,539,573	1,616,002	.129	483,679
Minnesota and Wisconsin.....	11,609,390	9.63	6,188,481	42,810,232	9,182,621	.214	61,558
Ohio.....	89,443,055	8.64	34,959,635	5,191,479	1,007,469	.194	229,430
Pennsylvania.....	272,505,920	10.77	106,983,526	53,534,366	12,609,106	.236	949,054
West Virginia.....	55,560,009	11.24	15,537,437	163,796,053	34,166,602	.209	1,726,341
Total 1964.....	904,697,479	10.37	314,197,930	39,342,402	8,994,916	.229	680,170
At merchant plants.....	79,584,684	9.02	37,778,553	582,147,312	132,267,464	.227	8,352,237
At furnace plants.....	825,112,795	10.52	276,419,377	40,932,939	11,527,931	.282	873,192
Total 1963.....	800,582,375	10.47	277,584,414	541,214,373	120,739,533	.223	7,479,045
				516,083,978	116,721,052	.226	6,913,983

TABLE 48.—Surplus coke-oven gas used by producers in the United States and sold in 1964, by State

(Thousand cubic feet)

State	Used by producers—					
	Under boilers, etc.			In steel or allied plants		
	Quantity	Value		Quantity	Value	
		Total	Average		Total	Average
Alabama.....	12, 379, 374	\$1, 689, 569	\$0. 136	15, 535, 559	\$1, 988, 448	\$0. 128
California, Colorado, Utah.....	(1)	(1)	(1)	(1)	(1)	(1)
Connecticut, Maryland, New Jersey, New York.....	(1)	(1)	(1)	66, 196, 861	23, 555, 749	.356
Illinois.....	(1)	(1)	(1)	15, 587, 858	3, 087, 223	.198
Indiana.....	8, 242, 851	1, 528, 991	.185	79, 085, 353	14, 467, 157	.183
Kentucky, Missouri, Tennessee, Texas.....	5, 094, 515	592, 746	.116	(1)	(1)	(1)
Michigan.....	(1)	(1)	(1)	36, 015, 724	7, 465, 587	.207
Minnesota and Wisconsin.....	(1)	(1)	(1)	(1)	(1)	(1)
Ohio.....	7, 301, 176	1, 575, 341	.216	39, 706, 291	9, 824, 235	.247
Pennsylvania.....	26, 768, 385	4, 944, 434	.185	133, 862, 889	28, 537, 669	.213
West Virginia.....	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed.....	14, 702, 603	3, 114, 170	.212	74, 279, 511	16, 253, 545	.219
Total 1964.....	74, 458, 904	13, 445, 251	.181	460, 270, 046	105, 179, 613	.229
At merchant plants.....	9, 771, 397	1, 661, 068	.170	2, 905, 293	627, 642	.216
At furnace plants.....	64, 717, 507	11, 784, 183	.182	457, 364, 753	104, 551, 971	.229
Total 1963.....	80, 049, 588	15, 662, 374	.196	390, 342, 904	88, 296, 205	.226
	Sold					
	Distributed through city mains			For industrial use		
	Quantity	Value		Quantity	Value	
		Total	Average		Total	Average
Alabama.....	(1)	(1)	(1)	(1)	(1)	(1)
California, Colorado, Utah.....	(1)	(1)	(1)	(1)	(1)	(1)
Connecticut, Maryland, New Jersey, New York.....	15, 715, 237	\$7, 527, 608	\$0. 479	(1)	(1)	(1)
Illinois.....	(1)	(1)	(1)	(1)	(1)	(1)
Indiana.....	(1)	(1)	(1)	(1)	(1)	(1)
Kentucky, Missouri, Tennessee, Texas.....	(1)	(1)	(1)	(1)	(1)	(1)
Michigan.....	(1)	(1)	(1)	(1)	(1)	(1)
Minnesota and Wisconsin.....	(1)	(1)	(1)	(1)	(1)	(1)
Ohio.....	(1)	(1)	(1)	6, 526, 899	\$1, 209, 530	\$0. 185
Pennsylvania.....	(1)	(1)	(1)	(1)	(1)	(1)
West Virginia.....	(1)	(1)	(1)	(1)	(1)	(1)
Undistributed.....	6, 177, 362	1, 760, 324	.285	18, 968, 864	3, 145, 138	.166
Total 1964.....	21, 892, 599	9, 287, 932	.424	25, 495, 763	4, 354, 668	.171
At merchant plants.....	14, 506, 232	6, 790, 505	.468	13, 750, 017	2, 448, 716	.178
At furnace plants.....	7, 386, 367	2, 497, 427	.338	11, 745, 746	1, 905, 952	.162
Total 1963.....	20, 808, 789	8, 671, 867	.417	24, 882, 697	4, 090, 606	.164

<sup>1</sup> Included with "Undistributed" to avoid disclosing individual company data.

monium sulfate; 3 produced diammonium phosphate; 1 produced monoammonium phosphate; and 10 recovered ammonia liquor. One plant produced both ammonium sulfate and ammonia liquor.

Coke-oven ammonia represented only about 3 percent of the estimated total of 7.6 million tons of ammonia produced by all processes in the United States in 1964. Production of synthetic ammonium sulfate as a byproduct of the chemical industry has increased steadily in recent years, with output in 1964 estimated at 1.6 million

TABLE 49.—Coke-oven gas and other gases used in heating coke ovens in the United States in 1964, by State<sup>1</sup>

(Thousand cubic feet)

State	Coke-oven gas	Blast-furnace gas	Natural gas	Total coke-oven gas equivalent
Alabama.....	29,235,060	-----	8,012	29,243,072
California, Colorado, Utah.....	16,295,145	7,177,542	9,864	23,482,551
Connecticut, Maryland, New Jersey, New York.....	35,286,280	2 12,609,803	1,335,367	49,231,450
Illinois.....	9,924,745	3,306,792	-----	13,231,537
Indiana.....	36,101,496	11,695,372	414,765	48,211,633
Kentucky, Missouri, Tennessee, Texas.....	14,254,313	-----	-----	14,254,313
Michigan.....	9,431,812	14,599,745	-----	24,031,557
Minnesota and Wisconsin.....	6,188,481	-----	-----	6,188,481
Ohio.....	34,959,635	3,336,322	-----	38,295,957
Pennsylvania.....	106,983,626	1,876,456	318,957	109,178,939
West Virginia.....	15,537,437	6,277,205	-----	21,814,642
Total 1964.....	314,197,930	60,879,237	2,086,965	377,164,132
At merchant plants.....	37,778,553	1,345,372	337,016	39,460,941
At furnace plants.....	276,419,377	59,533,865	1,749,949	337,703,191
Total 1963.....	277,584,414	2 54,211,429	2,235,999	334,031,842

<sup>1</sup> A adjusted to an equivalent of 550 Btu per cubic foot.<sup>2</sup> Includes small amount of producer gas.

tons, compared with 680,887 tons of ammonium sulfate produced at coke plants.

Table 50 shows production and sales of ammonia products and yields in terms of sulfate equivalent. Approximately the same percentages of each product were recovered as in 1963, but output of the various products increased 10 percent because of the larger quantity of coal carbonized. The average yield of ammonia decreased 4 percent, however, because of the increased rate of operation of ovens in 1964.

Most of the ammonium sulfate and virtually all di- and monoammonium phosphate produced at coke plants was sold for use as fertilizer materials. Some ammonia liquor is used in agriculture also, and some is used for producing a variety of other products, such as ammonium chloride, sulfuric acid, and household ammonia. Complete data on end uses are not available, however. Most of the production was consumed in the United States; only 6 percent of the 731,062 tons of ammonium sulfate and di- and monoammonium phosphate produced was exported.

Coke-oven operators sold 94 percent of their production of ammonia (NH<sub>3</sub> equivalent of all forms) in 1964, and sales were about 5 percent greater than in 1963. Although the quantity of each product sold also increased over that of 1963, yearend stocks of NH<sub>3</sub> equivalent increased over one-third because of a significant increase in the stock of ammonium sulfate, which increased from 114,000 tons in 1963 to 159,000 tons in 1964. Stocks of ammonia liquor and di- and monoammonium phosphate at the end of the year were at about the same level as at the end of 1963.

The average value per ton, f.o.b. plant, of ammonium sulfate increased \$2.68 to \$28.27, and the plant value for combined sales of di- and monoammonium phosphate increased \$4.74 per ton to \$98.76. These increases, combined with the larger quantity of products sold, resulted in a 16-percent increase in the value of all ammonia products sold in 1964. The total value of sales was not significantly affected by the slight decline in f.o.b. plant value of ammonia liquor.

TABLE 50.—Coke-oven ammonia produced in the United States and sold in 1964, by State

(Short tons)

State	Active plants <sup>1</sup>	Produced					
		Sulfate equivalent	Pounds per ton of coal coked	As sulfate <sup>2</sup>	As liquor (NH <sub>3</sub> content)		
Alabama.....	7	60,959	19.15	60,125	( <sup>3</sup> )		
California, Colorado, Utah <sup>4</sup> .....	3	53,075	22.65	53,075	-----		
Connecticut, Maryland, New Jersey, New York <sup>5</sup> .....	6	106,836	19.35	98,690	( <sup>3</sup> )		
Illinois.....	4	36,258	22.23	36,258	-----		
Indiana.....	5	90,785	15.46	74,847	( <sup>3</sup> )		
Kentucky, Tennessee, Texas.....	3	19,392	17.98	( <sup>3</sup> )	( <sup>3</sup> )		
Michigan <sup>6</sup> .....	4	37,910	14.29	( <sup>3</sup> )	( <sup>3</sup> )		
Minnesota and Wisconsin.....	2	6,512	13.33	( <sup>3</sup> )	( <sup>3</sup> )		
Ohio.....	10	90,942	17.79	78,413	( <sup>3</sup> )		
Pennsylvania.....	12	246,309	19.46	246,309	-----		
West Virginia.....	3	44,930	18.65	44,930	-----		
Undistributed.....				38,415	16,202		
Total 1964.....	59	793,908	18.49	<sup>8</sup> 731,062	16,202		
At merchant plants.....	14	74,033	17.94	26,431	12,272		
At furnace plants.....	45	719,875	18.54	704,631	3,930		
Total 1963.....	59	718,778	19.23	661,904	14,662		
		Sold <sup>7</sup>				On hand Dec. 31	
		As sulfate <sup>2</sup>		As liquor (NH <sub>3</sub> content)		Sulfate <sup>2</sup>	Liquor (NH <sub>3</sub> content)
		Quantity	Value	Quantity	Value		
Alabama.....		55,806	\$1,775,365	( <sup>3</sup> )	( <sup>3</sup> )	17,090	16
California, Colorado, Utah <sup>4</sup> .....		51,433	3,375,104	-----	-----	10,737	-----
Connecticut, Maryland, New Jersey, New York <sup>5</sup> .....		95,190	2,810,647	( <sup>3</sup> )	( <sup>3</sup> )	14,254	38
Illinois.....		30,932	1,008,257	-----	-----	7,484	-----
Indiana.....		65,732	1,852,825	( <sup>3</sup> )	( <sup>3</sup> )	21,211	714
Kentucky, Tennessee, Texas.....		( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	480	288
Michigan <sup>6</sup> .....		( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	8,010	56
Minnesota and Wisconsin.....		( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	785	134
Ohio.....		74,324	2,060,068	( <sup>3</sup> )	( <sup>3</sup> )	12,288	610
Pennsylvania.....		233,176	6,376,150	-----	-----	67,593	-----
West Virginia.....		45,087	1,173,718	-----	-----	5,101	-----
Undistributed.....		34,244	2,001,525	14,923	\$1,048,499	-----	-----
Total 1964.....		<sup>8</sup> 685,924	22,933,659	14,923	1,048,499	165,033	1,854
At merchant plants.....		26,522	1,026,363	11,209	815,758	5,088	1,174
At furnace plants.....		659,402	21,907,296	3,714	232,741	159,945	680
Total 1963.....		662,058	19,710,955	12,697	906,247	120,250	1,875

<sup>1</sup> Number of plants that recovered ammonia.  
<sup>2</sup> Includes diammonium and monoammonium phosphate.  
<sup>3</sup> Included with "Undistributed" to avoid disclosing individual company data.  
<sup>4</sup> Figures include diammonium phosphate.  
<sup>5</sup> Figures include monoammonium phosphate.  
<sup>6</sup> Comprises 680,887 tons of ammonium sulfate and 50,175 tons of diammonium and monoammonium phosphate.  
<sup>7</sup> Includes 46,281 tons of ammonium sulfate and diammonium phosphate valued at \$1,350,507 exported.  
<sup>8</sup> Comprises 639,633 tons of ammonium sulfate valued at \$17,967,085 and 50,291 tons of diammonium and monoammonium phosphate valued at \$4,966,574.

CRUDE COAL TAR AND DERIVATIVES

Crude coal tar is a complex mixture of organic compounds that are condensed from the gas after it leaves the ovens. The bulk of the tar is recovered in collecting mains where the gas is cooled by spraying

with ammonia liquor; most of the remainder is recovered from the primary coolers, where the gas undergoes further cooling.

Tar is produced at all oven-coke plants, and the quantities recovered represent, roughly, 4 to 5 percent of the weight of the coals carbonized. Recovery yields differ greatly among plants, depending upon the rank and grade of the coals used, oven temperatures, and other operating factors. Yields at individual plants for the year varied from about 4 to 11 gallons per ton of coal carbonized, with the yield for all plants averaging 8.75 gallons. This was virtually the same yield as in 1963. Yields were highest in California, Colorado, Pennsylvania, Utah, and West Virginia, where plants used larger percentages of higher-volatile coals. Yields were lowest in Minnesota and Wisconsin, where a large part of the production was foundry coke which was produced from higher percentages of low-volatile coals, as well as additions of anthracite. Yields were lower for merchant plants, most of which produced foundry coke.

Table 51 shows the quantities of tar produced, used by producers for various purposes, sold, and on hand at the end of the year. Although the average yield declined slightly, production increased 14 percent because of the larger amount of coal carbonized. Virtually all of the output in 1964 either was used by producers or was sold, as year-end stocks remained at about the same level as at the beginning of the year.

Fifty-six percent of the 763 million gallons of tar produced was used by producers. The bulk of this tar was partially refined or "topped," but about 30 percent was burned as fuel without processing. Producers also used minor quantities for a number of miscellaneous purposes, such as tarring ingots, road materials, and making tar paints. The remaining tar was sold to tar-distilling plants which refined it to produce a large number of tar derivatives.

The topping process, which is used by most of the coke plants that refine tar, is a method used to separate the low-boiling distillate fraction consisting principally of tar acids, bases, and naphthalenes from crude tar. The residue, known as soft pitch usually is burned as fuel. Furnace plants have found this process attractive because they can sell the distillate and retain the pitch which is used principally as fuel for open-hearth furnaces. This reduces the quantities of other fuels that would normally have to be purchased. The relative quantities of tar topped and burned, however, as well as the quantities sold, depend upon a number of economic factors such as the availability and current market prices of tar, tar distillates, and other substitute fuels. Merchant plants normally sell their tar because, unlike furnace plants, they do not have readily available markets for pitch, which makes up the bulk of the products recovered through topping.

Although most of the plants that processed tar in 1964 recovered only crude chemical oil and a refined tar or soft pitch, a few larger plants recovered a number of other tar derivatives, including creosote oil, cresylic acid, cresols, naphthalene, phenol, pyridine, and medium and hard pitch. Statistics on some of these products could not be shown in this report, but the data were transmitted to the U.S. Tariff Commission which published them, along with similar data from tar distillers and petroleum refiners, in monthly and annual reports on synthetic organic chemicals. The 1-percent decrease in output of

crude chemical oil and the 28-percent increase in hard pitch at coke plants indicate that production of naphthalene, creosote oil, and other tar derivatives not shown, increased in 1964 as roughly the same quantities of tar were processed by producers in 1964 as in 1963.

The increased demand for various pitch products continued, and about one-third of the pitch produced by coke plants was sold rather than burned as fuel. Sales of pitch have increased steadily in recent years, and the quantity sold in 1964 was about 5 times greater than that sold in 1960.

TABLE 51.—Coke-oven tar produced in the United States, used by producers, and sold in 1964, by State

State	Produced		Used by producers—		
	Total	Per ton of coal coked	For refining or topping	As fuel	Other-wise
Alabama.....	43,062,478	6.77	(1)	(1)	(1)
California, Colorado, Utah.....	48,395,076	10.32	(1)	(1)	(1)
Connecticut, Maryland, New Jersey, New York.....	99,439,758	9.00	(1)	9,807,430	(1)
Illinois.....	24,579,410	7.30	(1)	(1)	(1)
Indiana.....	100,659,819	8.57	(1)	(1)	(1)
Kentucky, Missouri, Tennessee, Texas.....	19,277,519	6.65	(1)	(1)	(1)
Michigan.....	38,629,703	7.28	(1)	(1)	(1)
Minnesota and Wisconsin.....	7,175,557	5.95	(1)	(1)	(1)
Ohio.....	92,205,487	8.91	(1)	36,461,083	(1)
Pennsylvania.....	241,099,196	9.52	136,463,192	39,371,162	267,895
West Virginia.....	48,393,502	9.79	(1)	(1)	(1)
Undistributed.....			157,493,506	42,232,136	103,051
Total 1964.....	762,917,505	8.75	293,956,698	127,871,811	370,946
At merchant plants.....	54,801,347	6.21	649,246		
At furnace plants.....	708,116,158	9.03	293,307,452	127,871,811	370,946
Total 1963.....	671,875,628	8.78	289,568,551	91,313,170	557,788
	Sold for refining into tar products <sup>2</sup>				On hand Dec. 31
	Quantity	Value			
		Total	Average		
Alabama.....	26,899,278	\$3,100,319	\$0.115	3,319,366	
California, Colorado, Utah.....	23,048,992	2,931,019	.127	2,206,107	
Connecticut, Maryland, New Jersey, New York.....	21,860,549	2,184,364	.100	5,967,098	
Illinois.....	23,984,853	2,322,170	.097	387,860	
Indiana.....	47,949,705	4,507,822	.094	4,210,697	
Kentucky, Missouri, Tennessee, Texas.....	19,272,722	2,075,138	.108	312,762	
Michigan.....	28,560,296	2,868,116	.100	2,337,019	
Minnesota and Wisconsin.....	7,214,482	710,215	.098	782,491	
Ohio.....	54,419,701	5,536,202	.102	5,710,828	
Pennsylvania.....	64,684,896	6,576,447	.102	12,983,208	
West Virginia.....	18,188,782	1,670,979	.092	1,406,556	
Undistributed.....					
Total 1964.....	336,084,256	34,482,791	.103	39,623,992	
At merchant plants.....	54,666,199	5,509,092	.101	1,683,477	
At furnace plants.....	281,418,057	28,973,699	.103	37,940,515	
Total 1963.....	290,698,355	31,110,909	.107	34,960,682	

<sup>1</sup> Included with "Undistributed" to avoid disclosing individual company data.

<sup>2</sup> Comprises 31,936,362 gallons valued at \$3,182,874 sold to affiliated companies and 304,147,894 gallons valued at \$31,299,917 sold to other purchasers. Also includes small amount exported.



Of significance also were pitch exports in 1964. Although only a portion of the 222,000 tons of coal-tar-pitch exported in 1964 was produced from tar refined at coke plants, it is estimated that at least two-thirds of the total was coke-plant pitch that was shipped principally to France for use as a binder for coal briquets.

The total value of tar and tar derivatives used and sold was \$94.7 million, a 17-percent increase over 1963. Most of the increase was due to the larger quantity of crude tar used and sold, as the average value per gallon of crude tar decreased slightly. The quantity and value of the pitch used and sold, however, increased substantially over 1963 and added materially to the increase in total value of tar and tar products.

#### CRUDE LIGHT OIL AND DERIVATIVES

Light oil, a light-colored liquid composed of a number of aromatic hydrocarbons, is extracted from the gas after tar, ammonia, and, in some instances, naphthalene, have been removed. Crude tar also contains a small amount of light oil, but this usually is not recovered by coke plants. Virtually all light oil produced at coke plants is recovered by an absorption process in which the gas is sprayed with a higher-boiling petroleum oil as the gas stream is channeled through absorption towers. After recovery, light oil is separated from the absorption oil by direct steam distillation.

About 3 gallons of light oil, equal to 1 percent of the weight of the coal, is recovered for each ton of coal carbonized. Yields vary with the kind of coals carbonized and with operating conditions, but an average of 2.92 gallons of light oil per ton of coal was recovered at the plants that extracted light oil in 1964. This was virtually the same average yield as in 1963.

Fifty-eight of the 64 plants active in 1964 produced light oil. Although this was one plant less than in 1963, production increased 14 percent because of the larger quantity of coal carbonized. Year-end stocks of light oil were significantly higher than at the end of 1963, but the amount on hand was small when related to production, and the quantities processed and sold both increased. Producers continued to sell an increasingly larger part of their output, and only 77 percent of the light oil produced was refined on the premises, compared with 85 percent in 1963, and 96 percent in 1957. The substantial increase in light oil sales in recent years is attributed principally to the inability of some plants to produce benzene that will meet the specifications required for certain recent applications. These plants sell light oil to petroleum-refining companies which process it along with petroleum fractions into benzene and a variety of other chemical intermediates.

Table 52 shows the crude light oil produced and refined by producers, and derived products produced and sold in 1964.

Light oil is refined by a number of processes involving fractional distillation, and the principal products recovered at coke plants are benzene, toluene, xylene, and solvent naphtha. Thirty-five of the 58 plants that produced light oil also processed it, recovering one or more of the above products. A number of plants also shipped their light oil production to affiliated plants for distillation.

Table 53 shows the yield of various products from the refining of crude light oil. As with other coal-chemical materials, yields vary somewhat, but approximately 85 percent of the light oil processed is recovered as salable products. The average yield of toluene decreased slightly in 1964, while benzene, solvent naphtha, and other product yields increased. The xylene yield remained at the 1963 level.

Table 54 shows the quantities of the various grades of benzene and toluene produced at coke plants, while table 55 shows the principal products produced and sold. Roughly two-thirds of the benzene and four-fifths of the toluene produced was nitration grade (1° C), and most of the remainder was industrial grade (2° C). Motor-grade benzene, which has declined steadily in use since World War II, accounted for

TABLE 52.—Coke-oven crude light oil produced in the United States and derived products produced and sold in 1964, by State

(Gallons)

State	Active plants <sup>1</sup>	Crude light oil				Derived products		
		Produced	Per ton of coal coked	Refined on premises <sup>2</sup>	On hand Dec. 31	Produced	Sold <sup>3</sup>	
							Quantity	Value
Alabama.....	7	14,885,230	2.34	14,727,975	506,427	11,795,967	12,010,566	\$2,455,824
California, Colorado, Utah.....	3	16,001,188	3.41	10,733,908	239,116	9,539,165	9,206,396	1,688,503
Connecticut, Maryland, New Jersey, New York.....	6	35,282,841	3.19	31,088,030	865,052	25,544,652	25,884,348	5,272,064
Illinois and Michigan.....	8	22,771,284	2.66	13,887,844	651,213	11,509,355	11,539,106	2,475,232
Indiana.....	4	32,808,793	2.94	20,652,863	1,958,540	16,064,769	16,619,612	3,373,350
Kentucky, Missouri, Tennessee, Texas, West Virginia.....	8	22,593,950	2.88	9,406,074	459,379	8,423,717	7,913,289	1,540,097
Ohio.....	10	28,738,521	2.84	21,544,177	543,069	19,200,188	18,574,570	3,634,143
Pennsylvania.....	12	75,587,160	2.99	70,190,149	1,961,552	63,091,293	59,897,483	12,631,060
Total 1964.....	58	248,668,967	2.92	192,231,020	7,184,348	165,169,106	161,645,370	33,070,273
At merchant plants.....	12	16,086,996	2.22	9,527,396	875,868	8,285,398	8,127,587	1,567,645
At furnace plants.....	46	232,581,971	2.99	182,703,624	6,308,480	156,883,708	153,517,783	31,502,628
Total 1963.....	59	218,165,707	2.91	185,794,876	4,680,775	156,010,453	150,997,370	32,180,467

<sup>1</sup> Number of plants that recovered crude light oil.

<sup>2</sup> Includes small quantity of material also reported in sales of crude light oil in table 43.

<sup>3</sup> Excludes 53,702,264 gallons of crude light oil valued at \$6,709,092 sold as such.

TABLE 53.—Yield of light-oil derivatives from refining crude light oil at oven-coke plants in the United States

(Percent)

Year	Benzene		Toluene (all grades)	Xylene (all grades)	Solvent naphtha (crude and refined)	Other light-oil products
	Motor	All other grades				
1929.....	54.4	12.8	9.4	(1)	3.7	3.4
1939.....	48.6	15.4	12.1	2.5	2.9	3.3
1949.....	9.5	55.6	12.5	3.3	2.3	3.2
1957-59 (average).....	5.5	60.4	13.5	3.9	2.1	3.3
1961.....	5.5	60.5	14.3	3.8	2.3	1.8
1962.....	5.9	60.5	14.4	4.0	2.3	2.2
1963.....	1.6	60.5	13.9	3.7	1.9	2.4
1964.....	.4	61.9	13.3	3.7	2.3	4.3

<sup>1</sup> Included with "Solvent naphtha (crude and refined)."

TABLE 54.—Benzene and toluene produced at oven-coke plants in the United States, by grade

(Gallons)

Year	Benzene				Toluene		
	Motor	Nitration (1° C)	Industrial (2° C)	All other	Nitration (1° C)	Industrial (2° C)	All other
1941.....	106,372,000	15,414,500	18,286,400	4,182,600	14,689,800	13,268,500	1,378,900
1949.....	20,923,700	28,988,700	91,717,300	2,035,600	20,808,300	6,317,200	545,100
1957-59 (average).....	1,240,500	83,881,700	50,045,700	5,193,600	24,810,700	6,196,400	(1)
1961.....	1,027,400	85,648,800	33,111,900	1,444,600	22,820,100	5,586,700	(1)
1962.....	1,786,200	81,831,600	32,062,800	332,800	22,140,900	5,089,800	(1)
1963.....	2,907,000	78,071,800	33,699,700	655,900	20,514,100	5,280,300	(1)
1964.....	863,900	81,508,400	34,783,300	2,652,500	19,959,300	5,561,200	(1)

<sup>1</sup> Included with "Industrial (2° C)" to avoid disclosing individual company data.

less than 1 percent of the benzene output. Both production and sales of benzene and xylene increased in 1964. Toluene sales also increased, but production was slightly lower than in 1963.

Although coke-oven light oil was the principal source of benzene until 1950, and toluene and xylene until the beginning of World War II, it now furnishes the smaller part of the total output of these products. According to preliminary data published by the U.S. Tariff Commission, only 15 percent of the benzene, 5 percent of the toluene, and 2 percent of the xylene was produced by coke-oven operators in 1964. The bulk of these products now is derived from petroleum, although a part of the production credited to tar distillers and petroleum processors was derived from coke-oven light oil that was sold by producers, rather than refined.

Table 56 shows estimated consumption of commercial benzene in the United States, by use. These data, published annually by the Coal-Chemicals Committee of the American Coke and Coal Chemicals Institute, show that most of the benzene was used for producing styrene, synthetic phenol, and cyclohexane. About one-third of the estimated 802 million gallons of benzene used in 1964 was used in making styrene monomer, which subsequently was used principally for manufacturing plastics, synthetic rubber, and protective coatings. About one-fifth of the benzene was used for producing cyclohexane, which is used principally as a nylon intermediate, and 18 percent, for, synthetic phenol, used principally for phenolic resins, epoxy resins, nylon 6, and polycarbonates.

Similar use data for toluene were not available, but large quantities were dealkylated to benzene which, currently, is in greater demand. Large quantities of toluene are used also as an additive to increase the octane rating of aviation and motor gasoline. This use has declined somewhat in importance, however, because of the increased number of compact cars in use, and the replacement of propeller-type airplanes by jets. Other uses for toluene are chemicals, plastics, explosives, paints, varnishes, lacquers, and solvent.

The average values of virtually all light-oil derivatives sold by producers in 1964 were slightly lower than in 1963. Spot prices,

f.o.b. plant, of the principal products, as published by the trade journals, remained at the same level throughout the year, however, with benzene and toluene selling at \$0.25 and \$0.21, respectively, per gallon, while the price of xylene ranged from \$0.25 to \$0.26 per gallon.

TABLE 55.—Light-oil derivatives produced at oven-coke plants in the United States and sold in 1964, by State

State	Benzene (all grades except Motor)				Toluene (all grades)			
	Produced	Yield from crude light oil refined (percent)	Sold		Produced	Yield from crude light oil refined (percent)	Sold	
			Quantity	Value			Quantity	Value
Alabama.....	9,021,421	61.3	9,417,350	\$2,000,480	1,787,580	12.1	1,637,848	\$282,776
California, Colorado, Utah.....	6,455,466	60.1	6,843,499	1,204,542	1,023,309	9.5	1,047,515	185,487
Illinois and Michigan.....	9,401,227	67.7	9,510,232	2,106,657	1,600,013	11.5	1,536,609	293,655
Indiana.....	12,473,893	60.4	13,409,037	2,782,187	2,355,038	11.4	2,468,296	449,732
Maryland and New York.....	20,424,928	65.7	20,687,679	4,318,850	3,424,204	11.0	3,423,701	657,408
Ohio.....	14,339,830	66.6	14,021,139	2,741,092	3,291,697	15.3	3,145,109	592,613
Pennsylvania.....	40,726,815	58.0	39,009,427	8,899,085	10,633,972	15.2	10,942,713	2,025,759
Tennessee, Texas, West Virginia.....	6,100,624	64.9	6,171,838	1,209,860	1,404,696	14.9	1,327,981	241,470
Total 1964.....	118,944,204	61.9	119,070,201	25,262,753	25,520,509	13.3	25,529,772	4,728,900
At merchant plants.....	5,689,942	59.7	5,548,615	1,137,357	1,348,446	14.2	1,332,864	259,305
At furnace plants.....	113,254,262	62.0	113,521,586	24,125,396	24,172,063	13.2	24,196,908	4,469,595
Total 1963.....	112,427,410	60.5	110,200,042	24,192,014	25,794,419	13.9	24,825,639	4,849,243
Xylene (all grades)				Solvent naphtha (crude and refined)				
Produced	Yield from crude light oil refined (percent)	Sold		Produced	Yield from crude light oil refined (percent)	Sold		
		Quantity	Value			Quantity	Value	
Alabama.....	465,027	3.2	459,696	\$112,549	95,653	0.6	104,001	\$22,190
California, Colorado, Utah.....	355,629	3.3	367,707	83,682	325,704	3.0	341,821	75,444
Illinois and Michigan.....	235,900	1.7	223,050	49,366	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
Indiana.....	388,296	1.9	327,249	68,500	506,086	1.5	238,599	63,697
Maryland and New York.....	842,279	2.7	926,981	215,015	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
Ohio.....	809,137	3.8	790,001	186,896	645,247	3.0	618,321	113,542
Pennsylvania.....	3,603,258	5.1	3,688,402	818,740	2,911,209	2.6	2,889,944	563,710
Tennessee, Texas, West Virginia.....	419,872	4.5	352,264	81,769	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
Total 1964.....	7,119,398	3.7	7,135,350	1,616,517	4,483,899	2.3	4,192,666	838,583
At merchant plants.....	332,049	3.5	342,202	83,945	34,928	.4	42,549	8,896
At furnace plants.....	6,787,349	3.7	6,793,148	1,532,572	4,448,971	2.4	4,150,137	829,687
Total 1963.....	6,888,320	3.7	7,123,527	1,693,892	3,560,953	1.9	3,359,390	712,974

<sup>1</sup> Included with Indiana.

<sup>2</sup> Included with Pennsylvania.

TABLE 56.—Estimated consumption of commercial benzene (excluding Motor grade) in the United States, by use<sup>1</sup>

(Thousand gallons)

Use	1957-59 (average)	1961	1962	1963	1964
Styrene.....	160,000	210,000	224,000	<sup>2</sup> 232,000	270,000
Phenol (synthetic).....	74,000	100,000	106,000	<sup>2</sup> 121,000	143,000
Dodecylbenzene.....	36,000	37,000	40,000	<sup>2</sup> 37,000	37,000
Cyclohexane.....	30,000	55,000	65,000	<sup>2</sup> 120,000	162,000
Aniline.....	14,000	16,000	17,000	19,000	21,000
DDT.....	14,000	16,000	16,000	17,000	17,000
Dichlorobenzene and monochlorobenzene.....	11,000	15,000	16,000	<sup>2</sup> 19,000	20,000
Maleic anhydride.....	9,000	14,000	15,000	<sup>2</sup> 14,000	20,000
Benzene hexachloride.....	3,000	2,000	1,000	(?)	.....
Diphenyls.....	4,500	5,000	5,000	5,000	5,000
Nitrobenzene.....	2,000	2,000	2,000	2,000	2,000
Miscellaneous.....	21,500	9,000	17,000	20,000	20,000
Exported.....	7,000	46,000	41,000	65,000	85,000
<b>Total.....</b>	<b>386,000</b>	<b>527,000</b>	<b>565,000</b>	<b><sup>2</sup> 671,000</b>	<b>802,000</b>

<sup>1</sup> Coal-Chemicals Committee, American Coke and Coal-Chemicals Institute, Washington, D.C.<sup>2</sup> Revised figure.

# Fuel Briquets and Packaged Fuel

By Eugene T. Sheridan<sup>1</sup>



## Contents

	<i>Page</i>		<i>Page</i>
General summary.....	271	Fuel briquets—Continued	
Scope of report.....	272	Technology.....	280
Fuel briquets.....	273	Packaged fuel.....	281
Capacity.....	273	Capacity.....	281
Production.....	274	Production.....	281
Raw materials.....	275	Raw materials.....	282
Shipments.....	277	Shipments.....	283
Value and price.....	278	Value and price.....	283
Foreign trade.....	278	World review.....	284

## GENERAL SUMMARY

**P**RODUCTION of both fuel briquets and packaged fuel continued to decline in 1964, and output of each fuel was roughly one-third less than in 1963. This decline continued the steady downward trend in production that began shortly after World War II when natural gas and fuel oil began replacing solid fuels for residential heating.

Ten briquet plants with a total maximum productive capacity of 2.1 million tons produced 359,000 tons of fuel briquets. Nine packaged-fuel plants with a combined maximum annual productive capacity of 78,000 tons produced 9,300 tons of packaged fuel. All plants in both industries operated at reduced rates throughout the year.

Most briquets were produced in Wisconsin, and most packaged fuel was produced in Michigan. Briquets were produced also in Michigan, Missouri, North Dakota, and West Virginia. In addition to Michigan, Illinois, Indiana, Minnesota, Ohio, and Virginia produced packaged fuels.

Exports of briquets increased 44 percent over that in 1963, but were 69 percent below the average quantity exported in 1957-59. Imports were over 2.5 times larger than in 1963, but about 28 times greater than the average quantity imported in 1957-59.

The total value of shipments, f.o.b. plant, of both fuels was \$6.2 million—\$5.9 million for briquets and \$241,000 for packaged fuel. Briquets were sold at an average plant value of \$16.47 per ton; packaged fuel was sold at an average plant value of \$24.26 per ton.

<sup>1</sup> Supervisory mineral specialist.

TABLE 1.—Salient fuel-briquet and packaged-fuel statistics

	1957-59 (average)	1961	1962	1963	1964
<b>Fuel briquets:</b>					
United States:					
Production..... short tons..	1,002,054	572,264	570,023	551,207	359,232
Shipments <sup>1</sup> ..... do.....	999,444	567,779	569,913	551,459	360,015
Value of shipments.....	\$13,471,783	\$7,956,102	\$8,597,021	\$8,207,989	\$5,923,476
Average per ton, f.o.b. plant.....	\$13.45	\$14.01	\$15.08	\$14.88	\$16.47
Imports..... short tons..	406	7,338	8,396	4,020	11,593
Exports..... do.....	58,294	12,731	18,596	12,380	17,857
World production, apparent <sup>2</sup> ..... do.....	941,556	562,386	559,713	543,699	353,751
Packaged fuel..... do.....	117,000,000	124,600,000	131,000,000	133,900,000	129,900,000
United States:					
Production..... do.....	38,923	19,180	17,439	14,215	9,322
Shipments..... do.....	38,432	19,005	17,259	14,555	9,955
Value of shipments.....	\$868,112	\$441,497	\$394,065	\$340,021	\$241,462
Average per ton, f.o.b. plant.....	\$22.59	\$23.23	\$22.83	\$23.36	

<sup>1</sup> Includes briquets used by producers.

<sup>2</sup> Shipments plus imports minus exports. Import and export data do not include briquets made from petroleum products.

## SCOPE OF REPORT

This report covers the fuel-briquet<sup>1</sup> and<sup>2</sup> packaged-fuel industries for the calendar year 1964. Similar reports on the fuel-briquet industry have been published each year since 1907, except in 1910 when no data were collected. A report on the packaged-fuel industry has been published annually since 1935.

The data presented include only processed fuels made from coals, petroleum coke, and lignite char. Specifically excluded were briquets made from wood and nutshell charcoal, as these materials are forest products, outside the scope of the Bureau's commodity programs. Except where noted, all data were compiled from reports submitted voluntarily by producers.

The two industries are similar in that both produce a high-quality solid fuel by compacting screenings or other fines. The products differ, however, in physical properties and manner of use. Whereas briquets usually are pillow-shaped pieces, 2 to 4 inches long, packaged fuel is produced as 3- or 4-inch cubes, six or eight of which are wrapped together in heavy paper to form a package weighing from 10 to 15 pounds. Briquets, generally made with a water-insoluble binder, are handled as other bulk solid fuels and used chiefly for cooking and residential heating. Packaged fuel, which must be stored indoors to prevent deterioration, is a specialty fuel, used principally for space heating to supplement other fuels in the months preceding and following the regular heating season. Briquet plants are relatively large and usually are located at mines or coal unloading docks. Most packaged-fuel plants are small and operate in conjunction with coalyards.

Data on production and shipments of fuel briquets are shown by geographic regions, arbitrarily established, to avoid revealing individual plant data in States with less than three producers. The States in each region are: Eastern—West Virginia; Central—Michigan and Wisconsin; Western—Missouri and North Dakota.

The term "capacity" in this report refers to the total maximum quantity of fuel that each industry could produce if all active plants,

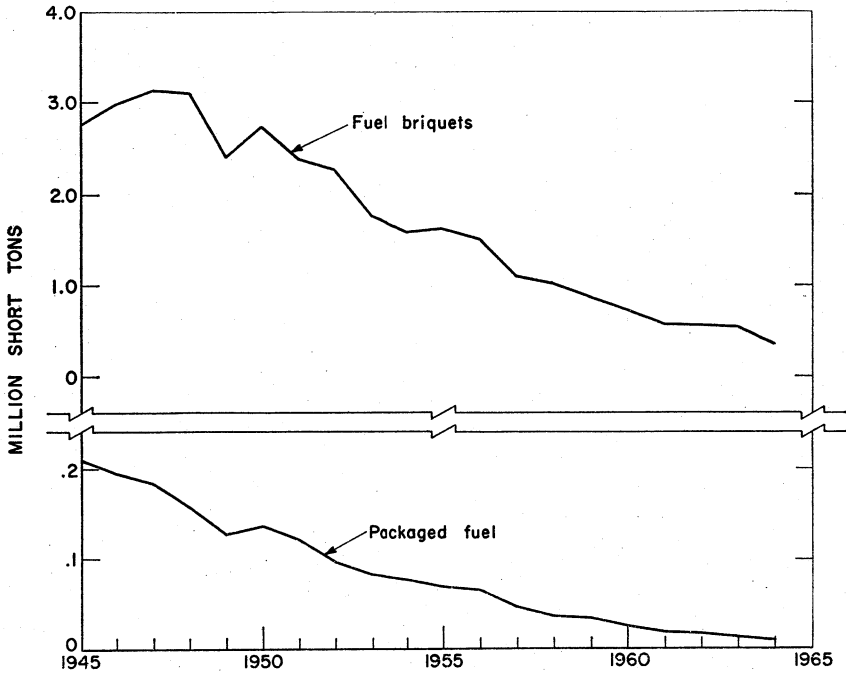


FIGURE 1.—Production of fuel briquets and packaged fuel in the United States, 1945-64.

working their regular number of shifts each day but allowing for unavoidable shutdowns, operated at their maximum rate for a year. The quantities shown include only plants that reported production for 1964. These plants, however, accounted for virtually the entire capacity of both industries, as only two small packaged-fuel plants were reported idle during 1964.

The terms "consumption" and "distribution" are used synonymously, as it was assumed that, except for the briquets exported, the fuels were consumed in the States where shipped by producers.

No information was collected on stocks, as briquets and packaged fuel usually are sold as produced.

## FUEL BRIQUETS

### CAPACITY

Ten briquet plants with a total maximum annual productive capacity of 2.1 million tons were active in 1964. One small plant that operated in 1963 was abandoned, and the capacity of the industry decreased 8 percent.

Individual plant capacities varied from less than 100,000 tons to more than 500,000 tons; only three plants had capacities in excess of 200,000 tons. During the past decade, the number of operating plants



TABLE 2.—Annual capacity and production of fuel-briquet plants in the United States

	Active plants	Annual capacity (short tons)	Production	
			Short tons	Percent of capacity
1960.....	14	2,624,500	744,385	28.4
1961.....	12	2,344,500	572,264	24.4
1962.....	11	2,307,500	570,023	24.7
1963.....	11	2,327,500	551,207	23.7
1964:				
Plants with capacity of—				
Less than 25,000 tons.....				
25,000 to less than 100,000 tons.....	2	(1)	(1)	(1)
100,000 to less than 200,000 tons.....	5	643,500	152,060	23.6
200,000 to less than 400,000 tons.....				
400,000 or more tons.....	3	1,500,000	207,172	13.8
Total.....	10	2,143,500	359,232	16.8
Plants with production of—				
Less than 5,000 tons.....				
5,000 to less than 10,000 tons.....	1	(2)	(2)	(2)
10,000 to less than 25,000 tons.....	4	396,000	61,954	15.6
25,000 to less than 100,000 tons.....	4	1,747,500	297,278	17.0
100,000 or more tons.....	1	(3)	(3)	(3)
Total.....	10	2,143,500	359,232	16.8

<sup>1</sup> Combined with "100,000 to less than 200,000 tons" to avoid disclosing individual company data.

<sup>2</sup> Combined with "10,000 to less than 25,000 tons" to avoid disclosing individual company data.

<sup>3</sup> Combined with "25,000 to less than 100,000 tons" to avoid disclosing individual company data.

has declined steadily, and the current capacity of the industry is, roughly, one-half as large as it was in 1955.

All plants operated at reduced rates during the year, and the industry produced at only 16.8 percent of its capacity.

Data on capacity and operating rates are shown in table 2.

## PRODUCTION

Demand for briquets continued to decline in 1964, and output for the year was about one-third less than in 1963. The current decrease continued the trend that began in 1948 when fuel oil and natural gas moved into fuel markets in the Midwest and North Central States formerly supplied by solid fuels. The year's production of 359,000 tons was about one-third as large as the amount produced annually in the base years, 1957-59, and only about one-tenth as large as output in 1947, the year of peak production.

Ten plants in five States reported production. Wisconsin, with five plants, was the largest producer. West Virginia, with one plant, ranked second in output. Together, these States accounted for nearly three-fourths of the total production. Other producing States, in order of output, were Michigan, Missouri, and North Dakota.

Demand for briquets is seasonal, and most plants operated at reduced rates during the summer months. Monthly production ranged from 64,000 tons in January to less than 11,000 tons in July.

The quantity of briquets produced and shipped, and the value of shipments are shown in tables 3 and 4.

TABLE 3.—Production and shipments of fuel briquets in the United States, by region

Region	Active plants	Production (short tons)	Shipments <sup>1</sup>		
			Short tons	Value	
				Total	Average
1963:					
Eastern States.....	1	(?)	(?)	(?)	(?)
Central States.....	7	293, 610	290, 066	\$4, 627, 934	\$15. 95
Western States.....	3	257, 597	261, 393	3, 580, 055	13. 70
Total.....	11	551, 207	551, 459	8, 207, 989	14. 88
1964:					
Eastern States.....	1	(?)	(?)	(?)	(?)
Central States.....	6	210, 833	213, 640	3, 434, 737	16. 08
Western States.....	3	148, 399	146, 375	2, 493, 738	17. 04
Total.....	10	359, 232	360, 015	5, 928, 475	16. 47

<sup>1</sup> Includes small amount used by producers in 1964.

<sup>2</sup> Included with "Western States" to avoid disclosing individual company data.

TABLE 4.—Production of fuel briquets in the United States in 1964, by month

Month	Short tons	Month	Short tons	Month	Short tons
January.....	64, 119	May.....	14, 017	September.....	38, 368
February.....	25, 067	June.....	15, 124	October.....	53, 810
March.....	12, 759	July.....	10, 630	November.....	37, 924
April.....	16, 243	August.....	11, 143	December.....	60, 028

## RAW MATERIALS

**Fuels.**—Briquets were manufactured from seven different fuels, but 60 percent of the total fuel used was low-volatile bituminous coal. Other fuels in order of the quantities consumed were petroleum coke, lignite char, high-volatile bituminous coal, Pennsylvania anthracite, semianthracite, and other anthracite.

Five of the 10 active plants used more than one type of fuel. In most instances, these plants combined the fuels to produce a composite briquet.

Nine percent of the fuels consumed originated from screenings in coalyards; the remainder was supplied chiefly by mines and unloading docks.

The average value per ton of all raw fuels consumed was \$8.51, a 5-percent increase over the average value in 1963. The total value of all fuels used for briquets was \$2.9 million.

**Binders.**—A total of 26,000 tons of binding materials was used for manufacturing fuel briquets. Included in this quantity was a small quantity of spray oil used at two plants for dustproofing. Nine of the active plants used petroleum asphalt exclusively for binder. Asphalt was preferred because it has good cohesive properties, is relatively low in cost, has a low ash content, and is insoluble in water, thereby making the briquets weatherproof. One plant that manufactured barbecue briquets from lignite char used starch for a binder because asphalt is unsuitable for this type of briquets.

Excluding water, binders constituted 7 percent of the total raw materials. The quantities consumed at individual plants, however, ranged up to 10 percent of the total raw materials.

Binders consumed, including spray oil, averaged \$31.26 per ton, and their total value was \$820,000. This was about one-fifth the value of total raw materials.

The quantities and values of raw materials used in 1964 are shown in tables 5 and 6.

TABLE 5.—Raw fuels used in making fuel briquets in the United States in 1964

Type	Number of plants	Used		
		Short tons	Value	
			Total	Average
<b>Anthracite:</b>				
Pennsylvania.....	2	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
Other than Pennsylvania.....	1	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
Semianthracite.....	1	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
<b>Bituminous coal:</b>				
Low-volatile.....	8	206,675	\$1,708,151	\$8.26
High-volatile.....	1	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
Petroleum coke.....	5	98,568	817,571	8.29
Lignite char.....	1	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
Undistributed.....		37,258	387,982	10.41
<b>Total.....</b>	<b>2 10</b>	<b>342,501</b>	<b>2,913,704</b>	<b>8.51</b>

<sup>1</sup> Included with "Undistributed" to avoid disclosing individual company data.

<sup>2</sup> Some plants used more than one type of raw fuel; hence, the number of plants exceeds the total shown.

TABLE 6.—Quantity and value of raw materials used in making fuel briquets in the United States in 1964, by region

Region	Short tons	Value	
		Total	Average
<b>Fuels:</b>			
Eastern States.....	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
Central States.....	203,717	\$1,894,932	\$9.30
Western States.....	138,784	1,018,772	7.34
<b>Total.....</b>	<b>342,501</b>	<b>2,913,704</b>	<b>8.51</b>
<b>Binders: <sup>2</sup></b>			
Eastern States.....	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
Central States.....	16,212	429,729	26.51
Western States.....	10,031	390,556	38.93
<b>Total.....</b>	<b>26,243</b>	<b>820,285</b>	<b>31.26</b>
<b>Fuels and binders:</b>			
Eastern States.....	( <sup>1</sup> )	( <sup>1</sup> )	( <sup>1</sup> )
Central States.....	219,929	2,324,661	10.57
Western States.....	148,815	1,409,328	9.47
<b>Grand total.....</b>	<b>368,744</b>	<b>3,733,989</b>	<b>10.13</b>

<sup>1</sup> Included with "Western States" to avoid disclosing individual company data.

<sup>2</sup> Includes small amount of spray oil used by two plants for dustproofing briquets.

## SHIPMENTS

Briquets were distributed in 41 States and the District of Columbia in 1964, but the quantities received by individual States varied greatly. Michigan, the largest consumer, received 71,000 tons of briquets, one-fifth the total distributed. Wyoming, the smallest consumer, received only five tons.

The major briquet markets are in eight Central and North Central States—Indiana, Michigan, Minnesota, Missouri, North Dakota, Ohio, South Dakota, and Wisconsin. These States received three-fourths of all briquets distributed. Michigan, Wisconsin, and Minnesota, the principal consumers, received about one-half of the briquet shipments.

Approximately three-fourths of the plant shipments were by rail. The mode of transportation varied, however, with the producing region. Virtually all briquets produced in West Virginia were shipped by rail, because most markets were too distant for practical delivery by truck. The bulk of the shipments in the Central States were by rail also, except for a few States that retained most of their output and delivered principally by truck.

Except for barbecue briquets and a small quantity of the conventional heating and cooking briquets that were sold in bags, briquets were shipped as bulk fuel. Shipments by State of origin were not shown because of the small number of producing companies.

The destinations of briquets used and sold by producers and method of shipment in 1964 are shown in tables 7 and 8.

TABLE 7.—Destination of fuel briquets used and sold by producers<sup>1</sup>

(Short tons)

Destination	1963	1964	Destination	1963	1964
Arizona.....	185	170	New York.....	1,941	1,815
California.....	3,815	3,560	North Carolina.....	17,726	14,923
Colorado.....	374	350	North Dakota.....	19,535	17,006
Connecticut.....	196	180	Ohio.....	29,343	19,363
District of Columbia.....	113	52	Oklahoma.....	38	40
Florida.....	.....	52	Oregon.....	361	340
Hawaii.....	60	60	Pennsylvania.....	512	414
Idaho.....	14	10	Rhode Island.....	15	10
Illinois.....	15,880	10,018	South Carolina.....	576	349
Indiana.....	38,599	24,472	South Dakota.....	20,512	16,553
Iowa.....	13,833	9,230	Tennessee.....	556	494
Kansas.....	1,011	940	Texas.....	558	520
Kentucky.....	2,644	1,972	Utah.....	356	330
Maryland.....	873	803	Virginia.....	27,172	23,123
Massachusetts.....	518	390	Washington.....	1,530	1,436
Michigan.....	94,315	71,113	West Virginia.....	302	105
Minnesota.....	59,218	47,912	Wisconsin.....	88,798	57,630
Missouri.....	24,755	18,709	Wyoming.....	3	5
Montana.....	101	90			
Nebraska.....	1,956	1,973	Total.....	470,528	348,615
Nevada.....	20	20	Exported.....	80,931	11,400
New Hampshire.....	52	53			
New Jersey.....	2,060	1,930	Grand total.....	551,459	360,015
New Mexico.....	102	100			

<sup>1</sup> Based upon reports from producers showing destination of briquets used and sold.

TABLE 8.—Shipments of fuel briquets in the United States, by method of transportation<sup>1</sup>

(Short tons)

Origin	1963			1964		
	Rail	Truck	Total	Rail	Truck	Total
Eastern States.....	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
Central States.....	137, 979	102, 087	290, 066	134, 853	78, 787	213, 640
Western States.....	234, 797	26, 596	261, 393	126, 525	19, 850	146, 375
Total.....	422, 776	128, 683	551, 459	261, 378	98, 637	360, 015

<sup>1</sup> Includes shipments destined for export as reported by producers directly to the Bureau of Mines.

<sup>2</sup> Included with "Western States" to avoid disclosing individual company data.

### VALUE AND PRICE

The average value per ton, f.o.b. plant, of all briquets distributed in 1964 was \$16.47, an increase of 11 percent over the preceding year. The total value of shipments decreased 28 percent, however, because of the substantial decline in the quantity of briquets shipped.

Plant prices varied according to the area of production. Briquets produced in the Eastern region had a relatively low value because they were produced at the mine; briquets produced in the Central and Western regions generally had higher values because most were produced from fuels that originated in other areas. Briquets produced in the East, however, were shipped to more distant markets, and transportation costs were reflected in the price of the briquet rather than in the raw fuel. In general, briquets that were produced and sold in the Central and Western States were competitively priced at the retail level with briquets that were produced in the East and shipped to more distant markets.

The values of briquets shipped in 1964, f.o.b. plant, are shown in table 3. Because of the relatively small quantity of briquets distributed, wholesale and retail prices of briquets are not quoted by the coal trade journals and are generally unavailable.

### FOREIGN TRADE

Foreign trade was small; only 12,000 tons of briquets was imported and 18,000 tons exported, according to data compiled from records of the Bureau of the Census, U.S. Department of Commerce.

Imports in 1964 increased about 2½ times over 1963, but were about 28 times larger than the average quantity imported annually in 1957-59. All were imported from Canada, with about one-half entering the United States through the Dakota customs district and the other one-half through the Montana-Idaho customs district.

Exports increased 44 percent over the previous year but were 69 percent below the average quantity exported in 1957-59. Canada was the principal export market, receiving 89 percent of the total export shipments. Small quantities were shipped to 14 other countries.

The average value per ton of imported briquets was \$15.68, and the

total value of imports was \$182,000. Briquets exported averaged \$11.77 per ton, and the total value of exports was \$210,000.

Import and export data are shown in tables 9 and 10. The data on exports reported by producers differ from those compiled from records of the Bureau of the Census because shipments made by export firms are not included in the producer reports.

**TABLE 9.—Fuel briquets (coal and coke) imported for consumption in the United States, by country and customs district**

Country and customs district	1962		1963		1964	
	Short tons	Value	Short tons	Value	Short tons	Value
Canada:						
Buffalo.....	3,166	\$156,633	140	\$7,000		
Dakota.....	1,101	40,614	1,289	18,957	5,867	\$89,607
Duluth and Superior.....	135	6,788				
Hawaii.....	162	5,581	127	6,879		
Michigan.....	1,006	57,698	36	1,687		
Montana and Idaho.....	1,341	66,081	3,028	47,300	5,726	92,186
Washington.....	1,462	74,902				
Total.....	8,373	408,297	4,620	81,823	11,593	181,793
Japan:						
Hawaii.....	11	675				
San Francisco.....	3	231				
Total.....	14	906				
United Kingdom: Los Angeles.....	9	597				
Grand total.....	8,396	409,800	4,620	81,823	11,593	181,793

Source: Bureau of the Census.

**TABLE 10.—Fuel briquets (coal and coke) exported from the United States, by country of destination and customs district**

Country or area:	1962		1963		1964	
	Short tons	Value	Short tons	Value	Short tons	Value
North America:						
Bahamas.....			14	\$206		
Barbados.....	16	\$232				
British Honduras.....	18	270				
Canada.....	17,028	213,314	9,062	125,257	15,911	\$182,992
Costa Rica.....	85	650				
Dominican Republic.....	538	5,670	831	12,849	344	4,898
Guatemala.....					79	1,120
Honduras.....					22	302
Jamaica.....			14	200		
Leeward and Windward Islands.....	19	232				
Mexico.....	186	2,823	286	3,939	341	4,844
Total.....	17,890	223,191	10,207	142,451	16,697	194,156
South America:						
Brazil.....					268	3,818
Chile.....					250	3,388
Colombia.....			608	8,594		
Paraguay.....			69	976	74	970
Surinam.....	61	832				
Venezuela.....	44	676	179	2,541	138	1,920
Total.....	105	1,508	856	12,111	730	10,096

See footnote at end of table.

TABLE 10.—Fuel briquets (coal and coke) exported from the United States, by country of destination and customs district—Continued

	1962		1963		1964	
	Short tons	Value	Short tons	Value	Short tons	Value
Country or area—Continued						
Europe:						
Germany, West			425	\$6,000	57	\$800
Spain	123	\$1,841	45	640	59	842
United Kingdom						
Total	123	1,841	470	6,640	116	1,642
Asia:						
India					163	2,217
Indonesia					47	673
Japan			( <sup>1</sup> )	( <sup>1</sup> )		
Nansei and Nanpo Islands	403	5,690				
Philippines					64	898
Saudi Arabia	20	300	119	1,689		
Total	423	5,990	119	1,689	274	3,788
Africa: Western Equatorial Africa, n.e.c.	55	426				
Oceania:						
Australia			728	43,973		
New Zealand					40	564
Total			728	43,973	40	564
Grand total	18,596	232,956	12,380	206,864	17,857	210,246
Customs district:						
Buffalo	1,433	19,366	400	6,070	1,450	21,580
Chicago	3,641	25,490				
Dakota	3,622	51,676	1,762	25,870	1,211	18,864
Duluth and Superior	2,804	43,947	1,583	23,053	2,170	30,130
El Paso				67		836
Florida	35	464		28		406
Galveston				170		2,564
Laredo	169	2,563		156	169	2,203
Los Angeles				728		43,973
Maryland	61	832				
Michigan	4,758	62,203	4,267	57,644	3,250	44,410
Mobile	538	5,670	661	10,285	344	4,898
New Orleans	103	920	69	976	175	2,392
New York	590	8,507	951	13,464	970	13,478
Ohio			425	6,000	7,600	64,916
Philadelphia	65	919			59	842
Sabine	55	426				
St. Lawrence	606	8,066	1,050	12,620	287	3,892
San Diego	17	260	63	900	172	2,440
Vermont	45	873				
Washington	54	774				
Total	18,596	232,956	12,380	206,864	17,857	210,246

<sup>1</sup> Adjusted by Bureau of Mines to none.

Source: Bureau of the Census.

## TECHNOLOGY

A new process for producing smokeless briquets without binder by rapidly heating weakly coking or noncoking coals to 350°–500° C and then briquetting the char while still hot is described in British Patent Specification 964799.<sup>2</sup>

The Andre Dumont and Zolder Collieries in Belgium have developed a process for manufacturing briquets from high-volatile bituminous coal which are rendered smokeless by an appropriate thermic treat-

<sup>2</sup> British Coal Utilization Research Association. Monthly Bull., v. 28, No. 11, October-November, 1964, pt. 2, p. 445.

ment. One plant, with an annual capacity of 200,000 tons of smokeless briquets having all the characteristics of an anthracite fuel, will be in operation by September 1965.<sup>3</sup>

British Patent Specification 947972 describes a method for preparing coal agglomerates resembling artificial anthracite. In the process, briquets are compacted from a paste consisting of fine coal particles, coal-tar pitch, sulfur, anthracene oil, and water. The paste is heated to 90°–100° C, pressed to form agglomerates, and then steadily heated in the absence of oxidizing agents to 700° C for a period of time varying from 1 hour 35 minutes for anthracite, to 5 hours 45 minutes for high-volatile bituminous coal.<sup>4</sup>

Recent studies conducted by the Bureau of Mines on an experimental blast furnace indicate that anthracite briquets can be used successfully to replace coke as metallurgical fuel for blast furnaces. Although tuyere pressures were somewhat higher and more erratic, and higher hot-blast temperatures were required to maintain the quality of the metal, fuel and production rates, and slag volumes, were comparable to those obtained for all-coke operations. The briquets used exhibited excellent mechanical strength and descended through the shaft of the blast furnace with little breakage or reduction in size.<sup>5</sup>

Extensive pilot-plant tests conducted by the Dravo Corp. have demonstrated that coal fines of widely varying size and moisture content can be pelletized for re-use as shipping coal or as feed for producing metallurgical coke in shaft furnaces, traveling grates, or circular furnaces. The tests revealed that, for most coal fines, the use of binders improved the strength of the pellets and assisted in the pelletizing process. The most satisfactory binder was found to be bentonite combined with a liquid lignosulphate.<sup>6</sup>

## PACKAGED FUEL

### CAPACITY

Productive capacity of this industry decreased about one-third in 1964 as operating plants declined from 13 to 9. Virtually all packaged-fuel plants are small. Eight had annual capacities of less than 15,000 tons, and only one had the capability of producing more than 25,000 tons.

As with briquet plants, all plants operated at reduced rates during the year, and the industry produced at only 11.9 percent of capacity.

### PRODUCTION

Although three small plants that were idle in 1963 reported production for 1964, seven other plants were idle or abandoned during the year, and output of the industry decreased about one-third. Of the plants active in both years, only one small plant reported an increase

<sup>3</sup> Defandre, H. Smokeless Briquets from High-Volatile Bituminous Coal. *Ann. Min. Belg.*, v. 6, June 1964, pp. 701-734; *Fuel Abs. and Current Titles*, (abs. 6561), v. 5, No. 10, October 1964.

<sup>4</sup> British Coal Utilization Research Association. *Monthly Bull.*, v. 28, No. 4, April-May 1964, pt. 1, p. 184.

<sup>5</sup> Eckard, J. W., E. E. McKeever, W. S. Sanner, and P. L. Woolf. Anthracite Metallurgical Briquets as Blast-Furnace Fuel. *BuMines Rept. of Inv.* 6383, 1964, 16 pp.; *Fuel Abs. and Current Titles*, (abs. 610), v. 6, No. 1, January 1965, p. 113.

<sup>6</sup> Edwards, J. A. Pelletizing Coal Fines. *Coll. Guard.*, v. 207, No. 5344, September 19, 1963, pp. 369-370.



TABLE 11.—Annual capacity and production of packaged-fuel plants in the United States

	Active plants	Annual capacity (short tons)	Production	
			Short tons	Percent of capacity
1960.....	19	123,000	24,706	20.1
1961.....	16	114,300	19,180	16.8
1962.....	15	112,900	17,439	15.4
1963.....	13	113,300	14,215	12.5
1964:				
Plants with capacity of—				
Less than 5,000 tons.....	6	8,400	1,573	18.7
5,000 to less than 10,000 tons.....	1			
10,000 to less than 15,000 tons.....	1			
15,000 to less than 25,000 tons.....	1			
25,000 or more tons.....	1	169,800	17,749	11.1
Total.....	9			
Plants with production of—				
Less than 1,000 tons.....	7	78,200	9,322	11.9
1,000 to less than 3,000 tons.....	1	(?)	(?)	(?)
3,000 to less than 5,000 tons.....	1	(?)	(?)	(?)
5,000 or more tons.....	1	(?)	(?)	(?)
Total.....	9	78,200	9,322	11.9

<sup>1</sup> Combined to avoid disclosing individual company data.

<sup>2</sup> Included with "Less than 1,000 tons" to avoid disclosing individual company data.

of production in 1964. Seven of the active plants produced less than 1,000 tons.

Packaged fuel was produced in six States. Michigan had 70 percent of the total output, and Indiana and Ohio, virtually all of the remainder.

Production, which was seasonal, ranged from 7 tons in July to 1,705 tons in January. Total output was slightly less than the combined total of fuels and binders because of breakage and other minor losses.

The quantities of packaged fuel produced by States and months are shown in tables 12 and 13.

## RAW MATERIALS

**Fuels.**—Most of the packaged fuel was manufactured from bituminous coals. One plant, however, used petroleum coke in addition to bituminous coal.

Three plants used yard screenings exclusively, three used raw fuels purchased from other sources, and three used both types. Yard screenings accounted for only 9 percent of the total raw fuels because the larger plants used purchased coals, obtained chiefly from docks and other unloading points.

The average value per ton of all raw fuels consumed was \$9.48, an increase of 1 percent over the average value of fuels consumed in 1963.

**Binders.**—All plants used starch for binder, with the exception of one small plant that used corn syrup. Excluding water, binders constituted 0.6 percent of the total raw materials. This was an average of 12.2 pounds of binder consumed for each ton of raw fuel processed.

**TABLE 12.—Production and shipments of packaged fuel in the United States, by State**

State	Active plants	Production (short tons)	Shipments		
			Short tons	Value	
				Total	Average
<b>1963:</b>					
Indiana.....	2	(1)	(1)	(1)	(1)
Michigan.....	4	7,998	8,342	\$200,046	\$23.98
Ohio.....	4	1,080	1,068	23,482	21.99
Other States <sup>2</sup> .....	3	5,137	5,145	116,493	22.64
<b>Total.....</b>	<b>13</b>	<b>14,215</b>	<b>14,555</b>	<b>340,021</b>	<b>23.36</b>
<b>1964:</b>					
Indiana.....	2	(1)	(1)	(1)	(1)
Michigan.....	3	6,518	7,125	179,748	25.23
Ohio.....	1	(1)	(1)	(1)	(1)
Other States <sup>2</sup> .....	3	2,804	2,830	61,714	21.81
<b>Total.....</b>	<b>9</b>	<b>9,322</b>	<b>9,955</b>	<b>241,462</b>	<b>24.26</b>

<sup>1</sup> Included with "Other States" to avoid disclosing individual company data.

<sup>2</sup> Illinois, Virginia, Wisconsin.

**TABLE 13.—Production of packaged fuel in the United States in 1964, by month**

Month	Short tons	Month	Short tons	Month	Short tons
January.....	1,705	May.....	10	September.....	626
February.....	1,129	June.....	7	October.....	1,177
March.....	1,354	July.....	518	November.....	913
April.....	645	August.....		December.....	1,238

Binders consumed averaged \$118.53 per ton, and their total value was \$6,756. This was about 7 percent of the total value of the raw fuels and binders consumed.

Table 14 shows the quantities and values of raw materials consumed in 1964.

### SHIPMENTS

Packaged fuel was sold principally in the areas of production, and all shipments were by truck. In some instances, packaged fuel was sold directly to consumers at the plant where it was manufactured. Sales were about 7 percent greater than production because two plants sold packaged fuel that was on hand from the previous year.

### VALUE AND PRICE

The average value per ton, f.o.b. plant, of all packaged fuel distributed in 1964 was \$24.26, an increase of 4 percent over the average value in 1963. However, the total value of shipments declined nearly one-third because of the substantial decrease in the quantity of packaged fuel shipped.

The average plant price of packaged fuel was \$7.79 greater than the f.o.b. plant value of fuel briquets, but the values are not com-

TABLE 14.—Quantity and value of raw materials used in making packaged fuel in the United States in 1964, by State

State	Short tons	Value	
		Total	Average
<b>Fuels:</b>			
Michigan.....	6,518	\$59,504	\$9.13
Other States <sup>1</sup> .....	2,792	28,799	10.31
Total.....	9,310	88,303	9.48
<b>Binders:</b>			
Michigan.....	35	4,003	114.37
Other States <sup>1</sup> .....	22	2,753	125.14
Total.....	57	6,756	118.53
<b>Fuels and binders:</b>			
Michigan.....	6,553	63,507	9.69
Other States <sup>1</sup> .....	2,814	31,552	11.21
Grand total.....	9,367	95,059	10.15

<sup>1</sup> Illinois, Indiana, Minnesota, Ohio, Virginia.

parable because the products and methods in which they are marketed are different. Because most briquets were sold in bulk for residential heating, their prices were largely competitive with other quality bulk solid fuels. Also, briquets were sold principally through wholesale and retail channels, and the actual price to the consumer was substantially greater than the f.o.b. plant value. Packaged fuel, however, is a specialty item, sold mostly in small quantities directly to the consumer by the producer; the f.o.b. plant value generally is equivalent to the retail price. The values of packaged fuel shipments in 1964 are shown in table 12.

## WORLD REVIEW

World production of fuel briquets and other briquetted fossil fuels was estimated at 130 million short tons in 1964, a 3-percent decrease below the production in 1963 but 11 percent more than the average amount produced annually in 1957-59. Most of the decrease in 1964 was attributed to smaller outputs in Europe, chiefly in Belgium, France, and West Germany.

Virtually all European countries produced briquets, and Europe's output was 91 percent of the world total. East Germany, the largest producer, manufactured 56 percent of Europe's output and 52 percent

of the world total. Virtually all briquets produced in East Germany were made from lignite. These briquets, which made up a substantial part of East Germany's total fuel requirement, were used extensively for residential and industrial heating; some briquets were carbonized for use in metallurgical applications.

West Germany ranked second in output with 18 percent of the world total. About three-fourths of the West German production was manufactured from lignite; the remainder was from bituminous coal and anthracite. Briquets in West Germany were used principally as household fuel, but substantial quantities were used also as industrial fuel. West Germany exported nearly 10 percent of its output.

Ranking third in world production, the U.S.S.R. had an estimated 7 percent of the world briquet output. Data were not available on the quantities of different fuels briquetted in the U.S.S.R., but, in addition to briquets manufactured from bituminous coal and anthracite, large quantities also were produced from peat. As in other European countries, briquets were used principally for domestic heating and as industrial fuel in the Soviet Union.

France has fourth in world production with 6 percent of the total. French briquets, manufactured principally from bituminous coal, also were used chiefly as domestic and industrial fuel. France also imported more than 1 million tons of briquets, principally from Belgium, the Netherlands, and West Germany.

Other European countries with substantial production were Belgium, Bulgaria, Hungary, the Netherlands, Poland, Spain, and the United Kingdom. All produced more than 1 million tons, and their combined output was 8 percent of the world total.

Seven percent of all briquets were produced in Asia, chiefly in Japan and the Republic of Korea. Both countries used large quantities of briquets for domestic heating and cooking. About one-half of Japan's output was produced from anthracite or an anthracite-coke mixture, and the remainder, known as pitch briquets, from bituminous coal. Anthracite briquets were used principally for domestic fuel, and pitch briquets were used for railway fuel.

Australia ranked eighth in world output. Australia's production also was consumed chiefly for domestic fuel and as fuel for light industries.

The United States, with 0.3 percent of the world production, ranked 16th in output.

Production, by countries, is shown in table 15.

TABLE 15.—World production of fuel briquets and packaged fuel, by country<sup>1</sup>

(Thousand short tons)

Country	1960	1961	1962	1963	1964 <sup>2</sup>
<b>North America:</b>					
Canada.....	81	67	56	72	• 65
United States:					
Briquets.....	744	572	570	551	359
Packaged fuel.....	25	19	17	14	9
<b>Total</b> .....	<b>850</b>	<b>658</b>	<b>643</b>	<b>637</b>	<b>433</b>
<b>Europe:</b>					
Belgium.....	1,190	1,290	1,756	2,534	• 1,650
Bulgaria •.....	275	440	1,100	1,380	1,700
Czechoslovakia:					
Bituminous.....	360	166	.....	.....	.....
Lignite.....	481	793	868	858	• 880
Denmark.....	53	62	61	• 55	• 55
Finland.....	12	10	7	20	• 15
France.....	6,693	6,714	7,660	8,834	7,330
Germany:					
East, Lignite.....	61,781	63,930	65,838	66,421	• 67,000
West:					
Anthracite and bituminous.....	5,753	5,367	6,242	7,003	5,962
Lignite.....	16,805	17,102	17,383	17,454	16,927
Greece.....	97	73	89	155	• 100
Hungary.....	1,171	1,254	1,311	1,360	• 1,380
Ireland •.....	137	233	266	323	316
Italy, Anthracite.....	30	32	65	141	• 75
Netherlands:					
Anthracite and bituminous.....	1,302	1,310	1,379	1,721	1,495
Lignite.....	69	82	78	69	73
Poland:					
Bituminous.....	791	744	721	704	• 660
Lignite.....	345	373	380	392	• 380
Portugal.....	45	42	50	46	42
Rumania •.....	330	330	330	330	330
Spain.....	1,260	1,232	1,364	1,315	1,145
Sweden.....	60	68	47	• 65	• 45
U. S. S. R. •.....	9,400	9,400	9,400	9,400	9,600
United Kingdom.....	1,532	1,645	1,734	1,851	1,489
Yugoslavia.....	10	6	3	18	• 7
<b>Total</b> .....	<b>110,000</b>	<b>112,700</b>	<b>118,100</b>	<b>122,450</b>	<b>118,700</b>
<b>Asia:</b>					
Afghanistan.....	• 22	21	• 21	• 22	• 22
Indonesia •.....	11	11	11	11	11
Japan.....	• 3,200	4,529	4,605	4,740	4,500
Korea, Republic of.....	3,206	• 4,400	5,460	3,805	• 3,900
Pakistan •.....	17	22	22	22	22
Turkey.....	165	74	17	• 17	62
Viet-Nam, South •.....	61	61	61	61	61
<b>Total</b> .....	<b>6,700</b>	<b>9,100</b>	<b>10,200</b>	<b>8,700</b>	<b>8,600</b>
<b>Africa:</b>					
Algeria.....	50	45	• 18	.....	.....
Morocco.....	25	26	25	20	20
Tunisia •.....	6	7	8	8	8
<b>Total</b> .....	<b>81</b>	<b>78</b>	<b>51</b>	<b>28</b>	<b>28</b>
<b>Oceania:</b>					
Australia.....	1,694	2,062	2,002	2,113	2,073
New Zealand.....	17	17	13	12	• 13
<b>Total</b> .....	<b>1,711</b>	<b>2,079</b>	<b>2,015</b>	<b>2,125</b>	<b>2,091</b>
<b>World total (estimate)</b> .....	<b>119,300</b>	<b>124,600</b>	<b>131,000</b>	<b>133,900</b>	<b>129,900</b>

• Estimated.   • Preliminary.

<sup>1</sup> Includes briquets made from coal, lignite, and peat and revisions of data published previously. Data do not add to totals shown owing to rounding.<sup>2</sup> Year ended Mar. 31 of year following that stated.

# Peat



By Eugene T. Sheridan<sup>1</sup>

## Contents

	Page		Page
General summary.....	287	Consumption and uses.....	294
Government regulations.....	288	Value and price.....	295
Scope of report.....	289	Foreign trade.....	296
Reserves.....	290	Technology.....	300
Production.....	292	World review.....	301

## GENERAL SUMMARY

**P**EAT PRODUCTION continued to increase in 1964, and output reached 648,708 short tons. This was a 12-percent increase over 1963 production and the largest output reported to date.

There were 141 active commercial operations in 26 States. Michigan was the leading producer, with 41 percent of the total production and about one-fifth of the active plants. Indiana, Pennsylvania, California, Washington, and New York ranked next in output in the order named. These States and Michigan produced nearly three-fourths of the total peat in 1964.

Fifty-six percent of the output was reed-sedge peat. The remaining production was divided about equally between moss peat and humus. Fourteen percent was sold as excavated, and the remainder was processed by shredding or pulverizing, screening, and, in a few instances, thermal drying.

Virtually all peat was sold for agricultural and horticultural applications. Of the total domestic peat distributed by producers, 96 percent was sold for general soil-improvement use. The remainder was sold principally for use in potting soils, for packing flowers and shrubs, and in mixed fertilizers. No peat was reported sold for use as fuel.

Forty-eight percent of the domestic peat was sold in bulk, and the balance was sold in packages. Peat was sold in bulk in all producing States except Maine; producers in 19 States sold peat in packages.

The value of commercial sales by producers was \$6.2 million. The average value per ton of all peat sold was \$9.67.

Imports increased 3 percent because of increased shipments from Canada. Imports from Europe declined.

World production was estimated at 183 million short tons. The U.S.S.R. was the largest producer, with an estimated 96 percent of the total output.

<sup>1</sup> Mineral specialist, Division of Bituminous Coal.

Salient statistics are shown in table 1. Figure 1 shows data on production, imports, and available supply.

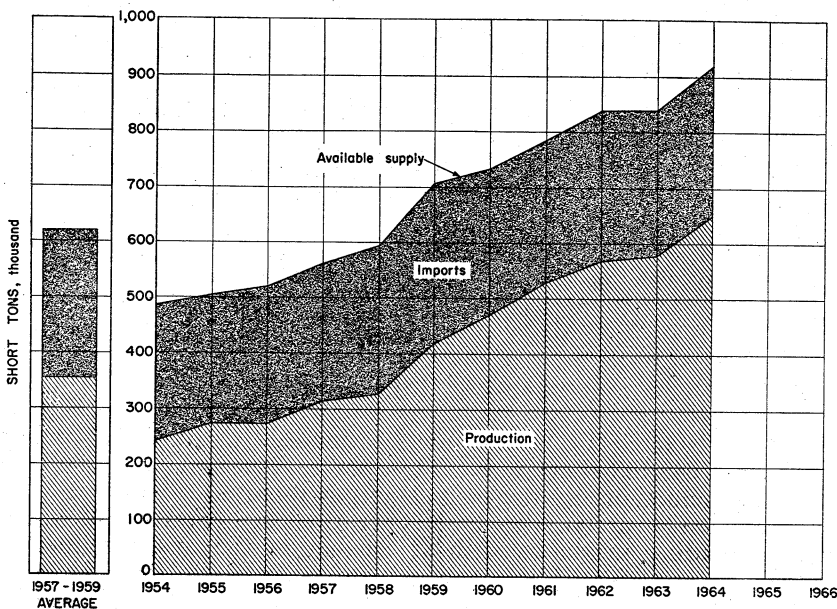


FIGURE 1.—Production, imports, and available supply of peat in the United States, 1954-64.

TABLE 1.—Salient peat statistics

	1957-59 (average)	1961	1962	1963	1964
United States:					
Number of operations .....	87	128	117	113	141
Production.....short tons...	354,497	531,067	571,373	578,530	648,708
Commercial sales.....do.....	342,711	492,798	566,441	546,621	639,365
Values of sales.....do.....	\$3,556,213	\$4,072,938	\$5,185,627	\$5,422,877	\$6,181,341
Average per ton.....do.....	\$10.38	\$9.48	\$9.15	\$9.92	\$9.67
Imports.....short tons...	267,525	252,437	267,678	261,331	270,419
Available for consumption <sup>1</sup> .....do.....	610,236	745,235	834,119	807,952	909,784
World production.....do.....	<sup>2</sup> 71,100,000	<sup>3</sup> 165,800,000	<sup>3</sup> 144,400,000	<sup>3</sup> 171,200,000	183,400,000

<sup>1</sup> Commercial sales plus imports.

<sup>2</sup> In addition, the U.S.S.R. produced an undetermined quantity of agricultural peat.

<sup>3</sup> Revised figure.

## GOVERNMENT REGULATIONS

There are no national standards in the United States for differentiating among peats according to their various chemical and physical characteristics and suitability for different uses. The sale of peat, however, is governed by trade regulations, established by the Federal Trade Commission, to promote fair labeling and selling practices. In general, the regulations forbid unfair or deceptive practices in marketing, misrepresentations, and the use of deceptive trade or corporate names. They also state the requirements for labeling a product

"peat" and the manner in which the terms "peat moss" and "moss peat" may be used. According to the regulations, peat is any partially decomposed plant matter that has accumulated under water or in a water-saturated environment. It is unlawful to designate a product "peat" unless 75 percent of the material, by dryweight, is composed of peat, as defined previously, and the remainder consists of normally associated soil materials. A product labeled "moss peat" must conform to this definition, and the peat must have been formed from sphagnum, hypnum, or other mosses. The use of the term "peat moss," a misnomer generally applied to all types of peat, is subject to the requirements for "moss peat" except when the kind or kinds of peat of which the product is composed are conspicuously stated in immediate conjunction with the term "peat moss."

The trade practice rules also prohibit discriminatory practices in pricing, grants for services or facilities, and advertising or promotional allowances. To further protect the public and assist consumers in using the various kinds of peat, the rules recommend that producers furnish such information as degree of acidity, ash content, moisture-holding capacity, and degree of decomposition of the peat. They also recommend that peat be sold on a dry-measure basis and that information be furnished on the principal uses for which the product is suitable.

Government purchases of peat are subject to Federal specifications, developed by the Federal Supply Service, General Services Administration. The current specification, Q-P-166e, May 10, 1961, classifies and lists the requirements for four types of peat: (1) Sphagnum-moss peat; (2) other moss peats; (3) humus peat; and (4) reed-sedge peat. The Federal Supply Service also supplies information on sampling, inspection, and testing procedures and outlines the requirements for packaging and marking containers.

### SCOPE OF REPORT

This chapter, except where noted, is based upon data submitted voluntarily by producers of peat in the United States. Similar reports on the peat industry have been published each year since 1934 when the Bureau of Mines resumed the industry survey conducted from 1908 to 1926 by the U.S. Geological Survey. No data were collected or published by either agency between 1926 and 1934.

Complete coverage of the industry was attempted, and all reported production was included. No estimates were made for nonreporting companies, which were assumed to have been idle or not commercial producers. Questionnaires were mailed to all companies that reported commercial production within the past 3 years and to companies that were reported as possible peat producers. Because of the nature of the industry, this survey may have failed to reach all producers. However, all major and most of the smaller producers were canvassed, and the data include virtually all peat produced in the United States for commercial sale.

The survey revealed that there were 141 active and 26 idle peat operations in 1964. Of the other plants canvassed, 15 were abandoned and 14 did not respond. Two plants produced peat in 1964 but had no commercial sales.



Peat is classified in this report as moss peat, reed-sedge peat, and humus. The first two types are classified according to botanical origin; the last type is classified according to degree of decomposition. Moss peat is a type that has formed predominantly from sphagnum, hypnum, or other mosses, whereas reed-sedge peat has originated principally from reeds, sedges, and associated swamp plants. Plant remains in both the moss and reed-sedge types are identifiable, but reed-sedge peat usually is more decomposed. Humus includes all peat so decomposed that its biological identity cannot be determined. These classifications are less restrictive than those of the Federal specifications governing purchases of peat by the Federal Government, but the nature of the domestic peat industry makes it impractical to make them more limiting, particularly for reporting purposes.

Unprepared peat had no processing other than air drying. Processed peat was shredded, screened, and, in some instances, artificially dried. Cultivating refers to the operation of aerating peat before excavating it by turning over the surface layer of the deposit with a disk or spike harrow.

Data were requested on production, sales, values, uses, location and size of deposits, and types of equipment used. Data shown on uses include peat produced in the United States only, because no information was available on the ultimate uses of imported peat.

All values for domestic peat were based upon producers' selling prices at the plant. In general, the prices did not include the cost of containers, but this cost may have been included by some producers. Values not reported by producers were estimated by using the values of similar types reported by other producers within the State.

All quantities are shown in short tons of 2,000 pounds.

## RESERVES

The known reserves of peat in the United States are estimated at approximately 14 billion air-dried short tons. These resources are widely distributed, and deposits occur in 34 States. Approximately nine-tenths of the total, however, are in four States—Florida, Michigan, Minnesota, and Wisconsin.

Major peat deposits occur in two general geographic areas. The northern region (with about 80 percent of the total reserves) covers, roughly, the area north of the 41st parallel and east of the 97th meridian. It includes all of the New England States, Illinois, Indiana, Iowa, Michigan, Minnesota, New Jersey, New York, Ohio, Pennsylvania, and Wisconsin. The Atlantic coast region, with most of the remaining reserves, includes all of Florida and the coastal areas of all States south of New Jersey that border the Atlantic Ocean.

In the northern region, peat has accumulated chiefly in former lakes, marshes, and ponds, and the deposits are classified as the filled-basin type. They consist of partially decomposed peat, formed principally from reeds, sedges, grasses, or other swamp plants, underlain by a layer of well-decomposed peat that formed from algae and other simple plants when the basin was first established. In many areas these deposits are covered with a layer of "built-up" peat, formed principally from mosses and shrubs that grew on the surface of the deposit after the basin was filled to the level of the surrounding

countryside. In most areas this stratum of moss peat is quite thin. In others, however, where drainage was poor, many feet of moss peat have accumulated. In a few of the northern areas, particularly Maine, there are large deposits of built-up peat, formed from the accumulation of mosses and shrubs on flat or gently sloping surfaces.

The Atlantic coast region is characterized by many salt- and fresh-water marshes and swamps, and peat deposits occur principally in valleys and lagoons that were formed by the gradual subsidence of the coastal plain. This peat has formed principally from salt-marsh grasses and other salt-water plants; however, many deposits also have an underlayer of peat formed from fresh-water plants that were deposited before the coast subsided. Deciduous and coniferous trees also have contributed to peat formation in many areas in this region.

Approximately 75 percent of the total U.S. reserves are in three northern States—Minnesota, Wisconsin, and Michigan. Deposits occur in most areas of all three States; the bulk of the peat, however, is found north of the 45th parallel. This region is characterized by relatively low temperatures and high humidity which are conducive to peat formation.

Minnesota's reserves, estimated at 6.8 billion tons, are the largest in the United States. Peat deposits are in virtually all areas of Minnesota, but more than three-fourths of the total reserves are in four northern counties.

Wisconsin has about 1 million acres of peatlands, and reserves are estimated at 2.5 billion tons. As in Minnesota, these reserves are scattered widely, but the most extensive deposits are in the northern part of the State.

Michigan's reserves are estimated at 1 billion tons. Deposits are well distributed throughout the State, but the largest and most extensive are in the north where some bogs exceed 25 square miles in area and are 2 to 20 feet deep. There are many smaller deposits in central and southern Michigan.

Peat occurs in all New England States, but four-fifths of the New England reserves are in Maine. Maine's reserves are estimated at 100 million tons, of which about one-half are in the coastal areas and near the lower courses of major streams. The remainder is in heavily forested areas in the northern and western parts of the State and is therefore relatively inaccessible.

All States along the Atlantic coast have peat deposits, but about 75 percent of the estimated 2.7 billion tons of the Atlantic coastal region is in Florida. Peat occurs in virtually all parts of Florida, which ranks third in total U.S. reserves. The Dismal Swamp in Virginia and North Carolina is the second largest peat area of the Atlantic coast region.

There are small deposits of peat also in the coastal areas of Alabama, Louisiana, Mississippi, and Texas; on the west coast in California, Oregon, and Washington; and in Colorado, Idaho, and Montana. Less than 1 percent of the total U.S. reserves are in these States.

Known original reserves of peat in the United States, as reported by the U.S. Geological Survey in 1922, are shown in table 2. The reserves remain virtually intact because only 6.9 million tons, or less than 0.05 percent of the estimated total, has been extracted for commercial sale.

**TABLE 2.—Known original reserves of peat in the United States, estimated on an air-dried basis, by region and State<sup>1</sup>**

(Thousand short tons)

Region and State	Reserves	Region and State	Reserves
<b>Northern region:</b>		<b>Atlantic coast region:</b>	
Minnesota.....	6,835,000	Virginia and North Carolina.....	700,000
Wisconsin.....	2,500,000	Florida.....	2,000,000
Michigan.....	1,000,000	Other States <sup>2</sup> .....	2,000
Iowa.....	22,000	<b>Total.....</b>	<b>2,702,000</b>
Illinois.....	10,000		
Indiana.....	13,000	<b>Other regions:</b>	
Ohio.....	50,000	Gulf coast <sup>3</sup> .....	2,000
Pennsylvania.....	1,000	California.....	72,000
New York.....	480,000	Oregon and Washington.....	1,000
New Jersey.....	15,000	<b>Total.....</b>	<b>75,000</b>
Maine.....	100,000		
New Hampshire.....	1,000		
Vermont.....	8,000		
Massachusetts.....	12,000		
Connecticut.....	2,000		
Rhode Island.....	1,000		
<b>Total.....</b>	<b>11,050,000</b>	<b>Total all regions.....</b>	<b>13,827,000</b>

<sup>1</sup> U.S. Geological Survey, Coal Resources of the United States (Progress Report): Circ. 293, Oct. 1, 1963, p. 38.<sup>2</sup> Includes Delaware, Maryland, South Carolina, and Georgia.<sup>3</sup> Excludes Florida.

## PRODUCTION

Peat production reached 648,708 tons in 1964, a 12-percent increase over output in 1963 and 83 percent more peat than the average quantity produced annually in 1957-59. This increase can be attributed principally to an increased demand for domestic peat as total peat consumption increased in 1964 and imports supplied a smaller percentage of the total.

There were 141 active operations, 28 more than the number that reported production in 1963. Michigan, with 29, had the largest number, followed by Washington with 15, Colorado with 14, and Pennsylvania with 10 operations. These four States had nearly one-half of the total number of operations.

Most peat operations were small. Approximately three-fourths of the active plants had outputs of less than 5,000 tons. Only five plants produced more than 25,000 tons. These five plants, however, accounted for nearly one-third of the total output.

Michigan, with 41 percent of the total output, was also the largest producer. Indiana, Pennsylvania, California, Washington, and New York followed in output in the order named.

More than one-half of the production was reed-sedge peat, which was produced principally in Michigan. However, all producing States except Alaska, Georgia, Maine, and Wisconsin also produced this type. Fifty-five percent of the total peat was cultivated before it was extracted, and 86 percent was subjected to some form of processing before it was sold.

Production methods varied, but virtually all peat was excavated with some type of machinery. Most of the equipment consisted of conventional excavating and earth-moving machines, including power shovels, clamshells, draglines, dredges, bulldozers, front-end loaders, and belt and bucket loaders. The most widely used machine was the

front-end loader; next in popularity was the bulldozer. Processing machinery included a variety of shredders, grinders, pulverizers, hammermills, screens, and rotary dryers.

Table 4 shows production, commercial sales, and the number of active plants in each State.

TABLE 3.—Peat produced in the United States in 1964, by kind

(Short tons)

Kind	Total	Unprepared	Processed	
			Shredded	Shredded and kiln-dried
Moss.....	144, 899	11, 952	111, 958	20, 989
Reed-sedge.....	360, 700	21, 065	336, 548	3, 087
Humus.....	143, 109	59, 897	79, 942	3, 270
Total .....	648, 708	92, 914	528, 448	27, 346

TABLE 4.—Production and commercial sales of peat in the United States, by State

State	Active plants	Production (short tons)	Commercial sales		
			Short tons	Value	
				Total	Average
1963:					
California.....	5	43, 873	39, 873	\$450, 193	\$11. 29
Colorado.....	5	13, 774	13, 774	97, 724	7. 09
Connecticut, Maine, Massachusetts.....	5	4, 941	4, 441	58, 933	13. 27
Florida.....	7	22, 143	21, 049	129, 380	6. 15
Georgia, Maryland, South Carolina.....	5	11, 642	10, 998	112, 640	10. 24
Idaho, Montana, North Dakota.....	3	2, 070	1, 320	24, 550	18. 60
Illinois and Iowa.....	4	21, 732	21, 732	239, 939	11. 04
Indiana.....	6	55, 745	47, 695	411, 848	8. 64
Michigan.....	28	255, 859	251, 809	2, 412, 995	9. 58
Minnesota.....	6	8, 373	8, 110	294, 373	36. 30
New Jersey.....	3	23, 685	23, 685	241, 042	10. 18
New York.....	5	21, 358	21, 358	177, 664	8. 32
Ohio.....	10	7, 110	6, 910	108, 876	15. 76
Pennsylvania.....	7	44, 910	33, 952	338, 667	9. 97
Washington.....	11	38, 648	37, 248	187, 549	5. 04
Wisconsin.....	3	2, 667	2, 667	136, 504	51. 18
Total.....	113	578, 530	546, 621	5, 422, 877	9. 92
1964:					
Alaska.....	1	2, 350	2, 350	18, 800	8. 00
California.....	5	35, 391	35, 391	442, 941	12. 52
Colorado.....	14	27, 931	27, 931	187, 864	6. 73
Connecticut, Massachusetts, New Jersey.....	5	22, 431	22, 431	254, 334	11. 34
Florida.....	7	19, 813	19, 813	102, 152	5. 16
Georgia, Maryland, South Carolina.....	5	16, 101	14, 624	151, 075	10. 33
Idaho.....	2	6, 900	6, 900	8, 000	8. 89
Illinois and Iowa.....	7	36, 843	36, 843	420, 272	11. 41
Indiana.....	8	66, 548	66, 568	543, 046	8. 16
Maine.....	3	6, 300	6, 350	170, 750	26. 89
Michigan.....	29	268, 913	269, 074	2, 412, 274	8. 97
Minnesota.....	8	17, 552	19, 188	405, 333	21. 12
Montana, Nevada, North Dakota.....	3	309	309	11, 896	38. 50
New York.....	5	32, 574	32, 574	261, 366	8. 02
Ohio.....	8	6, 636	6, 363	82, 608	12. 98
Pennsylvania.....	10	43, 500	39, 500	397, 123	10. 05
Vermont.....	3	303	286	4, 492	15. 71
Washington.....	15	35, 017	35, 609	170, 497	4. 79
Wisconsin.....	3	3, 296	3, 261	136, 518	41. 86
Total.....	141	648, 708	639, 365	6, 181, 341	9. 67

TABLE 5.—Relative size of peat operations in the United States

Size	Active plants		Production	
	Number	Percent of total	Short tons	Percent of total
<b>1963:</b>				
Less than 500 tons.....	25	22.1	5,062	0.9
500 to less than 1,000 tons.....	18	15.9	12,678	2.2
1,000 to less than 5,000 tons.....	44	39.0	108,552	18.7
5,000 to less than 15,000 tons.....	16	14.2	123,816	21.4
15,000 to less than 25,000 tons.....	5	4.4	88,484	15.3
25,000 or more tons.....	5	4.4	239,938	41.5
<b>Total.....</b>	<b>113</b>	<b>100.0</b>	<b>578,530</b>	<b>100.0</b>
<b>1964:</b>				
Less than 500 tons.....	35	24.8	8,399	1.3
500 to less than 1,000 tons.....	20	14.2	15,834	2.5
1,000 to less than 5,000 tons.....	54	38.3	134,517	20.7
5,000 to less than 15,000 tons.....	20	14.2	162,397	25.0
15,000 to less than 25,000 tons.....	7	5.0	117,416	18.1
25,000 or more tons.....	5	3.5	210,145	32.4
<b>Total.....</b>	<b>141</b>	<b>100.0</b>	<b>648,708</b>	<b>100.0</b>

## CONSUMPTION AND USES

Both imports and sales of domestic peat increased and more than 100,000 additional tons of peat was consumed or was available for consumption in 1964 than in 1963. This was a 13-percent increase over the quantity placed on the market in the preceding year.

Sales for general soil improvement accounted for 96 percent of the peat marketed by domestic producers. This peat was sold principally to nurseries and greenhouses for use in growing plants, trees, and shrubs; to landscape gardeners and contractors for building lawns and golf course greens and for transplanting trees and shrubs; and to garden, chain, and variety stores that sold peat to homeowners for mulching and improving lawn and garden soils. Two percent of the total was sold for use in potting soils and seed inoculant, and the remainder, for packing flowers and shrubs, and for use in mixed fertilizers, mushroom beds, and earthworm culture. No peat was reported sold for fuel or energy purposes.

Fifty-two percent of all peat sold was packaged. Sales of packaged peat in 1964 increased 21 percent over the preceding year and were more than three times greater than the 1957-59 average quantity sold in packages. The sharp increase in packaged sales in recent years has resulted from the development of synthetic films from which relatively inexpensive moistureproof bags are manufactured. These containers have enabled producers to distribute peat on a national basis, whereas only a few years ago it was uneconomical to ship peat from the producing area. Most packaged domestic peat was sold by weight in packages of 25, 50, and 100 pounds.

Bulk and packaged commercial sales, by kind and use, are shown in tables 6 and 7.

TABLE 6.—Commercial sales of peat in the United States in 1964, by kind and use

Use	Moss			Reed-sedge			Humus		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average		Total	Average		Total	Average
<b>Bulk:</b>									
Soil improvement.....	77,574	\$559,157	\$7.21	107,850	\$865,617	\$8.03	99,539	\$577,880	\$5.81
Other uses.....	1,910	16,700	8.74	3,885	42,668	10.98	13,308	79,501	5.97
<b>Total.....</b>	<b>79,484</b>	<b>575,857</b>	<b>7.24</b>	<b>111,735</b>	<b>908,285</b>	<b>8.13</b>	<b>112,847</b>	<b>657,381</b>	<b>5.83</b>
<b>Packaged:</b>									
Soil improvement.....	65,449	1,230,653	18.80	240,060	2,234,778	9.31	21,051	85,322	4.05
Other uses.....	997	4,035	41.60	6,712	325,045	48.43	1,930	159,985	82.89
<b>Total.....</b>	<b>65,546</b>	<b>1,234,688</b>	<b>18.84</b>	<b>246,772</b>	<b>2,559,823</b>	<b>10.37</b>	<b>22,981</b>	<b>245,307</b>	<b>10.67</b>
<b>Total:</b>									
Soil improvement.....	143,023	1,789,810	12.51	347,910	3,100,395	8.91	120,590	663,202	5.50
Other uses.....	2,007	20,735	10.33	10,597	367,713	34.70	15,238	239,486	15.72
<b>Grand total.....</b>	<b>145,030</b>	<b>1,810,545</b>	<b>12.48</b>	<b>358,507</b>	<b>3,468,108</b>	<b>9.67</b>	<b>135,828</b>	<b>902,688</b>	<b>6.65</b>

TABLE 7.—Commercial sales of peat in the United States in 1964, by use

Use	In bulk			In packages			Total		
	Short tons	Value		Short tons	Value		Short tons	Value	
		Total	Average		Total	Average		Total	Average
Soil improvement.....	284,963	\$2,002,654	\$7.03	326,560	\$3,550,753	\$10.87	611,523	\$5,553,407	\$9.08
Potting soils <sup>1</sup> .....	6,684	43,192	6.46	6,536	450,068	68.86	13,220	493,260	37.31
Packing flowers, shrubs, etc.....	4,352	40,092	9.21	2,203	38,997	17.70	6,555	79,089	12.07
Mushroom beds <sup>2</sup> .....	1,649	16,208	9.83	-----	-----	-----	1,649	16,208	9.83
In mixed fertilizers.....	6,418	39,377	6.14	-----	-----	-----	6,418	39,377	6.14
<b>Total.....</b>	<b>304,066</b>	<b>2,141,523</b>	<b>7.04</b>	<b>335,299</b>	<b>4,039,818</b>	<b>12.05</b>	<b>639,365</b>	<b>6,181,341</b>	<b>9.67</b>

<sup>1</sup> Includes small amount sold for seed inoculant.<sup>2</sup> Includes small amount sold for earthworm culture and other uses.

## VALUE AND PRICE

The total value, f.o.b. plant, of all domestic peat sold in 1964 was \$6.2 million, an increase of 14 percent over the total value of sales in 1963 and the highest value reported to date. The average value per ton for all peat sold in 1964, however, decreased \$0.25 to \$9.67.

Average prices of various kinds of peat varied greatly, as selling prices at individual plants were based principally upon the kind of peat sold, the amount of processing to which the peat was subjected, and the manner of sale whether bulk or packaged. The average plant price per ton of all peat sold in bulk was \$7.04, whereas the unit price for packaged peat was \$12.05 per ton. Peat sold in bulk for use in mixed fertilizers had the lowest average unit value; packaged peat sold for packing flowers and for seed inoculant had the highest.

The total value of imported peat was \$12.3 million, about the same value as in 1963. This value, established at the port of embarkation,

was approximately equal to prices paid by importers, less transportation and other miscellaneous charges. In some instances, ocean freight and other nondutiable charges such as insurance may have been included inadvertently in this value.

The average unit value of all peat imported was \$45.31 per ton, a decrease of \$1.98 from 1963, caused principally by lower values of peat imported from Canada. This value was nearly four times greater than the average value of packaged domestic peat, but the values are not comparable because they were assigned at different marketing levels. Also, imported peat has different physical properties than most of the peat produced in the United States. Whereas imported peat usually is light and fibrous, has a low moisture content, and is sold in packages or bales on a volume basis, most packaged domestic peat is relatively decomposed, has a high moisture content, and is sold by weight. Each 100 pounds of a typical imported peat will measure approximately 12 bushels, compared with a volume of only 3 or 4 bushels for a typical domestic peat. A few domestic operations, however, produce peat with properties similar to those of the imported type.

The plant values of domestic peat sold in bulk and in packages are shown in tables 6 and 7.

## FOREIGN TRADE

Imports increased 3 percent in 1964 over 1963 and were but slightly higher than the 1957-59 average quantity imported. The increase over 1963 imports was due mainly to a 6-percent increase in shipments from Canada.

Canada remained the principal source of foreign peat, supplying 83 percent of the total imported. Virtually all of the remainder was shipped from Europe.

Imports from Europe decreased 9 percent, principally because of smaller shipments from West Germany and Sweden. Of the total European shipments, 72 percent was supplied by West Germany, and most of the remainder, from Poland and Danzig, Ireland, and Sweden. Minor quantities were imported from six other countries.

Imported peat was classified according to use into two grades: (1) Poultry and stable and (2) fertilizer. No data were available on ultimate uses, but in general, poultry and stable grade was imported for use as poultry and animal litter, whereas fertilizer grade was imported for various types of soil improvement. Of the total imports, 98 percent was fertilizer grade which entered the United States duty free. A duty of \$0.25 per long ton was levied upon peat classified poultry and stable grade.

Canadian shipments were principally fertilizer grade that entered the United States chiefly through the Great Lakes ports and the St. Lawrence, Vermont, and Washington customs districts. West German imports, also chiefly fertilizer grade, were shipped principally to eastern and gulf coast ports.

Tables 8, 9, and 10 show the quantity and value of the different grades of peat imported, by country and customs district.

TABLE 8.—Peat moss imported for consumption in the United States, by kind and by country

Country	Poultry and stable grade		Fertilizer grade		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
<b>1962:</b>						
North America:						
Canada.....	5,601	\$389,434	209,266	\$10,418,008	214,867	\$10,807,442
Mexico.....	58	2,885			58	2,885
Total.....	5,659	392,319	209,266	10,418,008	214,925	10,810,327
Europe:						
Belgium-Luxembourg.....			26	496	26	496
Denmark.....			163	5,109	163	5,109
Finland.....			25	919	25	919
France.....			34	1,110	34	1,110
Germany, West.....	559	20,134	33,972	1,296,940	34,531	1,317,074
Ireland.....			3,002	111,635	3,002	111,635
Netherlands.....	104	4,611	1,953	76,312	2,057	80,923
Norway.....			32	7,912	32	7,912
Poland and Danzig.....			8,531	335,200	8,531	335,200
Sweden.....			3,624	169,171	3,624	169,171
U.S.S.R.....			525	17,834	525	17,834
United Kingdom.....			194	7,255	194	7,255
Total.....	663	24,745	52,081	2,029,893	52,744	2,054,638
Asia: Japan.....	9	3,203			9	3,203
Grand total.....	6,331	420,267	261,347	12,447,901	267,678	12,868,168
<b>1963:</b>						
North America:						
Canada.....	4,135	248,500	206,649	10,038,335	210,784	10,286,835
Guatemala.....	7	358			7	358
Mexico.....	40	4,239			40	4,239
Total.....	4,182	253,097	206,649	10,038,335	210,831	10,291,432
Europe:						
Denmark.....	1	767	212	9,736	229	10,503
Finland.....			123	5,240	123	5,240
France.....			7	368	7	368
Germany, West.....	1,273	55,440	34,099	1,411,885	35,372	1,467,325
Ireland.....	62	2,200	2,293	88,993	2,355	91,193
Netherlands.....	84	3,959	1,558	57,993	1,642	61,952
Poland and Danzig.....			6,786	247,017	6,786	247,017
Sweden.....			3,677	171,173	3,677	171,173
Portugal.....			124	2,000	124	2,000
United Kingdom.....			130	5,345	130	5,345
Total.....	1,436	62,366	49,009	1,999,750	50,445	2,062,116
Asia: Japan.....	4	2,085	51	1,924	55	4,009
Grand total.....	5,622	317,548	255,709	12,040,009	261,331	12,357,557
<b>1964:</b>						
North America:						
Canada.....	3,764	208,080	220,516	10,360,374	224,280	10,568,454
Mexico.....	25	4,345	257	11,800	282	16,145
Total.....	3,789	212,425	220,773	10,372,174	224,562	10,584,599
South America: Colombia.....			6	267	6	267
Europe:						
Belgium-Luxembourg.....	1	135	44	1,890	45	2,025
Denmark.....			25	876	25	876
Finland.....			124	3,332	124	3,332
France.....			181	4,832	181	4,832
Germany, West.....	993	38,706	32,000	1,178,560	32,993	1,217,266
Ireland.....			2,677	94,614	2,677	94,614
Netherlands.....	45	1,773	732	23,383	777	25,156
Poland and Danzig.....			7,428	242,177	7,428	242,177
Sweden.....			1,455	67,462	1,455	67,462
United Kingdom.....			140	7,827	140	7,827
Total.....	1,039	40,614	44,806	1,624,953	45,845	1,665,567
Asia: Japan.....	6	2,575			6	2,575
Grand total.....	4,834	255,614	265,585	11,997,394	270,419	12,263,008

Source: Bureau of the Census.



TABLE 9.—Peat moss imported for consumption in the United States in 1964, by kind and by customs district

Customs district	Poultry and stable grade		Fertilizer grade		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Arizona.....			44	\$2,530	44	\$2,530
Buffalo.....	57	\$2,550	37,065	1,718,366	37,122	1,720,916
Chicago.....	47	1,525	204	7,348	251	8,873
Connecticut.....			20	853	20	853
Dakota.....	2,069	125,177	18,305	762,834	20,374	888,011
Duluth and Superior.....	15	972	83	5,362	98	6,334
Florida.....	44	3,030	6,581	226,320	6,625	229,350
Galveston.....	31	1,266	1,528	59,077	1,559	60,343
Georgia.....			473	15,760	473	15,760
Hawaii.....	25	3,746	17	965	42	4,711
Laredo.....	25	4,345	91	5,877	116	10,222
Los Angeles.....	17	588	1,647	64,547	1,664	65,135
Maine and New Hampshire.....	68	2,516	1,273	49,266	1,341	51,782
Maryland.....	95	3,761	4,048	157,989	4,143	161,750
Massachusetts.....			2,044	69,243	2,044	69,243
Michigan.....	402	18,304	23,947	1,043,099	24,349	1,061,403
Mobile.....			2,860	101,303	2,860	101,303
Montana and Idaho.....			4,078	169,216	4,078	169,216
New Orleans.....	326	11,720	4,766	184,736	5,092	196,506
New York.....	319	13,079	9,302	338,804	9,621	351,883
North Carolina.....			196	6,163	196	6,163
Ohio.....			589	19,933	589	19,933
Oregon.....			344	13,291	344	13,291
Philadelphia.....	109	4,205	5,374	186,671	5,483	190,876
Puerto Rico.....			77	5,049	77	5,049
Rochester.....			15	761	15	761
St. Lawrence.....	353	14,620	32,282	1,178,350	32,635	1,192,970
San Francisco.....			689	23,296	689	23,296
San Francisco.....			866	32,781	866	32,781
South Carolina.....			49,322	1,866,197	49,783	1,884,412
Vermont.....	461	18,215	2,959	99,037	3,010	100,477
Virginia.....	51	1,440	2,959	99,037	3,010	100,477
Washington.....	320	24,555	54,356	3,577,634	54,676	3,602,189
Wisconsin.....			140	4,636	140	4,636
Total.....	4,834	255,614	265,585	11,997,394	270,419	12,253,008

Source: Bureau of the Census.

**TABLE 10.—Peat moss imported from Canada and West Germany for consumption in the United States in 1964, by kind and by customs district**

Customs district	Canada				West Germany			
	Poultry and stable grade		Fertilizer grade		Poultry and stable grade		Fertilizer grade	
	Short tons	Value	Short tons	Value	Short tons	Value	Short tons	Value
Arizona.....							44	\$2,530
Buffalo.....	57	\$2,550	37,051	\$1,717,596				
Chicago.....					47	\$1,525	204	7,348
Connecticut.....			20	853				
Dakota.....	2,069	125,177	18,305	762,834				
Duluth and Superior.....	15	972	83	5,362				
Florida.....					44	3,030	6,168	210,207
Galveston.....					31	1,266	1,279	49,444
Georgia.....							326	11,069
Hawaii.....	19	1,171	17	965				
Laredo.....							91	5,877
Los Angeles.....			106	4,858	17	588	1,541	59,689
Maine and New Hampshire.....	68	2,516	1,273	49,266				
Maryland.....					95	3,761	2,471	98,119
Massachusetts.....			16	810			417	14,414
Michigan.....	402	18,304	23,936	1,042,689			11	410
Mobile.....							2,727	94,942
Montana and Idaho.....			4,078	169,216				
New Orleans.....			69	2,990	326	11,720	2,775	109,349
New York.....					273	11,171	5,780	220,591
North Carolina.....							102	3,331
Ohio.....							589	19,933
Oregon.....							344	13,291
Philadelphia.....					109	4,205	3,898	141,661
Puerto Rico.....							77	5,049
Rochester.....			15	761				
St. Lawrence.....	353	14,620	32,105	1,171,280				
San Francisco.....							662	21,080
South Carolina.....							789	30,487
Vermont.....	461	18,215	49,307	1,865,640				
Virginia.....					51	1,440	1,527	52,224
Washington.....	320	24,555	54,145	3,565,254			48	1,929
Wisconsin.....							140	4,686
Total.....	3,764	208,080	220,516	10,360,374	993	38,706	32,000	1,178,560

Source: Bureau of the Census.

## TECHNOLOGY

A survey of technical literature revealed that most of the current research on peat was conducted in the Soviet Union where enormous tonnages of peat are used for both soil-improvement and energy purposes.

An important area of Soviet research is concerned with the agricultural applications of peat, and recent studies have developed a new method for evaluating the suitability of various types of peat for use in the production of concentrated peat-mineral-ammonia fertilizers. These fertilizers, which are produced in very large quantities in the U.S.S.R., require peats with particular chemical and physical properties, and the test method, based upon ammonia absorption, aids in the selection of the most suitable peat deposits for development.<sup>2</sup>

Another Soviet study on peat used for agricultural purposes demonstrated the effect of ammoniated peat fertilizers on the microbiological and chemical processes in soils. Besides enhancing the availability of phosphates to plants, these fertilizers further the development of soil organisms that are necessary for the decomposition of organic residues before they can be assimilated by plants. It was found also that ammoniated peat fertilizers increase the number of microorganisms in the soil, an effect that was not noticeable when the usual nitrogen-phosphorus-potassium fertilizers were used.<sup>3</sup>

The degree to which the nutritive elements of mineral fertilizers are assimilated by plants in soils containing additions of peat also was studied in the Soviet Union. These investigations found that when peat is added to soils containing mineral fertilizers, the peat absorbs anions and cations which are assimilated by plants under normal moisture conditions during the whole period of vegetation. It was found, also, that several forms of fertilizers behaved differently in peat soils than in soils without peat and that mineral fertilizer applications on a peat-containing soil changed the protein, carbohydrate, and elemental composition of the plants grown. The addition of chlorine-containing fertilizers, particularly, accelerated the decomposition of peat and hastened the accumulation of hydrolyzed nitrogen compounds.<sup>4</sup>

The effect of drying on the properties of peat was the subject of another Soviet study. This investigation concluded that changes in the hydrous and porous structure of peat directly affected its structural-mechanical properties and that these changes could be controlled by the drying procedure. By controlling the moisture of peat within certain limits, the hydrous and mechanical properties of peat are changed irreversibly because of the change in the chemical structure of the peat substance.<sup>5</sup>

The possibility of obtaining products from peat, useful in the synthesis of organic compounds, was studied also in recent experiments

<sup>2</sup> Chekalov, K. I., and Z. V. Trunina. Concentrated Peat-Mineral-Ammonia Fertilizers. *Chem. Abs.*, v. 62, No. 5, sec. 5840e, Mar. 1, 1965.

<sup>3</sup> Kuznetsova, N. A., and N. V. Kozlova. Microbiological and Chemical Processes in Ammoniated Peat Fertilizers and in Soils Treated With Them. *Chem. Abs.*, v. 62, No. 4, sec. 4569, Feb. 15, 1965.

<sup>4</sup> Kasatkin, M. I. The Assimilability of Nutritive Elements from Mineral Fertilizers on a Peat Background. *Chem. Abs.*, v. 61, No. 13, sec. 16732, Dec. 21, 1964.

<sup>5</sup> Churaev, N. V. Effect of Peat Drying on Its Hydrous and Structural-Mechanical Properties. *Chem. Abs.*, v. 61, No. 9, sec. 10509, Oct. 26, 1964.

in the U.S.S.R. In these investigations, three types of peat with varying ash contents and degrees of decomposition were carbonized at temperatures between 900° and 1,050° C. Although the less decomposed peat yielded more hydrocarbons than the more decomposed types at all temperatures tested, the latter yielded larger amounts of crude benzene. The properties of the benzene obtained from all three types of peat were similar to the benzene obtained from coal, but the coking of peat at these temperatures yielded from 6.1 to 8.3 gallons of crude benzene per short ton of peat, compared with 2.5 to 3.0 gallons recovered through the high-temperature carbonization of each short ton of a typical coking coal. From 3.3 to 3.4 tons of dry peat were required for each ton of coke produced. In addition to coke and benzene, the process also yielded olefins, aromatic tars, and ammonia.<sup>6</sup>

A meeting of the Group of Experts on the Use of Black Peat in the Production of Fertilizers, Committee for Scientific Research, Organization for Economic Cooperation and Development, was held in Paris, France, in 1964. The agenda included reports on (1) the status of the research on ammonia-peat reactions presently being conducted at University College, Dublin, Ireland; (2) certain storage properties of urea-peat and ammonia-peat mixtures; (3) the development of the process for urea-peat reactions at the Torfinstitut, Hanover, Germany; and (4) the testing of peat mixtures in pot trials. A revised specification of test procedures for peat mixtures was agreed to by members of the committee.<sup>7</sup>

## WORLD REVIEW

World production of peat in 1964 was estimated at 183.4 million short tons, an increase of 7 percent over estimated production for 1963. All but 1.2 million tons (less than 1 percent of the total) was produced in Europe.

The U.S.S.R. was the leading producer with output estimated at 176.1 million tons, 96 percent of the estimated world total. Because of severe shortages of other fuels in certain areas, peat has long been used in the Soviet Union for both industrial and domestic fuel, and current Soviet production targets are aimed at producing 70 million tons of peat for fuel purposes in 1965. A large part of this output will be used for generating electric power, particularly in the area west of Moscow and north of the Donyetz basin where there is a lack of sufficient coal and petroleum. The remainder will be used principally to make briquets for domestic and industrial heating. In addition to fuel peat, the U.S.S.R. also produces tremendous quantities of peat for use in agriculture. The 1964 estimate of production for agricultural use was 110 million tons, and the production goal for agricultural peat in 1965 has been set at 130 million tons. The major part of this peat will be used for producing peat-fertilizer mixtures.

Ireland, with 2.4 million tons of production, ranked second in world output. Peat is used in Ireland principally for generating electric power and, in 1964, peat-fired boilers generated 36 percent of

<sup>6</sup> Kashirskii, V. G. The Coking of Peats. Chem. Abs., v. 61, No. 9, sec. 10505, Oct. 26, 1964.

<sup>7</sup> Organization for Economic Cooperation and Development. Committee for Scientific Research, International Cooperation in Scientific Research. Use of Black Peat in the Production of Fertilizers. OECD Document, DAS/RS/64.42, Paris, France, Mar. 19, 1964.

the total electricity produced in Ireland. Five peat-fired power stations are presently in operation, and one additional plant under construction is scheduled to go into operation in 1966. Another plant is planned and should be operating by 1975 when the total annual peat requirement of power plants will be 2.4 million tons.

Ireland also produces substantial quantities of peat briquets for fuel and moss peat for use in agriculture. In 1964, three plants produced 320,000 tons of peat briquets, and another plant under construction will produce an additional 135,000 tons by 1968. Output of moss peat, which is produced principally for export, is expected to increase to 350,000 bales in 1965.

West Germany, the third leading producer, had an estimated output of 1.9 million tons, of which 55 percent was used in agriculture, and the remainder, for fuel. Fuel peat was consumed in West Germany principally in producing areas for domestic and industrial heating. Large quantities of agricultural peat were composted with organic wastes and mineral fertilizers before being used for soil improvement. About 3 percent of the West German production for agriculture was exported to the United States.

The United States, East Germany, The Netherlands, Sweden, Canada, Norway, the Republic of Korea, and Finland followed in output, in the order named. All produced more than 100,000 tons in 1964. The United States, with 648,708 tons ranked fourth in world output but had less than 1 percent of the total production.

Table 11 shows world production of peat by country.

TABLE 11.—World production of peat, by country<sup>1</sup>

(Thousand short tons)

Country	1960	1961	1962	1963	» 1964
Argentina, fuel *	3	3	3	3	3
Austria, fuel	• 40	• 40	• 40	11	6
Canada, agricultural use <sup>2</sup>	186	224	238	243	245
Denmark, fuel	187	125	67	55	40
Finland:					
Agricultural use	6	4	4	8	4
Fuel	159	128	99	123	121
France:					
Agricultural use	19	33	31	35	• 40
Fuel	2	( <sup>3</sup> )	• 3	• 3	• 3
Germany:					
East *	550	550	550	550	550
West:					
Agricultural use	895	830	911	884	• 1,060
Fuel	871	672	776	837	• 850
Hungary, agricultural use *	65	65	65	65	70
Ireland:					
Agricultural use	14	21	24	25	21
Fuel	4,514	3,912	1,448	1,770	2,361
Israel, agricultural use *	50	55	55	55	60
Japan *	80	80	80	80	75
Korea, Republic of, agricultural use	107	45	137	128	• 125
Netherlands *	500	500	500	440	440
Norway:					
Agricultural use	42	50	40	40	46
Fuel	198	180	161	115	115
Poland, fuel	125	83	73	112	• 110
Sweden:					
Agricultural use	77	• 70	61	• 75	• 70
Fuel	231	252	169	• 275	• 275
U.S.S.R.:					
Agricultural use *	100,000	100,000	100,000	100,000	110,000
Fuel	59,100	57,300	38,300	64,700	• 66,100
United States, agricultural use	471	531	572	579	649
World total • 1 <sup>4</sup>	168,500	165,800	144,400	171,200	183,400
Fuel peat (included in world total) • 4	66,000	63,300	41,700	68,600	70,600

• Estimate. » Preliminary.

<sup>1</sup> Includes revisions of data published previously.<sup>2</sup> In addition, Canada produced a negligible quantity of fuel peat.<sup>3</sup> Less than 500 tons.<sup>4</sup> In addition, Iceland, Italy, and Spain produced a negligible quantity of fuel peat.



# Carbon Black

By Carl W. Kelley<sup>1</sup>



## GENERAL SUMMARY

**P**RODUCTION in the United States of carbon black has increased from 20 million pounds per year in 1920 to over 2 billion pounds in 1964 valued at \$156 million, mostly for consumption by the rubber-tire industry, which uses over 90 percent of total production. Production of over 2 billion pounds in 1964 is a 7.8-percent increase over 1963 and is the first time furnace black production has topped 2 billion pounds. Although 1964 channel black production dropped 6 percent below 1963, carbon black produced by the furnace process, which accounted for 92 percent of total production, increased 9 percent to 2,053 million pounds. Total shipments during 1964 amounted to 2,245 million pounds, a 7 percent increase. This growth parallels the expansion of the automotive and petroleum industries. Along with this expansion have been many advances, both in methods of manufacture and in the quality and variety of blacks available to industry. There are several kinds of carbon black, thermal, channel, furnace, lamp, and oil blacks. Until recently, channel has been the important black in rubber compounding. Following the introduction of the synthetic GR-S, and more recently of "cold rubber," it has been found that certain furnace blacks with particle size larger than that of the standard channel black give superior reinforcement. A great advantage of furnace black is that its yield per unit of gas feedstock is higher than that of channel black.

The 184-million-pound increase in domestic carbon black sales was partially offset by a 37-million-pound decrease in exports. Decrease in exports especially to Europe, is expected to continue. In Europe, as in the United States, the major end use for carbon black is in the manufacture of automobile and truck tires. Although the number of automobiles in Europe is predicted to grow by about 7.5 percent per year, compounded until 1975, the increased demand will be met by a 20 percent increase in existing capacity and by the new plants being built in Europe by U.S. companies. Also, aromatic oils for producing furnace blacks are plentiful now that western Europe's chemical industry is switching to a petroleum base.

---

<sup>1</sup> Chemist, Division of Petroleum.

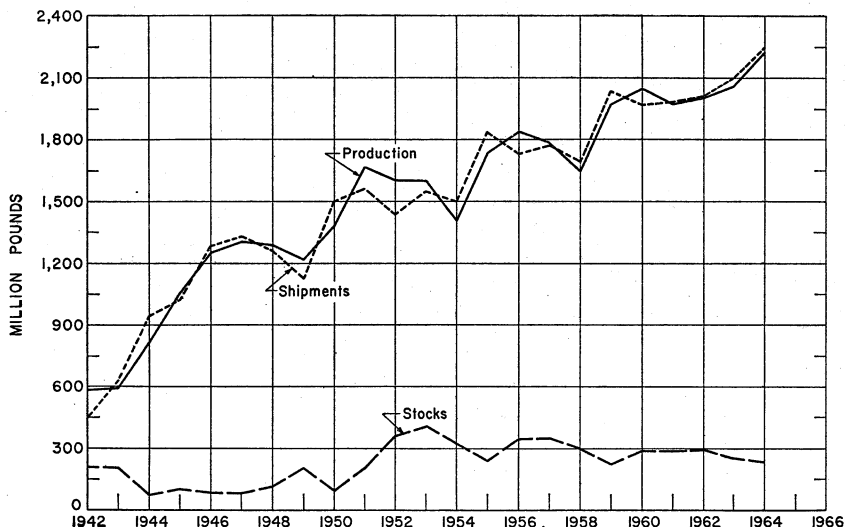


**TABLE 1.—Salient statistics of carbon black produced from natural gas and liquid hydrocarbons in the United States, 1960–64**

(Thousand pounds)

	1960	1961	1962	1963	1964
<b>Production:</b>					
Channel process.....	292,422	262,507	207,438	179,012	169,919
Furnace process.....	1,761,305	1,717,045	1,849,026	1,879,904	2,053,297
<b>Total.....</b>	<b>2,053,727</b>	<b>1,979,552</b>	<b>2,056,464</b>	<b>2,058,916</b>	<b>2,223,216</b>
<b>Shipments:</b>					
Domestic Sales.....	1,429,618	1,460,005	1,639,897	1,727,420	1,911,494
Exports.....	543,047	522,331	442,437	370,928	333,907
<b>Total.....</b>	<b>1,972,665</b>	<b>1,982,336</b>	<b>2,082,334</b>	<b>2,098,348</b>	<b>2,245,401</b>
Losses.....	6,973	2,299	370	592	910
Stocks of producers, December 31.....	292,982	287,899	293,434	254,216	231,121
<b>Value:</b>					
Production.....thousand dollars.....	150,774	144,421	145,256	147,824	155,761
Average per pound.....cents.....	7.34	7.30	7.06	7.18	7.01

\* Revised. No attempt has been made to revise stocks for previous years, since data are not available.

**FIGURE 1.—Production, stocks, and shipments of carbon black, 1942–64.**

## SCOPE OF REPORT

Carbon black is a pure grade of quasi-graphitic carbon; particle diameters range from 50 to 5,000 angstroms.

Annual reports were submitted to the Bureau of Mines on a voluntary basis by operators of all commercial plants in the United States.

Monthly figures are based on reports prepared by the National Gas Products Association and are adjusted to agree with the annual reports received by the Bureau of Mines.

Import and export data are compiled by the Bureau of the Census, U.S. Department of Commerce.

Statistics are obtained on both furnace and channel blacks. Furnace blacks are reported in eight grades: Semireinforcing furnace (SRF), high-modulus furnace (HMF), general-purpose furnace (GPF), fast-extrusion furnace (FEF), high-abrasion furnace (HAF), superabrasion furnace (SAF), intermediate-abrasion furnace (ISAF), and thermal.

## PRODUCTION AND CAPACITY

**Production by States.**—Output of carbon black in 1964 was 2,223 million pounds, an 8 percent increase over the 1963 figure. Texas, the major producing State, showed an increase of 5 percent. The output in Louisiana increased 12 percent in 1964; however, a small quantity of the Louisiana production was included in production of Texas to avoid disclosure of confidential data. Texas accounted for 52 percent of the national production, and 33 percent came from Louisiana; the remaining 15 percent came from plants in Arkansas, California, Kansas, New Mexico, and Oklahoma.

**Output and Shipments by Grades.**—Carbon black output by the furnace process was 2,053 million pounds, which is 92 percent of the national production. High-abrasion furnace (HAF) and intermediate-abrasion furnace (ISAF) continued to represent about half of total furnace black output. Channel black production continued to decline and was 9 million pounds less than in 1963. Total carbon black shipments, including exports and losses, exceeded production by 23 million pounds, resulting in a decline in stocks during the year.

**Number and Capacity of Plants.**—The number of channel and furnace plants each declined by one during the year, so at the end of the year only 37 carbon black plants were operating. The total daily capacity of all operating plants was 7,269,300 pounds, an increase in capacity of 243,300 pounds during the year. Twenty plants operated in Texas had 54 percent of total operating capacity; Louisiana with 9 plants accounted for 29 percent. The remaining 17 percent of capacity was distributed among eight plants in the five producing States.

**Method and Yield.**—During the year 106,759 million cubic feet of natural gas was used to produce 416,359 thousand pounds of furnace black (a yield of 11.9 pounds per thousand cubic feet) and 157,639 thousand pounds of channel black with an average yield of 2.2 pounds per thousand cubic feet. At furnace black plants 354,874 thousand gallons of liquid hydrocarbons was used to produce 1,649,218 thousand pounds of carbon black, a yield of 4.6 pounds per gallon. The propor-

tion of furnace black output derived from liquid hydrocarbons leveled off at about 81 percent during the 1961-63 period and continues at the same proportion.

**TABLE 2.—Carbon black produced from natural gas and liquid hydrocarbons in the United States, 1960-64, by States and districts**

(Thousand pounds)

State	1960	1961	1962	1963	1964	Change from 1963 (percent)
Louisiana.....	<sup>1</sup> 631, 488	<sup>1</sup> 582, 833	<sup>1</sup> 608, 499	649, 170	725, 669	+12
Texas.....	<sup>1</sup> 1, 084, 856	<sup>1</sup> 1, 070, 843	<sup>1</sup> 1, 106, 874	1, 105, 189	1, 165, 593	+5
Other States.....	337, 383	325, 876	341, 091	304, 557	331, 954	+9
Total.....	2, 053, 727	1, 979, 552	2, 056, 464	2, 058, 916	2, 223, 216	+8

<sup>1</sup> Small quantity of channel black produced in Louisiana included in Texas to avoid disclosure of confidential data.

**TABLE 3.—Production and shipments of carbon black in the United States in 1964, by months and grades**

(Thousand pounds)

Month	Furnace									Channel	Total
	SRF <sup>1</sup>	HMF <sup>2</sup>	GPF <sup>3</sup>	FEF <sup>4</sup>	HAF <sup>5</sup>	SAF <sup>6</sup>	ISAF <sup>7</sup>	Thermal	Total		
<b>PRODUCTION <sup>8</sup></b>											
January.....	27,747	4,117	15,579	20,838	40,018	1,830	38,939	17,688	166,766	14,530	181,296
February.....	24,544	3,641	14,393	20,980	35,505	981	38,281	15,921	154,246	14,170	168,416
March.....	29,034	3,539	14,741	23,295	41,475	1,785	33,816	20,558	168,243	14,738	182,981
April.....	29,001	3,387	15,233	21,515	43,211	2,737	35,713	20,370	171,167	14,417	185,584
May.....	27,952	4,486	17,518	21,289	44,401	1,928	39,454	21,350	178,378	14,648	193,026
June.....	26,494	3,611	15,089	23,937	42,995	579	37,449	18,787	168,941	13,902	182,843
July.....	26,348	2,544	16,570	20,996	40,365	2,508	40,508	17,614	167,453	13,820	181,273
August.....	27,952	3,018	16,820	18,047	43,777	1,857	41,283	19,689	172,443	13,862	186,305
September.....	26,850	3,251	14,465	23,058	43,889	690	41,162	20,074	173,439	13,673	187,112
October.....	25,564	3,945	18,674	22,987	44,322	1,762	41,603	18,159	177,016	13,905	190,921
November.....	26,097	3,403	15,049	24,873	45,490	2,757	41,607	19,607	178,883	13,862	192,745
December.....	28,338	2,165	14,766	21,743	44,133	705	42,608	21,874	176,332	14,392	190,724
Total.....	325,921	41,107	188,897	263,558	509,581	20,119	472,423	231,691	2,053,297	169,919	2,223,216
<b>SHIPMENTS (INCLUDING EXPORTS) <sup>9</sup></b>											
January.....	26,894	4,087	15,306	22,462	44,491	908	38,608	18,725	171,476	13,732	185,208
February.....	24,791	4,764	12,980	23,053	35,747	1,176	34,713	17,875	155,099	15,857	170,956
March.....	28,100	2,404	15,820	23,230	43,870	1,718	37,694	19,703	172,539	14,612	187,151
April.....	28,095	2,885	14,905	22,157	44,317	2,165	38,286	20,999	173,809	15,188	188,997
May.....	26,482	4,410	15,630	20,562	41,560	1,632	38,817	18,966	168,059	13,570	181,629
June.....	26,752	3,554	15,194	20,659	39,799	1,164	40,523	18,542	166,187	13,788	179,925
July.....	22,854	3,103	13,920	20,559	42,952	1,065	40,906	18,691	164,050	14,391	178,441
August.....	28,735	2,601	15,191	22,089	46,635	1,615	41,790	19,580	178,236	13,000	191,236
September.....	26,616	3,225	16,282	22,181	47,053	2,271	43,999	20,492	182,119	14,657	196,776
October.....	28,059	3,881	18,284	24,408	48,706	1,755	46,359	19,678	191,130	15,361	206,491
November.....	24,717	1,747	15,747	23,281	43,571	1,962	42,916	18,444	172,385	16,478	188,863
December.....	25,727	3,139	14,601	21,413	46,123	1,719	42,146	20,805	175,673	14,865	190,538
Total.....	317,822	39,800	183,860	266,054	524,824	19,150	486,752	232,500	2,070,762	175,549	2,246,311

<sup>1</sup> Semireinforcing furnace.  
<sup>2</sup> High-modulus furnace.  
<sup>3</sup> General-purpose furnace.  
<sup>4</sup> Fast-extrusion furnace.  
<sup>5</sup> High-abrasion furnace.  
<sup>6</sup> Superaabrasion furnace.

<sup>7</sup> Intermediate-abrasion furnace.  
<sup>8</sup> Compiled from reports of a consulting engineer of the carbon black industry and of producing companies not included in his figures. Figures adjusted to agree with annual reports of individual producers.  
<sup>9</sup> Includes losses.

TABLE 4.—Number and capacity of carbon black plants operated in the United States, 1963-64

State or district	County or parish	Number of plants				Total daily capacity (pounds)	
		1963		1964		1963	1964
		Chan-nel	Fur-nace	Chan-nel	Fur-nace		
Texas.....	Aransas.....	1	1	1	1	3,799,000	3,945,300
	Brooks.....	1					
	Carson.....	1		1			
	Ector.....	1		1			
	Galnes.....	1		1			
	Gray.....	1	1	1	1		
	Harris.....		1		1		
	Howard.....		2		2		
	Hutchinson.....	1	4	1	4		
	Montgomery.....		1		1		
	Moore.....		1		1		
	Orange.....		1		1		
	Terry.....		1		1		
	Wheeler.....		1		1		
<b>Total Texas.....</b>		<b>7</b>	<b>14</b>	<b>6</b>	<b>14</b>		
Louisiana.....	Avozelles.....		1		1	1,927,000	2,130,000
	Calcasieu.....		1		1		
	Evangeline.....		1		1		
	Ouachita.....		2		2		
	St. Mary.....	1	3	1	3		
<b>Total Louisiana.....</b>		<b>1</b>	<b>8</b>	<b>1</b>	<b>8</b>		
Arkansas.....	Union.....		1		1	1,300,000	1,194,000
California.....	Contra Costa.....		1		1		
	Kern.....		2		2		
Kansas.....	Grant.....		2		1		
New Mexico.....	Lea.....	1	1	1	1		
Oklahoma.....	Kay.....		1		1		
		<b>1</b>	<b>8</b>	<b>1</b>	<b>7</b>		
<b>Total United States.....</b>		<b>9</b>	<b>30</b>	<b>8</b>	<b>29</b>	<b>7,026,000</b>	<b>7,269,300</b>

TABLE 5.—Carbon black and the feedstocks used in its production, 1963-64, by States

	Louisiana	Texas	Other States <sup>1</sup>	Total
<b>1963:</b>				
<b>Carbon black production:</b>				
Total.....	649,170	1,105,189	304,557	2,058,916
Value.....	43,058	83,605	21,161	147,824
Average value.....	6.63	7.56	6.94	7.18
<b>Natural gas used:</b>				
Total.....	21,924	76,750	18,704	117,378
Value.....	3,310	8,405	2,677	14,392
Average value.....	15.10	11.62	14.31	12.70
cents per thousand cubic feet.....	267,375	201,600	73,952	542,927
Carbon black produced.....	90,135	194,972	47,996	333,103
Value.....	6,417	12,856	2,925	22,198
Average value.....	7.12	6.59	6.09	6.66
cents per gallon.....	381,795	903,589	230,605	1,515,989
Carbon black produced.....	<b>1964:</b>			
<b>Carbon black production:</b>				
Total.....	725,669	1,165,593	331,954	2,223,216
Value.....	47,908	86,494	21,859	156,261
Average value.....	6.60	7.42	6.43	7.01
<b>Natural gas used:</b>				
Total.....	21,642	65,438	19,679	106,759
Value.....	3,314	7,948	2,980	14,242
Average value.....	15.31	12.15	15.14	13.34
cents per thousand cubic feet.....	298,750	188,416	86,832	573,998
Carbon black produced.....	102,153	206,517	46,204	354,874
Value.....	7,328	14,003	2,773	24,104
Average value.....	7.17	6.78	6.00	6.79
cents per gallon.....	426,919	977,177	245,122	1,649,218
Carbon black produced.....				

<sup>1</sup> Arkansas, California, Kansas, New Mexico, and Oklahoma.

TABLE 6.—Natural gas and liquid hydrocarbons used in manufacturing carbon black in the United States and average yield, 1960-64

	1960	1961	1962	1963	1964
Natural gas used.....	197,628	161,377	133,302	117,378	106,759
Average yield of carbon black per thousand cubic feet.....	3.23	3.71	4.03	4.63	5.38
Average value of natural gas used per thousand cubic feet.....	10.05	10.37	11.25	12.70	13.34
Liquid hydrocarbons used.....	313,020	307,637	330,399	333,103	354,874
Average yield of carbon black per gallon.....	4.52	4.49	4.60	4.55	4.65
Average value of liquid hydrocarbons used per gallon.....	7.05	7.02	6.71	6.66	6.79
Number of producers reporting.....	11	11	10	9	9
Number of plants.....	42	44	41	39	37

## CONSUMPTION AND USES

Shipments during the year totaled 2,245 million pounds and were 7 percent above those in 1963. An increase of 174 million pounds in domestic sales was partially offset by a decline of 37 million pounds in exports.

The rubber industry consumes about 94 percent of all carbon black produced in the manufacture of tires. It is in this application that the reinforcing ability of carbon black is most strikingly displayed. The tread of a modern passenger-car tire contains about 30 percent by weight of reinforcing black and will provide some 40,000 miles of

road wear. By contrast, an equal loading of an inert filler, such as clay, would provide less than 4,000 miles of service. The use of carbon black improves the properties of both natural and synthetic rubber and is employed in tire carcass, tread base, side wall, and the inner tubes. Each application has its particular requirements, as for example, in the tread, resistance to abrasive wear is paramount, while in the side wall, resistance to cracking and low heat generation are essential. In order to meet these varied requirements, some 15 separate grades of carbon black are produced. The major differences among these grades of black is particle size.

In extruded rubber goods fast extrusion rates and conformity to die dimensions are of particular importance. This property is most pronounced in the oil-furnace blacks.

Various carbon blacks can be compounded into rubber to provide stocks with either high electrical resistance or good conducting properties.

Carbon black was originally produced as a pigment for the printing-ink industry; the 48 million pounds presently consumed in ink manufacture is the second most important use of the commodity. Two grades of carbon black are produced for the printing-ink industry; "short-ink" black used in the preparation of news inks and "long-ink" blacks used in lithographic or halftone printing inks. Because news inks are relatively cheap, raw materials cost is of first importance; hence only the cheaper nonpremium grades of black are used, formerly channel blacks, but now almost entirely oil-furnace blacks. However, lithographic inks require a high quality specific type of product, not feasible to produce by the furnace process, so their source is still the channel process.

Carbon black is still the favored black pigment in the paint and lacquer industry. To date only the channel process has been capable of producing blacks sufficiently fine in particle size and masstone, the most important requirements in the manufacture of paints and lacquers.

Recently it has been found that the addition of 2 percent of a medium-color black to polyethylene imports vastly improved resistance to embrittlement caused by sunlight aging. This application has resulted in a great increase in the life of polyethylene coating on cables exposed to sunlight, and the protective action extends to other plastics as well.

The applications of carbon black discussed above accounts for about 98 percent of the consumption, and the remainder, although small, covers a variety of other uses among which are the dry cell industry, which consumes about 7 million pounds black a year. Formerly specific requirements were met only by acetylene black, but recently oil-furnace blacks, which compare favorably with acetylene black, are in production. Duplicating carbon paper is also an important application of carbon black. A premium grade of channel black similar to that employed in lithographic ink is used. There are many other applications of carbon black, demonstrating its versatility. Among them are its use as a tinting agent in nylon, anticaking agent in cements and fertilizers, pigment in the confectionery and cosmetic industry, and a vital ingredient in liquid-oxygen explosives.

**TABLE 7.—Sales of carbon black for domestic consumption in the United States, 1960-64 by uses**

(Thousand pounds)

Uses	1960	1961	1962	1963	1964	Change from 1963 (percent)
Rubber.....	1,362,912	1,382,893	1,551,204	1,629,905	1,789,432	+10
Ink.....	47,980	42,987	41,162	46,471	45,688	-2
Paint.....	12,270	15,267	15,766	13,008	17,982	+38
Miscellaneous.....	6,456	18,858	31,765	38,036	58,392	+54
Total.....	1,429,618	1,460,005	1,639,897	1,727,420	1,911,494	+11

**STOCKS**

Total stocks of carbon black for 1962 were revised because of a change in one company's reporting procedure. No attempt was made to revise data for earlier years. Total stocks decreased 23 million pounds in 1964. Stocks of furnace black declined about 18 million pounds, and stocks of channel black decreased 6 million pounds. Four of the eight grades of furnace black increased during 1964, while the other four declined.

**TABLE 8.—Producers' stock of channel- and furnace-type blacks in the United States, December 31, 1960-64**

(Thousand pounds)

Year	Furnace								Total	Chan- nel	Total
	SRF <sup>1</sup>	HMF <sup>1</sup>	GPF <sup>1</sup>	FEF <sup>1</sup>	HAF <sup>1</sup>	SAF <sup>1</sup>	ISAF <sup>1</sup>	Thermal			
1960.....	43,402	12,050	7,827	23,420	66,325	4,437	39,075	23,032	219,568	73,424	292,992
1960 <sup>2</sup> .....	43,402	11,040	8,827	23,420	66,325	4,437	39,075	23,032	219,558	73,424	292,982
1961.....	41,171	7,694	9,055	22,069	69,799	8,510	62,728	16,229	237,255	50,644	287,899
1962.....	38,509	12,046	24,619	28,507	68,470	8,939	58,471	13,575	253,136	40,298	293,434
1963.....	31,101	7,927	21,129	23,137	61,473	4,115	50,391	6,338	205,611	48,605	254,216
1964.....	39,200	9,234	26,166	20,641	46,230	5,084	36,062	5,529	188,146	42,975	231,121

<sup>1</sup> Revised. No attempt has been made to revise stocks for previous years since data are not available.

<sup>2</sup> For explanation, see footnotes to table 3.

<sup>3</sup> Reclassification of grades.

**EXPORTS**

Total exports of carbon black continued a downward trend in 1964. Exports decreased 37,021,000 pounds to 333,907,000 pounds. Furnace black exports were down 36,922,000 pounds from the 1963 level, and channel black exports also were down 99,000 pounds. The decline in exports during the past 4 years was due to the expanded production in foreign countries.



TABLE 9.—U.S. exports of carbon black, 1964, by months

(Thousand pounds)

Month	Channel	Furnace	Total	Month	Channel	Furnace	Total
January.....	4,346	17,367	21,713	August.....	5,243	19,103	24,346
February.....	6,591	20,356	26,947	September.....	8,187	32,280	40,467
March.....	7,040	23,050	30,090	October.....	4,751	19,199	23,950
April.....	6,726	20,851	27,577	November.....	5,148	20,627	25,775
May.....	5,771	22,203	27,974	December.....	8,828	23,553	32,381
June.....	6,389	19,983	26,372	Total: 1964..	75,378	258,529	333,907
July.....	6,358	19,957	26,315	1963..	75,477	295,451	370,928

Source: Bureau of the Census.

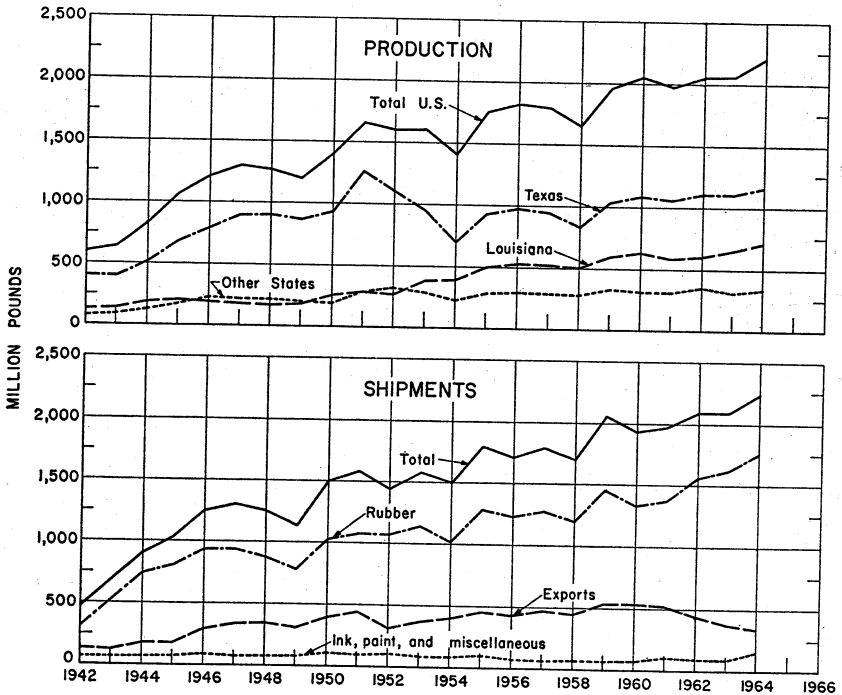


FIGURE 2.—Production and shipments of carbon black, 1942-64.

TABLE 10.—U.S. exports of carbon black, by countries

Destination	1962		1963		1964	
	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars	Thousand pounds	Thousand dollars
<b>North America:</b>						
Canada.....	25,540	\$2,177	29,266	\$2,435	22,578	\$1,905
Guatemala.....	701	62	1,482	128	1,364	123
Mexico.....	24,245	1,920	18,880	1,581	3,889	364
Other North America.....	16	4	114	10	84	15
Total.....	50,502	4,163	49,742	4,154	27,915	2,407
<b>South America:</b>						
Argentina.....	24,974	2,133	5,967	533	10,710	1,051
Brazil.....	12,777	1,022	6,600	578	4,749	407
Chile.....	2,926	255	5,273	488	5,762	588
Colombia.....	9,535	848	11,143	995	9,065	820
Peru.....	3,890	336	3,964	344	4,578	401
Uruguay.....	2,094	184	2,157	184	2,744	238
Venezuela.....	9,979	865	2,188	201	1,729	168
Other South America.....	237	22	1,332	121	1,315	126
Total.....	66,412	5,665	38,624	3,444	40,652	3,799
<b>Europe:</b>						
Austria.....	2,097	160	1,728	131	1,738	131
Belgium-Luxembourg.....	8,890	808	4,457	430	5,139	498
Czechoslovakia.....	110	11	4,616	410	265	23
Denmark.....	1,506	194	1,159	177	1,107	148
Finland.....	1,571	144	852	82	621	58
France.....	48,474	4,842	33,905	* 3,346	41,583	3,988
Germany, West.....	48,543	4,120	39,445	3,242	41,713	3,420
Greece.....	394	31	563	45	289	24
Ireland.....	128	21	88	13	27	5
Italy.....	47,206	4,369	32,746	3,194	21,317	2,129
Netherlands.....	8,089	796	6,738	647	8,433	836
Norway.....	1,781	159	1,382	129	998	96
Poland and Danzig.....	4	1	375	32	287	25
Portugal.....	1,744	169	2,229	211	2,526	238
Spain.....	5,921	582	3,129	376	4,435	482
Sweden.....	6,780	622	4,161	377	4,265	379
Switzerland.....	1,440	157	1,593	159	1,464	138
U.S.S.R.....			18,631	1,602	3,512	303
United Kingdom.....	23,576	3,180	19,418	2,780	25,384	3,408
Yugoslavia.....	1,577	159	1,678	230	2,165	243
Other Europe.....	151	19	43	4	459	37
Total.....	209,982	20,544	178,936	* 17,617	167,727	16,609
<b>Asia:</b>						
India.....	39,409	3,300	30,948	2,575	24,146	1,987
Indonesia.....	2,822	235	6,448	561	1,778	161
Iran.....	1,037	87	1,253	120	1,636	161
Israel.....	5,685	477	3,145	267	4,768	416
Japan.....	18,241	2,162	10,117	1,617	6,028	1,104
Korea, Republic of.....	6,048	573	3,356	302	6,154	597
Malaysia Republic.....	1,510	143	1,613	141	1,042	91
Pakistan.....	648	61	699	70	1,603	147
Philippines.....	7,462	673	9,357	843	10,220	890
Taiwan.....	2,646	234	1,310	115	427	55
Turkey.....	2,977	240	3,833	339	6,102	508
Other Asia.....	1,905	201	3,124	311	4,190	396
Total.....	90,390	8,386	75,203	7,261	68,094	6,513
<b>Africa:</b>						
South Africa, Republic of.....	11,860	1,002	15,330	* 1,301	16,287	1,405
United Arab Republic (Egypt).....	62	6	2,333	214	1,029	88
Other Africa.....	977	96	771	72	1,463	127
Total.....	12,899	1,104	18,434	* 1,587	18,779	1,620
<b>Oceania:</b>						
Australia.....	8,615	854	6,588	636	7,134	653
New Zealand.....	3,637	320	3,401	311	3,606	328
Total.....	12,252	1,174	9,989	947	10,740	981
Grand total.....	442,437	41,036	370,928	* 35,010	333,907	31,929

\* Revised.

Source: Bureau of the Census.

## WORLD PRODUCTION

TABLE 11.—World production of carbon black by countries<sup>1,2</sup>

(Thousand pounds)

Country <sup>1</sup>	1960	1961	1962	1963	1964 <sup>2</sup>
Argentina.....			NA	12,820	NA
Brazil.....	35,274	37,467	43,430	54,784	NA
France.....	76,941	• 101,400	138,890	167,991	NA
Germany, West.....	154,878	173,462	201,549	221,119	• 265,200
Italy.....	17,637	29,769	65,426	97,717	147,708
Japan.....	55,093	93,936	147,025	176,882	243,602
Rumania.....	55,186	62,589	65,082	73,142	78,030
South Africa, Republic of.....		4,123	16,840	21,402	26,334
Spain.....	NA	NA	2,866	2,866	NA
Taiwan.....	310	676	453	425	434
United Kingdom.....	322,500	300,900	281,700	308,200	338,600
United States.....	2,053,727	1,979,552	2,056,464	2,058,916	2,223,216
Venezuela.....			NA	10,000	13,499
Yugoslavia.....	8,514	9,696	8,234	9,438	10,523

• Estimate.

• Preliminary.

NA Not available.

<sup>1</sup> Australia, China, India, Mexico, Netherlands, and Sweden produce carbon black, but production data are not available. Canada's carbon black capacity was increased late in 1961 to about 100 million pounds annually. Actual production is not published to avoid disclosure of individual company data.

<sup>2</sup> This table incorporates some revisions.

## TECHNOLOGY

Carbon black is a semigraphitic form of carbon prepared in a fine state of subdivision by the partial combustion of hydrocarbons. These hydrocarbons may be either gaseous or liquid products of the petroleum industry, that is, natural gas or other gas or oil fractions from refinery streams.

Up to 1945 carbon black was made by the channel, gas-furnace, and thermal processes, and the principal raw material was natural gas, with occasional enrichment of distillate oils. Since the introduction of the oil-furnace process in 1945, the position has changed such that more black is made currently from liquid hydrocarbons than from gas and, it is anticipated that liquid hydrocarbon raw material will predominate increasingly. Tremendous quantities of natural gas are still used, however.

There are several kinds of carbon black produced by means of several manufacturing processes, one of which is the channel process. The first channel plant was built in 1872 in New Cumberland, W. Va. When the natural gas of this area was subsequently piped to the main cities of Pennsylvania and Ohio the industry migrated to Louisiana, until the pipelines were constructed in that region, when the industry migrated once more. Between 1925–29 it became established in the Texas Panhandle; from that time until recently Texas produced more than 70 percent of the world's supply of carbon black. The channel process of carbon-black manufacture involves burning natural gas in a deficiency of air. Thousands of smoky flames, burning from small lava tips, are impinged on cool metal surfaces, depositing a layer of soot or carbon black, which is continuously removed by scraping devices. The depositing surfaces, long channel irons, moving slowly back and forth over the flames are collectors of the product

and have since lent their name to both the methods of manufacture and the product. The products are referred to as channel blacks, although the term gas blacks as well as the term impingement blacks are also in common use. The channel process produces several grades of very fine carbon blacks which have maximum color and tinctorial strength, very applicable for reinforcing rubber. By altering the distance of the lava tip from the channel, modifying the volume of gas through the tip, and varying the amount of air admitted, it is possible to change the particle size of the black.

Although the channel process has been almost replaced by the more efficient oil-furnace process as the principal source of rubber grades of carbon black, it still remains the principal source of the premium grades of the high- and intermediate-color black used in the paint and lacquer industry, as well as the premium grades of halftone or lithographic blacks used in the printing ink industry.

The thermal process produces coarser blacks, giving softer rubber stocks more desired for tire carcasses than the narrow range of fine-particle carbon blacks manufactured by the channel process. In the thermal process, as the name implies a thermal cracking process, natural gas is passed on a make cycle through checker-brick furnaces preheated to 2,500 to 3,000° F. At these temperatures the gas decomposes to carbon and hydrogen. After the make cycle, the furnace cools off and is then fired with an air-gas mixture and heated once again to make temperatures. It is then charged with either natural gas or natural gas diluted with hydrogen and carbon dioxide, and the make cycle is repeated.

Thermal black particles are approximately 17 to 20 times larger in size than those made by the channel process.

The gas-furnace process, introduced in 1922, is an extension of the channel process in that laminar diffusion flames are produced, but in more concentrated fashion, and confined by a refractory furnace. The development of this process resulted from the desire to improve recovery and produce blacks with reinforcing ability intermediate between the thermal and channel blacks. In this process special slotted or drilled burners are used, through which natural gas and air in alternate layers are fired into large insulated furnaces or retorts. In a swirling mass of partial combustion the natural gas is converted to carbon black. The hot carbon, suspended in the spent gas, is carried from the furnace through large flues to a water-spray tower where the reaction is quenched. The cooled carbon aerosol is then partially flocculated in an electrical precipitator and subsequently removed and collected in a series of cyclone separators. Average yield is four times that of the channel process. Although gas-furnace black does not provide sufficient reinforcement for use in tire treads it is superior to thermal black and has found wide application in a variety of rubber goods in which abrasive wear is not a factor.

The oil-furnace process developed in 1943, represented a significant advance in the carbon black industry. The use of liquid hydrocarbons or oils was substituted for natural gas in the furnace process. The burner assemblies of the gas-furnace process was replaced by burner nozzles through which liquid hydrocarbons could be either atomized or vaporized into the furnace together with the requisite amount of

air. The first product of the process was a medium-reinforcing black, but further research on equipment design led to production of a black equal in particle size to channel black and superior in reinforcing properties. This superiority persists in both synthetic and natural rubber stocks. From the time of its introduction the oil furnace process has increased steadily due to its high efficiency and versatility, taking over production from both the channel and gas-furnace process until more than three quarters of all carbon black now produced is made by the oil-furnace process. The raw material preferred is a highly aromatic oil, and although some auxiliary gas is used, the process is independent of natural gas resources. As a result, carbon black plants may now be located anywhere the oil may be shipped.

Among the other methods of manufacturing carbon black, the acetylene process should be included. In this process, principally confined to Canada, the black is made by the thermal decomposition of acetylene. Acetylene is fed into a retort through specially designed nozzles. The black aerosol enters a settling chamber and is periodically removed. The decomposed hydrogen is vented and burned.

Lampblacks, the oldest member of the carbon-black family, are manufactured by slowly burning suitable oils and tars in a restricted supply of air. The smoke, carried by natural draft, passes into a series of settling chambers in which the black collects on the walls and floors and is periodically removed.

An important black produced for many years in Germany is made from coal tar residues such as naphthalene and anthracene oils. Vapors of these oils are used to enrich water gas ( $\text{CO}$  and  $\text{H}_2$ ), and the mixture is then burned from slotted pipes so that the smoky flames impinge on cooled rollers. The products are very similar to American channel grade rubber blacks.

# Natural Gas

By R. F. Zaffarano<sup>1</sup> and Ivan F. Avery<sup>2</sup>



## Contents

	<i>Page</i>		<i>Page</i>
General summary.....	319	Domestic production.....	327
Scope of report.....	319	Gross withdrawal.....	327
Trends and developments.....	320	Storage.....	327
Marketed production.....	320	Consumption.....	333
Legislation and Government pro- grams.....	321	Imports and exports.....	341
Domestic.....	321	Value and price.....	346
Foreign.....	322	World production.....	348
Reserves.....	323	World review.....	350
		Technology.....	350

## GENERAL SUMMARY

**T**HE NATURAL gas industry, sixth in the Nation in term of plant investment continued to provide the major share of fuel growth in total energy supply.

Marketed production reached a record 15,547 billion cubic feet.

Total consumption in 1964 was 15,536 billion cubic feet, an increase of 696 million cubic feet over the 1963 level. The average value of natural gas at the wellhead was 15.4 cents per Mcf.

## SCOPE OF REPORT

Data on natural gas production, consumption, and value are collected by annual surveys of oil and gas producers, natural-gasoline-plant operators, gas-pipeline companies, and gas-utility companies. Separate reports are obtained from respondents for each State in which they operate.

Gas volumes reported by the Bureau of Mines are calculated to a pressure base of 14.65 pounds per square inch absolute (psia) at 60° F.

The reports received reflected approximately 80 percent of gross natural gas production. The large number of respondents and the difficulty of canvassing each small producer has made direct acquisition of total production impractical. Most of the output of nonreporting producers has been shown in purchase listings of reporting

<sup>1</sup> Petroleum engineer, Division of Petroleum.

<sup>2</sup> Mineral specialist (petroleum), Division of Statistics.

companies. Marketed production for each State equals consumption in the State, plus losses in transmission, plus gas placed in storage, plus shipments to other States, less gas withdrawn from storage, less receipts from other States.

## TRENDS AND DEVELOPMENTS

All trends in the natural gas industry depict growth, but at declining rates. Gas consumption increased more than 10 percent per year from 1950 to 1955, about 8.3 percent annually between 1955 and 1960, and 5.5 percent per year from 1960 to 1964 for a record high of 15.5 trillion cubic feet in 1964 (table 1). Gas companies continued to diversify, to venture into foreign investments, and to improve efficiency of their operations for increased earnings.

## MARKETED PRODUCTION

The total marketed production of natural gas was 15.5 trillion cubic feet (table 1), an increase of nearly 800 billion cubic feet from that of 1963. The 1964 marketed production was almost double that of 1954—reflecting an annual growth rate of 6.6 percent per year over the 10-year period.

Gas distribution and transmission systems are continuing to be expanded to keep pace with the increased gas demand in the nation. Distribution lines are increasing rapidly because of increased space-heating loads as well as other domestic use in suburban areas.

TABLE 1.—Salient statistics of natural gas in the United States

	1960	1961	1962	1963	1964
<b>Supply:</b>					
Marketed production <sup>1</sup>					
million cubic feet...	12, 771, 038	13, 254, 025	13, 876, 622	14, 746, 663	15, 546, 592
Withdrawn from storage.....do.....	712, 658	698, 050	854, 336	916, 720	885, 307
Imports.....do.....	155, 646	218, 860	401, 534	406, 204	443, 326
Total.....do.....	13, 639, 342	14, 170, 935	15, 132, 492	16, 069, 587	16, 875, 225
<b>Disposition:</b>					
Consumption.....do.....	12, 509, 427	13, 081, 714	13, 890, 129	14, 640, 480	15, 536, 373
Exports.....do.....	11, 332	10, 747	15, 814	16, 957	19, 603
Stored.....do.....	844, 352	843, 666	940, 823	1, 047, 492	1, 014, 814
Lost in transmission, etc.....do.....	274, 231	234, 808	285, 726	364, 658	304, 435
Total.....do.....	13, 639, 342	14, 170, 935	15, 132, 492	16, 069, 587	16, 875, 225
<b>Value at wellhead:</b>					
Total.....thousand dollars.....	1, 789, 970	1, 996, 241	2, 145, 301	2, 328, 030	2, 387, 689
Average.....cents per Mcf.....	14.0	15.1	15.5	15.8	15.4

<sup>1</sup> Comprises nonprocessed gas sold or consumed by products, including losses in transmission, amounts added to storage, and increases in gas in pipelines.

Underground storage facilities have been developed by pipeline and distribution companies; these have been additions of major significance to the pipeline network for load-balancing. These facilities continued to increase in 1964. In 1952, 151 storage fields were in 16 States, having a total capacity of 1.3 trillion cubic feet. By 1964 underground storage capacity had grown to 3.9 trillion cubic feet stored in 286 reservoirs in 24 States. Underground storage in 1964 is

capable of meeting approximately one-third of the peak-day loads of distribution companies in most of the large market areas.

The short term projection of atomic energy as a competitive source of fuel energy has not developed as rapidly as expected by some prognosticators. Consequently, the present stage of development of atomic power plants for public utility service that has been termed embryonic may be expected to be continued, and natural gas will continue to be the major mineral fuel in the U.S. economy.

As reported in the American Gas Association Heating Survey an additional 1.1 million customers installed gas heating in 1964, which increased the gas househeating customers to more than 25 million, about 4.5 percent more than in 1963. In addition to these, 2.3 million multifamily dwellings, such as apartments, received gas heat from a central source. About two-thirds of the new customers for services of utility companies were in new homes, the remainder represented those converting from other fuels in existing dwellings. Illinois, Indiana, Michigan, Ohio, and Wisconsin continued to lead the Nation in growth of househeating customers, based primarily on conversions from other fuels.

The gaseous and liquid hydrocarbon industries in 1964 were faced with a fast-developing competition for energy markets by the electric utility industry. At the end of 1963, about 1.5 million homes were heated electrically. In 1964, such installations increased approximately to 2.0 million and are forecast to rise to 2.5 million in 1965. The New England and mid-Atlantic areas of the United States showed the largest increase in electrically heated homes, predominantly in multifamily dwellings.

## LEGISLATION AND GOVERNMENT PROGRAMS

### DOMESTIC

The Federal Power Commission is the prime governmental regulatory agency administering the Natural Gas Act enacted by the Congress in 1938. The purpose of the act, as interpreted by the Supreme Court, is to underwrite just and reasonable rates to consumers of natural gas so as to afford them a complete, permanent, and effective bond of protection from excessive rates and changes.

The act grants the Commission comprehensive regulatory authority over wholesale gas rates and the accounting and depreciation practices of the natural gas companies engaged in interstate commerce, as well as jurisdiction over the export of natural gas from and import into the United States.

On January 9, 1964, the Federal Power Commission issued a ruling that the rate of return of a gas producing affiliate for an interstate pipeline company should be based on standards used for pipeline production generally and not on those applicable to independent producers.<sup>3</sup>

In a case involving Florida Gas Transmission Co., the Federal Power Commission on June 8, 1964, ordered the company to eliminate

<sup>3</sup> Federal Power Commission Annual Report, 1964. FPC A-90, p. 23.



from its rate base more than \$8 million representing profits to affiliated engineering and construction companies.<sup>4</sup> The Commission found that these groups were in a position where they could control the action of the pipeline company in awarding contracts for building the line and that they exercised this control in favor of their own firms. "The Commission ruling follows its policy of preventing insiders from taking advantage of their position and creating costs which are not subject to the check of ordinary business relationships."

### FOREIGN

**Canada.**—Policy decisions of the Alberta Oil and Gas Conservation Board in 1964 supported future expansion in the Canadian natural gas industry. A significant feature of the export decisions of the Board was removal of an additional 4.8 trillion cubic feet of gas from Alberta, reducing the remaining surplus beyond domestic needs to less than 1 trillion cubic feet. Therefore, the industry will need to accelerate gas exploration to discover more gas to support future export demand.

**United Kingdom.**—Under the Continental Shelf Act of 1964, the United Kingdom acquired sovereign rights over a designated 100,000 square miles of the North Sea Shelf. This act gives the Crown any rights exercisable by the United Kingdom outside territorial waters for the seabed and subsoil and their natural resources. Both exploration and production licenses are granted by the Minister of Power to United Kingdom nationals or registered companies. If natural gas is discovered, its use in or transmission to Great Britain will not be approved unless the gas is to be used for nonfuel purposes and the appropriate Area Gas Board has been given an opportunity to purchase the gas.

**Netherlands.**—The Netherlands Government regulations on mineral development are somewhat unusual in that all minerals belong to the Government, and permits are not required to conduct exploration work. Concessions can only be applied for after the discovery has been made. Unusual leasing procedures have discouraged operators other than Netherlands Petroleum Co. (NAM) from working in Netherlands. However, with the discovery at Groningen in 1959 at least 13 other companies are exploring for natural gas, chiefly in the northern part of the country. Limited preliminary exploration in offshore Dutch waters took place in 1964, pending the establishment of new mining legislation by the Dutch Government.

Final agreement on the Continental Shelf delimitation between Netherlands and West Germany was signed in December 1964. This agreement established the border line between the Dutch and German area of the Continental Shelf to the 54th parallel without setting a precedent for the final national frontier. Fixing boundaries in the central district of the North Sea will require future multilateral negotiation between West Germany, Netherlands, United Kingdom, Norway, and Denmark.

<sup>4</sup>Work cited in footnote 3, p. 24.

## RESERVES

At the end of 1964, the American Gas Association (AGA) Committee on Natural Gas Reserves reported that proved recoverable natural gas reserves of the United States reached a new high of 281.3 trillion cubic feet (table 2), 5 trillion cubic feet more than the gas reserves at the beginning of the year. During the past 14 years, as shown, national gas reserves have increased from 185 to 281 trillion cubic feet (fig. 2) to meet the rapidly expanding energy requirements of the United States. The disposition of the annual estimates of natural gas reserves for the 1950-64 period by type of gas reservoir is given in figure 2. A slight growth in nonassociated gas reserves has occurred within the past 5 years (table 2). This growth has resulted from the deeper exploratory drilling required for new discoveries, which generally produces gas in this nonassociated category.

The annual gross additions to gas reserves for the period 1947-64, including new field discoveries as well as extensions of old fields and revisions of previous estimates are given in figure 1. In 1956, the peak year in exploratory drilling and best discovery year, 24.8 trillion cubic feet were proved, motivated by the Suez Canal situation. Likewise, the low number of exploratory wells drilled in 1954 (fig. 1) is attributed to the termination of the Korean War and overcapacity within the petroleum industry. The sharp decline in gross additions to gas reserves from 1959 to 1960 resulted from the aftermath of the 1958

TABLE 2.—Estimated proved recoverable reserves of natural gas in the United States

(Million cubic feet—14.73 psi at 60° F)

State	Reserves as of December 31, 1963 <sup>1</sup>	Changes in reserves during 1964			
		Extensions and revisions <sup>1</sup>	Discoveries of new fields and new pools in old fields <sup>1</sup>	Net change in underground storage <sup>2</sup>	Net production <sup>3</sup>
Alaska.....	1,690,724	146,058	1,000	0	6,417
Arkansas.....	1,792,644	286,586	97,780	7,165	84,083
California <sup>4</sup> .....	8,865,726	672,499	141,808	11,598	637,924
Colorado.....	1,876,057	-64,438	18,050	1,313	101,724
Illinois.....	168,595	-128	80	17,301	6,347
Indiana.....	60,180	2,264	46	12,048	3,270
Kansas.....	17,994,235	42,157	57,134	2,579	817,963
Kentucky.....	1,085,236	5,217	68,776	9,578	74,452
Louisiana <sup>4</sup> .....	75,364,992	4,915,365	2,950,060	121	4,154,229
Michigan.....	722,812	44,293	14,309	23,566	30,704
Mississippi.....	2,481,627	58,306	10,250	581	195,000
Montana.....	598,131	6,660	2,176	11,397	28,095
Nebraska.....	100,042	-534	2,771	3,035	11,931
New Mexico.....	15,037,822	1,116,604	85,800	598	886,389
New York.....	1,132,285	-1,147	1,360	3,785	2,794
North Dakota.....	1,119,575	10,420	7,884	0	36,234
Ohio.....	748,187	-22,378	6,000	15,325	37,713
Oklahoma.....	19,138,820	1,586,206	239,688	149	1,207,628
Pennsylvania.....	1,214,498	69,555	14,560	30,284	85,322
Texas <sup>4</sup> .....	117,809,376	4,403,407	3,074,409	4,112	6,436,249
Utah.....	1,638,324	-65,955	12,058	64	65,088
Virginia.....	31,303	0	2,800	0	1,923
West Virginia.....	2,311,164	175,859	27,353	30,022	196,453
Wyoming.....	3,938,546	-53,775	70,062	-880	235,393
Other States <sup>4</sup> .....	180,332	736	3,087	11,370	3,703
Total.....	276,151,233	13,342,837	6,909,301	195,111	15,347,028

See footnotes at end of table.

TABLE 2.—Estimated proved recoverable reserves of natural gas in the United States—Continued

State	Reserves as of December 31, 1964				
	Nonassociated <sup>1</sup>	Associated <sup>2</sup>	Dissolved <sup>3</sup>	Underground storage <sup>4</sup>	Total
Alaska.....	1,748,527	0	82,838	0	1,831,365
Arkansas.....	1,569,426	317,722	189,191	23,753	2,100,092
California <sup>5</sup> .....	3,354,184	1,647,953	3,849,350	202,220	9,053,707
Colorado.....	1,399,949	79,323	244,421	5,565	1,729,258
Illinois.....	72	0	35,047	144,382	179,501
Indiana.....	607	597	16,883	53,181	71,268
Kansas.....	16,578,324	428,220	178,777	92,821	17,278,142
Kentucky.....	982,153	0	66,978	45,224	1,094,355
Louisiana <sup>6</sup> .....	65,012,415	9,175,211	4,887,971	712	79,076,309
Michigan.....	151,853	73,709	53,663	495,051	774,276
Mississippi.....	1,907,408	179,547	262,256	6,553	2,355,764
Montana.....	384,278	21,122	78,165	106,704	590,269
Nebraska.....	56,484	8,169	15,352	13,378	93,383
New Mexico.....	11,463,976	2,114,892	1,749,048	26,519	15,354,435
New York.....	38,288	0	31	95,170	133,489
North Dakota.....	6,372	328,340	775,933	0	1,110,645
Ohio.....	228,818	0	89,278	391,325	709,421
Oklahoma.....	14,963,987	2,700,233	1,959,732	133,233	19,757,235
Pennsylvania.....	709,957	0	18,104	521,514	1,249,575
Texas <sup>7</sup> .....	80,457,781	25,010,649	13,309,782	76,843	118,855,055
Utah.....	882,146	382,106	254,299	852	1,519,403
Virginia.....	32,180	0	0	0	32,180
West Virginia.....	1,936,618	0	61,202	350,125	2,347,945
Wyoming.....	3,223,793	151,545	372,687	20,535	3,768,560
Other States <sup>8</sup> .....	38,764	0	19,005	134,053	191,822
<b>Total.....</b>	<b>207,122,360</b>	<b>42,619,338</b>	<b>28,569,993</b>	<b>2,939,763</b>	<b>281,251,454</b>

<sup>1</sup> Excludes gas loss due to natural gas liquids recovery.

<sup>2</sup> Net difference between gas stored in and gas withdrawn from underground storage reservoirs, including adjustments and native gas transferred from other reserves categories.

<sup>3</sup> Net production equals gross withdrawals less gas injected into producing reservoirs. Changes in underground storage and gas loss due to natural gas liquids recovery are excluded. Fourth quarter production estimated in some instances.

<sup>4</sup> Includes offshore reserves.

<sup>5</sup> Includes Alabama, Arizona, Florida, Iowa, Maryland, Missouri, Tennessee and Washington.

<sup>6</sup> Free gas not in contact with crude oil in the reservoir and free gas in contact with oil, where the production of such gas is not significantly affected by the production of crude oil.

<sup>7</sup> Free gas in contact with crude oil in the reservoir where the production of such gas is significantly affected by the production of crude oil.

<sup>8</sup> Gas in solution with crude oil in the reservoirs.

<sup>9</sup> Gas held in underground reservoirs (including native and net injected gas) for storage.

Source: Committee on Natural Gas Reserves, American Gas Association.

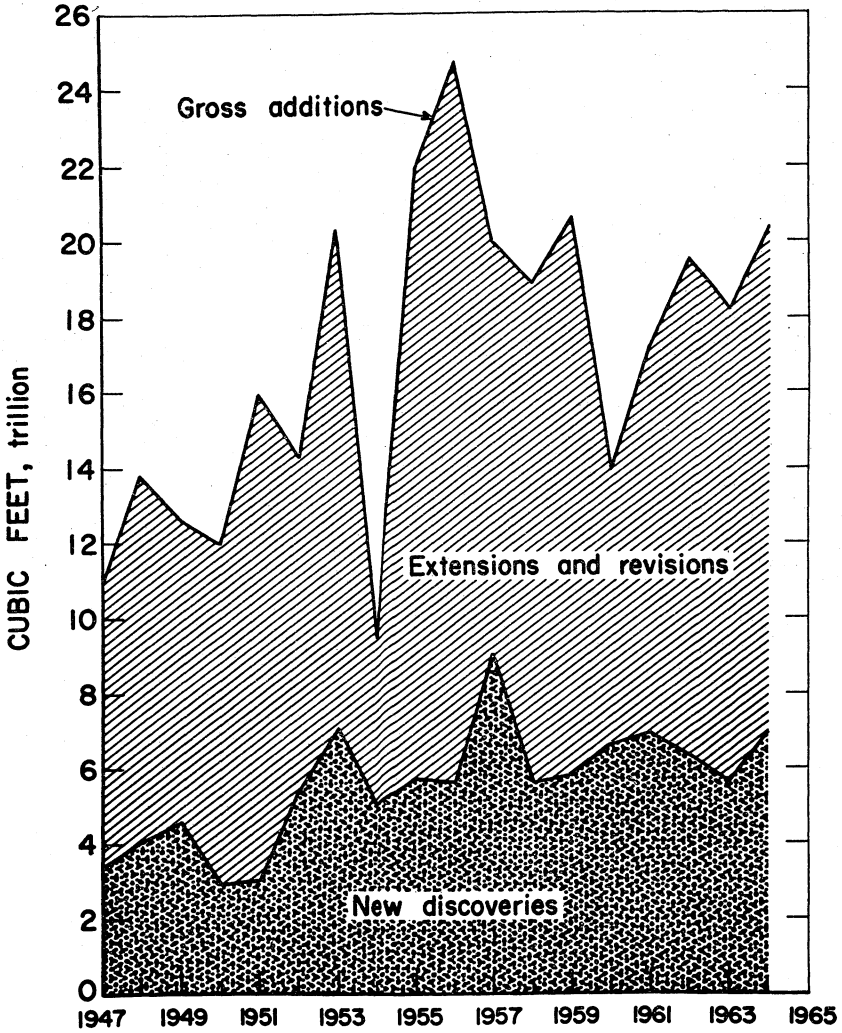
recession when the industry experienced stringent cutbacks in exploration. The 17-year record of the new additions to proved gas reserves, (fig. 1), exhibits an overall increasing trend.

The reserves added each year by extensions and revisions have been roughly twice the reserve added by new discoveries, which is related to the procedure used to estimate total reserves of a field in the year of its discovery. Satisfactory estimates can only be made following sufficient field development whereby adequate production history is available for reserve estimation. For these reasons, the reserves listed as discovered during any current year must be considered only as the reserves estimates indicated by the drilling in that year.

Effective December 31, 1963, the standard conditions for reporting natural gas reserves estimated by the AGA Committee on Nature Gas Reserves were changed from 14.65 psia to 14.73 psia at 60° F.

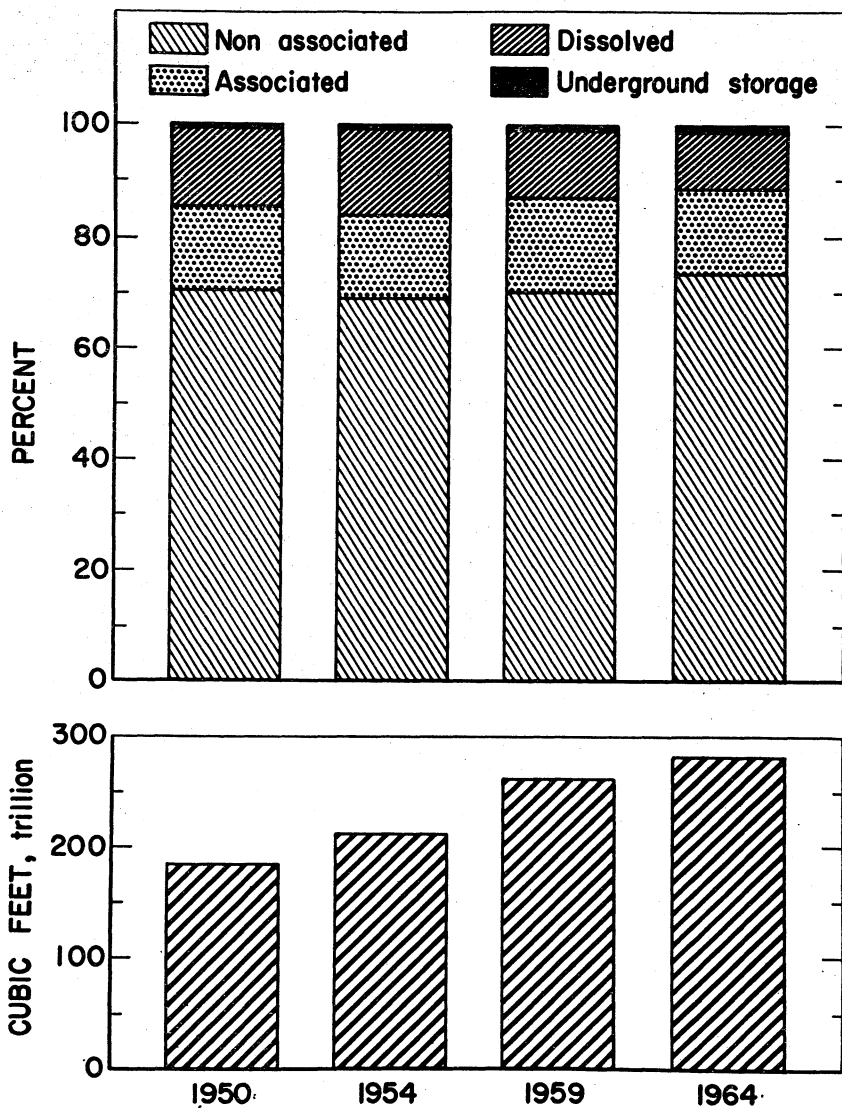
Gross additions to natural gas reserves in 1964, were more than 20 trillion cubic feet for the sixth time in the past 17 years. About 39 percent of this increase occurred within onshore and offshore Louisiana, and more than 80 percent of these new reserves were non-associ-

ated gas. About 74 percent of all natural gas reserves were contained within non-associated gas reservoirs (table 2). Texas, the major gas supply State, contained 27 percent of the national additions to reserves.



Source : A.G.A.

FIGURE 1.—Trends in annual gross additions to natural gas reserves, trillion cubic feet, 1947-64.



Source: A.G.A.

FIGURE 2.—Annual estimates of natural gas reserves by type of gas reservoir, cubic feet, 1950-64.

## DOMESTIC PRODUCTION

### GROSS WITHDRAWAL

Gross withdrawal represents the sum of marketed production, which comprises gas sold or consumed by producers, including loss due to natural gas liquids recovery (shrinkage); loss in transmission, amount added to storage; and increases in gas pipeline, gas repressured—which includes gas returned to formations, used for pressure maintenance and cycling; and gas vented and flared. Total withdrawals from gas wells and oil wells are estimated from annual Bureau of Mines Supply and Distribution Surveys (fig. 3). The quantity of gas vented and flared is compiled from company data reported to the Bureau of Mines. The data are supplemented by estimates of losses derived from figures published by the Natural Gas Reserves Committee of the American Gas Association and State conservation bodies.

Total gross withdrawals of 17.5 trillion cubic feet include all gas withdrawn; however, not all is included in the marketed production figure of 15.5 trillion cubic feet, representing the quantity entering the gas market. The remaining 2.0 trillion cubic feet was reinjected in the producing formation, vented, and flared.

The amount of gas produced from gas wells and oil wells is shown in table 3. The proportion of total gas production coming from gas wells has increased since 1935, and in 1964 was approximately 75 percent, with the remainder derived from oil wells. This increase in gas resulted from deeper drilling to reach productive formations, which generally contain more gas.

The amount of gas returned to formation (table 3) decreased 196 billion cubic feet to 1.6 trillion cubic feet from the 1963 level. The amount vented and flared (partly estimated) was 341 billion cubic feet, an 11.0 percent decrease from 1963.

Marketed production of natural gas in the United States in 1964 was 15.5 trillion cubic feet, 5.4 percent more than in 1963 (table 4). From 1960 to 1964 (figs. 3 and 4, table 4) the total marketed production increased 4.9 percent per year. Gas used for repressuring and cycling remained relatively unchanged, and gas vented and flared continued to decline at the rate of 13 percent per year.

Production of natural gas, while occurring in at least 29 states, is concentrated mainly in the West South Central States. Texas is the leading State in marketed production. It has been the leading producer in the Nation since 1929, when it displaced Oklahoma.

### STORAGE

Storage gas near consuming centers is proving to be a successful method of handling seasonal peak requirements to gas transmission systems. Often this storage is supplemented with some type of standby facility, such as manufactured and mixed gases of liquefied natural gas. Economics govern the choice to shave peaks during high demand periods. When the transmission line is relatively short it may be more economical to build sufficient capacity into the line to deliver peak requirements. In other instances, involving long trans-

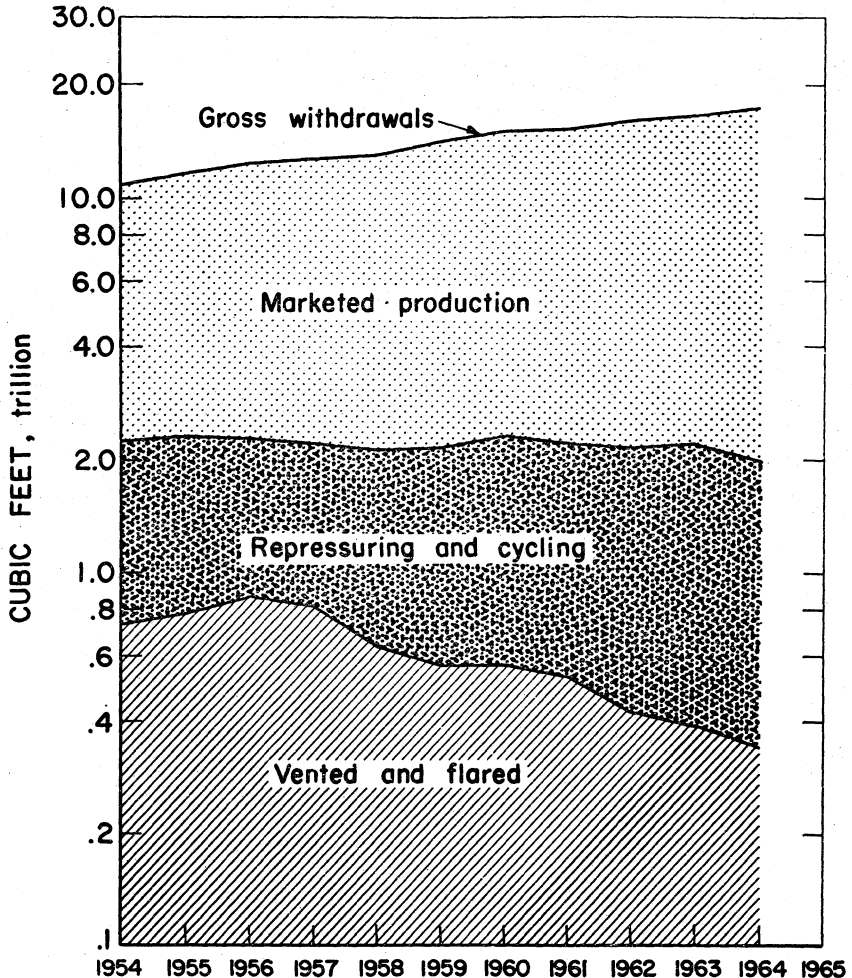


FIGURE 3.—Gross withdrawals and disposition of natural gas in the United States, trillion cubic feet, 1954–64.

mission lines and extreme demand fluctuation, terminal storage is preferred.

Approximately 1.0 trillion cubic feet (table 5) were injected as input to underground storage. The volume of gas withdrawn from storage was 885 billion cubic feet, a net increase of 130 billion cubic feet (fig. 5), which equals the 1963 net stored volume. The 1950–64 trend in net gas stored in the United States (fig. 5) indicates an increasing trend at a decreasing rate, an overall growth rate of 6.5 percent per year for the period. The increase in net gas stored for the 1959–64 period was at the reduced rate of 1.8 percent per year. It is not uncommon on peak days for more than 80 percent of the gas sendout deliveries to be taken from storage to meet gas requirements.

NATURAL GAS

329

TABLE 3.—Gross withdrawals and disposition of natural gas in the United States

(Million cubic feet)

State	Gross withdrawals			Disposition		
	From gas wells <sup>1</sup>	From oil wells <sup>1</sup>	Total <sup>2</sup>	Marketed production <sup>3</sup>	Repressuring	Vented and flared <sup>4</sup>
<b>1963:</b>						
Alaska.....	8,100	2,800	10,900	4,498	6,316	86
Arkansas.....	57,700	41,500	99,200	76,101	19,191	3,908
California.....	281,200	668,300	949,500	646,486	297,413	5,601
Colorado.....	65,400	79,500	144,900	105,705	35,070	4,125
Illinois.....	1,900	7,700	9,600	9,459	-----	141
Indiana.....	1,300	3,300	3,600	286	-----	3,314
Kansas.....	718,000	50,000	768,000	732,946	155	34,899
Kentucky.....	71,700	3,000	74,700	74,634	-----	66
Louisiana.....	3,540,100	710,000	4,250,100	3,928,427	212,116	109,557
Maryland.....	1,633	-----	1,633	1,633	-----	-----
Michigan.....	25,200	10,400	35,600	32,850	1,640	1,110
Mississippi.....	138,100	92,100	230,200	176,807	45,368	8,025
Montana.....	23,400	8,000	31,400	30,026	598	776
Nebraska.....	8,200	6,100	14,300	13,051	-----	1,249
New Mexico.....	528,000	288,400	826,400	808,377	11,814	6,209
New York.....	3,800	200	4,000	3,962	-----	38
North Dakota.....	1,100	38,800	39,900	32,798	3,034	4,068
Ohio.....	33,500	5,000	38,500	36,817	-----	1,683
Oklahoma.....	850,900	496,100	1,347,000	1,233,883	62,203	50,914
Pennsylvania.....	90,200	3,000	93,200	92,657	204	339
Texas.....	5,769,300	1,683,000	7,452,300	6,205,034	1,114,288	132,978
Utah.....	26,600	67,000	93,600	77,122	13,771	2,707
Virginia.....	2,085	-----	2,085	2,085	-----	-----
West Virginia.....	207,000	3,400	210,400	210,223	116	61
Wyoming.....	151,000	89,500	240,500	209,060	20,000	11,440
Other States <sup>5</sup> .....	1,604	246	1,850	1,736	-----	114
<b>Total.....</b>	<b>12,606,022</b>	<b>4,367,346</b>	<b>16,973,368</b>	<b>14,746,663</b>	<b>1,843,297</b>	<b>383,408</b>
<b>1964:</b>						
Alaska.....	8,800	3,200	12,000	6,272	5,479	249
Arkansas.....	59,200	42,100	101,300	76,167	21,480	3,653
California.....	290,300	629,200	919,500	664,051	244,310	11,139
Colorado.....	71,900	74,900	146,800	114,312	28,293	4,195
Illinois.....	1,100	6,900	8,000	7,867	-----	133
Indiana.....	100	2,500	2,600	200	-----	2,400
Kansas.....	744,200	41,000	785,200	768,246	11	16,943
Kentucky.....	70,900	6,500	77,400	77,360	-----	40
Louisiana.....	3,702,300	812,700	4,515,000	4,175,412	222,477	117,111
Maryland.....	1,381	-----	1,381	1,381	-----	-----
Michigan.....	21,200	12,700	33,900	31,558	1,624	718
Mississippi.....	128,700	89,100	217,800	181,414	27,315	9,071
Montana.....	19,400	7,500	26,900	25,188	606	1,106
Nebraska.....	7,500	5,200	12,700	11,155	-----	1,545
New Mexico.....	594,700	288,200	892,900	878,720	9,196	4,984
New York.....	3,100	100	3,200	3,125	-----	75
North Dakota.....	1,000	45,100	46,100	34,700	5,687	5,713
Ohio.....	31,800	6,000	37,800	37,309	98	393
Oklahoma.....	926,100	497,200	1,423,300	1,323,390	68,937	30,973
Pennsylvania.....	80,200	2,500	82,700	82,166	222	312
Texas.....	5,914,700	1,707,300	7,622,000	6,525,649	978,964	117,387
Utah.....	45,900	52,600	98,500	80,175	16,655	1,670
Virginia.....	1,609	-----	1,609	1,609	-----	-----
West Virginia.....	201,500	2,500	204,000	203,872	111	17
Wyoming.....	176,400	83,500	259,900	232,878	15,562	11,460
Other States <sup>5</sup> .....	2,074	438	2,512	2,416	-----	96
<b>Total.....</b>	<b>13,106,064</b>	<b>4,428,938</b>	<b>17,535,002</b>	<b>15,546,592</b>	<b>1,647,027</b>	<b>341,383</b>

<sup>1</sup> Estimated from the annual Bureau of Mines Supply and Distribution, Natural Gas Survey.

<sup>2</sup> Marketed production plus quantities used in repressuring, vented, and flared.

<sup>3</sup> Comprises gas sold or consumed by producers, including gas loss due to natural gas liquids recovery, losses in transmission, quantities added to storage, and increases in gas in pipelines.

<sup>4</sup> Partly estimated: Includes direct losses on producing properties and residue blown to the air.

<sup>5</sup> Alabama, Arizona, Florida, Missouri, South Dakota, and Tennessee.



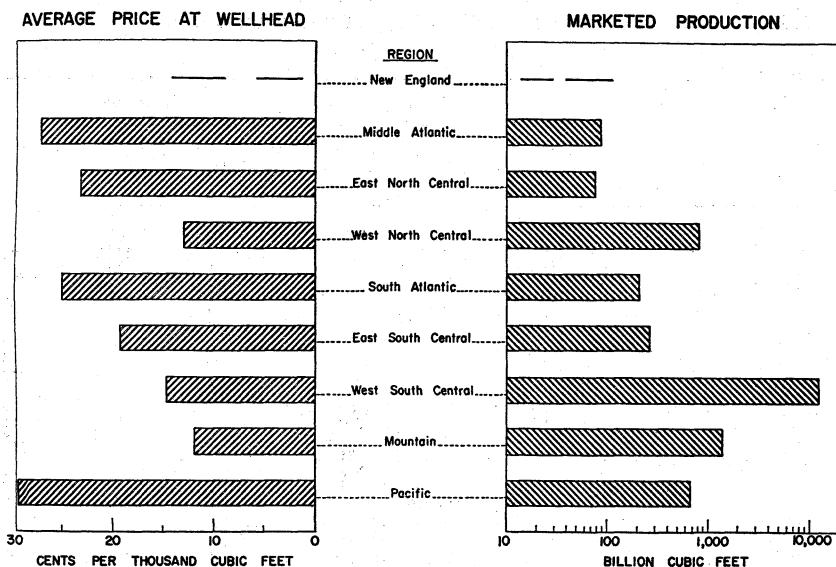


FIGURE 4.—Marketed production of natural gas by regions and average wellhead price.

TABLE 4.—Marketed production of natural gas in the United States<sup>1</sup>

State	Quantity (million cubic feet)					Change from 1963 (per cent)	Estimated value at wells (thousand dollars)	
	1960	1961	1962	1963	1964		1963	1964
Alabama	57	56	128	177	166	-6.2	21	18
Alaska	246	631	2,184	4,498	6,272	39.4	1,111	1,719
Arizona			230	1,334	2,025	51.8	161	241
Arkansas	55,451	59,547	66,213	76,101	76,167	0.1	11,796	11,806
California	517,535	556,241	564,220	646,486	664,051	2.7	189,420	198,551
Colorado	107,404	108,142	101,826	105,705	114,312	8.1	12,367	13,489
Florida	30	29	29	35	40	14.3	7	5
Illinois	11,666	9,970	10,650	9,459	7,867	-16.8	1,220	905
Indiana	342	382	284	286	200	-30.1	67	47
Kansas	634,410	649,083	694,352	732,946	768,246	4.8	97,482	96,031
Kentucky	75,329	70,937	70,241	74,634	77,360	3.7	17,838	18,257
Louisiana	2,988,414	3,271,857	3,525,456	3,928,427	4,175,412	6.3	777,829	793,328
Maryland	4,065	3,578	2,472	1,633	1,381	-15.4	439	366
Michigan	20,790	27,697	28,987	32,850	31,558	-3.9	8,902	7,984
Mississippi	172,478	172,543	170,271	176,807	181,414	2.6	31,825	31,385
Missouri	75	90	92	100	108	8.0	27	26
Montana	33,418	33,901	29,955	30,026	25,188	-16.1	2,253	1,965
Nebraska	15,258	15,743	14,880	13,051	11,155	-14.5	2,454	1,707
New Mexico	798,928	789,662	804,612	808,377	878,720	8.7	96,197	101,932
New York	4,990	5,742	4,262	3,962	3,125	-21.1	1,169	963
North Dakota	19,483	20,100	25,155	32,798	34,700	5.8	6,264	7,634
Ohio	36,074	36,423	36,747	36,817	37,309	1.3	8,909	8,880
Oklahoma	824,266	892,697	1,060,717	1,233,883	1,323,390	7.3	160,405	166,747
Pennsylvania	113,928	100,427	90,053	92,657	82,166	-11.3	24,091	22,349
Tennessee	63	71	75	90	77	-14.4	17	15
Texas	5,892,704	5,963,605	6,080,210	6,205,034	6,525,649	5.2	775,629	809,180
Utah	51,040	57,175	74,128	77,122	80,175	4.0	14,036	10,904
Virginia	2,227	2,466	2,499	2,085	1,609	-22.8	488	479
West Virginia	208,757	210,556	210,698	210,223	203,872	-3.0	55,919	50,968
Wyoming	181,610	194,674	204,996	209,060	232,878	11.4	29,687	29,808
Total	12,771,038	13,254,025	13,876,622	14,746,663	15,546,592	5.4	2,328,030	2,387,689

<sup>1</sup> Comprises gas either sold or consumed by producers, including gas loss due to natural gas liquids recovery, losses in transmission, quantities added to storage, and increases of gas in pipelines.

TABLE 5.—Natural gas stored underground in and withdrawn from storage fields

(Million cubic feet)

State	1963			1964		
	Total stored	Total withdrawn	Net stored	Total stored	Total withdrawn	Net stored
Arkansas.....	71,728	1,037	691	1,552	920	632
California.....	73,556	46,768	26,788	72,878	61,916	10,962
Colorado.....	2,220	851	1,369	3,837	2,530	1,307
Delaware.....	401	329	72	440	390	50
Illinois.....	69,954	57,078	12,876	49,403	31,926	17,477
Indiana.....	22,516	12,841	9,675	23,420	11,997	11,423
Iowa.....	33,777	25,379	8,398	39,811	27,720	12,091
Kansas.....	40,791	40,353	438	42,753	38,719	4,034
Kentucky.....	18,863	19,000	-137	19,428	15,856	3,572
Michigan.....	153,008	128,651	24,357	170,967	154,488	16,479
Mississippi.....	3,567	3,467	100	4,569	3,994	575
Missouri.....	10,093	7,179	2,914	7,156	5,207	1,949
Montana.....	18,529	5,594	12,935	17,083	5,691	11,392
Nebraska.....	457	716	-259	5,147	2,036	3,111
New Jersey.....				798	1,103	-305
New Mexico.....	5,414	7,354	-1,940	6,574	5,073	1,501
New York.....	43,223	42,297	926	38,624	33,617	5,007
Ohio.....	138,757	127,029	11,728	131,615	123,677	7,938
Oklahoma.....	30,435	26,067	4,368	21,971	22,611	-640
Pennsylvania.....	195,513	194,890	623	197,684	180,313	17,371
Texas.....	26,313	25,244	1,069	29,505	25,114	4,391
Utah.....	1,284	1,088	196	644	577	67
Virginia.....						
West Virginia.....	154,297	140,325	13,972	126,478	125,755	723
Wyoming.....	2,796	3,167	-371	2,477	4,077	-1,600
Total.....	1,047,492	916,720	130,772	1,014,814	885,307	129,507

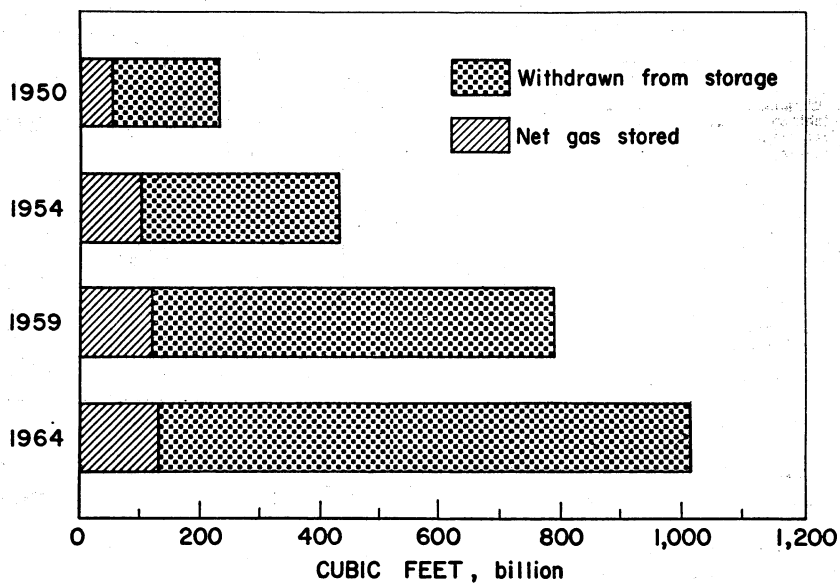


FIGURE 5.—Trends in net gas stored underground in U.S. storage fields, 1950-64.

Underground storage areas for the U.S. gas industries increased to 286 pools, involving 11,566 wells with a total reservoir capacity of 3.9 trillion cubic feet (table 6). These former dry gas productive reservoirs serve as giant banks from which gas can be withdrawn during cold weather and deposited as storage in summer. Capital investments for storage sites totaled more than \$1.2 billion. Gas storage in water sands (aquifers) is rapidly developing, and approximately 11 percent of the storage pools were of this type—representing about 6 percent of the total storage capacity.

As shown in the American Gas Association 1964 report (table 6), Pennsylvania is the leading storage State—having 693 billion cubic feet of capacity. Michigan, Ohio, West Virginia, California, Illinois, and Oklahoma are within the top seven storage States and contain approximately three-quarters of the gas storage. Devonian, Mississippian, and Pennsylvanian age geologic formations are the predominant storage reservoirs in use. Effective December 31, 1964, 2.3 trillion cubic feet of gas excluding native gas was in storage, utilizing about 59 percent of the available storage capacity.

TABLE 6.—Underground storage statistics, December 31, 1964  
(Million cubic feet—14.73 psi at 60° F)

State	Number of pools	Number of active wells	Total gas in storage reservoirs (million cubic feet)	Total reservoir capacity (million cubic feet)
Arkansas.....	6	25	16, 069	23, 753
California.....	6	143	130, 650	281, 950
Colorado.....	2	18	4, 197	7, 937
Illinois.....	13	541	134, 433	280, 245
Indiana.....	19	591	42, 220	53, 429
Iowa.....	5	154	109, 033	154, 876
Kansas.....	16	742	79, 406	103, 368
Kentucky.....	14	457	31, 534	48, 380
Louisiana.....	1	3	212	1, 000
Michigan.....	25	1, 707	260, 686	530, 462
Mississippi.....	2	27	6, 047	6, 916
Missouri.....	2	59	24, 636	70, 000
Montana.....	5	136	69, 522	155, 457
Nebraska.....	1	7	2, 319	39, 270
New Mexico.....	3	35	5, 699	57, 802
New York.....	15	722	87, 238	108, 430
Ohio.....	17	2, 600	320, 181	480, 951
Oklahoma.....	10	99	117, 213	253, 201
Pennsylvania.....	69	2, 104	492, 438	692, 709
Texas.....	13	111	58, 248	92, 326
Utah.....	1	9	852	918
Washington.....	1	14	384	20, 000
West Virginia.....	38	1, 253	306, 073	416, 066
Wyoming.....	2	9	13, 600	62, 628
Total.....	286	11, 566	2, 312, 890	3, 942, 074

Source: American Gas Association.

The producing gas and condensate wells in the United States at yearend was 103,084 (table 7). Texas, West Virginia, and Pennsylvania are the leading States in gas wells and condensate wells containing more than 63 percent of the 1963 wells and 53 percent in 1964. The increase in total producing gas wells is the result of deeper development drilling to meet the increased gas demand.

TABLE 7.—Gas wells and condensate wells in the United States

State	Completed during 1963 <sup>1</sup>	Producing Dec. 31, 1963	Completed during 1964 <sup>1</sup>	Producing Dec. 31, 1964
Alabama.....		2		
Alaska.....	5	10	2	13
Arizona.....	2	7	6	10
Arkansas.....	43	490	48	515
California.....	118	879	123	950
Colorado.....	93	501	70	560
Illinois.....	12	25	17	25
Indiana.....	8	285	2	280
Kansas.....	227	7,050	219	7,174
Kentucky.....	167	5,210	194	5,320
Louisiana.....	614	7,859	538	8,260
Maryland.....		33		16
Michigan.....	84	175	53	195
Mississippi.....	22	450	18	435
Missouri.....		6		6
Montana.....	15	905	16	869
Nebraska.....	1	44	2	41
New Mexico.....	281	7,150	340	7,306
New York.....	22	1,130	45	1,155
North Dakota.....		31		31
Ohio.....	217	7,128	288	7,160
Oklahoma.....	430	6,639	464	6,813
Pennsylvania.....	220	16,600	358	14,120
Tennessee.....		30		30
Texas.....	1,308	22,016	1,328	22,995
Utah.....	21	135	19	135
Virginia.....	2	98	2	100
West Virginia.....	791	17,500	652	17,960
Wyoming.....	53	578	51	610
Total.....	4,756	102,966	4,855	103,084

<sup>1</sup> Source: Oil and Gas Journal.

## CONSUMPTION

Consumption of natural gas has a predominant concentration in areas favoring certain types of industries. The primary reason for such market concentration is determined by availability of pipelines for transportation from source areas. Markets are increased as pipelines expand.

More than one-fifth of marketed natural gas in the Nation was consumed in Texas (table 8). The second ranking State in gas consumption was California, having 1.74 trillion cubic feet of gas. The large gas consumption in Texas, is attributed to the substantial volume used within the State in oil and gas fields, plant operation, and petroleum refineries.

Total gas consumption represented 99.9 percent of the total marketed production with the remainder in storage, exported, or lost in transmission. Louisiana and Texas led the Nation in the quantity of interstate gas shipments (table 8).

TABLE 8.—Marketed production, interstate shipments, and total consumption of natural gas in the United States<sup>1</sup>

(Million cubic feet)

State by region or country	Marketed production		Interstate movements		Transmission loss and unaccounted for	Change in underground storage	Consumption
	Quantity	Average value at wellhead (cents per Mcf)	Quantity shipped	Quantity received			
<b>New England:</b>							
Connecticut.....				37,650	148		37,502
Massachusetts.....				107,104	405		106,699
New Hampshire.....				4,086	273		3,813
Rhode Island.....				15,621	156		15,465
Total:							
1964.....				164,461	982		163,479
1963.....				153,893	2,316		151,577
<b>Middle Atlantic:</b>							
New Jersey.....				209,874	10,070	-305	200,109
New York.....	3,125	30.8	741	531,118	14,667	5,007	513,828
Pennsylvania.....	82,166	27.2	65,445	637,494	29,567	17,371	607,277
Total:							
1964.....	85,291	27.3	66,186	1,378,486	54,304	22,073	1,321,214
1963.....	96,619	26.1	118,613	1,353,150	48,990	1,549	1,280,617
<b>East North Central:</b>							
Illinois.....	7,867	11.5	3,265	747,384	2,588	17,477	731,921
Indiana.....	200	23.5	3,299	349,648	1,408	11,423	333,718
Michigan.....	31,558	25.3		493,665	8,116	16,479	500,628
Ohio.....	37,309	23.8	437	800,126	4,949	7,938	824,111
Wisconsin.....				174,296	4,094		170,202
Total:							
1964.....	76,934	23.2	7,001	2,565,119	21,155	53,317	2,560,580
1963.....	79,412	24.0	1,382	2,423,305	73,031	58,636	2,369,668
<b>West North Central:</b>							
Iowa.....				254,253	-1,472	12,091	243,634
Kansas.....	763,246	12.5	502,160	183,971	12,594	4,034	433,429
Minnesota.....				237,116	140		236,976
Missouri.....	108	24.3		330,864	3,829	1,949	325,194
Nebraska.....	11,155	15.3		155,651	-529	3,111	164,224
North Dakota.....	34,700	22.0	11,108	3,100	460		26,232
South Dakota.....				27,477	-162		27,639
Total:							
1964.....	814,209	12.9	513,288	1,192,432	14,860	21,185	1,457,328
1963.....	778,895	13.6	676,270	1,269,409	33,598	11,491	1,326,945
<b>South Atlantic:</b>							
Delaware.....				17,508	367	50	17,091
District of Columbia.....				20,721	88		20,633
Florida.....	40	13.3		186,898	1,689		185,249
Georgia.....				207,643	952		206,691
Maryland.....	1,381	26.5	223	87,521	1,866		86,813
North Carolina.....				70,654	2,121		68,533
South Carolina.....				82,015	3,299		78,716
Virginia.....	1,609	29.8	1,605	91,683	2,615		89,072
West Virginia.....	203,872	25.0	144,760	133,052	8,926	723	132,515
Total:							
1964.....	206,902	25.0	146,588	897,695	21,923	773	935,313
1963.....	213,976	26.6	232,687	950,605	24,589	14,028	893,277
<b>East South Atlantic:</b>							
Alabama.....	166	11.1	6	220,626	-1,261		222,047
Kentucky.....	77,360	23.6	55,666	172,282	4,624	3,572	185,780
Mississippi.....	181,414	17.3	130,624	208,137	6,329	575	252,023
Tennessee.....	77	19.0		188,392	6,993		181,476
Total:							
1964.....	259,017	19.2	186,296	789,437	16,685	4,147	841,326
1963.....	251,708	19.7	200,745	739,718	12,425	-37	778,293

See footnotes at end of table.

TABLE 8.—Marketed production, interstate shipments, and total consumption of natural gas in the United States—Continued

State by region or country	Marketed production		Interstate movements		Transmission loss and unaccounted for	Change in underground storage	Consumption
	Quantity	Average value at wellhead (cents per Mcf)	Quantity shipped	Quantity received			
<b>West South Central:</b>							
Arkansas.....	76,167	15.5	5,685	222,647	18,826	632	273,671
Louisiana.....	4,175,412	19.0	3,242,590	220,734	14,370	-----	1,139,186
Oklahoma.....	1,323,390	12.6	728,459	17,333	14,273	-640	598,631
Texas.....	6,525,649	12.4	3,180,381	96,634	60,418	4,391	3,377,093
<b>Total:</b>							
1964.....	12,100,618	14.7	7,157,115	557,348	107,887	4,383	5,388,581
1963.....	11,443,445	15.1	6,657,636	544,111	100,110	6,128	5,223,682
<b>Mountain:</b>							
Arizona.....	2,025	11.9	1,230	163,645	1,871	-----	162,570
Colorado.....	114,312	11.8	52,254	176,923	1,349	1,307	236,325
Idaho.....	-----	-----	-----	29,259	-1,566	-----	30,825
Montana.....	25,188	7.8	1,887	58,019	2,276	11,392	67,652
Nevada.....	-----	-----	-----	24,004	76	-----	23,928
New Mexico.....	878,720	11.6	650,481	47,147	16,712	1,501	257,173
Utah.....	80,175	13.6	28,098	73,232	5,617	67	119,625
Wyoming.....	232,878	12.8	174,008	7,509	420	-1,600	67,559
<b>Total:</b>							
1964.....	1,333,298	11.9	907,958	579,739	26,755	12,667	965,657
1963.....	1,231,624	12.6	795,788	539,975	35,725	12,189	927,897
<b>Pacific:</b>							
Alaska.....	6,272	27.4	-----	-----	491	-----	5,781
California.....	664,051	29.9	-----	1,130,068	45,816	10,962	1,737,341
Oregon.....	-----	-----	-----	52,699	-1,285	-----	53,984
Washington.....	-----	-----	-----	100,651	-5,138	-----	105,789
<b>Total:</b>							
1964.....	670,323	29.9	-----	1,283,418	39,884	10,962	1,902,895
1963.....	650,984	29.3	-----	1,098,202	33,874	26,788	1,688,524
<b>Total United States:</b>							
1964.....	15,546,592	15.4	8,984,412	9,408,135	304,435	129,507	15,536,373
1963.....	14,746,663	15.8	8,683,121	9,072,368	364,658	130,772	14,640,480
<b>Foreign:</b>							
Canada.....	-----	-----	390,721	9,763	-----	-----	-----
Mexico.....	-----	-----	52,605	9,840	-----	-----	-----
<b>Grand total movements:<sup>1</sup></b>							
1964.....	-----	-----	9,427,738	9,427,738	-----	-----	-----
1963.....	-----	-----	9,089,325	9,089,325	-----	-----	-----

<sup>1</sup> No shipments were made into Maine, Vermont, and Hawaii.

<sup>2</sup> Includes total Foreign shipments of 406,204 million cubic feet.

<sup>3</sup> Includes total Foreign receipts of 16,957 million cubic feet.

TABLE 9.—Natural gas moving interstate, imports, and exports

(Million cubic feet)

State by region or country	Quantity received	Producing region								
		Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Moun- tain	Canada	Mex- ico
<b>New England:</b>										
Connecticut.....	37,650	173	40	-----	11	796	35,438	-----	-----	1,192
Massachusetts.....	107,104	443	103	-----	28	2,042	101,432	-----	-----	3,056
New Hampshire.....	4,086	-----	-----	-----	-----	-----	4,086	-----	-----	-----
Rhode Island.....	15,621	92	21	-----	6	423	14,448	-----	-----	631
<b>Total.....</b>	<b>164,461</b>	<b>708</b>	<b>164</b>	-----	<b>45</b>	<b>3,261</b>	<b>155,404</b>	-----	-----	<b>4,879</b>
<b>Middle Atlantic:</b>										
New Jersey.....	209,874	455	351	-----	109	2,856	201,958	-----	-----	4,145
New York.....	531,118	51,662	192	-----	9,068	5,110	457,032	-----	2,078	5,976
Pennsylvania.....	637,494	1,168	1,064	4	49,366	14,657	555,703	-----	-----	15,532
<b>Total.....</b>	<b>1,378,486</b>	<b>53,285</b>	<b>1,607</b>	4	<b>58,543</b>	<b>22,623</b>	<b>1,214,693</b>	-----	<b>2,078</b>	<b>25,653</b>
<b>East North Central:</b>										
Illinois.....	747,384	-----	101	32,464	-----	133	712,769	1,005	297	615
Indiana.....	349,648	-----	2,605	29,568	-----	1,226	315,319	58	-----	872
Michigan.....	493,665	-----	-----	41,286	-----	662	451,046	199	205	267
Ohio.....	800,126	11,734	2,074	27,824	64,288	32,439	649,087	53	-----	12,627
Wisconsin.....	174,296	-----	117	10,069	-----	-----	97,824	1,694	64,588	4
<b>Total.....</b>	<b>2,565,119</b>	<b>11,734</b>	<b>4,897</b>	<b>141,211</b>	<b>64,288</b>	<b>34,460</b>	<b>2,226,045</b>	<b>3,009</b>	<b>65,090</b>	<b>14,385</b>
<b>West North Central:</b>										
Iowa.....	254,253	-----	-----	53,427	-----	-----	191,745	9,051	-----	30
Kansas.....	183,971	-----	-----	3	-----	-----	181,179	2,777	-----	12
Minnesota.....	237,116	-----	-----	71,990	-----	-----	149,203	12,200	3,682	41
Missouri.....	330,864	-----	165	103,396	-----	14	226,500	29	-----	760
Nebraska.....	155,651	-----	-----	65,045	-----	-----	68,783	21,806	-----	17
North Dakota.....	3,100	-----	-----	140	-----	-----	-----	366	2,594	-----
South Dakota.....	27,477	-----	-----	8,021	-----	-----	11,634	7,818	-----	4
<b>Total.....</b>	<b>1,192,432</b>	-----	<b>165</b>	<b>302,022</b>	-----	<b>14</b>	<b>829,044</b>	<b>54,047</b>	<b>6,276</b>	<b>864</b>
<b>South Atlantic:</b>										
Delaware.....	17,508	3	-----	-----	-----	38	17,465	-----	-----	2
District of Columbia.....	20,721	17	17	-----	2,457	1,441	16,780	-----	-----	9
Florida.....	186,898	-----	-----	-----	-----	9,850	177,043	-----	-----	5
Georgia.....	207,643	-----	-----	-----	-----	36,081	171,555	-----	-----	7
Maryland.....	87,521	137	69	-----	9,515	5,833	71,899	-----	-----	68
North Carolina.....	70,654	-----	-----	-----	-----	-----	70,643	-----	-----	11
South Carolina.....	82,015	-----	-----	-----	-----	10,385	71,626	-----	-----	4
Virginia.....	91,683	-----	64	12	9,384	5,714	76,498	-----	-----	11
West Virginia.....	133,052	302	14	2	1,480	7,291	123,894	-----	-----	69
<b>Total.....</b>	<b>897,695</b>	<b>459</b>	<b>164</b>	<b>14</b>	<b>22,836</b>	<b>76,633</b>	<b>797,403</b>	-----	-----	<b>186</b>
<b>East South Central:</b>										
Alabama.....	220,626	-----	-----	-----	-----	35,601	184,656	-----	-----	369
Kentucky.....	172,282	-----	4	1	876	537	169,701	-----	-----	1,163
Mississippi.....	208,137	-----	-----	-----	-----	175	207,231	-----	-----	731
Tennessee.....	188,392	-----	-----	-----	-----	210	187,123	-----	-----	1,059
<b>Total.....</b>	<b>789,437</b>	-----	<b>4</b>	<b>1</b>	<b>876</b>	<b>36,523</b>	<b>748,711</b>	-----	-----	<b>3,322</b>
<b>West South Central:</b>										
Arkansas.....	222,647	-----	-----	-----	-----	11	222,063	-----	-----	573
Louisiana.....	220,734	-----	-----	-----	-----	12,771	207,421	-----	-----	542
Oklahoma.....	17,333	-----	-----	817	-----	-----	16,328	188	-----	-----
Texas.....	96,634	-----	-----	8	-----	-----	71,535	22,890	-----	2,201
<b>Total.....</b>	<b>557,348</b>	-----	-----	<b>825</b>	-----	<b>12,782</b>	<b>517,347</b>	<b>23,078</b>	-----	<b>3,316</b>

TABLE 9.—Natural gas moving interstate, imports, and exports—Continued

State by region or country	Quantity received	Producing region								
		Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Moun- tain	Canada	Mex- ico
<b>Mountain:</b>										
Arizona.....	163,646						66,701	96,945		
Colorado.....	176,923			58,309			66,314	52,300		
Idaho.....	29,259							28,912	347	
Montana.....	58,019			8,531				21,974	27,514	
Nevada.....	24,004						8,237	15,757	10	
New Mexico.....	47,147			1			44,015	3,131		
Utah.....	73,232							73,232		
Wyoming.....	7,509			943			1,834	4,732		
<b>Total.....</b>	<b>579,739</b>			<b>67,784</b>			<b>187,101</b>	<b>296,983</b>	<b>27,871</b>	
<b>Pacific:</b>										
California.....	1,130,068			69			464,891	519,803	145,305	
Oregon.....	52,699							9,249	43,450	
Washington.....	100,651								100,651	
<b>Total.....</b>	<b>1,283,418</b>			<b>69</b>			<b>464,891</b>	<b>529,052</b>	<b>289,406</b>	
<b>Total United States.....</b>	<b>9,408,135</b>	<b>66,186</b>	<b>7,001</b>	<b>511,930</b>	<b>146,588</b>	<b>186,296</b>	<b>7,140,639</b>	<b>906,169</b>	<b>390,721</b>	<b>52,605</b>
<b>Foreign:</b>										
Canada.....	9,763			1,338			8,327	98		
Mexico.....	9,840						8,149	1,691		
<b>Total.....</b>	<b>19,603</b>			<b>1,338</b>			<b>16,476</b>	<b>1,789</b>		
<b>Grand total.....</b>	<b>9,427,738</b>	<b>66,186</b>	<b>7,001</b>	<b>513,268</b>	<b>146,588</b>	<b>186,296</b>	<b>7,157,115</b>	<b>907,958</b>	<b>390,721</b>	<b>52,605</b>



TABLE 10.—Consumption of natural gas in the United States<sup>1</sup>

State by region	Quantity (million cubic feet)					Change from 1963 (percent)	Estimated value at point of consumption	
	1960	1961	1962	1963	1964		1963	1964
<b>New England:</b>								
Connecticut.....	28,453	30,361	32,227	34,809	37,502	7.7	55,209	58,721
Massachusetts.....	77,886	81,768	89,015	98,447	106,699	8.4	145,529	171,858
New Hampshire.....	2,852	3,018	3,315	3,596	3,813	6.0	5,949	5,906
Rhode Island.....	11,839	12,780	13,794	14,725	15,465	5.0	22,723	23,296
<b>Total.....</b>	<b>121,030</b>	<b>127,927</b>	<b>138,351</b>	<b>151,577</b>	<b>163,479</b>	<b>7.9</b>	<b>229,410</b>	<b>259,781</b>
<b>Middle Atlantic:</b>								
New Jersey.....	139,258	153,806	174,210	188,249	200,109	6.3	258,879	267,581
New York.....	419,460	435,417	474,384	506,942	513,828	1.4	559,543	573,371
Pennsylvania.....	520,788	529,716	550,080	585,426	607,277	3.7	467,638	500,545
<b>Total.....</b>	<b>1,079,506</b>	<b>1,118,939</b>	<b>1,198,674</b>	<b>1,280,617</b>	<b>1,321,214</b>	<b>3.2</b>	<b>1,286,060</b>	<b>1,341,497</b>
<b>East North Central:</b>								
Illinois.....	536,549	574,346	620,309	658,432	731,921	11.2	509,572	535,676
Indiana.....	212,851	239,932	272,309	297,897	333,718	12.0	192,725	205,336
Michigan.....	368,531	407,732	443,677	463,667	500,628	8.0	381,533	405,434
Ohio.....	698,569	719,674	756,398	797,318	824,111	3.4	568,000	583,823
Wisconsin.....	90,620	113,679	136,516	152,354	170,202	11.7	136,589	142,038
<b>Total.....</b>	<b>1,907,120</b>	<b>2,055,363</b>	<b>2,229,209</b>	<b>2,369,668</b>	<b>2,560,580</b>	<b>8.1</b>	<b>1,788,419</b>	<b>1,872,307</b>
<b>West North Central:</b>								
Iowa.....	187,138	204,663	213,552	219,005	243,634	11.2	124,253	134,115
Kansas.....	372,302	364,957	380,055	387,880	433,429	11.7	119,191	134,923
Minnesota.....	179,827	192,584	214,130	219,047	236,976	8.2	137,400	151,638
Missouri.....	261,372	274,487	289,482	303,075	325,194	7.3	169,147	187,653
Nebraska.....	139,028	143,169	146,043	149,014	164,224	10.2	69,135	76,634
North Dakota.....	17,274	19,625	22,196	23,765	26,232	10.4	9,662	10,841
South Dakota.....	24,533	25,820	27,413	25,159	27,639	9.9	15,518	17,019
<b>Total.....</b>	<b>1,181,474</b>	<b>1,225,305</b>	<b>1,292,871</b>	<b>1,326,945</b>	<b>1,457,328</b>	<b>9.8</b>	<b>644,306</b>	<b>712,823</b>
<b>South Atlantic:</b>								
Delaware.....	9,035	9,380	14,492	16,378	17,091	4.4	14,971	15,413
District of Columbia.....	18,142	18,518	19,338	19,359	20,633	6.6	28,731	28,942
Florida.....	137,875	143,656	157,735	177,496	185,249	4.4	90,122	100,795
Georgia.....	182,087	179,957	192,638	187,600	206,691	10.2	120,080	129,673
Maryland.....	64,923	68,390	76,551	81,774	86,813	6.2	106,554	110,755
North Carolina.....	45,442	50,523	56,373	62,296	68,533	10.0	46,415	52,609
South Carolina.....	58,532	60,928	70,645	75,099	78,716	4.8	45,184	49,121
Virginia.....	66,181	70,579	77,254	83,011	89,072	7.3	85,575	85,566
West Virginia.....	179,969	192,221	188,602	190,264	182,515	-4.1	103,684	101,841
<b>Total.....</b>	<b>762,186</b>	<b>794,152</b>	<b>853,628</b>	<b>893,277</b>	<b>935,313</b>	<b>4.7</b>	<b>641,316</b>	<b>674,715</b>
<b>East South Central:</b>								
Alabama.....	184,118	184,909	194,369	205,763	222,047	7.9	112,688	118,395
Kentucky.....	159,710	161,912	168,138	175,928	185,780	5.6	97,858	101,346
Mississippi.....	188,864	190,930	199,733	227,184	252,023	10.9	76,305	84,398
Tennessee.....	155,623	160,667	167,737	169,418	181,476	7.1	89,045	87,787
<b>Total.....</b>	<b>688,315</b>	<b>698,418</b>	<b>729,977</b>	<b>778,293</b>	<b>841,326</b>	<b>8.1</b>	<b>375,896</b>	<b>391,926</b>
<b>West South Central:</b>								
Arkansas.....	216,516	209,420	224,744	251,129	273,671	9.0	82,409	92,576
Louisiana.....	947,938	1,036,887	1,007,041	1,070,471	1,139,186	6.4	268,358	271,333
Oklahoma.....	383,042	378,096	485,726	588,245	598,631	1.8	151,723	153,227
Texas.....	2,981,167	3,030,914	3,209,968	3,313,837	3,377,093	1.9	707,973	766,425
<b>Total.....</b>	<b>4,528,663</b>	<b>4,655,317</b>	<b>4,927,479</b>	<b>5,223,682</b>	<b>5,388,581</b>	<b>3.2</b>	<b>1,210,463</b>	<b>1,283,561</b>

See footnote at end of table.

TABLE 10.—Consumption of natural gas in the United States<sup>1</sup>—Continued

State by region	Quantity (million cubic feet)					Change from 1963 (percent)	Estimated value at point of consumption	
	1960	1961	1962	1963	1964		1963	1964
<b>Mountain:</b>								
Arizona.....	135,494	153,674	157,892	157,494	162,570	3.2	77,744	74,450
Colorado.....	207,646	212,611	204,940	207,663	236,325	13.8	81,611	99,219
Idaho.....	22,006	23,969	25,806	26,635	30,825	15.7	15,868	18,807
Montana.....	54,569	57,781	63,298	67,337	67,652	0.5	27,786	30,944
Nevada.....	12,447	15,864	17,528	19,292	23,928	24.0	14,279	15,556
New Mexico.....	266,409	288,455	292,495	275,969	257,173	-6.8	66,645	64,176
Utah.....	75,650	81,879	92,890	103,628	119,625	15.4	44,716	50,027
Wyoming.....	59,635	61,451	67,336	69,879	67,559	-3.3	15,994	17,822
<b>Total.....</b>	<b>833,856</b>	<b>895,684</b>	<b>922,185</b>	<b>927,897</b>	<b>965,657</b>	<b>4.1</b>	<b>344,643</b>	<b>371,001</b>
<b>Pacific:</b>								
Alaska.....	229	557	2,137	4,214	5,781	37.2	3,128	4,120
California.....	1,311,253	1,405,882	1,476,322	1,554,126	1,737,341	11.8	887,674	1,003,699
Oregon.....	30,861	33,827	37,865	43,350	53,984	24.5	31,912	39,373
Washington.....	64,934	70,343	81,431	86,834	105,789	21.8	53,769	65,585
<b>Total.....</b>	<b>1,407,277</b>	<b>1,510,609</b>	<b>1,597,755</b>	<b>1,688,524</b>	<b>1,902,895</b>	<b>12.7</b>	<b>976,483</b>	<b>1,112,777</b>
<b>Total United States.....</b>	<b>12,509,427</b>	<b>13,081,714</b>	<b>13,890,129</b>	<b>14,640,480</b>	<b>15,536,373</b>	<b>6.1</b>	<b>7,496,996</b>	<b>8,020,388</b>

<sup>1</sup> Includes volume of natural gas which is distributed as a component of mixed gas.

**Industrial Use.**—Gas consumed in the United States is given by principal use in figure 6 and table 11. The most gas consumption was for industrial use, 66.8 percent of the total. For industrial use, gas consumption is that generally described as "Other industrial—including electric utilities used," which consumed 6.9 trillion cubic feet (table 11).

Most of the subclassification for "other industrial" involves a wide variety of industrial uses, such as chemical and allied products, iron and steel, stone, clay, and glass, food and kindred products, paper and allied products, and nonferrous metals and their products. In 1964, the cement industry consumed 202 billion cubic feet of gas. Natural gas consumed for utility electric generation is consumed in the major gas-producing areas.

Field use ranked second for industrial gas consumption, 2.1 trillion cubic feet (fig. 6, table 11), 13.5 percent of the entire U.S. consumption. This includes gas used in oil and gas well drilling, pumping, shrinkage from natural gas processing plants, and gas consumed in operating natural gas extraction plants. Also included is gas consumed in artificial gaslift operations, that is, gas pumped into the casing of oil wells to aerate the oil column to assist ascent of the oil to the surface.

Natural gas used in the petroleum-refining industry, ranked third in industrial natural gas consumption. Refineries are often located near or adjacent to oil and gas fields, therefore, it is natural for them to turn to this source of fuel. Gas consumption within petroleum refineries has increased from 123 billion cubic feet in 1927 following World War I to more than 825 billion, an increase of 5.5 percent per year. The increase is the result of the greater availability of gas in the refinery area and in the increased number of refineries.

Natural gas consumption as a pipeline fuel continued on an increasing trend to 436 billion cubic feet (table 11). Among natural gas industrial consumers, carbon black plants—107 billion cubic feet (fig. 11)—were the smallest users, but ranked second before 1949. Since 1949, carbon black production has followed a decreasing trend because of increases in prices of natural gas from distress levels and development of oil furnace black which now appears to be a complete replacement for channel black. Oil feedstocks have an economic edge over gas furnace blacks and will capture more of the future carbon black market.

**Residential and Commercial.**—Both the residential and commercial classifications of natural gas consumption given in figure 6 and table 11 involve less concentrated markets than the industrial use, and in 1964 they included more than 37 million consumers.

The classifications of gas consumption indicate service to the comfort, heat, and power energy markets and show sensitive consideration of population, urbanization, and increased size of establishments. In 1964, increases in househeating and gas-air-conditioning markets insured continuation of the 14-year increased trend in home use of gas. Approximately 80 percent of all new U.S. dwellings used gas for heating, in contrast to 70 percent in 1950. Effective December 31, 1964, about 1.8 million tons of cooling capacity of gas-air-conditioning equipment was utilized, 20 percent more than the previous year. Of

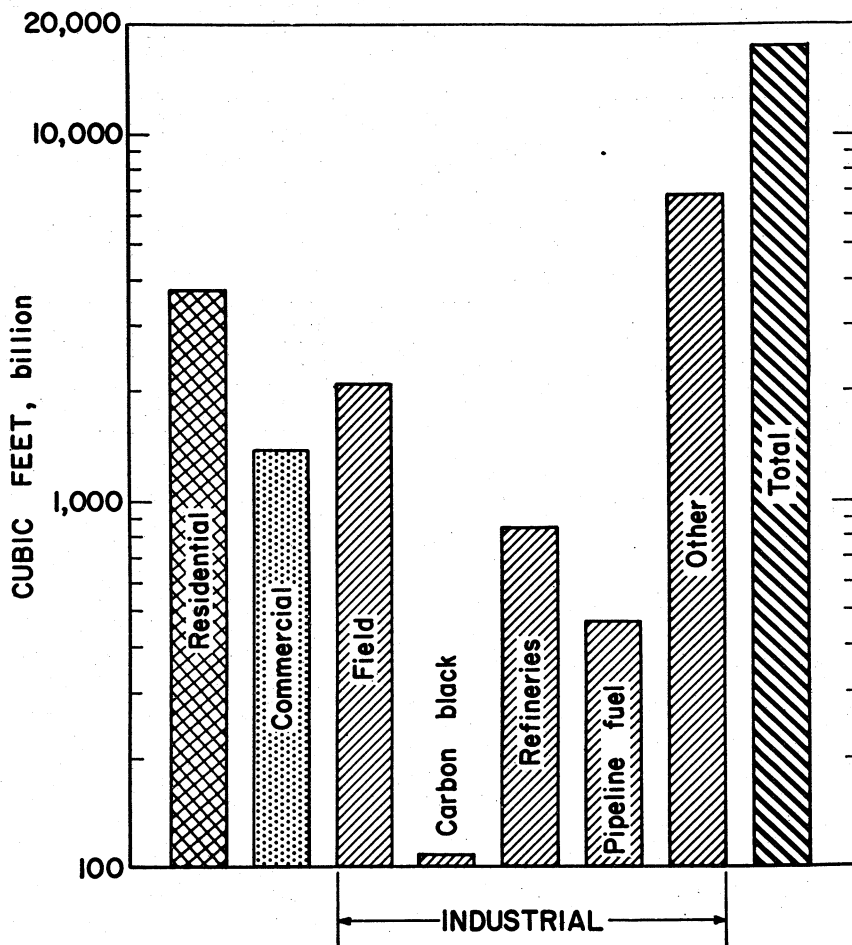


FIGURE 6.—Disposition of the natural gas consumed in United States by principal use, billion cubic feet.

this capacity, 15 percent was for residential use and the remainder for commercial and industrial consumption.

About 24.4 percent of the end-use gas consumption was by residential customers, and 8.8 percent by commercial customers (table 11). Within the East North Central States (table 11) were contained the largest number of customers. Consequently the greatest volume of gas was consumed within both residential and commercial classifications.

**Imports and Exports.**—Imports of 443.3 billion cubic feet of gas (table 8) from Canada and Mexico reflected a 9 percent increase from 1963, compared with a 5.4 percent growth in marketed production. Exports of natural gas to Canada and Mexico totaled 19.6 billion cubic feet, compared to 17 billion in 1963.

TABLE 11.—Number of consumers and volume of natural gas consumed by principal uses in the United States<sup>1</sup>

State by region	Number of consumers (thousands)		Volume of natural gas, million cubic feet							Total consumption	Consumed at electric utilities (included in other industrial use) <sup>2</sup>	
	Residential	Commercial	Residential	Commercial	Industrial							
					Field (pumping, drilling, extraction loss, and plant fuel)	Carbon black	Petroleum refineries	Used as pipeline fuel	All other fuel including electric utilities			Total industrial
<b>New England:</b>												
Connecticut.....	352	24	20,777	6,157				103	10,465	10,568	37,502	396
Massachusetts.....	959	60	61,671	14,795				194	30,039	30,233	106,699	13,128
New Hampshire.....	34	2	2,515	719					579	579	3,813	
Rhode Island.....	146	7	8,580	2,115				101	4,669	4,770	15,465	438
<b>Total.....</b>	<b>1,491</b>	<b>93</b>	<b>93,543</b>	<b>23,786</b>				<b>398</b>	<b>45,752</b>	<b>46,150</b>	<b>163,479</b>	<b>13,962</b>
<b>Middle Atlantic:</b>												
New Jersey.....	1,495	107	106,911	21,373				496	71,329	71,825	200,109	28,033
New York.....	3,774	278	269,594	81,142	433			2,799	159,860	163,092	513,828	77,410
Pennsylvania.....	2,088	135	251,708	64,688	1,087		28,092	18,254	243,448	290,881	607,277	4,681
<b>Total.....</b>	<b>7,357</b>	<b>520</b>	<b>628,213</b>	<b>167,203</b>	<b>1,520</b>		<b>28,092</b>	<b>21,549</b>	<b>474,637</b>	<b>525,798</b>	<b>1,321,214</b>	<b>110,124</b>
<b>East North Central:</b>												
Illinois.....	2,429	153	314,930	102,291	16,592			12,193	268,943	314,700	731,921	50,504
Indiana.....	844	77	108,011	37,521	33		9,712	8,181	170,260	188,186	333,718	14,637
Michigan.....	1,667	133	250,971	74,367	4,698		2,109	4,595	163,888	175,290	500,628	2,383
Ohio.....	2,254	175	402,014	120,872	1,885		10,165	10,279	278,896	301,225	824,111	2,991
Wisconsin.....	619	44	68,463	19,233			( <sup>3</sup> )	1,313	<sup>2</sup> 81,143	82,456	170,202	9,458
<b>Total.....</b>	<b>7,813</b>	<b>582</b>	<b>1,144,389</b>	<b>354,334</b>	<b>23,208</b>		<b>38,958</b>	<b>36,561</b>	<b>963,130</b>	<b>1,061,857</b>	<b>2,560,580</b>	<b>79,973</b>
<b>West North Central:</b>												
Iowa.....	518	64	71,753	36,327				10,004	125,550	135,554	243,634	57,457
Kansas.....	563	51	86,049	37,412	49,179		30,018	30,787	199,984	309,968	433,429	113,824
Minnesota.....	573	47	79,015	24,286			( <sup>3</sup> )	1,009	<sup>2</sup> 132,666	133,675	236,976	53,112
Missouri.....	850	69	123,857	46,763				8,452	146,132	154,684	325,194	46,824
Nebraska.....	334	46	45,107	24,187	4,662		( <sup>3</sup> )	8,218	<sup>2</sup> 82,050	94,930	164,224	37,540
North Dakota.....	41	5	5,542	4,221	13,432			2	3,035	16,469	26,282	20
South Dakota.....	66	9	9,311	8,493				44	9,791	9,835	27,639	4,161
<b>Total.....</b>	<b>2,945</b>	<b>291</b>	<b>420,634</b>	<b>181,679</b>	<b>67,273</b>		<b>30,018</b>	<b>58,516</b>	<b>699,208</b>	<b>855,015</b>	<b>1,457,328</b>	<b>312,938</b>
<b>South Atlantic:</b>												
Delaware.....	68	4	5,255	1,092			( <sup>3</sup> )		<sup>2</sup> 10,744	10,744	17,091	3,852
District of Columbia.....	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )					( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	

Florida.....	315	25	11,356	18,144	3,368		2,431	149,950	155,749	185,249	92,394
Georgia.....	635	50	69,942	26,693		( <sup>3</sup> )	4,606	<sup>3</sup> 105,450	110,056	206,691	2,619
Maryland.....	737	68	65,543	16,626	10		1,166	24,101	25,277	107,446	58
North Carolina.....	163	24	13,995	6,633			4,151	43,754	47,905	68,533	2,212
South Carolina.....	198	19	11,577	6,273			2,032	58,834	60,866	78,716	18,613
Virginia.....	388	43	34,399	13,438	47		6,560	34,628	41,235	89,072	1,828
West Virginia.....	331	30	51,841	14,952	21,439			79,873	115,722	182,515	887
<b>Total.....</b>	<b>2,835</b>	<b>253</b>	<b>263,908</b>	<b>103,851</b>	<b>24,864</b>	<b>582</b>	<b>34,774</b>	<b>507,334</b>	<b>567,554</b>	<b>935,313</b>	<b>122,463</b>
<b>East South Central:</b>											
Alabama.....	548	42	51,351	34,343	141	2,010	11,398	122,804	136,353	222,047	4,164
Kentucky.....	436	44	66,252	20,935	13,030	( <sup>3</sup> )	25,315	<sup>3</sup> 60,248	98,593	185,780	1,139
Mississippi.....	286	36	26,802	20,912	20,276	4,078	39,439	140,516	204,309	282,023	50,486
Tennessee.....	371	45	36,569	28,212			18,924	97,771	116,695	181,476	6,853
<b>Total.....</b>	<b>1,641</b>	<b>167</b>	<b>180,974</b>	<b>104,402</b>	<b>33,447</b>	<b>6,088</b>	<b>95,076</b>	<b>421,339</b>	<b>555,950</b>	<b>841,326</b>	<b>62,642</b>
<b>West South Central:</b>											
Arkansas.....	346	49	41,296	23,918	7,990	10,757	11,388	178,322	208,457	273,671	64,419
Louisiana.....	739	62	70,658	26,313	230,435	21,642	108,539	43,073	1,042,215	1,139,186	158,804
Oklahoma.....	589	64	67,439	29,219	167,376	46,090	8,086	280,421	501,973	598,631	122,529
Texas.....	2,245	237	193,093	81,850	1,208,747	65,438	442,586	66,254	1,319,625	3,102,650	3,377,093
<b>Total.....</b>	<b>3,919</b>	<b>412</b>	<b>372,486</b>	<b>160,800</b>	<b>1,614,548</b>	<b>87,080</b>	<b>607,972</b>	<b>128,801</b>	<b>2,416,894</b>	<b>4,855,295</b>	<b>5,388,581</b>
<b>Mountain:</b>											
Arizona.....	337	34	28,329	22,741	171		17,358	93,971	111,500	162,570	49,429
Colorado.....	419	56	65,952	38,463	10,968	1,682	1,290	117,970	131,910	236,325	37,635
Idaho.....	42	8	4,787	4,080		4,025	631	17,322	21,978	30,825	
Montana.....	121	20	18,895	13,131	5,322		1,290	29,014	35,626	67,652	2,450
Nevada.....	44	2	3,682	1,948			103	18,195	18,298	23,928	12,242
New Mexico.....	182	27	22,372	12,462	<sup>3</sup> 118,814	( <sup>3</sup> )	1,835	19,816	81,874	222,339	257,173
Utah.....	192	25	32,869	16,681	14,633	6,650	297	49,495	71,075	119,625	4,009
Wyoming.....	65	9	10,183	8,647	26,126	10,715	1,389	10,499	48,729	67,559	158
<b>Total.....</b>	<b>1,402</b>	<b>181</b>	<b>187,049</b>	<b>117,153</b>	<b><sup>3</sup> 176,034</b>	<b>(<sup>3</sup>)</b>	<b>24,907</b>	<b>42,174</b>	<b>418,340</b>	<b>661,455</b>	<b>965,657</b>
<b>Pacific:</b>											
Alaska.....	5	1	1,045	1,925	1,031			1,780	2,811	5,781	1,598
California.....	4,887	341	466,607	141,963	<sup>3</sup> 171,154	( <sup>3</sup> )	75,298	16,592	865,727	1,128,771	1,737,341
Oregon.....	125	17	11,172	5,315			473	37,024	37,497	53,984	321
Washington.....	155	26	17,272	12,306			656	75,555	76,211	105,789	
<b>Total.....</b>	<b>5,172</b>	<b>385</b>	<b>496,096</b>	<b>161,509</b>	<b><sup>3</sup> 172,185</b>	<b>(<sup>3</sup>)</b>	<b>75,298</b>	<b>17,721</b>	<b>980,086</b>	<b>1,245,290</b>	<b>1,902,895</b>
<b>Total United States:</b>											
1964.....	34,575	2,884	3,787,292	1,374,717	<sup>3</sup> 2,093,400	<sup>3</sup> 106,759	<sup>3</sup> 825,473	435,570	<sup>3</sup> 6,913,162	10,374,364	15,536,373
1963.....	33,451	2,788	3,589,021	1,267,783	2,081,339	117,378	789,951	423,783	6,371,225	9,783,676	14,640,480

<sup>1</sup> Includes natural gas which is distributed as component of mixed gas.

<sup>2</sup> Federal Power Commission, preliminary figures.

<sup>3</sup> 13,558 million cubic feet included in "Other industrial fuel", to avoid disclosure; included in U.S. "Refinery fuel" total.

<sup>4</sup> Included with Maryland to avoid disclosure.

<sup>5</sup> 19 679 million cubic feet included in "Field" to avoid disclosure; included in U.S. "Carbon black" total.

TABLE 12.—Value of natural gas at the point of consumption in the United States

State by region	Value (thousand dollars)						Average value (cents per Mcf)							
	Residential	Commercial	Industrial			Total consumption	Residential	Commercial	Industrial			Total consumption		
			Field (pumping, drilling, extraction loss and plant fuel)	Carbon black	All other, including electric utilities				Total industrial	Field	Carbon black		All other, including electric utilities	Total
<b>New England:</b>														
Connecticut.....	39,258	9,190			10,273	10,273	58,721	188.9	149.3			97.2	97.2	156.6
Massachusetts.....	120,152	24,787			26,919	26,919	171,858	194.8	167.5			89.0	89.0	161.1
New Hampshire.....	4,294	1,119			493	493	5,906	170.7	155.6			85.1	85.1	154.9
Rhode Island.....	16,428	3,184			3,684	3,684	23,296	191.5	150.5			77.2	77.2	150.6
<b>Total.....</b>	<b>180,132</b>	<b>38,280</b>			<b>41,369</b>	<b>41,369</b>	<b>259,781</b>	<b>192.6</b>	<b>160.9</b>			<b>89.6</b>	<b>89.6</b>	<b>158.9</b>
<b>Middle Atlantic:</b>														
New Jersey.....	207,107	26,531			33,943	33,943	267,581	193.7	124.1			47.3	47.3	133.7
New York.....	380,063	100,835	234		92,239	92,473	573,371	141.0	124.3	54.0		56.7	56.7	111.6
Pennsylvania.....	292,578	57,805	461		149,701	150,162	500,545	116.2	89.4	42.4		51.7	51.6	82.4
<b>Total.....</b>	<b>879,748</b>	<b>185,171</b>	<b>695</b>		<b>275,883</b>	<b>276,578</b>	<b>1,341,497</b>	<b>140.0</b>	<b>110.7</b>	<b>45.7</b>		<b>52.6</b>	<b>52.6</b>	<b>101.5</b>
<b>East North Central:</b>														
Illinois.....	334,673	78,098	1,910		120,995	122,005	535,676	106.3	76.3	11.5		40.6	39.1	73.2
Indiana.....	102,528	31,617	5		71,186	71,191	205,336	94.9	84.3	15.1		37.8	37.8	61.5
Michigan.....	249,281	63,988	1,530		90,635	92,165	405,434	99.3	86.0	32.6		53.1	52.6	81.0
Ohio.....	331,497	89,988	678		161,660	162,338	583,823	82.5	74.4	36.0		54.0	53.9	70.8
Wisconsin.....	82,077	19,157			40,804	40,804	142,038	119.9	99.3			49.5	49.5	83.5
<b>Total.....</b>	<b>1,100,056</b>	<b>282,848</b>	<b>4,123</b>		<b>485,280</b>	<b>489,403</b>	<b>1,872,307</b>	<b>96.1</b>	<b>79.8</b>	<b>17.8</b>		<b>46.7</b>	<b>46.1</b>	<b>73.1</b>
<b>West North Central:</b>														
Iowa.....	67,396	24,715			42,004	42,004	134,115	93.9	68.0			31.0	31.0	55.0
Kansas.....	49,263	15,393	6,200		64,067	70,267	134,923	57.2	41.1	12.6		24.6	22.7	31.1
Minnesota.....	85,574	19,925			46,139	46,139	151,638	108.3	82.0			34.5	34.5	64.0
Missouri.....	104,085	36,458			47,110	47,110	187,653	84.0	78.0			30.5	30.5	57.7
Nebraska.....	37,006	13,652	569		25,407	25,976	76,634	82.0	56.4	12.2		28.1	27.3	46.7
North Dakota.....	4,955	2,619	2,010		1,257	3,267	10,841	89.4	62.0	15.0		41.4	19.8	41.3
South Dakota.....	8,909	4,949			3,161	3,161	17,019	95.6	58.3			32.1	32.1	61.6
<b>Total.....</b>	<b>357,188</b>	<b>117,711</b>	<b>8,779</b>		<b>229,145</b>	<b>237,924</b>	<b>712,823</b>	<b>84.9</b>	<b>64.8</b>	<b>13.0</b>		<b>29.1</b>	<b>27.8</b>	<b>48.9</b>

Delaware.....	8,848	1,529		5,036	5,036	15,413	168.4	140.0				46.9	46.9	90.2
District of Columbia.....	(1)	(1)		(1)	(1)	(1)	(1)	(1)				(1)	(1)	(1)
Florida.....	30,331	21,208	674	48,582	49,256	100,795	287.1	116.9	20.0			31.9	31.6	54.4
Georgia.....	72,018	18,683		38,872	38,872	129,673	103.0	70.0				35.4	35.4	62.7
Maryland.....	98,397	21,813	5	19,482	19,487	139,697	150.1	131.2	50.0			80.8	77.1	130.0
North Carolina.....	20,254	8,018		24,337	24,337	52,609	144.7	120.9				50.8	50.8	76.8
South Carolina.....	16,588	6,582		25,951	25,951	49,121	143.3	104.9				42.6	42.6	62.4
Virginia.....	50,954	15,176	21	19,415	19,436	85,566	148.1	112.9	44.7			47.1	47.1	96.1
West Virginia.....	43,314	10,330	5,977	42,220	48,197	101,841	83.6	69.1	27.9			44.8	41.6	55.8
<b>Total.....</b>	<b>340,704</b>	<b>103,339</b>	<b>6,677</b>	<b>223,995</b>	<b>230,672</b>	<b>674,715</b>	<b>129.1</b>	<b>99.5</b>	<b>26.9</b>			<b>41.3</b>	<b>40.6</b>	<b>72.1</b>
<b>East South Central:</b>														
Alabama.....	57,890	18,751	53	41,701	41,754	118,395	112.7	54.6	37.6			30.6	30.6	53.3
Kentucky.....	53,266	14,144	2,461	31,475	33,936	101,346	80.4	67.6	18.9			36.8	34.4	54.6
Mississippi.....	22,615	10,316	3,654	47,913	51,567	84,398	84.0	49.3	18.0			26.0	25.2	33.5
Tennessee.....	33,599	19,754		34,434	34,434	87,787	91.9	70.0				29.5	29.5	48.4
<b>Total.....</b>	<b>167,270</b>	<b>62,965</b>	<b>6,168</b>	<b>155,523</b>	<b>161,691</b>	<b>391,926</b>	<b>92.4</b>	<b>60.3</b>	<b>18.4</b>			<b>29.8</b>	<b>29.1</b>	<b>46.6</b>
<b>West South Central:</b>														
Arkansas.....	30,317	12,524	1,077	48,658	49,735	92,576	73.4	52.4	13.5			24.3	23.9	33.8
Louisiana.....	48,841	11,010	39,891	3,314	168,277	211,482	271,333	69.1	41.8	15.3		21.3	20.3	23.8
Oklahoma.....	48,951	14,658	17,939	71,679	89,618	153,227	72.6	50.2	10.7			21.4	17.9	25.6
Texas.....	162,307	45,604	182,748	7,948	367,818	558,514	766,425	84.1	56.1	15.1	12.1	20.1	18.0	22.7
<b>Total.....</b>	<b>290,416</b>	<b>83,796</b>	<b>241,655</b>	<b>11,262</b>	<b>656,432</b>	<b>909,349</b>	<b>1,283,561</b>	<b>78.0</b>	<b>52.1</b>	<b>15.0</b>	<b>13.3</b>	<b>20.8</b>	<b>18.7</b>	<b>23.8</b>
<b>Mountain:</b>														
Arizona.....	26,659	12,173	22	35,596	35,618	74,450	94.1	53.5	12.9			32.0	31.9	45.8
Colorado.....	47,178	21,434	1,231	29,376	30,607	99,219	71.5	55.7	11.2			24.3	23.2	42.0
Idaho.....	6,085	3,886		8,836	8,836	18,807	127.6	95.2				40.2	40.2	61.0
Montana.....	14,420	6,995	347	9,182	9,529	30,944	76.3	53.3	6.5			30.3	26.7	45.7
Nevada.....	5,524	1,885		8,147	8,147	15,556	150.0	96.8				44.5	44.5	65.0
New Mexico.....	20,463	5,841	<sup>2</sup> 13,040	<sup>(2)</sup>	24,832	37,872	64,176	91.5	46.9	<sup>2</sup> 11.0	<sup>(2)</sup>	24.0	17.0	25.0
Utah.....	23,158	8,674	2,023	16,172	18,195	50,027	70.5	55.3	13.8			28.7	25.6	41.8
Wyoming.....	6,664	3,723	2,588	4,847	7,435	17,822	65.4	43.1	9.9			21.4	15.3	26.4
<b>Total.....</b>	<b>150,151</b>	<b>64,611</b>	<b><sup>2</sup> 19,251</b>	<b><sup>(2)</sup></b>	<b>136,988</b>	<b>156,239</b>	<b>371,001</b>	<b>80.3</b>	<b>55.2</b>	<b><sup>2</sup> 10.9</b>	<b><sup>(2)</sup></b>	<b>28.2</b>	<b>23.6</b>	<b>38.4</b>
<b>Pacific:</b>														
Alaska.....	1,322	1,806	282	710	992	4,120	126.5	93.8	27.4			39.9	35.3	71.3
California.....	483,083	97,103	<sup>2</sup> 51,219	<sup>(2)</sup>	372,294	423,513	1,003,699	103.5	68.4	<sup>2</sup> 29.9	<sup>(2)</sup>	38.9	37.5	57.8
Oregon.....	16,780	7,461		15,132	15,132	39,373	150.2	140.4				40.4	40.4	72.9
Washington.....	23,614	14,159		27,812	27,812	65,585	136.7	115.1				36.5	36.5	62.0
<b>Total.....</b>	<b>524,799</b>	<b>120,529</b>	<b><sup>2</sup> 51,501</b>	<b><sup>(2)</sup></b>	<b>415,948</b>	<b>467,449</b>	<b>1,112,777</b>	<b>105.8</b>	<b>74.6</b>	<b><sup>2</sup> 29.9</b>	<b><sup>(2)</sup></b>	<b>38.8</b>	<b>37.5</b>	<b>58.5</b>
<b>Total:</b>														
1964.....	3,990,464	1,059,250	<sup>2</sup> 335,869	<sup>2</sup> 14,242	2,620,563	2,970,674	8,020,388	105.4	77.1	<sup>2</sup> 16.0	<sup>2</sup> 13.3	32.1	28.6	51.6
1963.....	3,749,881	995,912	294,655	14,912	2,441,636	2,751,203	7,496,996	104.5	78.6	14.2	12.7	32.2	28.1	51.2

<sup>1</sup> Included with Maryland to avoid disclosure.

<sup>2</sup> \$2,980,000 in value included in "Field" to avoid disclosure; included in "Carbon black" U.S. total.



**Value and Price.**—The average value of natural gas at point of consumption was residential, \$1.05; commercial, \$0.77; and industrial, \$0.29 per Mcf (tables 12 and 13). The average value for total gas consumption was \$0.51 per Mcf, essentially the same as in 1963.

For the first time in the history of this series, all wellhead values of natural gas (tables 1, 8, and 13) exclude all taxes to reflect the actual value of the gas at wellhead. Tax values deducted from wellhead prices amounted to \$49.2 million; 90 percent came from reported data in the West South Central States. Consequently, the average value at wellhead shown (table 8) for this region appears to have decreased from 15.1 cents per Mcf in 1963 to 14.7 cents. This difference resulted from the change in basis of calculation and does not reflect a regional price variation.

**TABLE 13.—Average value of natural gas in the United States**  
(Cents per thousand cubic feet)

State	At wells (estimated)		At point of consumption		State	At wells (estimated)		At point of consumption	
	1963	1964	1963	1964		1963	1964	1963	1964
Alabama	11.8	11.1	54.8	53.3	Nebraska	18.8	15.3	46.4	46.7
Alaska	24.7	27.4	74.2	71.3	Nevada			74.0	65.0
Arizona	12.1	11.9	49.4	45.8	New Hampshire			165.4	154.9
Arkansas	15.5	15.5	32.8	33.8	New Jersey			137.5	133.7
California	29.3	29.9	57.1	57.8	New Mexico	11.9	11.6	24.1	25.0
Colorado	11.7	11.8	39.3	42.0	New York	29.5	30.8	110.4	111.6
Connecticut			158.6	156.6	North Carolina			74.5	76.8
Delaware			91.4	90.2	North Dakota	19.1	22.0	40.7	41.3
District of Columbia			148.4	140.3	Ohio	24.2	23.8	71.2	70.8
Florida	20.0	13.3	50.8	54.4	Oklahoma	13.0	12.6	25.8	25.6
Georgia			64.0	62.7	Oregon			73.6	72.9
Idaho			59.6	61.0	Pennsylvania	26.0	27.2	79.9	82.4
Illinois	12.9	11.5	77.4	73.2	Rhode Island			154.3	150.6
Indiana	23.4	23.5	64.7	61.5	South Carolina			60.2	62.4
Iowa			56.7	55.0	South Dakota			61.7	61.6
Kansas	13.3	12.5	30.7	31.1	Tennessee	18.9	19.0	52.6	48.4
Kentucky	23.9	23.6	55.6	54.6	Texas	12.5	12.4	21.4	22.7
Louisiana	19.8	19.0	25.1	23.8	Utah	18.2	13.6	43.2	41.8
Maryland	26.9	26.5	130.3	127.6	Virginia	23.4	29.8	103.1	96.1
Massachusetts			147.8	161.1	Washington			61.9	62.0
Michigan	27.1	25.3	82.3	81.0	West Virginia	26.6	25.0	54.5	55.8
Minnesota			62.7	64.0	Wisconsin			89.7	83.5
Mississippi	18.0	17.3	33.6	33.5	Wyoming	14.2	12.8	22.9	26.4
Missouri	27.0	24.3	55.8	57.7					
Montana	7.5	7.8	41.3	45.7	Total	15.8	15.4	51.2	51.6

Approximately 13.2 trillion cubic feet of natural gas (table 14) was processed in plants. During the 1960-64 period the quantity of gas processed has had a growth rate of 8.0 percent per year. Effective December 31, 1964, the operating capacity for gas-processing plants exceeded 65 million gallons per day, 9 percent more than the 1962 capacity. If present processing trends continue, refrigerated absorption plants may capture the largest share of future capacity.

TABLE 14.—Natural gas processed at natural gas processing plants in the United States

(Million cubic feet)

State	1960	1961	1962	1963	1964
Arkansas.....	120,943	112,490	121,911	132,535	127,862
California.....	548,406	553,734	539,594	549,077	532,250
Colorado.....	84,322	96,177	83,643	121,043	117,910
Illinois <sup>1</sup> .....	194,679	198,964	197,180	199,877	196,907
Kansas.....	451,676	508,213	592,035	687,331	804,129
Kentucky <sup>1 2</sup> .....	273,558	295,314	329,137	293,450	408,859
Louisiana.....	1,491,078	1,694,071	2,015,188	2,646,572	2,844,739
Michigan.....	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )
Mississippi.....	131,369	108,156	95,486	60,459	82,775
Montana <sup>3</sup> .....	41,480	55,850	53,890	50,986	52,955
Nebraska.....	<sup>4</sup> 41,663	<sup>4</sup> 40,388	<sup>4</sup> 34,837	10,667	10,393
New Mexico.....	662,479	655,602	732,421	696,880	726,370
North Dakota.....	( <sup>4</sup> )	( <sup>4</sup> )	( <sup>4</sup> )	32,854	32,364
Oklahoma.....	760,743	798,653	880,422	878,755	899,926
Pennsylvania.....	2,639	2,612	2,555	3,127	2,149
Texas.....	4,578,023	4,771,916	4,997,825	5,665,071	5,888,150
Utah.....	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )	( <sup>3</sup> )
West Virginia <sup>1</sup> .....	214,372	209,753	<sup>5</sup> 241,136	<sup>5</sup> 209,324	331,656
Wyoming.....	170,159	149,776	171,981	157,345	188,697
Total.....	9,768,189	10,261,669	11,089,241	12,430,353	13,248,091

<sup>1</sup> Includes gas from transmission lines, previously treated in other States.<sup>2</sup> Michigan included in Kentucky.<sup>3</sup> Utah included in Montana.<sup>4</sup> North Dakota included in Nebraska.<sup>5</sup> Florida included in West Virginia.

## WORLD PRODUCTION

The United States, U.S.S.R., Canada, and Rumania were the leading countries in world marketed production of natural gas (fig. 7, table 15). The 1960-64 growth shown in figure 7 is presented on logarithmic scale. Asia was not included in the comparison because 1964 data were not available. Nigeria and Algeria are the important countries in marketed production of natural gas in Africa.

TABLE 15.—Marketed production of natural gas by countries<sup>1</sup> at 60° F (15.56° C) and normal atmospheric pressure<sup>2</sup>

(Million cubic feet)

Country <sup>1</sup>	1960	1961	1962	1963	1964 <sup>p</sup>
<b>North America:</b>					
Barbados.....	88	109	120	128	94
Canada.....	522,972	655,738	946,909	1,117,425	1,363,814
Mexico <sup>3</sup> .....	360,691	381,027	392,420	424,366	NA
Trinidad.....	27,042	29,375	30,018	29,693	42,114
United States.....	12,771,038	13,254,025	13,876,622	14,746,663	15,546,592
<b>South America:</b>					
Argentina.....	51,607	88,673	111,852	120,400	148,500
Brazil <sup>4</sup> .....	19,962	19,663	19,082	18,806	19,844
Chile <sup>3</sup> .....	81,873	95,120	132,844	192,402	235,166
Colombia.....	15,077	15,562	22,093	26,199	NA
Peru.....	29,558	33,710	35,151	37,353	45,134
Venezuela.....	190,033	200,184	214,254	230,190	250,902
<b>Europe:</b>					
Austria.....	54,830	58,073	61,013	63,406	65,827
Czechoslovakia.....	161,633	167,977	187,533	199,961	NA
France.....	106,199	151,951	176,886	195,012	194,363
Germany, West.....	16,709	17,960	23,007	34,148	54,368
Hungary <sup>5</sup> .....	12,750	12,078	12,692	22,834	29,250
Italy.....	240,610	256,116	266,860	271,227	286,778
Netherlands.....	13,435	18,212	20,713	48,066	11,731
Poland.....	20,205	26,956	29,531	35,275	45,930
Rumania.....	243,804	268,603	329,805	376,970	426,073
U.S.S.R.....	1,754,040	2,272,788	2,806,464	3,414,780	4,105,349
United Kingdom.....	35	106	115	NA	NA
Yugoslavia.....	1,976	2,566	3,557	7,131	10,224
<b>Asia:</b>					
Brunei.....	3,043	3,005	2,990	2,377	NA
Burma <sup>3</sup> .....	784	560	672	597	NA
India.....	5,201	NA	NA	NA	NA
Indonesia <sup>3</sup> .....	90,725	95,577	101,212	104,421	NA
Iran.....	33,558	104,221	107,161	108,511	NA
Iraq.....	22,504	23,773	NA	NA	NA
Israel.....	1,203	106	396	367	1,069
Japan <sup>3</sup> .....	27,297	35,464	45,122	63,243	69,368
Pakistan.....	29,842	34,665	42,076	49,459	59,100
Taiwan.....	949	1,383	1,433	1,890	6,322
<b>Africa:</b>					
Algeria (Sahara).....	NA	8,615	13,189	14,715	30,182
Gabon, Republic of.....	278	249	328	321	353
Morocco.....	352	299	278	372	436
Nigeria.....	<sup>5</sup> 4,949	<sup>5</sup> 13,802	<sup>5</sup> 18,159	NA	36,333
Tunisia.....	252	259	262	272	293
Oceania: New Zealand.....	<sup>5</sup>	<sup>5</sup>	<sup>4</sup>	<sup>3</sup>	<sup>5</sup>

<sup>p</sup> Preliminary.

<sup>e</sup> Estimate.

NA. Not available.

<sup>1</sup> Natural gas is produced in China, but there is no recent information available.

<sup>2</sup> Table incorporates some revisions.

<sup>3</sup> Total production.

<sup>4</sup> Deliveries for sale.

<sup>5</sup> Year ended March 31 of year following that stated.

NOTE.—Data relate, as far as possible, to natural gas actually collected and utilized as fuel or raw material. They exclude gas used for repressuring, as well as gas flared, vented, or otherwise wasted, whether or not it has first been processed for the extraction of natural gasoline.

For countries reporting in the metric system, the following conversion factor will be used:

$$\text{m}^3 \text{ at } 32^\circ \text{ F } (0^\circ \text{ C}) \times 37.32 = \text{ft}^3 \text{ at } 60^\circ \text{ F}$$

$$(\text{ft}^3 \text{ at } 60^\circ \text{ F} \times 0.026795 = \text{m}^3 \text{ at } 32^\circ \text{ F})$$

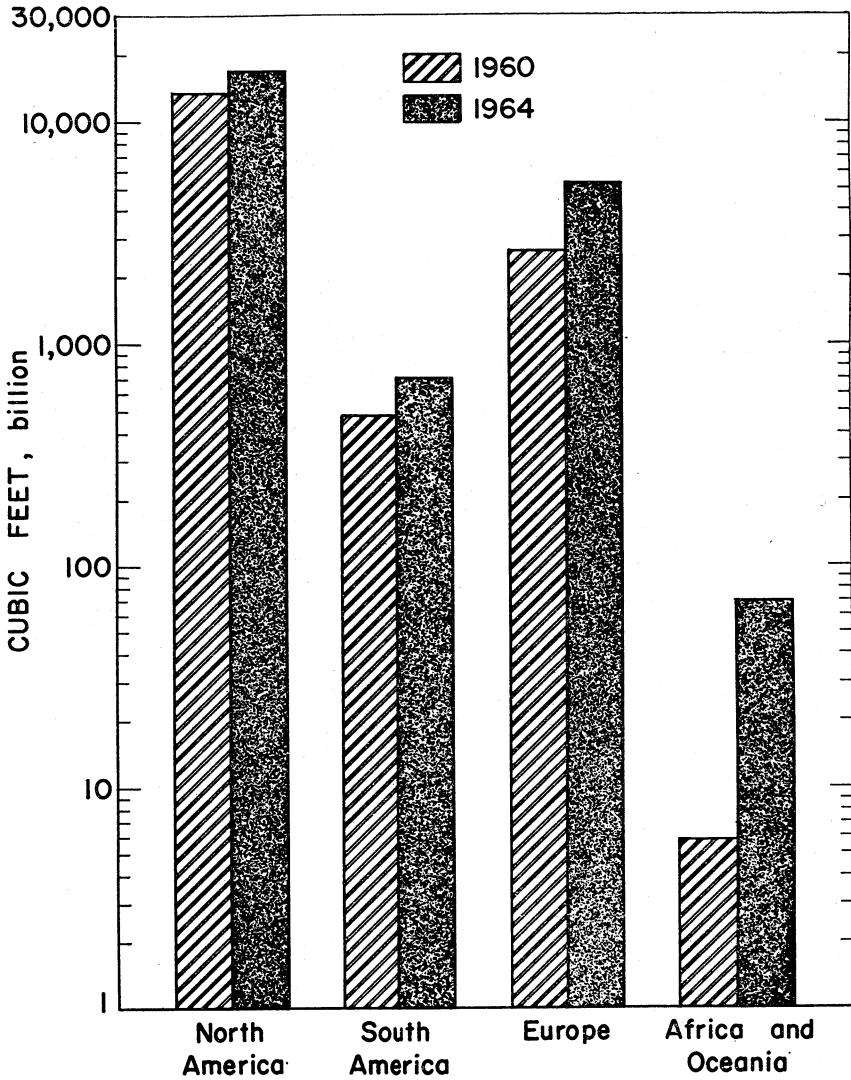


FIGURE 7.—World marketed production of natural gas, 1960-64.

## WORLD REVIEW

Requirements of natural gas and other energy in Europe increased and are expected to continue to grow at a steady and healthy rate. Rapidly expanding demand for gas and the consequent change in the pattern of the European energy market will ensure continued and expanded use of natural gas. Development of the Groningen gasfields in the Netherlands, the North Sea potential, and the feasibility of importing gas provide the impetus for the future for natural gas in the European market as a supplement to other mineral fuels.

These natural gas developments plus new discoveries in France, Netherlands, Italy, and Austria gradually will provide most of the gas for long-term growth in rate of fuel consumption in Europe.

World interests in natural gas were focused on the 1957 gas discovery in the Groningen gasfield in the Netherlands. This field contains an estimated reserve of 39 trillion cubic feet of gas, nearly three times the energy of all the present proved oil reserves in Free Europe and 40 times the present Netherlands total yearly consumption. Through forceful development of the natural gas pipeline system of the Netherlands, gas from Groningen began moving into the energy markets in 1964. Eventually it will be extended to nearby areas of Europe. These Groningen gas reserves have been the main stimulus in extensive preliminary gas-exploratory work in the North Sea areas.

## TECHNOLOGY

**Cryogenics.**—A new and dominating technique, cryogenics, is the basis for some of the recent industry advancements in technology. Previously, cryogenics was used largely in manufacturing gases such as oxygen, nitrogen, and carbon dioxide. Its application in natural gas was principally for separation and purification of helium at extremely low temperatures. The cryogenics technology has been refined and experience is being gained for using LNG from above-ground and underground storage systems to meet a small portion of off-peak demands in a few locations at promising economic costs.

**Liquefied Natural Gas (LNG) Storage.**—The first commercial cryogenic inground natural gas storage in the United States was completed by Transcontinental Gas Pipeline Co. late in 1964 near Carlstadt, N.J. The \$12 million natural gas storage facility is capable of receiving 11.5 million cubic feet per day of gas during the off-season months and of delivering 200 million cubic feet of gas during peak demand periods. The installation is located adjacent to the 30- and 36-inch-interstate-transmission pipeline terminal of the company, in the center of a densely populated area. Accessibility to the main transmission line and large consumption markets give it an added advantage over distant underground storage. The gas will be sold to utility companies for winter peak-shaving purposes at \$2.20 per Mcf, about  $\frac{1}{2}$  to  $\frac{3}{4}$  the cost of using liquefied petroleum gas (LPG) for peak shaving.

**High Pressure Gas Storage.**—A natural gas distribution company completed an underground gas storage project in New Jersey, in which gas is stored in high-pressure containers made from 42-inch-diameter line pipe. This underground-storage facility, though of small ca-

capacity, will improve company economics by providing greater flexibility in operations, balancing daily requirements, and reducing pipeline storage service. Sixteen lengths of newly developed 42-inch, type-X-60 line pipe, each 1,080 feet long, will store 10 million cubic feet of gas at 980 psi.

**Cushion Gas in Underground Storage.**—The Bureau of Mines, continuing a 40-year program of cooperative research with the American Gas Association, has completed a feasibility study for using inert-gas cushions in underground natural gas storage. Use of gas storage in permeable underground formations is an increasing trend by the gas industry for augmenting gas-transmission volumes during peak-demand periods.

A fundamental requirement for such operations is an initial quantity (cushion) of compressed gas in storage to furnish the expulsive energy for removing gas (working gas) during withdrawal periods. In gas storage operations, cushion gas represents a large investment; consequently, use of a relatively inexpensive inert gas (nitrogen), if feasible, would be economically desirable.

Results of laboratory and field studies show that the use of an inert-gas cushion would be tedious and expensive, requiring precise monitoring and measurement of reservoir pressure, produced, and injected gas; also, cushion and working gases are subject to mixing.

**LNG Tankers.**—The first commercial cargo of Algerian LNG for Britain arrived in October. The S.S. *Methane Princess* carried the gas in liquid form from the liquefaction plant at Arzew, Algeria, for 1,500 miles to Canvey Island at a temperature of minus 258° F. The S.S. *Methane Progress*, a sister ship, has been placed in service; soon the two ships will make 60 round trips a year, supplying 10 percent of present yearly gas consumption of Britain. Within the next decade tankers are expected to move 330,000 barrels per day of liquefied methane, equivalent to about 2 billion cubic feet of gas daily.

**Plastics Pipe Used in the Gas Industry.**—In 1964, 78 gas companies installed more than 8 million feet of plastics pipe in new distribution systems and in reliner programs. Use of plastics pipe has increased in the last few years at more than 1,500 miles per year, and in 1964 plastic pipe in gas industry installations exceeded 6,000 miles. More than 100 million feet of plastic pipe was in use in rural natural gas distribution systems for domestic use, chiefly for irrigation power. Such distribution systems constructed of piping materials other than plastics would be too costly. The seasonal loads of these systems are high in summer and have aided the gas industry to offset winter-summer peak-load demands.

**Total Energy.**—A recently coined name "total energy" has been given to a system which from a single fuel source provides all the varied energy requirements of a consumer. This system as applied to natural gas is designed to heat, cool, light, and supply power for the facilities of commercial or industrial users. All of the energy is converted on the site by natural gas driven prime movers matched to the needs of the consumer.

Basically, the on-site generation package consists of reciprocating engines or turbines that drive alternators to generate electricity. Hot exhaust gases from the turbines are discharged into boilers to

provide energy for heating and absorption cooling. Hot water from the engine jackets also is utilized within the heating and cooling system.

It is estimated that total energy systems are operating in approximately 200 commercial, institutional, and industrial installations. If a prime mover of medium capacity has only the function of generating electricity, the cost to produce electricity is usually equal to utility company rates. When waste heat from engines is used for heating and cooling, savings in fuel costs result to the user.

**Automatic Gas Flow Control.**<sup>5</sup>—The increasing operating cost to produce natural gas and liquid hydrocarbons and to deliver them to pipelines has been a major concern of producing companies. One measure being taken to reduce costs is installation of fieldwide automatic-gas-flow control systems. A system in southern Louisiana controls production from 32 gas completions located in an inland water area accessible only by boat. The primary function of the system is to maintain field gas volumes adequate for the total demand of purchaser at all times. It will compensate automatically for wells going off production by increasing the flow rate of the individual producing completions in proportion to their capabilities. The master control point is capable of making changes either in rate of flow for the entire system or parts of it or in output of selective individual wells as may be needed. Field operators in attendance were reduced from a 24-hour-per-day, three-shift, four-man basis to an 8-hour-per-day, one-shift, two-man basis. Other savings and income-generating advantages resulted from the installation that will provide a 3-year payout of the \$120,000 investment.

**Improved Gas Well Completions.**<sup>6</sup>—A practical completion technique has been developed and field tested that involves control of the environmental conditions of fluids and pressure inside the well bore while making casing perforations in gas wells. Results show that the desired pressure condition at the time of perforating is a large differential between the formation and the well bore. Gas rather than liquid is the preferable fluid inside the casing. This method reduces plugging of the formation, which may occur when perforating with liquid at a high-hydrostatic pressure in the well bore. By a proper selection of pressure and fluid conditions in the well at the time of perforating, the efficiency of the completion may be improved considerably with an attendant increase in deliverability of gas from the formation to the well.

The high-pressure equipment required to perform these operations has been developed and is available. Tests have been conducted satisfactorily in wells having tubing pressures as high as 6,200 p.s.i. Gas wells have been successfully perforated by this method with as much as 4,000 p.s.i. differential in the well bore. Weights on top of the perforating guns prevent them from being blown uphole.

<sup>5</sup>Anderson, J. C. and McMillon, L. M. An Automatic Gas Flow Control System Adaptable to Gas Field Production. Pres. in New Orleans, La., AIME prepr. No. 642, October 6-9, 1963, 7 pp.

<sup>6</sup>White, B., T. Walker, and J. Diebold. A Proven Gas Well Completion Technique for Higher Deliverability. AIME, SPE, paper No. 1002, Houston, Texas, 1964, 12 pp.

# Natural Gas Liquids

By J. D. Lankford <sup>1</sup> and I. F. Avery <sup>2</sup>



## Contents

	<i>Page</i>		<i>Page</i>
General summary-----	353	Prices-----	368
Scope of report-----	353	Stocks-----	369
Districts-----	354	Storage-----	369
Reserves-----	356	Shipments of liquefied petroleum	
Production-----	357	gases and ethane-----	371
Natural gas processed, yield, and		Foreign trade-----	378
disposition of residue gas-----	359	Technology-----	379
Demand for natural gas liquids at			
processing plants and terminals-----	364		

## GENERAL SUMMARY

In the year 1964, production of natural gas liquids reached a record level of 17,744 million gallons, which exceeded 1963 production by 5.4 percent.

The output of all products included in the total was more than the 1963 level. A breakdown of the production in 1964 by products and the percentage increases over the level of the previous year are as follows: natural gasoline and isopentane, 5,287 million gallons, 7.9 percent; liquefied petroleum (LP) gases, 9,759 million gallons, 4.4 percent; ethane, 984 million gallons, 3.5 percent; and other finished products (including finished gasoline, naphtha, jet fuel, kerosene, distillate fuel oil, other miscellaneous products, and condensate) 1,713 million gallons, 4.7 percent.

The total value of the natural gas liquids at plants in 1964 was \$826,392,000. This was slightly higher than in 1963. The average value per gallon produced was the same as it was in 1963 (4.7 cents).

Shipments of liquefied gases and ethane for fuel and chemical uses totaled 12,473,258 thousand gallons in 1964, an increase of 8 percent for the year. Natural gas liquids used as blending material in motor fuel (excluding finished gasoline and naphtha) totaled 8,977 million gallons in 1964, compared with 8,375 million in 1963.

## SCOPE OF REPORT

Statistics on natural gas liquids are collected by the Bureau of Mines from reports submitted by natural gasoline plants, cycling plants, and fractionators that handle natural gas liquids. Information on pro-

<sup>1</sup> Chemical engineer, Division of Petroleum.

<sup>2</sup> Mineral specialist (petroleum), Division of Statistics.



duction, stocks, and distribution is obtained from monthly reports. Annual reports provide data on type of plant, production, value of production, and volume of gas processed. Reports submitted to the Bureau include all natural gas liquids except the small volume recovered at pipeline compressor stations and gas dehydration plants. Such recovery is considered to be of little significance in the national and State totals. Plant condensate is included in the category of natural gas liquids. Field condensate, however, is reported with crude oil and is excluded from the total for natural gas liquids. Liquid refinery (LR) gases and ethane produced at petroleum refineries are not natural gas liquids, but to obtain complete distribution information on liquefied gases, the sales data shown in this chapter cover the products of natural gasoline plants and petroleum refineries.

Data on shipments of LP gases are collected by the Bureau of Mines from annual reports received from all producers and distributors and from most of the dealers that sell more than 100,000 gallons of LP gases annually. The reported sample of dealer shipments is expanded by Petroleum Administration for Defense (PAD) districts on the basis of the domestic demand in the districts.

Data on shipments of LP gases used as fuels or chemicals include data on ethane and liquefied gas produced at natural gasoline plants and at petroleum refineries; they exclude, however, data on LP gases blended into motor fuel.

Liquefied gases and ethane, whether obtained from natural gas or from processing in refineries, are defined as follows:

**Ethane.**—Includes all ethane, ethylene, and mixtures containing more than 50 percent of either.

**Propane.**—Includes all products covered by Natural Gas Processors Association (NGPA) specifications for commercial propane.

**Butane-propane.**—Includes all products covered by NGPA specifications for commercial butane-propane mixtures.

**Butanes.**—Includes all products covered by NGPA specifications for commercial butane, except those that contain 60 percent or more isobutane.

**Isobutane.**—Includes all products covered by NGPA specifications for commercial butane that contain 60 percent or more isobutane.

**Other mixtures of liquefied petroleum gases.**—Includes mixtures that cannot be classified within the five classifications mentioned, such as mixtures containing less than 50 percent ethane but more than 50 percent propane and butane.

## DISTRICTS

The Bureau reports the production of natural gas liquids by States. Louisiana and Texas are also reported by districts.

Louisiana is divided into an Inland district and a Gulf Coast district. The Gulf Coast district includes Vernon, Rapides, Avoyelles, Pointe Coupee, West Feliciana, East Feliciana, Tangipahoa, St. Helena, and Washington Parishes (counties) and all parishes in the State south of these. All parishes not included in the Gulf Coast district are in the Inland district.

The Bureau of Mines producing districts in Texas correspond, with one exception, to groupings of the Texas Railroad Commission districts:

Bureau of Mines district :	<i>Railroad Commission district</i>
Gulf Coast-----	Nos. 2 and 3
West Texas-----	Nos. 7C and 8
East Proper-----	Part of No. 6 (east Texas field in Cherokee, Smith, Upshur, Rush, and Gregg Counties)
Panhandle-----	No. 10
Rest of State:	
North-----	Nos. 7B and 9
Central-----	No. 1
South-----	No. 4
Other East Texas-----	Nos. 5 and 6 (exclusive of East proper)

Refineries are also grouped by the Bureau of Mines into a set of refining districts. These refining districts may be combined to correspond with the grouping originated during World War II by the Petroleum Administration for War, called PAW districts (later changed to PAD districts).

PAD district :	<i>Refining district</i>
1-----	<i>East Coast</i> —District of Columbia, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, Florida, the following counties of New York: Cayuga, Tompkins, Chemung, and all counties east and north thereof, and the following counties of Pennsylvania: Bradford, Sullivan, Columbia, Montour, Northumberland, Dauphin, York, and all counties east thereof.
1-----	<i>Appalachian No. 1</i> —West Virginia and those parts of Pennsylvania and New York not included in the East Coast district.
2-----	<i>Appalachian No. 2</i> —The following counties of Ohio; Erie, Huron, Crawford, Marion, Delaware, Franklin, Pickaway, Ross, Pike, Scioto, and all counties east thereof.
2-----	<i>Indiana-Illinois-Kentucky</i> —Indiana, Illinois, Kentucky, Tennessee, Michigan, and that part of Ohio not included in the Appalachian district.
2-----	<i>Oklahoma-Kansas-Missouri</i> —Oklahoma, Kansas, Missouri, Nebraska, and Iowa.
2-----	<i>Minnesota-Wisconsin-North Dakota-South Dakota</i> —Minnesota, Wisconsin, North Dakota, and South Dakota.
3-----	<i>Texas Inland</i> —Texas, except Texas Gulf Coast district.
3-----	<i>Texas Gulf Coast</i> —The following counties of Texas: Newton, Orange, Jefferson, Jasper, Tyler, Hardin, Liberty, Chambers, Polk, San Jacinto, Montgomery, Harris, Galveston, Waller, Fort Bend, Brazoria, Wharton, Matagorda, Jackson, Victoria, Calhoun, Refugio, Aransas, San Patricio, Nueces, Kleberg, Kenedy, Willacy, and Cameron.
3-----	<i>Louisiana Gulf Coast</i> —The following parishes of Louisiana: Vernon, Rapides, Avoyelles, Pointe Coupee, West Feliciana, East Feliciana, Tangipahoa, St. Helena, Washington, and all parishes south thereof; the following counties of Mississippi; Pearl River, Stone, George Hancock, Harrison, and Jackson; and Mobile and Baldwin Counties, Alabama.
3-----	<i>North Louisiana-Arkansas</i> —Arkansas and those parts of Louisiana, Mississippi, and Alabama not included in the Louisiana Gulf Coast district.
3-----	<i>New Mexico</i> —New Mexico.
4-----	<i>Rocky Mountain</i> —Montana, Idaho, Wyoming, Utah, and Colorado.
5-----	<i>West Coast</i> —Washington, Oregon, California, Nevada, Alaska, Arizona, and Hawaii.

Some data in this chapter are based on the Bureau of Mines refining districts, while others refer to the PAD districts. Maps showing the PAD and Bureau of Mines refining districts appear in figure 2 of the "Petroleum" chapter of the Minerals Yearbook.

**TABLE 1.—Salient statistics of the natural gas processing industry in the United States, 1960–64**

(Thousands of gallons unless otherwise stated)

	1960	1961	1962	1963	1964
<b>Production:</b>					
Natural gasoline and isopentane.....	4, 479, 454	4, 666, 319	4, 772, 260	4, 899, 323	5, 286, 703
LP gases and ethane.....	8, 444, 074	9, 085, 465	9, 409, 083	10, 302, 250	10, 743, 591
Finished gasoline and naphtha.....	503, 659	473, 496	450, 991	499, 901	506, 505
Other finished products and condensate.....	859, 394	965, 648	1, 021, 271	1, 135, 743	1, 206, 973
<b>Total.....</b>	<b>14, 286, 581</b>	<b>15, 190, 928</b>	<b>15, 653, 605</b>	<b>16, 837, 217</b>	<b>17, 743, 772</b>
<b>Shipments for use in gasoline: 1</b>	<b>7, 019, 971</b>	<b>7, 493, 891</b>	<b>7, 788, 552</b>	<b>8, 375, 447</b>	<b>8, 976, 736</b>
Finished gasoline and naphtha.....	502, 401	479, 271	447, 312	499, 155	511, 034
Transfer to nongasoline uses (fuel and chemical):					
LP gases and ethane 2.....	6, 391, 217	6, 693, 573	7, 506, 776	7, 645, 055	7, 963, 990
Other finished products.....	212, 483	197, 823	171, 165	211, 558	230, 537
<b>Stocks at plants, terminals, and refineries:</b>					
Natural gasoline.....	197, 559	198, 608	174, 835	168, 228	183, 023
LP gases and ethane.....	946, 758	1, 294, 090	1, 057, 295	1, 166, 056	1, 243, 713
Other finished products.....	70, 507	64, 120	86, 034	83, 078	71, 757
<b>Total.....</b>	<b>1, 214, 824</b>	<b>1, 556, 818</b>	<b>1, 318, 164</b>	<b>1, 417, 362</b>	<b>1, 498, 493</b>
Value of natural gas liquids at plants thousand dollars.....	808, 385	782, 205	798, 151	798, 943	826, 392
Average value per gallon..... cents.....	5.7	5.1	5.1	4.7	4.7
Natural gas processed, million cubic feet.....	9, 768, 189	10, 261, 669	11, 089, 241	12, 430, 353	13, 248, 091
Average yield, all natural gas liquids gallons per thousand cubic feet.....	1.46	1.48	1.41	1.35	1.34
<b>Shipments for fuel and chemical uses:</b>					
Liquefied petroleum gas and ethane (LP gases).....	6, 332, 699	6, 482, 109	7, 502, 702	7, 565, 284	7, 999, 754
Liquefied refinery gas and ethane (LR gases).....	3, 211, 950	3, 315, 774	3, 226, 692	4, 004, 994	4, 473, 504
<b>Total.....</b>	<b>9, 544, 649</b>	<b>9, 797, 883</b>	<b>10, 729, 394</b>	<b>11, 570, 278</b>	<b>12, 473, 258</b>
<b>Exports of natural gasoline, LP gases, and LR gases.....</b>	<b>125, 590</b>	<b>149, 044</b>	<b>162, 968</b>	<b>193, 073</b>	<b>225, 346</b>
<b>Imports of LP gases and LR gases.....</b>	<b>68, 502</b>	<b>75, 852</b>	<b>94, 416</b>	<b>104, 790</b>	<b>196, 879</b>

<sup>r</sup> Revised.

<sup>1</sup> Includes exports of natural gasoline, and changed to show "finished gasoline and naphtha" separately.

<sup>2</sup> Includes exports of LP gases.

## RESERVES

The American Gas Association Reserves Committee has estimated the total proved reserves of natural gas liquids in the United States, as of December 31, 1964, to be 7,747 million barrels, an increase of 73 million barrels for the year. Texas accounted for 51 percent of the total natural gas-liquids reserves (a decrease of 2 percent from that of 1963). Texas reserves decreased 83 million barrels, and Louisiana reserves, with 25 percent of the total, increased 101 million barrels. Reserves decreased in 8 of the 21 States reported.

**TABLE 2.—Estimated proved recoverable reserves of natural gas liquids<sup>1</sup> in the United States**

(Thousand barrels)

State	Reserves as of Dec. 31, 1963	Changes in reserves during 1964			Reserves as of December 31, 1964			
		Extensions and revisions	Discoveries of new fields and new pools	Net production	Nonassociated with oil	Associated with oil	Dissolved in oil	Total
Arkansas.....	18,695	1,871	41	1,597	2,025	8,631	8,354	19,010
California <sup>2</sup> .....	290,070	6,624	1,610	25,340	9,745	80,513	182,706	272,964
Colorado.....	21,990	5,812	1,189	3,263	3,750	2,710	19,268	25,728
Illinois.....	3,744	-6	7	574	0	0	3,171	3,171
Indiana.....	95	13	0	17	3	3	85	91
Kansas.....	169,241	49,981	676	9,912	199,990	7,561	2,435	209,986
Kentucky.....	51,005	3,936	1,968	3,451	<sup>3</sup> 53,458	0	0	53,458
Louisiana <sup>2</sup> .....	1,840,823	170,782	59,878	129,983	1,681,799	197,543	62,158	1,941,500
Michigan.....	5,326	1,635	285	1,385	969	2,931	1,961	5,861
Mississippi.....	33,148	2,363	104	2,740	24,969	1,946	5,960	32,875
Montana.....	9,978	3,584	0	590	2,304	0	10,668	12,972
Nebraska.....	2,775	755	0	419	2,024	241	846	3,111
New Mexico.....	558,233	53,078	618	35,333	398,048	44,570	133,978	576,596
North Dakota.....	82,017	-12,517	0	2,360	0	19,313	47,827	67,140
Ohio.....	0	0	1,200	66	0	0	1,134	1,134
Oklahoma.....	328,193	40,531	3,225	29,047	204,285	44,900	93,717	342,902
Pennsylvania.....	1,437	0	0	59	<sup>3</sup> 1,378	0	0	1,378
Texas <sup>2</sup> .....	4,042,358	117,602	73,318	273,490	2,089,045	633,807	1,236,936	3,959,788
Utah.....	46,591	7,970	2,137	2,041	613	20,000	34,044	54,657
West Virginia.....	68,779	5,617	2,808	7,430	69,774	0	0	69,774
Wyoming.....	99,480	-1,929	1,978	6,993	47,654	379	44,503	92,536
Total.....	7,673,978	457,702	151,042	536,090	4,791,833	1,065,048	1,889,751	7,746,632

<sup>1</sup> Comprises natural gasoline, LP gases, and condensate.<sup>2</sup> Includes offshore reserves.<sup>3</sup> Not allocated by types but occurring principally in column shown.

Source: Committee on Natural Gas Reserves, American Gas Association.

## PRODUCTION

Since 1958, new production levels have been attained each year. For 1964 production was 17,744 million gallons, exceeding the previous high by 907 million gallons. Production of LP gases and ethane increased 441 million gallons. Propane, which represented 51 percent of all LP gases produced in 1964, totaled 5,446 million gallons, which was 274 million gallons more than the 1963 total. Ethane production also showed an increase for the year, up 34 million gallons. Production of natural gasoline and cycle products increased to 7 billion gallons, a gain of 465 million gallons for the year.

TABLE 3.—Natural gas liquids and ethane produced, value at plants in the United States in 1964, by State

State	Number of operators <sup>2</sup>	Natural gasoline <sup>1</sup>			LP gases and ethane			Condensate		
		Thousand gallons	Thousand dollars	Cents per gallon	Thousand gallons	Thousand dollars	Cents per gallon	Thousand gallons	Thousand dollars	Cents per gallon
Arkansas.....	5	27,068	1,521	5.6	61,616	2,460	4.0			
California.....	19	687,838	51,531	7.5	352,614	15,893	4.5	32,535	2,557	7.9
Colorado.....	6	52,400	2,845	5.4	88,916	3,894	4.4			
Illinois.....	3	14,109	1,030	7.3	312,173	13,758	4.4			
Kansas.....	12	159,635	8,577	5.4	512,747	18,121	3.5	2,649	106	4.0
Kentucky <sup>3</sup> .....	3	23,348	1,645	7.0	268,078	12,080	4.5	273	14	5.1
Louisiana.....	39	538,959	33,248	6.2	1,247,484	45,935	3.7	370,579	25,713	6.9
Mississippi.....	5	24,862	1,474	5.9	23,277	780	3.4	2,301	147	6.4
Montana <sup>4</sup> .....	5	28,386	1,565	5.9	73,456	2,316	3.2			
Nebraska.....	4	9,587	627	6.5	24,556	1,092	4.4			
New Mexico.....	14	346,068	21,033	6.1	739,190	21,641	2.9	845	47	5.6
North Dakota.....	3	21,368	1,338	6.3	84,338	2,960	3.5			
Oklahoma.....	36	473,405	28,504	6.0	880,804	28,055	3.2	76,780	5,257	6.8
Pennsylvania.....	4	1,138	64	5.6	1,481	100	6.8			
Texas.....	83	2,748,764	178,273	6.5	5,521,236	167,492	3.0	492,446	35,978	7.3
West Virginia <sup>5</sup> .....	9	45,158	2,924	6.5	398,643	19,782	5.0	1,406	61	4.3
Wyoming.....	12	84,610	5,515	6.5	152,982	6,433	4.2	1,374	86	6.3
Total.....	164	5,286,703	341,714	6.5	10,743,591	362,792	3.4	981,188	69,966	7.1

	Finished gasoline and naphtha			Other products <sup>6</sup>			Total		
	Thousand gallons	Thousand dollars	Cents per gallon	Thousand gallons	Thousand dollars	Cents per gallon	Thousand gallons	Thousand dollars	Cents per gallon
Arkansas.....				3,014	157	5.2	91,698	4,138	4.5
California.....							1,072,987	69,981	6.5
Colorado.....							141,316	6,739	4.8
Illinois.....							326,282	14,788	4.5
Kansas.....				441	30	6.8	675,472	26,834	4.0
Kentucky <sup>3</sup> .....							291,699	13,739	4.7
Louisiana.....	278,614	23,026	8.3	164,828	9,944	6.0	2,600,464	137,866	5.3
Mississippi.....				322	23	7.1	50,762	2,424	4.8
Montana <sup>4</sup> .....							101,842	3,881	3.9
Nebraska.....							34,143	1,719	5.0
New Mexico.....				9,134	490	5.4	1,095,237	43,211	3.9
North Dakota.....							105,706	4,298	4.1
Oklahoma.....	2,488	163	6.6	1,380	87	6.3	1,434,857	62,066	4.3
Pennsylvania.....							2,619	164	6.3
Texas.....	225,403	14,626	6.5	45,847	3,368	7.3	9,033,696	399,737	4.4
West Virginia <sup>5</sup> .....							445,207	22,767	5.1
Wyoming.....				819	6	7.3	239,785	12,040	5.0
Total.....	506,505	37,815	7.5	225,785	14,105	6.2	17,743,772	826,392	4.7

<sup>1</sup> Includes isopentane.<sup>2</sup> A producer operating in more than 1 State is counted but once in arriving at total United States.<sup>3</sup> Michigan (4 operators) included with Kentucky.<sup>4</sup> Utah (2 operators) included with Montana.<sup>5</sup> Florida (1 operator) included with West Virginia.<sup>6</sup> Includes kerosine, jet fuel, distillate fuel, etc.

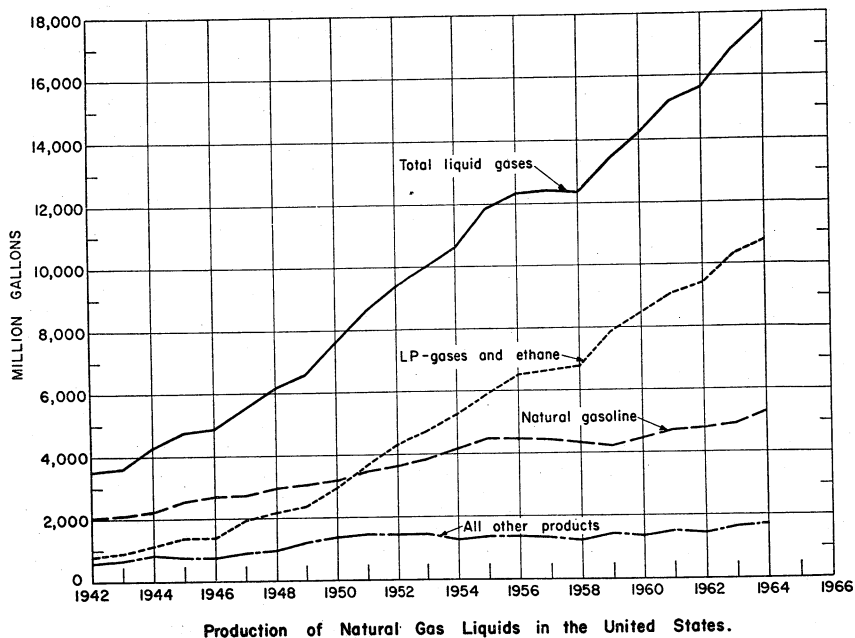


FIGURE 1.—Production of natural gas liquids in the United States, 1942-64.

## NATURAL GAS PROCESSED, YIELD, AND DISPOSITION OF RESIDUE GAS

The average yield of natural gas liquids per thousand cubic feet of natural gas processed was 1.34 gallons in 1964, compared with 1.35 gallons in 1963. The total volume of natural gas processed was 13,248 billion cubic feet.

Table 5 shows the disposition of residue gas and the volume of gas loss (shrinkage) brought about by the extraction of the natural gas liquids. Before 1962 the extraction loss per gallon of liquids produced was considered to approximate 34 cubic feet. Better reporting of the ethane component necessitated revising the previous extraction loss factor. According to data compiled for 1962 and 1963, the extraction loss averaged 40 cubic feet per gallon, and for 1964, 41 cubic feet per gallon.

Residue gas is defined as that gas which remains after the natural gas liquids have been extracted at processing plants. In 1964 this totaled 12,525,526 million cubic feet, of which 84 percent was marketed, 12 percent was returned to the well for repressuring, and 4 percent was used as fuel at the processing plant.

**TABLE 4.—Monthly production of natural gas liquids and ethane in the United States in 1964, by States and districts<sup>1</sup>**  
(Thousand gallons)

States by petroleum districts	January	February	March	April	May	June	July	August	September	October	November	December	Total
District 1:													
Western Pennsylvania.....	258	247	302	206	167	108	245	210	210	219	222	225	2,619
West Virginia and Florida.....	42,031	37,761	39,785	37,155	32,338	34,568	35,634	35,469	35,443	37,181	36,941	40,901	445,207
Total.....	42,289	38,008	40,087	37,361	32,505	34,676	35,879	35,679	35,653	37,400	37,163	41,126	447,826
District 2:													
Illinois.....	31,151	28,762	28,284	22,699	25,144	24,340	26,582	28,100	27,397	25,107	28,995	29,721	326,282
Kentucky and Michigan.....	25,685	27,209	23,506	23,055	23,353	17,961	19,837	25,570	24,926	26,851	26,579	27,167	291,699
Kansas.....	63,411	57,174	57,915	57,934	53,693	41,005	48,921	54,234	58,326	53,210	57,210	72,439	675,472
Nebraska.....	3,528	3,352	3,574	3,189	2,927	2,481	2,258	2,761	2,683	2,543	2,213	2,634	34,143
North Dakota.....	9,302	7,333	8,131	7,965	6,763	7,992	9,635	9,208	9,501	10,043	10,210	9,623	105,706
Oklahoma.....	126,888	120,820	128,148	119,721	116,059	114,715	107,408	114,620	110,596	122,836	122,619	130,427	1,434,857
Total.....	259,965	244,650	249,558	234,563	227,939	208,494	214,641	234,493	233,429	240,590	247,826	272,011	2,868,159

District 3:														
Arkansas.....	8,049	6,987	7,558	7,377	7,961	7,705	7,625	7,845	7,130	7,871	7,558	8,032	91,698	
Louisiana:														
Gulf.....	151,123	145,494	151,718	138,232	137,674	141,396	154,632	151,874	168,005	151,985	162,385	169,162	1,823,880	
Inland.....	67,470	66,166	68,071	65,482	61,101	58,483	61,666	64,017	62,418	65,232	66,697	69,981	776,784	
Total Louisiana.....	218,593	211,660	219,789	203,714	198,775	199,879	216,298	215,891	230,423	217,217	229,082	239,143	2,600,464	
Mississippi and Alabama.....	4,051	3,928	4,175	4,186	4,493	4,314	4,349	4,461	4,202	4,353	4,165	4,085	50,762	
New Mexico.....	89,042	83,127	93,638	92,813	93,694	91,349	95,537	94,312	86,938	91,341	89,663	93,783	1,095,237	
Texas:														
Gulf.....	174,051	165,008	177,773	166,915	163,587	160,336	171,736	167,014	168,349	173,143	166,288	175,825	2,030,025	
West.....	230,149	213,503	234,688	216,941	255,526	238,857	251,059	250,051	241,479	255,843	237,344	246,627	2,872,067	
East (field).....	16,256	15,492	16,944	16,964	17,508	17,650	18,216	17,943	17,621	17,656	16,706	17,902	206,858	
Panhandle.....	124,224	116,785	120,598	119,736	117,090	109,647	114,655	114,206	116,185	122,061	117,930	123,766	1,416,883	
Rest of State (other).....	228,817	209,375	217,025	203,968	201,467	194,446	204,436	208,566	202,712	211,530	217,988	207,533	2,507,863	
Total Texas.....	773,497	720,163	767,028	724,524	755,178	720,936	760,102	757,780	746,346	780,233	756,256	771,653	9,033,696	
Total.....	1,093,232	1,025,865	1,092,188	1,032,614	1,060,101	1,024,183	1,083,911	1,080,289	1,075,039	1,101,015	1,086,724	1,116,696	12,871,857	
District 4:														
Colorado.....	12,927	12,560	13,768	10,489	10,831	10,230	10,388	10,631	10,382	13,132	12,786	13,192	141,316	
Montana and Utah.....	8,330	8,033	8,780	9,145	10,039	8,790	9,191	7,876	8,167	8,113	7,113	8,265	101,842	
Wyoming.....	21,225	19,270	21,408	21,917	20,603	19,116	18,804	18,223	19,115	18,882	20,135	21,087	239,785	
Total.....	42,482	39,863	43,956	41,551	41,473	38,136	38,383	36,730	37,664	40,127	40,034	42,544	482,943	
District 5.....	99,063	91,269	95,844	89,182	90,221	84,099	86,141	85,607	83,426	87,291	87,962	92,882	1,072,987	
Grand total.....	1,537,031	1,439,655	1,521,633	1,435,271	1,452,239	1,389,588	1,458,955	1,472,798	1,465,211	1,506,423	1,499,709	1,565,259	17,743,772	

<sup>1</sup> West Pennsylvania separated from eastern part of State to allow grouping in either Bureau of Mines refinery district or Petroleum Administration for Defense district. Districts shown for Texas and Louisiana are Bureau of Mines production districts. (These districts are described under the heading "Districts.")



**TABLE 5.—Production at natural gas processing plants and disposition of residue gas in the United States in 1963-64, by States**

(Millions of cubic feet unless otherwise stated)

State	Total natural gas liquids and ethane production (thousand gallons)	Natural gas processed	Extraction loss (shrinkage)	Disposition of residue gas					
				Used at plants	Returned to formation	Vented or flared	Pipeline		Total residue gas
							Returned to producer	To other companies	
1963:									
Arkansas.....	92,596	132,535	4,705	3,430	19,191	30	639	104,540	127,830
California.....	1,108,806	549,077	38,393	33,830	191,007	386	86,367	199,094	510,684
Colorado.....	148,178	121,043	6,447	4,954	31,005	21	7,705	70,911	114,596
Illinois.....	352,217	199,877	13,674	1,845	-----	-----	184,180	178	186,203
Kansas.....	561,247	687,331	11,378	6,957	-----	86	392,854	276,056	675,953
Kentucky 2.....	274,928	1,298,450	14,404	3,185	-----	259	234,044	46,558	284,046
Louisiana.....	2,257,377	2,646,572	62,063	50,876	198,358	1,736	280,047	2,053,502	2,584,519
Louisiana 3.....	53,298	90,459	1,787	2,587	25,357	93	8,798	51,837	88,672
Mississippi.....	110,243	50,986	3,923	4,116	13,216	141	2,911	26,679	47,063
Montana 3.....	36,050	10,667	1,436	1,793	256	-----	812	6,370	9,231
New Mexico.....	1,019,588	696,880	43,868	28,870	19,496	2,528	93,848	508,270	653,012
North Dakota.....	100,164	32,854	4,793	4,269	-----	1,022	3,629	19,141	28,061
Oklahoma.....	1,366,361	878,755	52,578	47,486	85,105	3,771	90,966	598,849	826,177
Pennsylvania.....	3,032	3,127	102	31	45	-----	2,949	-----	3,025
Texas.....	8,687,247	5,665,071	385,054	262,051	908,890	27,682	812,670	3,268,724	5,280,017
Texas 4.....	429,434	1,209,324	16,980	10,113	-----	-----	130,077	52,154	192,344
West Virginia 4.....	236,451	157,345	8,676	7,199	14,183	211	4,826	122,250	148,669
Wyoming.....	-----	-----	-----	-----	-----	-----	-----	-----	-----
Total.....	16,837,217	12,430,353	670,251	473,592	1,506,109	37,966	2,337,322	7,405,113	11,760,102

1964:										
Arkansas.....	91,698	127,862	4,091	3,606	20,413	40	327	99,385	123,771	
California.....	1,068,516	532,250	36,970	33,100	183,196	296	80,670	198,018	495,280	
Colorado.....	141,316	117,910	5,556	4,062	27,637	244	10,733	69,678	112,354	
Illinois.....	326,282	1,196,907	14,400	998	124	201	180,774	410	182,507	
Kansas.....	675,472	804,129	21,475	6,918	-----	147	249,693	525,896	782,654	
Kentucky <sup>2</sup> .....	291,699	1,408,859	15,686	2,265	-----	275	14,537	376,096	393,173	
Louisiana.....	2,600,464	2,844,739	64,825	44,466	180,580	259	158,709	2,395,900	2,779,914	
Mississippi.....	50,762	82,775	1,836	2,183	23,340	36	9,678	45,702	80,939	
Montana <sup>3</sup> .....	101,842	52,955	3,819	4,075	16,460	173	3,076	25,852	49,136	
Nebraska.....	34,143	10,393	1,777	552	11	-----	4,299	3,754	8,616	
New Mexico.....	1,095,237	726,370	48,101	37,545	12,490	4,050	107,800	516,384	678,269	
North Dakota.....	105,706	32,364	5,407	4,813	-----	355	4,440	17,849	26,957	
Oklahoma.....	1,435,427	899,926	53,171	44,153	61,043	1,312	81,754	658,493	846,755	
Pennsylvania.....	2,619	2,149	115	13	50	-----	805	1,166	2,034	
Texas.....	9,033,696	5,888,150	419,320	258,901	875,938	18,285	788,380	3,527,326	5,468,830	
West Virginia <sup>4</sup> .....	445,207	1,331,656	17,115	5,101	126,915	-----	-----	182,525	314,541	
Wyoming.....	239,785	188,697	8,901	6,983	21,143	20	4,773	146,877	179,796	
Total.....	17,739,871	13,248,091	722,565	459,234	1,549,340	25,693	1,700,448	8,790,811	12,525,526	

<sup>1</sup> Includes gas from transmission lines previously treated in another State.

<sup>2</sup> Michigan included with Kentucky.

<sup>3</sup> Utah included with Montana.

<sup>4</sup> Florida included with West Virginia.

## DEMAND FOR NATURAL GAS LIQUIDS AT PROCESSING PLANTS AND TERMINALS

Total demand for natural gas liquids at plants and terminals in 1964 was 17,682 million gallons, compared with 16,731 million gallons in 1963. Of this total, 51 percent was shipped to refineries for use as blending fuel.

**Motor Fuel Use.**—Shipments of natural gas liquids for use as blending material for motor fuel were 8,977 million gallons in 1964, compared with 8,875 million gallons in 1963.

**Other Uses.**—Shipment of ethane used in the production of chemicals increased 3.4 percent. LP gases shipped for use in the manufacture of chemicals and for fuel use other than motor fuels totaled 6,980 million gallons, compared with 6,693 million gallons in 1963. Other finished products shipped from natural gas processing plants were jet fuel, 17.4 million gallons; kerosine, 62.7 million gallons; distillate fuel, 16.4 million gallons; and miscellaneous finished products, 134.0 million gallons, for a total of 230.5 million gallons. Detailed use of liquefied gases is shown later in this chapter under the heading "Shipments of Liquefied Gases and Ethane."

**TABLE 6.—Supply and distribution at plants and terminals of natural gas liquids and ethane in the United States in 1964, by months**  
(Thousand gallons)

	January	February	March	April	May	June	July	August	September	October	November	December	Total
<b>Production:</b>													
Natural gasoline.....	408,982	385,188	426,253	418,249	437,892	425,221	468,461	470,574	455,454	436,550	425,520	433,614	5,191,958
Ethane.....	87,616	85,204	85,257	75,529	76,214	76,100	77,411	82,538	80,952	81,364	85,877	90,225	984,287
<b>LP gases:</b>													
Propane.....	497,659	457,266	471,799	447,454	440,671	406,805	417,729	422,679	439,684	472,421	472,531	499,697	5,446,395
Butane, normal.....	222,894	207,399	216,238	201,363	196,637	196,331	194,778	186,798	196,306	210,021	210,278	217,667	2,456,710
Isobutane.....	79,216	78,138	85,223	78,444	80,592	74,515	82,410	74,452	79,566	81,262	79,296	84,532	957,646
Butane-propane mixture.....	43,012	37,992	42,680	39,278	40,993	36,854	38,034	39,106	33,552	37,355	36,114	35,418	400,388
Other LP gas mixtures.....	30,186	31,672	34,368	34,556	36,840	36,387	37,758	50,452	36,201	37,164	35,300	37,281	438,165
Isopentane.....	9,226	7,877	8,581	2,493	8,585	8,236	8,434	8,240	8,228	8,409	8,134	8,302	94,745
Finished gasoline and naphtha.....	47,857	44,654	46,404	43,858	38,808	38,485	39,662	40,133	39,711	41,476	42,192	43,275	506,505
Condensate, raw.....	89,665	83,212	83,556	74,613	74,347	73,580	76,294	78,793	79,393	83,004	87,848	96,698	981,188
Other finished products.....	20,718	21,053	21,274	19,434	20,660	17,074	17,994	18,848	16,164	17,397	16,619	18,550	225,785
<b>Total.....</b>	<b>1,537,031</b>	<b>1,439,655</b>	<b>1,521,633</b>	<b>1,435,271</b>	<b>1,452,239</b>	<b>1,389,588</b>	<b>1,458,955</b>	<b>1,472,798</b>	<b>1,465,211</b>	<b>1,506,423</b>	<b>1,499,709</b>	<b>1,565,259</b>	<b>17,743,772</b>
<b>Stock change at plants and terminals.....</b>	<b>-226,259</b>	<b>-41,882</b>	<b>103,503</b>	<b>169,487</b>	<b>203,233</b>	<b>159,125</b>	<b>100,153</b>	<b>64,236</b>	<b>22,733</b>	<b>-41,300</b>	<b>-124,128</b>	<b>-327,426</b>	<b>61,475</b>
<b>Shipments:</b>													
<b>For use in gasoline:</b>													
Natural gasoline.....	406,586	382,310	416,734	412,857	435,521	433,023	472,816	474,940	457,210	438,326	431,268	431,892	5,193,483
<b>LP gases:</b>													
Propane.....	15,750	16,842	11,676	3,612	6,258	4,662	5,880	4,956	12,558	3,654	8,946	4,746	99,540
Butane, normal.....	148,003	119,478	102,980	105,427	81,810	75,077	95,629	110,611	134,257	183,704	209,849	228,363	1,595,188
Isobutane.....	73,715	73,890	70,690	66,101	76,782	79,693	84,257	74,357	81,959	66,154	75,835	80,463	903,896
Butane-propane mixture.....	5,292	3,906	8,736	5,628	6,090	5,628	5,754	5,922	5,880	5,082	5,418	6,678	70,014
Other LP gas mixtures.....	3,628	3,150	4,284	2,100	1,848	2,016	1,218	1,176	6,552	7,392	3,486	1,218	37,968
Isopentane.....	9,030	7,639	8,836	2,824	8,563	7,783	8,996	8,177	8,238	7,451	7,597	9,083	94,217
Condensate.....	90,831	83,924	83,449	75,852	73,004	73,221	78,827	79,192	77,962	81,024	88,798	96,346	982,430
<b>For other uses:</b>													
Finished gasoline and naphtha.....	46,702	40,579	47,407	44,129	44,923	43,687	38,841	37,145	40,057	41,680	47,778	38,106	511,034
Ethane.....	83,556	84,965	84,853	75,676	76,059	76,216	75,917	82,866	82,029	81,812	85,290	89,865	983,904
<b>LP gases:</b>													
Propane.....	683,288	506,719	424,799	353,507	311,543	314,175	349,502	388,675	380,655	456,178	471,758	727,152	5,367,951
Butane, normal.....	100,195	70,214	70,460	38,174	37,196	45,808	53,385	38,406	67,066	85,520	100,526	81,782	788,732
Isobutane.....	1,477	1,466	1,589	1,462	1,502	1,389	1,535	1,388	1,483	1,515	1,478	1,576	17,850
Butane-propane mixture.....	39,710	35,811	34,856	33,763	33,971	25,280	30,208	29,163	27,083	28,512	29,620	31,792	379,719
Other LP gas mixtures.....	27,023	31,211	26,180	25,492	32,768	23,193	37,702	55,402	43,576	43,317	39,191	40,779	425,834
Other finished products.....	23,804	19,443	20,601	19,180	21,168	19,662	18,335	16,186	16,711	15,604	16,999	22,844	230,537
<b>Total demand for natural gas liquids at plants and terminals.....</b>	<b>1,763,290</b>	<b>1,481,537</b>	<b>1,418,130</b>	<b>1,265,784</b>	<b>1,249,006</b>	<b>1,230,463</b>	<b>1,358,802</b>	<b>1,408,562</b>	<b>1,442,478</b>	<b>1,547,723</b>	<b>1,623,837</b>	<b>1,892,685</b>	<b>17,682,297</b>

NATURAL GAS LIQUIDS

TABLE 7.—Natural gas liquids utilized at refineries in the United States in 1964 by Bureau of Mines refinery districts and by months  
(Thousand gallons)

District <sup>1</sup>	January	February	March	April	May	June	July	August	September	October	November	December	Total
East Coast.....	11,718	18,018	16,632	9,870	12,936	22,848	20,328	23,856	18,270	17,220	16,842	26,880	215,418
Appalachian.....	4,746	3,192	3,486	2,310	1,134	1,722	1,764	1,806	2,226	3,990	4,830	5,040	36,246
Indiana, Illinois, Kentucky, etc.....	75,810	60,522	50,232	54,096	53,382	43,848	42,882	48,048	63,924	81,648	82,866	94,710	751,968
Minnesota, Wisconsin, North Dakota, and South Dakota.....	6,804	6,132	4,326	4,284	3,234	6,426	7,644	8,232	7,854	8,736	10,164	8,190	82,026
Oklahoma, Kansas, Missouri.....	76,104	60,732	63,756	54,684	62,370	62,496	62,968	62,496	65,520	71,652	79,506	84,714	806,988
Texas:													
Inland.....	82,614	73,710	77,910	84,546	92,232	84,210	88,452	96,684	89,208	84,126	77,994	77,280	1,008,966
Gulf Coast.....	235,032	230,370	239,442	238,812	237,006	216,594	244,776	246,876	261,324	260,358	268,338	264,516	2,943,444
Total Texas.....	317,646	304,080	317,352	323,358	329,238	300,804	333,228	343,560	350,532	344,484	346,332	341,796	3,952,410
Louisiana-Arkansas:													
Louisiana Gulf Coast.....	51,408	51,114	56,616	56,406	53,382	57,960	61,656	62,874	66,738	71,820	76,944	79,842	746,760
Arkansas and Louisiana Inland.....	27,552	25,620	26,922	25,410	28,560	25,998	25,200	25,242	27,048	29,736	29,274	28,728	325,290
Total Louisiana-Arkansas.....	78,960	76,734	83,538	81,816	81,942	83,958	86,856	88,116	93,786	101,556	106,218	108,570	1,072,050
New Mexico.....	4,452	3,696	3,906	3,486	4,536	6,300	5,460	5,334	5,082	5,166	4,284	3,402	55,104
Other Rocky Mountain.....	16,884	14,364	14,448	13,398	14,154	13,566	13,482	15,162	15,708	16,002	17,766	15,582	180,516
West Coast.....	83,202	80,682	83,202	79,002	82,656	82,320	85,806	87,780	88,704	89,166	89,166	98,994	1,035,636
Total United States.....	676,326	628,152	640,878	626,304	645,582	624,288	660,408	684,390	717,024	739,158	757,974	787,878	8,188,362

<sup>1</sup> Districts are described under the heading "Districts."

**TABLE 8.—Percentage of natural gas liquids in refinery gasoline in the United States by Bureau of Mines refinery districts<sup>1</sup>**

Year	East Coast	Appalachian	Indiana, Illinois, Kentucky, etc.	Minnesota, Wisconsin, North Dakota, and South Dakota	Oklahoma, Kansas, Missouri, etc.	Texas Inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas and Louisiana Inland	Rocky Mountain	West Coast	Total
1960	1.0	(2)	5.3	3.6	11.1	35.6	13.5	13.5	35.7	7.8	13.4	11.0
1961	1.1	(2)	4.9	4.6	12.4	30.9	15.2	13.4	33.9	8.5	12.7	11.2
1962	1.3	0.7	5.1	5.4	12.4	31.0	17.8	14.2	34.2	7.5	11.6	11.9
1963	1.9	2.7	5.5	6.1	12.4	31.1	18.7	11.7	30.7	9.3	11.0	11.9
1964	2.5	2.4	5.8	7.1	12.0	30.9	18.1	11.7	31.0	8.8	11.0	11.6

<sup>1</sup> Bureau of Mines petroleum refining and PAD districts are described under the heading "Districts."<sup>2</sup> Less than 0.5 percent.**TABLE 9.—Liquefied petroleum gas and ethane produced at natural gas processing plants in 1964**  
(Thousand gallons)

States by petroleum districts	Propane	Butane-propane mix	Butane	Iso-butane	Other LP gas	Total
<b>District 1:</b>						
Western Pennsylvania	960		521			1,481
West Virginia	<sup>1</sup> 112,394		<sup>1</sup> 62,158	6,653	<sup>2</sup> 217,438	<sup>3</sup> 398,643
<b>Total</b>	113,354		62,679	6,653	217,438	400,124
<b>District 2:</b>						
Illinois	89,169	70	24,845	13,521	<sup>2</sup> 184,568	312,173
Kentucky	<sup>3</sup> 64,196	<sup>3</sup> 9,105	<sup>3</sup> 17,472	<sup>3</sup> 14,528	<sup>2</sup> 3 162,777	<sup>3</sup> 268,078
Michigan	(3)	(3)	(3)	(3)	(3)	(3)
Kansas	307,991	1,035	156,731	46,990		512,747
Nebraska	16,892		7,664			24,556
North Dakota	50,609	1,066	32,663			84,338
Oklahoma	576,224	34,216	198,170	50,118	22,076	880,804
<b>Total</b>	1,105,081	45,492	437,545	125,157	369,421	2,082,696
<b>District 3:</b>						
Arkansas	34,537	6,968	7,532	8,154	4,425	61,616
Louisiana:						
Gulf	526,552	22,119	213,237	133,190	<sup>2</sup> 40,570	935,668
Inland	170,693	43,976	67,532	29,615		311,816
<b>Total Louisiana</b>	697,245	66,095	280,769	162,805	40,570	1,247,484
Mississippi	11,703	9,062	2,512			23,277
New Mexico	407,716	20,660	247,979	56,813	6,022	739,190
Texas:						
Gulf	463,239	42,176	166,303	135,313	<sup>2</sup> 364,168	1,171,199
West	1,132,362	92,727	603,243	47,102	<sup>2</sup> 139,344	2,014,778
East (field)	53,342	2,093	40,965	390	11,131	107,921
Panhandle	396,746	14,690	191,186	239,296	34,407	876,325
Other	583,861	146,465	276,683	147,829	<sup>2</sup> 196,175	1,351,013
<b>Total Texas</b>	2,629,550	298,151	1,278,380	569,930	745,225	5,521,236
<b>Total</b>	3,780,751	400,936	1,817,172	797,702	796,242	7,592,803
<b>District 4:</b>						
Colorado	56,891		7,192	8,254	16,579	88,916
Montana	<sup>4</sup> 43,900	2,848	26,708			73,456
Utah	(1)		(1)			(1)
Wyoming	95,998		53,766		3,218	152,982
<b>Total</b>	196,789	2,848	87,666	8,254	19,797	315,354
<b>District 5</b>	250,420	11,112	51,648	19,880	19,554	352,614
<b>Grand total</b>	5,446,395	460,388	2,456,710	957,646	<sup>5</sup> 1,422,452	10,743,591

<sup>1</sup> Florida included with West Virginia.<sup>2</sup> Includes ethane production.<sup>3</sup> Michigan included with Kentucky.<sup>4</sup> Utah included with Montana.<sup>5</sup> Includes 984,287,000 gallons of ethane products.

TABLE 10.—Liquefied petroleum gas and ethane (LR gas) produced at refineries in 1964

(Thousand gallons)

States by petroleum district	Propane	Butane-propane mix	Butane	Other LR gases	Total
<b>District 1:</b>					
East Coast <sup>1</sup> .....	261,534		44,436	11,382	317,352
West New York.....	25,956		714		26,670
Pennsylvania.....	166,866		14,238	20,286	201,390
West Virginia.....					
<b>Total.....</b>	<b>454,356</b>		<b>59,388</b>	<b>31,668</b>	<b>545,412</b>
<b>District 2:</b>					
Illinois.....	160,146		4,326	<sup>2</sup> 25,494	189,966
Indiana.....	131,082		18,396	1,596	151,074
Kansas.....	91,392	126	18,186		109,704
Kentucky.....	<sup>3</sup> 28,770				28,770
Michigan.....	55,650	2,394	1,638	<sup>2</sup> 6,678	66,360
Minnesota.....	<sup>4</sup> 68,166	<sup>4</sup> 3,864	<sup>4</sup> 8,442	672	<sup>4</sup> 81,144
Missouri.....	( <sup>5</sup> )	( <sup>5</sup> )	( <sup>5</sup> )		( <sup>5</sup> )
North Dakota.....	( <sup>5</sup> )	( <sup>5</sup> )	( <sup>5</sup> )		( <sup>5</sup> )
Wisconsin.....	( <sup>5</sup> )	( <sup>5</sup> )	( <sup>5</sup> )		( <sup>5</sup> )
Ohio.....	148,050		798		148,848
Oklahoma.....	98,196	49,392	30,786	42	178,416
<b>Total.....</b>	<b>781,452</b>	<b>55,776</b>	<b>82,572</b>	<b>34,482</b>	<b>954,282</b>
<b>District 3:</b>					
Alabama.....	( <sup>5</sup> )	( <sup>5</sup> )			( <sup>5</sup> )
Arkansas.....	43,218		9,534	1,470	54,222
<b>Louisiana:</b>					
Gulf.....	207,396	6,930	14,196	223,020	451,542
Inland.....	210	1,848	7,434	<sup>2</sup> 30,198	39,690
<b>Total Louisiana.....</b>	<b>207,606</b>	<b>8,778</b>	<b>21,630</b>	<b>253,218</b>	<b>491,232</b>
Mississippi.....	<sup>5</sup> 10,374	<sup>5</sup> 1,176			<sup>5</sup> 11,550
New Mexico.....	5,292		6,552		11,844
<b>Texas:</b>					
Gulf.....	544,068	2,898	360,486	<sup>2</sup> 786,828	1,694,280
Inland.....	85,722	1,512	42,420	373	130,032
<b>Total Texas.....</b>	<b>629,790</b>	<b>4,410</b>	<b>402,906</b>	<b>787,206</b>	<b>1,824,312</b>
<b>Total.....</b>	<b>896,280</b>	<b>14,364</b>	<b>440,622</b>	<b>1,041,894</b>	<b>2,393,160</b>
<b>District 4:</b>					
Colorado.....	6,930	168	2,730		9,828
Montana.....	10,542		1,260		11,802
Utah.....	29,820		1,218		31,038
Wyoming.....	6,216		9,072	4,998	20,286
<b>Total.....</b>	<b>53,508</b>	<b>168</b>	<b>14,280</b>	<b>4,998</b>	<b>72,954</b>
<b>District 5:</b>					
<b>Total.....</b>	<b>253,974</b>	<b>23,562</b>	<b>127,512</b>	<b><sup>2</sup> 102,648</b>	<b>507,696</b>
<b>Grand total.....</b>	<b>2,439,570</b>	<b>93,870</b>	<b><sup>6</sup> 724,374</b>	<b><sup>7</sup> 1,215,690</b>	<b>4,473,504</b>

<sup>1</sup> Excludes Pennsylvania.<sup>2</sup> Includes ethane production.<sup>3</sup> Propane produced in Tennessee is included with Kentucky.<sup>4</sup> Missouri, North Dakota, and Wisconsin included with Minnesota.<sup>5</sup> Alabama included with Mississippi.<sup>6</sup> Includes 13,650,000 gallons of isobutane used in petrochemicals.<sup>7</sup> Includes 353,304,000 gallons of ethane.

## PRICES

The average value for all natural gas liquids at plants in 1964 was 4.7 cents per gallon. The average value per gallon for all other products is not comparable with previous years because condensate was excluded from the other product category in the 1964 compilations. The average price for natural gasoline and isopentane remained at 6.5 cents. Value of LP gases and ethane declined 0.1 cent; finished

gasoline and naphtha declined 0.7 cent; and other finished products and condensate increased 0.1 cent.

**TABLE 11.—Stocks of natural gas liquids and ethane in the United States**

(Thousand gallons)

Date	Natural gasoline and isopentane		LP gases and ethane		Other finished products and plant condensate		Total at plants and terminals	Total at refineries	Grand total
	At plants and terminals	At refineries	At plants and terminals	At refineries	At plants and terminals	At refineries			
Dec. 31:									
1960.....	143,295	54,264	920,340	26,418	64,543	5,922	1,128,178	86,604	1,214,782
1961.....	136,490	62,118	1,263,892	30,198	54,166	9,954	1,454,548	102,270	1,556,818
1962.....	113,179	61,656	1,019,747	37,548	61,422	24,612	1,194,348	123,816	1,318,164
1963.....	100,188	68,040	1,132,750	33,306	67,412	15,666	1,300,350	117,012	1,417,362
1964:									
Jan. 31.....	102,779	69,300	907,078	31,668	64,234	19,194	1,074,091	120,162	1,194,253
Feb. 29.....	105,892	63,042	857,255	35,070	69,062	20,034	1,032,209	118,146	1,150,355
Mar. 31.....	115,148	67,620	951,688	33,054	68,876	19,488	1,135,712	120,162	1,255,874
Apr. 30.....	120,204	69,846	1,117,440	40,908	69,555	17,430	1,305,199	128,184	1,433,383
May 31.....	122,595	70,182	1,323,359	33,978	62,478	22,260	1,508,432	126,420	1,634,852
June 30.....	115,252	71,064	1,497,111	31,542	55,194	15,960	1,667,557	118,566	1,786,123
July 31.....	110,339	81,396	1,604,336	32,256	53,035	10,290	1,767,710	123,942	1,891,652
Aug. 31.....	106,040	76,020	1,667,517	32,634	58,389	17,892	1,831,946	126,546	1,958,492
Sept. 30.....	104,274	66,612	1,691,430	32,088	58,975	11,886	1,854,679	110,586	1,965,265
Oct. 31.....	103,458	79,002	1,647,319	33,978	62,602	11,214	1,813,379	124,194	1,937,573
Nov. 30.....	98,252	81,060	1,535,204	34,650	55,795	10,962	1,689,251	126,672	1,815,923
Dec. 31.....	99,191	83,832	1,205,745	37,968	56,889	14,868	1,361,825	136,668	1,498,493

<sup>1</sup> Includes 882 million gallons in underground storage.

## STOCKS

Natural gas liquids stocks at plants and terminals increased 61 million gallons during the year, and stocks at refineries increased 20 million gallons.

## STORAGE

Storage facilities for LP and LR gases increased 349 million gallons for the year ending September 30, 1964. Aboveground storage facilities increased 3 million gallons, and underground storage increased 346 million gallons. As of September 30, 1964, storage facilities for liquefied gases were filled to 49 percent of capacity, compared with 52 percent a year ago.



**TABLE 12.—Liquefied petroleum gas storage capacity and stock, Sept. 30, 1964**  
(Thousand gallons)

State and district	Aboveground		Underground at plants, terminals, and re- fineries	Total	Stocks as of Sept. 30, 1964
	At plants and terminals	At refin- eries			
East Coast and Appalachian No. 1.....	15, 219	9, 072	103, 562		
Total PAD District 1.....	15, 219	9, 072	103, 562	127, 853	79, 794
Indiana, Illinois, Kentucky, and Appa- lachian No. 2:					
Indiana.....	<sup>(2)</sup>	<sup>(2)</sup>	<sup>(2)</sup>		
Illinois.....	<sup>2</sup> 15, 113	<sup>2</sup> 15, 036	<sup>2</sup> 71, 087		
Kentucky.....	4, 340	<sup>(4)</sup>	<sup>(4)</sup>		
Ohio.....	735	<sup>4</sup> 12, 180	<sup>(5)</sup>		
Michigan.....	1, 084	2, 688	<sup>3</sup> 171, 866		
Tennessee.....					
Oklahoma, Kansas, Minnesota, and Wis- consin:					
Oklahoma.....	19, 293	17, 598	23, 987		
Kansas.....	8, 595	<sup>5</sup> 8, 442	475, 432		
Minnesota.....	<sup>(6)</sup>	4, 620	13, 650		
Missouri, Nebraska, North Dakota, Iowa, and Wisconsin.....	<sup>6</sup> 8, 781	<sup>(6)</sup>	64, 360		
Total PAD District 2.....	57, 941	60, 564	320, 382	938, 887	663, 736
Texas Inland:					
Panhandle.....	27, 647	<sup>(7)</sup>	225, 506		
East.....	3, 657	<sup>(7)</sup>			
West.....	27, 281	<sup>7</sup> 25, 704	356, 089		
Other.....	32, 419	<sup>(7)</sup>	11, 880		
Texas Gulf Coast.....	22, 173	37, 758	1, 318, 013		
Louisiana Gulf Coast and Alabama.....	15, 748	16, 128	288, 270		
Arkansas and Louisiana Inland:					
Louisiana Inland.....	6, 805	<sup>(8)</sup>	<sup>(8)</sup>		
Arkansas.....	2, 359	<sup>(8)</sup>			
Mississippi.....	814	<sup>(8)</sup>	<sup>8</sup> 195, 834		
New Mexico.....	10, 308	<sup>(7)</sup>	<sup>3</sup> 53, 119		
Total PAD District 3.....	149, 211	79, 590	2, 448, 711	2, 677, 512	1, 072, 912
Rocky Mountain:					
Montana and Utah.....	1, 568	<sup>10</sup> 1, 344	<sup>11</sup> 20, 122		
Wyoming.....	3, 281	2, 772	<sup>(11)</sup>		
Colorado.....	4, 526	<sup>(10)</sup>			
Total PAD District 4.....	9, 375	4, 116	20, 122	33, 613	25, 553
West Coast.....	3, 446	32, 340	35, 700		
Total PAD District 5.....	3, 446	32, 340	35, 700	71, 486	41, 333
Total United States.....	235, 192	185, 682	3, 428, 477	3, 849, 351	<sup>12</sup> 1, 883, 328

<sup>1</sup> Includes storage capacity in Pennsylvania, West Virginia, Delaware, New Jersey, New York, Florida, and Georgia.

<sup>2</sup> Indiana included in Illinois.

<sup>3</sup> Kentucky, Indiana, and Ohio included in Michigan.

<sup>4</sup> Kentucky included in Ohio.

<sup>5</sup> Missouri, North Dakota, and Wisconsin included with Kansas.

<sup>6</sup> Minnesota included in Missouri, Nebraska, North Dakota, etc.

<sup>7</sup> Panhandle, East Texas, Other Texas, and New Mexico included in West Texas.

<sup>8</sup> Louisiana Inland, Mississippi, and Arkansas included in Louisiana Gulf Coast and Alabama.

<sup>9</sup> Louisiana Inland included in Mississippi.

<sup>10</sup> Colorado included in Montana and Utah.

<sup>11</sup> Wyoming included in Montana and Utah.

<sup>12</sup> Includes 1,373 million gallons in underground storage at plants and terminals, and 149 million gallons in underground storage at petroleum refineries.

## SHIPMENTS OF LIQUEFIED PETROLEUM GASES<sup>3</sup> AND ETHANE

The total shipments of liquefied petroleum gases for domestic uses,<sup>4</sup> excluding liquefied petroleum gases used in the production of gasoline, were 12,473 million gallons in 1964, an increase of 8 percent for the year—the same as the 1963 increase. With the exception of liquefied petroleum gases used for secondary recovery of petroleum and by utilities for peak shaving, other end-use categories increased in 1964. More than three-quarters of the shipments of liquefied petroleum gases are for residential and commercial use and for chemical manufacture. Residential and commercial use in 1964 totaled 5,476 million gallons, an 8-percent increase for the year, and that used for chemical manufacture increased 7 percent to 4,021 million gallons.

**TABLE 13.**—Shipments of liquefied petroleum gases and ethane in the United States, 1960–64  
(Thousand gallons)

	1960	1961	1962	1963	1964
United States, total.....	11,569,846	11,995,275	13,038,581	14,307,543	15,405,210
For export.....	125,537	149,052	162,735	193,073	225,346
For use in gasoline production.....	1,899,660	2,048,340	2,146,452	2,544,192	2,706,606
For all other uses.....	9,544,649	9,797,883	10,729,394	11,570,278	12,473,258
By type:					
Ethane.....	965,175	1,075,957	1,222,615	1,378,284	1,347,025
Propane.....	5,743,694	5,935,967	6,474,558	7,120,976	7,442,817
Butane.....	1,099,544	1,065,513	1,443,081	1,439,891	1,600,398
Isobutane.....	15,959	62,279	41,282	34,264	31,500
Butane-propane mixture.....	1,093,511	1,107,329	1,077,283	1,054,588	1,107,235
All other mixtures.....	626,766	550,838	470,575	542,275	944,283
By principal uses:					
Residential and commercial.....	4,224,537	4,318,215	4,712,682	5,053,157	5,475,539
Internal combustion.....	897,915	880,315	931,611	999,363	1,176,260
Industrial.....	438,659	402,428	424,730	493,208	521,006
Refinery fuel.....	157,036	166,572	231,084	356,958	439,110
Utility gas.....	157,041	168,989	173,481	216,627	117,004
Chemical.....	3,019,011	3,239,479	3,571,339	3,771,413	4,020,980
Synthetic rubber.....	538,971	519,637	587,379	599,556	651,472
Secondary recovery of petroleum.....	53,240	51,683	41,676	21,319	9,573
Miscellaneous uses.....	58,239	50,565	55,412	58,677	62,314

<sup>3</sup> Data include liquefied refinery gases but exclude liquefied petroleum gases blended into gasoline.

<sup>4</sup> Description of the uses of liquefied petroleum gases reported in this section of the chapter:

**Residential and Commercial.**—All liquefied petroleum gases, by type, shipped or used in private households for heating, cooking, water heating, and other household uses, such as clothes dryers and incinerators. Shipments to nonmanufacturing organizations, such as motels, restaurants, retail stores, laundries and other service enterprises, primarily for use in space heating, water heating and cooking.

**Internal-Combustion Engine Fuel.**—All gases by type, used by tractors, irrigation engines, highway vehicles of all kinds, forklift and other industrial tractors, and also oil-field drilling and production uses.

**Industrial.**—Liquefied petroleum gases shipped or used by manufacturing plants of all types for standby fuel, space heating, or other such uses as flame cutting, metallurgical furnaces, and plumber's torches.

**Gas Companies.**—Shipments made to gas utility companies for distribution through the mains.

**Raw Material and Solvents for Chemical Plants and Synthetic Rubber Components.**—Shipments of liquefied petroleum gases made to chemical plants and for use in the production of synthetic rubber.

**All Other.**—Liquefied petroleum gases shipped or used for agriculture purposes such as flame cultivation, crop drying, tobacco curing, poultry breeding, and miscellaneous other farm uses.

Table 14.—Consumption of liquefied petroleum gases and ethane by use, excluding use in gasoline production, by PAD district and State  
(Thousand gallons)

PAD district and State	Residential and commercial		Internal combustion engine fuel		Industrial fuel		Utility gas		Miscellaneous uses		Total 1	
	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964
<b>District 1:</b>												
Connecticut.....	35,116	39,056	472	534	13,373	17,117	7,019	2,809	1,433	1,395	57,413	60,911
Delaware.....	14,148	15,980	316	387	2,674	2,065	28	14	43	43	17,180	18,475
Florida.....	207,119	223,262	23,646	23,072	8,378	12,156	12,118	8,675	776	498	252,037	267,663
Georgia.....	130,748	139,613	19,348	21,824	10,980	16,548	11,837	7,549	4,111	4,229	177,024	189,763
Maine.....	23,778	25,892	270	308	1,683	2,046	50	227	52	30	25,833	28,503
Maryland and District of Columbia.....	42,741	43,545	1,807	2,190	5,721	7,413	8,891	6,271	92	81	59,252	59,500
Massachusetts.....	40,964	40,953	1,160	1,414	5,066	10,166	8,198	4,867	117	540	55,505	67,940
New Hampshire.....	18,848	21,960	88	177	1,948	2,276	1,137	1,439	23	13	22,044	25,865
New Jersey.....	41,689	55,137	2,723	4,255	21,937	20,232	2,520	3,928	34	11	68,903	83,563
New York.....	117,873	138,707	5,194	6,284	11,915	12,954	1,931	1,067	104	101	137,017	159,113
North Carolina.....	104,309	112,229	2,040	1,801	10,213	11,861	1,186	1,366	12,660	15,173	130,408	142,430
Pennsylvania.....	67,543	75,686	6,842	8,502	29,197	32,565	4,177	987	99	91	107,853	117,831
Rhode Island.....	9,905	8,785	411	486	1,308	1,622	961	409	-----	-----	12,675	11,302
South Carolina.....	56,387	66,790	2,796	3,992	9,506	13,128	1,824	1,115	3,157	2,995	73,670	88,020
Vermont.....	11,951	17,710	84	75	1,242	1,204	1,465	1,129	8	-----	14,750	20,118
Virginia.....	55,130	60,549	2,772	3,406	7,459	7,797	4,534	5,381	1,213	1,434	71,108	78,567
West Virginia.....	17,755	15,131	1,010	745	1,237	1,323	49	144	-----	-----	20,051	17,343
<b>Total.....</b>	<b>996,004</b>	<b>1,100,985</b>	<b>70,979</b>	<b>79,452</b>	<b>143,927</b>	<b>172,473</b>	<b>67,925</b>	<b>47,363</b>	<b>23,893</b>	<b>26,634</b>	<b>1,773,132</b>	<b>1,867,790</b>
<b>District 2:</b>												
Illinois.....	286,596	247,598	55,821	51,265	46,155	33,454	9,464	8,667	1,361	709	399,397	341,693
Indiana.....	202,636	154,396	10,493	9,130	51,662	49,257	6,632	2,573	1,418	1,320	272,841	216,676
Iowa.....	205,754	192,660	6,924	6,209	11,086	9,843	2,450	1,567	1,638	1,940	227,852	211,719
Kansas.....	200,993	177,367	50,378	42,356	7,142	7,013	403	-----	551	501	259,467	227,237
Kentucky.....	83,973	70,797	6,954	8,031	3,046	15,976	8,271	3,298	584	247	102,828	98,349
Michigan.....	128,441	115,546	5,454	4,652	12,671	15,295	5,547	3,613	458	1,040	152,571	140,146
Minnesota.....	178,826	177,272	6,865	6,454	23,207	23,622	5,570	2,773	1,111	1,476	215,579	211,597
Missouri.....	309,167	274,812	10,607	6,546	7,561	1,147	2,986	2,700	583	338	336,797	290,344
Nebraska.....	129,746	116,240	19,014	17,173	1,512	5,955	9,083	2,485	379	546	157,315	140,258
North Dakota.....	42,305	37,483	7,549	5,056	8,201	6,037	1,729	2,700	800	750	60,584	51,048
Ohio.....	98,788	101,524	9,482	10,486	17,186	16,553	30,626	10,588	1,233	1,203	157,315	140,258
Oklahoma.....	248,610	228,165	73,258	62,222	10,496	11,805	-----	-----	832	1,251	333,196	302,943
South Dakota.....	58,392	54,866	4,451	4,181	1,706	1,908	874	227	145	79	65,568	61,261
Tennessee.....	56,848	52,418	6,379	11,633	6,918	10,438	2,304	1,351	57	10	72,506	75,580
Wisconsin.....	179,082	177,156	5,590	4,901	34,282	27,722	2,912	1,535	699	475	222,565	211,789
<b>Total.....</b>	<b>2,410,157</b>	<b>2,178,300</b>	<b>279,219</b>	<b>250,295</b>	<b>242,831</b>	<b>235,025</b>	<b>88,851</b>	<b>43,099</b>	<b>11,849</b>	<b>11,787</b>	<b>3,579,264</b>	<b>3,376,048</b>

District 3:												
Alabama.....	126,339	174,722	9,081	12,499	4,933	8,424	4,437	3,128	311	188	145,051	198,961
Arkansas.....	149,760	213,043	61,814	87,663	1,677	4,023	-----	-----	1,640	704	214,891	305,333
Louisiana.....	91,652	101,667	53,785	64,516	12,653	23,599	-----	-----	699	600	158,789	190,382
Mississippi.....	143,915	187,474	52,926	57,524	1,682	2,474	-----	-----	81	28	2,323	1,563
New Mexico.....	77,315	124,027	21,946	39,049	835	1,679	-----	-----	300	366	778	873
Texas.....	517,610	771,369	374,290	509,443	23,939	27,037	-----	-----	757	804	10,693	11,849
Total.....	1,106,591	1,572,302	573,792	770,594	45,719	67,236	5,575	4,326	16,444	15,777	5,236,923	6,164,189
District 4:												
Colorado.....	102,428	130,625	10,471	12,333	3,284	2,593	470	620	1,211	665	117,864	146,836
Idaho.....	15,974	19,882	1,795	1,912	4,193	5,427	-----	-----	405	174	22,367	27,395
Montana.....	24,674	32,362	5,281	4,269	2,125	2,434	-----	-----	25	20	32,105	39,056
Utah.....	16,374	19,624	4,454	3,523	949	2,129	-----	-----	57	40	21,834	25,316
Wyoming.....	25,267	27,729	9,874	11,453	23,168	4,574	-----	-----	21	41	38,330	43,787
Total.....	184,717	230,222	31,875	33,490	13,719	17,157	470	620	1,719	940	259,735	307,425
District 5:												
Alaska.....	3,299	3,585	12	27	-----	-----	-----	-----	-----	-----	3,311	3,612
Arizona.....	35,820	37,578	5,483	5,329	388	289	-----	-----	592	425	42,293	43,621
California.....	233,962	244,576	33,799	32,292	36,090	23,039	26,494	12,179	3,245	5,870	333,590	317,956
Hawaii.....	4,783	5,073	129	484	361	162	4,437	5,140	-----	-----	9,710	10,509
Nevada.....	20,977	25,381	817	1,775	224	-----	15,486	3,040	-----	-----	37,504	30,196
Oregon.....	20,249	37,231	1,675	879	6,780	847	7,181	616	84	152	35,969	39,725
Washington.....	36,588	40,306	1,583	1,633	3,169	4,778	208	621	851	729	42,399	48,067
Total.....	355,688	393,730	43,498	42,429	47,012	29,115	53,806	21,596	4,772	7,176	721,224	757,806
Total United States shipments.....	5,053,157	5,475,539	999,363	1,176,260	493,208	521,006	216,627	117,004	58,677	62,314	11,570,278	12,473,258

<sup>1</sup> District totals do not equal the sum of State totals because of the inclusion in district totals and the exclusion in State totals of figures for refinery fuel, chemical, synthetic rubber, and secondary recovery uses to avoid disclosing company data. Data for these uses are shown in table 16.

TABLE 15.—Consumption of liquefied petroleum gases and ethane, by type, by PAD district and State

(Thousand gallons)

PAD district and State	Propane		Butane		Butane-propane mixture		Total	
	1963	1964	1963	1964	1963	1964	1963	1964
<b>District 1:</b>								
Connecticut.....	57,373	60,899	22	-----	18	12	57,413	60,911
Delaware.....	17,114	18,390	-----	-----	66	85	17,180	18,475
Florida.....	215,222	236,867	357	366	36,458	30,430	252,037	267,663
Georgia.....	141,535	155,100	2,577	3,035	32,912	31,628	177,024	189,763
Maine.....	25,833	28,503	-----	-----	-----	-----	25,833	28,503
Maryland and District of Columbia.....	58,989	59,192	-----	-----	263	308	59,252	59,500
Massachusetts.....	55,289	57,627	-----	-----	216	313	55,505	57,940
New Hampshire.....	21,398	25,098	646	767	-----	-----	22,044	25,865
New Jersey.....	68,555	83,156	13	29	335	378	68,903	83,563
New York.....	135,602	158,002	24	13	1,391	1,098	137,017	159,113
North Carolina.....	128,067	140,448	38	36	2,303	1,946	130,408	142,430
Pennsylvania.....	102,261	112,924	1,885	1,169	3,712	3,738	107,858	117,831
Rhode Island.....	12,675	11,302	-----	-----	-----	-----	12,675	11,302
South Carolina.....	66,041	78,093	69	169	7,560	9,758	73,670	88,020
Vermont.....	14,750	20,118	-----	-----	-----	-----	14,750	20,118
Virginia.....	70,660	78,220	437	347	11	-----	71,108	78,567
West Virginia.....	20,022	17,325	-----	-----	29	18	20,051	17,343
<b>Total</b> <sup>1</sup> .....	<b>1,250,757</b>	<b>1,392,737</b>	<b>69,151</b>	<b>71,830</b>	<b>86,399</b>	<b>81,638</b>	<b>2 1,773,132</b>	<b>2 1,867,790</b>
<b>District 2:</b>								
Illinois.....	390,956	336,070	5,974	4,184	2,467	1,439	399,397	341,693
Indiana.....	269,110	214,544	3,286	1,808	495	324	272,841	216,676
Iowa.....	227,586	211,522	191	197	75	-----	227,852	211,719
Kansas.....	225,061	208,123	15,801	6,413	18,605	12,701	259,467	227,237
Kentucky.....	101,025	96,616	213	222	1,590	1,511	102,828	98,349
Michigan.....	152,159	139,778	180	176	232	192	152,571	140,146
Minnesota.....	210,542	205,743	4,847	5,770	190	84	215,579	211,597
Missouri.....	327,247	280,257	3,404	3,112	6,146	6,975	336,797	290,344
Nebraska.....	152,367	136,285	828	719	646	594	153,841	137,598
North Dakota.....	52,866	45,598	2,856	2,139	4,862	3,311	60,584	51,048
Ohio.....	157,315	140,256	-----	-----	-----	-----	157,315	140,256
Oklahoma.....	254,348	247,667	22,797	17,400	56,051	37,876	333,196	302,943
South Dakota.....	63,770	60,223	178	110	1,620	928	65,568	61,261
Tennessee.....	66,927	70,878	514	360	5,065	4,612	72,506	75,850
Wisconsin.....	212,328	203,756	9,960	7,832	277	201	222,565	211,789
<b>Total</b> <sup>1</sup> .....	<b>3,040,402</b>	<b>2,821,554</b>	<b>169,384</b>	<b>164,421</b>	<b>114,775</b>	<b>104,377</b>	<b>2 3,579,264</b>	<b>2 3,376,048</b>
<b>District 3:</b>								
Alabama.....	107,203	152,211	2,836	3,044	35,011	43,706	145,050	198,961
Arkansas.....	150,585	229,688	8,570	14,511	55,786	61,134	214,891	305,333
Louisiana.....	69,572	111,571	9,443	6,040	79,774	72,771	153,789	190,382
Mississippi.....	125,154	167,049	7,399	8,014	68,375	74,000	200,928	249,063
New Mexico.....	85,264	143,223	2,727	4,969	13,183	17,802	101,174	165,994
Texas.....	429,959	780,437	54,328	76,661	443,002	463,404	927,289	1,320,502
<b>Total</b> <sup>1</sup> .....	<b>2,065,942</b>	<b>2,429,953</b>	<b>1,140,092</b>	<b>1,250,453</b>	<b>767,003</b>	<b>845,158</b>	<b>2 5,236,923</b>	<b>2 6,164,189</b>

**TABLE 15.—Consumption of liquified petroleum gases and ethane, by type, by PAD district and State—Continued**

(Thousand gallons)

PAD district and State	Propane		Butane		Butane-propane mixture		Total	
	1963	1964	1963	1964	1963	1964	1963	1964
<b>District 4:</b>								
Colorado.....	113,521	145,323	693	348	3,435	1,165	117,649	146,836
Idaho.....	22,362	27,245			220	150	22,582	27,395
Montana.....	29,306	36,469	1,055	838	1,744	1,778	32,105	39,085
Utah.....	21,485	24,824	12	7	337	485	21,834	25,316
Wyoming.....	33,557	38,590	138	76	4,635	5,131	38,330	43,797
<b>Total</b> <sup>1</sup> .....	<b>233,487</b>	<b>281,144</b>	<b>10,841</b>	<b>13,324</b>	<b>15,407</b>	<b>12,957</b>	<b>259,735</b>	<b>2307,425</b>
<b>District 5:</b>								
Alaska.....	3,311	3,590				22	3,311	3,612
Arizona.....	37,864	39,788	326		4,103	3,833	42,293	43,621
California.....	277,574	267,726		1,377	56,016	48,853	333,590	317,956
Hawaii.....	4,927	10,869			4,783		9,710	10,869
Nevada.....	37,421	30,136			83	60	37,504	30,196
Oregon.....	34,272	37,811			1,697	1,914	35,969	39,725
Washington.....	40,137	46,066			2,262	2,001	42,399	48,067
<b>Total</b> <sup>1</sup> .....	<b>530,388</b>	<b>517,429</b>	<b>50,423</b>	<b>100,370</b>	<b>71,004</b>	<b>63,105</b>	<b>2721,224</b>	<b>2757,806</b>
<b>Total United States shipments.</b>	<b>7,120,976</b>	<b>7,442,817</b>	<b>1,439,891</b>	<b>1,600,398</b>	<b>1,054,588</b>	<b>1,107,235</b>	<b>11,570,278</b>	<b>12,473,258</b>

<sup>1</sup> District totals do not equal the sum of State totals because of the inclusion in district totals and the exclusion in State totals of figures for refinery fuel, chemical, synthetic rubber, and secondary recovery uses to avoid disclosing company data. Data for these uses are shown in table 8.

<sup>2</sup> Includes ethane, isobutane, and all other mixtures. See table 8.

**TABLE 16.—Consumption of liquefied petroleum gases and ethane for chemical, synthetic rubber, refinery fuel, and secondary recovery of petroleum uses, by type, by PAD district <sup>1</sup>**  
(Thousand gallons)

Use and PAD district	Ethane		Propane		Butane		Isobutane		Butane-propane mixture		All other mixtures		Total	
	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964	1963	1964
<b>Chemical:</b>														
District 1.....	347,106	275,607	35,943	46,389	59,783	61,899	1,057	1,128	125	90	18,662	44,850	462,676	429,963
District 2.....	237,122	240,661	49,017	55,524	44,521	51,199	2,533	2,220	338	481	15,048	42,815	348,579	392,900
District 3.....	783,362	819,585	1,035,821	765,161	543,080	535,958	30,528	28,152	65,934	102,931	369,531	744,940	2,828,256	2,996,727
District 4.....														
District 5.....	10,694	11,172	50,498	57,540	11,969	63,378	146		26	3,570	58,569	65,730	131,902	201,390
Total.....	1,378,284	1,347,025	1,171,279	924,614	659,353	712,434	34,264	31,500	66,423	107,072	461,810	898,335	3,771,413	4,020,980
<b>Synthetic rubber:</b>														
District 1.....														
District 2.....														
District 3.....					493,093	576,712					80,465	45,948	573,558	622,660
District 4.....					25,998	28,812							25,998	28,812
District 5.....														
Total.....					519,091	605,524					80,465	45,948	599,556	651,472

Refinery fuel:														
District 1			3,428	5,084	3,300	4,000			1,000	1,836		7,728	10,920	
District 2			127,778	168,714	53,884	62,780			16,116	33,148		197,778	264,642	
District 3			57,506	77,136	18,616	24,544			5,988	9,410		82,110	111,090	
District 4			6,486	7,298	8,344	11,806			5,036	4,248		19,866	23,352	
District 5			37,292	20,490	12,130	6,803			54	1,813		49,476	29,106	
Total			232,490	278,722	96,274	109,933			28,194	50,455		356,958	439,110	
Secondary recovery of petroleum:														
District 1														
District 2														
District 3			4,878	3,477								4,878	3,477	
District 4			6,770	1,395	599	249						7,369	1,644	
District 5			7,092	3,413					1,980	1,039		9,072	4,452	
Total			18,740	8,285	599	249			1,980	1,039		21,319	9,573	
Total:														
District 1	347,106	275,607	39,371	51,473	63,083	65,899	1,057	1,128	1,125	1,926	18,662	44,850	470,404	440,883
District 2	237,122	240,661	176,795	224,238	98,405	113,979	2,533	2,220	16,454	33,629	15,048	42,815	546,357	657,542
District 3	783,362	819,585	1,098,205	845,774	1,054,789	1,137,214	30,528	23,152	71,922	112,341	449,996	790,888	3,488,802	3,733,954
District 4			13,266	8,693	8,943	12,065			5,036	4,248			27,235	24,996
District 5	10,694	11,172	94,882	81,443	50,097	98,993		146	2,060	6,422	53,569	65,730	216,448	263,760
Total United States	1,378,284	1,347,025	1,422,509	1,211,621	1,275,317	1,428,140	34,264	31,500	96,597	158,566	542,275	944,283	4,749,246	5,121,135

<sup>1</sup> State figures not shown to avoid disclosure of individual company data.



## FOREIGN TRADE

The imports and exports statistics included in this section were compiled by the U.S. Department of Commerce and differ slightly from those used in other sections of this chapter. The Bureau of Mines import data exclude from United States totals all imports from foreign sources to U.S. territories and possessions. Exports of liquefied gases totaled 225 million gallons, 32 million more than in 1963. As in past years, Mexico was the principal importer of LP gases from the United States, receiving 94 percent of the total exports.

TABLE 17.—LP gases<sup>1</sup> exported from the United States, by country or area  
(Thousand gallons \*)

Country or area	1955-59 (average)	1960	1961	1962	1963	1964
<b>North America:</b>						
Canada.....	37,528	5,251	4,134	3,657	6,347	4,900
Mexico.....	91,060	111,858	121,890	148,931	177,748	211,141
Bermuda and Caribbean.....	4,169	3,791	3,366	2,031	2,494	2,219
Central America.....	1,737	456	489	628	438	88
Other.....	5,804					
<b>Total.....</b>	<b>140,298</b>	<b>121,356</b>	<b>129,879</b>	<b>155,247</b>	<b>187,027</b>	<b>218,348</b>
<b>South America:</b>						
Argentina.....	244	3,818	14,514	3,518	9	1,060
Brazil.....	10,473		454	18	169	425
Other.....	264	32	34	223	89	51
<b>Total.....</b>	<b>10,981</b>	<b>3,850</b>	<b>15,002</b>	<b>3,759</b>	<b>267</b>	<b>1,536</b>
<b>Europe:</b>						
Denmark.....	128		24	22	336	13
France.....	33	( <sup>2</sup> )	149	113	2,113	427
Germany, West.....	95	( <sup>2</sup> )	528	1,353	1,416	2,461
Italy.....	202	21	399	489	436	40
Netherlands.....	9		133	132	187	84
Sweden.....	29	19	( <sup>2</sup> )	10	10	7
United Kingdom.....	40	15	1,566	354	174	429
Other.....	22		46	106	78	156
<b>Total.....</b>	<b>558</b>	<b>55</b>	<b>2,845</b>	<b>2,579</b>	<b>4,760</b>	<b>3,617</b>
<b>Asia:</b>						
Israel.....	25		9	15	27	71
Japan.....	229	23	673	374	172	245
Phillippines.....	92				24	24
Thailand.....					11	300
Other.....	17	2	22	8	21	42
<b>Total.....</b>	<b>363</b>	<b>25</b>	<b>704</b>	<b>397</b>	<b>255</b>	<b>658</b>
<b>Africa.....</b>	<b>119</b>	<b>6</b>	<b>212</b>	<b>325</b>	<b>109</b>	<b>172</b>
<b>Oceania.....</b>	<b>124</b>	<b>245</b>	<b>410</b>	<b>428</b>	<b>665</b>	<b>1,015</b>
<b>Grand total.....</b>	<b>182,443</b>	<b>125,537</b>	<b>149,052</b>	<b>162,735</b>	<b>193,073</b>	<b>225,346</b>

<sup>1</sup> Data include LR gases.

<sup>2</sup> 4.5 pounds=1 gallon.

<sup>3</sup> Less than 1,000 gallons.

Source: Bureau of the Census.

**TABLE 18.—Natural gasoline exported from the United States, by countries**  
(Thousand gallons)

Country	1955-59 (average)	1960	1961	1962	1963	1964
Bahamas.....	1				139	135
Canada.....	3,166	15	61	239	470	399
Mexico.....	26	38	40	35	60	
Turkey.....			24			
United Kingdom.....			140			11
Other countries.....			80	90	145	73
Total.....	3,193	53	345	364	814	618

Source: Bureau of the Census.

## TECHNOLOGY

**Sulfinol Process.**<sup>5</sup>—The first commercial application of a new process for removing acidic gases hydrogen sulfide ( $H_2S$ ), carbon dioxide ( $CO_2$ ), and carbonyl sulfide ( $COS$ ), as well as mercaptans, from natural gas being processed for natural gas liquids was started in March 1964 at the Person Gas Plant of Shell Oil Company in Karnes County, Texas. The process is called Sulfinol and uses a solvent composed of an alkanolamine admixed with an organic chemical named sulfolane. In this installation the plant was converted from using an MEA (monoethanolamine) acid gas absorption system which processed gas from 1,000-pound-per-square-inch oilfield separators that contained 1.6 percent  $H_2S$  and 6.9 percent  $CO_2$ . The change was made because of the process advantages and economics the new treating system offers, according to the operators.

In general, the new process absorber operates more smoothly and without the frequent attention required by the amine process while maintaining a very low and precise control of the  $H_2S$  content of the residue gas stream. Miscellaneous labor consuming items that are common in MEA operations, such as cleaning of filters and exchangers, solvent reclamation, and solvent makeup have required little attention within the brief operating time of this plant.

Several other installations of the new process in addition to the Person plant have been made in related applications for treating light gases. Three of these units are in operation removing  $CO_2$  from crude hydrogen being used as feedstock for ammonia synthesis and hydrofining processes; two, removing  $H_2S$  and  $COS$  from the process streams in a partial oxidation gas process for generating hydrogen; and one, removing  $CO_2$  for a natural gas stream. Fourteen other units of this new type are in design or under construction in plants producing natural gas liquids and in closely associated process operations.

**Cryogenics in Gas Processing Industry.**<sup>6</sup>—Cryogenics is being applied increasingly in natural gas and LNG processing. It is the science and technology of supercold fluids. The word is derived from the Greek word "Kryos," which means "cold." The upper limit of

<sup>5</sup> C. L. Dunn, E. R. Freitas, and E. S. Hill. "Sulfinol" Process in Commercial Operation. Proc. of the Forty-fourth Ann. Convention of Nat. Gas Processors Assoc., Dallas, Tex., Mar. 24-26, 1965, pp. 55-58.

<sup>6</sup> A. W. Mellen. Cryogenics and the Gas Processing Industry. Proc. of the Forty-fourth Ann. Convention of Nat. Gas Processors Assoc., Dallas, Tex., Mar. 24-26, 1965, pp. 12-17.

the cryogenic temperature range is not well defined and this point is often debated, but the lower limit is precisely fixed at absolute zero, which has been approached closely though not as yet attained. Cryogenics in practice usually includes those temperatures below minus 250° F., but some groups place the dividing line at temperatures as high as minus 150° F.

The greatest use of cryogenics in the lower temperature range in natural gas processing has been for the recovery of helium. Every helium-recovery plant in operation has used cryogenic techniques to extract the product from natural gas, despite substantial development efforts with high-temperature diffusion processes.

In the less cold range, cryogenics has been applied successfully to natural gas liquid processing utilizing propane refrigeration for process cooling and control, especially at plants in locations deficient in cooling water. An extension of this cryogenic application to lower temperatures has led to liquefied natural gas (LNG) in commercial applications. LNG now is being transported from Africa to England overseas in specially constructed ships and delivered to gas-deficient areas. LNG also is finding increasing use in gas pipeline peak shaving operations in the United States. LNG is now rapidly becoming the major interest in gas processing cryogenics. Several commercial projects have been completed within 1964 and others are well underway. One LNG peak shaving project was completed in New Jersey in 1964, and two were under construction in Alabama and California at the end of the year.

LNG plants have required the development of refrigeration systems to remove heat down to a temperature of minus 258° F., the normal boiling point of methane. The cascade-type system, which uses propane, ethane, and methane as refrigerants, has been used the most. An important development in this system has been the use of an expansion engine cycle for pressure let-down that also is a means of providing refrigeration for liquefaction. Since natural gas distribution systems operate at pressures significantly less than the transmission stations that waste the energy obtained from gas throttling. Efforts to convert this wasted energy into electrical energy by means of an expansion turbine have not been possible because of marginal economics, and there has not been a use for the refrigeration obtained from an expansion engine.

Uses are now being found for this refrigeration in natural gas liquefaction and LP gas processing, and especially for the recovery of ethane and other LP gases which, as relatively pure hydrocarbons feedstocks, are being extracted at a growing rate for use in the rapidly expanding chemical, rubber, and petrochemical industries.

# Crude Petroleum and Petroleum Products

By James G. Kirby<sup>1</sup> and Betty M. Moore<sup>2</sup>



## Contents

	<i>Page</i>		<i>Page</i>
General summary.....	381	Refined products—Continued	
Demand by products.....	382	Refinery capacity.....	434
Scope of report.....	387	Aviation gasoline.....	434
Districts.....	388	Gasoline.....	434
World oil supply.....	390	Kerosine.....	452
Reserves.....	391	Distillate fuel oil.....	457
Crude petroleum.....	391	Residual fuel oil.....	461
Supply and demand.....	391	Lubricants.....	462
Production.....	392	Jet fuel (military grade).....	467
General.....	392	Liquefied gases, ethane, ethyl-	
By States.....	392	ene.....	469
Wells.....	398	Asphalt and road oil.....	471
Consumption and distribution.....	400	Other products.....	479
Stocks.....	412	Intercoastal shipments.....	484
Storage capacity.....	417	Foreign trade.....	486
Value and price.....	422	Native asphalt.....	497
Refined products.....	424		
General review.....	424		

## GENERAL SUMMARY

**T****OTAL DEMAND**<sup>3</sup> for all oils in 1964 was 11,061,000 barrels daily, an increase of 2.8 percent over the 1963 daily average of 10,759,000. Domestic demand increased 2.9 percent to 10,859,000 barrels daily. Exports in 1964 were a little lower than in 1963, but much higher than in 1961 and 1962. The total new supply of all oils in 1964 was 11,071,000 barrels daily. Domestic crude oil pro-

<sup>1</sup> Industry economist, Division of Petroleum.

<sup>2</sup> Statistical assistant, Division of Statistics.

<sup>3</sup> Certain terms as used in this chapter are more or less unique to the petroleum industry. Principal terms and their meaning are:

*Total demand.*—A derived figure representing total new supply plus decreases or minus increases in reported stocks. Because there are substantial secondary and consumer's stocks that are not reported to the Bureau of Mines, this figure varies considerably from consumption.

*Domestic demand.*—Total demand less exports.

*New supply of all oils.*—The sum of crude oil production plus production of natural gas liquids, plus benzol (coke-oven) used for motor fuel, plus imports of crude oil and other petroleum products.

*Transfers.*—Crude oil conveyed to fuel-oil stocks without processing, or reclassification of products from one product category to another.

*All oils.*—Crude petroleum, natural gas liquids, and their derivatives.

*Principal product.*—Gasoline, kerosine, distillate fuel, and residual fuel oil.

TABLE 1.—Salient statistics of crude petroleum, refined products, and natural gas liquids in the United States

	1960	1961	1962	1963	▷ 1964
<b>Crude petroleum:</b>					
Domestic production.....thousand barrels <sup>1</sup> ..	2,574,933	2,621,758	2,676,189	2,752,723	2,786,822
World production.....do.....	7,688,668	8,183,899	8,882,227	9,537,420	10,327,591
U.S. proportion.....percent.....	33	32	30	29	27
Imports <sup>2</sup> .....thousand barrels <sup>1</sup> ..	371,575	381,548	411,039	412,660	438,643
Exports <sup>3</sup> .....do.....	3,087	3,227	1,790	1,698	1,363
Stocks, end of year.....do.....	239,800	244,664	252,011	237,361	230,057
Runs to stills.....do.....	2,952,534	2,987,158	3,069,631	3,170,652	3,241,632
Value of domestic production at wells:					
Total.....thousand dollars.....	7,420,181	7,565,582	7,774,051	7,965,743	8,017,078
Average per barrel.....	\$2.88	\$2.89	\$2.90	\$2.89	\$2.88
Total producing oils wells December 31.....	591,158	594,917	596,385	* 588,657	588,225
Total oil wells completed during year (successful wells).....	22,492	21,850	21,372	20,288	20,620
<b>Refined products:</b>					
Imports <sup>4</sup> .....thousand barrels <sup>1</sup> ..	292,536	318,118	348,754	362,053	388,200
Exports <sup>5</sup> .....do.....	70,819	60,836	59,600	74,216	72,405
Stocks, end of year.....do.....	515,827	543,343	* 553,848	564,451	573,499
Output of gasoline <sup>6</sup> .....do.....	1,522,497	1,534,464	1,583,376	1,625,198	1,706,005
Yield of gasoline.....percent.....	45.1	44.7	44.8	44.1	45.2
Average dealers' net price (excluding tax) of gasoline in 55 U.S. cities.....					
cents per gallon <sup>7</sup> .....	16.08	15.80	15.45	15.22	14.82
Completed refineries, end of year.....	311	311	308	304	300
Daily crude-oil capacity.....thousand barrels <sup>1</sup> ..	10,010	10,105	10,118	10,385	10,773
<b>Natural gas liquids:</b>					
Production.....do.....	340,157	361,689	372,705	400,886	419,924
Stocks, end of year.....do.....	28,931	37,067	31,385	33,747	35,679

▷ Preliminary (except for crude production and value). \* Revised.

<sup>1</sup> 42 gallons per barrel.

<sup>2</sup> Bureau of Mines data for crude oil and unfinished oils.

<sup>3</sup> U.S. Department of Commerce data.

<sup>4</sup> U.S. Department of Commerce data, except for unfinished oils.

<sup>5</sup> New basis. These data are comparable to 1963 because of product reclassification resulting from separately reporting data for petrochemical feedstocks.

<sup>6</sup> Beginning with 1961 excludes unfinished gasoline.

<sup>7</sup> Platt's Oil Price Handbook.

duction, 7,664,000 barrels daily (preliminary figure), represented 69.2 percent of the supply; natural gas liquids production, 10.4 percent; and imports of crude oil and refined products, 20.4 percent.

## DEMAND BY PRODUCTS

As most of the indicated consumption of crude oil in the United States is converted into products at refineries, before sale to ultimate consumers, the analysis of demand trends involves consideration of each major product. The fuel oils (residual, distillate, and kerosine) compete directly with natural gas or coal in heating, cooking, and industrial uses. Gasoline and diesel fuel are the major fuels used in the transportation field, followed by jet fuel (a blend of low-grade gasoline, kerosine, and distillate) used in military jetplanes, and straight kerosine which is used as fuel by commercial jetplanes. The other products serve a wide variety of uses and are in competition with other refined products both for fuel and nonfuel uses.

Petrochemical feedstocks produced at refineries are being reported as a separate product, as was done for the first time with 1963 data. This eliminates products used for chemical manufacture from the other petroleum products. For this reason, in 1963 and 1964 data on demands for individual petroleum products are not strictly comparable to the statistics published for earlier years.

TABLE 2.—Supply and demand of all oils in the United States, 1963-64 by months and totals for 1962-64

(Thousand barrels)

	1963												1962 total	
	January	February	March	April	May	June	July	August	September	October	November	December		Total
<b>New supply:</b>														
<b>Domestic production:</b>														
Crude petroleum.....	226,420	212,437	234,289	228,270	234,499	226,853	235,144	236,830	225,207	233,610	226,321	232,843	2,752,723	2,678,189
Natural gas liquids.....	33,520	32,136	34,407	31,932	33,053	31,907	33,236	34,012	32,773	34,089	34,280	35,541	400,886	372,705
Benzol, etc.....	7	6	7	10	7	6	7	7	6	7	5	5	80	91
<b>Total production.....</b>	<b>259,947</b>	<b>244,579</b>	<b>268,703</b>	<b>260,212</b>	<b>267,559</b>	<b>258,766</b>	<b>268,387</b>	<b>270,849</b>	<b>257,986</b>	<b>267,706</b>	<b>260,606</b>	<b>268,389</b>	<b>3,153,689</b>	<b>3,048,985</b>
<b>Imports:<sup>1</sup></b>														
Crude petroleum.....	41,043	30,898	36,070	32,593	34,484	31,872	38,214	36,666	34,898	31,362	34,241	30,319	412,660	411,039
Refined products.....	43,151	33,726	29,689	32,374	26,475	22,070	26,899	25,576	24,137	32,420	27,534	38,002	362,053	348,764
<b>Total new supply.....</b>	<b>344,141</b>	<b>309,203</b>	<b>334,462</b>	<b>325,179</b>	<b>328,518</b>	<b>312,708</b>	<b>333,500</b>	<b>333,091</b>	<b>317,021</b>	<b>331,488</b>	<b>322,381</b>	<b>336,710</b>	<b>3,928,402</b>	<b>3,808,778</b>
<b>Increase (+) or decrease (-) in stocks.....</b>	<b>-41,353</b>	<b>-33,419</b>	<b>+11,478</b>	<b>+24,525</b>	<b>+18,120</b>	<b>+19,735</b>	<b>+19,285</b>	<b>-12,272</b>	<b>+10,958</b>	<b>+11,701</b>	<b>+2,855</b>	<b>-54,894</b>	<b>+1,263</b>	<b>+11,795</b>
<b>Demand:</b>														
<b>Total demand.....</b>	<b>385,494</b>	<b>342,622</b>	<b>322,984</b>	<b>300,654</b>	<b>310,398</b>	<b>292,973</b>	<b>314,215</b>	<b>320,819</b>	<b>306,063</b>	<b>319,787</b>	<b>319,526</b>	<b>391,604</b>	<b>3,927,139</b>	<b>3,796,983</b>
<b>Exports:<sup>2</sup></b>														
Crude petroleum.....	179	116	95	170	140	123	146	178	100	179	106	166	1,698	1,790
Refined products.....	4,210	8,183	5,442	6,658	6,311	5,282	5,850	6,445	7,016	5,842	6,645	6,332	74,216	59,600
<b>Domestic demand:</b>														
Gasoline.....	124,592	115,022	128,150	137,839	143,036	140,517	149,724	150,735	133,721	141,774	132,573	134,420	1,632,103	1,584,691
Kerosine.....	22,655	18,992	14,199	10,122	10,053	9,325	10,904	12,358	13,326	12,477	15,402	21,999	172,212	164,167
Distillate fuel oil.....	103,285	88,294	72,018	48,899	48,243	39,680	40,269	42,965	50,476	49,649	61,317	102,159	747,254	732,405
Residual fuel oil.....	64,447	56,083	49,255	43,280	36,982	34,958	36,223	36,083	35,908	41,561	43,739	60,350	535,924	545,813
Military jet fuel.....	9,595	8,273	7,537	9,530	10,361	8,539	10,695	11,845	10,151	10,945	8,978	8,788	115,237	112,401
Lubricants.....	3,773	3,061	3,359	3,817	4,108	3,806	3,734	3,960	3,438	4,383	3,324	2,888	43,601	43,615
Wax.....	330	293	363	324	316	297	315	308	320	338	283	322	3,809	3,965
Coke.....	6,325	5,283	5,996	5,592	5,753	5,751	5,976	5,655	5,566	5,728	5,145	6,553	69,323	70,704
Asphalt.....	3,362	2,850	4,396	5,910	14,396	13,809	16,568	16,252	14,618	14,208	6,907	4,078	117,354	114,122
Road oil.....	120	126	158	366	595	1,072	1,534	1,262	812	529	203	137	6,914	6,985
Still gas.....	10,296	9,591	10,527	10,368	11,020	11,376	12,015	11,690	10,821	10,561	10,512	10,821	129,598	130,829
Liquefied gases.....	28,656	23,736	18,513	15,635	15,375	15,052	17,286	17,495	16,347	17,851	21,169	29,814	236,929	255,462
Petrochemical feedstocks <sup>3</sup> .....	6,578	6,143	7,723	6,781	7,718	7,871	7,891	8,174	7,727	8,379	7,961	8,810	91,756	91,756
Miscellaneous.....	1,173	1,556	1,399	1,221	1,426	1,326	1,364	1,426	1,478	1,516	1,294	1,171	16,350	30,890
<b>Total domestic product demand.....</b>	<b>385,187</b>	<b>339,308</b>	<b>323,593</b>	<b>299,684</b>	<b>309,382</b>	<b>293,879</b>	<b>314,498</b>	<b>320,208</b>	<b>304,709</b>	<b>319,849</b>	<b>318,857</b>	<b>392,210</b>	<b>3,921,364</b>	<b>3,796,029</b>
Crude losses.....	305	287	299	280	307	295	309	312	290	297	291	299	3,571	3,465
Less net processing gain.....	4,387	5,272	6,445	6,138	5,742	6,606	6,588	6,324	6,052	6,380	6,373	7,403	73,710	63,901
<b>Total domestic demand.....</b>	<b>381,105</b>	<b>334,323</b>	<b>317,447</b>	<b>293,826</b>	<b>303,947</b>	<b>287,568</b>	<b>308,219</b>	<b>314,196</b>	<b>298,947</b>	<b>313,766</b>	<b>312,775</b>	<b>385,106</b>	<b>3,851,225</b>	<b>3,735,593</b>
<b>Stocks:</b>														
Crude petroleum.....	249,209	240,396	241,029	251,391	255,666	250,036	249,962	249,077	248,261	245,539	244,387	237,361	237,361	252,011
Natural gas liquids.....	23,970	20,867	23,928	27,160	31,622	35,403	38,769	41,384	43,078	43,750	42,084	33,747	33,747	31,385
Refined products.....	519,764	498,261	506,045	516,976	526,359	547,943	563,936	574,478	584,558	598,309	603,982	564,451	564,451	550,900
<b>Total stocks.....</b>	<b>792,943</b>	<b>759,524</b>	<b>771,002</b>	<b>795,527</b>	<b>813,647</b>	<b>833,382</b>	<b>852,667</b>	<b>864,939</b>	<b>876,897</b>	<b>887,598</b>	<b>890,453</b>	<b>835,559</b>	<b>835,559</b>	<b>834,296</b>

See footnotes at end of table.

TABLE 2.—Supply and demand of all oils in the United States, 1963-64 by months and totals for 1962-64—Continued

(Thousand barrels)

	1964 <sup>r</sup>												1963 total
	January	February	March	April	May	June	July	August	September	October	November	December	
<b>New supply:</b>													
Domestic production:													
Crude petroleum.....	238,083	224,495	240,605	233,139	235,837	228,347	233,736	232,647	227,934	237,274	230,715	242,313	2,805,125
Natural gas liquids.....	36,359	34,059	36,002	33,955	34,366	32,889	34,536	34,921	34,675	35,642	35,484	37,036	419,924
Benzol, etc.....	9	3	1	1	2	1	2	3	2	1	1	3	29
Total production.....	274,451	258,557	276,608	267,095	270,205	261,237	268,274	267,571	262,611	272,917	266,200	279,352	3,225,078
Imports: <sup>1</sup>													
Crude petroleum.....	39,635	32,209	36,945	33,091	35,968	34,387	43,820	40,743	36,853	39,224	34,102	31,666	438,643
Refined products.....	48,975	35,210	32,176	35,201	28,169	26,303	28,071	27,232	25,563	31,772	30,004	39,524	388,200
Total new supply.....	363,061	325,976	345,729	335,387	334,342	321,927	340,165	335,546	325,027	343,913	330,306	350,542	4,051,921
Increase (+) or decrease (-) in stocks.....	-22,770	-9,902	+6,362	+8,797	+24,676	+1,137	+12,857	+16,566	+3,185	+1,773	+4,231	-43,236	+3,676
<b>Demand:</b>													
Total demand.....	385,831	335,878	339,367	326,590	309,666	320,790	327,308	318,980	321,842	342,140	326,075	393,778	4,048,245
Exports: <sup>2</sup>													
Crude petroleum.....	116	98	233	100	174	152	90	118	71	88	---	123	1,363
Refined products.....	6,677	4,763	6,012	6,400	5,711	6,442	6,669	6,026	5,592	6,485	5,403	6,235	72,405
Domestic demand:													
Gasoline.....	130,511	121,819	135,523	140,622	144,860	153,486	156,720	150,125	145,620	147,760	131,528	145,540	1,704,114
Kerosine.....	21,199	17,668	15,155	12,628	11,054	10,284	12,280	12,821	13,671	15,806	15,119	20,734	173,409
Distillate fuel oil.....	96,053	81,538	73,397	59,579	46,844	43,825	41,177	41,350	48,077	56,790	65,858	94,518	749,006
Residual fuel oil.....	66,431	53,373	49,740	48,187	37,546	35,704	38,167	36,660	38,323	45,065	45,653	61,209	556,058
Military jet fuel.....	9,727	8,354	9,452	10,281	10,448	11,859	10,299	10,730	10,648	9,756	9,696	7,331	118,581
Lubricants.....	3,982	3,355	3,775	4,390	3,603	4,314	3,968	3,722	3,924	3,740	3,589	3,442	45,804
Wax.....	314	255	339	321	289	288	308	281	311	323	315	252	3,596
Coke.....	5,789	5,724	6,284	5,557	5,446	6,001	5,952	6,247	5,955	5,948	5,546	6,001	70,450
Asphalt.....	3,276	3,327	4,349	7,135	11,934	15,524	16,702	16,656	15,532	13,895	7,923	3,894	120,147
Road oil.....	59	65	83	183	617	1,033	1,578	1,075	751	655	323	123	6,545
Still gas.....	10,617	9,942	10,820	10,618	11,212	11,654	12,208	11,479	10,935	10,539	10,438	10,795	131,257
Liquefied gases.....	27,770	22,165	19,896	16,857	15,809	15,697	17,626	18,597	18,779	20,894	21,944	28,970	245,004
Petrochemical feedstocks <sup>3</sup> .....	8,750	8,104	9,045	8,811	8,765	9,036	8,999	8,442	8,597	9,036	8,245	8,956	104,789
Miscellaneous.....	1,540	1,349	1,269	1,399	1,253	1,573	1,402	1,256	1,294	1,422	1,339	1,354	16,450

Total domestic product demand.....	386,018	337,023	339,127	326,568	309,680	320,278	327,386	319,441	322,417	341,629	327,519	393,119	4,050,210	3,921,364
Crude losses.....	303	287	300	283	298	295	312	311	299	303	293	310	3,602	3,571
Less net processing gain.....	7,283	6,283	6,305	6,766	6,197	6,380	7,149	6,916	6,537	6,365	7,140	6,009	79,335	73,710
Total domestic demand.....	379,038	331,027	333,122	320,090	303,781	314,196	320,549	312,836	316,179	335,567	320,672	387,420	3,974,477	3,851,225
<b>Stocks:</b>														
Crude petroleum.....	241,007	240,062	246,863	253,912	257,322	251,230	246,333	237,912	232,780	235,233	236,809	230,057	230,057	237,361
Natural gas liquids.....	23,435	27,389	29,901	34,123	33,925	42,527	45,039	46,631	46,792	46,133	43,236	35,679	35,679	33,747
Refined products.....	543,347	535,436	532,485	530,006	546,475	550,102	555,344	588,739	596,895	596,874	602,426	573,499	573,499	564,451
Total stocks.....	812,789	802,887	809,249	818,046	842,722	843,859	856,716	873,282	876,467	878,240	882,471	839,235	839,235	835,559

\* Preliminary.

† Bureau of Mines data for crude oil and unfinished oils, U.S. Department of Commerce data for all other imports.

‡ U.S. Department of Commerce data.

§ Produced at petroleum refineries.



**Gasoline.**—The total demand for gasoline, which includes motor gasoline, aviation gasoline, and naphthas, was 1,712,056,000 barrels in 1964, compared with 1,639,089,000 barrels in 1963. Domestic demand was 1,704,114,000 barrels, an increase of 4.4 percent for the year, and exports totaled 7,942,000 barrels, a gain of 13.6 percent. The demand for aviation gasoline continued to decline and for the year was 53,283,000 barrels, 1,517,000 barrels less than in 1963. A breakdown of domestic demand by use indicates that in 1964 civilian highway use accounted for 89.8 percent; aviation gasoline, 2.8 percent; and nonhighway vehicles, nonfuel use, and losses, 7.4 percent.

**Distillate Fuel Oil.**—The total demand for distillate fuel oil in 1964 was 754,440,000 barrels, a decrease of 1.0 percent. This included a domestic demand of 749,006,000 barrels and exports of 5,434,000 barrels.

**Residual Fuel Oil.**—The demand for residual fuel oil (574,928,000 barrels) was noticeably higher than in 1963. With domestic demand up 17.1 million barrels and exports up 3.6 million barrels, the total demand was 20.7 million barrels greater in 1964 than in 1963.

**Kerosine.**—Commercial jet aircraft use of kerosine as fuel continued to increase in 1964 and accounted for 85,672,000 barrels or 48 percent of the total domestic demand. Other uses for kerosine declined 4.4 percent for the year.

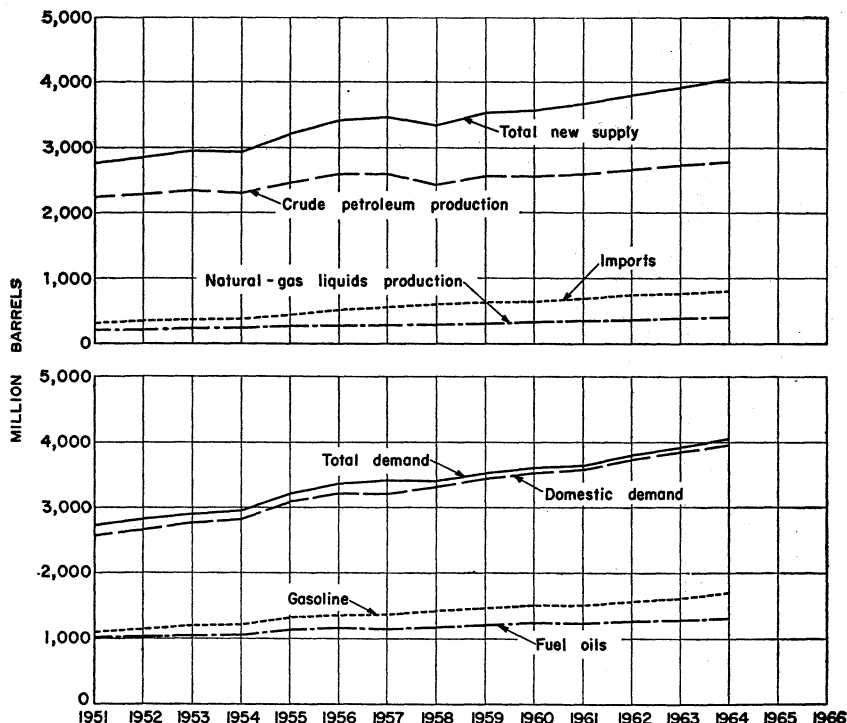


FIGURE 1.—Supply and demand of all oils in the United States, 1951-64.

TABLE 3.—Demand for all oils<sup>1</sup> in the United States, 1955–64

(Million barrels)

Year	Domestic demand	Exports	Total demand	Year	Domestic demand	Exports	Total demand
1955	3,087.8	134.2	3,222.0	1960	3,535.8	73.9	3,609.7
1956	3,213.2	157.4	3,370.6	1961	3,579.2	63.6	3,642.8
1957	3,218.6	207.2	3,425.8	1962	3,735.6	61.4	3,797.0
1958	3,315.2	100.6	3,415.8	1963	3,851.2	75.9	3,927.1
1959	3,449.6	77.1	3,526.7	1964 <sup>p</sup>	3,974.5	73.7	4,048.2

<sup>p</sup> Preliminary.<sup>1</sup> See text footnote 3 at the beginning of this chapter.

**Other Products.**—The total demand for all other products, including crude oil exports and losses as well as refinery overage, was 828,241,000 barrels in 1964, a gain of 3.7 percent. The 1964 demand for petrochemical feedstocks was 104,789,000 barrels, of which 7,698,000 barrels was produced from still gas, 47,190,000 barrels from liquefied refinery gas, 24,583,000 barrels from naphtha, and 25,318,000 barrels from the other products which are principally miscellaneous finished products, but which also include kerosine, distillate fuel oils, and residual fuel oil. The total demand for military-grade jet fuel increased 2.9 percent in 1964; asphalt demand increased 2.4 percent; petroleum coke, 4.9 percent; lubricating oils, 3.3 percent; and wax 1.3 percent. Demand for road oil declined 5.3 percent.

**Shipments to U.S. Territories and Possessions.**—Domestic demand, as defined in this chapter, refers to demand in all States of the United States. Shipments from the United States to territories and possessions are included with exports. Any foreign receipts into these territories and possessions are not included in the total imports shown.

Shipments from territories and possessions to foreign countries are excluded from total exports. Shipments to the United States are included in imports.

### SCOPE OF REPORT

This report deals primarily with statistics for production, refining, distribution, and indicated consumption of crude petroleum and refined products in the United States; it also contains a brief description of technological developments. The object of limiting data to the United States is to permit a breakdown and balancing of supply and demand of operations by States and districts. The composition of the districts used by the Bureau of Mines is explained in the next section.

The increasing volume of natural gas liquids recovered from natural gas has made it desirable to present data on these liquids with crude oil data, as these liquids are blended with refinery products and are similar to materials recovered from refinery gases. These natural gas liquids are recovered at natural-gas processing plants, away from the oil refineries.

Most of the data were compiled by the Bureau of Mines from detailed reports, submitted on a voluntary basis by the various companies. These data are published monthly for release about 8 weeks

after the end of the month. Complete coverage, with only minor estimates, is procured for production, stocks, and refinery operations. The Bureau of Mines uses the import data on crude oil and unfinished oils as reported by the refineries. Other product imports and all export data are taken from records of the U.S. Department of Commerce.

The Bureau of Mines uses crude-oil production data compiled by State agencies for those States which compile the information. Where such data are not available, the Bureau of Mines sends monthly questionnaires to all pipeline companies operating within the State. Monthly reports are received from refineries showing crude oil receipts by States of origin and method of transportation. These reports include information covering final receipts by water, tank-cars, and trucks and cover stocks of crude oil held at refineries, by State of origin. The Bureau of Mines crude production figure includes field condensate.

Individual refineries reported monthly receipts, input, stocks at the beginning and end of the month, refinery production, and deliveries. Data on both product stocks at refineries and pipeline and bulk terminal stocks are collected.

Semiannual canvasses of refineries, pipeline companies, and natural gas liquids plants provide data on storage tank capacities assigned to the various refined products and to liquefied gases at plants, terminals, and underground storage facilities.

Annual canvasses provide supplemental information on the value of crude petroleum at wells, the number of producing wells, sales of fuel oils, asphalt and road oils by uses, and refinery capacity.

The table showing world production of crude oil by countries is based on monthly reports that also included data on crude movements and refinery operations. Data on crude reserves, wells drilled, and current prices were taken from the sources indicated in the footnotes.

The 1964 Minerals Yearbook is the first one which gives final figures on production and value of crude petroleum and average value per barrel. Final figures are shown in tables 7, 8, 9, 17, 18 and 24. The production figures used in all other tables are preliminary, as they have been in the past.

#### DISTRICTS

The Bureau of Mines reported production of crude petroleum and natural gas liquids and the number of wells drilled by States. Louisiana, New Mexico, and Texas were also reported by districts.

New Mexico has two widely separated producing areas. The Southeastern district comprises mainly Lea, Eddy, Chaves, and Roosevelt Counties. The Northwestern district comprises mainly San Juan, Rio Arriba, Sandoval, and McKinley Counties.

The Bureau of Mines producing districts in Texas correspond, with one exception, to grouping of the Texas Railroad Commission districts.

Bureau of Mines districts:	<i>Railroad Commission districts</i>
Gulf Coast.....	Nos. 2 and 3
West Texas.....	Nos. 7C and 8
East Proper.....	Part of No. 6 (East Texas field in Cherokee, Smith, Upshur, Rusk, and Gregg Counties)
Panhandle.....	No. 10
Rest of State:	
North.....	Nos. 7B and 9
Central.....	No. 1
South.....	No. 4
Other East Texas....	Nos. 5 and 6 (exclusive of East Proper)

The Bureau of Mines groups refinery operations into another set of districts called refining districts. These refining districts correspond with the grouping originated by the Petroleum Administration for War during World War II and called PAW districts (later changed to PAD districts).

PAD district	<i>Refining district</i>
1.....	<i>East Coast</i> —Districts of Columbia and Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New Jersey, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida, and the following counties of New York: Cayuga, Tompkins, Chemung, and all counties east and north thereof, and the following counties of Pennsylvania: Bradford, Sullivan, Columbia, Montour, Northumberland, Dauphin, York, and all counties east thereof.
1.....	<i>Appalachian No. 1</i> —West Virginia and those parts of Pennsylvania and New York not included in the East Coast district.
2.....	<i>Appalachian No. 2</i> —The following counties of Ohio: Erie, Huron, Crawford, Marion, Delaware, Franklin, Pickaway, Ross, Pike, Scioto, and all counties east thereof.
2.....	<i>Indiana-Illinois-Kentucky</i> —Indiana, Illinois, Kentucky, Tennessee, Michigan, and that part of Ohio not included in the Appalachian district.
2.....	<i>Oklahoma-Kansas-Missouri</i> —Oklahoma, Kansas, Missouri, Nebraska, and Iowa.
2.....	<i>Minnesota-Wisconsin-North Dakota-South Dakota</i> —Minnesota, Wisconsin, North Dakota, and South Dakota.
3.....	<i>Texas Inland</i> —Texas, except Texas Gulf Coast district.
3.....	<i>Texas Gulf Coast</i> —The following counties of Texas: Newton, Orange, Jefferson, Jasper, Tyler, Hardin, Liberty, Chambers, Polk, San Jacinto, Montgomery, Harris, Galveston, Waller, Fort Bend, Brazoria, Wharton, Matagorda, Jackson, Victoria, Calhoun, Refugio, Aransas, San Patricio, Nueces, Kleberg, Kenedy, Willacy, and Cameron.
3.....	<i>Louisiana Gulf Coast</i> —The following parishes of Louisiana: Vernon, Rapides, Avoyelles, Pointe Coupee, West Feliciana, East Feliciana, Tangipahoa, St. Helena, Washington, and all parishes south thereof; the following counties of Mississippi: Pearl River, Stone, George, Hancock, Harrison, and Jackson; and Mobile and Baldwin Counties, Ala.
3.....	<i>North Louisiana-Arkansas</i> —Arkansas and those parts of Louisiana, Mississippi and Alabama not included in the Louisiana Gulf Coast district.
3.....	<i>New Mexico</i> —New Mexico.
4.....	<i>Rocky Mountain</i> —Montana, Idaho, Wyoming, Utah, and Colorado.
5.....	<i>West Coast</i> —Washington, Oregon, California, Nevada, Alaska, Arizona, and Hawaii.

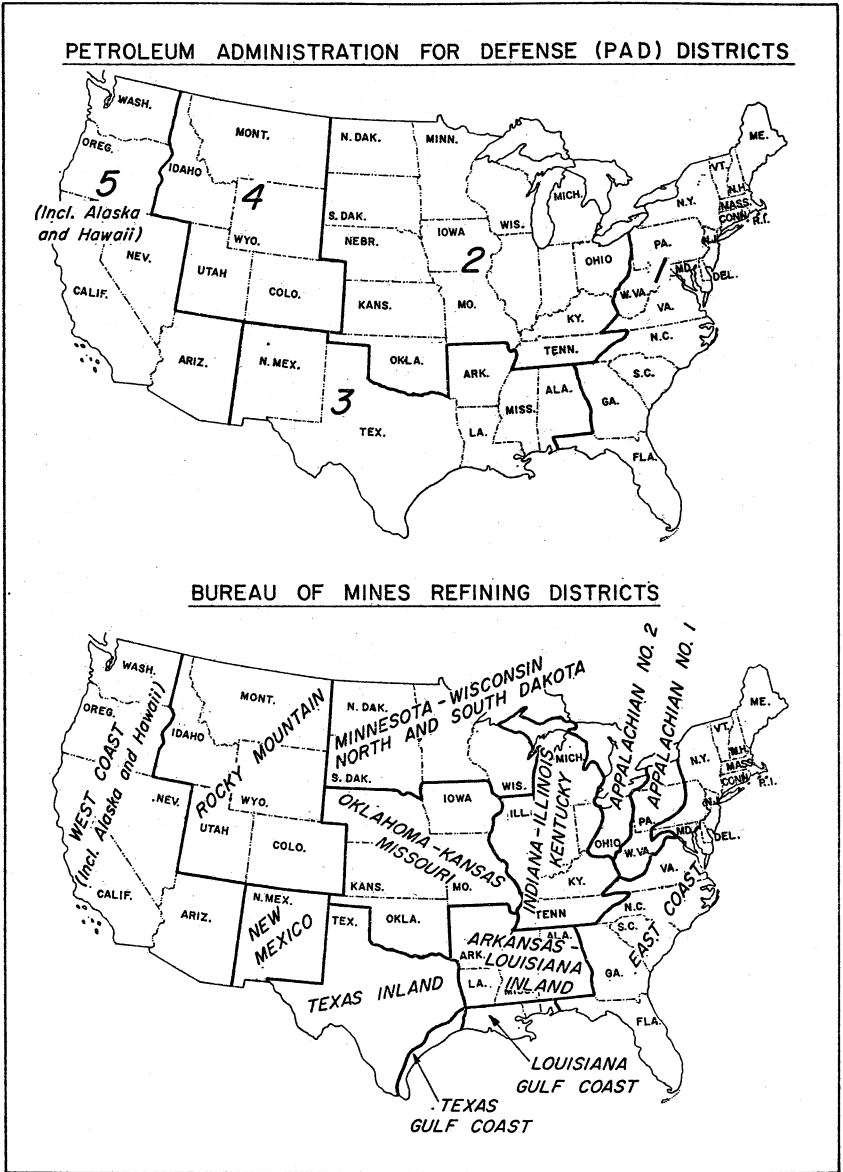


FIGURE 2.—Map of PAD districts and Bureau of Mines refining districts.

**WORLD OIL SUPPLY**

Crude oil production for the world in 1964 was 10,328 million barrels, compared with 9,537 million barrels in 1963. U.S. production represented 27.0 percent of the world total, less than in 1963.

## RESERVES

The American Petroleum Institute Committee on Petroleum Reserves estimated proved reserves of crude oil in the United States to be 30,990,510,000 barrels on December 31, 1964, an increase of 20,520,000 barrels for the year.

The estimates of crude-oil reserves include only oil recoverable under existing economic and operating conditions.

TABLE 4.—Estimates of proved crude-oil reserves in the United States on Dec. 31, by States<sup>1</sup>

(Million barrels)

State	1957	1958	1959	1960	1961	1962	1963	1964
<b>Eastern States:</b>								
Illinois.....	655	608	594	556	503	460	417	391
Indiana.....	67	71	74	66	62	61	63	61
Kentucky.....	138	126	136	129	116	109	100	118
Michigan.....	49	45	55	73	79	75	69	58
New York.....	37	36	34	32	28	23	18	14
Ohio.....	68	71	74	75	76	77	88	100
Pennsylvania.....	126	120	114	108	102	97	92	87
West Virginia.....	53	52	51	51	51	56	57	59
<b>Total.....</b>	<b>1,193</b>	<b>1,129</b>	<b>1,132</b>	<b>1,095</b>	<b>1,017</b>	<b>958</b>	<b>904</b>	<b>888</b>
<b>Central and Southern States:</b>								
Arkansas.....	305	318	313	302	281	247	225	205
Kansas.....	947	922	917	884	878	862	841	797
Louisiana <sup>2</sup> .....	3,858	4,044	4,660	4,785	4,931	5,087	5,089	5,162
Mississippi.....	360	379	389	407	401	388	385	357
Nebraska.....	63	69	81	86	100	94	84	71
New Mexico.....	832	894	1,026	1,094	1,090	1,065	1,011	957
North Dakota.....	258	314	382	431	413	404	389	377
Oklahoma.....	1,941	1,898	1,865	1,791	1,787	1,728	1,586	1,586
Texas <sup>2</sup> .....	14,555	14,322	14,860	14,768	14,850	14,648	14,573	14,300
<b>Total.....</b>	<b>23,119</b>	<b>23,160</b>	<b>24,493</b>	<b>24,528</b>	<b>24,731</b>	<b>24,523</b>	<b>24,225</b>	<b>23,812</b>
<b>Mountain States:</b>								
Colorado.....	310	392	381	364	420	388	368	346
Montana.....	320	338	309	267	251	249	271	252
Utah.....	140	199	195	208	218	198	220	219
Wyoming.....	1,420	1,409	1,403	1,427	1,381	1,297	1,254	1,204
<b>Total.....</b>	<b>2,190</b>	<b>2,338</b>	<b>2,288</b>	<b>2,266</b>	<b>2,270</b>	<b>2,132</b>	<b>2,113</b>	<b>2,021</b>
Pacific Coast States: California <sup>2</sup> .....	3,760	3,866	3,763	3,659	3,615	3,648	3,600	4,125
Other States <sup>2</sup> .....	38	43	43	65	126	128	128	145
<b>Total United States.....</b>	<b>30,300</b>	<b>30,536</b>	<b>31,719</b>	<b>31,613</b>	<b>31,759</b>	<b>31,389</b>	<b>30,970</b>	<b>30,991</b>

<sup>1</sup> From reports of Committee on Petroleum Reserves, American Petroleum Institute. Includes crude oil that may be extracted by present methods from fields completely developed or sufficiently explored to permit reasonably accurate calculations. The change in reserves during any year represents total new discoveries, extensions, and revisions, minus production.

<sup>2</sup> Includes offshore reserves.

<sup>3</sup> Includes Alabama, Arizona, Florida, Missouri, Nevada, South Dakota, Tennessee, Virginia, Washington 1967-60, and Alaska 1959-64.

## CRUDE PETROLEUM

## SUPPLY AND DEMAND

The new supply of crude petroleum was derived primarily from domestic production, but the supply was augmented by imports. Crude imports represented 13.5 percent of the crude supply in 1964, compared with 13.0 percent in 1963. Under the mandatory import control program, which became effective in March 1959, imports of

crude oil, unfinished oils, and refined products other than residual fuel oil are limited to 12.2 percent of the estimated total production of crude oil and natural gas liquids in all States east of the Rocky Mountains. In States west of the Rocky Mountains, including Alaska and Hawaii, the import quota is based on the difference between the estimated available domestic supply and the estimated total demand. Overland receipts (imports from Canada and Mexico) are exempted from provisions of the program; however, before setting the allocations for crude and unfinished oils, an estimate of probable receipts by pipeline from Canada and overland from Mexico are subtracted from the amounts to be allocated. Vessel and aircraft fuels imported in bond for use as fuel outside the United States are also exempted from provisions of the program. All refineries of record are granted an allocation based on their refinery throughput with certain special provisions applying to refineries that imported crude oil during 1957, the base year for the program.

## PRODUCTION

### GENERAL

Crude oil production in the United States averaged 7,664,000 barrels daily in 1964 compared with 7,542,000 barrels daily in 1963. The demand for domestic crude oil exceeded production, resulting in a 7 million barrel reduction in stocks of domestic crude oil.

### BY STATES

Additional data on production by States will be found in volume III of the 1964 Minerals Yearbook.

TABLE 5.—Supply and demand<sup>1</sup> for crude petroleum in the United States

(Thousand barrels)

	1960	1961	1962	1963	<sup>p</sup> 1964
Production.....	2,574,933	2,621,758	2,676,189	2,752,723	2,805,125
Imports <sup>2</sup> .....	371,575	381,548	411,039	412,660	438,643
Total new supply.....	2,946,508	3,003,306	3,087,228	3,165,383	3,243,768
Increase (+) or decrease (-) in stocks, end of year.....	-17,329	+4,864	+7,347	-14,650	-7,304
Demand:					
Domestic crude.....	2,592,289	2,614,919	2,669,398	2,767,129	2,813,433
Foreign crude.....	371,548	383,523	410,483	412,904	437,639
Total demand.....	2,963,837	2,998,442	3,079,881	3,180,033	3,251,072
Runs to stills:					
Domestic.....	2,581,568	2,604,127	2,659,826	2,758,168	2,804,198
Foreign.....	370,966	383,031	409,805	412,484	437,434
Exports <sup>3</sup> .....	3,087	3,227	1,790	1,698	1,363
Transfers to fuel oil:					
Distillate.....	1,001	851	1,198	807	755
Residual.....	3,948	3,854	3,797	3,305	3,720
Other fuel losses.....	3,267	3,352	3,465	3,571	3,602
Total demand.....	2,963,837	2,998,442	3,079,881	3,180,033	3,251,072

<sup>p</sup> Preliminary.

<sup>1</sup> For definition see footnote at the beginning of this chapter.

<sup>2</sup> Bureau of Mines data.

<sup>3</sup> U.S. Department of Commerce data.

TABLE 6.—Supply of and demand for crude petroleum in the United States, by months

(Thousand barrels)

	January	February	March	April	May	June	July	August	September	October	November	December	Total
<b>1963:</b>													
Supply:													
Production.....	226,420	212,437	234,289	228,270	234,499	226,853	235,144	236,830	225,207	233,610	226,321	232,843	2,752,723
Imports <sup>1</sup> .....	41,043	30,898	36,070	32,593	34,484	31,872	38,214	36,666	34,898	31,362	34,241	30,319	412,660
Total new supply.....	267,463	243,335	270,359	260,863	268,983	258,725	273,358	273,496	260,105	264,972	260,562	263,162	3,165,383
Change in stocks, end of period:													
Domestic.....	-6,902	-6,061	-727	+8,580	+4,084	-2,897	-1,554	-2,106	-2,025	-996	-2,349	-1,453	-14,406
Foreign.....	+4,100	-2,752	+1,360	+1,782	+191	-2,733	+1,480	+1,221	+1,209	-1,726	+1,197	-5,573	-244
Demand:													
Domestic.....	233,322	218,498	235,016	219,690	230,415	229,750	236,698	238,936	227,232	234,606	228,670	234,296	2,767,129
Foreign.....	36,943	33,650	34,710	30,811	34,293	34,605	36,734	35,445	33,689	33,088	33,044	35,892	412,904
Runs to stills:													
Domestic.....	232,556	217,809	234,284	218,924	229,689	228,972	235,973	238,086	226,561	233,903	227,991	233,420	2,758,168
Foreign.....	36,882	33,613	34,708	30,792	34,247	34,617	36,691	35,446	33,645	32,981	33,010	35,852	412,484
Exports <sup>2</sup> .....	179	116	95	170	140	123	146	178	100	179	106	166	1,698
Transfers:													
Distillate.....	77	72	94	66	61	63	62	64	61	61	57	69	807
Residual.....	266	251	246	269	264	285	251	295	264	273	259	382	3,305
Losses.....	305	287	299	280	307	295	309	312	290	297	291	299	3,571
<b>1964: *</b>													
Supply:													
Production.....	238,083	224,495	240,605	233,139	235,837	228,347	233,736	232,647	227,934	237,274	230,715	242,313	2,805,125
Imports <sup>1</sup> .....	39,635	32,209	36,945	33,091	35,968	34,387	43,820	40,743	36,853	39,224	34,102	31,666	438,643
Total new supply.....	277,718	256,704	277,550	266,230	271,805	262,734	277,556	273,390	264,787	276,498	264,817	273,979	3,243,768
Change in stocks, end of period:													
Domestic.....	-332	-43	+3,892	+7,447	+2,036	-1,607	-8,257	-9,066	-3,992	+1,922	+2,187	-2,495	-8,308
Foreign.....	+3,978	-902	+2,909	-898	+1,374	-4,485	+3,360	+645	-1,140	+531	-611	-4,257	+1,004
Demand:													
Domestic.....	238,415	224,538	236,713	225,692	233,801	229,954	241,993	241,713	231,926	235,352	228,528	244,808	2,813,433
Foreign.....	35,657	33,111	34,036	33,489	34,594	38,872	40,460	40,098	37,993	38,693	34,713	35,923	437,639
Runs to stills:													
Domestic.....	237,753	223,712	235,897	224,842	232,910	229,206	241,291	240,936	231,157	234,646	227,939	243,909	2,804,193
Foreign.....	35,586	33,120	33,996	33,627	34,675	38,832	40,427	40,071	37,969	38,689	34,661	35,881	437,434
Exports <sup>2</sup> .....	116	98	233	100	174	152	90	118	71	88	-----	123	1,363
Transfers:													
Distillate.....	68	60	87	61	53	62	63	62	58	58	62	61	755
Residual.....	246	372	236	363	285	276	270	313	365	261	286	447	3,720
Losses.....	303	287	300	288	298	298	312	311	299	303	293	310	3,602

 \* Preliminary.   <sup>1</sup> Bureau of Mines data.   <sup>2</sup> U.S. Department of Commerce.



TABLE 7.—Petroleum produced in the United States by States<sup>1</sup>

(Thousand barrels unless otherwise stated)

	1960	1961	1962	1963	1964	1859-1964 total
<b>Production:</b>						
Alabama.....	7,329	6,931	7,473	9,175	8,498	68,943
Alaska.....	559	6,327	10,259	10,740	11,059	39,131
Arkansas.....	30,117	29,246	27,649	27,406	26,737	1,199,106
California.....	305,352	299,609	296,590	300,908	300,009	13,224,857
Colorado.....	47,469	46,759	42,477	38,283	34,755	758,876
Florida.....	369	374	419	464	620	8,412
Illinois.....	77,341	76,818	78,796	74,796	70,168	2,528,245
Indiana.....	12,054	11,500	12,077	11,902	11,283	365,284
Kansas.....	113,453	112,241	112,076	109,107	106,252	3,751,191
Kentucky.....	21,147	18,344	17,789	18,344	19,772	2,491,447
Louisiana.....	400,832	424,962	477,153	515,057	549,689	7,485,002
Michigan.....	15,899	18,901	17,114	15,972	15,601	4,509,147
Mississippi.....	51,673	54,688	55,713	58,619	56,777	911,357
Montana.....	30,240	30,906	31,648	30,870	30,647	489,641
Nebraska.....	23,825	24,369	24,894	21,846	19,113	231,023
Nevada.....	27	154	141	118	255	972
New Mexico.....	107,380	112,553	109,328	109,941	113,863	1,961,938
New York.....	1,813	1,658	1,589	1,679	1,874	202,829
North Dakota.....	21,992	23,652	25,181	25,030	25,731	204,348
Ohio.....	5,405	5,639	5,835	6,039	15,859	700,610
Oklahoma.....	192,913	193,081	202,732	201,962	202,524	9,026,175
Pennsylvania.....	6,009	5,643	5,302	5,083	5,113	1,242,629
Texas.....	927,479	939,191	943,328	977,835	989,525	27,673,181
Utah.....	37,594	33,118	31,029	33,435	28,575	246,216
West Virginia.....	2,300	2,760	3,470	3,360	3,370	478,593
Wyoming.....	133,910	141,937	135,847	144,407	138,752	2,479,324
Other States <sup>2</sup> .....	452	397	280	355	392	4,842
<b>Total.....</b>	<b>2,574,933</b>	<b>2,621,758</b>	<b>2,676,189</b>	<b>2,752,723</b>	<b>2,786,822</b>	<b>76,283,319</b>
<b>Value at wells:</b>						
<b>Total (thousand dollars).....</b>	<b>7,420,181</b>	<b>7,565,582</b>	<b>7,774,051</b>	<b>7,965,743</b>	<b>8,017,078</b>	<b>158,360,871</b>
<b>Average per barrel.....</b>	<b>\$2.88</b>	<b>\$2.89</b>	<b>\$2.90</b>	<b>\$2.89</b>	<b>\$2.88</b>	<b>\$2.86</b>

<sup>1</sup> For detailed figures by States, 1859-1935, see 1937 Minerals Yearbook, p. 1008.<sup>2</sup> Oklahoma included with Kansas in 1905 and 1906.<sup>3</sup> Includes Tennessee, 1883-1907.<sup>4</sup> Figures represent 1925-64 production only; earlier years included with "Other States".<sup>5</sup> Figures represent 1924-64 production only; earlier years included with "Other States".<sup>6</sup> Earlier production in New York included with Pennsylvania.<sup>7</sup> Figures represent 1946-64 production only; earlier years included with "Other States".<sup>8</sup> Includes Alaska, 1912-33; Arizona, 1958-64; Arkansas, 1920; Michigan, 1900-1919; Mississippi, 1933-35; Missouri, 1899-1911, 1913-16; 1919-23, 1932-64; New Mexico, 1913, 1919-23; South Dakota, 1955-64; Tennessee, 1916-64; Utah, 1907-11, 1920, 1924-41; Virginia, 1943-64; Washington, 1958-60.

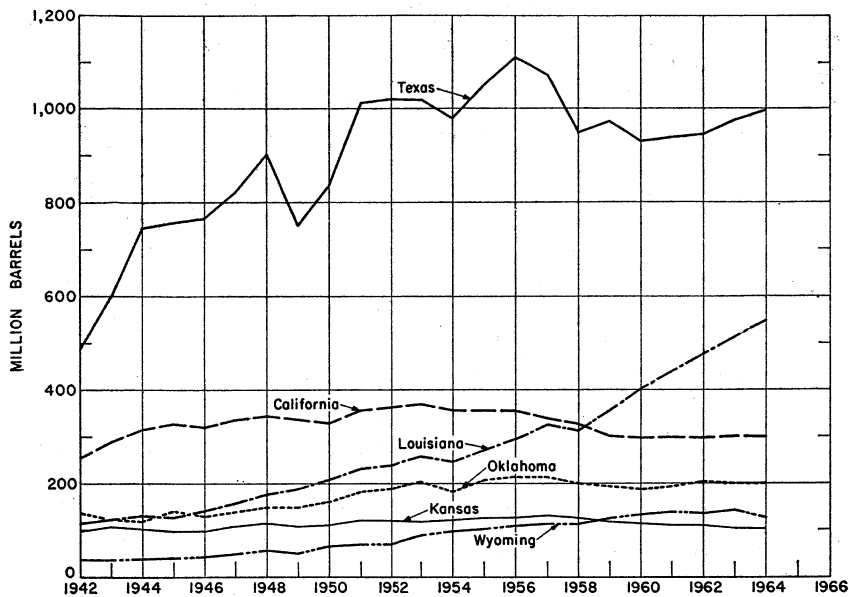


FIGURE 3.—Production of crude petroleum in the United States, 1942-64, by principal producing States.

TABLE 8.—Production of crude petroleum in the United States in 1963–64, by States and months<sup>1</sup>  
(Thousand barrels)

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
1963, final figures:													
Alabama.....	807	748	813	774	702	787	725	768	787	787	736	741	9,175
Alaska.....	944	813	894	863	892	867	907	896	889	945	903	927	10,740
Arkansas.....	2,252	2,121	2,315	2,238	2,330	2,252	2,334	2,391	2,298	2,355	2,265	2,255	27,406
California <sup>2</sup> .....	25,276	22,869	25,577	24,976	25,577	24,976	25,577	25,577	24,976	25,577	24,675	25,276	300,908
Colorado <sup>3</sup> .....	3,369	3,139	3,407	3,254	3,254	3,177	3,217	3,139	3,025	3,177	2,988	3,139	38,283
Florida.....	33	32	44	39	42	41	39	40	36	40	39	39	464
Illinois.....	6,257	5,812	6,346	6,384	6,459	6,087	6,540	6,406	6,087	6,384	5,991	6,063	74,796
Indiana.....	976	944	1,012	1,031	990	1,031	1,062	992	1,019	1,052	899	934	11,002
Kansas <sup>4</sup> .....	8,707	8,765	9,386	9,253	9,163	8,993	9,342	9,239	8,939	9,371	8,890	9,059	109,107
Kentucky.....	1,431	1,394	1,504	1,559	1,596	1,523	1,633	1,559	1,641	1,596	1,523	1,485	18,344
Louisiana <sup>5</sup> .....	42,512	38,952	43,993	42,500	43,943	42,623	44,206	44,436	41,411	43,304	42,679	44,498	515,037
Michigan <sup>6</sup> .....	1,344	1,266	1,348	1,362	1,381	1,302	1,362	1,319	1,297	1,360	1,285	1,346	15,972
Mississippi.....	4,865	4,572	4,983	4,807	4,983	5,100	4,455	4,924	5,041	5,217	4,748	4,924	58,610
Montana <sup>7</sup> .....	2,605	2,429	2,666	2,567	2,626	2,516	2,592	2,642	2,544	2,607	2,487	2,590	30,870
Nebraska.....	1,813	1,748	1,901	1,879	1,901	1,813	1,901	1,870	1,770	1,813	1,703	1,725	21,846
New Mexico <sup>8</sup> .....	9,015	8,465	9,345	8,905	9,125	8,905	9,235	9,455	9,235	9,455	9,235	9,566	100,941
New York.....	123	118	124	134	139	129	146	149	148	161	149	159	1,679
North Dakota <sup>9</sup> .....	2,278	2,128	2,278	2,163	1,977	1,352	2,077	2,228	2,052	2,103	2,102	2,302	25,030
Ohio.....	405	423	477	477	477	441	471	447	441	459	712	815	6,039
Oklahoma.....	16,323	15,818	17,612	17,095	17,556	17,225	17,035	18,311	15,717	16,328	16,955	15,987	201,962
Pennsylvania.....	407	357	392	428	448	417	473	447	437	478	412	387	5,083
Texas.....	79,205	75,297	82,137	80,182	83,114	80,182	84,091	84,092	81,159	84,091	80,184	84,101	977,835
Utah <sup>10</sup> .....	2,809	2,641	2,976	2,842	2,875	2,775	2,842	2,842	2,742	2,775	2,675	2,641	33,435
West Virginia.....	255	265	281	312	265	265	302	285	278	302	258	235	3,350
Wyoming.....	12,367	11,281	12,442	12,229	12,621	12,036	12,541	12,327	11,296	11,835	11,837	11,595	144,407
Other States.....	42	40	36	38	42	38	39	40	42	38	33	45	417
Total: 1963.....	226,420	212,437	234,289	228,270	234,499	226,853	235,144	236,830	225,207	233,610	226,321	232,843	2,752,723
1962.....	227,756	209,072	228,661	221,737	222,969	217,712	224,018	224,240	219,589	228,380	223,231	228,824	2,676,189
Daily average 1963.....	7,304	7,587	7,558	7,609	7,565	7,562	7,585	7,640	7,507	7,536	7,544	7,511	7,542
Pennsylvania grade (included above).....	968	895	969	1,041	1,076	970	1,082	1,029	1,021	1,090	962	981	12,034

1964:														
Alabama.....	738	682	773	688	705	713	747	759	667	687	669	670	8,498	
Alaska.....	945	885	859	913	949	916	941	941	914	946	909	941	11,059	
Arkansas.....	2,300	2,156	2,314	2,202	2,266	2,224	2,229	2,250	2,162	2,231	2,169	2,234	26,737	
California <sup>1</sup> .....	25,201	23,401	25,201	24,600	25,201	24,601	25,201	25,201	24,901	25,801	24,900	25,800	300,009	
Colorado <sup>2</sup> .....	3,093	2,885	3,024	2,885	2,989	2,850	2,815	2,919	2,746	2,815	2,780	2,954	34,755	
Colorado <sup>3</sup> .....													620	
Florida.....	38	35	36	33	41	47	57	56	54	63	81	79	168	
Florida.....	6,251	5,720	6,037	5,923	5,851	5,860	6,032	5,813	5,752	5,754	5,497	5,678	70,168	
Illinois.....	975	983	953	911	1,009	892	957	922	929	886	872	994	11,283	
Indiana.....	9,817	8,591	9,194	8,921	8,683	8,567	8,944	8,753	8,674	9,003	8,579	9,026	106,252	
Kansas.....	1,799	1,700	1,839	1,542	1,661	1,582	1,641	1,581	1,602	1,641	1,562	1,622	19,772	
Kentucky.....	47,273	44,526	47,274	46,175	45,625	43,976	45,075	45,075	43,976	45,075	46,175	49,473	549,698	
Louisiana <sup>4</sup> .....	1,361	1,243	1,311	1,312	1,293	1,307	1,330	1,289	1,279	1,313	1,254	1,309	15,601	
Michigan <sup>5</sup> .....	4,883	4,656	4,906	4,712	4,656	4,769	4,656	4,656	4,642	4,883	4,485	4,883	56,777	
Mississippi.....	2,392	2,561	2,649	2,526	2,600	2,599	2,528	2,562	2,539	2,676	2,456	2,559	30,647	
Montana <sup>6</sup> .....	1,701	1,567	1,644	1,568	1,605	1,529	1,586	1,625	1,548	1,605	1,548	1,587	19,113	
Nebraska.....	9,564	8,995	9,792	9,337	9,565	9,109	9,451	9,223	9,337	9,678	9,678	10,134	113,868	
New Mexico <sup>8</sup> .....	201	183	158	152	156	156	155	145	142	147	139	143	1,874	
New York.....	2,271	2,362	2,127	2,068	1,621	1,953	2,122	2,184	2,229	2,335	2,207	2,252	25,731	
North Dakota <sup>9</sup> .....	1,031	1,332	1,348	1,411	1,316	1,316	1,380	1,332	1,396	1,364	1,268	1,285	15,859	
Ohio.....	17,222	16,066	17,449	17,233	17,468	16,662	17,168	16,690	16,135	17,244	16,262	16,935	202,524	
Oklahoma.....	475	402	481	538	381	395	409	395	417	426	387	407	5,113	
Pennsylvania.....	83,118	78,162	85,107	82,067	84,114	81,138	82,175	82,127	80,160	84,095	81,166	86,096	989,525	
Texas.....	2,573	2,429	2,543	2,457	2,400	2,400	2,457	2,429	2,172	2,229	2,143	2,200	28,575	
Utah <sup>10</sup> .....	275	247	265	284	265	295	300	271	275	301	279	313	3,370	
West Virginia.....	11,291	11,125	11,643	11,585	12,139	10,902	11,246	11,668	11,357	13,046	11,513	11,237	138,752	
Wyoming.....	49	53	51	56	49	50	56	60	60	60	61	52	12,647	
Other States.....														
Total: 1964.....	236,337	222,947	239,068	232,185	234,742	226,808	231,648	230,926	225,965	236,304	229,029	240,863	2,786,822	
1963.....	226,420	212,437	234,289	228,270	234,499	226,853	235,144	236,830	225,207	233,610	226,321	232,843	2,752,723	
Daily average 1964.....	7,624	7,688	7,712	7,739	7,572	7,560	7,473	7,449	7,532	7,623	7,634	7,770	7,614	
Pennsylvania grade (included above).....	1,120	968	1,118	1,117	929	967	994	912	959	1,002	943	1,009	12,038	

<sup>1</sup> Includes field condensate.<sup>2</sup> Conservation Committee of California Oil Producers.<sup>3</sup> Colorado Oil Conservation Commission.<sup>4</sup> Kansas Geological Survey.<sup>5</sup> Louisiana Conservation Commission.<sup>6</sup> Michigan Department of Conservation.<sup>7</sup> Montana Oil Conservation Board.<sup>8</sup> New Mexico Oil and Gas Conservation Commission.<sup>9</sup> North Dakota Geological Survey.<sup>10</sup> Utah Oil and Gas Conservation Commission.<sup>11</sup> Includes Arizona (68), Missouri (53), Nevada (118), South Dakota (215), Tennessee (16), and Virginia (3).<sup>12</sup> Arizona (64), Missouri (65), Nevada (255), South Dakota (247), Tennessee (10), and Virginia (6).

TABLE 9.—Percentage of total crude petroleum produced in the United States, by States

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
Texas.....	42.4	42.3	41.0	38.4	37.8	36.0	35.8	35.2	35.5	35.5
Louisiana.....	10.9	11.4	12.6	12.8	14.1	15.6	16.2	17.8	18.7	19.7
California.....	14.3	13.4	13.0	12.8	12.0	11.8	11.4	11.1	10.9	10.8
Oklahoma.....	8.2	8.2	8.2	8.2	7.7	7.5	7.4	7.6	7.3	7.3
Wyoming.....	4.0	4.0	4.2	4.7	4.9	5.2	5.4	5.1	5.2	5.0
New Mexico.....	3.3	3.4	3.6	4.0	4.1	4.2	4.3	4.1	4.0	4.1
Kansas.....	4.9	4.7	4.7	4.9	4.6	4.4	4.3	4.2	4.0	3.8
Illinois.....	3.3	3.1	2.9	3.3	3.0	3.0	2.9	2.9	2.7	2.5
Mississippi.....	1.5	1.6	1.5	1.6	1.9	2.0	2.1	2.1	2.1	2.0
Colorado.....	2.1	2.2	2.1	2.0	1.8	1.9	1.8	1.6	1.4	1.2
Montana.....	.6	.8	1.0	1.1	1.2	1.2	1.1	1.2	1.1	1.1
Arkansas.....	1.1	1.1	1.2	1.2	1.0	1.2	1.2	1.0	1.0	1.0
Kentucky.....	.6	.7	.7	.7	1.1	.8	.7	.7	.7	.7
Michigan.....	.5	.4	.4	.4	.4	.6	.7	.6	.6	.6
Other States.....	2.3	2.7	2.9	3.9	4.4	4.6	4.7	4.8	4.8	4.7
Total.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

## WELLS

In 1964 the number of wells drilled (42,963) was 1,577 more than in 1963 but 816 less than in 1962. Service wells are not included in this total. The percentage of dry holes to the total wells drilled increased from 39.5 percent in 1963 to 40.7 percent in 1964.

The largest increases in number of well completions were in Ohio (1,428), Kansas (344), and Pennsylvania (333). In Texas there was an overall decline in number of wells drilled, although there were moderate increases in the east and west districts of the State and the drilling activity along the Texas Gulf Coast was steady.

The number of oil wells reported in operation as of December 31, 1964, was 588,225; in 1963, 432 more wells were reported in operation. The average daily production per well was 12.9 barrels. In Louisiana, the largest gainer, the number of operating wells, increased by 1,814.

TABLE 10.—Production and reserves of crude petroleum in leading fields in the United States

(Thousand barrels)

Field <sup>1</sup>	State	1963	1964	Total since discovery <sup>2</sup>	Estimated reserves
East Texas	Texas	40,777	40,055	3,624,910	1,485,090
Wilmington	California	34,647	35,350	1,013,578	586,422
Sho-Vel-Tum	Oklahoma	24,995	26,660	649,484	150,516
Bay Marchand, Block 2	Louisiana	26,452	25,056	131,025	468,975
Panhandle Field <sup>3</sup>	Texas	13,270	25,052	1,110,867	536,133
Caillou Island	Louisiana	20,425	22,186	239,795	260,205
Seeligson (all fields)	Texas	20,860	21,926	285,880	214,120
West Delta, Block 30	Louisiana	16,522	20,134	79,987	320,013
South Pass, Block 24	do	17,451	19,968	212,286	537,714
Ward-Estes N	Texas	17,495	19,192	197,560	105,440
Elk Basin	Montana, Wyoming	24,370	18,702	272,101	127,899
Midway-Sunset	California	16,550	18,270	947,614	164,566
Aneth	Utah	22,841	16,954	172,358	279,642
Timblar Bay	Louisiana	16,948	16,876	116,375	183,625
Kelly-Snyder	Texas	16,838	16,832	323,139	422,861
South Pass, Block 27	Louisiana	17,451	16,822	72,843	238,157
Huntington Beach	California	15,741	15,785	730,318	150,284
Rangley	Colorado	16,262	15,342	364,393	235,607
Golden Trend	Oklahoma	18,427	14,292	283,316	76,684
Wasson	Texas	18,099	14,174	406,383	244,617
Goldsmith	do	15,995	13,465	346,481	113,519
Burbank	Oklahoma	13,685	13,417	436,209	64,791
Loudon	Illinois	14,125	12,612	302,943	47,057
Sprayberry Trend	Texas	11,984	11,890	184,379	90,621
Lake Barre	Louisiana	10,231	11,634	76,295	173,705
Ventura	California	12,470	11,576	693,920	120,956
Vacuum	New Mexico	8,223	11,171	120,390	164,610
Swanson River-Soldatna	Alaska	10,737	11,163	39,267	160,736
Old Illinois	Illinois	11,150	11,030	613,925	61,075
Slaughter	Texas	9,700	10,865	306,828	133,172
Grand Isle, Block 16	Louisiana	8,361	10,584	41,218	133,732
High Island	Texas	9,586	10,181	94,498	90,507
Colinga Nose	California	11,510	10,147	372,832	111,016
Maine Pass, Block 69	Louisiana	8,861	10,072	90,209	219,791
Kern River	California	9,298	9,772	393,433	56,091
San Ardo	do	9,968	9,457	144,626	97,205
Katy, North	Texas	9,684	9,452	163,261	136,639
Hamilton Dome	Wyoming	9,624	9,392	109,569	90,431
Salt Creek	do	8,017	9,004	419,701	90,299
Hawkins	Texas	8,868	9,002	296,073	228,922
Salem	Illinois	10,100	8,832	318,456	31,544
Dover-Hennessey	Oklahoma	9,010	8,667	29,963	130,037
West Bay	Louisiana	7,615	8,299	79,734	130,266
Buena Vista	California	8,669	8,282	524,231	90,785
Tom O'Connor	Texas	7,389	8,083	280,968	169,032
San Hills	do	8,055	8,019	111,497	85,503
Hastings, East and West	do	7,770	7,895	342,256	157,744
McElroy	do	7,747	7,773	218,294	131,706
Bay St. Elaine	Louisiana	7,925	7,705	71,644	81,356
Citronelle	Alabama	8,304	7,700	49,369	70,631
Cowden (and Foster and Johnson)	Texas	6,061	7,658	205,381	114,619
Cowden, North	do	7,246	7,522	180,826	69,174
Capprock East	New Mexico	6,231	7,503	69,752	70,248
Keystone	Texas	6,375	7,457	196,731	106,269
Belfridge South	California	7,534	7,385	109,430	27,412
Bayou Sale	Louisiana	7,307	7,283	94,977	105,033
Inglewood	California	6,335	7,173	247,641	53,552
Howard Glasscock	Texas	7,071	7,111	230,493	46,507
Cuyama South	California	8,189	7,073	175,560	108,332

<sup>1</sup> Fields under 7 million barrels not shown for current year.

<sup>2</sup> Includes revisions.

<sup>3</sup> Includes Badger, Borger-Pantex, Dial, Finley, and Pampa West.

Source: Oil and Gas Journal.

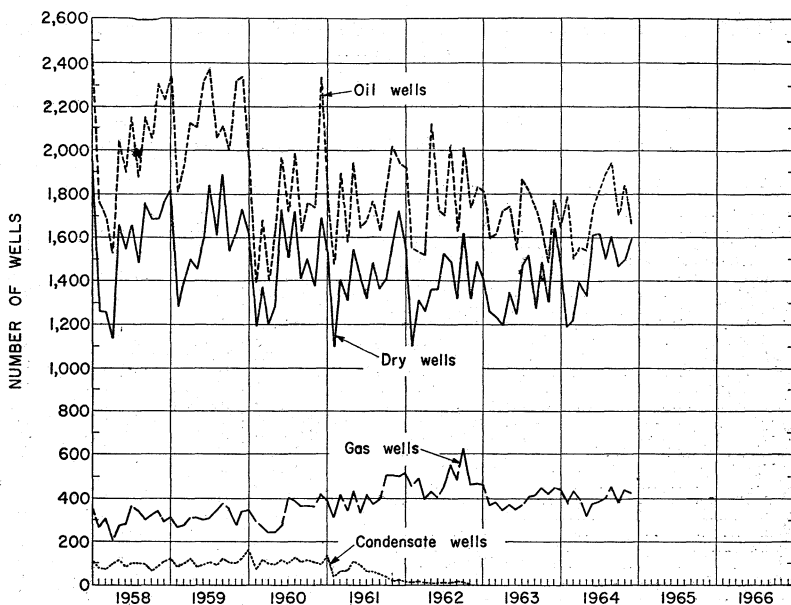


FIGURE 4.—Wells drilled for oil and gas in the United States, 1958-64, by months.

TABLE 11.—Well completions in the United States, by months<sup>1</sup>

Wells	January	February	March	April	May	June	July	August	September	October	November	December	Total		
													Number	Percent	
<b>1963:</b>															
Oil.....	1,809	1,593	1,611	1,721	1,737	1,542	1,860	1,809	1,725	1,633	1,480	1,768	20,288	49.0	
Gas <sup>2</sup> .....	459	366	379	342	367	349	367	406	412	443	418	443	4,751	11.5	
Dry.....	1,405	1,251	1,229	1,194	1,342	1,248	1,469	1,513	1,271	1,485	1,302	1,638	16,347	39.5	
<b>Total...</b>	<b>3,673</b>	<b>3,210</b>	<b>3,219</b>	<b>3,257</b>	<b>3,446</b>	<b>3,139</b>	<b>3,696</b>	<b>3,728</b>	<b>3,408</b>	<b>3,561</b>	<b>3,200</b>	<b>3,849</b>	<b>41,386</b>	<b>100.0</b>	
<b>1964:</b>															
Oil.....	1,647	1,788	1,500	1,554	1,542	1,730	1,819	1,892	1,945	1,705	1,836	1,662	20,620	48.0	
Gas <sup>2</sup> .....	441	386	437	397	322	375	389	400	455	386	440	427	4,855	11.3	
Dry.....	1,450	1,191	1,222	1,400	1,332	1,611	1,617	1,505	1,603	1,469	1,494	1,594	17,488	40.7	
<b>Total...</b>	<b>3,538</b>	<b>3,365</b>	<b>3,159</b>	<b>3,351</b>	<b>3,196</b>	<b>3,716</b>	<b>3,825</b>	<b>3,797</b>	<b>4,003</b>	<b>3,560</b>	<b>3,770</b>	<b>3,683</b>	<b>42,963</b>	<b>100.0</b>	

<sup>1</sup> Excludes service wells.

<sup>2</sup> Includes condensate wells.

Source: Oil and Gas Journal.

## CONSUMPTION AND DISTRIBUTION

The total demand for crude oil in the United States in 1964 was 8,832,700 barrels per day, a gain of 1.4 percent for the year. The 1964 demand for domestic crude oil (7,637,000 barrels per day) was 55,800 barrels per day more than that for 1963, and the demand for foreign crude oil (1,195,700 barrels per day) was 64,500 barrels per day more than that for 1963.

**Runs to Stills.**—Crude runs to stills in 1964 averaged 8,857,000 barrels per day, including 7,662,000 barrels per day of domestic crude

TABLE 12.—Well completions in the United States by States, and districts <sup>1</sup>

State and district	1963				1964			
	Oil	Gas <sup>2</sup>	Dry	Total	Oil	Gas <sup>2</sup>	Dry	Total
Alabama.....	71		24	95	17		32	49
Alaska.....	8	5	12	25	4	2	15	21
Arizona.....	1	2	13	16		6	34	40
Arkansas.....	207	43	204	454	167	48	206	421
California.....	1,707	118	566	2,391	1,616	123	550	2,289
Colorado.....	96	93	409	598	99	70	395	564
Florida.....	1		1	2	4		8	12
Georgia.....							2	2
Idaho.....			2	2			1	1
Illinois.....	746	12	764	1,522	665	17	801	1,483
Indiana.....	271	8	450	729	224	2	321	547
Iowa.....	1		12	13			12	12
Kansas.....	2,017	227	1,590	3,834	2,259	219	1,700	4,178
Kentucky.....	653	162	825	1,640	485	194	655	1,334
Louisiana:								
North.....	1,482	339	1,036	2,857	1,486	228	1,204	2,918
South.....	751	204	772	1,727	663	220	682	1,565
Offshore.....	312	71	307	690	393	90	364	847
Total Louisiana.....	2,545	614	2,115	5,274	2,542	538	2,250	5,330
Maryland.....			1	1			1	1
Michigan.....	143	84	382	609	84	53	385	522
Mississippi.....	254	22	448	724	188	18	513	719
Missouri.....			9	9			12	12
Montana.....	155	15	212	382	142	16	251	409
Nebraska.....	153	1	366	520	136	2	320	458
Nevada.....			2	2	2		6	8
New Jersey.....			1	1			1	1
New Mexico:								
West.....	112	239	119	470	48	291	85	424
East.....	480	42	267	789	672	49	318	1,039
Total New Mexico.....	592	281	386	1,259	720	340	403	1,463
New York.....	246	22	40	308	123	45	57	225
North Dakota.....	84		98	182	113		162	275
Ohio.....	475	217	357	1,049	737	288	1,452	2,477
Oklahoma.....	2,273	430	1,260	3,963	2,256	464	1,286	4,006
Oregon.....			1	1			2	2
Pennsylvania.....	250	220	73	543	370	358	148	876
South Dakota.....	1		9	10	3		23	26
Tennessee.....	3		26	29			19	19
Texas:								
Gulf Coast.....	810	333	882	2,075	762	392	907	2,061
West.....	2,080	163	799	3,042	2,129	155	867	3,151
East.....	307	91	321	719	407	123	359	889
Other districts.....	3,485	671	2,908	7,064	3,449	658	2,517	6,624
Total Texas.....	6,682	1,308	4,910	12,900	6,747	1,328	4,650	12,725
Utah.....	67	21	121	209	50	19	109	178
Virginia.....		2	1	3	1	2	2	5
Washington.....			7	7			5	5
West Virginia.....	257	791	151	1,199	411	652	170	1,233
Wyoming.....	329	53	499	881	455	51	529	1,035
Total United States.....	20,288	4,751	16,347	41,386	20,620	4,855	17,488	42,963

<sup>1</sup> Excludes service wells.<sup>2</sup> Includes condensate wells.

Source: Oil and Gas Journal.

oil and 1,195,000 barrels per day of foreign-origin crude. This represented a gain of 2.0 percent for the year in total crude runs to stills, a 1.4-percent increase for domestic crude oil and a 5.8-percent increase for foreign crude.

**Distribution.**—The Bureau of Mines collects data on receipts of domestic and foreign crude petroleum at refineries in the United States. These receipts include the crude runs to stills, a small quantity used as refinery fuel, and any increase in crude stocks at refineries.



TABLE 13.—Producing oil wells in the United States and average production per well per day by States

State	Producing oil wells			
	1963		1964	
	Approximate number of producing oil wells, Dec. 31	Average production per well per day (barrels) <sup>1</sup>	Approximate number of producing oil wells, Dec. 31	Average production per well per day (barrels) <sup>1</sup>
Alabama.....	502	52.8	519	45.5
Alaska.....	54	555.2	56	549.4
Arkansas.....	6,010	12.6	6,018	12.1
California.....	40,233	20.7	40,916	20.2
Colorado.....	2,030	50.7	1,981	47.3
Illinois.....	30,149	6.8	29,500	6.4
Indiana.....	5,951	5.6	5,381	5.4
Kansas.....	46,951	6.4	46,715	6.2
Kentucky.....	† 14,903	† 2.9	15,226	3.6
Louisiana:				
Gulf Coast.....	14,571	89.8	15,114	91.3
Northern.....	13,067	10.7	14,338	10.7
Total Louisiana.....	27,638	52.2	29,452	52.6
Michigan.....	4,234	10.3	4,151	10.2
Mississippi.....	2,682	61.3	2,580	59.0
Montana.....	3,642	23.1	3,329	24.0
Nebraska.....	1,726	34.3	1,711	30.4
New Mexico:				
Southeastern.....	14,921	18.8	15,651	18.6
Northwestern.....	1,875	14.7	1,919	14.4
Total New Mexico.....	16,796	18.3	17,570	18.1
New York.....	13,431	0.3	12,526	0.4
North Dakota.....	1,824	37.9	1,881	38.0
Ohio.....	† 14,605	† 1.1	13,752	3.1
Oklahoma.....	81,475	6.8	80,511	6.8
Pennsylvania.....	54,062	0.2	53,065	0.3
Texas: <sup>2</sup>				
Gulf Coast.....	19,601	26.4	19,562	26.7
East Texas Proper.....	19,104	6.2	27,758	5.1
West Texas.....	66,144	18.2	67,068	18.2
Other districts.....	93,221	9.1	84,731	9.5
Total Texas.....	198,070	13.5	199,119	13.6
Utah.....	835	108.6	840	93.2
West Virginia.....	13,044	0.7	13,205	0.7
Wyoming.....	7,611	52.1	8,019	49.1
Other States:				
Arizona.....	9	28.7	8	20.6
Florida.....	12	110.5	19	109.3
Missouri.....	105	1.4	100	1.7
Nevada.....	4	80.8	5	154.8
South Dakota.....	24	27.4	24	28.1
Tennessee.....	39	1.1	38	0.7
Virginia.....	6	1.5	8	2.3
Total other States.....	199	13.3	202	17.3
Total United States.....	† 588,657	12.7	588,225	12.9

† Revised.

<sup>1</sup> Based on the average number of wells during the year.<sup>2</sup> Division of the Texas Railroad Commission.

Classification of receipts, by State of origin, shows receipts from local production (intrastate), receipts from other States (interstate), and receipts of imported crude. Classification by method of transportation indicated the final receipts by water, pipeline, and tank car and truck. Receipts of domestic crude by water usually were moved by pipeline from the point of production to the point of water shipment.

Receipts of domestic and foreign crude petroleum at refineries totaled 3,244.7 million barrels in 1964; foreign crude (438.8 million barrels) represented 13.5 percent of this total. The refineries processed 3,241.6 million barrels and reported 0.6 million barrels used for refinery fuel and losses; the difference, 2.5 million barrels, was added to stocks.

Refineries received 75.7 percent of their supply of crude oil by pipeline, 23.1 percent by water, and the remainder by tank cars and trucks.

The major waterborne shipments were from the gulf coast to the east coast and between States in the gulf coast districts. There are also interstate and intrastate shipments by water on the west coast and Mississippi River.

All foreign crude receipts into the east coast and the major part of those into the gulf coast are received by water. Refineries in District 2, which comprises the Great Lakes and the mid-continent areas, receive most of their foreign crude by pipeline from Canada; however, some is barged up the river from gulf coast ports where it arrives by tanker. Very little foreign crude is processed at refineries in the Rocky Mountain States; such crude as is used arrives at the refineries by pipeline and rail from Canada. West coast refiners received 63.7 percent of their foreign crude supply by water, the rest was received by pipeline at refineries near the Canadian border.

TABLE 14.—Receipts of domestic and foreign crude petroleum at refineries in the United States

(Million barrels)

Method of transportation	1960	1961	1962	1963	1964 <sup>a</sup>
By water:					
Intrastate.....	125.8	136.0	140.9	129.8	125.9
Interstate.....	261.6	268.3	277.6	307.1	285.9
Foreign.....	330.0	317.1	330.2	322.2	337.1
Total by water.....	717.4	721.4	748.7	759.1	748.9
By pipeline:					
Intrastate.....	1,291.6	1,286.1	1,333.4	1,377.2	1,426.0
Interstate.....	857.4	871.9	865.8	900.8	929.4
Foreign.....	40.6	64.1	79.7	90.1	101.7
Total by pipeline.....	2,189.6	2,222.1	2,278.9	2,368.1	2,457.1
By tank cars and trucks:					
Intrastate.....	33.9	34.9	36.9	36.2	34.4
Interstate.....	10.1	8.1	6.2	4.5	4.3
Foreign.....		0.5	0.1	0.1	
Total by tank cars and trucks.....	44.0	43.5	43.2	40.8	38.7
Grand total.....	2,951.0	2,987.0	3,070.8	3,168.0	3,244.7

<sup>a</sup> Preliminary.

**Demand by States of Origin.**—Distribution of domestic oil by refining States and districts can be analyzed from receipts of crude at refineries. When long-distance shipments are involved, various crudes may be mixed in transit or storage, and identification of origin may be only approximate.

TABLE 15.—Refinery receipts of domestic crude oil by States and districts, 1964

(Thousand barrels)

Receiving State and district	Total domestic receipts	Intrastate receipts	Interstate receipts from																	Total receipts	
			Alabama	Arkansas	California Nevada Alaska	Colorado	New York, Florida	Illinois	Indiana Michigan	Kansas	Ohio Kentucky	Louisiana	Montana	Nebraska N. Dakota and S. Dakota	New Mexico	Oklahoma	Texas	Utah	West Virginia		Wyoming
Delaware, Massachusetts, Rhode Island, Florida, Georgia, South Carolina, Virginia	4,951										4,576						375			4,951	
Maryland	2,472		1,403														1,069			2,472	
New Jersey	53,515		8,402			609					30,811						13,693			53,515	
New York	13,245						2,302			1,141		3,480				4,936	1,386			13,245	
Pennsylvania:																					
East	99,871		5,571								39,348						54,952			99,871	
West	15,635	5,752			444	2,007		223		1,469		2,915	442			850		1,533		9,883	
West Virginia	1,944	1,118								826										826	
<b>Total District 1.</b>	<b>191,633</b>	<b>6,870</b>	<b>15,376</b>		<b>444</b>	<b>2,616</b>	<b>2,302</b>	<b>223</b>		<b>3,436</b>	<b>74,735</b>	<b>6,395</b>	<b>442</b>		<b>5,786</b>	<b>71,475</b>		<b>1,533</b>		<b>184,763</b>	
Illinois	218,044	28,473				2,058					483	858	2,281	30,096	31,422	98,318	1,061		10,461	189,571	
Indiana	152,845	1,522				4,051		8,242		166	11,759	10,551	7,643	8,449	34,110	30,457			30,754	151,323	
Kansas	110,867	70,560				3,226													86	40,307	
Kentucky, Tennessee	42,417	21,972	2,031							36	16,388		958	7,047	16,052	12,938				20,445	
Michigan	46,705	17,423																		9,689	
Minnesota								5,992								13,601				29,282	
Wisconsin	10,802																				
Missouri, Nebraska	24,798	39								276		20	8,670							2,112	
North Dakota	16,564	16,440											559	9,166	3,273	4,321				10,802	
Ohio:												124								7,164	
East	37,256					1,303														124	
West	103,940	12,100				19,994						114								4,223	
Oklahoma	136,018	106,058	2,683	2,169		3,811	8,924	336			23,262		4,030	2,871	7,650	45,136				2,500	
						124				7,682				2,977	16,475	2,702				28,960	
<b>Total District 2.</b>	<b>900,256</b>	<b>274,677</b>	<b>4,714</b>	<b>2,169</b>		<b>14,573</b>		<b>43,152</b>	<b>3,266</b>	<b>36,588</b>	<b>65</b>	<b>40,133</b>	<b>11,667</b>	<b>24,141</b>	<b>60,606</b>	<b>92,507</b>	<b>221,246</b>	<b>3,763</b>		<b>66,989</b>	<b>625,579</b>

Alabama.....	4,321	841	2,963									517								3,480
Arkansas.....	28,618	26,409										2,209								2,209
Louisiana.....	277,272	211,050	22,800	219										29	43,174					66,222
Mississippi.....	47,500	8,843										38,657								38,657
New Mexico.....	10,823	10,818													5					5
Texas.....	898,185	683,007	746									4	171,482		38,521	3,181		1,244		215,178
Total District 3.....	1,266,719	940,968	26,509	219							4	212,865		38,521	3,210	43,179	1,244			325,751
Colorado.....	11,206	1,030										709		67						9,400
Montana.....	27,935	10,070																		17,865
Utah.....	33,043	7,844			2	1	16,831							80						8,287
Wyoming.....	40,050	38,462					1,552						36							1,588
Total District 4.....	112,234	57,406					1,18,383					709	36	147						35,552
California.....	326,614	300,380					4,753							5,486						26,234
Other States <sup>1</sup> .....	8,381	6,028					2,353													2,353
Total District 5.....	334,995	306,408					7,106							5,486						15,995
United States, total.....	2,805,837	1,586,329	46,599	2,388	7,107	33,400	2,616	45,454	3,489	36,592	3,501	327,733	18,771	24,619	104,760	101,503	335,900	21,002	1,533	1,219,508
Daily average.....	7,666	4,334	127	6	20	91	7	124	10	100	9	896	51	67	287	277	918	57	4	3,332

<sup>1</sup> Alaska, Hawaii, Oregon, and Washington.<sup>2</sup> Oil from Arizona.

TABLE 16.—Crude runs to stills and refinery receipts of crude oil by origin of the crude and method of transportation, 1964  
(Thousand barrels)

State and district	Crude runs to stills	Refinery fuel use and losses	Refinery receipts of domestic crude—							Refinery receipts of foreign crude		
			By State of origin of domestic crude	Change in refinery stocks	By receiving State and method of transportation							
					Intrastate			Interstate				
					Pipelines	Tank cars and trucks	Tankers and barges	Pipelines	Tank cars and trucks	Tankers and barges	Pipelines	Tankers and barges
Delaware, Massachusetts, Rhode Island	42,158			+97						4,951		37,304
Florida, Georgia, South Carolina, Virginia	17,412	2	609	-69					497	1,975		14,873
Maryland	5,796	-6		-40								5,750
New Jersey	156,584	1		+1,207							53,515	104,277
New York	30,366		2,007	-49				13,245			7,871	9,201
Pennsylvania:												
East	173,765	82		-651							99,871	73,325
West	15,658	-11	5,752	-12	5,646	106		8,733	247		853	
West Virginia	1,919		2,651	+24	1,076	42		467	359			
Total District 1	1 443,658	69	11,019	+507	6,722	148		22,495	1,103	161,165	7,871	244,730
Illinois	218,763	12	73,927	-561	28,379	94		189,088		483	170	
Indiana	153,238	1	4,286	-215	863	659		151,128	195		179	
Kansas	110,894	38	107,152	-85	68,566	1,994		40,276	31			
Kentucky, Tennessee	42,500	4	21,972	-87	6,130	244				15,598		
Michigan	51,659	26	18,148	-9	17,022	401					20,445	
Minnesota, Wisconsin	37,160	-20		-207				29,282			4,971	
Missouri, Nebraska	24,696		15,952	+102				9,555	22		1,225	26,131
North Dakota	16,536		26,146	+28	15,816	624		24,759	124			
Ohio:												
East	37,235			+21	10,646	513	463	25,634				
West	111,548	-18	15,691	-151	539	29		103,372			6,230	1,209
Oklahoma	136,659	29	207,561	-670	104,088	1,970		29,960				
Total District 2	940,888	72	489,835	-1,814	252,049	6,567	16,061	603,054	372	22,153	37,681	1,209

Alabama.....	4,876	-14	9,374	+40			841		261	3,219		581
Arkansas.....	28,798	-29	28,797	-151	25,394	1,015		2,135	74			
Louisiana.....	276,689	36	538,783	+584	163,305	3,855	44,390	63,595	237	2,390		37
Mississippi.....	47,020	2	46,909	+478	7,220	1,623		38,657				
New Mexico.....	10,811	8	115,578	+4	9,996	822			5			
Texas.....	898,023	146	1,018,907	+35	635,425	9,027	38,555	125,312	1	89,865	419	
<b>Total District 3.....</b>	<b>1,266,217</b>	<b>149</b>	<b>1,758,348</b>	<b>+990</b>	<b>841,340</b>	<b>15,842</b>	<b>83,786</b>	<b>229,699</b>	<b>578</b>	<b>95,474</b>	<b>19</b>	<b>618</b>
Colorado.....	11,243	-7	34,430	-30	399	631		10,109	67			
Montana.....	32,028	2	28,841	-33	9,801	269		17,865			4,062	
Utah.....	32,930	-5	28,846	+118	7,352	492		24,642	557			
Wyoming.....	40,648	5	141,003	-37	37,619	543			1,588		566	
<b>Total District 4.....</b>	<b>116,849</b>	<b>-5</b>	<b>233,120</b>	<b>+18</b>	<b>55,171</b>	<b>2,235</b>		<b>52,616</b>	<b>2,212</b>		<b>4,628</b>	
California.....	394,793	428	302,733	+2,581	264,708	9,618	26,054	21,481		4,753		71,188
Other States <sup>6</sup> .....	79,227	-102	10,782	+139	6,028					2,353	51,526	19,357
<b>Total District 5.....</b>	<b>474,020</b>	<b>326</b>	<b>313,515</b>	<b>+2,720</b>	<b>270,736</b>	<b>9,618</b>	<b>26,054</b>	<b>21,481</b>		<b>7,106</b>	<b>51,526</b>	<b>90,545</b>
United States, total.....	3,241,632	611	2,805,837	+2,421	1,426,018	34,410	125,901	929,345	4,265	285,898	101,725	337,102
Daily Average.....	8,857	2	7,666	+7	3,896	94	344	2,539	11	782	278	921

<sup>1</sup> Includes 270,461,000 barrels in Delaware River Valley.

<sup>2</sup> Includes 36,000 barrels from South Dakota.

<sup>3</sup> Transhipped from PAD District 3.

<sup>4</sup> Tank cars and trucks.

<sup>5</sup> Includes tank cars and trucks 34,000 barrels.

<sup>6</sup> Alaska, Arizona, Hawaii, Oregon, and Washington.

<sup>7</sup> Excludes crude oil imported for direct fuel use by pipelines.

TABLE 17.—Daily average total demand for crude petroleum in the United States, 1963–64, by States of origin and months  
(Thousand barrels)

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
1963:													
Alabama.....	30.0	17.9	22.6	33.4	15.0	33.9	25.5	12.9	24.1	34.5	16.5	35.7	25.2
Alaska.....	37.3	19.8	32.4	21.5	32.0	26.0	21.9	47.3	26.4	33.0	27.8	35.9	30.3
Arkansas.....	67.8	78.1	76.8	70.9	79.6	76.0	67.2	82.9	79.5	76.1	76.0	73.8	75.3
California.....	801.0	782.3	845.5	786.9	790.0	823.3	864.9	829.6	871.4	834.1	846.5	834.5	826.1
Colorado.....	115.6	113.6	108.2	99.5	101.9	107.2	109.4	115.6	100.2	93.0	122.5	78.0	105.3
Florida.....	3.8			3.3		0.7	3.0		1.0	2.7		2.9	1.5
Illinois.....	229.0	199.0	208.4	197.8	188.0	193.0	216.8	202.3	210.9	225.5	193.6	213.7	206.7
Indiana.....	34.0	34.7	31.2	31.9	31.5	37.5	34.1	28.6	33.4	35.4	27.3	34.2	32.8
Kansas.....	285.9	331.0	308.8	291.2	267.4	307.6	325.6	309.6	298.6	269.9	282.3	332.1	300.7
Kentucky.....	48.2	65.3	47.2	45.6	49.2	46.2	52.5	42.5	54.6	47.6	55.5	54.3	50.6
Louisiana.....	1,365.7	1,423.7	1,372.1	1,416.4	1,436.3	1,445.5	1,402.1	1,374.5	1,435.8	1,439.5	1,428.8	1,435.4	1,414.3
Michigan.....	44.5	42.9	44.6	42.6	44.9	45.1	44.8	43.9	43.5	43.5	39.1	43.8	43.6
Mississippi.....	145.6	175.1	148.5	168.1	166.0	170.3	148.7	163.6	162.9	161.5	167.9	157.2	161.1
Montana.....	95.2	83.7	92.4	76.4	86.5	91.2	98.5	88.5	90.0	79.8	81.2	90.3	87.9
Nebraska.....	60.8	63.2	61.8	61.3	57.0	74.8	60.5	50.4	66.7	59.1	58.0	54.9	59.8
New Mexico.....	312.5	307.9	318.7	302.3	287.6	324.9	294.1	280.5	289.5	293.2	313.9	287.1	300.8
New York.....	3.9	4.2	4.3	4.2	4.6	4.3	4.1	3.8	5.5	5.4	5.3	5.5	4.6
North Dakota.....	78.0	71.5	74.8	70.2	56.9	40.1	76.5	75.3	62.6	66.5	69.8	76.6	68.3
Ohio.....	14.7	13.0	14.4	12.8	13.7	15.7	14.8	17.8	14.3	11.7	25.7	31.5	16.7
Oklahoma.....	550.8	565.3	606.1	555.3	559.9	585.7	567.1	593.6	522.9	501.9	562.0	488.8	554.9
Pennsylvania.....	16.0	13.2	16.6	13.9	11.8	17.4	14.5	11.7	16.7	13.0	13.3	16.7	14.6
Texas.....	2,699.5	2,857.1	2,649.5	2,568.6	2,650.1	2,633.3	2,648.6	2,802.3	2,666.8	2,773.9	2,721.2	2,735.4	2,700.0
Utah.....	90.3	95.6	95.1	87.6	94.8	100.9	89.6	89.1	88.9	98.9	92.8	92.5	93.0
West Virginia.....	9.6	9.4	10.4	8.5	8.5	8.2	9.5	9.4	12.0	9.9	9.6	8.9	9.5
Wyoming.....	385.3	434.7	389.4	361.4	398.1	448.2	439.7	430.6	394.8	357.2	384.6	336.7	396.3
Other States.....	1.5	1.4	1.3	1.3	1.4	1.3	1.4	1.3	1.4	1.2	1.1	1.5	1.3
Total domestic crude.....	7,526.5	7,803.5	7,581.1	7,322.9	7,432.7	7,658.3	7,635.4	7,707.6	7,574.4	7,568.0	7,622.3	7,557.9	7,581.2
Foreign crude.....	1,191.7	1,201.7	1,119.7	1,027.0	1,106.2	1,153.5	1,185.0	1,143.4	1,123.0	1,067.4	1,101.4	1,157.8	1,131.2
Grand total 1963.....	8,718.2	9,005.2	8,700.8	8,349.9	8,538.9	8,811.8	8,820.4	8,851.0	8,697.4	8,635.4	8,723.7	8,715.7	8,712.4
Pennsylvania grade (included above).....	36.8	34.7	33.1	31.9	30.6	36.2	33.2	30.7	39.4	33.2	33.6	37.3	34.2

1964:															
Alabama	23.2	22.4	23.6	22.6	30.7	13.9	32.9	12.8	33.0	9.5	36.9	18.0	23.2		
Alaska	27.5	33.4	22.7	28.1	39.6	28.9	30.2	29.0	30.7	26.3	32.9	27.5	29.6		
Arkansas	73.1	71.8	75.0	77.9	73.7	76.4	74.0	73.6	70.9	70.6	73.4	71.7	73.5		
California	828.4	809.0	880.5	800.2	823.1	845.7	788.2	832.9	821.8	824.7	843.5	790.5	824.0		
Colorado	103.5	110.3	81.3	96.6	73.4	107.2	94.3	105.5	92.4	94.2	91.1	95.2	95.3		
Florida	0.7			3.2		3.6		3.3	0.2	3.3	3.4		1.5		
Illinois	195.9	195.5	196.9	181.1	162.6	161.7	207.5	188.3	210.7	186.8	203.0	199.8	190.8		
Indiana	32.2	31.5	29.8	29.0	34.1	29.9	29.2	29.3	34.1	30.1	28.5	30.7	30.7		
Kansas	302.4	300.7	285.7	277.3	280.9	318.7	314.4	278.4	285.2	267.9	288.8	285.1	290.4		
Kentucky	52.5	58.3	58.7	42.7	64.9	50.7	50.5	54.6	50.8	59.9	50.5	52.8	53.9		
Louisiana	1,491.7	1,504.7	1,506.3	1,547.2	1,500.9	1,504.0	1,503.8	1,423.9	1,495.5	1,384.7	1,514.2	1,610.8	1,498.8		
Michigan	51.4	42.6	39.3	45.1	33.9	45.8	44.0	40.7	45.8	40.8	43.1	40.0	42.7		
Mississippi	159.7	149.1	173.6	145.8	140.9	159.3	151.4	150.2	144.3	164.0	160.9	162.7	154.4		
Montana	76.7	88.3	76.7	83.5	66.9	99.2	76.1	83.7	88.2	90.4	82.0	93.5	83.7		
Nebraska	67.5	56.7	60.9	39.6	46.0	56.9	48.1	36.4	55.7	48.4	59.5	63.7	53.3		
New Mexico	322.0	327.0	323.9	313.4	274.3	329.8	297.5	337.3	309.6	310.1	325.3	343.1	317.7		
New York	6.9	6.3	5.2	5.1	4.9	5.2	4.9	4.7	4.7	4.7	4.6	4.6	5.2		
North Dakota	70.8	81.0	71.3	75.3	39.9	65.9	67.6	75.5	76.0	69.3	71.1	75.9	69.9		
Ohio	33.7	34.8	34.9	56.7	47.2	46.1	41.4	45.5	44.1	46.4	41.3	42.2	42.9		
Oklahoma	571.2	537.8	547.2	545.1	588.3	502.9	604.5	566.1	546.9	573.7	557.6	550.8	558.0		
Pennsylvania	16.4	13.0	19.3	15.7	15.3	15.8	11.1	11.1	14.1	14.0	9.2	15.7	14.2		
Texas	2,710.0	2,756.5	2,606.2	2,620.2	2,675.6	2,648.6	2,739.4	2,860.9	2,726.5	2,764.4	2,617.9	2,838.4	2,717.9		
Utah	68.7	94.1	86.6	85.1	75.2	81.9	80.1	78.6	75.5	60.5	74.2	73.1	77.7		
West Virginia	9.5	8.4	8.8	9.6	7.9	6.6	7.9	7.2	9.2	7.7	9.1	10.8	8.6		
Wyoming	337.3	354.3	370.3	343.3	405.0	407.5	388.0	410.3	397.3	406.4	347.8	357.0	377.3		
Other States	1.6	1.8	1.7	1.9	1.5	1.7	1.8	1.9	2.1	1.9	1.7	1.7	21.8		
Total domestic crude	7,634.5	7,689.3	7,586.4	7,401.3	7,506.7	7,613.9	7,738.8	7,741.7	7,665.3	7,560.7	7,561.5	7,850.3	7,637.0		
Foreign crude	1,150.2	1,141.8	1,097.9	1,116.3	1,115.9	1,295.7	1,305.2	1,293.5	1,266.4	1,248.2	1,157.0	1,158.8	1,195.7		
Grand total 1964	8,784.7	8,831.1	8,684.3	8,607.6	8,622.6	8,909.6	9,044.0	9,035.2	8,931.7	8,808.9	8,718.5	9,009.1	8,832.7		
Pennsylvania grade (included above)	38.6	32.4	39.5	35.0	32.2	31.5	28.8	26.2	32.5	30.5	27.8	34.5	32.5		

<sup>1</sup> Arizona, 0.2; Missouri, 0.2; Nevada, 0.3; South Dakota, 0.6; Tennessee and Virginia less than 0.05.  
<sup>2</sup> Arizona, 0.2; Missouri, 0.2; Nevada, 0.7; South Dakota, 0.7; Tennessee and Virginia less than 0.05.

789-780-65-27



TABLE 18.—Total demand for crude petroleum in the United States 1963-64 by States of origin and months

(Thousand barrels)

State	January	February	March	April	May	June	July	August	September	October	November	December	Total
1963:													
Alabama.....	931	502	702	1,001	464	1,016	790	399	723	1,069	495	1,108	9,200
Alaska.....	1,155	555	1,003	645	993	779	680	1,469	792	1,022	534	1,115	11,042
Arkansas.....	2,102	2,188	2,382	2,126	2,468	2,281	2,084	2,570	2,394	2,858	2,281	2,287	27,511
California.....	24,832	21,904	26,212	23,610	24,489	24,700	26,811	25,718	26,141	25,556	25,396	25,870	301,539
Colorado.....	3,585	3,179	3,354	2,986	3,160	3,215	3,382	3,583	3,006	2,884	3,674	2,419	38,487
Florida.....	117			98		20	94		30	83		89	531
Illinois.....	7,099	5,572	6,459	5,935	5,829	5,791	6,722	6,272	6,328	6,990	5,809	6,624	75,428
Indiana.....	1,053	972	968	959	977	1,126	1,056	887	1,002	1,098	819	1,061	11,978
Kansas.....	8,864	9,267	9,575	8,735	8,290	9,229	10,095	9,599	8,959	8,366	8,469	10,295	109,743
Kentucky.....	1,495	1,827	1,463	1,367	1,525	1,385	1,629	1,318	1,637	1,475	1,664	1,683	18,468
Louisiana.....	42,338	39,864	42,536	42,493	44,526	43,364	43,466	42,608	43,075	44,625	42,865	44,496	516,256
Michigan.....	1,380	1,202	1,383	1,279	1,392	1,353	1,388	1,360	1,304	1,347	1,174	1,357	15,010
Mississippi.....	4,513	4,902	4,604	5,042	5,145	5,106	4,610	5,072	4,888	5,008	5,039	4,872	58,801
Montana.....	2,952	2,343	2,864	2,292	2,681	2,737	3,050	2,743	2,701	2,475	2,437	2,800	32,075
Nebraska.....	1,886	1,769	1,915	1,540	1,767	2,244	1,874	1,561	2,000	1,833	1,741	1,702	21,832
New Mexico.....	9,686	8,618	9,880	9,069	8,916	9,748	9,118	8,694	8,684	9,086	9,419	8,899	109,817
New York.....	122	118	132	127	143	130	128	118	165	168	158	170	1,679
North Dakota.....	2,418	2,001	2,319	2,106	1,763	1,204	2,370	2,334	1,880	2,061	2,095	2,375	24,926
Ohio.....	456	365	445	385	424	472	458	552	430	363	770	973	6,093
Oklahoma.....	17,076	15,827	18,788	16,658	17,358	17,572	17,581	18,402	15,690	16,559	16,861	15,155	202,527
Pennsylvania.....	497	870	514	416	365	521	451	362	502	408	395	518	5,314
Texas.....	83,681	79,999	82,137	77,057	82,154	78,998	82,106	86,871	80,005	85,991	81,633	84,798	985,430
Utah.....	2,799	2,678	2,949	2,628	2,940	3,028	2,779	2,762	2,666	3,067	2,784	2,869	33,949
West Virginia.....	298	264	321	256	262	246	295	292	360	307	290	278	3,469
Wyoming.....	11,945	12,172	12,072	10,842	12,342	13,447	13,632	13,350	11,840	11,074	11,535	10,438	144,689
Other States.....	42	40	39	38	42	38	39	40	42	38	33	45	1,476
Total domestic crude.....	233,322	218,498	235,016	219,690	230,415	229,750	236,698	238,936	227,232	234,606	228,670	234,296	2,767,129
Foreign crude.....	36,943	33,650	34,710	30,811	34,293	34,605	36,734	35,445	33,689	33,088	33,044	35,892	412,904
Grand total 1963.....	270,265	252,148	269,726	250,501	264,708	264,355	273,432	274,381	260,921	267,694	261,714	270,188	3,180,033
Daily average:													
Domestic crude.....	7,527	7,804	7,581	7,323	7,493	7,658	7,635	7,708	7,574	7,568	7,622	7,558	7,581
Domestic and foreign crude.....	8,718	9,005	8,701	8,350	8,539	8,812	8,820	8,851	8,697	8,635	8,724	8,716	8,713
Pennsylvania grade (included above).....	1,142	972	1,026	966	948	1,085	1,029	951	1,181	1,029	1,008	1,155	12,482

1964:																			
Alabama.....	718	648	733	679	952	414	1,023	396	991	293	1,107	559	8,513						
Alaska.....	863	967	703	842	1,227	867	935	898	917	816	986	854	10,865						
Arkansas.....	2,265	2,083	2,324	2,339	2,285	2,291	2,295	2,282	2,126	2,188	2,203	2,223	26,904						
California.....	25,681	23,461	27,296	24,007	25,513	25,372	24,433	25,820	24,655	25,596	25,905	24,505	301,614						
Colorado.....	3,209	3,197	2,519	2,898	2,276	3,215	2,923	3,270	2,773	2,920	2,732	2,960	34,882						
Florida.....	22			93		107		101	5	102	103		538						
Illinois.....	6,072	5,670	6,104	5,434	5,040	4,850	6,431	5,836	6,318	5,790	6,090	6,195	69,880						
Indiana.....	999	914	922	871	1,054	900	905	909	1,024	933	854	962	11,237						
Kansas.....	9,375	8,720	8,857	8,319	8,707	9,560	9,745	8,631	8,555	8,308	8,664	8,888	106,279						
Kentucky.....	1,626	1,692	1,818	1,280	2,012	1,521	1,564	1,692	1,524	1,856	1,615	1,637	19,737						
Louisiana.....	46,243	43,636	46,696	46,415	46,527	45,119	46,618	44,144	44,866	42,926	45,425	49,935	648,550						
Michigan.....	1,592	1,235	1,218	1,353	1,051	1,370	1,365	1,262	1,375	1,265	1,292	1,240	15,018						
Mississippi.....	4,952	4,324	5,383	4,375	4,369	4,779	4,694	4,657	4,328	5,086	4,526	5,045	56,618						
Montana.....	2,378	2,560	2,379	2,504	2,073	2,977	2,359	2,594	2,647	2,802	2,461	2,897	30,631						
Nebraska.....	2,092	1,643	1,889	1,187	1,427	1,707	1,491	1,127	1,671	1,499	1,786	1,975	19,494						
New Mexico.....	9,982	9,484	10,042	9,402	8,503	9,895	9,223	10,456	9,289	9,615	9,758	10,633	116,282						
New York.....	215	183	158	152	153	156	155	145	142	147	139	143	1,888						
North Dakota.....	2,195	2,348	2,211	2,258	1,238	1,980	2,096	2,340	2,280	2,147	2,132	2,362	25,577						
Ohio.....	1,044	1,010	1,083	1,702	1,464	1,384	1,282	1,411	1,324	1,438	1,239	1,309	15,690						
Oklahoma.....	17,708	15,597	16,963	16,354	18,237	15,090	18,738	17,549	16,403	17,784	16,728	17,074	204,230						
Pennsylvania.....	507	378	598	471	474	474	344	344	424	434	277	486	5,211						
Texas.....	84,011	79,937	80,792	78,607	82,943	79,455	86,470	88,688	81,794	85,696	78,534	87,835	694,762						
Utah.....	2,131	2,780	2,685	2,554	2,331	2,456	2,483	2,438	2,266	1,874	2,226	2,267	28,441						
West Virginia.....	292	244	274	289	246	199	248	222	275	239	274	334	3,137						
Wyoming.....	10,457	10,276	11,478	10,297	12,556	12,226	12,029	12,720	11,920	12,598	10,435	11,068	138,060						
Other States.....	49	53	51	56	43	51	56	60	60	60	51	62	2,647						
Total domestic crude.....	236,669	222,990	235,176	224,738	232,706	228,415	239,905	239,992	229,957	234,382	226,842	243,358	2,795,130						
Foreign crude.....	35,657	33,111	34,036	33,489	34,594	38,872	40,460	40,098	37,993	38,693	34,713	35,923	437,639						
Grand total 1964.....	272,326	256,101	269,212	258,227	267,300	267,287	280,365	280,090	267,950	273,075	261,555	279,281	3,232,769						
Daily average:																			
Domestic crude.....	7,634	7,689	7,586	7,491	7,507	7,614	7,739	7,742	7,665	7,561	7,561	7,860	7,637						
Domestic and foreign crude.....	8,785	8,331	8,684	8,608	8,623	8,910	9,044	9,035	8,932	8,069	8,718	9,009	8,833						
Pennsylvania grade (included above).....	1,198	940	1,224	1,051	998	945	892	813	976	946	834	1,068	11,885						

<sup>1</sup> Arizona, 68; Missouri, 53; Nevada, 118; South Dakota, 218; Tennessee, 16 and Virginia, 3.

<sup>2</sup> Arizona, 64; Missouri, 65; Nevada, 255; South Dakota, 247; Tennessee, 10, and Virginia, 6.

## STOCKS

Refinery stocks of gasoline, kerosine, distillate fuel oil, residual fuel oil, liquefied refinery gas, miscellaneous oils, and unfinished oils are on the basis described in the 1963 Minerals Yearbook. That is, petrochemical feedstocks are treated as a separate item, whereas they formerly had been included in these other categories in instances where chemical plants were adjacent to refineries. By excluding the chemical manufacture from the regular petroleum refining, the current reporting procedure furnishes better data on the refinery products.

Stocks of all oils increased 3,676,000 barrels in 1964 and at the end of the year totaled 839,235,000 barrels. Stocks of refined products increased 9,048,000 barrels, natural gas liquids increased 1,932,000 barrels, while stocks of crude oil declined 7,304,000 barrels during the year.

**TABLE 19.—Stocks of crude petroleum, natural gas liquids, and refined products in the United States at end of year**

(Thousand barrels)

	1960	1961	1962	1963	1964
<b>Crude petroleum:</b>					
At refineries.....	66,450	64,644	64,836	61,487	63,908
Pipeline and tank farm.....	152,848	159,105	167,390	157,544	149,415
Producers.....	20,502	20,915	19,785	18,330	16,784
<b>Total crude petroleum.....</b>	<b>239,800</b>	<b>244,664</b>	<b>252,011</b>	<b>237,361</b>	<b>230,057</b>
Natural gas liquids.....	28,931	37,067	31,385	33,747	35,679
Refined products.....	515,827	543,343	550,900	564,451	573,499
<b>Grand total.....</b>	<b>784,558</b>	<b>825,074</b>	<b>834,296</b>	<b>835,559</b>	<b>839,235</b>

TABLE 20.—Stocks of crude petroleum in the United States by States of origin and district location, by months: 1964

(Thousand barrels)

State of origin	Jan. 1	Jan. 31	Feb. 29	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
<b>Domestic crude:</b>													
Alabama.....	281	301	335	375	384	137	436	160	523	199	593	155	266
Alaska.....	210	302	220	376	447	169	218	224	267	264	394	317	404
Arkansas.....	1,111	1,146	1,219	1,209	1,072	1,053	986	920	888	924	967	933	944
California.....	23,428	22,948	22,888	20,793	21,386	21,074	20,303	21,071	20,452	20,698	20,933	20,528	21,823
Colorado.....	3,294	3,178	2,866	3,371	3,358	4,071	3,706	3,598	3,247	3,220	3,115	3,163	3,167
Florida.....	61	77	112	148	88	129	69	126	81	130	91	69	148
Illinois.....	6,430	6,609	6,659	6,592	7,081	7,892	8,902	8,503	8,480	7,914	7,878	7,285	6,768
Indiana.....	303	279	348	379	419	374	366	418	431	336	289	307	349
Kansas.....	7,671	7,513	7,384	7,721	8,323	8,299	7,306	6,505	6,627	6,746	7,441	7,356	7,544
Kentucky.....	1,832	1,505	1,513	1,534	1,796	1,445	1,506	1,583	1,472	1,550	1,335	1,382	1,367
Louisiana.....	21,424	22,454	23,344	23,922	23,682	22,780	21,637	20,094	21,025	20,135	22,284	23,084	22,572
Michigan.....	1,029	798	806	899	858	1,100	1,037	1,002	1,029	933	981	943	1,012
Mississippi.....	2,351	2,282	2,614	2,227	2,564	2,851	2,841	2,803	2,802	3,016	2,813	2,772	2,610
Montana.....	3,630	3,544	3,645	3,815	3,837	4,364	3,986	4,155	4,123	4,015	3,889	3,884	3,546
Nebraska.....	2,064	1,673	1,597	1,352	1,733	1,911	1,733	1,828	2,326	2,203	2,309	2,071	1,683
New Mexico.....	9,999	9,581	9,092	8,842	8,777	9,839	9,053	9,281	8,048	8,096	8,159	8,079	7,580
New York.....	44	30	30	30	30	30	30	30	30	30	30	30	30
North Dakota.....	1,741	1,817	1,831	1,747	1,557	1,940	1,913	1,939	1,783	1,732	1,920	1,995	1,895
Ohio.....	597	584	906	1,171	880	812	744	842	763	835	761	790	766
Oklahoma.....	18,522	18,036	18,505	18,991	19,870	19,101	20,673	19,093	18,234	17,961	17,421	16,955	16,816
Pennsylvania.....	1,319	1,287	1,311	1,194	1,261	1,168	1,089	1,154	1,205	1,198	1,190	1,300	1,221
South Dakota.....						1							
Texas.....	99,449	98,556	96,781	101,096	104,556	105,727	107,410	103,115	96,554	94,920	93,319	95,951	94,212
Utah.....	2,542	2,984	2,683	2,541	2,530	2,656	2,600	2,574	2,565	2,471	2,826	2,743	2,676
West Virginia.....	771	753	756	747	742	761	857	909	958	958	1,020	1,025	1,004
Wyoming.....	15,613	16,447	17,296	17,461	18,749	18,332	17,008	16,225	15,173	14,610	15,058	16,136	16,305
<b>Total domestic crude.....</b>	<b>225,016</b>	<b>224,684</b>	<b>224,641</b>	<b>228,533</b>	<b>235,980</b>	<b>238,016</b>	<b>236,409</b>	<b>228,152</b>	<b>219,086</b>	<b>215,094</b>	<b>217,016</b>	<b>219,203</b>	<b>216,708</b>
<b>Foreign crude located in districts:</b>													
Districts 1-4.....	8,811	10,737	11,062	14,081	11,691	14,698	11,326	12,326	11,576	10,623	11,971	11,240	8,723
District 5.....	3,534	5,586	4,359	4,249	6,241	4,608	3,495	5,855	7,250	7,063	6,246	6,366	4,626
<b>Total foreign crude.....</b>	<b>12,345</b>	<b>16,323</b>	<b>15,421</b>	<b>18,330</b>	<b>17,932</b>	<b>19,306</b>	<b>14,821</b>	<b>18,181</b>	<b>18,826</b>	<b>17,686</b>	<b>18,217</b>	<b>17,606</b>	<b>13,349</b>
<b>Total crude stocks.....</b>	<b>237,361</b>	<b>241,007</b>	<b>240,062</b>	<b>246,863</b>	<b>253,912</b>	<b>257,322</b>	<b>251,230</b>	<b>246,333</b>	<b>237,912</b>	<b>232,780</b>	<b>235,233</b>	<b>236,809</b>	<b>230,067</b>
Pennsylvania grade (included above).....	2,335	2,257	2,285	2,179	2,245	2,176	2,198	2,300	2,399	2,382	2,438	2,547	2,488

CRUDE PETROLEUM AND PETROLEUM PRODUCTS

TABLE 21.—Stocks of crude petroleum in the United States by location, by months: 1964

(Thousand barrels)

State	Jan. 1	Jan. 31	Feb. 29	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
Alabama.....	222	307	299	475	392	399	494	442	466	471	266	175	261
Alaska.....	208	301	220	264	327	169	218	224	267	264	394	317	404
Arizona.....	449	448	447	448	448	448	447	447	447	448	448	447	447
Arkansas.....	1,544	1,553	1,667	1,658	1,513	1,470	1,422	1,359	1,330	1,373	1,352	1,313	1,350
California, Oregon, Washington.....	26,886	28,734	27,372	25,274	27,766	25,840	24,071	27,132	27,424	28,004	27,399	26,049	26,779
Colorado.....	1,452	1,496	1,270	1,382	1,849	1,689	1,639	1,756	1,549	1,556	1,505	1,363	1,291
Florida, Georgia, South Carolina, Virginia.....	701	838	883	932	1,035	781	912	966	1,093	923	947	796	645
Hawaii.....	272	749	460	493	589	527	444	417	944	490	693	1,055	372
Illinois.....	14,505	14,301	15,217	14,927	15,536	15,873	16,247	15,860	15,563	15,497	15,110	14,725	13,751
Indiana.....	3,842	3,743	3,765	3,762	4,520	4,638	4,351	4,214	4,202	3,883	3,775	3,946	3,535
Iowa, Missouri.....	6,559	6,717	6,633	7,171	6,860	7,225	6,729	6,714	6,813	6,937	7,308	6,973	6,844
Kansas.....	9,607	9,826	9,683	9,797	10,798	10,649	10,063	9,843	9,672	9,492	9,596	9,725	9,460
Kentucky, Tennessee.....	3,096	3,517	3,300	3,426	3,465	3,369	3,240	3,572	3,317	3,208	3,282	2,937	2,985
Louisiana.....	14,208	15,388	15,184	15,926	16,620	16,193	14,743	13,498	14,018	13,997	14,572	14,647	15,004
Maryland.....	239	305	494	532	557	383	525	433	510	348	322	323	199
Massachusetts, Delaware, Rhode Island.....	691	1,041	996	959	581	1,155	591	861	881	1,214	1,205	1,114	788
Michigan.....	1,809	1,789	1,747	2,015	1,933	2,210	2,187	2,105	2,099	1,897	1,973	1,879	1,900
Minnesota, Wisconsin.....	2,432	2,101	2,145	1,918	1,890	2,371	2,589	2,118	1,999	1,778	1,882	2,019	2,055
Mississippi.....	2,289	2,292	2,104	2,380	2,480	2,402	2,138	2,176	2,341	2,172	2,489	2,697	2,723
Montana.....	1,959	1,981	2,196	2,213	2,403	2,295	2,387	2,253	2,286	2,157	2,083	2,087	1,821
Nebraska.....	1,787	1,702	1,751	1,800	1,849	1,807	1,802	1,859	1,746	1,817	1,782	1,753	1,737
New Jersey.....	4,108	4,843	4,866	6,323	4,950	6,271	5,170	5,987	4,639	5,544	5,481	6,340	5,475
New Mexico.....	3,686	3,641	3,892	3,656	3,851	3,630	3,558	3,393	3,267	3,670	3,808	3,696	3,877
New York.....	1,115	821	777	1,082	882	1,191	1,176	1,035	973	991	1,017	1,077	890
North Dakota.....	1,189	1,367	1,435	1,294	1,216	1,556	1,404	1,361	1,265	1,357	1,426	1,418	1,860
Ohio.....	6,728	6,782	7,045	7,385	6,777	7,498	7,256	7,246	7,372	7,185	6,840	7,134	6,752
Oklahoma.....	20,778	19,397	18,683	18,667	19,535	20,780	22,230	20,353	18,251	17,687	17,072	17,605	17,645
Pennsylvania.....	9,498	9,668	9,213	10,933	8,969	8,747	8,578	8,960	10,210	8,910	11,196	10,418	8,961
South Dakota.....						1							
Texas.....	85,839	86,057	86,774	89,841	93,638	94,281	94,563	90,367	84,320	81,447	80,688	82,080	80,764
Utah.....	1,102	1,040	1,230	1,075	1,046	1,158	1,116	1,067	1,137	1,088	1,042	1,291	1,368
West Virginia.....	602	599	558	575	619	605	646	682	706	737	749	701	690
Wyoming.....	7,899	7,663	7,756	8,080	9,038	9,711	8,294	7,631	6,825	6,238	7,281	8,109	8,418
Total.....	237,361	241,007	240,062	246,863	253,912	257,322	251,230	246,333	237,912	232,780	235,233	236,809	230,057

TABLE 22.—Stocks of crude petroleum in the United States by classification and location, by months: 1964

(Thousand barrels)

Classification and location	Jan. 1	Jan. 31	Feb. 29	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
<b>At refineries:</b>													
Alabama.....	157	242	256	332	311	337	422	367	399	389	210	124	197
Alaska.....	46	44	86	59	50	56	58	49	80	77	73	45	78
Arkansas.....	413	422	572	586	478	470	404	381	339	346	276	249	262
California, Oregon, Washington..	12,319	14,258	13,682	13,157	15,403	13,721	12,660	15,331	16,000	16,251	16,489	16,150	14,907
Colorado.....	230	307	230	179	419	193	215	262	209	197	268	188	200
Florida, Georgia, South Carolina, Virginia.....	662	761	771	878	947	759	843	941	1,012	896	856	727	593
Hawaii.....	272	749	460	493	589	527	444	417	944	490	693	1,055	372
Illinois.....	3,353	3,340	3,308	3,468	3,460	3,461	3,528	3,747	3,379	3,312	3,274	3,057	2,792
Indiana.....	1,315	1,338	1,124	1,217	1,377	1,429	988	985	973	1,055	1,103	1,236	1,100
Kansas.....	1,497	1,555	1,419	1,588	1,943	1,772	1,586	1,455	1,563	1,636	1,635	1,521	1,432
Kentucky, Tennessee.....	1,095	1,346	1,103	1,217	1,283	1,151	1,190	1,394	1,273	1,122	1,202	948	1,008
Louisiana.....	3,659	4,224	4,266	4,096	4,992	5,044	3,834	3,649	3,894	4,225	4,303	4,396	4,243
Maryland.....	239	305	494	532	557	383	525	433	510	348	322	323	199
Massachusetts, Delaware, Rhode Island.....	691	1,041	996	959	581	1,155	591	861	881	1,214	1,205	1,114	788
Michigan.....	815	825	941	943	1,064	945	1,014	894	927	868	821	768	806
Minnesota, Wisconsin.....	1,656	1,467	1,571	1,315	1,341	1,713	1,886	1,532	1,382	1,184	1,296	1,425	1,449
Mississippi.....	534	486	526	719	697	522	465	523	661	483	698	807	1,012
Missouri.....	188	279	225	331	234	275	274	265	265	266	270	247	233
Montana.....	517	622	708	660	820	689	747	737	704	666	612	603	484
Nebraska.....	29	32	28	20	27	26	25	30	30	34	31	21	36
New Jersey.....	4,168	4,843	4,866	6,323	4,950	6,271	5,170	5,987	4,639	5,544	5,481	6,340	5,375
New Mexico.....	217	240	231	218	225	219	148	127	157	188	200	218	221
New York.....	633	392	419	665	550	695	727	640	493	624	653	711	584
North Dakota.....	210	251	285	237	135	368	248	215	213	244	282	232	238
Ohio.....	1,678	1,893	2,127	2,120	1,823	2,369	2,097	2,049	1,842	1,953	1,741	1,941	1,848
Oklahoma.....	2,262	2,213	2,106	2,226	2,050	2,110	2,393	2,479	2,200	2,149	2,219	1,984	1,592
Pennsylvania.....	7,839	8,041	7,584	9,406	7,497	7,255	7,005	7,382	8,508	7,312	9,520	8,640	7,176
Texas.....	13,414	13,736	15,372	15,805	16,240	16,125	16,142	15,044	15,031	14,075	14,936	14,519	13,449
Texas.....	422	408	534	464	369	493	475	409	432	395	412	555	540
Utah.....	47	50	43	43	49	33	38	44	58	68	80	69	71
West Virginia.....	610	566	589	499	879	802	717	585	548	449	507	497	573
Wyoming.....													
<b>Total at refineries.....</b>	<b>61,487</b>	<b>66,276</b>	<b>66,922</b>	<b>70,755</b>	<b>71,360</b>	<b>71,368</b>	<b>66,859</b>	<b>69,214</b>	<b>69,486</b>	<b>68,050</b>	<b>71,668</b>	<b>70,710</b>	<b>63,908</b>

CRUDE PETROLEUM AND PETROLEUM PRODUCTS

TABLE 22.—Stocks of crude petroleum in the United States by classification and location, by months: 1964—Continued

(Thousand barrels)

Classification and location	Jan. 1	Jan. 31	Feb. 29	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
<b>Pipeline and tank-farm stocks:</b>													
Alabama	52	56	29	129	52	33	41	46	38	62	36	32	43
Alaska	159	253	131	202	273	109	156	171	184	184	317	267	322
Arkansas	1,028	1,032	1,000	980	944	913	937	892	895	932	980	965	979
California, Arizona	12,706	13,090	12,322	10,760	11,007	10,749	10,032	10,463	10,113	10,439	9,585	9,249	11,086
Colorado	1,123	1,084	935	1,098	1,325	1,391	1,319	1,380	1,226	1,245	1,123	1,042	958
Florida	32	71	103	45	79	14	58	16	72	22	88	62	45
Illinois	10,705	10,520	11,459	11,018	11,635	11,919	12,254	11,663	11,709	11,728	11,379	11,198	10,489
Indiana	2,497	2,375	2,611	2,515	3,113	3,179	3,333	3,199	3,199	2,680	2,642	2,680	2,405
Iowa, Missouri	6,371	6,438	6,408	6,840	6,626	6,950	6,455	6,449	6,548	6,671	7,038	6,726	6,561
Kansas	7,550	7,773	7,749	7,687	8,333	8,315	7,963	7,884	7,595	7,365	7,764	7,652	7,525
Kentucky, Tennessee	1,936	2,106	2,132	2,144	2,117	2,153	1,985	2,113	1,979	2,021	1,965	1,924	1,912
Louisiana	8,297	8,976	8,696	9,663	9,461	9,061	8,787	7,754	7,985	7,600	8,060	7,933	8,430
Michigan	824	794	636	902	679	1,080	988	1,026	987	854	967	926	909
Minnesota, Wisconsin	776	634	574	603	549	658	703	586	617	594	586	594	606
Mississippi	1,402	1,426	1,198	1,281	1,423	1,498	1,309	1,300	1,314	1,350	1,429	1,505	1,378
Montana	1,095	1,030	1,140	1,188	1,232	1,275	1,174	1,174	1,220	1,157	1,120	1,127	980
Nebraska	1,649	1,561	1,608	1,665	1,707	1,666	1,662	1,714	1,601	1,668	1,636	1,617	1,586
New Mexico	2,390	2,322	2,557	2,373	2,546	2,284	2,318	2,161	1,982	2,389	2,495	2,334	2,132
New York	452	399	328	387	282	466	419	365	450	337	334	336	276
North Dakota	798	926	957	842	902	962	938	930	853	915	979	1,006	944
Ohio	4,670	4,809	4,838	5,185	4,874	5,049	5,079	5,119	5,450	5,152	5,019	5,113	4,824
Oklahoma	17,065	15,775	15,175	15,239	16,119	17,255	18,416	16,423	14,625	14,158	13,461	14,237	14,722
Pennsylvania	1,509	1,477	1,479	1,377	1,322	1,342	1,423	1,428	1,552	1,448	1,526	1,628	1,635
Texas	64,672	64,848	63,900	66,553	70,198	70,613	71,114	68,033	61,741	60,061	58,301	59,933	60,182
Utah	613	556	614	545	607	608	574	588	628	623	561	664	739
West Virginia	390	384	350	367	405	407	443	473	483	504	504	467	454
Wyoming	6,783	6,579	6,649	7,069	7,633	8,355	7,081	6,510	5,741	5,253	6,230	7,051	7,293
<b>Total pipeline and tank-farm stocks</b>	<b>157,544</b>	<b>157,294</b>	<b>155,578</b>	<b>158,687</b>	<b>165,429</b>	<b>168,261</b>	<b>167,012</b>	<b>159,860</b>	<b>150,787</b>	<b>147,535</b>	<b>146,125</b>	<b>148,318</b>	<b>149,415</b>
<b>Lease stocks</b>	<b>18,330</b>	<b>17,437</b>	<b>17,562</b>	<b>17,421</b>	<b>17,123</b>	<b>17,693</b>	<b>17,359</b>	<b>17,259</b>	<b>17,639</b>	<b>17,195</b>	<b>17,440</b>	<b>17,781</b>	<b>16,734</b>
<b>Total stocks: 1964</b>	<b>237,361</b>	<b>241,007</b>	<b>240,062</b>	<b>246,863</b>	<b>253,912</b>	<b>257,322</b>	<b>251,230</b>	<b>246,333</b>	<b>237,912</b>	<b>232,780</b>	<b>235,233</b>	<b>236,809</b>	<b>230,057</b>
<b>1963</b>	<b>252,011</b>	<b>249,209</b>	<b>240,396</b>	<b>241,029</b>	<b>251,391</b>	<b>255,666</b>	<b>250,036</b>	<b>249,962</b>	<b>249,077</b>	<b>248,261</b>	<b>245,539</b>	<b>244,387</b>	<b>237,361</b>

### STORAGE CAPACITY

The Bureau of Mines conducts semiannual surveys of petroleum refineries, bulk terminals, and underground storage facilities to ascertain the capacity assigned to the storage of gasoline, kerosine, distillate fuel oil, residual fuel oil, military jet fuel, and liquefied petroleum gases. Liquefied gases require special storage facilities, the bulk being underground caverns. Tanks for storing residual fuel oil can also be used for crude oil. Storage for the other products is interchangeable depending on demand.



TABLE 23.—Capacity of storage tanks for finished petroleum products and capacity of underground storage facilities for liquefied gases, at refineries, gasoline plants, bulk terminals<sup>1</sup> and tank farms

(Thousand barrels)

Refinery district and date	Gasoline			Kerosine			Distillate fuel oil			Residual fuel oil			Military jet fuel			Liquefied petroleum gases			
	At refineries	At bulk terminals	Total	At refineries	At bulk terminals	Total	At refineries	At bulk terminals	Total	At refineries	At bulk terminals	Total	At refineries	At bulk terminals	Total	Aboveground		Underground	Total
																At plants and terminals	At refineries		
1963:																			
East Coast:																			
Apr. 1.....	25,750	59,522	85,272	3,816	18,988	22,804	21,755	71,280	93,035	7,259	17,738	24,997	476	665	1,141	3 329	3 252	3 1,982	3 2,563
Oct. 1.....	22,572	58,441	81,013	4,078	19,372	23,450	25,096	73,712	98,808	7,847	17,372	25,219	470	432	902	3 329	3 231	3 2,157	3 2,717
Appalachian No. 1:																			
Apr. 1.....	2,734	6,697	9,331	280	967	1,247	1,334	4,368	5,702	564	393	957	40	-----	40	(2)	(2)	(2)	(2)
Oct. 1.....	2,327	6,317	8,644	282	952	1,234	1,414	4,012	5,426	535	226	761	87	-----	87	(2)	(2)	(2)	(2)
Appalachian No. 2:																			
Apr. 1.....	1,517	4,539	6,056	209	693	902	487	2,225	2,712	404	67	471	27	169	196	(3)	(3)	(3)	(3)
Oct. 1.....	1,311	4,592	5,903	261	753	1,019	593	2,361	2,959	464	67	531	27	169	196	(3)	(3)	(3)	(3)
Indiana, Illinois, Kentucky, etc.:																			
Apr. 1.....	40,366	27,282	67,648	5,421	4,987	10,408	19,019	20,270	39,289	9,334	1,703	11,037	1,613	697	2,310	3 471	3 787	3 4,712	3 5,970
Oct. 1.....	35,585	26,572	62,157	6,325	5,264	11,589	26,119	20,044	46,163	10,213	1,252	11,465	1,420	611	2,031	3 495	3 754	3 4,385	3 5,634
Minnesota, Wisconsin, North and South Dakota:																			
Apr. 1.....	3,950	10,365	14,315	586	2,193	2,779	2,245	9,370	12,115	1,164	327	1,491	202	63	265	(4)	(4)	(4)	(4)
Oct. 1.....	3,832	9,725	13,557	825	2,362	3,187	2,435	10,328	12,763	1,139	185	1,324	258	41	299	(4)	(4)	(4)	(4)

Oklahoma, Kansas, Missouri, etc.:																			
Apr. 1 .....	19,164	13,346	32,500	1,886	1,008	2,394	10,797	8,648	19,445	1,952	21	1,973	1,441	361	1,802	4,695	4,711	10,168	11,574
Oct. 1 .....	18,047	12,828	30,875	1,986	1,046	3,082	11,597	9,357	20,954	1,875	21	1,896	1,387	321	1,708	4,749	4,722	11,623	13,094
Texas Inland:																			
Apr. 1 .....	11,195	5,316	16,511	653	792	1,445	3,001	1,156	4,157	1,051	-----	1,051	1,126	404	1,530	2,105	4,674	14,684	17,463
Oct. 1 .....	10,978	5,593	16,571	682	813	1,445	3,386	1,233	4,619	1,011	-----	1,011	1,049	356	1,405	1,964	4,670	14,426	17,060
Texas Gulf Coast:																			
Apr. 1 .....	43,359	6,906	50,265	5,689	809	6,498	21,537	3,070	24,607	7,162	236	7,398	3,457	-----	3,457	628	971	27,791	29,390
Oct. 1 .....	41,232	6,247	47,479	6,205	1,267	7,472	25,465	3,696	29,161	7,367	236	7,603	2,943	-----	2,943	641	961	27,383	28,985
Louisiana Gulf Coast:																			
Apr. 1 .....	18,041	3,726	21,767	2,717	726	3,443	7,281	1,639	8,920	1,138	550	1,688	1,845	-----	1,845	320	4,324	6,849	7,493
Oct. 1 .....	18,459	3,657	22,116	3,568	732	4,300	9,846	1,569	11,415	2,290	366	2,656	1,947	-----	1,947	388	4,394	6,484	7,266
Arkansas, Louisiana Inland, etc.:																			
Apr. 1 .....	2,250	7,747	9,997	329	813	1,142	1,090	1,922	3,012	300	10	310	120	265	385	232	( <sup>6</sup> )	4,642	4,874
Oct. 1 .....	2,726	7,584	10,310	464	878	1,342	981	2,142	3,123	321	-----	321	127	345	472	212	( <sup>6</sup> )	4,511	4,723
New Mexico:																			
Apr. 1 .....	515	437	952	67	42	109	128	161	289	230	-----	230	137	60	197	229	( <sup>6</sup> )	1,274	1,503
Oct. 1 .....	526	436	962	68	42	110	129	160	289	41	-----	41	193	60	253	246	( <sup>6</sup> )	1,263	1,509
Rocky Mountain:																			
Apr. 1 .....	9,646	2,683	12,329	476	182	658	3,560	1,645	5,205	1,892	2	1,894	960	93	1,053	201	95	274	570
Oct. 1 .....	9,288	2,612	11,900	780	117	897	3,909	1,685	5,594	1,903	2	1,905	970	135	1,105	216	98	319	633
West Coast:																			
Apr. 1 .....	40,047	17,095	57,142	3,654	1,957	5,611	18,273	11,832	30,105	17,915	12,718	30,633	2,689	119	2,808	96	922	850	1,868
Oct. 1 .....	40,050	17,049	57,099	3,487	1,977	5,464	18,942	11,497	30,439	17,996	12,479	30,475	3,649	168	3,817	80	784	850	1,714
United States:																			
Apr. 1 .....	218,524	165,561	384,085	25,283	34,157	59,440	110,507	138,086	248,593	50,365	33,765	84,130	14,133	2,896	17,029	5,306	4,736	73,226	83,268
Oct. 1 .....	206,933	161,653	368,586	28,961	35,580	64,541	129,917	141,796	271,713	53,002	32,206	85,208	14,527	2,638	17,166	5,320	4,614	73,401	83,335

See footnotes at end of table.

TABLE 23.—Capacity of storage tanks for finished petroleum products and capacity of underground storage facilities for liquefied gases, at refineries, gasoline plants, bulk terminals<sup>1</sup> and tank farms—Continued

(Thousand barrels)

Refinery district and date	Gasoline			Kerosine			Distillate fuel oil			Residual fuel oil			Military jet fuel			Liquefied petroleum gases			
	At refineries	At bulk terminals	Total	At refineries	At bulk terminals	Total	At refineries	At bulk terminals	Total	At refineries	At bulk terminals	Total	At refineries	At bulk terminals	Total	Aboveground		Underground	Total
																At plants and terminals	At refineries		
1964:																			
East Coast:																			
Apr. 1.....	25,629	59,794	85,423	3,812	19,541	23,353	21,796	72,899	94,695	7,379	17,084	24,463	470	399	869				
Oct. 1.....	22,740	58,450	81,190	3,751	19,331	23,082	25,140	74,056	99,196	7,042	17,812	24,854	465	312	777	2 329	2 230	2 2,157	22,716
Appalachian No. 1:																			
Apr. 1.....	2,503	6,313	8,816	296	1,006	1,302	1,251	4,005	5,256	588	233	821	50	-----	50	(2)	(2)	(2)	(2)
Oct. 1.....	2,280	6,835	9,115	256	1,051	1,307	1,788	4,446	6,234	553	232	785	23	-----	23	(2)	(2)	(2)	(2)
Appalachian No. 2:																			
Apr. 1.....	1,465	5,009	6,474	251	696	947	439	2,264	2,703	398	67	465	27	169	196	(2)	(2)	(2)	(2)
Oct. 1.....	1,411	4,758	6,169	251	786	1,037	596	2,560	3,156	387	67	454	27	169	196	(2)	(2)	(2)	(2)
Indiana, Illinois, Kentucky, etc.:																			
Apr. 1.....	40,942	27,954	68,896	5,629	5,690	11,319	19,759	19,729	39,488	9,598	1,792	11,390	1,583	777	2,360				
Oct. 1.....	35,974	27,017	62,991	6,447	5,415	11,862	24,223	20,795	45,018	10,155	2,033	12,188	1,512	749	2,261	2 508	2 726	2 4,592	2 5,826
Minnesota, Wisconsin, North and South Dakota:																			
Apr. 1.....	4,031	10,123	14,154	612	1,787	2,399	2,439	10,347	12,786	1,234	182	1,416	260	117	377	(4)	(4)	(4)	(4)
Oct. 1.....	3,819	9,756	13,575	615	2,017	2,632	3,016	10,710	13,726	1,167	182	1,349	270	115	385	(4)	(4)	(4)	(4)

Oklahoma, Kansas, Missouri, etc.:																							
Apr. 1.....	19,205	13,609	32,814	1,366	944	2,310	10,131	8,800	18,931	2,380	21	2,401	1,480	286	1,766	486	472	412,096	413,629				
Oct. 1.....	17,708	12,721	30,429	1,482	943	2,425	12,190	9,743	21,933	2,439	253	2,692	1,819	428	2,247	487	470	413,748	415,351				
Texas Inland:																							
Apr. 1.....	10,729	5,558	16,287	530	872	1,402	3,087	1,237	4,324	932		932	1,083	420	1,503	2,077	467	14,633	17,386				
Oct. 1.....	8,499	5,516	14,015	546	943	1,489	3,625	1,266	4,891	865		865	1,073	433	1,506	2,167	462	14,130	16,909				
Texas Gulf Coast:																							
Apr. 1.....	45,256	7,898	53,154	6,318	1,635	7,953	22,693	3,839	26,532	7,426	236	7,662	2,518		2,518	646	984	29,458	31,088				
Oct. 1.....	40,722	7,741	48,463	6,999	1,413	8,412	26,656	4,645	31,301	7,630	236	7,866	2,518	1	2,519	528	899	31,381	32,808				
Louisiana Gulf Coast:																							
Apr. 1.....	17,922	3,556	21,478	3,135	753	3,888	7,941	1,555	9,496	2,265	372	2,637	2,003	105	2,108	361	484	7,100	7,845				
Oct. 1.....	17,863	4,953	22,816	3,576	858	4,434	9,193	2,374	11,567	1,920	290	2,210	1,639	105	1,744	376	484	6,863	7,623				
Arkansas, Louisiana Inland, etc.:																							
Apr. 1.....	2,212	8,152	10,364	464	1,049	1,513	1,128	2,274	3,402	328		328	224	425	649	209	(9)	4,622	4,831				
Oct. 1.....	2,214	8,171	10,385	462	903	1,365	1,159	2,501	3,660	401		401	133	265	398	238	(9)	4,663	4,901				
New Mexico:																							
Apr. 1.....	481	472	953	44	53	97	108	151	259	40		40	198	60	258	246	(9)	1,265	1,511				
Oct. 1.....	539	472	1,011	46	53	99	175	151	326	61		61	198	60	258	245	(9)	1,265	1,510				
Rocky Mountain:																							
Apr. 1.....	10,198	2,751	12,949	526	117	643	3,660	1,806	5,466	1,898	2	1,900	738	167	905	212	98	460	770				
Oct. 1.....	9,489	3,093	12,582	742	167	909	3,646	2,090	5,736	1,914	2	1,916	962	125	1,087	223	98	479	800				
West Coast:																							
Apr. 1.....	39,097	17,470	56,567	3,525	2,013	5,538	18,542	11,402	29,944	17,828	12,484	30,312	4,026	468	4,494	82	752	860	1,684				
Oct. 1.....	38,379	17,587	55,966	3,209	2,529	5,738	19,319	12,156	31,475	17,820	9,677	27,497	3,868	521	4,389	82	770	860	1,702				
United States:																							
Apr. 1.....	219,670	168,659	388,329	26,508	36,156	62,664	112,974	140,308	253,282	52,294	32,473	84,767	14,660	3,393	18,053	5,476	4,577	77,233	87,286				
Oct. 1.....	201,637	167,070	368,707	28,382	36,409	64,791	130,726	147,498	278,219	52,354	30,784	83,138	14,507	3,283	17,790	5,600	4,421	81,630	91,651				

<sup>1</sup> Includes only bulk terminals operated by refinery and pipeline companies.<sup>2</sup> Figures for Appalachian No. 1 included with those for East Coast.<sup>3</sup> Figures for Appalachian No. 2 included with those for Indiana, Illinois, etc.<sup>4</sup> Figures for Minnesota, Wisconsin, etc. included with those for Oklahoma, Kansas,

etc.

<sup>5</sup> Figures for New Mexico included with those for Texas Inland.<sup>6</sup> Figures for Arkansas, Louisiana Inland, etc. included with those for Louisiana Gulf.

## VALUE AND PRICE

The total value of crude oil produced in the United States in 1964 was \$8,017,078,000, which is an average wellhead price of \$2.88 per barrel. The price at the well in 1963 was \$2.89.

TABLE 24.—Value of crude petroleum at wells in the United States, by States

State	1963		1964	
	Total value at wells (thousand dollars)	Average value per barrel	Total value at wells (thousand dollars)	Average value per barrel
Alabama.....	23,763	\$2.59	22,095	\$2.60
Alaska.....	32,650	3.04	33,627	3.04
Arkansas.....	72,900	2.66	71,120	2.66
California.....	746,252	2.48	729,022	2.43
Colorado.....	110,255	2.88	100,094	2.88
Illinois.....	222,892	2.98	205,592	2.93
Indiana.....	35,230	2.96	32,157	2.85
Kansas.....	317,501	2.91	310,256	2.92
Kentucky.....	53,564	2.92	56,746	2.87
Louisiana:				
Gulf Coast.....	1,455,297	3.13	1,548,052	3.12
Northern.....	152,823	3.05	161,570	3.01
Total Louisiana.....	1,608,120	3.12	1,709,622	3.11
Michigan.....	45,520	2.85	43,839	2.81
Mississippi.....	161,788	2.76	151,595	2.67
Montana.....	75,323	2.44	74,621	2.43
Nebraska.....	61,824	2.83	51,605	2.70
New Mexico:				
Southeastern.....	290,392	2.90	300,181	2.89
Northwestern.....	26,182	2.67	26,384	2.64
Total New Mexico.....	316,574	2.88	326,565	2.87
New York.....	7,707	4.59	8,321	4.44
North Dakota.....	68,332	2.73	63,813	2.48
Ohio.....	19,023	3.15	46,420	2.93
Oklahoma.....	587,709	2.91	587,320	2.90
Pennsylvania.....	23,178	4.56	22,088	4.32
Texas: <sup>1</sup>				
Gulf Coast.....	610,965	3.25	613,328	3.20
East Texas Proper.....	135,598	3.10	131,717	3.03
West Texas.....	1,249,656	2.87	1,272,496	2.86
Other districts.....	912,161	2.95	911,453	2.94
Total Texas.....	2,908,380	2.97	2,928,994	2.96
Utah.....	90,943	2.72	74,867	2.62
West Virginia.....	13,367	3.99	12,975	3.85
Wyoming.....	361,018	2.50	351,043	2.53
Other States <sup>2</sup> .....	1,930	2.06	2,681	2.12
Total United States.....	7,965,743	2.89	8,017,078	2.88

<sup>1</sup> Texas Railroad Commission divisions.<sup>2</sup> Arizona, Florida, Missouri, Nevada, South Dakota, Tennessee, and Virginia.

TABLE 25.—Posted price per barrel of petroleum at wells in the United States in 1964 by grade, with data of change

Date	Pennsylvania grade		Corning grade	Western Kentucky	Indiana-Illinois	Cold-water, Mich.	Oklahoma-Kansas	
	Bradford and Allegheny districts	In south-west Pennsylvania					34°-34.9°	36°-36.9°
Jan. 1.....	4.63	4.08	2.67	3.00	3.00	2.80	2.91	2.97
Jan. 11.....	4.48	3.93						
July 20.....								2.92

Date	Pan-handle, Texas (Carson, Gray, Hutchinson, and Wheeler Counties), 35°-36.9°	West Texas 30°-30.9° (sweet)	Lea County, N. Mex., 30°-30.9°	South Texas Mirando, 24°-24.9°	East Texas	Gulf Coast			
						Conroe, Tex.	Texas		Louisiana, 30°-30.9°
							30°-30.9°	20°-20.9°	
Jan. 1.....	2.80	2.81	2.65	2.97	3.10	3.35	3.10	2.90	2.85

Date	Caddo-Pine Island, La., 36°-36.9°	Magnolia-Smackover, Limestone, Ark., 31°-31.9°	Elk Basin Wyo. (incl. Montana), 30°-30.9°	California			
				Coalinga, 32°-32.9°	Kettleman Hills, 37°-37.9°	Midway Sunset, 19°-19.9°	Wilmington, 24°-24.9°
Jan. 1.....	2.97	2.67	2.63	2.96	3.21	2.23	2.58
June 1.....		2.62					

1 Now priced on a gravity basis.  
 Source: Platt's Oil Price Handbook.

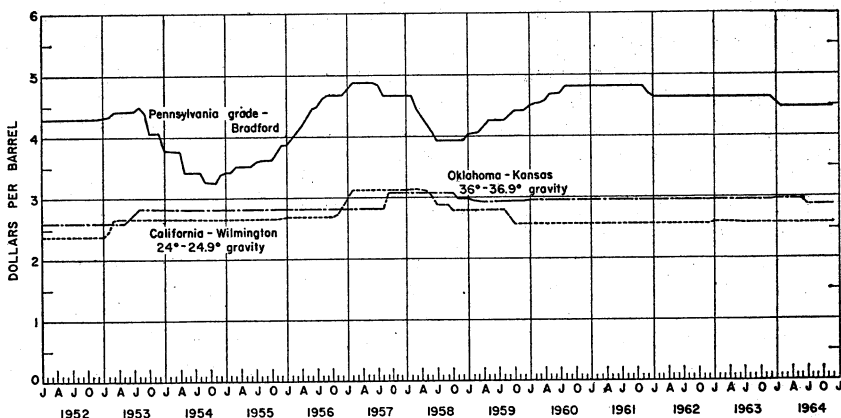


FIGURE 5.—Posted prices of selected grades of crude petroleum in the United States, 1952-64, by months.

## REFINED PRODUCTS

### GENERAL REVIEW

Petroleum is consumed in many finished products that must be considered individually. Competition with other fuels and economic and climatic conditions influence the consumption.

Gasoline is consumed principally in highway transport, aviation, and mechanized farming. The demand for kerosine (a product defined as meeting lamp-oil specifications for color and flashpoint) continued to climb with the expanding market for commercial jet fuel, as straight kerosine is used to fuel commercial jet aircraft. Distillate fuel oil, including light diesel oils, is used for space heating and for diesel-locomotive fuel and has nearly replaced residual fuel oil and coal in railroad use. Residual fuel oil usually sells for less than crude oil at the refineries and competes directly with natural gas and coal for heavy-fuel uses. As it is not normally moved by pipeline, its distribution depends on cheap water transport and limited tank car movement. Therefore, it cannot normally compete with coal in coal-producing areas. Liquefied gases, in competition with kerosine and light distillate fuel oil in domestic use, are gaining in importance as fuel in internal-combustion engines and as the initial raw material in synthesizing many petrochemicals.

The total demand for all oils in 1964 averaged 11,061,000 barrels per day, including a domestic demand of 10,859,000 barrels and exports which averaged 202,000 barrels per day. On a percentage basis, total demand increased 2.8 percent; domestic demand increased 2.9 percent; and exports decreased 2.9 percent.

Military purchases of all petroleum products from domestic sources in 1964 averaged 464,000 barrels daily, compared with 442,000 barrels daily in 1963.

The new supply of refined products comes from crude oil fed to refineries, natural gas liquids, a small quantity of motor benzol derived from coal, and imports of refined products from foreign countries. The new supply exceeded demand in 1964 resulting in an increase of 9,048,000 barrels in stocks of refined products.

Because of separating statistics on the petrochemical feedstocks from those on the other products, some of the individual products yields for 1963 and 1964 are not comparable with previous years. The continuing decline in the residual fuel oil yield and the increase in the refinery shortage (excess of refinery output over input) reflect the trend in the petroleum industry to install more hydrocracking and coking facilities to obtain higher yields of the lighter end products.

According to the Bureau of Labor Statistics, the wholesale price index for refined products in 1964 was 92.7, compared with 97.2 in 1963. The average wholesale price for the four principal products—gasoline, kerosine, distillate fuel oil, and residual fuel oil—was 8.8 cents per gallon, compared with 9.0 cents in 1963.

TABLE 26.—Salient statistics of the major refined petroleum products in the United States

(Thousand barrels)

	1960	1961	1962	1963	1964 <sup>a</sup>
<b>Gasoline and naphtha:</b>					
Production, total.....	1,522,497	1,534,462	1,583,376	1,625,198	1,706,005
From crude.....	1,343,341	1,344,819	1,387,706	1,413,673	1,480,288
From natural gas liquids.....	178,881	189,474	195,579	211,445	225,688
Benzol, etc., blended.....	275	169	91	80	29
Imports.....	9,790	10,685	13,878	16,145	14,626
Exports.....	13,456	8,976	6,592	6,986	7,942
Stocks, end of year.....	194,774	184,167	188,683	190,937	199,512
Domestic demand.....	1,511,670	1,533,173	1,584,691	1,632,103	1,704,114
<b>Kerosine:</b>					
Production, total.....	136,842	142,690	157,379	165,946	169,514
From crude.....	135,772	141,410	156,373	164,805	168,021
From natural gas liquids.....	1,070	1,280	1,006	1,141	1,493
Imports.....	68	2,964	6,417	8,642	11,129
Exports.....	689	231	337	672	171
Stocks, end of year.....	31,445	32,433	32,398	34,102	36,165
Domestic demand.....	132,499	144,435	164,167	172,212	173,409
<b>Distillate fuel oil:</b>					
Production, total.....	668,684	696,622	720,087	765,067	741,082
From crude.....	667,050	696,015	719,590	764,567	740,689
From natural gas liquids.....	1,634	607	497	470	393
Crude used directly as distillate.....	1,001	851	1,198	807	755
Imports.....	12,771	17,377	11,831	9,110	11,772
Exports.....	9,897	6,931	8,224	15,014	5,434
Stocks, end of year.....	138,455	152,018	143,961	156,677	155,846
Domestic demand.....	685,268	694,356	732,405	747,254	749,006
<b>Residual fuel oil:</b>					
Production.....	332,147	315,577	295,679	275,910	268,182
Crude used directly as residual.....	3,948	3,854	3,797	3,305	3,720
Imports.....	233,208	243,268	264,314	272,753	295,891
Exports.....	18,495	14,022	12,850	15,281	18,870
Stocks, end of year.....	44,870	44,869	49,775	47,538	40,403
Domestic demand.....	559,439	548,678	545,813	538,924	556,058
<b>Military jet fuel:</b>					
Production, total.....	89,109	95,923	102,974	99,360	107,993
JP-4 grade.....				83,189	90,476
JP-5 grade.....				11,441	12,677
Other military grades.....				4,730	4,840
Imports.....	12,372	10,045	10,897	14,947	12,118
Exports.....	113	122	82	194	170
Stocks, end of year.....	6,456	8,280	9,668	8,544	9,904
Domestic demand.....	102,803	104,436	112,401	115,237	118,581
<b>Lubricants:</b>					
Production.....	59,389	59,254	61,467	63,086	63,668
Imports.....	22	14	28	23	37
Exports, total.....	15,811	17,094	17,693	18,317	18,160
Grease.....	393	363	400	381	399
Oil.....	15,418	16,731	17,293	17,936	17,761
Stocks, end of year.....	9,874	12,943	13,130	14,321	14,062
Domestic demand.....	42,676	41,534	43,615	43,601	45,804
<b>Wax (1 barrel=280pounds):</b>					
Production.....	5,896	5,781	5,353	5,126	5,352
Imports.....	6	2		4	
Exports.....	1,333	1,333	1,429	1,455	1,734
Stocks, end of year.....	905	1,061	1,020	886	908
Domestic demand.....	4,438	4,390	3,965	3,809	3,596
<b>Coke (5 barrels=1 short ton):</b>					
Production, total.....	60,010	75,333	78,724	80,688	84,325
Marketable coke.....	26,057	30,480	31,624	32,428	34,872
Catalyst coke.....	33,953	44,853	47,100	48,260	49,453
Exports.....	6,856	7,270	7,456	10,762	13,563
Stocks, end of year.....	4,387	5,316	5,880	6,483	6,795
Domestic demand.....	54,472	67,134	70,704	69,323	70,450

See footnotes at end of table.



TABLE 26.—Salient statistics of the major refined petroleum products in the United States—Continued

(Thousand barrels)

	1960	1961	1962	1963	» 1964
<b>Asphalt (5.5 barrels=1 short ton):</b>					
Production.....	98,671	101,819	109,576	111,948	114,879
Imports (including natural).....	6,143	6,609	6,625	6,211	5,912
Exports.....	924	6,667	826	703	767
Stocks, end of year.....	10,142	12,999	14,252	14,354	14,231
Domestic demand.....	104,696	107,753	114,122	117,354	120,147
<b>Road oil:</b>					
Production.....	5,970	5,820	7,079	6,792	6,371
Stocks, end of year.....	743	761	875	753	579
Domestic demand.....	5,880	5,802	6,965	6,914	6,545
<b>Still gas:</b>					
Production.....	129,480	127,537	130,829	129,598	131,257
<b>Liquefied gases (including ethane):</b>					
Production <sup>4</sup> .....	77,578	78,947	76,826	56,394	59,244
Transfers of liquefied gas <sup>5</sup> from natural gasoline.....	152,173	159,371	178,733	182,042	186,718
Imports.....	1,631	1,806	2,248	2,516	4,128
Exports.....	2,988	3,541	3,874	4,593	5,358
Stocks, end of year.....	3,623	6,298	13,916	3,346	3,074
Domestic demand.....	227,291	233,908	255,462	236,929	245,004
<b>Petrochemical feedstocks:<sup>6</sup></b>					
Production.....			NA	91,356	104,846
Stocks, end of year.....	NA	NA	13,530	3,130	3,187
Domestic demand, total.....			NA	91,756	104,789
<b>Still gas.....</b>					
LRG <sup>4</sup> .....				7,834	7,698
Naphtha-400°.....	NA	NA	NA	39,276	47,190
Other.....				22,022	24,583
				22,624	25,318
<b>Miscellaneous:</b>					
Production, total.....	25,852	28,375	31,661	16,389	16,874
From crude.....	24,358	26,267	29,794	13,578	13,583
From natural gas liquids.....	1,494	2,108	1,867	2,811	3,291
Imports.....	47				
Exports.....	257	245	237	239	236
Stocks, end of year.....	2,715	2,832	1,831	1,631	1,819
Domestic demand.....	25,208	28,144	30,890	16,350	16,450
<b>Other unfinished oils:</b>					
Rerun (net).....	22,094	21,202	27,733	31,934	27,322
Imports.....	16,478	25,348	32,516	31,702	32,587
Stocks, end of year.....	61,615	79,366	81,981	81,749	87,014
Shortage or (overage).....	(53,282)	(65,429)	(63,901)	(73,710)	(79,335)

» Preliminary. NA Not available.

<sup>1</sup> New basis. These data are comparable to 1963 because of product reclassification resulting from separately reporting data for petrochemical feedstocks.<sup>2</sup> Sales of commercial jet fuel: PAD districts 1-4, 61,077,000 barrels; district 5, 24,595,000 barrels.<sup>3</sup> Includes military jet fuel produced at natural gas liquid plants: 1963; 615,000 barrels, 1964; 409,000 barrels.<sup>4</sup> Liquefied refinery gases (LRG).<sup>5</sup> Liquefied petroleum gases (LPG).<sup>6</sup> Produced at petroleum refineries.

TABLE 27.—Input and output of petroleum products at refineries in the United States

(Thousand barrels)

	1960	1961	1962	1963	P 1964
<b>Input:</b>					
Crude petroleum:					
Domestic.....	2,581,568	2,604,127	2,659,826	2,758,168	2,804,198
Foreign.....	370,966	383,031	409,805	412,484	437,434
<b>Total crude petroleum.....</b>	<b>2,952,534</b>	<b>2,987,158</b>	<b>3,069,631</b>	<b>3,170,652</b>	<b>3,241,632</b>
Natural gas liquids.....	166,518	169,278	182,756	190,143	194,961
Benzol.....	275	169	91	80	29
<b>Total input.....</b>	<b>3,119,327</b>	<b>3,156,605</b>	<b>3,252,478</b>	<b>3,360,875</b>	<b>3,436,622</b>
<b>Output:</b>					
Gasoline <sup>1</sup> .....	1,510,134	1,514,266	1,570,553	1,603,896	1,675,278
Kerosine <sup>2</sup> .....	135,772	141,410	156,373	164,805	168,021
Distillate fuel oil <sup>2</sup> .....	667,050	696,015	719,590	764,597	740,689
Residual fuel oil.....	332,147	315,577	295,679	275,910	268,182
Military jet fuel <sup>2</sup> .....	88,248	95,210	102,269	98,745	107,584
Lubricants.....	59,389	59,254	61,467	63,086	63,668
Wax <sup>3</sup> .....	5,896	5,781	5,353	5,126	5,352
Coke <sup>3</sup> .....	60,010	75,333	78,724	80,688	84,325
Asphalt <sup>3</sup> .....	98,671	101,819	109,576	111,948	114,879
Road oil.....	5,970	5,820	7,079	6,792	6,371
Still gas.....	129,480	127,537	130,829	129,598	131,257
Liquefied gases.....	77,578	78,947	76,826	56,394	59,244
Petrochemical feedstocks.....	<sup>4</sup> NA	<sup>4</sup> NA	<sup>4</sup> NA	91,356	104,846
Other finished products <sup>2</sup> .....	24,358	26,267	29,794	13,578	13,583
Other unfinished oils (net) <sup>5</sup> .....	-22,094	1-21,202	1-27,733	1-31,934	1-27,322
Shortage (or overage) <sup>6</sup> .....	-53,282	-65,429	-63,901	-73,710	-79,335
<b>Total output.....</b>	<b>3,119,327</b>	<b>3,156,605</b>	<b>3,252,478</b>	<b>3,360,875</b>	<b>3,436,622</b>

<sup>p</sup> Preliminary. NA Not Available.

<sup>1</sup> For 1960 figures for unfinished gasoline are included in those for gasoline. For 1961-64 figures for unfinished gasoline are included in those for unfinished oils.

<sup>2</sup> Production at natural gasoline plants shown as direct "transfers" and omitted from the input and output at refineries.

<sup>3</sup> Conversion factors: 280 pounds of wax to the barrel; 5.0 barrels of coke to the short ton; 5.5 barrels of asphalt to the short ton.

<sup>4</sup> Formerly included with gasoline, kerosine, distillate fuel oil, residual fuel oil, liquefied petroleum gases, miscellaneous oils and unfinished oils.

<sup>5</sup> Negative quantity; represents net excess of unfinished oil reruns over unfinished oil produced.

<sup>6</sup> Includes losses or gains in volume during processing.

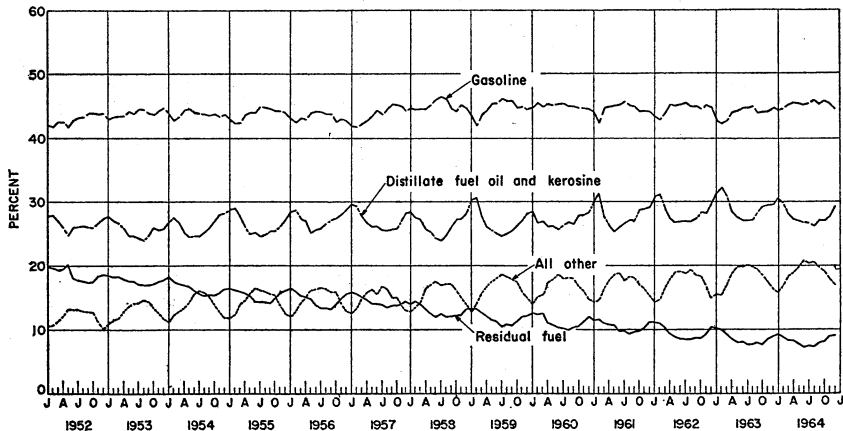


FIGURE 6.—Yields of principal products from crude runs to stills in the United States, 1952-64, by months.

TABLE 28.—Percentage yields of refined petroleum products from crude oil in the United States <sup>1</sup>

Product	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
<b>Finished products:</b>										
Gasoline.....	44.0	43.4	43.8	45.2	44.9	45.2	44.7	44.8	44.1	45.2
Kerosine.....	4.3	4.2	3.8	3.9	3.8	4.6	4.7	5.0	5.1	5.2
Distillate fuel oil.....	22.0	22.9	23.1	22.4	23.1	22.4	23.1	23.2	23.9	22.6
Residual fuel oil.....	15.3	14.7	14.4	12.9	11.8	11.2	10.5	9.6	8.6	8.2
Military jet fuel.....	2.1	2.3	2.2	2.6	3.2	3.0	3.1	3.3	3.1	3.3
Lubricating oil.....	2.0	2.0	1.9	1.8	1.9	2.0	2.0	2.0	2.0	2.0
Wax.....	.2	.2	.2	.2	.2	.2	.2	.1	.1	.1
Coke.....	1.0	1.1	1.2	1.3	1.4	2.0	2.5	2.6	2.6	2.6
Asphalt.....	3.0	3.1	3.0	3.2	3.3	3.3	3.4	3.5	3.5	3.5
Road oil.....	.3	.3	.2	.2	.2	.2	.2	.2	.2	.2
Still gas.....	4.3	4.2	4.3	4.4	4.3	4.4	4.2	4.3	4.0	4.0
Liquefied gases.....	1.6	1.8	1.9	2.0	2.3	2.6	2.7	2.5	1.8	1.9
Petrochemical feedstocks.....	(?)	(?)	(?)	(?)	(?)	(?)	(?)	(?)	2.8	3.2
Other finished products.....	-.4	-.4	-.5	-.7	-.7	-.8	-.8	-.9	-.4	-.4
Shortage.....	-.5	-.6	-.5	-.8	-1.1	-1.9	-2.1	-2.0	-2.2	-2.4
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

<sup>1</sup> Preliminary.

<sup>2</sup> Other unfinished oils added to crude in computing yields.

<sup>3</sup> Included with gasoline, kerosine, distillate fuel oil, residual fuel oil, liquefied petroleum gases, and miscellaneous and unfinished oils.

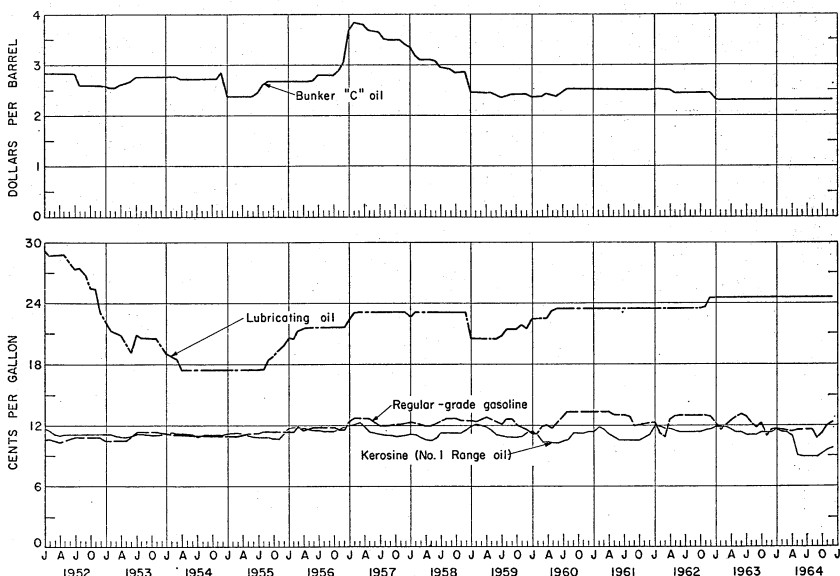


FIGURE 7.—Prices of Bunker "C" oil at New York Harbor, bright stock at Oklahoma refineries, No. 1 range oil at Chicago district, and regular-grade gasoline at refineries in Oklahoma, 1952-64, by months.

TABLE 29.—Stocks of refined petroleum products in the United States at end of month

(Thousand barrels)

Product	January	February	March	April	May	June	July	August	September	October	November	December
<b>1963:</b>												
Gasoline.....	201,005	209,396	214,717	204,787	195,706	192,629	184,712	177,714	181,283	178,265	181,257	190,937
Kerosine.....	26,103	23,789	23,216	27,344	29,578	32,285	35,246	36,214	35,978	39,118	39,131	34,102
Distillate fuel oil.....	111,674	87,812	83,913	91,718	103,160	123,364	145,239	164,917	177,231	191,394	192,561	156,677
Residual fuel oil.....	46,896	43,627	42,867	44,685	46,648	48,100	50,885	52,456	52,624	54,359	52,250	47,538
Military jet fuel.....	9,774	8,979	9,792	9,287	9,628	10,180	10,245	9,619	9,310	8,589	8,912	8,544
Lubricating oil.....	13,343	13,783	14,147	13,678	13,240	13,380	13,447	13,450	13,815	13,435	14,035	14,321
Wax.....	1,032	1,004	918	881	859	911	885	908	903	877	860	886
Coke.....	5,954	6,020	6,003	5,905	5,692	5,643	5,786	5,762	5,857	5,973	6,906	6,483
Asphalt.....	16,316	18,228	20,729	23,850	20,948	19,850	16,814	14,495	12,779	10,366	11,874	14,354
Road oil.....	969	1,028	1,318	1,630	1,698	1,687	1,424	1,170	942	851	780	753
Liquefied refinery gases.....	2,824	2,172	2,642	2,967	3,707	4,089	4,477	4,677	4,922	4,860	4,568	3,346
Petrochemical feedstocks.....	3,016	2,852	2,900	3,432	3,611	3,785	3,793	3,719	3,595	3,457	3,134	3,130
Miscellaneous.....	2,086	1,744	1,693	1,675	1,529	1,597	1,689	1,682	1,575	1,404	1,427	1,631
Other unfinished oils.....	78,772	79,216	81,190	85,137	90,355	90,443	89,294	86,793	83,744	85,361	86,287	81,749
<b>Total 1963.....</b>	<b>519,764</b>	<b>499,650</b>	<b>506,045</b>	<b>516,976</b>	<b>526,359</b>	<b>547,943</b>	<b>563,936</b>	<b>573,576</b>	<b>584,558</b>	<b>598,309</b>	<b>603,982</b>	<b>564,451</b>
<b>1964:*</b>												
Gasoline.....	203,237	215,091	220,357	214,671	210,924	198,500	191,363	190,868	188,573	187,165	197,245	199,512
Kerosine.....	30,863	28,528	28,454	29,063	30,535	32,845	34,428	36,042	37,280	37,874	38,620	36,165
Distillate fuel oil.....	128,534	110,527	99,195	97,758	112,185	130,272	153,642	175,035	186,726	189,364	182,579	155,846
Residual fuel oil.....	46,352	43,262	39,100	38,477	40,459	40,356	42,977	44,644	45,964	45,986	46,135	40,903
Military jet fuel.....	8,510	8,982	9,832	9,158	9,331	8,580	9,497	10,701	9,577	9,073	8,907	9,094
Lubricating oil.....	14,291	14,330	14,399	13,318	13,838	13,142	12,885	12,889	13,006	13,043	13,323	14,062
Wax.....	854	871	868	859	889	911	900	881	837	835	866	908
Coke.....	6,421	6,564	6,646	6,794	6,893	6,963	7,086	6,894	6,696	6,619	6,873	6,795
Asphalt.....	15,815	18,137	21,261	22,318	21,998	20,172	17,825	15,351	12,781	11,066	11,705	14,231
Road oil.....	849	972	1,432	1,696	1,591	1,506	1,210	1,094	856	529	538	579
Liquefied refinery gases.....	2,732	2,445	2,693	2,790	3,413	3,865	4,076	4,204	4,046	4,349	4,054	3,074
Petrochemical feedstocks.....	3,343	3,454	3,460	3,530	3,146	2,793	2,948	3,211	3,321	3,056	3,288	3,187
Miscellaneous.....	1,570	1,535	1,597	1,559	1,650	1,591	1,611	1,675	1,671	1,591	1,658	1,810
Other unfinished oils.....	80,976	80,738	83,151	88,015	89,623	88,606	84,896	85,252	86,161	86,374	86,620	87,014
<b>Total 1964.....</b>	<b>543,347</b>	<b>535,436</b>	<b>532,485</b>	<b>530,006</b>	<b>546,475</b>	<b>550,102</b>	<b>565,344</b>	<b>588,739</b>	<b>596,895</b>	<b>596,874</b>	<b>602,426</b>	<b>573,499</b>

\* Preliminary.

CRUDE PETROLEUM AND PETROLEUM PRODUCTS

TABLE 30.—Input and output at refineries in the United States, by months

(Thousand barrels)

	January	February	March	April	May	June	July	August	September	October	November	December	Total
<b>1963:</b>													
<b>Input:</b>													
Crude petroleum:													
Domestic.....	232,556	217,809	234,284	218,924	229,689	228,972	235,973	238,086	226,561	233,903	227,991	233,420	2,758,168
Foreign.....	36,882	33,613	34,708	30,792	34,247	34,617	36,691	35,446	33,645	32,981	33,010	35,852	412,484
Natural gas liquids.....	16,607	14,343	15,300	15,263	15,350	14,738	14,786	15,884	16,235	17,432	16,673	17,532	190,143
Benzol.....	7	6	7	10	7	6	7	7	6	7	5	5	80
<b>Total input.....</b>	<b>286,052</b>	<b>265,771</b>	<b>284,299</b>	<b>264,989</b>	<b>279,293</b>	<b>278,333</b>	<b>287,457</b>	<b>289,423</b>	<b>276,447</b>	<b>284,323</b>	<b>277,679</b>	<b>286,809</b>	<b>3,360,875</b>
<b>Output:</b>													
Gasoline <sup>1</sup> .....	134,872	121,760	131,053	124,957	131,597	134,356	139,450	141,670	133,362	136,130	133,204	141,485	1,603,896
Kerosine <sup>2</sup> .....	15,667	14,043	14,428	13,461	11,840	11,610	12,834	12,445	12,163	14,709	14,659	16,046	164,805
Distillate fuel oil <sup>2</sup> .....	70,904	66,598	68,407	57,234	60,155	60,073	62,319	63,309	63,117	63,824	62,858	65,799	764,597
Residual fuel oil.....	27,313	25,334	25,406	21,481	21,000	21,811	21,748	21,795	21,521	21,081	22,501	24,969	275,910
Military jet fuel <sup>2</sup> .....	7,631	7,032	8,312	8,141	8,527	8,874	9,055	8,836	8,450	7,822	8,322	7,743	98,745
Lubricating oil.....	5,110	4,844	5,122	5,206	5,478	5,252	5,570	5,422	5,367	5,433	5,314	4,968	63,086
Wax <sup>3</sup> .....	379	386	420	437	440	473	404	461	447	443	384	452	5,126
Coke <sup>3</sup> .....	6,634	6,182	6,683	6,478	6,505	6,598	7,037	6,925	6,748	6,835	6,776	7,287	80,688
Asphalt.....	4,954	4,588	6,520	8,603	11,056	12,100	12,878	13,182	12,360	11,286	8,182	6,239	111,948
Road oil.....	214	185	448	678	663	1,061	1,271	1,008	584	438	132	110	6,792
Still gas.....	10,296	9,591	10,527	10,368	11,020	11,376	12,015	11,690	10,821	10,561	10,512	10,821	129,598
Liquefied refinery gases.....	4,628	4,359	4,903	4,758	5,043	4,951	5,041	4,878	4,447	4,176	4,202	5,028	56,394
Petrochemical feedstocks.....	6,064	5,979	7,771	7,313	7,897	8,045	7,899	8,100	7,603	8,241	7,638	8,806	91,356
Miscellaneous.....	1,182	976	1,149	979	1,085	1,177	1,244	1,212	1,180	1,163	1,110	1,121	13,873
Other unfinished oils (net) <sup>4</sup> .....	-5,409	-1,714	-405	1,033	2,729	-2,798	-4,720	-5,186	-5,671	-1,389	-1,742	-6,662	-31,934
Shortage or overage.....	-4,387	-5,272	-6,445	-6,138	-5,742	-6,606	-6,588	-6,324	-6,052	-6,380	-6,373	-7,403	-73,710
<b>Total output.....</b>	<b>286,052</b>	<b>265,771</b>	<b>284,299</b>	<b>264,989</b>	<b>279,293</b>	<b>278,333</b>	<b>287,457</b>	<b>289,423</b>	<b>276,447</b>	<b>284,323</b>	<b>277,679</b>	<b>286,809</b>	<b>3,360,875</b>

1964: <sup>p</sup>

## Input:

## Crude petroleum:

Domestic.....

Foreign.....

Natural gas liquids.....

Benzol.....

Total.....

## Output:

Gasoline <sup>1</sup>.....Kerosine <sup>2</sup>.....Distillate fuel oil <sup>3</sup>.....

Residual fuel oil.....

Military jet fuel <sup>3</sup>.....

Lubricating oil.....

Wax <sup>4</sup>.....

Coke.....

Asphalt.....

Road oil.....

Still gas.....

Liquefied refinery gases.....

Petrochemical feedstocks.....

Miscellaneous.....

Other unfinished oils (net) <sup>4</sup>.....

Shortage or overage.....

Total output.....

237,753	223,712	235,897	224,842	232,910	229,206	241,291	240,936	231,157	234,646	227,939	243,909	2,804,198
35,586	33,120	33,996	33,527	34,675	38,832	40,427	40,071	37,969	38,689	34,661	35,881	437,434
16,103	14,956	15,259	14,912	15,371	14,864	15,724	16,295	17,072	17,599	18,047	18,759	194,961
9	3	1	1	2	1	2	3	2	1	1	3	2
289,451	271,791	285,153	273,282	282,958	282,903	297,444	297,305	286,200	290,935	280,648	298,552	3,436,622
139,475	130,437	137,400	131,861	137,925	137,934	146,630	146,724	139,566	143,930	138,518	144,878	1,675,278
17,080	14,567	14,211	12,396	11,500	11,419	12,548	13,288	13,825	15,211	14,939	17,037	168,021
67,443	62,812	61,681	57,525	60,775	61,092	64,184	61,986	59,347	59,010	58,662	66,172	740,689
25,826	22,747	22,298	21,231	20,821	19,519	21,556	21,114	21,280	22,543	23,545	25,702	268,182
7,766	7,896	9,070	8,812	9,467	9,829	9,971	10,364	8,850	8,699	8,662	8,198	107,584
5,150	4,828	5,207	5,285	5,397	5,250	5,357	5,415	5,284	5,431	5,347	5,717	63,668
404	409	456	443	491	446	433	433	435	473	449	449	5,352
7,200	6,715	7,287	6,831	7,045	7,180	7,505	7,075	6,747	6,910	6,770	7,060	84,325
4,435	5,556	7,286	7,995	11,168	12,743	13,562	13,658	12,474	11,712	8,191	6,079	114,879
155	188	543	447	512	948	1,282	959	513	328	332	164	6,371
10,617	9,942	10,820	10,618	11,212	11,654	12,208	11,479	10,935	10,539	10,438	10,795	131,257
5,030	4,680	5,208	4,788	5,179	5,061	5,136	4,932	4,643	4,869	4,625	5,093	59,244
8,963	8,215	9,051	8,881	8,381	8,083	8,164	8,705	8,707	8,771	8,490	8,845	104,846
1,182	1,024	1,057	1,075	1,065	1,284	1,186	1,076	1,081	1,110	1,175	1,268	13,583
-3,992	-1,937	-117	1,860	-1,783	-3,759	-6,144	-2,987	-950	-2,236	-2,381	-2,896	-27,322
-7,283	-6,288	-6,305	-6,766	-6,197	-6,380	-7,149	-6,916	-6,537	-6,365	-7,140	-6,009	-79,335
289,451	271,791	285,153	273,282	282,958	282,903	297,444	297,305	286,200	290,935	280,648	298,552	3,436,622

<sup>p</sup> Preliminary.<sup>1</sup> Includes natural gas liquids: naphtha and benzol blended at refineries.<sup>2</sup> Production at natural gas processing plants shown as direct transfers and omitted from the input and output at refineries.<sup>3</sup> Conversion factors: 280 pounds of wax to the barrel; 5.0 barrels of coke to the short ton; 5.5 barrels of asphalt to the short ton.<sup>4</sup> Negative quantity; represents net excess of unfinished oils rerun over unfinished oils produced.

TABLE 31.—Input and output at refineries in the United States, by districts

(Thousand barrels)

	East Coast	Appalachian No. 1	Appalachian No. 2	Indiana, Illinois, Kentucky, etc.	Minnesota, Wisconsin, etc.	Oklahoma, Kansas, etc.	Texas Inland	Texas Gulf Coast	Louisiana Gulf Coast	Arkansas, Louisiana Inland etc.	New Mexico	Rocky Mountain	West Coast	Total
<b>1963:</b>														
<b>Input:</b>														
Crude petroleum:														
Domestic.....	174,863	31,590	36,269	555,992	27,784	272,233	112,934	763,318	282,491	43,980	9,944	108,744	338,026	2,758,168
Foreign.....	242,138	6,028		13,873	21,167			277	607			3,429	124,965	412,484
Natural gas liquids.....	3,890	54	881	16,107	1,492	19,213	24,771	70,659	16,026	7,557	1,468	4,127	23,898	190,143
Benzol.....	24			18								38		80
<b>Total input.....</b>	<b>420,915</b>	<b>37,672</b>	<b>37,150</b>	<b>585,990</b>	<b>50,443</b>	<b>291,446</b>	<b>137,705</b>	<b>834,254</b>	<b>299,124</b>	<b>51,537</b>	<b>11,412</b>	<b>116,338</b>	<b>486,889</b>	<b>3,360,875</b>
<b>Output:</b>														
Gasoline <sup>1</sup> .....	202,888	15,669	18,920	292,632	24,447	154,622	78,671	377,480	136,965	24,626	5,837	54,444	216,695	1,603,896
Kerosine <sup>2</sup> .....	15,093	1,337	1,976	33,012	1,997	5,269	4,509	53,362	25,942	1,729	167	2,304	18,108	164,805
Distillate fuel oil <sup>2</sup> .....	129,378	9,108	7,310	123,297	11,220	68,465	19,448	208,686	74,098	9,966	1,597	24,545	77,479	764,597
Residual fuel oil.....	40,809	3,882	3,431	51,295	6,209	6,124	4,642	35,744	14,378	2,205	671	13,614	93,406	275,910
Military jet fuel <sup>2</sup> .....	2,573	318	189	11,290	1,940	13,261	12,160	16,475	12,428	1,077	1,564	5,789	19,681	98,745
Lubricating oil.....	7,960	3,315	413	5,316		5,050	158	25,334	7,712	1,916		364	5,548	63,086
Wax <sup>2</sup> .....	1,662	383	81	344		516	85	1,032	471			82	470	5,126
Coke <sup>3</sup> .....	13,468	148	568	16,438	2,001	7,760	2,015	17,057	6,382	2,087	47	2,548	10,169	80,688
Asphalt <sup>3</sup> .....	26,115	1,668	3,185	21,346	1,582	10,961	5,475	7,786	5,371	5,577	602	6,535	15,745	111,948
Road oil.....	26		9	1,838	108			15	1			1,905	1,173	6,792
Still gas.....	17,128	1,838	1,833	24,911	1,303	11,255	5,821	26,120	8,159	2,001	283	3,658	25,288	129,598
Liquefied refinery gas.....	9,890	681	430	10,268	1,059	7,520	2,710	7,842	5,547	960	301	1,633	7,553	56,394
Petrochemical feedstocks.....	5,773	311		6,989		733	1,562	52,379	15,054	877	104	280	7,294	91,356
Miscellaneous.....	1,863	231	50	1,234	73	1,710	2,136	3,335	121	24		280	2,615	13,578
Other unfinished oils (net).....	-40,458	-899	-652	769	-142	1,446	-1,114	21,531	-4,584	-845	-21	-407	-6,558	-31,934
Shortage or overage <sup>4</sup> .....	-12,753	-318	-593	-14,989	-1,354	-4,969	-573	-19,924	-8,921	-663	260	-1,236	-7,677	-73,710
<b>Total output.....</b>	<b>420,915</b>	<b>37,672</b>	<b>37,150</b>	<b>585,990</b>	<b>50,443</b>	<b>291,446</b>	<b>137,705</b>	<b>834,254</b>	<b>299,124</b>	<b>51,537</b>	<b>11,412</b>	<b>116,338</b>	<b>486,889</b>	<b>3,360,875</b>

1964: <sup>p</sup>

Input:																
Crude petroleum:																
Domestic.....	160,612	30,821	37,235	564,795	27,297	272,249	115,721	782,283	311,780	44,985	10,811	112,202	333,407	2,804,201		
Foreign.....	244,332	7,895		12,913	26,399			19	557	61		4,647	140,613	487,431		
Natural gas liquids.....	5,129	12	851	17,904	1,953	19,214	24,023	70,082	17,780	7,745	1,312	4,298	24,658	194,961	29	
Benzol.....	3			7								19				
<b>Total input.....</b>	<b>410,076</b>	<b>38,726</b>	<b>38,086</b>	<b>595,619</b>	<b>55,649</b>	<b>291,463</b>	<b>139,744</b>	<b>852,384</b>	<b>330,117</b>	<b>52,791</b>	<b>12,123<sup>3</sup></b>	<b>121,166</b>	<b>498,678</b>	<b>3,436,622</b>		
Output:																
Gasoline <sup>1</sup> .....	207,241	16,604	19,671	309,491	27,455	160,324	77,812	388,003	156,788	24,983	6,770	56,840	223,296	1,675,278		
Kerosine <sup>2</sup> .....	14,046	1,404	1,924	31,409	1,823	6,070	4,758	53,528	27,576	2,008	152	2,800	20,438	168,021		
Distillate fuel oil <sup>2</sup> .....	119,640	9,429	7,001	115,956	12,873	65,070	19,319	200,801	74,555	10,386	1,712	25,833	78,114	740,689		
Residual fuel oil.....	37,291	3,864	3,569	48,567	6,257	4,532	4,342	32,249	17,540	2,280	423	12,947	94,321	268,182		
Military jet fuel <sup>2</sup> .....	2,200	270	397	11,233	1,941	12,067	13,665	19,362	15,171	1,330	1,373	5,044	22,631	107,584		
Lubricating oil.....	8,075	3,210	399	5,609		4,925	156	25,932	7,436	2,012		337	5,677	63,668		
Wax <sup>3</sup> .....	1,931	445	91	358		537	95	905	380			92	428	5,352		
Coke.....	14,318	226	540	17,448	2,550	7,649	2,128	17,106	7,199	2,110	51	2,634	10,357	84,325		
Asphalt.....	26,554	1,643	3,144	21,945	1,792	11,724	5,525	7,731	4,722	5,592	775	7,417	16,315	114,879		
Road oil.....	20		10	1,882		150		1			2	1,445	1,088	6,371		
Still gas.....	17,132	1,839	1,816	26,063	1,437	11,116	5,542	27,526	9,000	1,776	317	3,785	23,908	131,257		
Liquefied refinery gas.....	9,826	726	453	11,640	1,154	7,620	2,969	8,505	5,459	1,580	282	1,737	7,293	59,244		
Petrochemical feedstocks.....	6,958	330		7,969		730	3,571	57,290	18,140	961	131	274	8,492	104,846		
Miscellaneous.....	1,428	243	71	1,328	95	2,043	1,803	3,496	156	17		137	2,766	13,583		
Other unfinished oils (net) <sup>4</sup> .....	-45,419	-1,139	-477	1,952	-159	-361	-1,265	30,415	-3,159	-978	-34	335	-7,083	-27,322		
Shortage or overage.....	-11,165	-368	-532	-17,231	-1,719	-4,256	-676	-20,566	-10,846	-1,261	169	-1,481	-9,413	-79,335		
<b>Total output.....</b>	<b>410,076</b>	<b>38,726</b>	<b>38,086</b>	<b>595,619</b>	<b>55,649</b>	<b>291,563</b>	<b>139,744</b>	<b>852,384</b>	<b>330,117</b>	<b>52,791</b>	<b>12,123</b>	<b>121,166</b>	<b>498,678</b>	<b>3,436,622</b>		

<sup>p</sup> Preliminary.<sup>1</sup> Includes natural gas liquids and benzol blended at refineries.<sup>2</sup> Production at natural gas processing plants shown as direct transfers and omitted from the input and output at refineries.<sup>3</sup> Conversion factors: 280 pounds of wax to the barrel; 5.0 barrels of coke to the short ton; 5.5 barrels of asphalt to the short ton.<sup>4</sup> Negative quantity: represents net excess of unfinished oils rerun over unfinished oil produced.



## REFINERY CAPACITY

On January 1, 1965, there were 300 petroleum refineries in the United States with a total installed crude-oil throughput capacity of 10,774,595 barrels per calendar day. Compared with last year, this represents a decrease of 4 in the number of refineries and an increase of 389,221 barrels per day in total capacity. At the beginning of 1965, 2.5 percent of the total operable capacity was shut down compared with 2.4 percent a year ago.

The operating ratio of the petroleum refining industry at the beginning of 1965, which is the ratio of January 1965 crude runs to the total operable capacity was 85.8 percent. This compares with 85.6 percent at the beginning of 1964.

TABLE 32.—Petroleum refinery capacity in the United States as of Jan. 1, 1960–65

	Number of refineries				Crude-oil throughput capacity (barrels per day)				
	Operat- ing	Shut- down	Total	Building	Operating	Shutdown		Total	Building
						Operable	Inoperable		
1960....	290	20	310	2	9,543,329	299,295	58,800	9,901,424	70,947
1961....	289	22	311	-----	9,629,685	368,888	11,500	10,010,073	36,500
1962....	287	24	311	1	9,812,248	220,799	72,100	10,105,147	119,350
1963....	287	21	308	2	9,814,791	196,130	107,400	10,118,321	178,300
1964....	282	22	304	1	10,083,164	242,610	79,600	10,385,374	64,700
1965....	278	27	300	1	10,161,311	258,540	354,744	10,774,595	74,960

## AVIATION GASOLINE

Because of a decline in deliveries to the military, the total demand for aviation gasoline in 1964 was 2.8 percent less than in 1963. Alkylate production increased over 7.6 million barrels and was used mainly in the production of automotive gasoline.

Jet-type fuels are not included in aviation gasoline. The fuel used in commercial jetplanes (mostly straight kerosine) is reported in the section on kerosine and that used by the military is reported in the section on jet fuel.

## GASOLINE

The total demand for gasoline was 4,678,000 barrels per day in 1964 and included a domestic demand of 4,656,000 barrels per day and exports of 22,000 barrels per day.

Civilian highway use of gasoline, as calculated from data compiled

by the Bureau of Public Roads, totaled 1,530.2 million barrels in 1964, compared with 1,458.9 million barrels in 1963. Nonhighway motor vehicles, military vehicles, stationary and marine engines, and losses, consumed the remainder of the gasoline (126.1 million barrels).

The production of gasoline and naphtha from crude oil in 1964 was 1,480,288,000 barrels. Natural-gas liquids plants produced 225,688,000 barrels, and in addition, 29,000 barrels of benzol were blended into the gasoline at the refineries.

Table 36 shows consumption and distribution of gasoline by PAD districts, and the interdistrict shipments which balance the supply and demand for each district. The consumption data compiled by the American Petroleum Institute exclude naphtha and offshore military shipments. For comparative purposes in the table, the naphtha has been excluded from gasoline production and stocks. No breakdown is available on the 30.7 million barrels of natural gas liquids which were blended with gasoline at terminal facilities away from the refineries in 1964; therefore it has been omitted from the production figures. This roughly offsets the omission of offshore military shipments in consumption data.

Gasoline deliveries by pipeline in 1964 (924,637,000 barrels) were greater than the corresponding 1963 deliveries by 137,223,000 barrels. A new products pipeline company began operating in September 1963. The line runs from the gulf coast to the vicinity of New York City. Tidewater shipments of gasoline from the gulf to the east coast were 216,337,000 barrels in 1964, compared with 245,508,000 barrels in 1963. A small quantity of gasoline (19,000 barrels) was shipped by water from the west coast to the east coast. Interdistrict barge shipments of gasoline on the Mississippi River totaled 44,635,000 barrels in 1964, a decline of 8,930,000 barrels for the year. Gasoline shipments from the gulf to the west coast were 5.9 million barrels greater than in 1963. Data on intradistrict barge shipments are not available.

Stocks of gasoline and naphtha increased at an average rate of 23,429 barrels daily during 1964 and at the end of the year totaled 199,512,000 barrels. This includes stocks held at the refineries and at bulk terminals operated by refineries and pipeline companies but does not include stocks held by secondary distributors and consumers nor those in military custody. The Bureau of Mines definition of a bulk-terminal installation is any storage facility operated by a refining or pipeline company which receives its principal products by tanker, barge, or pipeline or any storage point which has a combined capacity for storing refined products of 50,000 barrels or more regardless of transportation means by which products are received.

TABLE 33.—Salient statistics of aviation gasoline in the United States in 1964,<sup>1</sup> by months and total for 1963  
(Thousand barrels)

Item	1964													1963 total
	Jan-uary	Feb-ruary	March	April	May	June	July	August	Sep-tember	Octo-ber	Novem-ber	Decem-ber	Total	
<b>Production:</b>														
By grades:														
Military 115/145.....	1,430	1,367	2,000	1,312	1,774	1,670	1,491	1,317	1,806	1,421	1,630	1,977	19,195	17,147
Military 100/130.....	22	27	18	17	34	13	26	20	25	23	8	41	274	324
Commercial 115/145.....	1,168	1,128	868	1,009	705	993	979	944	926	942	900	1,011	11,573	17,760
Commercial 100/130.....	905	1,047	829	1,089	830	1,130	1,081	1,013	1,112	999	1,036	998	12,069	11,519
91/98.....	52	7	17	19	36	30	3	13	9	24	8	13	231	464
Other grades (including commercial 108/135).....	157	273	192	267	311	262	464	399	380	357	198	283	3,543	3,624
Alkylate (net) <sup>2</sup> .....	6,297	6,125	6,717	6,510	6,828	6,665	7,688	7,860	6,979	6,345	6,360	6,564	80,938	73,358
Total.....	10,031	9,974	10,641	10,223	10,518	10,763	11,732	11,566	11,237	10,111	10,140	10,887	127,823	124,196
<b>Transfers out: <sup>3</sup></b>														
Alkylate.....	5,347	5,216	6,350	6,082	6,455	6,515	7,304	7,173	6,778	5,815	5,293	5,670	73,978	69,987
Finished avgas.....	37	66	33	263	79	41	66	56	90	76	44	31	882	900
Total.....	5,384	5,282	6,383	6,325	6,534	6,556	7,370	7,229	6,868	5,891	5,337	5,701	74,860	70,887
<b>Exports from:</b>														
District 1.....	36	24	5	43	45	5	57	44	5	63	1	8	336	293
District 2.....			1	8	2	1	1	1	5			3	22	125
District 3.....	367	131	436	134	298	297	459	510	253	451	443	595	4,379	3,669
District 4.....														
District 5.....	25	51	133	10	7	237	122	5	52	6	19	23	690	556
Total.....	428	206	575	195	352	540	639	560	320	520	463	629	5,427	4,643
<b>Stocks:</b>														
By grades:														
Military 115/145.....	907	1,144	1,254	1,151	1,356	782	939	762	757	766	839	735	735	1,152
Military 100/130.....	40	47	47	41	53	43	41	45	44	45	28	52	52	34
Commercial 115/145.....	2,396	2,582	2,282	2,334	2,003	2,142	2,113	2,101	1,846	1,804	1,867	1,945	1,945	2,285
Commercial 100/130.....	2,062	2,174	1,964	2,049	1,843	1,935	1,932	1,906	1,896	1,960	2,047	2,103	2,103	2,129
91/98.....	236	218	203	196	193	194	171	153	133	135	127	119	119	217
Other grades (including commercial 108/135).....	834	845	784	767	743	640	706	721	696	726	692	772	772	867
Alkylate.....	3,256	3,803	3,779	3,768	3,706	3,477	3,110	3,226	3,108	2,662	3,116	3,345	3,345	2,707
Total.....	9,731	10,813	10,313	10,306	9,897	9,213	9,012	8,914	8,480	8,088	8,716	9,071	9,071	9,391

Domestic demand: All grades (including alkylate)-----	3,879	3,404	4,183	3,710	4,041	4,351	3,924	3,875	4,483	4,092	3,712	4,202	47,856	50,157
Total demand: All grades (including alkylate)-----	4,307	3,610	4,758	3,905	4,393	4,891	4,563	4,435	4,803	4,612	4,175	4,831	53,283	54,800
Deliveries:														
To U.S. military:														
Military 115/145-----	1,464	997	1,559	1,072	1,170	1,994	1,051	1,337	1,419	1,137	1,437	1,789	16,426	15,051
Military 100/130-----	3	3	3	1	3	4	4	-----	7	4	3	3	38	48
Commercial 115/145-----	259	135	142	395	349	212	395	219	484	289	259	217	3,355	6,452
Commercial 100/130-----	3	4	3	5	4	4	3	2	6	31	7	2	74	86
91/98-----	5	4	4	-----	1	2	2	-----	1	1	2	1	23	103
Other grades (including commercial 108/135)-----	33	34	31	-----	1	3	6	4	5	16	7	6	146	518
Total-----	1,767	1,177	1,742	1,473	1,528	2,219	1,461	1,562	1,922	1,478	1,715	2,018	20,062	22,258
To other consumers and exports:														
Military 115/145-----	200	128	330	160	391	234	256	141	335	234	119	281	2,809	2,460
Military 100/130-----	13	17	15	22	19	19	23	16	18	17	22	14	215	343
Commercial 115/145-----	792	802	1,012	556	685	640	609	735	692	688	551	712	8,474	11,364
Commercial 100/130-----	966	890	1,022	948	976	1,027	1,070	1,024	1,109	888	941	931	11,792	11,413
91/98-----	22	22	28	22	38	26	22	19	16	20	14	15	264	430
Other grades (including commercial 108/135)-----	146	212	218	265	321	347	371	367	392	301	210	195	3,345	2,829
Alkylate-----	401	302	391	459	435	379	751	571	319	086	603	665	6,322	3,703
Total-----	2,540	2,433	3,016	2,432	2,865	2,672	3,102	2,873	2,881	3,134	2,460	2,813	33,221	32,542
Shipments originating in--														
District 1-----	194	169	126	119	167	168	169	206	258	268	67	53	1,964	2,159
District 2-----	394	390	448	529	427	438	474	426	449	506	325	393	5,199	6,157
District 3-----	2,575	2,331	2,987	2,203	2,800	2,824	2,952	2,666	2,878	2,937	2,884	3,218	33,255	33,595
District 4-----	100	79	92	68	193	103	93	98	106	92	74	80	1,178	1,238
District 5-----	1,044	641	1,105	986	806	1,358	875	1,039	1,112	809	825	1,087	11,687	11,651
Total-----	4,307	3,610	4,758	3,905	4,393	4,891	4,563	4,435	4,803	4,612	4,175	4,831	53,283	54,800

<sup>1</sup> Included in gasoline figures in other tables of this report.

<sup>2</sup> Excludes alkylate produced and blended to finished avgas during the month.

<sup>3</sup> Represents alkylate and a small amount of finished avgas transferred or used in the production of other products, mainly automotive gasoline.

TABLE 34.—Salient statistics of gasoline and naphtha in the United States, 1963-64 by months and totals for 1962-63

(Thousand barrels)

	1963													1962 total
	January	February	March	April	May	June	July	August	September	October	November	December	Total	
Production:														
Finished gasoline from crude oil . .	116,391	105,895	113,827	107,998	114,458	117,732	122,678	123,688	115,299	116,650	114,613	121,757	1,390,986	1,350,409
Naphtha from crude oil.....	1,867	1,516	1,919	1,686	1,782	1,880	1,979	2,091	1,822	2,041	1,913	2,191	22,687	37,297
Total gasoline production from crude oil.....	118,258	107,411	115,746	109,684	116,240	119,612	124,657	125,779	117,121	118,691	116,526	123,948	1,413,673	1,387,706
Gasoline produced from natural gas liquids.....	17,469	15,996	16,678	16,929	16,885	16,891	16,514	17,899	18,347	19,253	18,776	19,808	211,445	195,579
Benzol blended.....	7	6	7	10	7	6	7	7	6	7	5	5	80	91
Total gasoline and naphtha production.....	135,734	123,413	132,431	126,623	133,132	136,509	141,178	143,685	135,474	137,951	135,307	143,761	1,625,198	1,583,376
Daily average.....	4,379	4,408	4,272	4,221	4,295	4,550	4,554	4,635	4,516	4,450	4,510	4,637	4,463	4,338
Imports.....	1,589	750	1,487	1,923	1,060	1,488	1,068	1,242	1,848	1,569	932	1,189	16,145	13,878
Exports.....	409	750	447	637	237	557	439	559	663	764	674	850	6,986	6,592
Daily average.....	13	27	14	21	8	19	14	18	22	25	22	27	19	18
Stocks, end of period:														
Finished gasoline.....	196,438	205,323	210,833	201,075	192,193	189,098	181,157	174,483	177,308	174,354	177,626	186,860	186,860	183,701
Naphtha.....	4,567	4,073	3,884	3,712	3,413	3,531	3,555	3,862	3,975	3,911	3,631	4,077	4,077	4,962
Total stocks.....	201,005	209,396	214,717	204,787	195,706	192,629	184,712	178,345	181,283	178,265	181,257	190,937	190,937	188,683
Domestic demand.....	124,592	115,022	128,150	137,839	143,036	140,517	149,724	160,735	133,721	141,774	132,573	134,420	1,632,103	1,584,691
Daily average.....	4,019	4,108	4,134	4,595	4,614	4,684	4,830	4,862	4,467	4,673	4,419	4,336	4,472	4,342

	1964													1963 total
<b>Production:</b>														
Finished gasoline from crude oil.....	121,434	113,233	120,202	114,554	120,189	120,977	128,416	128,133	120,666	124,218	118,381	124,007	1,454,410	1,390,986
Naphtha from crude oil.....	1,929	2,245	1,938	2,394	2,363	2,092	2,488	2,293	1,826	2,112	2,089	2,109	25,878	22,687
Total gasoline production from crude oil.....	123,363	115,478	122,140	116,948	122,552	123,069	130,904	130,426	122,492	126,330	120,470	126,116	1,480,288	1,413,673
Gasoline produced from natural gas liquids.....	18,985	17,496	17,943	16,932	17,551	17,468	18,756	18,924	20,016	19,584	20,893	21,150	225,688	211,445
Benzol blended.....	9	3	1	1	2	1	2	3	2	1	1	3	29	80
Total gasoline and naphtha production.....	142,357	132,977	140,084	133,881	140,105	140,528	149,662	149,353	142,510	145,915	141,364	147,269	1,706,005	1,625,198
Daily average.....	4,592	4,585	4,519	4,463	4,519	4,684	4,828	4,818	4,750	4,707	4,712	4,750	4,661	4,453
Imports.....	1,040	1,069	1,492	1,430	1,557	1,218	918	1,099	1,344	1,165	908	1,386	14,626	16,145
Exports.....	586	373	787	375	549	684	997	822	529	728	664	848	7,942	6,986
Daily average.....	19	13	25	13	18	23	32	27	18	23	22	27	22	19
<b>Stocks, end of period:</b>														
Finished gasoline.....	199,037	210,517	216,053	210,364	206,818	194,434	186,838	186,314	184,017	182,613	192,488	194,691	194,691	186,860
Naphtha.....	4,200	4,574	4,304	4,307	4,106	4,066	4,525	4,554	4,556	4,552	4,757	4,821	4,821	4,077
Total stocks.....	203,237	215,091	220,357	214,671	210,924	198,500	191,363	190,868	188,573	187,165	197,245	199,512	199,512	190,937
Domestic demand.....	130,511	121,819	135,523	140,622	144,860	153,486	156,720	150,125	145,620	147,780	131,528	145,540	1,704,114	1,632,103
Daily average.....	4,210	4,201	4,372	4,687	4,673	5,116	5,064	4,843	4,854	4,766	4,384	4,695	4,656	4,472

▷ Preliminary.

TABLE 35.—Production of gasoline and naphtha at refineries in the United States in 1964 <sup>v</sup>, by districts and months

(Thousand barrels)

	Janu- ary	Febru- ary	March	April	May	June	July	August	Sep- tember	Octo- ber	Novem- ber	Decem- ber	Total
<b>Gasoline from crude oil:</b>													
East Coast.....	17,000	15,658	16,275	15,386	16,932	17,051	18,012	17,555	16,471	16,913	16,588	16,757	200,598
Appalachian No. 1.....	1,399	1,271	1,361	1,350	1,402	1,279	1,380	1,142	1,413	1,429	1,290	1,438	16,154
Appalachian No. 2.....	1,497	1,384	1,531	1,465	1,557	1,614	1,629	1,708	1,581	1,612	1,471	1,599	18,648
Indiana, Illinois, Kentucky, etc.....	24,151	22,944	23,819	22,597	22,363	23,141	25,291	25,705	24,576	25,230	23,639	24,415	287,871
Minnesota, Wisconsin, etc.....	2,121	2,129	2,055	2,190	1,632	2,201	2,323	2,294	2,108	2,092	2,091	2,266	25,502
Oklahoma, Kansas, etc.....	11,411	11,187	11,583	10,231	11,538	11,950	12,005	12,484	11,080	11,210	11,939	12,524	139,142
Texas Inland.....	4,723	4,107	4,381	4,129	4,687	4,315	4,663	4,509	4,372	4,554	4,244	4,734	53,418
Texas Gulf Coast.....	25,341	22,988	25,509	24,640	26,081	25,472	27,686	27,202	24,301	26,006	24,516	25,518	305,260
Louisiana Gulf Coast.....	11,039	10,628	11,716	11,606	12,003	11,614	12,335	12,105	11,837	11,797	10,453	11,218	138,351
Arkansas, Louisiana Inland, etc.....	1,365	1,331	1,372	1,211	1,336	1,368	1,382	1,435	1,376	1,464	1,340	1,483	16,463
New Mexico.....	434	382	471	380	433	449	516	454	495	451	476	5,458	5,458
Rocky Mountain.....	4,312	3,994	4,214	3,629	4,355	4,517	4,664	4,425	4,576	4,594	4,437	4,643	52,360
West Coast.....	16,641	15,230	15,915	15,740	15,870	16,006	16,530	17,052	16,521	16,822	15,922	16,936	195,185
Total gasoline from crude.....	121,434	113,233	120,202	114,554	120,189	120,977	128,416	128,133	120,666	124,218	118,381	124,007	1,454,410
<b>Natural gas liquids blended at refineries:</b>													
East Coast.....	279	429	396	235	308	544	484	568	435	410	401	640	5,129
Appalachian No. 1.....	1	1	1					2	2	1	2	2	12
Appalachian No. 2.....	112	75	82	55	27	41	42	41	51	94	113	118	851
Indiana, Illinois, Kentucky, etc.....	1,805	1,441	1,196	1,288	1,271	1,044	1,021	1,144	1,522	1,944	1,973	2,255	17,904
Minnesota, Wisconsin, etc.....	162	146	103	102	77	153	182	196	187	208	242	195	1,953
Oklahoma, Kansas, etc.....	1,812	1,446	1,518	1,302	1,485	1,488	1,499	1,488	1,560	1,706	1,893	2,017	19,214
Texas Inland.....	1,967	1,755	1,751	2,013	2,196	2,005	2,106	2,302	2,124	2,003	1,867	1,840	24,023
Texas Gulf Coast.....	5,596	5,485	5,805	5,686	5,643	5,157	5,828	5,878	6,222	6,199	6,389	6,298	70,082
Louisiana Gulf Coast.....	1,224	1,217	1,348	1,343	1,271	1,380	1,468	1,497	1,689	1,710	1,832	1,901	17,780
Arkansas, Louisiana Inland, etc.....	656	610	641	605	680	619	600	601	644	708	697	684	7,745
New Mexico.....	106	88	93	83	108	150	130	127	121	123	102	81	1,312
Rocky Mountain.....	402	342	344	319	337	323	321	361	374	381	423	371	4,298
West Coast.....	1,981	1,921	1,981	1,881	1,968	1,960	2,043	2,090	2,241	2,112	2,123	2,357	24,658
Total natural gas liquids blended.....	16,103	14,956	15,259	14,912	15,371	14,864	15,724	16,295	17,072	17,599	18,047	18,759	1194,861

Benzol blended.....	9	3	1	1	2	1	2	3	2	1	1	3	29
Total gasoline produced at refineries.....	137,546	128,192	135,462	129,467	135,562	135,842	144,142	144,431	137,740	141,818	136,429	142,769	1,649,400
Naphtha from crude oil:													
East Coast.....	122	131	128	168	111	132	94	131	115	131	156	92	1,511
Appalachian No. 1.....	35	27	39	36	43	44	31	38	33	39	45	28	438
Appalachian No. 2.....	14	11	14	13	18	16	18	16	15	14	11	12	172
Indiana, Illinois, Kentucky, etc.....	252	326	271	281	415	304	263	394	349	261	275	318	3,709
Minnesota, Wisconsin, etc.....													
Oklahoma, Kansas, etc.....	133	137	156	172	201	193	165	183	133	167	166	162	1,988
Texas Inland.....	32	32	29	26	30	27	34	38	36	30	30	27	371
Texas Gulf Coast.....	989	1,008	922	1,106	1,151	1,011	1,085	1,120	852	1,191	1,063	1,168	12,661
Louisiana Gulf Coast.....	69	34	44	72	65	77	65	23	38	71	42	57	657
Arkansas, Louisiana Inland, etc.....	82	64	66	68	71	50	78	62	64	66	49	55	775
New Mexico.....													
Rocky Mountain.....	18	18	10	8	25	12	15	12	6	18	14	7	163
West Coast.....	183	462	259	444	233	226	640	276	185	124	238	183	3,453
Total naphtha from crude oil.....	1,920	2,245	1,938	2,394	2,363	2,092	2,488	2,293	1,826	2,112	2,089	2,109	25,878
Total gasoline and naphtha produced at refineries.....	139,475	130,437	137,400	131,861	137,925	137,934	146,630	146,724	139,566	143,930	138,518	144,878	1,675,278

<sup>p</sup> Preliminary figures.

<sup>1</sup> Excludes gasoline blended at terminal facilities.



The dealer's average net price for regular-grade gasoline (exclusive of dealer's margin and sales tax) in 55 representative cities in the United States provides an index of wholesale gasoline prices. The average service station price (excluding taxes) decreased from 20.11 cents per gallon in 1963 to 19.98 cents per gallon in 1964. The average tax on gasoline in 1964 was 10.37 cents per gallon. Federal tax was 4.0 cents per gallon; State taxes, including some local taxes, averaged 6.33 cents per gallon.

TABLE 36.—Consumption, production, and distribution<sup>1</sup> of gasoline in 1964, by PAD districts

(Million barrels)

	PAD districts					Total
	1	2	3	4	5	
Consumption <sup>2</sup> .....	615.1	559.2	224.5	49.2	250.1	1,698.1
Supply:						
Production <sup>3</sup> .....	221.9	511.1	640.0	56.6	219.8	1,649.4
Imports.....	12.8		.4		1.4	14.6
Received from other districts:						
From district 1.....		23.3	.1			
From district 2.....	3.7		14.3	.1		
From district 3.....	333.1	75.2		4.4	17.2	
From district 4.....		4.1			7.5	
From district 5.....				.5		
Total Receipts.....	336.8	102.6	14.4	5.0	24.7	
Total Supply.....	571.5	613.7	654.8	61.6	245.9	1,664.0
Stock change <sup>4</sup> .....	+1.3	+2.1	+4.8	+3	-.7	+7.8
Shipped to other districts.....	23.4	18.1	429.9	11.6	.5	
Exports.....	.9	.5	5.4		1.1	7.9
Domestic demand.....	545.9	593.0	214.7	49.7	245.0	1,648.3
Difference between consumption and demand.....	+69.2	-33.8	+9.8	-.5	+5.1	+49.8

<sup>1</sup> Apparent distribution of gasoline by districts is based on actual data on tidewater and river shipments (for the first half of 1964) compiled by the Geological Survey, U.S. Department of the Interior and the last half by the Bureau of Mines. An estimate of annual interdistrict railroad shipments was computed from 1961 data compiled by the Bureau of Transport Economics, Interstate Commerce Commission, and records compiled by the San Francisco office of the Bureau of Mines. Interdistrict pipeline shipments are compiled by the Bureau of Mines. Information on shipments moving from PAD district 2 by way of the Great Lakes ports and the Ohio River to PAD district 1 were compiled from data supplied by the U.S. Army Corps of Engineers.

<sup>2</sup> Compiled by the American Petroleum Institute.

<sup>3</sup> Excludes naphtha production and gasoline blended at terminal facilities.

<sup>4</sup> Excludes naphtha.

TABLE 37.—Production (refinery output) and consumption of gasoline (excluding naphtha) in the United States, by States

(Thousand barrels)

	1962		1963		1964	
	Production	Consumption <sup>1</sup>	Production	Consumption <sup>1</sup>	Production	Consumption <sup>1</sup>
Alabama.....	(2)	25,913	(2)	26,777	(2)	28,374
Alaska.....		1,697		1,624		1,757
Arizona.....		13,626		14,288		14,948
Arkansas.....	12,168	16,038	12,697	16,824	12,895	17,616
California.....	<sup>2</sup> 205,837	154,958	<sup>2</sup> 214,726	162,945	<sup>2</sup> 219,843	173,178
Colorado.....	6,991	18,191	7,051	18,458	5,867	18,343
Connecticut.....		20,364		21,249		22,117
Delaware.....	(4)	5,292	(4)	5,464	(4)	5,502
District of Columbia.....		5,174		4,956		5,263
Florida.....		48,084		50,164		52,729
Georgia.....	(3)	34,250	(3)	35,690	(3)	37,923
Hawaii.....	(3)	4,581	(3)	4,490	(3)	4,414
Idaho.....		7,131		7,191		7,461
Illinois.....	107,708	79,629	112,187	81,966	117,746	84,671
Indiana.....	72,219	44,404	72,606	45,608	78,268	47,355
Iowa.....		29,074		29,983		30,467
Kansas.....	63,825	26,851	65,329	27,233	66,088	26,827
Kentucky.....	<sup>6</sup> 15,209	23,377	<sup>6</sup> 16,188	24,395	<sup>6</sup> 17,524	25,409
Louisiana.....	<sup>2</sup> 152,491	24,342	<sup>2</sup> 147,659	24,959	<sup>2</sup> 167,444	26,868
Maine.....		8,379		8,564		8,902
Maryland.....	(5)	23,959	(5)	25,355	(5)	26,467
Massachusetts.....	<sup>4</sup> 27,154	36,403	<sup>4</sup> 22,388	37,458	<sup>4</sup> 23,198	38,899
Michigan.....	21,431	67,857	23,710	71,542	24,989	75,757
Minnesota.....	11,945	33,344	12,725	34,348	15,027	35,216
Mississippi.....	(2)	16,989	(2)	17,999	(2)	18,517
Missouri.....	<sup>7</sup> 13,594	42,959	<sup>7</sup> 12,439	43,983	<sup>7</sup> 14,206	45,182
Montana.....	11,943	8,753	12,733	8,848	15,304	8,631
Nebraska.....	(7)	15,523	(7)	16,011	(7)	16,549
Nevada.....		4,655		5,132		5,413
New Hampshire.....		5,117		5,321		5,609
New Jersey.....	62,044	50,228	78,639	52,832	77,958	54,316
New Mexico.....	5,416	10,098	5,837	10,619	6,770	10,953
New York.....	11,909	112,743	12,696	117,586	14,056	123,252
North Carolina.....		38,157		40,119		42,446
North Dakota.....	<sup>8</sup> 10,888	7,786	<sup>8</sup> 11,722	8,017	<sup>8</sup> 12,428	8,316
Ohio.....	76,054	80,688	82,851	81,547	86,754	85,539
Oklahoma.....	74,292	27,848	74,689	28,278	78,062	28,741
Oregon.....		17,501		18,029		19,056
Pennsylvania.....	92,993	79,610	95,484	81,268	99,647	84,269
Rhode Island.....	(4)	6,079	(4)	6,270	(4)	6,415
South Carolina.....	(5)	18,744	(5)	19,472	(5)	20,345
South Dakota.....		8,943		9,320		9,117
Tennessee.....	(9)	29,411	(9)	30,663	(9)	32,596
Texas.....	436,740	117,287	444,928	115,949	452,783	122,243
Utah.....	16,332	9,152	16,536	9,481	17,650	10,047
Vermont.....		3,347		3,468		3,590
Virginia.....	<sup>5</sup> 6,418	33,070	<sup>5</sup> 6,752	34,276	<sup>5</sup> 6,482	36,279
Washington.....	(3)	30,153	(3)	30,004	(3)	31,328
West Virginia.....	716	11,790	731	12,101	555	12,407
Wisconsin.....	(8)	33,430	(8)	34,352	(8)	35,726
Wyoming.....	16,939	4,544	17,906	4,728	17,856	4,800
Total.....	1,533,256	1,577,523	1,581,209	1,627,204	1,649,400	1,698,145

<sup>2</sup> Preliminary.

<sup>1</sup> American Petroleum Institute.

<sup>2</sup> Alabama and Mississippi included with Louisiana.

<sup>3</sup> Washington and Hawaii included with California.

<sup>4</sup> Delaware and Rhode Island included with Massachusetts.

<sup>5</sup> Maryland, South Carolina, and Georgia included with Virginia.

<sup>6</sup> Tennessee included with Kentucky.

<sup>7</sup> Nebraska included with Missouri.

<sup>8</sup> Wisconsin included with North Dakota.

TABLE 38.—Stocks of gasoline and naphtha in the United States in 1964 by districts and months

(Thousand barrels)

	Jan. 31	Feb. 29	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30	Dec. 31
<b>Gasoline:</b> <sup>1</sup>												
East Coast.....	46,081	48,389	48,471	48,623	50,242	49,773	47,871	46,680	47,073	44,771	49,629	47,690
Appalachian No. 1.....	5,174	5,593	5,605	5,407	5,365	5,269	4,968	5,054	5,327	5,009	5,658	5,611
Appalachian No. 2.....	3,232	3,479	3,365	3,216	3,151	3,082	2,954	3,201	3,285	2,852	3,240	3,050
Indiana, Illinois, Kentucky, etc.....	34,153	37,939	40,361	39,213	36,286	32,625	30,671	31,395	32,137	31,309	32,273	33,363
Minnesota, Wisconsin, North Dakota and South Dakota.....	7,308	7,374	8,139	8,027	7,879	7,851	7,634	7,223	6,848	6,643	7,606	7,539
Oklahoma, Kansas, etc.....	19,772	21,338	21,270	20,764	19,551	18,302	16,889	16,034	15,704	15,090	16,800	17,746
Texas Inland.....	8,167	8,214	8,805	8,462	8,560	7,401	6,680	6,566	6,789	6,986	7,403	8,270
Texas Gulf Coast.....	25,273	26,925	26,416	24,690	22,627	20,222	23,331	22,084	22,040	23,069	23,195	24,118
Louisiana Gulf Coast.....	10,696	12,229	12,643	12,451	12,966	11,904	12,552	11,865	11,994	13,652	11,373	10,748
Arkansas, Louisiana Inland, etc.....	9,630	8,161	9,423	9,173	8,303	8,887	5,997	8,885	7,063	8,093	8,522	8,438
New Mexico.....	797	730	810	792	711	626	718	779	800	792	781	700
Rocky Mountain.....	6,677	7,437	7,818	7,437	7,426	6,903	5,863	4,857	4,754	4,681	5,348	6,108
West Coast.....	22,077	22,709	22,927	22,109	23,771	21,589	20,710	19,891	19,373	19,666	20,660	21,310
Total gasoline.....	199,037	210,517	216,053	210,364	206,818	194,434	186,838	186,314	184,017	182,613	192,488	194,691
<b>Naphtha:</b>												
East Coast.....	611	660	649	613	631	604	615	515	526	460	616	583
Appalachian No. 1.....	70	71	90	84	90	94	86	84	78	81	89	93
Appalachian No. 2.....	21	18	18	16	17	17	18	18	16	15	16	17
Indiana, Illinois, Kentucky, etc.....	611	639	547	479	560	555	482	582	654	594	569	605
Minnesota, Wisconsin, North Dakota and South Dakota.....												
Oklahoma, Kansas, etc.....	238	250	238	197	227	225	231	245	203	204	227	263
Texas Inland.....	32	36	31	24	23	23	23	24	29	29	25	21
Texas Gulf Coast.....	1,570	1,564	1,368	1,373	1,287	1,273	1,368	1,336	1,373	1,507	1,468	1,485
Louisiana Gulf Coast.....	93	88	86	92	93	124	128	113	101	114	127	143
Arkansas, Louisiana Inland, etc.....	126	143	150	124	88	60	71	68	74	78	82	87
New Mexico.....												
Rocky Mountain.....	41	47	50	32	47	47	48	37	23	27	33	32
West Coast.....	787	1,058	1,077	1,273	1,043	1,044	1,455	1,532	1,479	1,443	1,505	1,492
Total naphtha.....	4,200	4,574	4,304	4,307	4,106	4,066	4,525	4,554	4,556	4,552	4,757	4,821

Total gasoline and naphtha:														
East Coast.....	46,692	49,049	49,120	49,236	50,873	50,377	48,486	47,195	47,599	45,231	50,245	48,273		
Appalachian No. 1.....	5,244	5,664	5,695	5,491	5,455	5,363	5,054	5,138	5,405	5,090	5,747	5,704		
Appalachian No. 2.....	3,253	3,497	3,383	3,232	3,168	3,099	2,972	3,219	3,251	2,867	3,256	3,067		
Indiana, Illinois, Kentucky, etc.....	34,764	38,578	40,908	39,692	36,826	33,180	31,153	31,977	32,791	31,903	32,842	33,968		
Minnesota, Wisconsin, North Dakota and South Dakota.....	7,308	7,374	8,139	8,027	7,879	7,851	7,634	7,223	6,848	6,643	7,606	7,539		
Oklahoma, Kansas, etc.....	20,010	21,588	21,508	20,961	19,778	18,527	17,120	17,179	15,907	15,294	17,027	18,009		
Texas Inland.....	8,199	8,250	8,836	8,486	8,583	7,424	6,703	6,590	6,798	7,015	7,428	8,291		
Texas Gulf Coast.....	26,843	28,489	27,784	26,063	23,914	21,495	24,699	24,320	24,313	24,576	24,663	25,603		
Louisiana Gulf Coast.....	10,739	12,317	12,729	12,543	13,059	12,028	12,680	11,978	12,095	13,766	11,500	10,891		
Arkansas, Louisiana Inland, etc.....	9,756	8,304	9,573	9,297	8,391	8,947	6,068	8,953	7,137	8,171	8,504	8,525		
New Mexico.....	797	730	810	792	711	626	718	779	800	792	781	700		
Rocky Mountain.....	6,718	7,484	7,868	7,469	7,473	6,950	5,911	4,894	4,777	4,708	5,981	6,140		
West Coast.....	22,864	23,767	24,004	23,382	24,814	22,633	22,165	21,423	20,852	21,109	22,165	22,802		
Total: 1964.....	203,237	215,091	220,357	214,671	210,924	198,500	191,363	190,808	188,573	187,165	197,245	199,512		
1963.....	201,005	209,396	214,717	204,787	195,706	192,629	184,712	178,345	181,283	178,265	181,257	190,937		

<sup>1</sup> Includes stocks of gasoline at refineries, bulk terminals, and in pipelines.

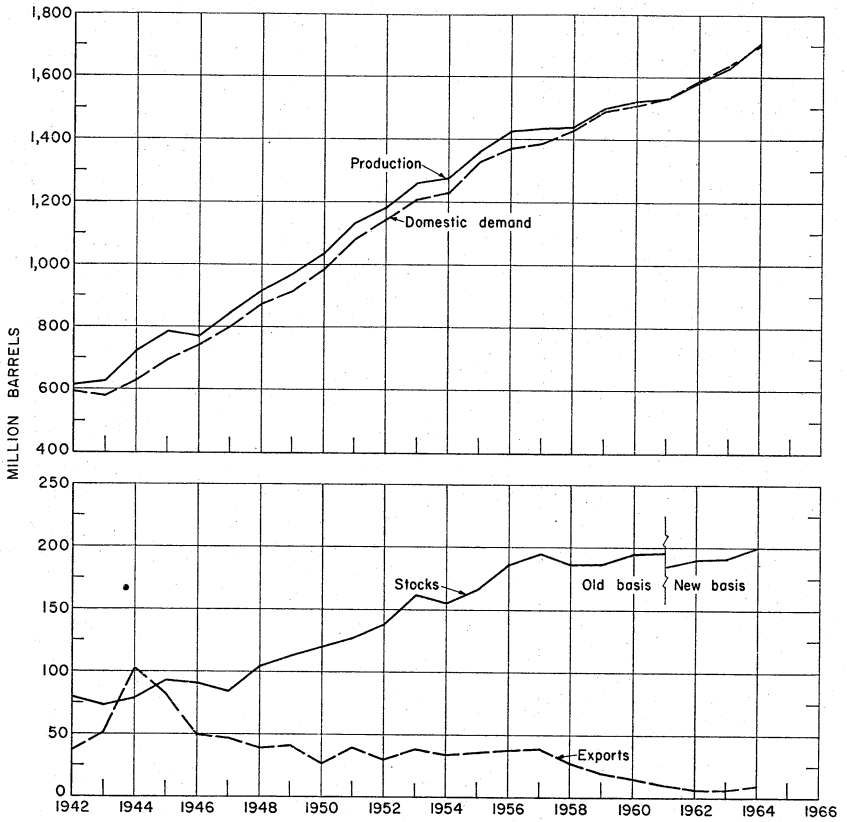


FIGURE 8.—Production, domestic demand, exports, and stocks of gasoline in the United States, 1942-64.

TABLE 39.—Day's supply of gasoline and naphtha on hand in the United States at end of month <sup>1</sup>

	1962	1963	▷ 1964		1962	1963	▷ 1964
January.....	49.9	48.6	48.2	July.....	38.3	37.8	39.3
February.....	48.8	50.4	48.9	August.....	40.8	39.6	39.2
March.....	47.4	46.5	46.9	September.....	40.5	39.4	39.4
April.....	44.0	44.3	45.8	October.....	39.6	40.1	42.5
May.....	40.9	41.6	41.0	November.....	43.1	41.5	41.8
June.....	40.1	39.7	39.0	December.....	46.9	45.1	48.9

▷ Preliminary.

<sup>1</sup> Stocks divided by daily average total demand (domestic demand plus exports) for succeeding month.

TABLE 40.—Average monthly prices of gasoline in the United States, by months and average for year

(Cents per gallon)

Monthly average	January	February	March	April	May	June	July
1963:							
At refineries in Oklahoma, regular, 91 octane.....	12.10	11.64	12.00	12.48	12.75	13.06	12.94
Of 55 cities on 1st of month:							
Dealer's net (excluding tax).....	15.45	15.26	14.64	14.91	15.55	14.35	15.75
Service station (including State, local, and Federal taxes).....	30.67	30.43	29.56	30.03	30.67	29.46	31.14
1964:							
At refineries in Oklahoma, regular, 91 octane.....	11.63	11.63	11.51	11.41	11.63	11.63	11.63
Of cities on 1st of month:							
Dealer's net (excluding tax).....	15.20	14.66	14.91	14.75	14.35	14.44	15.50
Service station (including State, local, and Federal taxes).....	30.74	29.97	30.29	30.24	29.86	29.93	31.09
		Aug- ust	Sep- tem- ber	Octo- ber	Novem- ber	Decem- ber	Average for year
1963:							
At refineries in Oklahoma, regular, 91 octane.....	12.19	11.80	12.23	11.00	11.57	12.15	
Of 55 cities on 1st of month:							
Dealer's net (excluding tax).....	15.70	15.85	15.18	14.76	15.22	15.22	
Service station (including State, local, and Federal taxes).....	31.16	31.07	30.39	30.08	30.43	30.42	
1964:							
At refineries in Oklahoma, regular, 91 octane.....	11.63	10.83	11.31	12.04	12.25	11.59	
Of 55 cities on 1st of month:							
Dealer's net (excluding tax).....	14.91	14.59	14.89	14.77	14.92	14.82	
Service station (including State, local, and Federal taxes).....	30.52	30.20	30.45	30.33	30.63	30.35	

Source: Platt's Oil Price Handbook and Platt's Oilgram Price Service.

TABLE 41.—Transportation of petroleum products by pipeline, by months  
(Thousand barrels)

Item	January	February	March	April	May	June	July	August	September	October	November	December	Total
1963:													
Turned into lines: <sup>1</sup>													
Gasoline.....	59,262	55,220	61,716	63,916	68,506	67,922	70,703	69,233	68,238	70,070	69,604	69,019	793,409
Kerosine.....	9,121	6,878	7,131	5,212	5,037	5,049	5,734	5,820	6,311	7,982	8,447	9,896	82,596
Distillate fuel oil.....	32,921	29,492	25,542	17,563	17,777	19,939	20,064	20,117	19,932	21,963	23,673	31,327	280,310
Military jet fuel.....	2,552	2,405	2,853	2,340	2,573	2,368	2,312	2,437	2,334	2,519	2,221	2,146	29,080
Natural gas liquids.....	13,107	10,254	7,971	7,272	7,789	7,527	8,930	10,169	9,433	10,172	10,524	14,024	117,222
Delivered from lines: <sup>1</sup>													
Gasoline.....	59,045	53,937	60,079	63,699	68,675	68,538	71,482	69,629	66,479	69,302	67,387	69,162	787,414
Kerosine.....	8,793	7,451	6,657	5,224	4,970	4,844	5,325	5,568	5,885	7,265	7,856	9,401	79,239
Distillate fuel oil.....	34,703	31,518	26,986	17,597	16,969	17,238	18,901	18,214	18,381	21,098	22,214	33,108	276,927
Military jet fuel.....	2,489	2,413	2,795	2,347	2,778	2,239	2,330	2,510	2,328	2,508	2,066	2,328	29,160
Natural gas liquids.....	13,001	10,382	8,890	7,246	7,563	7,357	9,013	9,857	8,519	9,677	10,618	13,754	115,877
Shortage or overage: <sup>2</sup>													
Gasoline.....	(8)	(62)	(128)	63	8	(69)	47	58	54	(6)	85	(65)	(23)
Kerosine.....	133	160	132	105	75	100	96	129	93	95	116	192	1,426
Distillate fuel oil.....	(2)	(103)	16	(119)	29	2	27	(69)	(26)	(36)	(109)	4	(386)
Military jet fuel.....	(1)	84	10	13	8		11	12	9	(19)	31	4	162
Natural gas liquids.....	80	101	47	15	27	24	21	(4)	38	10	28	11	398
Stocks in lines and working tanks at end of month:													
Gasoline.....	25,635	26,980	28,745	28,899	28,722	28,175	27,349	26,895	28,600	29,374	31,506	31,428	31,428
Kerosine.....	2,791	2,056	2,398	2,281	2,273	2,378	2,691	2,814	3,147	3,749	4,224	4,527	4,527
Distillate fuel oil.....	13,846	11,923	10,463	10,548	11,327	14,026	15,162	17,134	18,711	19,612	21,180	19,395	19,395
Military jet fuel.....	842	750	798	784	571	700	571	577	574	604	708	522	522
Natural gas liquids.....	4,586	4,357	3,391	3,402	3,601	3,747	3,643	3,959	4,885	5,370	5,248	5,507	5,507

1964:														
<b>Turned into lines:<sup>1</sup></b>														
Gasoline.....	68,700	67,130	70,690	73,377	79,962	80,279	82,573	82,584	76,920	81,817	78,246	82,620	924,898	
Kerosine.....	10,842	8,130	6,804	6,561	6,460	6,876	7,087	7,069	8,388	9,183	10,913	12,304	100,617	
Distillate fuel oil.....	35,395	24,632	21,299	20,773	21,644	21,035	24,780	23,160	25,197	26,247	31,669	43,000	318,731	
Military jet fuel.....	2,479	2,300	2,959	2,896	2,647	2,695	2,812	2,047	2,376	2,907	2,686	2,623	31,427	
Natural gas liquids.....	13,797	10,623	9,798	9,920	9,544	8,904	10,079	9,990	10,102	12,036	12,452	15,188	132,333	
<b>Delivered from lines:<sup>1</sup></b>														
Gasoline.....	68,056	63,865	68,232	73,516	78,642	83,404	82,633	83,672	77,899	81,757	78,874	84,087	924,637	
Kerosine.....	10,822	8,991	6,844	6,278	6,248	6,215	6,758	7,034	7,597	8,613	10,242	12,530	98,172	
Distillate fuel oil.....	36,754	27,121	23,481	20,611	19,462	19,284	22,607	20,617	23,934	25,629	30,663	44,542	314,705	
Military jet fuel.....	2,307	2,351	2,786	2,764	2,765	2,657	2,666	2,265	2,363	2,990	2,561	2,673	31,148	
Natural gas liquids.....	13,695	11,162	10,156	9,825	9,818	8,679	9,415	10,181	9,354	12,264	11,634	14,602	130,785	
<b>Shortage or overage:<sup>2</sup></b>														
Gasoline.....	5	(319)	(51)	(47)	52	(46)	(52)	7	16	(91)	(91)	(271)	(888)	
Kerosine.....	191	174	149	143	144	142	151	162	143	139	156	284	1,978	
Distillate fuel oil.....	(109)	95	32	(66)	(23)	(66)	(37)	123	(33)	(48)	16	(23)	(139)	
Military jet fuel.....		5	1	4	13	5	11	5	16	9		3	81	
Natural gas liquids.....	77	19	13	48	18	32	64	43	33	137	132	194	810	
<b>Stocks in lines and working tanks at end of month:</b>														
Gasoline.....	32,067	35,651	38,160	38,068	39,336	36,257	36,249	35,154	34,159	34,310	33,773	32,577	32,577	
Kerosine.....	4,356	3,321	3,132	3,272	3,340	3,859	4,037	3,910	4,558	4,989	5,504	4,994	4,994	
Distillate fuel oil.....	13,145	15,461	13,247	13,475	15,680	17,497	19,707	22,127	23,423	24,089	25,079	23,560	23,560	
Military jet fuel.....	694	633	810	938	807	840	975	752	749	667	773	720	720	
Natural gas liquids.....	5,532	4,874	4,503	4,550	4,258	4,461	5,061	4,817	5,632	5,167	5,833	6,245	6,245	

<sup>1</sup> The quantities "Turned into lines" and "Delivered from lines" are on a net basis, eliminating intersystem transfers.

<sup>2</sup> Figures in parentheses represent overage.



TABLE 42.—Transportation of petroleum products by pipeline between PAD districts in the United States, by months  
(Thousand barrels)

Item	January	February	March	April	May	June	July	August	September	October	November	December	Total
<b>1963:</b>													
From district 1 to district 2:													
Gasoline.....	1,539	1,139	1,287	1,532	1,526	1,455	1,496	1,525	1,553	1,566	1,589	1,461	17,668
Kerosine.....	113	110	100	46	30	59	16	58	19	75	148	123	897
Distillate fuel oil.....	220	313	306	232	204	249	258	238	233	323	312	381	3,289
From district 2 to district 1:													
Gasoline.....	493	297	304	360	400	468	413	770	330	344	386	411	4,976
Natural gas liquids.....	209	76					115	158	168	215	346	202	1,321
From district 2 to district 3:													
Gasoline.....	955	762	994	1,040	1,065	1,049	1,096	866	1,108	930	1,040	1,192	12,097
Distillate fuel oil.....	664	463	441	284	157	274	277	286	273	419	379	610	4,527
Military jet fuel.....	80	126	104	118	87	59	125	88	105	55	69	58	1,074
From district 3 to district 1:													
Gasoline.....	5,098	4,390	5,501	6,094	6,922	5,817	6,071	6,003	5,943	6,574	7,628	7,554	73,595
Kerosine.....	1,448	1,323	942	866	449	542	772	893	761	891	1,892	1,699	12,478
Distillate fuel oil.....	2,037	2,009	2,066	1,275	858	1,442	1,601	1,334	1,492	1,046	2,534	2,928	20,622
Military jet fuel.....	150	120	205	199	323	130	255	293	188	235	185	234	2,517
Natural gas liquids.....	520	561	264	135	148	196	359	367	235	275	352	765	4,177
From district 3 to district 2:													
Gasoline.....	3,405	2,900	3,705	4,337	4,495	3,827	3,714	4,086	3,945	4,228	3,802	3,335	45,779
Kerosine.....	437	608	165	167	218	29	149	162	165	132	194	296	2,722
Distillate fuel oil.....	1,217	1,527	751	626	720	1,090	975	909	1,059	596	758	1,016	11,244
Military jet fuel.....	15	50											65
Natural gas liquids.....	4,272	3,696	2,783	1,500	1,706	1,618	2,162	2,729	2,702	3,435	3,291	4,856	34,750
From district 3 to district 4:													
Gasoline.....	264	239	271	288	297	330	365	381	325	352	324	319	3,755
Kerosine.....	142	124	137	134	144	140	144	137	146	160	156	149	1,713
Distillate fuel oil.....	44	23	34	41	44	33	34	40	33	39	39	45	454
Natural gas liquids.....	156	61	57	31	23	22	24	45	22	23	53	131	648
From district 3 to district 5:													
Gasoline.....	664	575	598	731	602	649	587	649	629	715	739	562	7,700
Kerosine.....	33	33	35	25	23	16	14	36	20	22	30	32	319
Distillate fuel oil.....	115	158	163	153	85	113	119	179	143	156	156	134	1,674
Military jet fuel.....	202	176	270	140	139	60	60	152	140	129	93	223	1,789
From district 4 to district 2:													
Gasoline.....	188	212	298	277	262	312	286	335	253	191	218	266	3,098
Kerosine.....	4	4	4	2	4	3	3	3	2	4	3	2	38
Distillate fuel oil.....	147	106	145	103	112	94	118	88	116	157	174	130	1,490
From district 4 to district 5:													
Gasoline.....	513	470	660	537	618	643	547	666	549	573	529	523	6,833
Distillate fuel oil.....	374	390	407	281	202	242	322	203	296	302	274	475	3,768
Military jet fuel.....	268	242	343	224	359	197	199	68	117	391	327	332	3,067

1964:

From district 1 to district 2:																				
Gasoline.....	1,441	1,348	1,856	1,816	2,130	1,935	2,298	2,086	2,170	2,050	1,952	2,033	23,115							
Kerosine.....	140	150	96	70	39	40	48	51	47	94	126	1,066								
Distillate fuel oil.....	307	344	234	356	236	333	297	345	286	380	398	462	3,978							
From district 2 to district 1:																				
Gasoline.....	339	299	221	258	156	257	370	204	254	296	254	284	3,192							
Natural gas liquids.....	105	118	57	123	116	82	105	113	376	472	468	375	2,510							
From district 2 to district 3:																				
Gasoline.....	891	924	1,165	1,125	1,368	1,315	1,123	1,104	1,260	1,299	1,232	1,036	13,842							
Distillate fuel oil.....	808	737	301	233	175	300	172	313	282	347	307	405	4,380							
Military jet fuel.....	45	66	70	119	69	99	30	30	96	70	129	89	912							
From district 3 to district 1:																				
Gasoline.....	5,452	6,625	6,678	8,574	10,461	8,175	10,622	8,117	10,250	8,304	10,626	12,521	106,405							
Kerosine.....	2,229	1,203	826	909	696	1,451	1,066	1,569	1,040	2,392	2,604	3,027	19,012							
Distillate fuel oil.....	3,582	2,378	2,346	1,371	1,748	2,791	1,981	4,090	2,852	5,183	4,929	7,975	41,226							
Military jet fuel.....	101	213	291	180	245	276	221	225	152	292	247	163	2,606							
Natural gas liquids.....	822	559	345	244	181	269	466	573	363	493	443	699	5,457							
From district 3 to district 2:																				
Gasoline.....	2,545	3,162	2,822	3,438	3,904	4,046	3,752	3,436	3,220	2,801	3,381	2,594	39,101							
Kerosine.....	589	320	166	93	187	17	91	38	84	45	219	143	1,992							
Distillate fuel oil.....	1,951	1,218	479	623	814	233	946	665	684	663	813	982	10,071							
Military jet fuel.....			42										42							
Natural gas liquids.....	5,333	2,897	2,179	2,113	2,114	1,968	1,965	2,626	2,961	4,052	4,235	4,767	37,210							
From district 3 to district 4:																				
Gasoline.....	669	300	328	340	345	391	391	395	340	337	288	311	4,435							
Kerosine.....	168	144	145	156	167	161	174	174	135	298	178	197	2,057							
Distillate fuel oil.....	43	40	44	48	44	50	41	43	39	40	33	33	498							
Natural gas liquids.....	174	404	103	65	41	35	56	67	170	109	84	138	1,446							
From district 3 to district 5:																				
Gasoline.....	688	637	632	744	843	732	643	763	709	718	646	659	8,464							
Kerosine.....	34	33	49	16	29	40	40	19	24	40	33	78	435							
Distillate fuel oil.....	167	162	172	147	116	119	174	95	143	139	165	129	1,733							
Military jet fuel.....	82	120	203	168	210	208	215	212	103	174	174	223	2,092							
From district 4 to district 2:																				
Gasoline.....	191	227	291	247	443	350	384	387	339	269	274	235	3,637							
Kerosine.....	3		7	5	2				2	2	4	5	30							
Distillate fuel oil.....	165	111	146	146	147	128	127	134	88	164	114	182	1,652							
From district 4 to district 5:																				
Gasoline.....	487	474	579	573	618	693	506	803	627	764	616	661	7,401							
Distillate fuel oil.....	423	331	332	358	247	253	193	191	322	521	478	531	4,180							
Military jet fuel.....	386	397	434	393	501	465	147	338	346	224	299	407	4,337							

CRUDE PETROLEUM AND PETROLEUM PRODUCTS

451

### KEROSINE

The total demand for kerosine in 1964 was 178,580,000 barrels and this included exports of 171,000 barrels; shipments for commercial jet aircraft fuel consisted of 85,672,000 barrels; and other domestic uses amounted to 92,737,000 barrels. The increase in requirements for kerosine destined for jet-fuel usage accounts for most of the growth in domestic kerosine demand. In 1963, the jet-fuel usage accounted for 44 percent of the demand, while in 1964 it represented 48 percent.

The use of kerosine, imported in bond (duty-free), as jet fuel for aircraft engaged in overseas flights increased from 24,000 barrels per day in 1963 to about 30,000 barrels daily in 1964. Pipeline deliveries of kerosine were about 19 million barrels more in 1964 than in 1963, and tidewater shipments from the gulf to the east coast decreased by nearly 9 million barrels.

Tanker rates for kerosine from the gulf coast to U.S. destinations north of Cape Hatteras in 1964 averaged 39.9 cents per barrel, compared with 42.4 cents per barrel in 1963.

The average posted price of kerosine at Oklahoma refineries in 1964 was 10.5 cents per gallon. The average posted price on barges in New York Harbor for 1964 was 10.2 cents per gallon.

TABLE 43.—Salient statistics of kerosine in the United States, by months and refinery districts

(Thousand barrels)

Month and district	1963							1964							Shipments for commercial jet aircraft <sup>1</sup>	
	Production from crude	Yield (per cent)	Production from natural gas liquids	Imports	Exports	Stocks (end of period)	Domestic demand	Production from crude	Yield (per cent)	Production from natural gas liquids	Imports	Exports	Stocks (end of period)	Domestic demand	1963	1964
	<b>Month:</b>															
January.....	15,667	5.6	171	625	103	26,103	22,655	17,080	6.2	212	675	7	30,863	21,199	6,227	6,456
February.....	14,943	5.9	126	393	173	22,400	18,992	14,567	5.6	116	666	26	28,528	17,658	5,424	6,121
March.....	14,428	5.4	71	566	50	23,216	14,199	14,211	5.3	99	782	11	28,464	15,155	6,161	6,898
April.....	13,461	5.4	89	722	22	27,344	10,122	12,396	5.3	74	779	12	29,063	12,628	6,177	6,777
May.....	11,840	4.5	46	588	187	29,578	10,053	11,500	4.3	151	896	21	30,535	11,054	6,282	6,697
June.....	11,610	4.4	68	861	7	32,285	9,825	11,419	4.2	147	1,033	5	32,845	10,284	6,177	7,060
July.....	12,834	4.6	73	979	21	35,246	10,904	12,548	4.4	107	1,230	22	34,428	12,820	6,655	7,707
August.....	12,445	4.4	65	848	32	36,214	12,368	13,288	4.4	66	1,001	10	36,042	12,831	6,561	7,619
September.....	12,163	4.6	43	896	12	35,973	13,326	13,825	5.1	98	997	11	37,280	13,671	6,212	7,276
October.....	14,709	5.5	148	776	16	39,118	12,477	15,211	5.5	78	1,121	10	37,874	15,806	6,822	7,954
November.....	14,659	5.6	100	682	26	39,131	15,402	14,939	5.6	107	838	19	38,620	15,119	6,205	7,649
December.....	16,046	5.8	141	706	23	34,102	21,899	17,037	6.0	238	1,021	17	36,165	20,734	6,333	7,458
<b>Total.....</b>	<b>164,805</b>	<b>5.1</b>	<b>1,141</b>	<b>8,642</b>	<b>672</b>	<b>34,102</b>	<b>172,212</b>	<b>168,021</b>	<b>5.2</b>	<b>1,493</b>	<b>11,129</b>	<b>171</b>	<b>36,165</b>	<b>178,409</b>	<b>75,236</b>	<b>85,672</b>
<b>District:</b>																
East Coast.....	15,093	3.3	-----	-----	-----	12,262	-----	14,046	3.1	-----	-----	-----	14,605	-----	-----	-----
Appalachian No. 1.....	1,337	3.5	-----	5,787	75	674	-----	1,404	3.5	-----	7,785	74	861	-----	-----	-----
Appalachian No. 2.....	1,976	5.4	-----	-----	-----	468	-----	1,924	5.1	-----	-----	-----	418	-----	-----	-----
Indiana, Illinois, Kentucky, etc.	33,012	5.8	-----	-----	11	6,210	-----	31,409	5.4	-----	-----	3	6,498	-----	-----	-----
Minnesota, Wisconsin, etc.	1,997	4.1	-----	-----	-----	1,685	-----	1,823	3.4	-----	-----	-----	1,330	-----	-----	-----
Oklahoma, Kansas, etc.	5,269	1.9	-----	-----	-----	1,360	-----	6,070	2.2	-----	-----	-----	1,202	-----	-----	-----
Texas Inland.....	4,509	4.0	310	-----	-----	597	NA	4,758	4.1	320	-----	-----	661	-----	-----	-----
Texas Gulf Coast.....	53,362	7.2	90	-----	-----	4,304	-----	53,528	7.2	92	-----	-----	4,312	-----	-----	-----
Louisiana Gulf Coast.....	25,942	9.0	419	20	543	1,695	-----	27,576	8.8	358	-----	68	2,404	-----	-----	-----
Arkansas, Louisiana Inland, etc.	1,729	3.9	303	-----	-----	1,788	-----	2,003	4.4	698	-----	-----	973	-----	-----	-----
New Mexico.....	167	1.7	19	-----	-----	70	-----	152	1.4	25	-----	-----	54	-----	-----	-----
Rocky Mountain.....	2,304	2.1	-----	-----	-----	433	-----	2,890	2.5	-----	-----	-----	379	-----	-----	-----
West Coast.....	18,108	3.9	-----	2,835	43	2,556	NA	20,438	4.3	-----	3,344	26	2,468	NA	20,703	24,595
<b>Total.....</b>	<b>164,805</b>	<b>5.1</b>	<b>1,141</b>	<b>8,642</b>	<b>672</b>	<b>34,102</b>	<b>172,212</b>	<b>168,021</b>	<b>5.2</b>	<b>1,493</b>	<b>11,129</b>	<b>171</b>	<b>36,165</b>	<b>178,409</b>	<b>75,236</b>	<b>85,672</b>

<sup>1</sup> Preliminary. NA Not available.  
<sup>1</sup> Included in total demand for kerosine.

TABLE 44.—Consumption of kerosine in the United States, by PAD districts, States, and uses<sup>1</sup>

(Thousand barrels)

District and State	Range oil		Tractor fuel		All other uses		Total	
	1963	1964	1963	1964	1963	1964	1963	1964
<b>District 1:</b>								
Connecticut.....	1,282	1,100			88	93	1,370	1,193
Delaware.....	883	584			25	104	908	688
District of Columbia.....	132	69			3	13	135	82
Florida.....	4,099	3,274	76	69	431	907	4,606	4,250
Georgia.....	884	733	81	83	333	373	1,298	1,189
Maine.....	2,532	1,866	3	3	94	195	2,629	2,064
Maryland.....	2,422	2,257	1	7	64	72	2,487	2,336
Massachusetts.....	4,422	3,500			224	386	4,646	3,886
New Hampshire.....	883	676			14	17	897	693
New Jersey.....	1,861	1,507	6	7	264	296	2,131	1,810
New York.....	4,958	4,513	19	16	434	605	5,411	5,134
North Carolina.....	11,617	10,356	64	58	1,484	1,309	13,165	11,723
Pennsylvania.....	3,151	2,934	26	17	357	547	3,534	3,498
Rhode Island.....	719	422			44	48	763	470
South Carolina.....	3,666	3,012	4	10	532	382	4,202	3,404
Vermont.....	709	540	13	7			722	547
Virginia.....	5,380	4,667	36	35	211	352	5,627	5,054
West Virginia.....	216	142			13	37	229	179
<b>Total.....</b>	<b>49,816</b>	<b>42,152</b>	<b>329</b>	<b>312</b>	<b>4,615</b>	<b>5,736</b>	<b>54,760</b>	<b>48,200</b>
<b>District 2:</b>								
Illinois.....	4,300	3,989	26	20	1,195	1,033	5,521	5,042
Indiana.....	3,040	2,898	7	5	786	696	3,833	3,599
Iowa.....	2,083	1,903	19	12	135	140	2,237	2,055
Kansas.....	266	225		13	110	132	376	370
Kentucky.....	1,020	1,012			218	162	1,238	1,174
Michigan.....	4,466	4,470	36	40	1,458	1,278	5,960	5,788
Minnesota.....	2,126	2,093	14	15	239	248	2,379	2,356
Missouri.....	958	888	22	25	104	102	1,084	1,015
Nebraska.....	315	322	15	15	113	139	443	476
North Dakota.....	902	873			9	13	911	886
Ohio.....	2,665	2,123	8	15	663	924	3,336	3,062
Oklahoma.....	309	212	11	5	180	99	500	316
South Dakota.....	883	881	2	15	19	20	904	916
Tennessee.....	1,402	1,040	5	3	852	1,235	2,259	2,278
Wisconsin.....	2,398	2,020	5	3		86	2,403	2,109
<b>Total.....</b>	<b>27,133</b>	<b>24,949</b>	<b>170</b>	<b>186</b>	<b>6,081</b>	<b>6,307</b>	<b>33,384</b>	<b>31,442</b>
<b>District 3:</b>								
Alabama.....	316	386	25	104	119	230	460	720
Arkansas.....	121	179	19	80	61	124	201	333
Louisiana.....	271	328	16	109	210	283	497	720
Mississippi.....	88	80	13	13	72	206	173	299
New Mexico.....	110	164	1	9	54	184	165	357
Texas.....	584	793	131	149	1,330	2,595	2,045	3,537
<b>Total.....</b>	<b>1,490</b>	<b>1,930</b>	<b>205</b>	<b>464</b>	<b>1,846</b>	<b>3,622</b>	<b>3,541</b>	<b>6,016</b>
<b>District 4:</b>								
Colorado.....	242	378	2	7	35	140	279	525
Idaho.....	290	363		4	7	18	267	385
Montana.....	345	629			3	22	348	651
Utah.....	337	493		8	35	40	372	541
Wyoming.....	89	126		4	11	10	100	140
<b>Total.....</b>	<b>1,273</b>	<b>1,989</b>	<b>2</b>	<b>23</b>	<b>91</b>	<b>230</b>	<b>1,366</b>	<b>2,242</b>
<b>District 5:</b>								
Alaska.....	6	8			22		28	8
Arizona.....	10	10			4	16	14	26
California.....	118	123			741	828	859	951
Hawaii.....	34	44			14	4	48	48
Nevada.....		1			3	6	3	7
Oregon.....	5	9			15	5	20	14
Washington.....	4	9			34	13	38	22
<b>Total.....</b>	<b>177</b>	<b>204</b>			<b>833</b>	<b>872</b>	<b>1,010</b>	<b>1,076</b>
<b>Total United States.....</b>	<b>79,889</b>	<b>71,224</b>	<b>706</b>	<b>985</b>	<b>13,466</b>	<b>16,767</b>	<b>94,061</b>	<b>88,976</b>

<sup>1</sup> Excludes kerosene type jet fuel.

TABLE 45.—Monthly average refinery and terminal prices of kerosine including No. 1 fuel oil in the United States, 1963-64

(Cents per gallon)

Year and area	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1963:													
No. 1 range oil at Chicago district.	11.92	11.93	11.90	11.71	11.43	11.37	11.18	11.18	11.18	11.41	11.29	11.44	11.49
No. 1 fuel oil at Oklahoma.....	10.69	11.13	11.08	11.00	10.94	10.88	10.88	10.88	10.88	10.88	10.88	10.88	10.91
Kerosine (and/or No. 1 fuel oil) at New York Harbor (cargo).....	11.64	11.50	11.44	11.28	10.52	10.50	10.50	10.40	10.25	10.29	10.40	10.84	10.80
Kerosine (and/or No. 1 fuel oil) at Tampa.....	12.05	12.10	12.10	12.10	11.68	11.60	11.60	11.60	11.60	11.60	11.60	11.60	11.77
1964:													
No. 1 range oil at Chicago district.	11.73	11.45	11.36	11.00	9.14	8.89	8.88	8.88	8.90	9.23	9.50	9.81	9.90
No. 1 fuel oil at Oklahoma.....	10.83	10.88	10.68	10.38	10.38	10.38	10.38	10.38	10.38	10.38	10.38	10.60	10.49
Kerosine (and/or No. 1 fuel oil) at New York Harbor (cargo).....	11.14	10.99	10.75	10.00	9.85	9.80	9.80	9.80	9.80	10.00	10.19	10.55	10.22
Kerosine (and/or No. 1 fuel oil) at Tampa.....	11.60	11.60	11.60	11.60	11.50	11.35	11.35	11.35	11.35	11.35	11.35	11.35	11.45

Source: Platt's Oil Price Handbook.

TABLE 46.—Salient statistics of distillate fuel oil in the United States, by months and refinery districts

(Thousand barrels unless otherwise stated)

Month and district	1963								1964							
	Production from crude	Yield (percent)	Production from natural gas liquids	Crude used directly as distillate <sup>1</sup>	Imports	Exports	Stocks (end of period)	Domestic demand	Production from crude	Yield (percent)	Production from natural gas liquids	Crude used directly as distillate <sup>1</sup>	Imports	Exports	Stocks (end of period)	Domestic demand
Month:																
January.....	70,904	25.8	45	77	1,076	1,104	111,674	103,285	67,443	24.3	40	68	1,581	1,222	128,534	96,053
February.....	66,598	26.3	42	72	722	3,002	87,812	88,294	62,812	24.3	32	60	1,069	442	110,527	81,538
March.....	68,407	25.4	33	94	710	1,125	83,913	72,018	61,681	22.8	38	87	875	616	99,195	73,897
April.....	57,234	23.0	36	66	606	1,238	91,718	48,899	57,525	22.8	33	61	787	264	97,758	59,579
May.....	60,155	23.0	38	61	606	1,175	103,160	48,243	60,775	22.6	31	53	723	311	112,135	46,844
June.....	60,073	22.6	34	63	711	997	123,364	39,680	61,092	22.5	33	62	1,035	310	130,272	43,825
July.....	62,319	22.5	44	62	714	995	145,239	40,269	64,184	22.3	37	63	627	364	153,462	41,177
August.....	63,309	22.8	39	64	631	1,129	165,188	42,965	61,986	21.8	33	62	856	196	175,033	41,350
September.....	63,117	23.7	34	61	678	1,371	177,231	50,476	59,347	22.0	29	58	912	576	186,726	48,077
October.....	63,824	23.8	45	61	867	985	191,394	49,649	59,010	21.4	28	58	840	508	189,364	56,790
November.....	62,858	23.9	44	57	956	1,431	192,561	61,317	58,662	22.1	28	62	574	253	182,579	65,858
December.....	65,799	23.8	36	69	833	462	156,677	102,159	66,172	23.4	31	61	1,893	372	155,846	94,518
Total.....	764,597	23.9	470	807	9,110	15,014	156,677	747,254	740,689	22.6	393	755	11,772	5,434	155,846	749,006
District:																
East Coast.....	129,378	28.3					58,026		119,640	26.6					64,470	
Appalachian No. 1.....	9,108	23.6			7,787	990	3,775		9,429	23.7				144	3,823	
Appalachian No. 2.....	7,310	19.8					1,803		7,001	18.5					1,730	
Indiana, Illinois, Kentucky, etc.....	123,297	21.7		198	63	53	26,774		115,956	20.2		176		217	22,792	
Minnesota, Wisconsin, etc.....	11,220	22.8		182			7,762		12,873	23.9		177			7,368	
Oklahoma, Kansas, etc.....	68,465	25.3		122			14,166		65,070	23.9		109			12,232	
Texas Inland.....	19,448	17.0	232	90			2,143	NA	19,319	16.5	172	87			2,513	
Texas Gulf Coast.....	208,686	28.1	69	50			16,727		200,801	26.7	42	50			15,578	
Louisiana Gulf Coast.....	74,098	25.8	2	31	1,250	4,320	5,409		74,555	23.6	26	26	1,119	155	6,396	
Arkansas, Louisiana Inland, etc.....	9,966	22.2	167				3,448		10,386	22.5	179				2,619	
New Mexico.....	1,597	16.0		57			180		1,712	15.8		53			179	
Rocky Mountain.....	24,545	21.8		77	1	20	2,587		25,833	22.2		77		30	2,465	
West Coast.....	77,479	16.5			9	9,631	13,877		78,114	16.2			43	4,888	13,691	
Total.....	764,597	23.9	470	807	9,110	15,014	156,677	747,254	740,689	22.6	393	755	11,772	5,434	155,846	749,006

<sup>p</sup> Preliminary. NA Not available.<sup>1</sup> Figures represent crude oil used as fuel on pipelines, which is considered part of the demand for distillate.

## DISTILLATE FUEL OIL

The total demand for distillate fuel oil in 1964 was 754,440,000 barrels. This included a domestic demand of 749,006,000 barrels and exports of 5,434,000 barrels. Domestic demand did not change significantly over that of 1963, but exports in 1964 were only a little more than a third the amount exported in 1963.

Refineries decreased the production of distillate fuel oil in 1964 by 23,908,000 barrels. The production at natural gas liquids plants declined, as did direct transfers from crude oil; imports increased appreciably. The total new supply for the year (753,609,000 barrels) was 21,375,000 less than in 1963. The new supply satisfied nearly all the demand in 1964, leaving stocks at a level only slightly lower at the end of 1964 than they were at the end of 1963.

The average wholesale price for distillate fuel oils in 1964 was 8.65 cents per gallon compared with 9.18 cents in 1963.

The tanker rate for No. 2 distillate fuel oil from the gulf coast to New York Harbor averaged 42.0 cents per barrel in 1964, compared with 44.5 cents in 1963.

Pipeline deliveries of distillate fuel oil increased 13.6 percent in 1964 to 314,705,000 barrels. Tidewater shipments from the gulf coast to the east coast decreased about 14 percent, and tidewater shipments from the west to the east coast in 1964 were less than half the 1963 shipments.

TABLE 47.—Consumption of distillate fuel oil<sup>1</sup> in the United States, by uses

(Thousand barrels)

Use	1960	1961	1962	1963	1964
Heating oils.....	422,855	434,805	450,031	449,159	436,204
Range oil (No. 1 fuel oil).....	15,155	15,487	16,799	16,156	15,656
Industrial (excluding oil company).....	34,271	31,226	34,951	36,647	36,007
Oil company (excluding heating oil).....	8,347	8,743	9,055	10,253	10,576
Gas and electric public utility powerplants.....	4,742	4,151	4,100	4,149	3,849
Railroads.....	86,490	85,180	86,803	88,117	88,198
Bunkering of vessels (including company tankers but excluding military).....	18,730	14,566	15,836	15,148	16,001
Military (U.S. Army, Navy, Air Force, and Marine Corps).....	10,793	11,484	13,041	13,436	13,609
Miscellaneous uses:					
Diesel fuel.....	74,562	77,825	89,729	106,341	117,534
Other light distillates.....	7,380	7,407	8,750	8,718	9,917
Total United States.....	683,325	690,874	729,095	748,124	747,651

<sup>1</sup> Includes diesel fuel.



TABLE 48.—Consumption of distillate fuel oil<sup>1</sup> in the United States, by PAD districts and States

(Thousand barrels)

District and State	1960	1961	1962	1963	1964
<b>District 1:</b>					
Connecticut.....	23,230	23,199	23,099	22,906	20,378
Delaware.....	2,723	2,537	3,097	3,474	3,257
District of Columbia.....	2,914	2,726	2,878	2,872	2,957
Florida.....	8,971	9,369	10,611	10,902	11,076
Georgia.....	5,117	5,269	6,218	6,969	6,977
Maine.....	7,456	8,307	8,645	9,487	8,792
Maryland.....	13,101	14,257	15,146	16,014	16,863
Massachusetts.....	51,022	52,266	53,448	51,664	49,966
New Hampshire.....	4,484	5,486	5,834	6,327	5,742
New Jersey.....	45,542	46,992	48,622	51,466	51,655
New York.....	81,677	86,029	94,501	95,856	94,610
North Carolina.....	13,353	13,366	15,617	16,000	16,249
Pennsylvania.....	45,668	45,982	49,315	51,702	50,699
Rhode Island.....	8,093	7,547	7,411	7,391	6,272
South Carolina.....	5,203	5,116	5,776	6,169	5,228
Vermont.....	2,939	3,299	3,602	3,787	3,603
Virginia.....	14,184	14,631	15,843	16,945	16,542
West Virginia.....	2,462	2,525	2,490	2,622	2,320
<b>Total.....</b>	<b>338,139</b>	<b>348,903</b>	<b>372,153</b>	<b>382,553</b>	<b>373,186</b>
<b>District 2:</b>					
Illinois.....	42,490	42,255	41,361	41,421	41,580
Indiana.....	25,596	25,452	25,743	25,934	25,813
Iowa.....	11,141	10,043	11,022	11,106	10,968
Kansas.....	4,751	5,187	5,242	5,612	5,487
Kentucky.....	4,833	4,426	5,822	5,532	5,697
Michigan.....	30,464	30,547	31,131	30,471	29,576
Minnesota.....	16,241	15,967	16,776	16,629	16,739
Missouri.....	12,830	12,858	13,412	13,939	13,884
Nebraska.....	4,183	4,481	4,099	4,387	4,689
North Dakota.....	3,775	3,693	4,472	4,584	4,529
Ohio.....	23,836	23,433	24,250	26,348	27,121
Oklahoma.....	2,631	3,152	3,243	3,729	3,325
South Dakota.....	2,964	3,085	3,212	3,370	3,823
Tennessee.....	5,268	5,552	6,167	6,706	6,784
Wisconsin.....	21,711	22,153	23,399	23,461	23,328
<b>Total.....</b>	<b>212,714</b>	<b>212,284</b>	<b>219,351</b>	<b>223,229</b>	<b>223,343</b>
<b>District 3:</b>					
Alabama.....	5,370	4,310	4,938	5,148	5,887
Arkansas.....	2,052	3,078	2,451	2,579	3,358
Louisiana.....	10,694	9,038	9,622	9,762	9,688
Mississippi.....	2,364	1,954	2,715	2,885	3,322
New Mexico.....	3,065	2,841	3,512	3,642	3,946
Texas.....	24,315	21,795	23,959	24,092	23,998
<b>Total.....</b>	<b>47,860</b>	<b>43,016</b>	<b>47,197</b>	<b>48,108</b>	<b>50,199</b>
<b>District 4:</b>					
Colorado.....	4,225	4,441	4,148	4,580	4,074
Idaho.....	4,055	4,037	4,204	4,108	4,501
Montana.....	4,877	5,248	5,522	5,400	5,684
Utah.....	3,841	3,085	3,607	3,640	3,766
Wyoming.....	3,258	3,250	3,838	3,816	3,653
<b>Total.....</b>	<b>20,256</b>	<b>20,061</b>	<b>21,319</b>	<b>21,544</b>	<b>21,678</b>
<b>District 5:</b>					
Alaska.....	2,616	2,849	2,897	3,076	3,482
Arizona.....	2,774	3,107	3,001	3,520	3,528
California.....	26,697	27,410	29,685	32,256	34,991
Hawaii.....	876	1,666	1,641	1,375	1,769
Nevada.....	2,428	2,985	3,017	2,844	3,523
Oregon.....	10,920	11,061	11,777	12,823	13,855
Washington.....	18,045	17,532	17,057	16,791	17,997
<b>Total.....</b>	<b>64,356</b>	<b>66,610</b>	<b>69,075</b>	<b>72,690</b>	<b>79,145</b>
<b>Total United States.....</b>	<b>683,325</b>	<b>690,874</b>	<b>729,095</b>	<b>743,124</b>	<b>747,551</b>

<sup>1</sup> Includes diesel fuel oil.

TABLE 49.—Monthly average prices of distillate fuel oil and diesel fuel in the United States 1963-64

Year and grade	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
<b>1963:</b>													
No. 2 fuel oil at refineries, Oklahoma.....cents per gallon.....	9.69	10.13	10.08	10.00	9.92	9.88	9.88	9.88	9.88	9.88	9.88	9.88	9.91
No. 2 fuel oil at New York Harbor.....cents per gallon.....	10.53	10.50	10.44	10.28	9.52	9.50	9.50	9.40	9.25	9.29	9.40	9.99	9.80
Diesel oil, shore plants, New York.....cents per gallon.....	10.87	10.41	10.41	10.83	9.87	9.85	9.85	9.85	9.85	9.85	9.85	10.20	10.14
Diesel oil for ships:													
New York.....dollars per barrel.....	4.39	4.37	4.37	4.36	3.96	3.95	3.95	3.95	3.95	3.95	3.95	4.13	4.11
New Orleans.....do.....	4.15	4.16	4.16	4.16	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	4.02
San Pedro.....do.....	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09
<b>1964:</b>													
No. 2 fuel oil at refineries, Oklahoma.....cents per gallon.....	9.88	9.88	9.68	9.38	9.38	9.38	9.38	9.38	9.38	9.38	9.38	9.50	9.49
No. 2 fuel oil at New York Harbor.....cents per gallon.....	10.14	9.99	9.75	9.00	8.85	8.80	8.80	8.80	8.80	9.00	9.19	9.55	9.22
Diesel oil, shore plants, New York.....cents per gallon.....	10.50	10.50	10.33	9.30	9.30	9.30	9.30	9.30	9.30	9.37	9.49	9.88	9.66
Diesel oil for ships:													
New York.....dollars per barrel.....	4.29	4.29	4.23	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.91	4.12	3.99
New Orleans.....do.....	4.00	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.09	4.07
San Pedro.....do.....	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09	5.09

Source: Platt's Oil Price Handbook.

TABLE 50.—Salient statistics of residual fuel oil in the United States, by months and refinery districts

(Thousand barrels unless otherwise stated)

Month and district	1963							1964 <sup>a</sup>										
	Production	Yield (percent)	Crude used directly as residual <sup>1</sup>	Imports	Exports	Stocks (end of period)	Domestic demand	Production	Yield (percent)	Crude used directly as residual <sup>1</sup>	Imports	Exports	Stocks (end of period)	Domestic demand				
<b>Month:</b>																		
January.....	27,313	10.2	266	34,803	814	46,896	64,447	25,826	9.3	246	39,734	1,561	45,352	66,431				
February.....	25,334	10.0	251	28,711	1,477	43,627	56,088	22,747	8.8	372	29,187	1,023	43,262	53,373				
March.....	25,406	9.4	246	23,903	1,060	42,867	49,255	22,298	8.3	236	24,712	1,668	39,100	49,740				
April.....	21,481	8.6	269	24,663	1,315	44,685	43,280	21,231	8.3	363	27,970	2,000	38,477	48,187				
May.....	21,000	8.1	264	19,019	1,338	46,648	36,982	20,821	7.7	285	19,797	1,375	40,459	37,546				
June.....	21,811	8.2	285	15,281	967	48,100	34,958	19,519	7.2	276	17,748	1,942	40,356	35,704				
July.....	21,748	7.8	251	18,132	1,123	50,885	36,223	21,556	7.5	270	20,460	1,498	42,977	38,167				
August.....	21,795	7.8	295	16,922	1,358	52,456	36,083	21,114	7.4	313	18,447	1,547	44,644	36,660				
September.....	21,521	8.1	264	16,010	1,719	52,624	35,908	21,280	7.9	365	18,915	1,517	45,364	38,323				
October.....	21,031	7.8	273	22,951	959	54,359	41,561	22,543	8.2	261	24,712	1,879	45,936	45,065				
November.....	22,501	8.6	259	20,749	1,829	52,250	43,789	23,545	8.9	286	23,342	1,321	46,135	45,653				
December.....	24,969	9.1	382	31,609	1,322	47,538	60,350	25,702	9.1	447	30,867	1,539	40,403	61,209				
<b>Total.....</b>	<b>275,910</b>	<b>8.6</b>	<b>3,305</b>	<b>272,753</b>	<b>15,281</b>	<b>47,538</b>	<b>538,924</b>	<b>268,182</b>	<b>8.2</b>	<b>3,720</b>	<b>295,891</b>	<b>18,870</b>	<b>40,403</b>	<b>556,058</b>				
<b>District:</b>																		
East Coast.....	40,309	8.9	26	252,785	68	10,318	NA	37,291	8.3	35	274,426	66	10,213	NA				
Appalachian No. 1.....	3,882	10.1						3,864	9.7						3,864	9.7		459
Appalachian No. 2.....	3,431	9.3						3,569	9.5	259					3,569	9.5		137
Indiana, Illinois, Kentucky, etc.....	51,295	9.0	197	800	168	6,518	NA	48,567	8.4	189	804	226	6,726	NA				
Minnesota, Wisconsin, etc.....	6,209	12.7	39					6,257	11.6	36					6,257	11.6	36	502
Oklahoma, Kansas, etc.....	6,124	2.2	360					4,532	1.7	362					4,532	1.7	362	851
Texas Inland.....	4,642	4.1	341	12,327	4,012	2,339	NA	4,342	3.7	343	11,204	3,068	2,350	NA				
Texas Gulf Coast.....	35,744	4.8	516					3,581	4.2	516					3,581	4.2	516	2,928
Louisiana Gulf Coast.....	14,378	5.0	635					1,162	5.5	638					1,162	5.5	638	1,306
Arkansas, Louisiana Inland, etc.....	2,205	4.9	200	6,815	11,032	150	NA	2,280	5.0	213	9,412	1,031	1,306	NA				
New Mexico.....	671	6.7	83					423	3.9	84					423	3.9	84	80
Rocky Mountain.....	13,614	12.1	276					786	11.1	273					12,947	11.1	273	19
West Coast.....	93,406	19.9	632	6,815	11,032	20,604	NA	94,321	19.6	1,031	9,412	15,509	821	NA				
<b>Total.....</b>	<b>275,910</b>	<b>8.6</b>	<b>3,305</b>	<b>272,753</b>	<b>15,281</b>	<b>47,538</b>	<b>538,924</b>	<b>268,182</b>	<b>8.2</b>	<b>3,720</b>	<b>295,891</b>	<b>18,870</b>	<b>40,403</b>	<b>556,058</b>				

<sup>a</sup> Preliminary. NA Not available.

<sup>1</sup> Represents crude oil used as fuel on leases and for general industrial purposes.

## RESIDUAL FUEL OIL

The total demand for residual fuel oil in 1964 was 574,928,000 barrels. This includes a domestic demand of 556,058,000 barrels, and 18,870,000 barrels that was exported. Total demand increased 3.7 percent for the year, reflecting an increase of 3.2 percent in domestic demand and an increase of 23.5 percent in exports.

The supply of residual fuel oil available from domestic sources declined in 1964, though not as much as in 1963, and additional imports were needed to meet demand requirements. The refinery output of residual declined at an average rate of 21,000 barrels per day in 1964. Imports rose from 747,000 barrels per day in 1963 to 808,000 barrels per day in 1964, an increase of 8.5 percent. Imports subject to quota regulations of the Oil Imports Administration totaled 628,000 barrels daily in 1964, compared with 561,000 barrels for 1963. Residual fuel oil imported in bond for use as bunker fuel for vessels engaged in foreign trade, imports by the military for offshore use, imports from Puerto Rico, and overland receipts from Canada and Mexico are exempt from the quota regulations.

During 1964 residual fuel oil shipments from the gulf coast to PAD District I totaled 31,377,000 barrels, slightly less than corresponding shipments in 1963.

The average tanker rate for Bunker "C" fuel oil from the gulf coast to destinations north of Cape Hatteras was 48.4 cents per barrel in 1964, compared with 50.1 cents in 1963.

TABLE 51.—Consumption of residual fuel oil<sup>1</sup> in the United States, by uses

(Thousand barrels)

	1960	1961	1962	1963	1964
Heating oils.....	125, 088	121, 097	125, 164	125, 248	126, 215
Industrial (excluding oil company fuel).....	157, 270	153, 766	156, 221	149, 269	157, 176
Oil-company use (excluding heating oil).....	45, 061	44, 399	45, 978	46, 976	43, 098
Gas and electric public utility powerplants.....	85, 408	87, 881	88, 261	91, 615	97, 595
Railroads.....	5, 610	5, 347	5, 501	5, 342	5, 350
Bunkering of vessels (including company tankers but excluding military).....	94, 084	87, 308	84, 415	76, 502	83, 024
Military use (U.S. Army, Navy, Air Force, and Marine Corps).....	31, 724	36, 762	35, 667	36, 444	35, 568
Miscellaneous uses.....	6, 291	6, 426	7, 226	7, 126	8, 606
Total United States.....	550, 536	542, 986	548, 433	538, 522	556, 632

Includes Navy grade and crude oil burned as fuel.

## LUBRICANTS

The domestic demand for lubricants in 1964 was 5.1 percent higher than in 1963, however, exports decreased 0.9 percent, and total demand for the year was up 3.3 percent.

There were no changes in the posted prices of lubricating oils in 1964.

TABLE 52.—Consumption of residual fuel oil<sup>1</sup> in the United States, by PAD districts and States

(Thousand barrels)

District and State	1960	1961	1962	1963	1964
<b>District 1:</b>					
Connecticut.....	14,450	14,549	16,019	16,260	19,848
Delaware.....	6,081	4,986	4,775	4,707	4,473
District of Columbia.....	2,387	1,955	2,243	2,533	3,914
Florida.....	28,978	32,600	37,044	36,698	39,425
Georgia.....	6,413	5,048	5,285	5,663	7,049
Maine.....	5,742	6,366	5,985	5,332	7,546
Maryland.....	16,490	12,955	13,751	13,270	14,444
Massachusetts.....	38,942	40,242	41,852	37,693	43,320
New Hampshire.....	2,324	2,067	2,545	2,524	2,588
New Jersey.....	42,791	42,990	50,422	50,539	50,135
New York.....	76,586	83,518	89,667	88,606	84,596
North Carolina.....	4,537	4,738	3,725	3,318	3,781
Pennsylvania.....	42,731	38,070	41,422	42,245	43,636
Rhode Island.....	9,502	7,543	8,274	8,177	8,218
South Carolina.....	4,634	5,031	5,908	5,833	5,050
Vermont.....	498	5,540	629	607	413
Virginia.....	17,448	14,195	13,225	14,055	15,516
West Virginia.....	1,451	1,216	1,480	1,572	2,287
<b>Total.....</b>	<b>321,985</b>	<b>319,509</b>	<b>344,251</b>	<b>339,602</b>	<b>356,249</b>
<b>District 2:</b>					
Illinois.....	25,893	25,750	24,756	25,582	21,411
Indiana.....	12,885	11,988	10,736	10,756	11,464
Iowa.....	1,021	1,032	873	931	1,034
Kansas.....	2,249	1,433	1,533	1,565	1,127
Kentucky.....	321	278	389	460	559
Michigan.....	11,242	9,896	9,275	9,746	8,905
Minnesota.....	6,363	5,524	6,307	6,102	5,671
Missouri.....	3,026	2,638	2,131	2,335	2,400
Nebraska.....	378	419	626	1,133	958
North Dakota.....	663	552	524	553	678
Ohio.....	11,382	9,023	8,227	7,790	9,233
Oklahoma.....	1,396	873	967	797	825
South Dakota.....	60	36	152	245	106
Tennessee.....	184	171	105	275	287
Wisconsin.....	4,275	4,028	3,813	4,110	4,145
<b>Total.....</b>	<b>81,338</b>	<b>73,641</b>	<b>70,414</b>	<b>72,380</b>	<b>68,803</b>
<b>District 3:</b>					
Alabama.....	4,202	3,555	2,749	3,184	2,274
Arkansas.....	474	379	566	864	750
Louisiana.....	8,599	8,537	6,563	6,653	7,293
Mississippi.....	339	338	474	878	826
New Mexico.....	173	311	323	209	146
Texas.....	22,102	21,437	18,711	17,485	17,509
<b>Total.....</b>	<b>35,889</b>	<b>34,557</b>	<b>29,386</b>	<b>29,273</b>	<b>28,798</b>
<b>District 4:</b>					
Colorado.....	1,790	2,465	2,497	2,572	2,617
Idaho.....	201	422	223	260	433
Montana.....	2,022	2,533	3,049	2,836	2,356
Utah.....	5,562	5,654	6,048	5,790	5,502
Wyoming.....	1,738	2,555	3,288	2,490	2,241
<b>Total.....</b>	<b>11,313</b>	<b>13,629</b>	<b>15,105</b>	<b>13,948</b>	<b>13,149</b>
<b>District 5:</b>					
Alaska.....	695	641	715	742	800
Arizona.....	95	94	117	60	113
California.....	78,774	81,587	68,949	62,842	66,927
Hawaii.....	5,613	6,646	6,716	6,940	7,539
Nevada.....	202	258	165	180	133
Oregon.....	5,453	4,879	4,989	4,930	5,314
Washington.....	9,179	7,545	7,626	7,625	8,807
<b>Total.....</b>	<b>100,011</b>	<b>101,650</b>	<b>89,277</b>	<b>83,319</b>	<b>89,633</b>
<b>Total United States.....</b>	<b>550,536</b>	<b>542,986</b>	<b>548,433</b>	<b>538,522</b>	<b>556,632</b>

<sup>1</sup>Includes some crude oil burned as fuel.

TABLE 53.—Monthly average prices of residual fuel oil in the United States, 1963-64

(Dollars per barrel)

Year and grade	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1963:													
No. 6 fuel oil at refineries, Oklahoma.....	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90	1.90
No. 5 fuel oil at New York Harbor.....	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.85	2.87	2.85
Bunker "C" for ships:													
New York.....	2.31	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
New Orleans.....	2.20	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19
San Pedro.....	2.30	2.30	2.30	2.30	2.30	2.21	2.20	2.20	2.20	2.20	2.20	2.20	2.24
1964:													
No. 6 fuel oil at refineries, Oklahoma.....	2.10	2.10	2.10	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.08	2.03
No. 5 fuel oil at New York Harbor.....	2.89	2.89	2.87	2.84	2.84	2.84	2.84	2.84	2.84	2.84	2.83	2.78	2.84
Bunker "C" for ships:													
New York.....	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30
New Orleans.....	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19
San Pedro.....	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20	2.20

Source: Platt's Oil Price Handbook.

TABLE 54.—Salient statistics of lubricants in the United States, by months and districts

(Thousand barrels unless otherwise stated)

Month and district	1963											
	Production				Yield (per- cent)	Imports (all types)	Exports (all types)	Stocks, end of period				Domestic demand (all types)
	Bright stock	Neutral	Other grades	Total				Bright stock	Neutral	Other grades	Total	
<b>By months:</b>												
January.....	653	2,038	2,410	5,110	1.9		1,124	1,350	3,548	8,445	13,343	3,773
February.....	599	1,981	2,264	4,844	1.9	2	1,345	1,570	3,698	8,515	13,783	3,061
March.....	582	2,181	2,359	5,122	1.9	3	1,402	1,614	3,895	8,638	14,147	3,359
April.....	780	1,890	2,536	5,206	2.1		1,858	1,653	3,770	8,255	13,678	3,817
May.....	598	2,091	2,789	5,478	2.1	2	1,810	1,464	3,662	8,114	13,240	4,108
June.....	659	1,864	2,729	5,252	1.9	2	1,308	1,424	3,643	8,313	13,380	3,806
July.....	679	2,153	2,738	5,570	2.0	2	1,771	1,399	3,685	8,363	13,447	3,734
August.....	533	2,041	2,848	5,422	2.0	4	1,463	1,379	3,707	8,364	13,460	3,960
September.....	634	1,970	2,763	5,367	2.0	3	1,567	1,565	3,756	8,494	13,815	3,438
October.....	563	2,199	2,671	5,433	2.0	2	1,482	1,555	3,926	7,954	13,435	4,333
November.....	621	2,118	2,575	5,314	2.1	1	1,391	1,593	3,984	8,458	14,035	3,324
December.....	524	2,108	2,336	4,968	1.8	2	1,796	1,567	4,500	8,254	14,321	2,888
<b>Total.....</b>	<b>7,425</b>	<b>24,634</b>	<b>31,027</b>	<b>63,086</b>	<b>2.0</b>	<b>23</b>	<b>18,317</b>	<b>1,567</b>	<b>4,500</b>	<b>8,254</b>	<b>14,321</b>	<b>43,601</b>
<b>By districts:</b>												
East Coast.....	1,148	2,971	3,841	7,960	1.8							
Appalachian No. 1.....	1,212	1,459	644	3,315	8.6	14			334	589	2,342	3,265
Appalachian No. 2.....		266	149	415	1.1				237	328	271	836
Indiana, Illinois, Kentucky, etc.	957	4,049	310	5,316	.9				3	35	112	150
Minnesota, Wisconsin, etc.						6			74	616	1,198	1,888
Oklahoma, Kansas, etc.										27	27	823
Texas Inland.....	1,053	2,790	1,207	5,050	1.9				271	343	209	827
Texas Gulf Coast.....			156	156	.2					39	39	39
Louisiana Gulf Coast.....	1,810	5,452	18,072	25,334	3.5				289	1,373	2,565	4,227
Arkansas, Louisiana Inland.....	809	5,753	1,150	7,712	2.7	2			28	575	202	805
New Mexico.....			1,820	1,916	4.3					10	352	362
Rocky Mountain.....	49	233	82	364	.3	1				3	3	3
West Coast.....	367	1,565	3,596	5,548	1.1		1,519		8	58	47	113
<b>Total.....</b>	<b>7,425</b>	<b>24,634</b>	<b>31,027</b>	<b>63,086</b>	<b>2.0</b>	<b>23</b>	<b>18,317</b>	<b>1,567</b>	<b>4,500</b>	<b>8,254</b>	<b>14,321</b>	<b>43,601</b>

See footnotes at end of table.

By months:												
January.....	667	1,760	2,723	5,150	1.9	4	1,202	1,809	4,082	8,400	14,291	3,982
February.....	519	1,705	2,604	4,828	1.9	2	1,436	1,803	4,038	8,489	14,390	3,355
March.....	548	2,019	2,640	5,207	1.9	3	1,366	1,760	4,172	8,467	14,399	3,775
April.....	535	2,063	2,687	5,285	2.1	4	1,980	1,571	3,633	8,114	13,318	4,390
May.....	492	1,896	3,009	5,397	2.0	2	1,276	1,887	3,400	8,551	13,838	3,603
June.....	586	1,961	2,703	5,250	1.9	5	1,637	1,787	3,237	8,118	13,142	4,314
July.....	467	2,052	2,838	5,357	1.9	4	1,650	1,629	3,103	8,153	12,885	3,968
August.....	729	1,744	2,942	5,415	1.9	2	1,691	1,529	3,214	8,146	12,889	3,722
September.....	517	2,103	2,664	5,284	2.0	3	1,246	1,554	3,523	7,929	13,006	3,924
October.....	525	2,123	2,783	5,431	2.0	5	1,659	1,497	3,556	7,990	13,043	3,740
November.....	586	2,158	2,603	5,347	2.0	1	1,479	1,596	3,747	7,980	13,323	3,589
December.....	569	2,077	3,071	5,717	2.0	2	1,538	1,609	3,967	8,486	14,062	3,442
Total.....	6,740	23,661	33,267	63,668	2.0	37	18,160	1,609	3,967	8,486	14,062	45,804
By districts:												
East Coast.....	936	2,525	4,614	8,075	1.8	31	16,674	226	510	2,339	3,075	NA
Appalachian No. 1.....	1,041	1,430	739	3,210	8.1			220	264	278	762	
Appalachian No. 2.....	1	130	268	399	1.1			3	36	97	136	
Indiana, Illinois, Kentucky, etc.....	1,068	4,064	477	5,609	.9	3	16,674	82	632	1,109	1,823	NA
Minnesota, Wisconsin, etc.....												
Oklahoma, Kansas, etc.....	857	2,920	1,048	4,825	1.8			126	475	202	803	
Texas Inland.....			156	156	.1					37	37	
Texas Gulf Coast.....	1,872	5,462	18,598	25,932	3.5			281	1,039	2,752	4,072	
Louisiana Gulf Coast.....	703	5,530	1,203	7,436	2.4			60	773	284	1,117	
Arkansas, Louisiana Inland, etc.....		67	1,945	2,012	4.3			21	3	339	363	
New Mexico.....										3	3	
Rocky Mountain.....	42	223	72	337	.3	1		11	31	42	84	
West Coast.....	220	1,310	4,147	5,677	1.2	2	1,486	579	204	969	1,752	
Total.....	6,740	23,661	33,267	63,668	2.0	37	18,160	1,609	3,967	8,486	14,062	45,804

▷ Preliminary. NA Not Available.



TABLE 55.—Average monthly refinery prices of five selected grades of lubricating oil in the United States

(Cents per gallon)

Year and grade	January	February	March	April	May	June	July	August	September	October	November	December	Average for year
1963:													
Oklahoma:													
200 viscosity, No. 3 color, neutral.....	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50
150-160 viscosity at 210° bright stock, 10-25 pour test.....	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50
Pennsylvania:													
200 viscosity, No. 3 color, neutral 420-425 flash, 25 pour test.....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
600 steam-refined, cylinder stock, filterable.....	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
South Texas: 500 viscosity, No. 2½-3½ color, neutral.....	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
1964:													
Oklahoma:													
200 viscosity, No. 3 color, neutral.....	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50	21.50
150-160 viscosity at 210° bright stock, 10-25 pour test.....	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50	24.50
Pennsylvania:													
200 viscosity, No. 2 color, neutral 420-425 flash, 25 pour test.....	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
600 steam-refined, cylinder stock, filterable.....	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
South Texas: 500 viscosity, No. 2½-3½ color, neutral.....	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00

Source: Platt's Oil Price Handbook.

**JET FUEL (MILITARY GRADE)**

The jet fuel included in this category represents that used by the military or by aircraft and missile manufactures which are testing equipment for the U.S. Government.

The total demand for military-grade jet fuels in 1964 was 118,751,000 barrels, an increase of 2.9 percent for the year. Production increased 8.6 million barrels in 1964. The increase in production was accompanied by an 18.9 percent decline in imports (2,829,000 barrels) and a stock increase of 1.4 million barrels.

Reporting of military jet fuels by grades was initiated in 1963 and is continuing. The JP-4 grade is a wide-cut gasoline type; JP-5 is a high flashpoint kerosine type; and the other grades include special type jet, jet propellant, and rocket fuels blended to military specifications.

TABLE 56.—Salient statistics of military jet fuel in the United States, 1963–64, by months and districts  
(Thousand barrels)

Month and district	1963								1964 <sup>p</sup>										
	Production				Im-ports	Ex-ports	Stocks, end of period	Do-mestic demand	Production				Im-ports	Ex-ports	Stocks, end of period	Do-mestic demand			
	JP-4 grade <sup>1</sup>	JP-5 grade	Other military grades	Total					JP-4 grade <sup>1</sup>	JP-5 grade	Other military grades	Total							
<b>By months:</b>																			
January.....	6,700	640	331	7,680	2,034	13	9,774	9,595	6,388	881	512	7,781	1,948	36	8,510	9,727			
February.....	6,300	400	393	7,093	405	20	8,979	8,273	6,682	872	354	7,908	931	13	8,982	8,354			
March.....	6,979	1,071	309	8,359	-----	9	9,792	7,537	7,521	1,209	405	9,135	1,231	14	9,882	9,452			
April.....	6,697	1,200	298	8,195	863	33	9,287	9,530	7,602	954	408	8,864	707	14	9,158	10,281			
May.....	7,156	1,147	295	8,598	2,114	10	9,628	10,361	7,897	1,074	530	9,501	1,131	11	9,331	10,448			
June.....	7,412	1,181	359	8,952	149	10	10,180	8,539	8,183	1,336	358	9,877	1,242	11	8,580	11,859			
July.....	7,476	1,095	543	9,114	1,655	9	10,245	10,695	8,378	1,166	471	10,015	1,213	12	9,497	10,299			
August.....	7,351	1,174	377	8,902	2,329	12	9,619	11,845	8,593	1,360	440	10,393	1,550	9	10,701	10,730			
September.....	6,885	1,212	444	8,541	1,312	11	9,310	10,151	7,747	922	227	8,896	640	12	9,577	10,648			
October.....	6,641	590	603	7,834	2,403	13	8,589	10,945	7,195	1,202	322	8,719	542	9	9,073	9,756			
November.....	7,110	881	345	8,336	1,004	39	8,912	8,978	7,215	1,061	415	8,691	852	13	8,907	9,696			
December.....	6,473	850	433	7,756	679	15	8,544	8,788	7,175	640	398	8,213	131	16	9,904	7,331			
<b>Total.....</b>	<b>83,189</b>	<b>11,441</b>	<b>4,730</b>	<b>99,360</b>	<b>14,947</b>	<b>194</b>	<b>8,544</b>	<b>115,237</b>	<b>90,476</b>	<b>12,677</b>	<b>4,840</b>	<b>107,993</b>	<b>12,118</b>	<b>170</b>	<b>9,904</b>	<b>118,581</b>			
<b>By districts:</b>																			
East Coast.....	2,353	-----	220	2,573	13,308	66	221	1,090	1,565	462	173	2,200	10,804	19	483	NA			
Appalachian No. 1.....	318	-----	318	318													9	270	270
Appalachian No. 2.....	97	92	189	156													124	273	397
Indiana, Illinois, Kentucky, etc.....	9,132	337	1,821	11,290	778	-----	-----	9,003	260	1,970	11,233	938	-----	-----	-----	-----			
Minnesota, Wisconsin, North and South Dakota.....	1,723	-----	217	1,940	-----	-----	221	1,941	-----	-----	1,941	1,941	-----	-----	227	-----			
Oklahoma, Kansas, Missouri, etc.....	12,253	775	233	13,261	-----	-----	1,090	10,860	708	499	12,067	-----	-----	19	995	-----			
Texas Inland.....	11,025	250	875	12,160	-----	-----	604	12,604	270	791	13,665	-----	-----	-----	869	-----			
Texas Gulf.....	12,181	3,303	1,040	16,524	-----	-----	1,066	14,931	3,488	1,057	19,476	-----	-----	-----	1,994	-----			
Louisiana Gulf Coast.....	10,068	2,128	232	12,428	-----	-----	1,167	12,953	1,956	262	15,171	-----	-----	-----	1,223	-----			
Arkansas, Louisiana Inland, etc.....	1,551	-----	92	1,643	-----	-----	194	1,537	-----	88	1,625	-----	-----	-----	284	-----			
New Mexico.....	1,556	8	-----	1,564	-----	-----	165	1,373	-----	-----	1,373	-----	-----	-----	152	-----			
Rocky Mountain.....	5,789	-----	-----	5,789	-----	-----	611	5,944	-----	-----	5,944	-----	-----	-----	587	-----			
West Coast.....	15,143	4,538	-----	19,681	1,639	128	2,010	17,371	5,260	-----	22,631	1,314	151	2,093	-----	-----			
<b>Total.....</b>	<b>83,189</b>	<b>11,441</b>	<b>4,730</b>	<b>99,360</b>	<b>14,947</b>	<b>194</b>	<b>8,544</b>	<b>115,237</b>	<b>90,476</b>	<b>12,677</b>	<b>4,840</b>	<b>107,993</b>	<b>12,118</b>	<b>170</b>	<b>9,904</b>	<b>118,581</b>			

<sup>p</sup> Preliminary. NA Not Available.

<sup>1</sup> Includes military jet fuel produced at natural gas liquid plants: Texas Gulf, 1963–49; 1964–114; Arkansas, Louisiana Inland, etc., 1963–566; 1964–295.

**LIQUEFIED GASES, ETHANE, AND ETHYLENE**

Liquefied gases are derived from two sources. The gas produced at refineries is called liquefied refinery gas to distinguish it from natural gas, which is called liquefied petroleum gas. The liquefied petroleum gases (LPG) are all saturated (that is, propane, butane, etc.). The liquefied refinery gases (LRG) may contain unsaturated compounds or olefine (that is, propylene, butylene, etc.). The olefins are used as feedstock for chemical plants. The saturated gases may be used as chemical raw materials or as fuel. Beginning with 1963, separate data have been collected on liquefied refinery gas used as fuel and that used as raw material for petrochemical feedstocks. Liquefied gases are also used in producing gasoline and are reported in this chapter as natural gas liquids used at refineries or as gasoline. Although ethane and ethylene are not defined as liquefied gases, the statistics on these products are in some cases reported with those of LPG and LRG.

The production of liquefied gases, ethane, and ethylene (but excluding LRG used as petrochemical feedstocks) in 1964 was 315.0 million barrels. This included 59.2 million barrels produced at petroleum refineries and 255.8 million barrels produced at natural-gas-processing plants. The total demand for liquefied gases in 1964 was 250.4 million barrels. This excludes 64.4 million barrels delivered from natural-gas-processing plants and terminals for blending into motor fuel, and 47.2 million barrels of LRG used as petrochemical feedstocks.

More detailed information on liquefied gases may be found in the chapter on natural gas liquids.

TABLE 57.—Salient statistics of liquefied gases and ethane in the United States, by months and districts<sup>1</sup>

(Thousand barrels unless otherwise stated)

Month and district	1963							1964 <sup>p</sup>						
	Refinery production	Yield (per cent)	Transfers from gasoline plants	Imports	Exports	Stocks, end of period	Domestic demand	Refinery production	Yield (per cent)	Transfers from gasoline plants	Imports	Exports	Stocks, end of period	Domestic demand
<b>By months:</b>														
January.....	7,279	2.6	22,952	346	362	3,307	31,677	8,874	3.2	22,110	420	404	3,272	31,614
February.....	6,767	2.7	18,749	364	388	2,569	26,230	8,436	3.3	17,137	447	386	3,088	25,868
March.....	7,803	2.9	14,288	220	428	3,124	21,328	9,417	3.5	15,048	321	433	3,355	24,036
April.....	7,783	3.1	11,342	218	358	3,611	18,498	9,046	3.5	12,330	246	410	3,523	21,044
May.....	8,211	3.1	11,333	101	362	4,436	18,458	8,959	3.3	11,505	185	437	3,871	19,864
June.....	8,289	3.1	10,822	50	369	4,853	18,375	9,129	3.4	11,354	232	498	4,291	19,797
July.....	8,544	3.1	12,948	81	396	5,100	20,930	9,273	3.2	12,824	352	475	4,578	21,687
August.....	8,545	3.1	13,102	93	378	5,291	21,171	8,830	3.1	14,012	266	485	4,701	22,500
September.....	7,893	3.0	12,355	180	390	5,510	19,819	8,507	3.1	14,093	298	413	4,569	22,617
October.....	7,829	2.9	13,755	237	379	5,311	21,641	8,912	3.2	16,338	416	426	4,951	24,858
November.....	7,676	2.9	16,787	252	364	5,093	24,569	8,192	3.1	17,076	410	462	4,650	25,517
December.....	8,738	3.2	23,609	374	419	3,886	33,509	8,937	3.2	22,891	535	529	3,692	32,792
<b>Total.....</b>	<b>95,357</b>	<b>3.0</b>	<b>182,042</b>	<b>2,516</b>	<b>4,593</b>	<b>3,886</b>	<b>276,205</b>	<b>106,512</b>	<b>3.3</b>	<b>186,718</b>	<b>4,128</b>	<b>5,358</b>	<b>3,692</b>	<b>292,194</b>
<b>By districts:</b>														
East Coast.....	11,335	2.5	NA	401		343	NA	12,260	2.7	NA	308		458	NA
Appalachian No. 1.....	681	1.8				10		9						
Appalachian No. 2.....	430	1.1				2		2						
Indiana, Illinois, Kentucky, etc.....	11,895	2.1	NA	1,097		547	NA	13,476	2.3	NA	2,509		624	NA
Minnesota, Wisconsin, North and South Dakota.....	1,059	2.2				14		16						
Oklahoma, Kansas, etc.....	7,570	2.8				345		352						
Texas Inland.....	2,929	2.6	NA		3,722	95	NA	3,096	2.6	NA	2		100	NA
Texas Gulf Coast.....	33,759	4.5				1,018		910						
Louisiana Gulf Coast.....	10,812	3.8				502		313						
Arkansas, Louisiana Inland, etc.....	1,019	2.3	NA			8	NA	1,878	4.1	NA			10	NA
New Mexico.....	301	3.0				4		4						
Rocky Mountain.....	1,634	1.5				23		19						
West Coast.....	11,933	2.5	NA	1,008	871	975	NA	12,088	2.5	NA	1,197	928	875	NA
<b>Total.....</b>	<b>95,357</b>	<b>3.0</b>	<b>182,042</b>	<b>2,516</b>	<b>4,593</b>	<b>3,886</b>	<b>276,205</b>	<b>106,512</b>	<b>3.3</b>	<b>186,718</b>	<b>4,128</b>	<b>5,358</b>	<b>3,692</b>	<b>292,194</b>

<sup>p</sup> Preliminary. NA Not available.<sup>1</sup> Includes L. R. G. used as petrochemical feedstocks.

## ASPHALT AND ROAD OIL

The total demand for asphalt in 1964 was 21,984,000 short tons, an increase of 2.4 percent for the year. Shipments of asphalt and asphaltic products for domestic consumption increased 2.5 percent in 1964. Asphalt for paving purposes declined 1 percent, whereas use for roofing and "all other" increased by about 13 percent.

Road oil production declined 6.2 percent in 1964; the demand, or apparent domestic consumption, declined 5.3 percent, and stocks declined 23 percent. Production for the year was 6,371,000 barrels and demand totaled 6,545,000 barrels.

TABLE 58.—Statistical summary of petroleum asphalt and road oil

(Thousand short tons) <sup>1</sup>

	1960	1961	1962	1963	▷ 1964
<b>Petroleum asphalt:</b>					
Production.....	17,940	18,513	19,923	20,354	20,887
Imports (including natural).....	1,117	1,201	1,204	1,130	1,075
Exports.....	168	121	150	128	139
Stocks (end of period).....	2,362	2,363	2,591	2,610	2,538
Apparent domestic consumption.....	18,518	19,592	20,749	21,337	21,845
<b>Petroleum asphalt shipments:</b>					
Paving.....	14,674	15,318	16,322	16,947	16,771
Roofing.....	3,525	3,635	3,842	3,821	4,394
All other.....	1,855	1,755	1,932	1,879	2,043
Total.....	20,054	20,708	22,096	22,647	23,208
<b>Road oil:</b>					
Production.....	1,085	1,058	1,287	1,235	1,158
Stocks (end of period).....	135	138	159	137	105
Apparent domestic consumption.....	1,069	1,055	1,266	1,257	1,190
Road oil shipments.....	1,177	1,083	1,109	* 1,099	1,139

▷ Preliminary. \* Revised.

<sup>1</sup> Converted from barrels to short tons (5.5 barrels=1 short ton).

TABLE 59.—Salient statistics of petroleum asphalt in the United States, by months and districts

(Thousand short tons) <sup>1</sup>

Month and district	1963					P 1964				
	Production	Imports (including natural)	Exports	Stocks (end of period)	Domestic demand	Production	Imports (including natural)	Exports	Stocks (end of period)	Domestic demand
<b>Month:</b>										
January.....	902	87	1	2,967	611	806	64	9	2,875	596
February.....	834	40	9	3,314	518	1,010	25	9	3,298	605
March.....	1,185	77	8	3,769	799	1,325	42	8	3,866	791
April.....	1,564	85	7	4,336	1,075	1,454	50	14	4,058	1,297
May.....	2,010	90	11	3,809	2,617	2,031	89	7	4,000	2,170
June.....	2,200	117	6	3,609	2,511	2,317	191	17	3,668	2,823
July.....	2,341	126	8	3,057	3,012	2,469	151	11	3,241	3,037
August.....	2,397	149	13	2,635	2,955	2,483	105	10	2,791	3,028
September.....	2,247	107	8	2,323	2,658	2,268	108	19	2,324	2,824
October.....	2,052	111	18	1,885	2,583	2,129	95	10	2,012	2,526
November.....	1,488	53	10	2,159	1,256	1,490	82	14	2,128	1,440
December.....	1,134	88	29	2,610	742	1,105	73	11	2,588	708
<b>Total.....</b>	<b>20,354</b>	<b>1,130</b>	<b>128</b>	<b>2,610</b>	<b>21,337</b>	<b>20,887</b>	<b>1,075</b>	<b>139</b>	<b>2,588</b>	<b>21,845</b>
<b>District:</b>										
East Coast.....	4,748	} NA	} 108	738	} NA	4,827	} NA	} 108	694	} NA
Appalachian No. 1.....	303			76		299			47	
Appalachian No. 2.....	579			44		572			72	
Illinois, Indiana, Kentucky, etc.....	3,881			410		3,989			399	
Minnesota, Wisconsin, North Dakota.....	288			23		326			24	
Oklahoma, Kansas, etc.....	1,993			281		2,132			306	
Texas Inland.....	995			103		1,005			94	
Texas Gulf Coast.....	1,416			99		1,406			86	
Louisiana Gulf Coast.....	977			145		859			146	
Arkansas, Louisiana Inland, etc.....	1,014			130		1,017			138	
New Mexico.....	109			21		141			21	
Rocky Mountain.....	1,188			201		1,348			224	
West Coast.....	2,863			339		2,966			337	
<b>Total.....</b>	<b>20,354</b>			<b>1,130</b>		<b>128</b>			<b>2,610</b>	

P Preliminary. NA Not available.

<sup>1</sup> Converted from barrels to short tons (5.5 barrels=1 short ton).

TABLE 60.—Salient statistics of road oil in the United States, by months and refinery districts

(Short tons)<sup>1</sup>

Month and district	1963			1964 <sup>2</sup>		
	Production	Stocks (end of period)	Domestic demand	Production	Stocks (end of period)	Domestic demand
<b>Month:</b>						
January.....	38,909	176,182	21,818	28,182	154,364	10,727
February.....	33,636	186,909	22,909	34,182	176,727	11,818
March.....	81,454	239,636	28,727	98,727	260,364	15,091
April.....	123,273	296,364	66,545	81,273	308,364	33,273
May.....	120,545	308,727	108,182	93,091	289,273	112,182
June.....	192,909	306,727	194,909	172,364	273,818	187,818
July.....	231,091	258,909	278,909	233,091	220,000	286,909
August.....	183,273	212,727	229,455	174,364	198,909	195,455
September.....	106,182	171,273	147,636	93,273	155,636	136,545
October.....	79,636	154,727	96,182	59,636	96,182	119,091
November.....	24,000	141,818	36,909	60,364	97,818	58,727
December.....	20,001	136,909	24,909	29,818	105,273	22,364
<b>Total.....</b>	<b>1,234,909</b>	<b>136,909</b>	<b>1,257,090</b>	<b>1,158,365</b>	<b>105,273</b>	<b>1,190,000</b>
<b>District:</b>						
East Coast.....	4,727		NA	3,636		NA
Appalachian No. 1.....				1,818		
Appalachian No. 2.....	1,636			342,182	8,909	
Indiana, Illinois, Kentucky, etc.	334,182	8,545				
Minnesota, Wisconsin, North Dakota.....	19,636			27,273		
Oklahoma, Kansas, etc.....	312,182	24,000		322,364	24,364	
Texas Inland.....						
Texas Gulf Coast.....	2,727	545		182	364	
Louisiana Gulf Coast.....	182	182				
Arkansas, Louisiana Inland, etc.						
New Mexico.....			364			
Rocky Mountain.....	346,364	25,455	262,728	19,636		
West Coast.....	213,273	73,182	197,818	52,000		
<b>Total.....</b>	<b>1,234,909</b>	<b>136,909</b>	<b>1,257,090</b>	<b>1,158,365</b>	<b>105,273</b>	<b>1,190,000</b>

<sup>2</sup> Preliminary. NA Not available.

<sup>1</sup> Converted from barrels to short tons (5.5 barrels=1 short ton).



TABLE 61.—Shipments of petroleum-asphalt paving products for consumption in the United States, by PAD districts and States

(Short tons)

District and State	Asphalt cements		Cutback asphalts		Emulsified asphalts		Total	
	1963	1964	1963	1964	1963	1964	1963	1964
<b>District 1:</b>								
Connecticut.....	107,284	108,345	44,639	42,301	4,658	2,586	156,581	153,232
Delaware.....	17,306	18,998	16,589	20,231	2,645	2,396	36,540	41,625
Florida.....	380,942	403,679	84,997	90,540	48,864	47,948	514,803	542,187
Georgia.....	438,466	381,023	107,346	88,997	58,306	38,885	604,118	508,905
Maine.....	64,042	78,778	56,385	64,105	17,460	18,045	137,887	160,928
Maryland and District of Columbia.....	277,271	293,792	77,297	109,519	58,943	54,747	413,511	458,058
Massachusetts.....	276,623	311,489	42,024	37,154	1,289	754	319,936	349,397
New Hampshire.....	43,700	67,335	50,570	48,846	59	149	94,329	116,330
New Jersey.....	346,898	352,162	107,830	113,990	24,782	23,250	479,510	489,402
New York.....	628,783	651,050	362,865	242,675	133,027	110,765	1,124,675	1,004,390
North Carolina.....	197,039	225,256	68,837	74,726	135,611	122,216	401,487	422,198
Pennsylvania.....	405,900	510,268	174,159	186,373	60,411	58,640	640,470	755,281
Rhode Island.....	43,335	76,052	50,778	48,408	602	238	94,715	124,698
South Carolina.....	176,400	158,750	29,261	21,203	61,854	58,290	267,515	238,243
Vermont.....	23,966	12,172	13,793	18,493	244	323	38,003	30,988
Virginia.....	250,273	305,750	94,597	110,912	46,179	37,564	391,049	454,226
West Virginia.....	70,420	79,629	18,488	25,282	12,039	10,069	100,947	114,980
<b>Total.....</b>	<b>3,748,648</b>	<b>4,034,528</b>	<b>1,400,455</b>	<b>1,343,655</b>	<b>666,973</b>	<b>586,865</b>	<b>5,816,076</b>	<b>5,965,048</b>
<b>District 2:</b>								
Illinois.....	264,812	267,708	158,578	147,427	34,872	41,748	458,262	456,883
Indiana.....	271,515	244,056	155,484	188,945	176,440	195,379	603,439	628,380
Iowa.....	232,703	272,229	91,322	76,940	69,155	80,267	393,180	429,436
Kansas.....	258,553	274,820	230,138	189,944	38	16,196	488,729	480,960
Kentucky.....	243,812	187,811	80,233	57,850	67,065	43,597	391,110	289,258
Michigan.....	227,325	166,908	59,338	42,491	50,791	56,927	337,454	266,326
Minnesota.....	223,036	260,263	223,417	209,694	24,086	28,601	470,539	498,558
Missouri.....	190,587	163,086	270,644	251,901	3,741	5,657	464,972	420,644
Nebraska.....	55,092	56,947	74,254	58,739	17,148	1,511	146,494	117,197
North Dakota.....	95,255	89,710	69,868	68,534	39,963	19,822	205,086	178,066
Ohio.....	465,417	426,708	313,046	295,010	187,258	158,818	965,721	880,536
Oklahoma.....	220,733	348,768	219,403	207,765	1,982	546	442,118	557,079
South Dakota.....	71,911	77,842	56,818	59,916	10,498	3,083	139,227	140,841
Tennessee.....	278,874	353,227	60,762	40,848	31,120	41,991	370,756	436,066
Wisconsin.....	185,452	171,976	103,330	77,495	5,064	8,215	294,446	257,636
<b>Total.....</b>	<b>3,285,077</b>	<b>3,362,059</b>	<b>2,166,635</b>	<b>1,973,499</b>	<b>719,821</b>	<b>702,358</b>	<b>6,171,533</b>	<b>6,087,916</b>

District 3:								
Alabama.....	185,056	190,949	73,139	82,957	77,468	63,671	335,663	337,577
Arkansas.....	72,230	64,623	52,995	53,519	23,462	32,534	148,687	150,676
Louisiana.....	151,656	142,858	26,199	20,667	46,034	36,532	223,889	200,057
Mississippi.....	119,485	113,530	56,530	54,443	31,859	33,383	207,874	201,356
New Mexico.....	102,273	129,421	59,291	51,548	4,086	4,852	165,650	185,821
Texas.....	707,910	350,162	220,742	122,112	41,211	25,735	969,863	498,009
Total.....	1,338,610	991,543	488,896	385,246	224,120	196,707	2,051,626	1,573,496
District 4:								
Colorado.....	171,488	153,566	66,287	64,567	23	7,369	237,798	225,502
Idaho.....	40,085	37,880	43,279	39,050	7,674	2,722	91,038	79,652
Montana.....	92,263	158,719	53,670	45,621	13,773	7,281	159,706	214,621
Utah.....	78,375	97,472	39,919	32,151			118,294	129,623
Wyoming.....	63,541	96,991	34,808	28,403	2,682		101,031	125,394
Total.....	445,752	544,628	237,963	212,792	24,152	17,372	707,867	774,792
District 5:								
Alaska.....	5,186	12,655	7,391	6,297	2,181	3,098	14,758	22,050
Arizona.....	91,892	84,118	22,123	26,198	32,334	29,442	146,349	139,758
California.....	1,121,886	1,324,563	145,394	96,378	131,426	134,316	1,398,706	1,555,257
Hawaii.....	21,671	30,974	718	1,769	3,715	2,333	26,104	35,076
Nevada.....	87,339	86,275	17,036	13,641	2,197	1,426	106,572	101,342
Oregon.....	187,950	233,154	41,551	47,917	17,133	30,054	246,634	311,125
Washington.....	153,672	162,176	96,521	80,967	10,971	11,650	261,164	254,793
Total.....	1,669,596	1,933,915	330,734	273,167	199,957	212,319	2,200,287	2,419,401
Total United States.....	10,487,683	10,866,673	4,624,683	4,188,359	1,835,023	1,715,621	16,947,389	16,770,653

TABLE 62.—Shipments of petroleum-asphalt roofing products for consumption in the United States, by PAD districts and States

(Short tons)

District and State	Asphalt cements and fluxes		Emulsified asphalts		Total	
	1963	1964	1963	1964	1963	1964
<b>District 1:</b>						
Connecticut.....	10,541	12,357			10,541	12,357
Delaware.....	4,765	40,077			4,765	40,077
Florida.....	85,805	117,470	2	6	85,807	117,476
Georgia.....	189,358	186,297	114	94	189,472	186,391
Maine.....						
Maryland and District of						
Columbia.....	67,867	67,865	57		67,924	67,865
Massachusetts.....	58,829	59,670	2	1	58,831	59,671
New Hampshire.....	424	892			424	892
New Jersey.....	337,724	368,754		3	337,724	368,757
New York.....	31,001	78,193			31,001	78,193
North Carolina.....	43,071	82,223		13	43,071	82,236
Pennsylvania.....	186,370	197,092	1	25	186,371	197,117
Rhode Island.....	40,006	41,987	3	1	40,009	41,988
South Carolina.....	61,079	69,597		12	61,079	69,609
Vermont.....	18	9			18	9
Virginia.....	9,265	7,980	15		9,280	7,980
West Virginia.....	6,993	40,424			6,993	40,424
<b>Total</b> .....	<b>1,133,116</b>	<b>1,370,887</b>	<b>194</b>	<b>155</b>	<b>1,133,310</b>	<b>1,371,042</b>
<b>District 2:</b>						
Illinois.....	509,205	868,710		1	509,205	868,711
Indiana.....	124,407	122,311	1		124,408	122,311
Iowa.....	5,695	4,457			5,695	4,457
Kansas.....	39,019	18,597	112		39,131	18,597
Kentucky.....	1,418	1,738	4	7	1,422	1,745
Michigan.....	87,323	61,847		1	87,323	61,848
Minnesota.....	146,548	123,886			146,548	123,886
Missouri.....	185,052	121,742		1	185,052	121,743
Nebraska.....	10,506	6,622	43	42	10,549	6,664
North Dakota.....	3,097	3,747			3,097	3,747
Ohio.....	205,830	255,430	2,702	9,900	208,532	265,330
Oklahoma.....	50,614	47,403		1,970	50,614	49,373
South Dakota.....	2,208	3,961			2,208	3,961
Tennessee.....	24,312	50,325	21		24,333	50,325
Wisconsin.....	9,675	11,796	1		9,676	11,796
<b>Total</b> .....	<b>1,404,909</b>	<b>1,702,572</b>	<b>2,884</b>	<b>11,922</b>	<b>1,407,793</b>	<b>1,714,494</b>
<b>District 3:</b>						
Alabama.....	134,048	165,925	145	141	134,193	166,066
Arkansas.....	58,030	76,331			58,030	76,331
Louisiana.....	126,709	115,729	2		126,711	115,729
Mississippi.....	37,575	39,102	2		37,577	39,102
New Mexico.....	17,007	8,218		190	17,007	8,408
Texas.....	246,720	227,669	71	1,503	246,791	229,172
<b>Total</b> .....	<b>620,089</b>	<b>632,974</b>	<b>220</b>	<b>1,834</b>	<b>620,309</b>	<b>634,808</b>
<b>District 4:</b>						
Colorado.....	46,094	23,248			46,094	23,248
Idaho.....	3,525	3,344			3,525	3,344
Montana.....	4,879	5,622			4,879	5,622
Utah.....	17,850	15,717			17,850	15,717
Wyoming.....	2,034	1,200			2,034	1,200
<b>Total</b> .....	<b>74,382</b>	<b>49,131</b>			<b>74,382</b>	<b>49,131</b>
<b>District 5:</b>						
Alaska.....	1,664	1,244		12	1,664	1,256
Arizona.....	221	192			221	192
California.....	432,726	475,872	87	294	432,813	476,166
Hawaii.....	6,334	6,836	14		6,348	6,836
Nevada.....	2,051	1,903			2,051	1,903
Oregon.....	101,678	100,008	31	31	101,709	100,039
Washington.....	40,654	37,690	27	158	40,681	37,848
<b>Total</b> .....	<b>585,328</b>	<b>623,745</b>	<b>159</b>	<b>495</b>	<b>585,487</b>	<b>624,240</b>
<b>Total United States</b> .....	<b>3,817,824</b>	<b>4,379,309</b>	<b>3,457</b>	<b>14,406</b>	<b>3,821,281</b>	<b>4,393,715</b>

TABLE 63.—Shipments of all other petroleum-asphalt products for consumption in the United States, by PAD districts and States

(Short tons)

District and State	Asphalt cements and fluxes		Emulsified		Total	
	1963	1964	1963	1964	1963	1964
<b>District 1:</b>						
Connecticut.....	26,554	13,122	424	547	26,978	13,669
Delaware.....	3,739	4,372	8	-----	3,747	4,372
Florida.....	70,956	73,279	568	525	71,524	73,804
Georgia.....	84,323	100,431	781	840	85,104	101,271
Maine.....	4,064	2,613	118	133	4,182	2,746
Maryland and District of Columbia.....	36,845	36,535	1,093	1,085	37,938	37,620
Massachusetts.....	54,576	60,286	1,374	1,590	55,950	61,876
New Hampshire.....	517	1,052	23	45	540	1,097
New Jersey.....	213,287	188,532	2,476	1,102	215,763	189,634
New York.....	36,410	26,944	2,136	2,150	38,546	29,094
North Carolina.....	55,862	37,100	5,243	1,200	61,105	38,300
Pennsylvania.....	112,722	106,984	5,142	5,955	117,864	112,939
Rhode Island.....	6,764	31,557	195	264	6,949	31,821
South Carolina.....	18,363	2,739	4,731	6,176	23,094	8,915
Vermont.....	1,235	325	20	16	1,255	341
Virginia.....	41,664	15,554	1,138	899	42,802	16,453
West Virginia.....	28,772	9,107	62	-----	28,834	9,107
<b>Total.....</b>	<b>796,643</b>	<b>710,532</b>	<b>25,532</b>	<b>22,527</b>	<b>822,175</b>	<b>733,059</b>
<b>District 2:</b>						
Illinois.....	183,351	204,599	13,221	7,567	196,572	212,166
Indiana.....	80,963	78,624	441	35	81,404	78,659
Iowa.....	5,015	6,383	2,783	1,805	7,798	8,188
Kansas.....	14,270	14,680	68	9	14,338	14,689
Kentucky.....	1,141	2,410	1,665	1,258	2,806	3,668
Michigan.....	42,991	41,490	4,979	16,625	47,970	58,115
Minnesota.....	20,021	46,542	805	1,217	20,826	47,759
Missouri.....	58,516	97,094	2,484	2,722	61,000	99,816
Nebraska.....	2,518	2,372	23	59	2,541	2,431
North Dakota.....	613	616	21	2	634	618
Ohio.....	76,946	158,759	3,618	5,317	80,564	164,076
Oklahoma.....	20,054	20,647	2,030	21	22,084	20,668
South Dakota.....	452	1,260	-----	1	452	1,261
Tennessee.....	6,809	35,193	162	186	6,971	35,379
Wisconsin.....	29,923	25,503	881	869	30,804	26,372
<b>Total.....</b>	<b>543,583</b>	<b>736,172</b>	<b>33,181</b>	<b>37,693</b>	<b>576,764</b>	<b>773,865</b>
<b>District 3:</b>						
Alabama.....	6,469	5,811	486	548	6,955	6,359
Arkansas.....	11,798	8,551	36	137	11,834	8,688
Louisiana.....	80,298	86,901	1,006	468	81,304	87,369
Mississippi.....	14,699	9,801	817	409	15,516	10,210
New Mexico.....	2,083	1,744	24	5	2,107	1,749
Texas.....	137,504	174,333	3,621	4,153	141,125	178,486
<b>Total.....</b>	<b>252,851</b>	<b>287,141</b>	<b>5,990</b>	<b>5,720</b>	<b>258,841</b>	<b>292,861</b>
<b>District 4:</b>						
Colorado.....	5,515	40,769	37	1,211	5,552	41,980
Idaho.....	64	144	16	17	80	161
Montana.....	805	77	13	15	818	92
Utah.....	2,813	7	17	10	2,830	17
Wyoming.....	530	1,310	10	-----	540	1,310
<b>Total.....</b>	<b>9,727</b>	<b>42,307</b>	<b>93</b>	<b>1,253</b>	<b>9,820</b>	<b>43,560</b>
<b>District 5:</b>						
Alaska.....	695	557	2	-----	697	557
Arizona.....	2,206	2,380	183	292	2,389	2,672
California.....	163,515	125,235	12,788	6,695	176,303	131,930
Hawaii.....	34	104	127	138	161	292
Nevada.....	500	1,381	88	51	588	1,432
Oregon.....	14,873	49,768	1,894	1,920	16,767	51,688
Washington.....	12,806	9,147	1,840	2,337	14,646	11,484
<b>Total.....</b>	<b>194,629</b>	<b>188,572</b>	<b>16,922</b>	<b>11,483</b>	<b>211,551</b>	<b>200,055</b>
<b>Total United States.....</b>	<b>1,797,433</b>	<b>1,964,724</b>	<b>81,718</b>	<b>78,676</b>	<b>1,879,151</b>	<b>2,043,400</b>

TABLE 64.—Shipments of petroleum-asphalt and road oil for consumption in the United States, by PAD districts and States

(Short tons)

District and State	Asphalt cements and fluxes	Emulsified asphalts	Cutback asphalts	Total 1964	Total 1963	Road oil	
						1964	1963
<b>District 1:</b>							
Connecticut.....	133,824	3,133	42,301	179,258	194,100		4
Delaware.....	63,447	2,396	20,251	86,074	45,052	163	148
Florida.....	594,428	43,479	90,540	733,447	672,134	735	96
Georgia.....	667,751	39,819	88,997	796,567	878,604	23	1
Maine.....	81,391	18,178	64,105	163,674	142,069	452	116
Maryland and District of Columbia.....	398,192	55,832	109,519	563,543	519,373	612	202
Massachusetts.....	431,445	2,345	37,154	470,944	434,717	13	121
New Hampshire.....	69,279	194	48,846	118,319	95,293		
New Jersey.....	909,448	24,355	113,990	1,047,793	1,032,997	1,310	2,417
New York.....	756,187	112,915	242,575	1,111,677	1,194,222	4,970	3,513
North Carolina.....	344,579	123,429	74,726	542,734	505,663	737	702
Pennsylvania.....	814,344	64,620	186,373	1,065,337	944,705	4,529	6,349
Rhode Island.....	149,596	503	43,408	198,507	141,673	1,443	422
South Carolina.....	231,086	64,478	21,203	316,767	351,688		
Vermont.....	12,506	339	18,493	31,338	39,276	1	
Virginia.....	329,284	38,463	110,612	478,669	443,131		
West Virginia.....	129,160	10,069	25,282	164,511	136,774	315	353
<b>Total 1964.....</b>	<b>6,115,947</b>	<b>609,547</b>	<b>1,343,655</b>	<b>8,069,149</b>		<b>15,303</b>	
<b>Total 1963.....</b>	<b>5,678,407</b>	<b>692,699</b>	<b>1,400,455</b>		<b>7,771,561</b>		<b>14,444</b>
<b>District 2:</b>							
Illinois.....	1,341,017	49,316	147,427	1,537,760	1,164,039	218,553	201,638
Indiana.....	444,991	195,414	188,945	829,350	809,251	36,858	25,671
Iowa.....	283,069	82,072	76,940	442,081	406,673	26,977	34,052
Kansas.....	308,997	16,205	189,944	514,246	542,198	621	7,846
Kentucky.....	191,959	44,862	57,850	294,671	395,338	10,910	8,012
Michigan.....	270,245	73,553	42,491	386,289	472,747	14,774	26,185
Minnesota.....	430,691	29,318	209,694	670,203	637,913	78,288	80,602
Missouri.....	381,922	8,380	251,901	642,203	711,024	4,155	2,592
Nebraska.....	65,941	1,612	58,739	126,292	159,584	5,317	10,709
North Dakota.....	94,073	19,824	68,534	182,431	208,317	18,745	17,523
Ohio.....	840,897	174,035	295,010	1,309,942	1,254,817	14,797	5,102
Oklahoma.....	416,818	2,537	207,765	627,120	514,816	13,122	18,384
South Dakota.....	83,063	3,084	59,916	146,063	141,887		84
Tennessee.....	438,745	42,177	40,848	521,770	402,060		
Wisconsin.....	209,275	9,084	77,495	295,854	334,926	108,656	132,027
<b>Total 1964.....</b>	<b>5,800,803</b>	<b>751,973</b>	<b>1,973,499</b>	<b>8,526,275</b>		<b>573,053</b>	
<b>Total 1963.....</b>	<b>5,233,569</b>	<b>755,886</b>	<b>2,166,635</b>		<b>8,156,090</b>		<b>598,916</b>
<b>District 3:</b>							
Alabama.....	362,685	64,360	82,957	510,002	476,811	3	10
Arkansas.....	149,505	32,671	53,519	235,695	218,551	548	118
Louisiana.....	345,488	37,000	20,667	403,155	431,904	1,428	1,309
Mississippi.....	162,433	33,792	54,443	250,668	260,967		
New Mexico.....	139,383	5,047	51,548	195,978	184,764	5,660	11,079
Texas.....	752,164	31,391	122,112	905,667	1,357,779	7,590	17,681
<b>Total 1964.....</b>	<b>1,911,658</b>	<b>204,261</b>	<b>385,246</b>	<b>2,501,165</b>		<b>15,229</b>	
<b>Total 1963.....</b>	<b>2,211,550</b>	<b>230,330</b>	<b>488,896</b>		<b>2,930,776</b>		<b>30,197</b>

See footnote at end of table.

TABLE 64.—Shipments of petroleum-asphalt and road oil for consumption in the United States, by PAD districts and States—Continued

(Short tons)

District and State	Asphalt cements and fluxes	Emulsified asphalts	Cutback asphalts	Total 1964	Total 1963	Road oil	
						1964	1963
District 4:							
Colorado.....	217,583	8,580	64,567	290,730	289,444	9,913	22,456
Idaho.....	41,368	2,739	39,050	83,157	94,643	22,322	21,853
Montana.....	164,418	7,296	48,621	220,335	165,403	41,968	6,785
Utah.....	113,196	10	32,151	145,357	138,974	11,924	12,825
Wyoming.....	99,501	-----	28,403	127,904	103,605	12,212	17,348
Total 1964.....	636,066	18,625	212,792	867,483	-----	98,339	-----
Total 1963.....	529,861	24,245	237,963	-----	792,069	-----	81,267
District 5:							
Alaska.....	14,456	3,110	6,297	23,863	17,119	-----	-----
Arizona.....	86,690	29,734	26,198	142,622	148,959	83,971	* 73,547
California.....	1,925,670	141,305	96,378	2,163,353	2,007,822	324,949	273,873
Hawaii.....	37,914	2,521	1,769	42,204	32,613	1,801	58
Nevada.....	89,559	1,477	13,641	104,677	109,211	20,595	16,357
Oregon.....	382,930	32,005	47,917	462,852	365,110	5,762	7,336
Washington.....	209,013	14,145	80,967	304,125	316,491	299	2,514
Total 1964.....	2,746,232	224,297	273,167	3,243,696	-----	437,377	-----
Total 1963.....	2,449,553	217,038	330,734	-----	2,997,325	-----	* 373,685
Total United States (all uses) 1964.....	17,210,706	1,808,703	4,188,359	23,207,768	-----	1,139,301	-----
Total United States (all uses) 1963.....	16,102,940	1,920,198	4,624,683	-----	22,647,821	-----	* 1,098,509

\* Revised.

## OTHER PRODUCTS

**Wax.**—The total demand for petroleum wax in 1964 was 5,330,000 barrels, a 1.3 percent increase. Domestic demand continued to decline but the exports were higher than in 1963. The average of posted prices on bulk lots of crude scale wax were unchanged from last year, but lower postings were reported for refined and overrefined wax.

**Coke.**—Domestic demand for petroleum coke increased 1.6 percent over 1963. Exports increased 26.0 percent, and total demand for the year increased 4.9 percent. Production increased from 16.1 million tons in 1963 to 16.9 million tons in 1964. About 41 percent of the total production is marketable. The balance was coke burned off catalytic cracking units and was utilized as refinery fuel. Coke with a low sulfur content is used in making electrodes required in the electrolytic production of aluminum.

TABLE 65.—Salient statistics on wax in the United States, by types, months, and districts

(Thousand barrels) <sup>1</sup>

Month and district	1963												
	Production				Im-ports (all types)	Ex-ports (all types)	Stocks, end of period				Do- mestic de- mand (all types)		
	Micro- crys- talline	Fully re- fined	Other	Total			Micro- crys- talline	Fully re- fined	Other	Total			
<b>By months:</b>													
January.....	83	164	132	379	-----	37	243	397	392	1,032	330		
February.....	45	199	142	386	-----	121	236	375	393	1,004	293		
March.....	50	241	129	420	-----	143	214	340	364	918	363		
April.....	51	263	123	437	-----	150	195	346	340	881	324		
May.....	77	242	121	440	-----	146	195	332	332	859	316		
June.....	70	237	166	473	-----	124	194	364	353	911	297		
July.....	65	222	117	404	-----	3	118	182	364	339	885		
August.....	37	227	147	461	-----	130	188	361	359	908	308		
September.....	57	217	173	447	-----	132	177	363	363	903	320		
October.....	33	245	115	443	-----	1	132	184	353	340	877		
November.....	58	208	118	384	-----	118	166	372	322	860	283		
December.....	93	206	153	452	-----	104	191	390	305	886	322		
<b>Total.....</b>	<b>819</b>	<b>2,671</b>	<b>1,636</b>	<b>5,126</b>		<b>4</b>	<b>1,455</b>	<b>191</b>	<b>390</b>	<b>305</b>	<b>886</b>	<b>3,809</b>	
<b>By districts:</b>													
East Coast.....	211	1,101	350	1,662	}	4		31	85	46	162	}	NA
Appalachian No. 1.....	109	47	227	383				12	26	29	67		
Appalachian No. 2.....		61	20	81				8					
Indiana, Illinois, Kentucky, etc.....	15	197	132	344			2	22	69	93			
Minnesota, Wisconsin, etc.....													
Oklahoma, Kansas, etc.....	269	160	87	516	}		1,324	57	45	3	105	}	
Texas Inland.....	85			85				36			36		
Texas Gulf Coast.....	82	657	293	1,032				30	91	69	190		
Louisiana Gulf Coast.....	19	10	442	471				5	2	51	58		
Arkansas, Louisiana Inland, etc.....													
New Mexico.....													
Rocky Mountain.....	29	29	24	82				18	8	38	64		
West Coast.....		409	61	470					103		103		
<b>Total.....</b>	<b>819</b>	<b>2,671</b>	<b>1,636</b>	<b>5,126</b>		<b>4</b>	<b>1,455</b>	<b>191</b>	<b>390</b>	<b>305</b>	<b>886</b>	<b>3,809</b>	

See footnotes at end of table.

TABLE 65.—Salient statistics on wax in the United States, by types, months, and districts—Continued

(Thousand barrels)<sup>1</sup>

Month and district	1964										Domestic demand (all types)	
	Production				Imports (all types)	Exports (all types)	Stocks, end of period					
	Micro-cry-stalline	Fully re-fined	Other	Total			Micro-cry-stalline	Fully re-fined	Other	Total		
<b>By months:</b>												
January.....	57	191	156	404	-----	122	169	359	326	854	314	
February.....	78	250	81	409	-----	137	189	413	269	871	255	
March.....	79	233	144	456	-----	130	179	394	285	858	339	
April.....	85	208	150	443	-----	121	175	407	277	859	321	
May.....	108	269	114	491	-----	172	193	438	258	889	289	
June.....	88	249	109	446	-----	136	182	462	267	911	288	
July.....	104	248	86	438	-----	141	206	445	249	900	308	
August.....	63	226	144	433	-----	171	185	425	271	881	281	
September.....	94	253	88	435	-----	168	183	407	247	837	311	
October.....	77	255	141	473	-----	152	171	392	272	835	323	
November.....	81	256	138	475	-----	129	182	402	282	866	315	
December.....	86	251	112	449	-----	155	213	409	286	908	252	
<b>Total.....</b>	<b>1,000</b>	<b>2,889</b>	<b>1,463</b>	<b>5,352</b>	-----	<b>1,734</b>	<b>213</b>	<b>409</b>	<b>286</b>	<b>908</b>	<b>3,596</b>	
<b>By districts:</b>												
East Coast.....	244	1,226	461	1,931	}-----	1,579	25	82	40	147	} NA	
Appalachian No. 1.....	159	43	243	445			39	35	19	93		
Appalachian No. 2.....	-----	55	36	91			-----	5	-----	5		
Indiana, Illinois, Kentucky, etc.....	14	197	147	358			-----	2	15	80		97
Minnesota, Wisconsin, etc.....	-----	-----	-----	-----			-----	-----	-----	-----		-----
Oklahoma, Kansas, etc.....	247	212	78	537			-----	31	35	8		74
Texas Inland.....	95	-----	95	95			-----	56	-----	56		
Texas Gulf Coast.....	136	500	359	995			-----	28	67	99		194
Louisiana Gulf Coast.....	74	255	51	380			-----	16	67	1		84
Arkansas, Louisiana Inland, etc.....	-----	-----	-----	-----			-----	-----	-----	-----		-----
New Mexico.....	-----	-----	-----	-----	-----	-----	-----	-----	-----			
Rocky Mountain.....	31	44	17	92	-----	16	8	39	63			
West Coast.....	-----	357	71	428	-----	-----	95	-----	95			
<b>Total.....</b>	<b>1,000</b>	<b>2,889</b>	<b>1,463</b>	<b>5,352</b>	-----	<b>1,734</b>	<b>213</b>	<b>409</b>	<b>286</b>	<b>908</b>	<b>3,596</b>	

<sup>p</sup> Preliminary. NA Not Available.  
<sup>1</sup> Conversion factor: 280 pounds to the barrel.

TABLE 66.—Average monthly refinery prices of 124°-126° white crude scale wax at Pennsylvania refineries, 1960-64

(Cents per pound)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average for year
1960.....	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.23	6.13	6.24
1961.....	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13
1962.....	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13
1963.....	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13
1964.....	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13	6.13

Source: Platt's Oil Price Handbook.



TABLE 67.—Salient statistics of petroleum coke in the United States, by months and districts<sup>1</sup>  
(Thousand barrels unless otherwise stated)

Month and district	1963							P 1964						
	Production			Yield (per- cent)	Exports	Stocks, end of period	Domestic demand	Production			Yield (per- cent)	Exports	Stocks, end of period	Domestic demand
	Market- able	Cata- lyst	Total					Market- able	Cata- lyst	Total				
<b>By months:</b>														
January.....	2,431	4,203	6,634	2.4	235	5,954	6,325	2,903	4,297	7,200	2.6	1,473	6,421	5,789
February.....	2,360	3,822	6,182	2.5	333	6,020	5,283	2,712	4,003	6,715	2.6	848	6,564	5,724
March.....	2,672	4,011	6,683	2.5	704	6,003	5,996	3,132	4,155	7,287	2.6	921	6,646	6,284
April.....	2,744	3,734	6,478	2.6	984	5,905	5,592	2,895	3,936	6,831	2.7	1,126	6,794	5,557
May.....	2,505	4,000	6,505	2.5	965	5,692	5,753	2,938	4,107	7,045	2.6	1,509	6,893	5,446
June.....	2,734	3,864	6,598	2.5	896	5,643	5,751	3,092	4,088	7,180	2.6	1,109	6,963	6,001
July.....	2,893	4,144	7,037	2.6	918	5,786	5,976	3,226	4,279	7,505	2.6	1,430	7,086	5,952
August.....	2,749	4,176	6,925	2.4	1,294	5,762	5,655	2,834	4,241	7,075	2.5	1,020	6,894	6,247
September.....	2,724	4,024	6,748	2.5	1,087	5,857	5,566	2,675	4,072	6,747	2.5	990	6,696	5,955
October.....	2,750	4,085	6,835	2.6	991	5,973	5,728	2,774	4,136	6,910	2.5	1,039	6,619	5,948
November.....	2,886	3,890	6,776	2.6	698	6,906	5,145	2,797	3,973	6,770	2.6	965	6,878	5,546
December.....	2,980	4,307	7,287	2.7	1,157	6,483	6,563	2,894	4,166	7,060	2.5	1,142	6,795	6,001
<b>Total.....</b>	<b>32,428</b>	<b>48,260</b>	<b>80,688</b>	<b>2.6</b>	<b>10,762</b>	<b>6,483</b>	<b>69,323</b>	<b>34,872</b>	<b>49,453</b>	<b>84,325</b>	<b>2.6</b>	<b>13,563</b>	<b>6,795</b>	<b>70,450</b>
<b>By districts:</b>														
East Coast.....	5,755	7,713	13,468	2.9			1,089	6,168	8,150	14,318	3.2		601	
Appalachian No. 1.....		148	148	.4					226		.6			
Appalachian No. 2.....	51	517	568	1.5				20	529	549	1.5			
Indiana, Illinois, Kentucky, etc.....	6,753	9,685	16,438	2.9			1,013	7,286	10,162	17,448	3.0		1,478	
Minnesota, Wisconsin, etc.....	1,297	704	2,001	4.1			251	1,833	717	2,550	4.7		586	
Oklahoma, Kansas, etc.....	3,674	4,186	7,760	2.9			803	3,337	4,312	7,649	2.8		1,074	
Texas Inland.....	456	1,559	2,015	1.7	6,625			471	1,657	2,128	1.8		4	
Texas Gulf Coast.....	3,955	13,102	17,057	3.3			18	4,182	12,924	17,106	2.3		43	
Louisiana Gulf Coast.....	1,817	4,565	6,382	2.2			10	2,129	5,070	7,199	2.3		27	
Arkansas, Louisiana Inland, etc.....	1,317	770	2,087	4.7			677	1,288	822	2,110	4.6		513	
New Mexico.....		47	47	.5					51	51	.5			
Rocky Mountain.....	454	2,094	2,548	2.3			1,308	508	2,126	2,634	2.2		1,301	
West Coast.....	6,999	3,170	10,169	2.2	4,137		1,314	7,650	2,707	10,367	2.2	6,518	1,168	
<b>Total.....</b>	<b>32,428</b>	<b>48,260</b>	<b>80,688</b>	<b>2.6</b>	<b>10,762</b>	<b>6,483</b>	<b>69,323</b>	<b>34,872</b>	<b>49,453</b>	<b>84,325</b>	<b>2.6</b>	<b>13,563</b>	<b>6,795</b>	<b>70,450</b>

<sup>p</sup> Preliminary. NA Not available.

<sup>1</sup> Conversion factor: 5.0 barrels to the short ton.

**Still gas.**—The production of still gas in 1964 was 832,286 million cubic feet (131,257,000 barrels). This does not include 7,698,000 barrels used for petrochemical feedstocks. Refiners used 830,415 million cubic feet as refinery fuel. The heating value of the gas in 1964 was 946 B.t.u. per cubic foot compared with 976 B.t.u. in 1963.

TABLE 68.—Production of still gas in the United States, by districts

District	1962		1963		1964	
	Million cubic feet	Equivalent in thousand barrels	Million cubic feet	Equivalent in thousand barrels	Million cubic feet	Equivalent in thousand barrels
East Coast.....	92,733	15,922	101,737	17,128	104,110	17,132
Appalachian No. 1.....	11,524	1,837	9,659	1,838	10,439	1,839
Appalachian No. 2.....	12,450	1,829	12,844	1,833	13,112	1,816
Indiana, Illinois, Kentucky, etc.....	157,965	26,308	155,505	24,911	169,473	26,063
Minnesota, Wisconsin, North Dakota, and South Dakota.....	9,272	1,554	8,454	1,303	10,050	1,437
Oklahoma, Kansas, etc.....	67,163	10,831	69,463	11,255	70,434	11,116
Texas Inland.....	25,354	4,733	31,712	5,821	31,198	5,542
Texas Gulf Coast.....	176,709	26,118	186,844	26,120	196,107	27,526
Louisiana Gulf Coast.....	60,720	9,131	54,200	8,159	60,024	9,000
Arkansas, Louisiana Inland, etc.....	11,296	2,080	11,628	2,001	11,082	1,776
New Mexico.....	1,525	284	1,483	283	1,896	317
Rocky Mountain.....	20,609	4,047	20,193	3,658	21,338	3,785
West Coast.....	135,456	26,155	133,824	25,288	133,023	23,908
Total.....	782,776	130,829	797,546	129,598	832,286	131,257

• Preliminary.

**Petrochemical Feedstocks.**—With increasing volumes of refinery-produced petroleum products being used as feedstocks by the petrochemical industry, it became difficult to evaluate use patterns of the various products. For this reason, petroleum refiners were asked to report data for feedstocks separately beginning with the data for 1963. These feedstocks are being reported in four boiling-range categories (still gas, liquefied refinery gas, naphtha-400°, and other). This provides a measure of the volume of refinery output used in the manufacture of petrochemicals and eliminates chemical manufacture from the regular petroleum refining operations.

The demand for petrochemical feedstocks in 1964 was 104,789,000 barrels, of which 7.3 percent represented still gas; 45.0 percent, LRG; 23.5 percent, naphtha-400°; and 24.2 percent, other. The average yield of petrochemical feedstocks per barrel of crude oil processed in 1964 was 3.2 percent.

**Miscellaneous Oils.**—The total demand for miscellaneous finished products in 1964 was 16,686,000 barrels. Production for the year was 16,874,000 barrels, of which 80.5 percent was produced at petroleum refineries and 19.5 percent at natural-gas processing plants. Since 1963 petrochemical production and petrochemical feedstocks have been excluded from the data for miscellaneous oils.

TABLE 69.—Production of miscellaneous finished oils in the United States in 1964, by districts and classes

(Thousand barrels)

District	Absorption	Petrolatum	Specialty oils <sup>1</sup>	Petrochemicals	Other products	Total
East Coast.....			721	363	344	1,428
Appalachian No. 1.....		113	53		77	243
Appalachian No. 2.....			45		26	71
Indiana, Illinois, Kentucky, etc.		46	347	534	401	1,328
Minnesota, Wisconsin, North Dakota, and South Dakota.....				95		95
Oklahoma, Kansas, etc.....	52	406	501	834	234	2,087
Texas Inland.....	321		49	1,547	207	2,124
Texas Gulf.....	75	568	167	2,382	429	3,571
Louisiana Gulf.....	1,250	33	5	105	13	1,406
Arkansas, Louisiana Inland.....	1,413			17		1,430
Rocky Mountain, New Mexico.....	188		3	8	126	325
West Coast.....	34	29	1,509	811	383	2,766
Total.....	3,333	1,195	3,460	6,646	2,240	16,874

<sup>1</sup>Specialty oils include: Hydraulic 3; insulating 142; medicinal 210; spray oils 446; rust preventatives 6; sand frac 54; and others 2,599.

**Unfinished Oils.**—Unfinished oils include all oils that will be cracked or further distilled. The rerun (net) of unfinished oils represents the import plus or minus the change in stocks.

Imports of unfinished oils are included with crude oil under the quota established by the Oil Import Administration. By regulation, unfinished imports are restricted to 10 percent of the crude oil and unfinished oils quota.

### INTERCOASTAL SHIPMENTS

A total of 671,359,000 barrels of crude petroleum and petroleum products was shipped in intercoastal trade in 1964, a decrease of 11.8 percent compared with 1963 figures.

**TABLE 70.—Petroleum oils, crude and refined, shipped from gulf and west coasts to east coast ports and from the gulf coast to west coast ports, 1964, by months, and total for 1963**

(Thousand barrels)

Item	1964												1963 total	
	January	February	March	April	May	June	July	August	September	October	November	December		Total
<b>Gulf coast to east coast: <sup>1</sup></b>														
Crude oil.....	11,949	10,584	12,005	8,870	9,823	10,177	9,610	11,114	12,081	12,727	12,087	12,405	133,432	161,443
Gasoline.....	17,528	16,609	20,474	17,898	20,994	19,062	17,852	18,945	17,175	16,908	18,201	14,691	216,337	245,508
Kerosine.....	5,528	4,622	4,217	3,103	3,113	3,046	3,094	3,710	2,718	3,865	3,433	3,144	43,593	52,444
Distillate fuel oil.....	22,375	20,051	18,308	14,822	15,168	13,261	13,165	12,316	11,660	14,390	14,442	16,235	186,193	216,545
Residual fuel oil.....	2,841	2,523	2,863	2,051	3,259	2,174	2,378	2,940	2,961	2,199	2,486	2,702	31,377	31,638
Military jet fuel.....	908	990	1,379	1,934	1,662	1,887	928	771	1,653	1,057	1,381	917	15,467	14,807
Lubricating oil.....	624	517	672	708	882	892	771	612	873	789	826	601	8,767	8,768
Other products.....	1,421	1,726	980	888	756	918	1,132	1,509	1,092	1,394	1,211	1,000	14,021	13,287
<b>Total.....</b>	<b>63,174</b>	<b>57,621</b>	<b>60,898</b>	<b>50,269</b>	<b>55,657</b>	<b>51,417</b>	<b>48,930</b>	<b>51,917</b>	<b>50,213</b>	<b>53,329</b>	<b>54,067</b>	<b>51,695</b>	<b>649,187</b>	<b>744,440</b>
<b>West coast to east coast:</b>														
Gasoline.....									19				19	465
Distillate fuel oil.....		136		119	114				137	115	28	301	950	2,085
Residual fuel oil.....	278	818	1,243	695	848	1,322	568	266		528	204	199	6,969	6,673
Military jet fuel.....						11					15	14	40	
Lubricating oil.....	67	13	92	58	13	77	20	110	67		87	41	668	496
Other products.....	12	8	10	16	9	14		4			7		80	207
<b>Total.....</b>	<b>357</b>	<b>975</b>	<b>1,345</b>	<b>888</b>	<b>984</b>	<b>1,424</b>	<b>588</b>	<b>380</b>	<b>223</b>	<b>666</b>	<b>341</b>	<b>555</b>	<b>8,726</b>	<b>9,926</b>
<b>Gulf coast to west coast: <sup>1</sup></b>														
Gasoline.....	137	364	387	598	1,265	1,657	829	50	352	931	680	751	8,001	2,102
Kerosine.....						32	59	88	272		302	194	947	
Distillate fuel oil.....								82					82	20
Military jet fuel.....	206			100	668	680	160	236	613	123		75	2,861	3,897
Lubricating oil.....	91	185	52	134	213	39	203	93	25	66		93	1,316	979
Other products.....	34	34			13		42	33	14	41	117	17	239	81
<b>Total.....</b>	<b>468</b>	<b>583</b>	<b>439</b>	<b>832</b>	<b>2,164</b>	<b>2,408</b>	<b>1,293</b>	<b>582</b>	<b>1,276</b>	<b>1,161</b>	<b>1,110</b>	<b>1,130</b>	<b>13,446</b>	<b>7,079</b>

Source prior to July 1964: Geological Survey, U.S. Department of the Interior.

CRUDE PETROLEUM AND PETROLEUM PRODUCTS

## FOREIGN TRADE

Foreign trade statistics reported in this section were compiled from two sources. The imports of crude oil and unfinished oils were obtained from the petroleum refining companies. Imports of the refined petroleum products and all export data were compiled from records of the U.S. Department of Commerce.

**Imports.**—Total imports of all oils increased 52,130,000 barrels in 1964 to 826,843,000 barrels. Total imports increased 6.7 percent, which is in line with the trend of recent years. Imports of crude oil increased 6.3 percent (25,983,000 barrels), residual fuel oil imports increased 8.5 percent (23,138,000 barrels), and imports of unfinished oils increased 2.8 percent (885,000 barrels). Gasoline, military jet fuel, and asphalt decreased 9.6 percent, 18.9 percent and 4.8 percent, respectively; whereas imports of other products increased as follows: Kerosine, 28.8 percent; distillate fuel oil, 29.2 percent; liquefied gases, 64.1 percent; and lubricants, 60.9 percent.

**Exports.**—In 1964, total exports of petroleum and petroleum products (73,768,000 barrels) were a little lower than the 1963 exports (75,914,000 barrels) but well above the 1962 total (61,431,000 barrels). The 1964 distillate fuel oil exports (5,434,000 barrels) were only a little more than one-third of those in 1963 (15,014,000 barrels), and exports of kerosine in 1964 (171,000 barrels) were only one-fourth of those in 1963 (672,000 barrels). Exports of crude oil and military jet fuel decreased 19.7 percent and 12.4 percent, respectively, and slightly smaller amounts of lubricants and miscellaneous refined products were exported in 1964.

There were appreciable gains in exports of the other refinery products, gasoline (13.7 percent), residual fuel oil (23.5 percent), wax (19.2 percent), coke (26.0 percent), asphalt (9.1 percent), and liquefied gases (16.7 percent).

TABLE 71.—Petroleum oils, crude and refined, imported into the United States, by months <sup>1</sup>

(Thousand barrels)

Year and class	January	February	March	April	May	June	July	August	September	October	November	December	Total
<b>1963:</b>													
Crude petroleum.....	41,043	30,898	36,070	32,593	34,484	31,872	38,214	36,666	34,898	31,362	34,241	30,319	412,660
Refined products:													
Gasoline.....	1,589	750	1,487	1,923	1,060	1,488	1,068	1,242	1,848	1,569	932	1,189	16,145
Kerosine.....	625	393	566	722	588	861	979	848	896	776	682	706	8,642
Distillate fuel oil.....	1,076	722	710	606	606	711	714	631	678	867	956	833	9,110
Residual fuel oil.....	34,803	28,711	23,903	24,663	19,019	15,281	18,132	16,922	16,010	22,951	20,749	31,609	272,753
Military jet fuel.....	2,034	405	-----	863	2,114	149	1,655	2,329	1,312	2,403	1,004	679	14,947
Lubricants.....	-----	2	3	-----	2	2	2	4	3	2	1	2	23
Wax.....	-----	-----	-----	-----	-----	-----	3	-----	-----	1	-----	-----	4
Asphalt.....	478	221	421	465	496	642	694	822	588	608	290	486	6,211
Liquefied gases (including ethane).....	346	364	220	218	101	50	81	93	180	237	252	374	2,516
Unfinished oils.....	2,200	2,158	2,379	2,914	2,489	2,886	3,571	2,685	2,622	3,006	2,668	2,124	31,702
Total refined.....	43,151	33,726	29,689	32,374	26,475	22,070	26,899	25,576	24,137	32,420	27,534	33,002	362,053
Total crude and refined.....	84,194	64,624	65,769	64,967	60,959	53,942	65,113	62,242	59,035	63,782	61,775	63,321	774,713
<b>1964: <sup>p</sup></b>													
Crude petroleum.....	30,635	32,209	36,945	33,091	35,968	34,387	43,820	40,743	36,853	30,224	34,102	31,666	438,643
Refined products:													
Gasoline.....	1,040	1,069	1,492	1,430	1,557	1,218	918	1,099	1,344	1,165	908	1,386	14,626
Kerosine.....	675	666	782	779	896	1,033	1,230	1,091	997	1,121	838	1,021	11,129
Distillate fuel oil.....	1,581	1,069	875	787	723	1,035	627	856	912	840	574	1,893	11,772
Residual fuel oil.....	39,734	29,187	24,712	27,970	19,797	17,748	20,460	18,447	18,915	24,712	23,342	30,867	295,891
Military jet fuel.....	1,948	931	1,231	707	1,131	1,242	1,213	1,550	640	542	852	131	12,118
Lubricants.....	4	2	3	4	2	5	4	2	3	5	1	2	37
Asphalt.....	354	140	230	274	487	1,048	833	578	595	522	452	399	5,912
Liquefied gases (including ethane).....	420	447	321	246	185	232	352	266	298	416	410	535	4,128
Unfinished oils.....	3,219	1,699	2,530	3,004	3,391	2,742	2,434	3,343	1,859	2,449	2,627	3,290	32,587
Total refined.....	48,975	35,210	32,176	35,201	28,169	26,303	28,071	27,232	25,563	31,772	30,004	39,524	388,200
Total crude and refined.....	88,610	67,419	69,121	68,292	64,137	60,690	71,891	67,975	62,416	70,996	64,106	71,190	826,843

<sup>p</sup> Preliminary.

<sup>1</sup> Imports of crude and unfinished oils reported to the Bureau of Mines; imports of refined products compiled from records of the U.S. Department of Commerce.

CRUDE PETROLEUM AND PETROLEUM PRODUCTS

487

TABLE 72.—Crude oil and petroleum products imported into the United States, 1963-64, by countries and receiving districts  
(Thousand barrels)

Country	Crude oil <sup>1</sup>	Gasoline	Kerosine <sup>2,3</sup>	Distillate fuel oil <sup>3</sup>	Residual fuel oil <sup>3</sup>	Military jet fuel	Liquefied gases	Asphalt	Unfinished oils <sup>1</sup>	Lubricants	Wax	Total
<b>1963:</b>												
<b>North America:</b>												
Canada.....	90,394	576	4	179	1,727		2,259	77	1,504	16	1	96,737
Canal Zone.....					26							26
Mexico.....	3,657			7	6,781				6,926			17,371
Netherlands Antilles.....		3,716	3,633	3,308	88,854	6,408		2,949	3,733			112,601
Panama.....		257			3,300							3,557
Puerto Rico.....		8,521	19	2,276	3,156							15,972
Trinidad and Tobago.....		386	1,594	83	33,429	2,892		28	2,121			40,533
Total.....	94,051	13,456	5,250	5,853	139,273	9,300	2,259	3,054	14,284	16	1	286,797
<b>South America:</b>												
Argentina.....					2,411							2,411
Brazil.....	2,052				108							2,160
Colombia.....	8,293				605							8,898
Ecuador.....					1							1
Venezuela.....	174,537	2,580	3,258	3,209	127,017	5,430	195	3,112	9,193			328,531
Total.....	184,882	2,580	3,258	3,209	130,142	5,430	195	3,112	9,193			342,001
<b>Europe:</b>												
France.....			58			198						256
Germany, West.....							1				3	4
Italy.....			76						232			308
Netherlands.....					14			45	346			409
Spain.....				4	178	19						201
Sweden.....										2		2
United Kingdom.....		10			205		29		896	1		1,141
Total.....		10	134	4	397	217	30	45	1,474	7	3	2,321
<b>Asia:</b>												
Bahrain.....		99			1,109							1,208
Iran.....	22,717								80			22,797
Iraq.....	321											321
Japan.....									508			508
Kuwait.....	29,680								2,953			32,633
Kuwait-Saudi Arabia, neutral zone.....	15,855								328			16,183
Qatar.....	5,835								289			6,124
Saudi Arabia.....	28,806			44	1,832		32		786			31,500

Singapore.....									171			171	
Sumatra.....	21,340								1,636			22,976	
<b>Total.....</b>	<b>124,554</b>	<b>99</b>		<b>44</b>	<b>2,941</b>		<b>32</b>		<b>6,751</b>			<b>134,421</b>	
<b>Africa:</b>													
Algeria.....	380											380	
Libya.....	7,021											7,021	
United Arab Republic (Egypt).....	1,772											1,772	
<b>Total.....</b>	<b>9,173</b>											<b>9,173</b>	
<b>Total imports.....</b>	<b>412,680</b>	<b>16,145</b>	<b>8,642</b>	<b>9,110</b>	<b>272,753</b>	<b>14,947</b>	<b>2,516</b>	<b>6,211</b>	<b>31,702</b>	<b>23</b>	<b>4</b>	<b>774,713</b>	
<b>Imports by PAD Districts:</b>													
District 1.....	243,199	14,537	5,787	7,787	252,785	13,308		401	4,907		14	4	569,508
District 2.....	34,666	151		63	800			1,097	76		6		37,335
District 3.....	1,698	125	20	1,260	12,327				1,228		2		18,762
District 4.....	3,528	1		1	26				10		1		3,667
District 5.....	124,569	1,331	2,835	9	6,815	1,639		1,008					145,651
<b>1964: *</b>													
<b>North America:</b>													
Canada.....	101,607	515		110	1,826			3,952	149		28		109,330
Canal Zone.....					349								349
Mexico.....	3,577				6,684				6,973				17,234
Netherlands Antilles.....		3,313	6,012	4,224	95,182	7,585		3,350	2,241				121,907
Panama.....		142			1,541								1,683
Puerto Rico.....		8,395		3,891	4,787								17,073
Trinidad and Tobago.....		1,030	1,488	32	36,527				23				42,557
<b>Total.....</b>	<b>105,184</b>	<b>13,395</b>	<b>7,500</b>	<b>8,257</b>	<b>146,896</b>	<b>7,585</b>		<b>3,952</b>	<b>3,522</b>		<b>28</b>		<b>310,133</b>
<b>South America:</b>													
Argentina.....					1,290								1,290
Brazil.....					246								246
Colombia.....	9,606				1,485								11,091
Venezuela.....	174,222	862	3,629	3,515	142,256	4,533	174	2,356	10,188				341,735
<b>Total.....</b>	<b>183,828</b>	<b>862</b>	<b>3,629</b>	<b>3,515</b>	<b>145,277</b>	<b>4,533</b>	<b>174</b>	<b>2,356</b>	<b>10,188</b>				<b>354,362</b>
<b>Europe:</b>													
Germany, West.....									161				161
Italy.....					12				625				637
Netherlands.....		289			117			34		9			449
United Kingdom.....									149				149
<b>Total.....</b>		<b>289</b>			<b>129</b>			<b>34</b>	<b>935</b>	<b>9</b>			<b>1,396</b>

See footnotes at end of table.



TABLE 72.—Crude oil and petroleum products imported into the United States, 1963–64, by countries and receiving districts—Continued

(Thousand barrels)

Country	Crude oil <sup>1</sup>	Gasoline	Kerosine <sup>2 3</sup>	Distillate fuel oil <sup>3</sup>	Residual fuel oil <sup>3</sup>	Military jet fuel	Liquefied gases	Asphalt	Unfinished oils <sup>1</sup>	Lubricants	Wax	Total
1964: P—Continued												
Asia:												
Abu Dhabi.....	1, 112											1, 112
Aden.....					1							1
Bahrain.....					1, 043				336			1, 384
India.....							1		154			155
Iran.....	24, 143								107			24, 250
Japan.....							1		386			387
Kuwait.....	23, 263								2, 150			25, 413
Kuwait-Saudi Arabia (neutral zone).....	17, 565								114			17, 679
Leeward and Windward Isle.....					1							1
Qatar.....	7, 294								116			7, 410
Saudi Arabia.....	35, 464	80			2, 538				1, 033			39, 115
Singapore.....									531			531
Sumatra.....	23, 047								1, 708			24, 755
Total.....	131, 888	80			3, 588		2		6, 635			142, 193
Africa:												
Algeria.....	2, 249											2, 249
French Somaliland.....					1							1
Libya.....	14, 417											14, 417
United Arab Republic (Egypt).....	1, 077								1, 015			2, 092
Total.....	17, 743				1				1, 015			18, 759
Total imports.....	438, 643	14, 626	11, 129	11, 772	295, 891	12, 118	4, 128	5, 912	32, 587	37		826, 843
Imports by PAD districts:												
District 1.....	252, 527	12, 796	7, 785	10, 546	274, 426	10, 804	308	5, 405	21, 151	31		595, 779
District 2.....	37, 801	24		64	804		2, 509	148	478	3		41, 831
District 3.....	1, 835	435		1, 119	11, 204		2	359	1, 011			15, 965
District 4.....	4, 409	1			45		112			1		4, 568
District 5.....	142, 071	1, 370	3, 344	43	9, 412	1, 314	1, 197		9, 947	2		163, 700

<sup>p</sup> Preliminary.<sup>1</sup> Imports of crude oil and unfinished oils reported to the Bureau of Mines, imports of refined products compiled from records of the U.S. Department of Commerce.<sup>2</sup> Includes commercial jet fuel.<sup>3</sup> Includes quantities imported duty free for supply of vessels and aircraft engaged in foreign trade.

**TABLE 73.—Petroleum oils, crude and refined, exported from the United States, including shipments to territories and possessions, by months<sup>1</sup>**

(Thousand barrels)

Year and class	January	February	March	April	May	June	July	August	September	October	November	December	Total
<b>1963:</b>													
Crude petroleum.....	179	116	95	170	140	123	146	178	100	179	106	166	1,698
Refined products:													
Gasoline <sup>2</sup> .....	409	750	447	637	237	557	439	559	663	764	674	850	6,986
Kerosine.....	103	173	50	22	187	7	21	32	12	16	26	23	672
Distillate fuel oil.....	1,104	3,002	1,125	1,238	1,175	997	995	1,129	1,371	985	1,431	462	15,014
Residual fuel oil.....	814	1,477	1,060	1,315	1,338	967	1,123	1,358	1,719	959	1,829	1,322	15,281
Military jet fuel.....	13	20	9	33	10	10	9	12	11	13	39	15	194
Lubricants.....	1,124	1,345	1,402	1,858	1,810	1,308	1,771	1,463	1,567	1,482	1,391	1,796	18,317
Wax.....	37	121	143	150	146	124	118	130	132	132	118	104	1,455
Coke.....	235	833	704	984	965	896	918	1,294	1,087	991	698	1,157	10,762
Asphalt.....	6	47	44	37	58	31	40	71	46	99	57	167	703
Liquefied gases (including ethane).....	362	388	428	358	362	369	396	378	390	379	364	419	4,593
Miscellaneous.....	3	27	30	26	23	16	20	19	18	22	18	17	239
Total refined.....	4,210	8,183	5,442	6,058	6,311	5,282	5,850	6,445	7,016	5,842	6,645	6,332	74,216
Total crude and refined.....	4,389	8,299	5,537	6,228	6,451	5,405	5,996	6,623	7,116	6,021	6,751	6,498	76,914
<b>1964: <sup>p</sup></b>													
Crude petroleum.....	116	98	233	100	174	152	90	118	71	88	-----	123	1,363
Refined products:													
Gasoline <sup>2</sup> .....	586	373	787	375	549	684	997	822	529	728	664	848	7,942
Kerosine.....	7	26	11	12	21	5	22	10	11	10	19	17	171
Distillate fuel oil.....	1,222	442	616	264	311	310	364	196	576	508	253	372	5,434
Residual fuel oil.....	1,561	1,023	1,668	2,000	1,375	1,942	1,498	1,547	1,517	1,879	1,321	1,539	18,870
Military jet fuel.....	36	13	14	14	11	11	12	9	12	9	13	16	170
Lubricants.....	1,202	1,436	1,366	1,980	1,276	1,637	1,650	1,691	1,246	1,659	1,479	1,538	18,160
Wax.....	122	137	130	121	172	136	141	171	168	152	129	155	1,734
Coke.....	1,473	848	921	1,126	1,500	1,109	1,430	1,020	990	1,039	965	1,142	13,563
Asphalt.....	52	47	43	77	41	93	60	54	107	54	81	58	767
Liquefied gases (including ethane).....	404	386	433	410	437	498	475	485	413	426	462	529	5,358
Miscellaneous.....	12	22	23	21	18	17	20	21	23	21	17	21	236
Total refined.....	6,877	4,753	6,012	6,400	5,711	6,442	6,669	6,026	5,592	6,485	5,403	6,235	72,405
Total crude and refined.....	6,793	4,851	6,245	6,500	5,885	6,594	6,759	6,144	5,663	6,573	5,403	6,358	73,768

<sup>p</sup> Preliminary.

<sup>1</sup> Compiled from records of U.S. Department of Commerce.

<sup>2</sup> Includes benzol, naphtha, natural gasoline, and antiknock compounds.

CRUDE PETROLEUM AND PETROLEUM PRODUCTS

TABLE 74.—Crude petroleum and petroleum products exported from the United States by countries of destination and shipments to and exports from territories and possessions

(Thousand barrels)

Country	Crude petroleum	Gasoline <sup>1</sup>	Kerosine	Distillate oil	Residual oil	Lubricating oil	Asphalt	Liquefied petroleum gases	Wax	Coke	Petrolatum	Miscellaneous products	Total
<b>1963</b>													
<b>North America:</b>													
Canada.....	2	897	83	540	3,357	1,327	127	151	139	1,300	18	46	7,987
El Salvador.....		9				29	11	(?)	10		1	2	22
Mexico.....	3	312	(?)	215	1,554	99	63	4,232	183	61	16	154	6,892
Netherlands Antilles.....		2,526				16	(?)	(?)			(?)	(?)	2,542
Other.....		113	3	121	29	405	30	70	82		6	18	877
<b>Total.....</b>	<b>5</b>	<b>3,857</b>	<b>86</b>	<b>876</b>	<b>4,940</b>	<b>1,876</b>	<b>231</b>	<b>4,453</b>	<b>414</b>	<b>1,361</b>	<b>41</b>	<b>220</b>	<b>18,360</b>
<b>South America:</b>													
Argentina.....		1				198	3	(?)	1		(?)	(?)	203
Brazil.....		9	17	4		1,200	(?)	4	42	49	9	1	1,335
Chile.....		1	1			185	49		44		1	7	288
Colombia.....		16	(?)		(?)	192	(?)	(?)	100	(?)	5	6	319
Peru.....		1		1	205	144	(?)	(?)	28		2	9	390
Venezuela.....		196	1			47	6	(?)	42	(?)	3	1	296
Other.....		4	(?)	(?)	14	127	4	2	44		2	8	205
<b>Total.....</b>		<b>228</b>	<b>19</b>	<b>5</b>	<b>219</b>	<b>2,093</b>	<b>62</b>	<b>6</b>	<b>301</b>	<b>49</b>	<b>22</b>	<b>32</b>	<b>3,036</b>
<b>Europe:</b>													
Belgium-Luxembourg.....	1	1	1	2,176		876	8	1	14	101	3	9	3,191
Denmark.....		(?)		359		206	(?)	8	15	(?)	(?)	3	591
France.....		10	(?)	637	359	113	4	50	54	368	4	2	1,601
Germany, West.....		98	17	692	583	474	2	34	135	708	9	4	2,786
Greece.....		181				116	(?)	(?)	1		(?)	3	801
Italy.....		(?)	1		499	802	4	10	61	1,111	5	8	2,975
Netherlands.....		107	6	1,442	438	408	3	5	69	2,129	3	8	4,618
Norway.....		(?)				48	(?)	(?)	4	681	1	3	737
Sweden.....		1	(?)	1,276		466	2	(?)	14	49	1	12	1,821
United Kingdom.....	424	102	221	886	1,302	1,253	1	4	79	78	16	1	3,867
Other.....		10	3	(?)		656	9	1	62	585	8	9	1,343
<b>Total.....</b>	<b>425</b>	<b>984</b>	<b>249</b>	<b>6,968</b>	<b>3,181</b>	<b>5,418</b>	<b>33</b>	<b>113</b>	<b>503</b>	<b>5,810</b>	<b>50</b>	<b>62</b>	<b>23,801</b>

Asia:														
India.....		17	(?)	11	1	1,829	5	(?)	3	60	12	8	1,946	
Indonesia.....		17	(?)	22		133	1		5		20	1	199	
Japan.....	1,266	211	6	8,687	5,914	1,907	8	4	32	3,263	27	21	21,346	
Malaysia.....		39				179	(?)		1		3	4	226	
Philippines.....		17	1			367	16	1	16		13	22	453	
Turkey.....		114	2			492	(?)		1		(?)	27	636	
Other.....	1	80	1	1	(?)	1,300	55	1	69	46	14	50	1,613	
Total.....	1,267	495	10	8,721	5,915	6,207	85	6	127	3,369	89	133	26,424	
Africa:														
Congo (Leopoldville).....		480	95	182		240	13		1		2	40	1,053	
South Africa, Republic of.....		18	2		88	367	206	1	46	(?)	17	16	761	
United Arab Republic (Egypt).....		9	4			318	(?)		(?)		1	10	342	
Other.....		10	6	(?)	526	310	16	1	13		8	20	910	
Total.....		517	107	182	614	1,235	235	2	60	(?)	28	86	3,066	
Oceania:														
Australia.....		120	15	4	385	885	7	2	34	174	7	5	1,688	
French Pacific Islands.....		67	22	177	26	4	2	10	(?)			(?)	308	
New Zealand.....		93	4			87	(?)	3	11		3	28	229	
Other.....		57	1	1	1	1	1	2				(?)	64	
Total.....		337	42	182	412	977	10	17	45	174	10	33	2,239	
Grand total.....	1,697	6,418	513	16,934	15,281	17,806	656	4,597	1,455	10,763	240	566	76,926	
Shipments from the United States to territories and possessions:														
Puerto Rico.....		6	145		(?)	116	38	(?)	(?)	(?)	(?)	6	311	
Virgin Islands.....		63	9	60	(?)	7	2	(?)	(?)	(?)	(?)	(?)	141	
Wake.....		449		44	(?)	(?)	3	(?)	(?)	(?)	(?)	(?)	496	
Other.....		57	5	180	(?)	7	5	(?)	(?)	(?)	(?)	(?)	254	
Total.....		575	159	284	(?)	130	48	(?)	(?)	(?)	(?)	6	1,202	
Exports from territories to foreign countries:														
Puerto Rico.....		1		2,077	(?)	(?)	(?)	4					2,082	
Total net shipments from the United States.....	1,697	6,992	672	15,141	15,281	17,936	704	4,593	1,455	10,763	240	572	76,046	

See footnotes at end of table.

TABLE 74.—Crude petroleum and petroleum products exported from the United States by countries of destination and shipments to and exports from territories and possessions—Continued

(Thousand barrels)

Country	Crude petroleum	Gasoline <sup>1</sup>	Kerosine	Distillate oil	Residual oil	Lubricating oil	Asphalt	Liquefied petroleum gases	Wax	Coke	Petroleum	Miscellaneous products	Total
1964													
North America:													
Canada.....	7	837	14	619	4,628	1,495	75	117	146	1,800	18	42	9,798
El Salvador.....		15				27	( <sup>2</sup> )		9		1	2	54
Mexico.....	3	336	2	479	2,429	124	102	5,027	169	66	12	174	8,923
Netherlands Antilles.....	( <sup>2</sup> )	3,484				15	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )		( <sup>2</sup> )	( <sup>2</sup> )	3,499
Other.....		119	1	158	9	437	44	55	100		8	19	950
Total.....	10	4,791	17	1,256	7,066	2,098	221	5,199	424	1,866	39	237	23,224
South America:													
Argentina.....		2				449	4	25	1		( <sup>2</sup> )	1	482
Brazil.....		13	16			1,244	1	10	30	59	11	( <sup>2</sup> )	1,384
Chile.....		2	1	1		212	45		52			8	322
Colombia.....		14	( <sup>2</sup> )	5		95	1	( <sup>2</sup> )	82		3	9	209
Peru.....		1			397	164	1		34	2	1	9	609
Venezuela.....		168	( <sup>2</sup> )			45	8	( <sup>2</sup> )	69	118	3	1	412
Other.....		3	( <sup>2</sup> )		14	151	8	1	50		2	9	238
Total.....		203	17	6	411	2,360	68	36	318	179	21	37	3,650
Europe:													
Belgium-Luxembourg.....	( <sup>2</sup> )	9	1	116		877	7	1	15	248	3	12	1,289
Denmark.....		( <sup>2</sup> )				174	( <sup>2</sup> )	( <sup>2</sup> )	19	30	1	3	227
France.....		38	1	3	437	92	3	10	57	944	2	1	1,588
Germany, West.....		192	27			513	1	59	178	1,034	9	4	2,017
Greece.....		168			1	105	( <sup>2</sup> )	1	1		( <sup>2</sup> )	2	278
Italy.....		434	1	4	782	490	3	1	106	1,031	4	6	2,862
Netherlands.....	( <sup>2</sup> )	326	6	373	590	463	2	2	95	1,498	4	10	3,369
Norway.....		( <sup>2</sup> )				27	( <sup>2</sup> )	( <sup>2</sup> )	2	652	1	4	686
Sweden.....		1		634		406	2	( <sup>2</sup> )	15	101	1	12	1,172
United Kingdom.....	336	321	39		1,228	1,209	55	10	76	239	13	1	3,527
Other.....		31	( <sup>2</sup> )	6	( <sup>2</sup> )	428	8	3	103	299	11	10	899
Total.....	336	1,520	75	1,136	3,038	4,784	81	87	667	6,076	49	65	17,914

Asia:														
India.....		2	1	10	6	1,604	4	( <sup>2</sup> )	3	100	25	11	1,766	
Indonesia.....	53	( <sup>2</sup> )			212	212	( <sup>2</sup> )	( <sup>2</sup> )	2		2	8	277	
Japan.....	952	147	8	3,855	8,187	2,184	5	6	40	4,943	30	24	20,381	
Malaysia.....		( <sup>2</sup> )		( <sup>2</sup> )	157	157	( <sup>2</sup> )	( <sup>2</sup> )	2		2	3	164	
Philippines.....		9	( <sup>2</sup> )		( <sup>2</sup> )	402	19		15	20	12	21	498	
Turkey.....		74	1		605	605	5		( <sup>2</sup> )		( <sup>2</sup> )	36	621	
Other.....	10	90	1	( <sup>2</sup> )	2	1,238	57	9	( <sup>2</sup> )	51	17	52	1,572	
Total.....	1,015	322	11	3,865	8,195	6,302	90	15	113	5,108	88	155	25,279	
Africa:														
Congo (Leopoldville).....		6	1			104	6		2	( <sup>2</sup> )	1	5	125	
South Africa, Republic of.....		164	( <sup>2</sup> )		180	627	86	2	122	( <sup>2</sup> )	18	13	1,212	
United Arab Republic (Egypt).....		6				286		1	( <sup>2</sup> )		( <sup>2</sup> )	8	301	
Other.....		17	10	6		302	32	1	32	126	9	33	568	
Total.....		193	11	6	180	1,319	124	4	156	126	28	59	2,206	
Oceania:														
Australia.....		30	9	3	164	657	6	7	50	263	8	5	1,202	
French Pacific Islands.....		48	17	235	78	5	13	5			( <sup>2</sup> )	3	404	
New Zealand.....		18	2			103	( <sup>2</sup> )	2	8		3	( <sup>2</sup> )	136	
Other.....			1	3	( <sup>2</sup> )	3	11	10				( <sup>2</sup> )	25	
Total.....		96	29	233	245	765	30	24	58	263	11	8	1,767	
Grand total.....	1,361	7,125	160	6,507	19,135	17,628	614	5,365	1,736	13,618	236	561	74,046	
Shipments from the United States to territories and possessions:														
Puerto Rico.....		3	( <sup>2</sup> )	( <sup>2</sup> )		137	124	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	6	270	
Virgin Islands.....		78	6	84		7	278	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	453	
Wake.....		739	( <sup>2</sup> )	41		( <sup>2</sup> )	11	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	791	
Other.....		40	3	137		5	13	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	198	
Total.....		860	9	262		149	426	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	6	1,712	
Exports from Territories to foreign countries:														
Puerto Rico.....		1		1,382	266	( <sup>2</sup> )	( <sup>2</sup> )	7			1		1,657	
Total net shipments from the United States.....	1,361	7,984	169	5,387	18,869	17,777	1,040	5,358	1,736	13,618	235	567	74,101	

<sup>1</sup> Revised figure.

<sup>2</sup> Includes naphtha but excludes benzol: 1963—1,541,316 barrels; 1964—2,078,183 barrels.

<sup>3</sup> Less than 1/2 unit.

<sup>3</sup> Not separately classified.

Source: Bureau of the Census.

TABLE 75.—World production of crude petroleum by countries<sup>1</sup>(Thousand barrels)<sup>2</sup>

Country	1960	1961	1962	1963	1964 <sup>3</sup>
<b>North America:</b>					
Canada.....	189,534	220,861	244,139	258,435	275,364
Cuba <sup>4</sup> .....	108	80	90	72	80
Mexico.....	99,049	106,784	111,830	114,807	115,576
Trinidad.....	42,357	45,768	48,876	48,678	49,724
United States.....	2,574,933	2,621,758	2,676,189	2,752,723	2,805,125
<b>Total.....</b>	<b>2,905,981</b>	<b>2,995,251</b>	<b>3,081,124</b>	<b>3,174,775</b>	<b>3,245,869</b>
<b>South America:</b>					
Argentina.....	64,132	84,418	98,154	97,221	100,370
Bolivia.....	3,574	2,989	2,917	3,285	3,195
Brazil.....	29,613	34,807	33,401	35,714	33,310
Chile.....	7,231	9,283	11,689	13,206	13,687
Colombia.....	55,770	53,247	51,918	60,343	62,596
Ecuador.....	2,730	2,926	2,573	2,465	2,796
Peru.....	19,255	19,371	21,134	21,468	23,119
Venezuela.....	1,041,675	1,065,757	1,167,916	1,185,511	1,241,782
<b>Total.....</b>	<b>1,223,980</b>	<b>1,272,778</b>	<b>1,389,702</b>	<b>1,419,213</b>	<b>1,480,855</b>
<b>Europe:</b>					
Albania.....	4,854	5,144	5,238	5,339	• 5,238
Austria.....	16,874	16,237	16,694	18,271	18,571
Bulgaria.....	1,460	1,510	1,453	1,266	1,168
Czechoslovakia.....	1,929	1,045	1,200	1,220	1,322
France.....	14,233	15,578	17,071	18,117	20,487
Germany, West.....	40,076	44,960	48,943	53,325	55,419
Hungary.....	9,283	11,117	12,521	13,398	13,742
Italy.....	13,613	13,432	12,303	12,155	13,184
Netherlands.....	13,378	14,271	14,974	15,377	15,758
Poland.....	1,442	1,503	1,502	1,577	2,092
Rumania.....	85,712	86,321	88,420	91,171	92,383
U. S. S. R. <sup>4</sup> .....	1,079,371	1,212,300	1,359,600	1,504,300	1,646,400
United Kingdom.....	649	784	820	910	939
Yugoslavia.....	6,671	9,479	11,299	11,930	13,322
<b>Total<sup>4</sup>.....</b>	<b>1,288,545</b>	<b>1,433,681</b>	<b>1,592,038</b>	<b>1,748,356</b>	<b>1,905,125</b>
<b>Asia:</b>					
Bahrain.....	16,500	16,444	16,446	16,503	18,000
Burma.....	4,078	4,218	4,366	4,761	4,277
China <sup>5</sup> .....	40,150	45,260	49,640	54,750	62,050
India.....	3,370	3,356	8,016	12,266	16,965
Indonesia.....	152,988	155,369	167,771	165,002	170,739
Iran.....	385,748	431,653	481,939	538,107	618,731
Iraq.....	353,833	365,594	366,832	422,581	459,290
Israel.....	932	1,133	1,126	1,091	1,435
Japan.....	3,678	4,590	5,316	5,485	4,590
Kuwait.....	594,278	600,226	669,284	705,471	774,815
Kuwait—Saudi Arabia neutral zone.....	49,829	65,153	89,224	114,535	131,415
Mongolia <sup>6</sup> .....	290	360	360	360	360
Pakistan.....	2,636	2,829	3,338	3,514	3,732
Qatar.....	63,088	64,386	67,911	70,129	77,740
Sarawak and Brunei.....	34,005	30,551	28,286	29,639	26,265
Saudi Arabia.....	456,453	508,269	555,056	594,592	628,095
Taiwan (Formosa).....	14	17	14	19	61
Trucial States.....			5,976	17,571	67,465
Turkey.....	2,624	3,075	4,157	5,090	5,897
<b>Total<sup>4</sup>.....</b>	<b>2,164,494</b>	<b>2,302,483</b>	<b>2,525,058</b>	<b>2,761,466</b>	<b>3,071,922</b>

See footnotes at end of table.

TABLE 75.—World production of crude petroleum by countries <sup>1</sup>—Continued(Thousand barrels) <sup>2</sup>

Country	1960	1961	1962	1963	▷ 1964
<b>Africa:</b>					
Algeria <sup>3</sup> .....	67,613	121,494	158,094	184,311	202,290
Angola.....	477	757	3,404	5,776	6,535
Congo, Republic of (Brazzaville).....	365	724	926	820	619
Gabon, Republic of.....	5,626	5,446	5,992	6,446	7,668
Libya.....	695	6,642	67,052	167,786	315,642
Morocco.....	695	603	968	1,140	910
Nigeria.....	6,552	16,802	24,624	27,644	43,997
Senegal.....	12	16	3	—	—
United Arab Republic (Egypt).....	22,785	26,136	32,321	38,759	43,915
<b>Total.....</b>	<b>104,125</b>	<b>178,620</b>	<b>293,384</b>	<b>432,682</b>	<b>621,576</b>
<b>Oceania:</b>					
Australia.....	—	—	—	—	1,487
New Zealand.....	5	4	4	4	4
West Irian.....	1,538	1,082	917	924	753
<b>Total.....</b>	<b>1,543</b>	<b>1,086</b>	<b>921</b>	<b>928</b>	<b>2,244</b>
<b>World total.....</b>	<b>7,688,668</b>	<b>8,183,899</b>	<b>8,882,227</b>	<b>9,537,420</b>	<b>10,327,591</b>

• Estimate. ▷ Preliminary.

<sup>1</sup> This table incorporates some revisions.<sup>2</sup> 42-gallon barrels.<sup>3</sup> Natural naphtha and gas oil.<sup>4</sup> U.S.S.R. in Asia (including Sakhalin) included with U.S.S.R. in Europe.<sup>5</sup> Including Sahara.

## NATIVE ASPHALT

**Bituminous Limestone and Sandstone.**—In 1964 the production of bituminous limestone and bituminous sandstone combined was 1,444,000 short tons, a gain of 18.6 percent for the year. The total value of bituminous materials in these two categories produced in the United States in 1964 was valued at \$3,513,000 and the average value per ton was \$2.43, slightly less than the corresponding value, \$2.46, in 1963.

**Gilsonite.**—The production figure for gilsonite cannot be disclosed by the Bureau of Mines because of the limited number of producers. All gilsonite production is in the State of Utah, and most of the gilsonite produced is transported by pipeline to a refinery in southern Colorado for processing.





# Helium

By Edwin M. Thomasson<sup>1</sup>



**H**ELIUM SHIPMENTS in 1964 exceeded the volume shipped during the previous year for the 15th successive time. Shipments from Bureau of Mines helium plants were 667.4 million cubic feet,<sup>2</sup> about 6 percent more than in 1963. Production at Bureau of Mines plants totaled 784.5 million cubic feet. An additional 3,193.1 million cubic feet, which was produced by private companies participating in the helium conservation program, was purchased by the Bureau and stored underground for future use.

The Bureau of Mines continued to sell helium at \$35 a thousand cubic feet, the price established in 1961. Substantial railway freight rate reductions for tank car shipments of helium went into effect during the year, resulting in a lower delivered price for helium.

As the Nation moved ahead in the space age, it became increasingly apparent that helium would continue to play an essential role in research, in technology, in defense, and in industry.

## PRODUCTION

Eleven plants in the United States produced helium during 1964. For convenience, these plants can be segregated into three categories: (1) The plants owned by the U.S. Government and operated by the Bureau of Mines, which produce helium for sale to both Federal agencies and private customers, (2) the "conservation" plants, privately owned and operated, but producing helium solely for purchase by the Bureau of Mines for conservation purposes, and (3) privately owned plants producing helium for independent sale in the commercial market.

The Bureau of Mines operates five federally owned helium extraction plants, located at Amarillo and Exell, Tex.; Keyes, Okla.; Otis, Kans.; and Shiprock, N. Mex. These plants produced a combined total of 784.5 million cubic feet of helium during 1964, an increase of 1.3 percent over 1963 production. All Bureau plants produce only grade A helium; that is, helium with a purity of at least 99.995 percent. Each of the five Bureau plants processed essentially all available natural gas and operated without difficulty throughout the year. Production exceeded demand, and 131 million cubic feet of helium

<sup>1</sup> Staff engineer, Office of Assistant Director, Helium.

<sup>2</sup> All volumes of gases reported in this chapter are measured at 14.7 pounds per square inch absolute and 70° Fahrenheit.

produced by the Bureau plants was added to underground storage. However, 0.734 million cubic feet of stored helium was withdrawn from underground storage along with native helium-bearing natural gas in maintaining the plant load at the Amarillo plant. Table 1 shows helium production in the United States since 1921, and table 2 shows production of each of the five Bureau of Mines plants.

**TABLE 1.—Helium production in the United States**

(Million cubic feet)

Year	Production	Year	Production
1921-28	<sup>1</sup> 5.8	1961	727.6
1929-42	<sup>1</sup> 11.8	1962	713.4
1943-49	<sup>1</sup> 83.5	1963	2,231.5
1950-54	<sup>1</sup> 138.0	1964	4,027.4
1955-59	<sup>1</sup> 313.4		
1960	642.0	Total 1921-64	11,395.0

<sup>1</sup> Annual average.

**TABLE 2.—Production of helium by Bureau of Mines plants**

(Million cubic feet)

Plant location	Production	
	1963	1964
Amarillo, Tex.	62.7	51.3
Exell, Tex.	286.5	307.5
Keyes, Okla.	300.4	298.8
Otis, Kans.	46.4	44.8
Shiprock, N. Mex.	78.2	82.1
Total	774.2	784.5

The conservation plants extract crude helium (a mixture of principally helium and nitrogen, containing 50 to 85 percent helium) from natural gas before the natural gas is consumed as fuel. These five plants are owned and operated by private companies, but their entire output of crude helium is purchased by the United States for conservation purposes under long-term contracts. The conservation plants produced and sold to the United States 3,193.1 million cubic feet of helium during 1964, an increase of 125 percent over 1963 production. A more complete discussion of the helium conservation program is presented later in this chapter.

The final category of helium extraction plants comprises privately owned plants producing helium for independent sale in the commercial market. Only one plant falls into this category at present—the plant owned and operated by Kerr-McGee Oil Industries, Inc., near Navajo, Ariz. The Kerr-McGee plant has an annual capacity of about 60 million cubic feet of helium, and production during 1964 was slightly more than three-fourths of plant capacity, or about 46 million cubic feet. The Kerr-McGee plant produces grade A helium extracted from nonflammable gas resources owned or controlled by the company in the Pinta Dome and Navajo Springs fields, Apache County, Ariz. The market for the Kerr-McGee helium is made up of non-Federal customers, principally on the West Coast.

## SHIPMENTS

Helium shipments from Bureau of Mines plants totaled 667.4 million cubic feet. Federal agencies received 499.4 million cubic feet, and 168.0 million cubic feet was sold to non-Federal customers. In delivering helium to customers, the five Bureau plants together filled and shipped 1,928 railway tank cars, 1,230 highway semitrailers, and 247,539 standard gas cylinders.

Two early model, low capacity, Bureau of Mines railway tank cars were transferred to the U.S. Atomic Energy Commission for use as on-site helium storage containers. Another car was transferred to the National Aeronautics and Space Administration. These transfers reduced the Bureau's active railway tank car fleet to 233. Two highway semitrailers, each with a capacity of 135,000 cubic feet of helium at filling pressure of 2,640 pounds per square inch, were added to the Bureau fleet, bringing the total semitrailer fleet to seven. Many helium customers, both Federal and non-Federal, also own semitrailers used to transport helium from Bureau plants.

The Bureau plant at Amarillo, Tex., is specially equipped to fill, handle, and ship standard gas cylinders (Interstate Commerce Commission 3A and 3AA cylinders), and all cylinder shipments originate there. The four remaining Bureau plants are equipped to fill and ship railway tank cars, and all five plants can handle highway semitrailers. A new diaphragm-type compressor was installed at the Otis, Kans., plant during the year, and now all five Bureau plants can fill shipping containers to maximum pressures of 4,000 pounds per square inch.

## CONSUMPTION AND USE

Sales of helium from Bureau plants in 1964 of 667.4 million cubic feet was an increase of 40.1 million cubic feet, or slightly more than 6 percent, over the previous record of 627.3 million cubic feet set in 1963. Shipments (sales) from Bureau of Mines plants are shown in table 3.

About 46 million cubic feet of privately produced helium was consumed in addition to that supplied by the Bureau of Mines. Consequently, the total volume of helium delivered to consumers and presumably used in 1964 was about 713 million cubic feet, about 7.7 percent above the 1963 consumption of 662 million cubic feet.

No detailed helium utilization survey was undertaken during 1964, but it is believed that the overall use pattern reported in the 1963 "Helium" chapter remained substantially unchanged. Over one-half of all helium consumed was used in connection with the various space and missile programs. Shielded-arc welding and research applications continued to require significant quantities of helium.

Table 4 shows the quantity of helium used annually since 1950.

TABLE 3.—Shipments of helium from Bureau of Mines helium plants

Recipient	1963		1964	
	Million cubic feet	Percent	Million cubic feet	Percent
<b>Federal agencies:</b>				
Department of Defense.....	337.3	53.8	347.3	52.0
Atomic Energy Commission.....	75.5	12.0	64.8	9.7
National Aeronautics and Space Administration.....	52.6	8.4	79.7	11.9
Weather Bureau.....	7.8	1.2	7.0	1.1
Other.....	.5	.1	.6	.1
<b>Total.....</b>	<b>473.7</b>	<b>75.5</b>	<b>499.4</b>	<b>74.8</b>
<b>Non-Federal consumers.....</b>	<b>153.6</b>	<b>24.5</b>	<b>168.0</b>	<b>25.2</b>
<b>Total shipments.....</b>	<b>627.3</b>	<b>100.0</b>	<b>667.4</b>	<b>100.0</b>

TABLE 4.—Helium use in the United States

(Million cubic feet)

Year	Quantity	Year	Quantity
1950.....	81	1958.....	352
1951.....	109	1959.....	375
1952.....	145	1960.....	475
1953.....	158	1961.....	551
1954.....	190	1962.....	1 630
1955.....	236	1963.....	1 662
1956.....	267	1964.....	1 713
1957.....	310		

<sup>1</sup> Includes helium produced and sold by the privately owned Kerr-McGee plant at Navajo, Ariz.

## RESOURCES

The Bureau of Mines conducts a continuing survey of helium resources in the United States. The survey is conducted by obtaining and analyzing for helium content samples of natural gas from various natural gas wells and fields throughout the country. During 1964, 466 natural gas samples from 26 States were obtained and analyzed. No significant new deposits of helium-bearing natural gas were discovered, and there were no major additions to the known helium resources of the country.

The helium resources of the United States in helium-bearing natural gas containing at least 0.3 percent helium by volume are estimated to be approximately 194 billion cubic feet as of January 1, 1963, the date of the latest estimate. About 92 percent of these resources are located in five major helium-bearing gasfields: (1) The Hugoton field of Kansas, Oklahoma, and Texas, (2) the Panhandle field of Texas, (3) the Keyes field of Oklahoma, (4) the Greenwood field of Kansas and Colorado, and (5) the Cliffside field of Texas. All of these fields are within about 200 miles of Amarillo, Tex.

Other helium-bearing natural gas deposits occur in the Paradox basin area of western Colorado and eastern Utah, in northwestern New Mexico, in Arizona, in Wyoming, in Montana, and in Michigan. In general, the helium resources in these areas are limited. The natural gas production is also limited, and consequently, the resulting wastage of helium constitutes only a small percentage of the total volume of

helium wasted annually. Figure 1 shows the general location of known deposits of helium-bearing natural gas.

About 10 percent of the known helium-bearing natural gas resources in the United States is available to the five Bureau of Mines helium plants. The two largest Bureau plants—Exell, Tex., and Keyes, Okla.—extract helium from gas produced from the Panhandle and Keyes fields. The Cliffside field is the only developed source of helium-bearing natural gas owned by the Government and provides the source gas for the Amarillo plant. The plants at Shiprock, N. Mex., and Otis, Kans., extract helium from gas produced from small helium-bearing gasfields.

Two minor helium-bearing natural gas deposits discovered on public domain lands in Utah were established as Helium Reserves Nos. 1 and 2 in March 1924 and June 1933, respectively. The helium resources of the two reserves are very small in relation to the present rate of helium production and use, and engineering reappraisal in light of oil and gas exploration on or near the reserves resulted in major downward revision of the estimated helium therein. As a result, the Secretary of the Interior, by Public Land Order 3427 of August 4, 1964 (29 FR 11455), revoked the Executive orders creating the Helium Reserves, thereby terminating the helium reserve status of the lands involved.

In addition to helium-bearing natural gas, other sources of helium—such as gases from mineral springs, fumaroles, and volcanoes; the air; rocks and minerals; and meteorites—are of general and scientific interest. However, none of these occurrences offers an economically feasible source material from which to extract helium. Under present conditions helium-bearing natural gases remain the only economical sources of helium, and this situation seems likely to continue.

## CONSERVATION

Helium is a completely inert element, and thus its occurrence as a minor constituent in certain natural gases contributes nothing to the fuel value of the natural gases. However, unless this helium is removed before the natural gas is consumed as fuel, the contained helium is forever lost to the atmosphere without serving any useful purpose.

National resources of helium are diminishing rapidly as helium-bearing natural gas is consumed as fuel, and resources of helium appear adequate to meet predicted future needs only if the loss of this vital element is curtailed. This need to conserve a diminishing and irreplaceable natural resource was recognized, and the Congress enacted Public Law 86-777, effective March 1, 1961, which amended the Helium Act of 1925, as amended (43 Stat. 1110; 50 U.S.C. 161, 163-66). The new law included an authorization for the Bureau of Mines to purchase helium for conservation and ultimate resale. Authority to enter into purchase contracts, in an aggregate amount not to exceed \$47.5 million a year, was granted in the act (Public Law 87-122) making appropriations for the U.S. Department of the Interior and related agencies for the fiscal year ending June 30, 1962.

Under these authorizations, the Department of the Interior, through the Bureau of Mines, launched a long-term helium conservation program in 1961. The Department entered into four contracts under

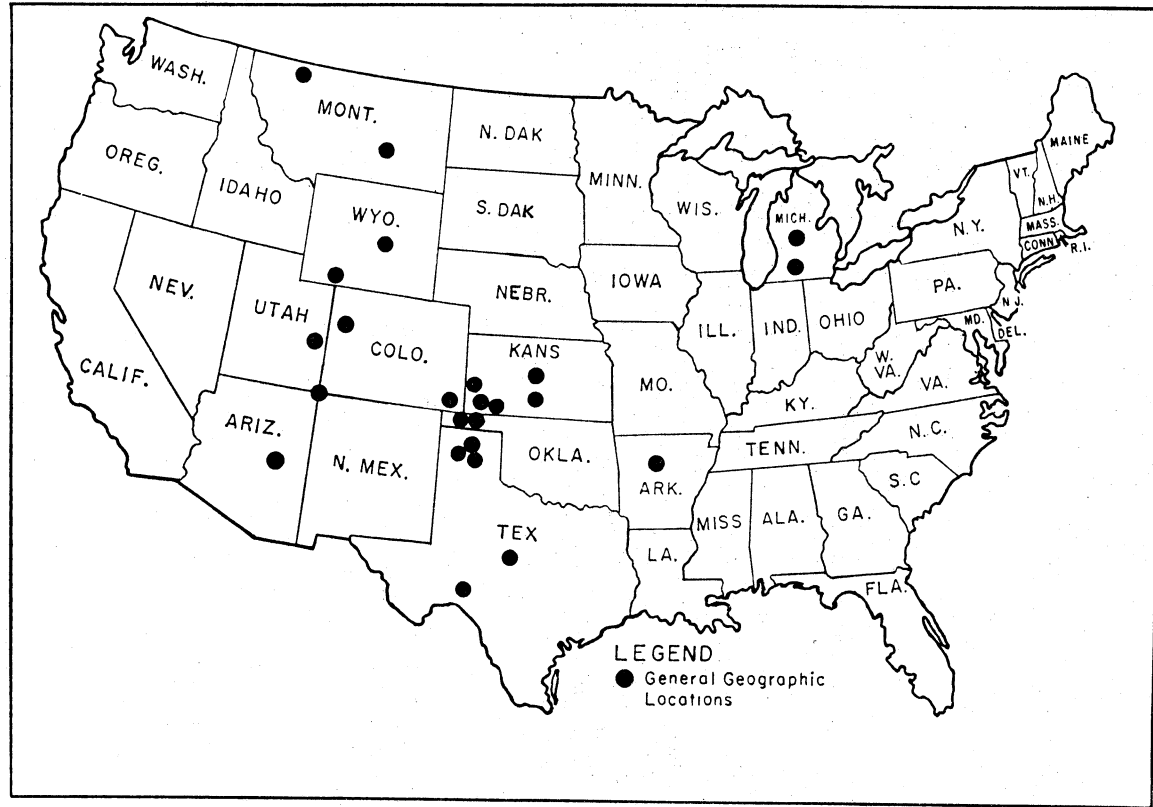


FIGURE 1.—Locations of known helium resources in the United States where the helium content of natural gas is 0.3 percent or more.

which four private companies agreed to finance, build, and operate five plants to recover helium from natural gas before the natural gas goes to market. Each contract is for 22 years and provides that the Bureau of Mines will purchase, up to specified limits, the entire output of helium from each plant. The four contracts utilize the entire \$47.5 million a year contracting authority established by Congress.

Concurrently, the Bureau constructed a 425-mile helium pipeline to connect these plants with the Government's Cliffside gasfield and conditioned the wells in the Cliffside gasfield to facilitate the injection of the helium into a natural gas-bearing formation. The pipeline extends from Bushton, Kans., to the Cliffside field near Amarillo, Tex.

Two of the conservation plants began production in 1962—the Northern Helix Co. plant near Bushton, Kans., and the Phillips Petroleum Co. plant in Hansford County, Tex. The remaining three plants—the Cities Service Helix, Inc., plant at Ulysses, Kans.; the National Helium Corp. plant near Liberal, Kans.; and the Phillips Petroleum Co. plant at Dumas, Tex.—commenced operations during 1963. All five plants operated throughout 1964.

In conception and operation, the helium conservation program is essentially a simple program. Helium-bearing natural gas, on the way to market, is routed through one of the five conservation plants, where the helium and some nitrogen are removed by low-temperature processing. The natural gas is returned to the pipeline for transmission to market. The gaseous helium-nitrogen mixture, ranging from 50 to 85 percent helium, is delivered to the Bureau of Mines pipeline, through which it is transported to the Cliffside field. At the Cliffside field it is injected into a partially depleted gas-bearing formation, to be stored until needed. When future needs demand, the helium-nitrogen mixture will be withdrawn and purified. The pure helium will then be sold to fulfill governmental and industrial requirements.

Table 5 shows the quantities of helium purchased by the Bureau of Mines from each of the conservation plants since the inception of the conservation program.

Whenever production at Bureau plants has exceeded market requirements, the helium produced in excess of demand has been stored in the Cliffside field. Table 6 shows the amounts stored each year and the amount in storage at yearend.

**TABLE 5.—Helium purchased by the Bureau of Mines for conservation**

(Million cubic feet)

Company and location of plant	Helium delivered		
	1962	1963	1964
Northern Helix Co., Bushton, Kans.....	1.9	208.1	493.9
Cities Service Helix, Inc., Ulysses, Kans.....		75.3	492.2
National Helium Corp., Liberal, Kans.....		457.5	1,184.4
Phillips Petroleum Co., Dumas, Tex.....		197.7	458.7
Phillips Petroleum Co., Hansford County, Tex.....	.5	481.7	563.9
Total.....	2.4	1,420.3	3,193.1

Revised.



TABLE 6.—Helium in conservation storage

(Million cubic feet)

Year	Amount stored during year		Amount in storage on Dec. 31
	From Bureau of Mines plants	From conservation plants	
1960.....	1 273		273
1961.....	174		447
1962.....	75.2	2.4	524.6
1963.....	165.0	1,420.3	2,109.9
1964.....	131.0	3,193.1	<sup>2</sup> 5,433.3

<sup>1</sup> Stored during 1960 and in previous years.<sup>2</sup> Total reflects 0.734 million cubic feet withdrawn from storage during 1964.

## PRICES

The revised Helium Act (Public Law 86-777) directs agencies of the Federal Government to purchase all major helium requirements from the Secretary of the Interior. It also provides that helium shall be sold at prices adequate to sustain the program and to cover all costs of carrying out provisions of the act, including repayment to the Treasury of the United States, with interest, the net capital and retained earnings when the act was passed.

Until November 18, 1961, sales were at prices of \$15.50 and \$19 a thousand cubic feet (f.o.b. plant) for Federal and non-Federal purchasers, respectively. These prices were established in 1954. The price necessary to cover all costs of carrying out the provisions of the Helium Act and to make the prescribed repayments was calculated to be \$35 a thousand cubic feet. On November 18, 1961, the \$35 price went into effect, applicable to all purchasers. This price has remained without change and is still in effect. Revised regulations, a schedule of charges, and other information on the sale of helium and rental of containers by the Bureau of Mines are included in the Code of Federal Regulations (30 CFR 1).

Substantial freight rate reductions for railway tank car shipments of helium were obtained from rail carriers during 1964. The reductions, averaging 31 percent, will result in an overall savings to the United States of about \$650,000 annually. While the selling price of helium f.o.b. plant remained unchanged, the freight reduction materially reduced the delivered unit price of helium in bulk lots to major Federal customers.

## FOREIGN TRADE

Helium is exported under licenses issued by the Office of Munitions Control, U.S. Department of State. Exports amount to less than 0.5 percent of the annual domestic consumption. It is believed that most exported helium is used in fundamental and applied research, in chromatography, and in various atomic energy applications.

In December 1963, a helium plant near Swift Current in Saskatchewan Province, Canada, commenced operation. The plant has an annual production capacity of 12 million cubic feet and produces grade A helium from a small, nonflammable helium-bearing gas de-

posit. Production for 1964 is not definitely known, but available information indicates that the plant has not reached sustained capacity production. The helium will be marketed principally in Canada and Europe. The Canadian plant is the only helium production facility in the free world outside the United States.

## TECHNOLOGY

Kerr-McGee Oil Industries, Inc., installed a 100-liter-an-hour helium liquefier at its Navajo, Ariz., helium plant. Also installed was a vacuum-jacked, nitrogen-shielded storage facility of 4,500-liter capacity.

A cryogenic filter method to produce superpure gaseous helium for experimental use was reported during the year.<sup>3</sup> The method involves cooling helium to below 2.19° K in a low-pressure environment, so that part of the helium becomes superfluid and then filtering through iron oxide particles. Impurities and normal liquid helium cannot pass through the filter. The method can also be used to separate the isotopes of helium.

It was announced that high-purity helium 3 for use as a vapor pressure standard, to measure temperatures between 0.3° K and 3.2° K, is available from Mound Laboratory, Miamisburg, Ohio. Its availability results from a cooperative effort by Los Alamos Scientific Laboratory, National Bureau of Standards, and Mound Laboratory (operated by Monsanto Research Corp. for the U.S. Atomic Energy Commission).

At yearend construction was underway on a privately owned helium plant at Otis, Kans. The plant, owned by Kansas Refined Helium Co., will extract helium from natural gas produced northwest of Otis. The company plans to install a 500-liter-an-hour helium liquefier at the plant. The Air Reduction Sales Co. announced plans for a large-scale bulk liquid helium distribution system, using liquid helium from the new plant. The distribution system will include highway tank trucks, specially designed containers, and three liquid-to-gas conversion plants. Plans called for the plant, the liquefier, and the liquid distribution system to be operational by mid-1965.

The 40,000-kilowatt helium-cooled nuclear power reactor being built by Philadelphia Electric Co. and 52 other private electrical utility companies near Peach Bottom, Pa., was being tested at yearend prior to the installation of the radioactive fuel core. Initial startup of the plant was expected in the spring of 1965. The plant will use helium to transfer the heat produced in the nuclear reactor to water, thus producing steam to power the turbines and generators.

Work completed at the Bureau of Mines Helium Research Center and the Helium Operations Office at Amarillo, Tex., for which results were published included phase equilibria data for low-helium-content natural gas,<sup>4</sup> the development of an apparatus for detecting helium

<sup>3</sup> Reviewed in National Aeronautics and Space Administration Technical Brief 63-10235, March 1964.

<sup>4</sup> DeVaney, Will E., Lowell Stroud, and W. J. Boone, Jr. Low-Temperature Phase Equilibria of a Natural Gas of Low Helium Content. BuMines Rept. of Inv. 6499, 1964, 17 pp.

leaks,<sup>5</sup> the application of the method of least squares to pressure-volume-temperature data on gases,<sup>6</sup> a method of determining trace impurities in grade A helium by use of a chromatograph,<sup>7</sup> and additional information collected in the continuous survey of helium-bearing natural gases.<sup>8</sup>

Work at the Helium Research Center is aimed at learning more about basic properties of helium. Thermodynamic and other data for helium and helium mixtures are being reviewed systematically to identify "best" values and to close gaps in data by experiments as warranted. Current projects include measurement of the absolute viscosity of helium, investigation of metastable energy levels in liquid helium, development of a method for measuring heat capacity of helium and helium mixtures, and measurement of the diffusion coefficients and solubility of helium in liquefied gases.

<sup>5</sup> Klingman, C. L., and J. C. Meeks. An Apparatus for Detecting Helium Leaks. BuMines Rept. of Inv. 6353, 1964, 17 pp.

<sup>6</sup> Dalton, B. J. Application of the Method of Least Squares to PVT Data on Gases. BuMines Inf. Circ. 8226, 1964, 18 pp.

<sup>7</sup> Purer, Al, and C. A. Seitz. A Chromatographic Method for Determination of Trace Impurities in Grade A Helium. Anal. Chem., v. 36, No. 8, July 1964, pp. 1694-1695.

<sup>8</sup> Miller, Richard D., and Geraldine P. Norrell. Analyses of Natural Gases of the United States, 1962. BuMines Inf. Circ. 8239, 1964, 120 pp.

# Appendix

## Tables of Measurement

### Volumetric measures

	U.S. gallons	Imperial gallons	Cubic feet	Barrels	Cubic centimeters	Liters	Cubic meter
1 U.S. gallon <sup>1</sup> .....	1	0.83268	0.133681	0.0238095	3,675.41	3.78533	0.0037854
1 imperial gallon <sup>2</sup> .....	1.20094	1	.160544	.028594	4,546.04	4.54596	.004546
1 cubic foot.....	7.4805	6.2288	1	.17811	28,317.01	28.316	.028317
1 barrel <sup>3</sup> .....	42	34.9726	5.6146	1	158,987.55	158.984	.15899
1 cubic centi- meter.....	.000026417	.00021996	.000035314	.0000062895	1	.00099997	.000001
1 liter.....	.264178	.219975	.035316	.00629	1,000.027	1	.001000027
1 cubic meter.....	264.17	219.97	35.315	6.2898	1,000,000	999.973	1

<sup>1</sup> U.S. gallon=the volume occupied by 231 cubic inches.

<sup>2</sup> 1 imperial gallon=the volume occupied by 10 pounds of water at 62° F when weighed against brass in air at 30 inches of barometric pressure.

<sup>3</sup> 1 barrel=42 U.S. gallons.

### Weight measures

	Pounds	Kilograms	Short or net tons	Metric tons	Long ton
1 pound.....	1	0.453592	0.0005	0.00045359	0.00044643
1 short or net hundred weight.....	100.0	45.359	.05	.04536	.04464
1 gross or long hundred weight.....	112.0	50.802	.056	.05080	.05
1 kilogram.....	2.20462	1	.0011023	.0011	.0009842
1 short or net ton.....	2,000.	907.185	1	.907185	.892857
1 metric ton.....	2,204.6	1,000	1.10231	1	.98421
1 long ton.....	2,240	1,016.05	1.12	1.01605	1

NOTE: 1 English water ton=the volume occupied by 1 long ton of water at 60° F.