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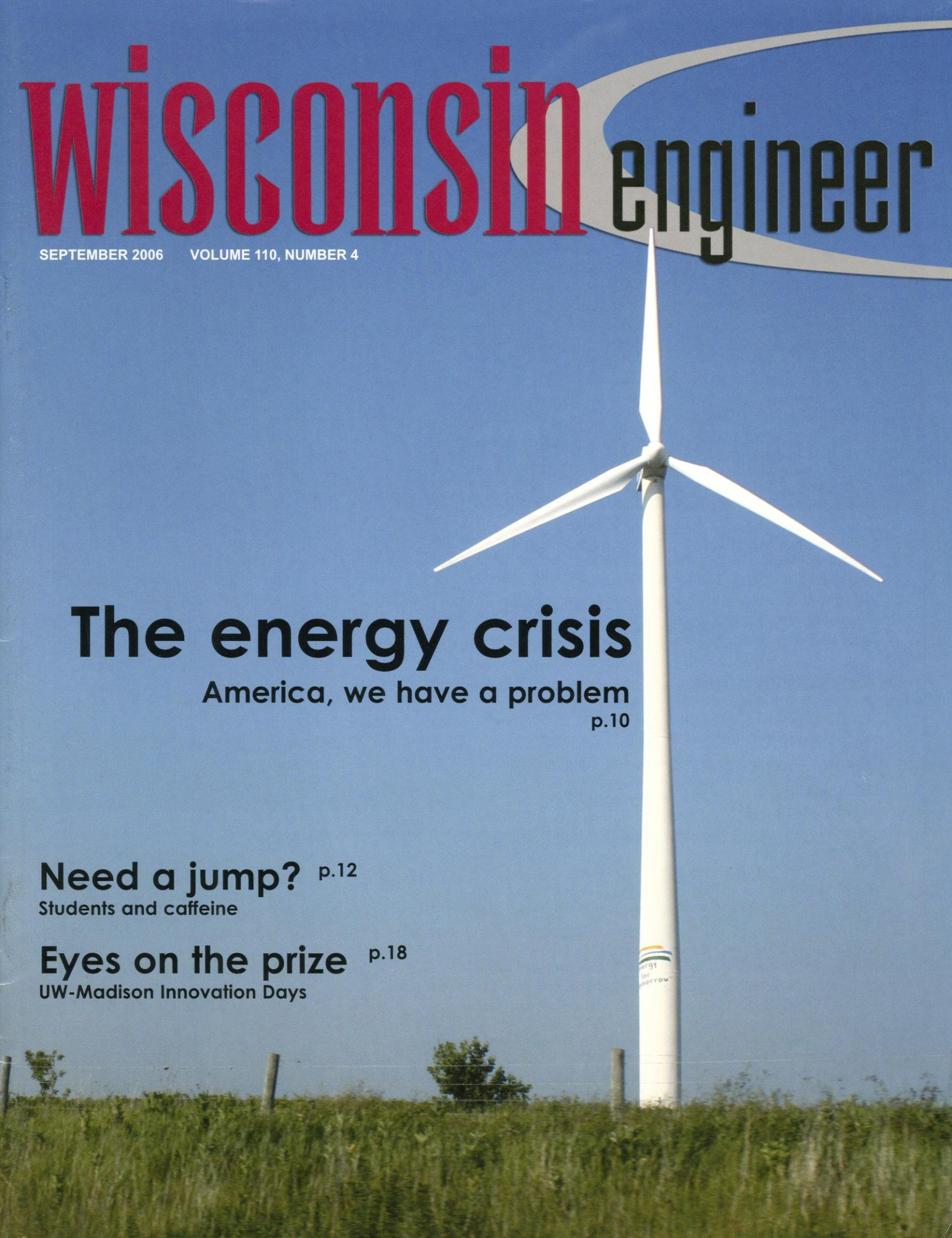

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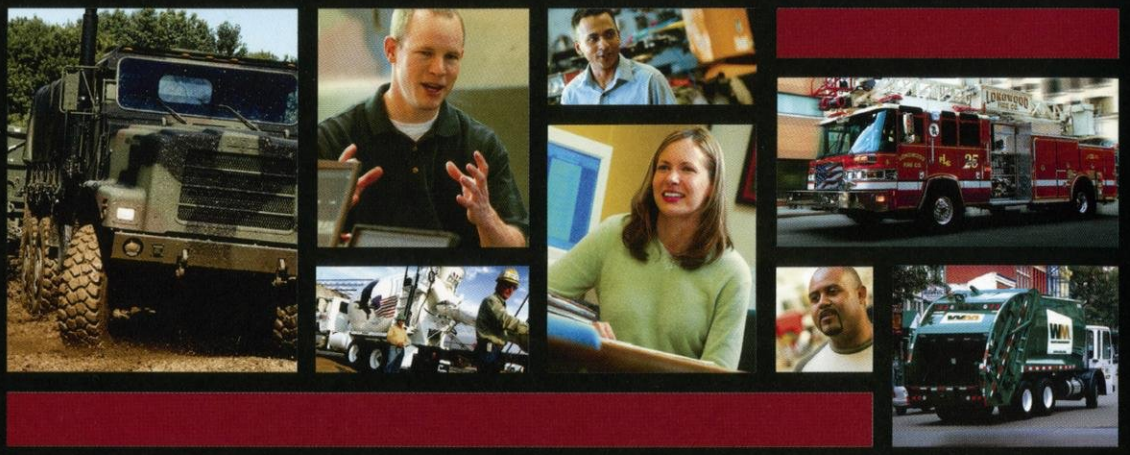

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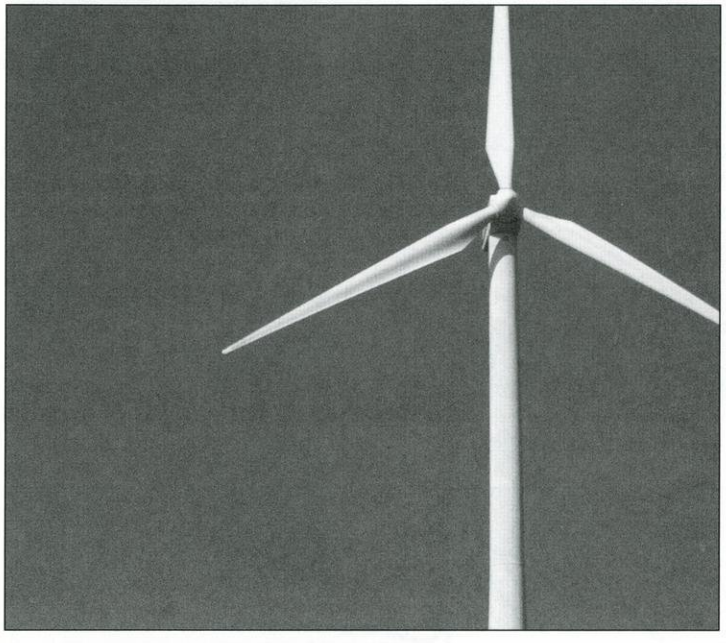

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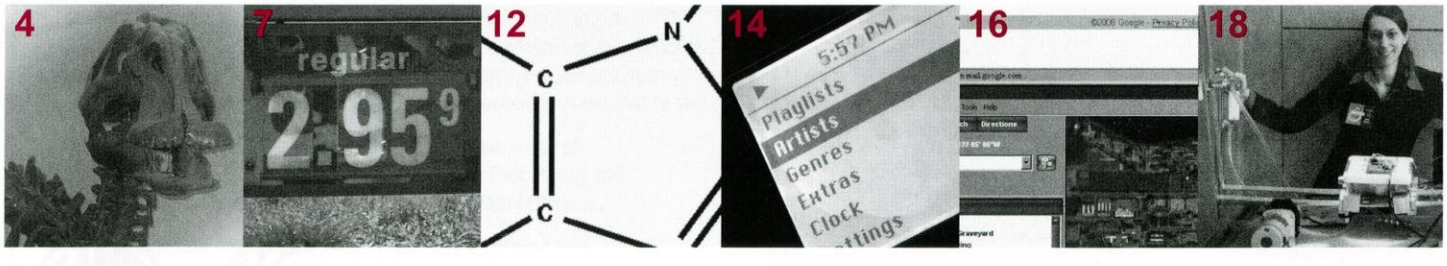
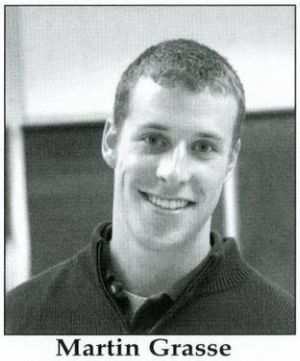


COMMENTARY



Martin Grasse
Writing Editor

Engineers must lead the charge

In this issue of *Wisconsin Engineer*, we feature several articles that tackle one of the most controversial, most explosive and most interesting issues of our generation: energy.

In the last 50 years, technological development has become an exponential phenomenon. New progress is occurring on a nearly daily basis, in fields ranging from computing to genetics. Driving this ever increasing race to develop is energy, which seems to be making itself more and more scarce.

This summer, the price of gas rose to more than three dollars per gallon. Things were not helped, of course, by the instability of the present situation in the Middle East--the source of most of the world's oil. Politicians have expounded time and again that we need a better solution and that the country needs to end its dependence on foreign oil. However, it seems that little actually changes; we haven't made any realistic commitments or plans to accomplish these goals.

Everyone has read stories about miraculous new technology that is "just around the corner" and is going to solve all our energy problems. I have heard otherwise intelligent people say, "Don't worry, in three years we will have [insert new technology here], and then everything will be fine." One such idea is the conversion to a "hydrogen economy," as described in "It's not easy being green," (p. 7) of this issue. The article points out many of the flaws in a wholesale conversion to hydrogen and explains the folly of relying on the substance to replace oil and resolve our crisis.

Don't get me wrong, researching breakthrough technologies is great. Many of the items that we have come to depend on have been breakthroughs. But as engineers, we know that these technological "miracles" are rare. While breakthroughs are possible, most technologies are developed through careful, methodical research and development work.

Instead of relying on such drastic and far-fetched technological advances to solve the energy crisis we are facing, we need to leverage existing technologies to find a realistic solution. This solution will not be thought up in a political rally and will not arise from an executive boardroom where the motivations are making profits or winning elections. Instead, the solution must come from the front line: the engineers who know how real development occurs.

Many companies are on the right track; hybrid vehicles have taken off in the last few years, and efficient appliances are becoming more and more popular. But we need to do more than just dabble with strategies that hinge on consumer whims.

One organization, known as the Apollo Alliance and featured in this issue's cover story (p. 10), is taking action. The group advocates an investment by the federal government of $300 billion to fuel the development of creative and practical solutions to the energy crisis. If the government is serious about solving the crisis, this is truly the kind of commitment and straightforward approach necessary to make a difference.

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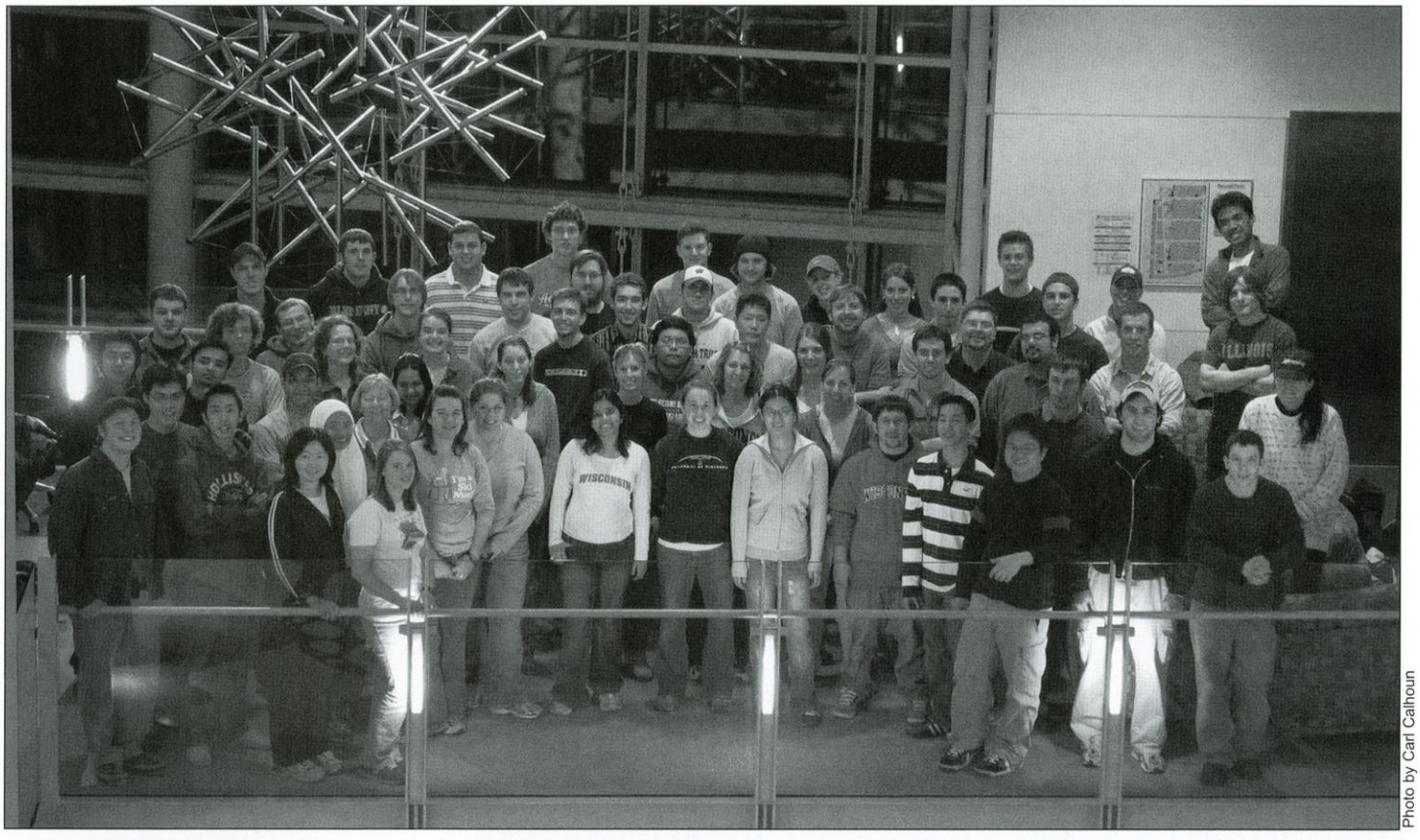

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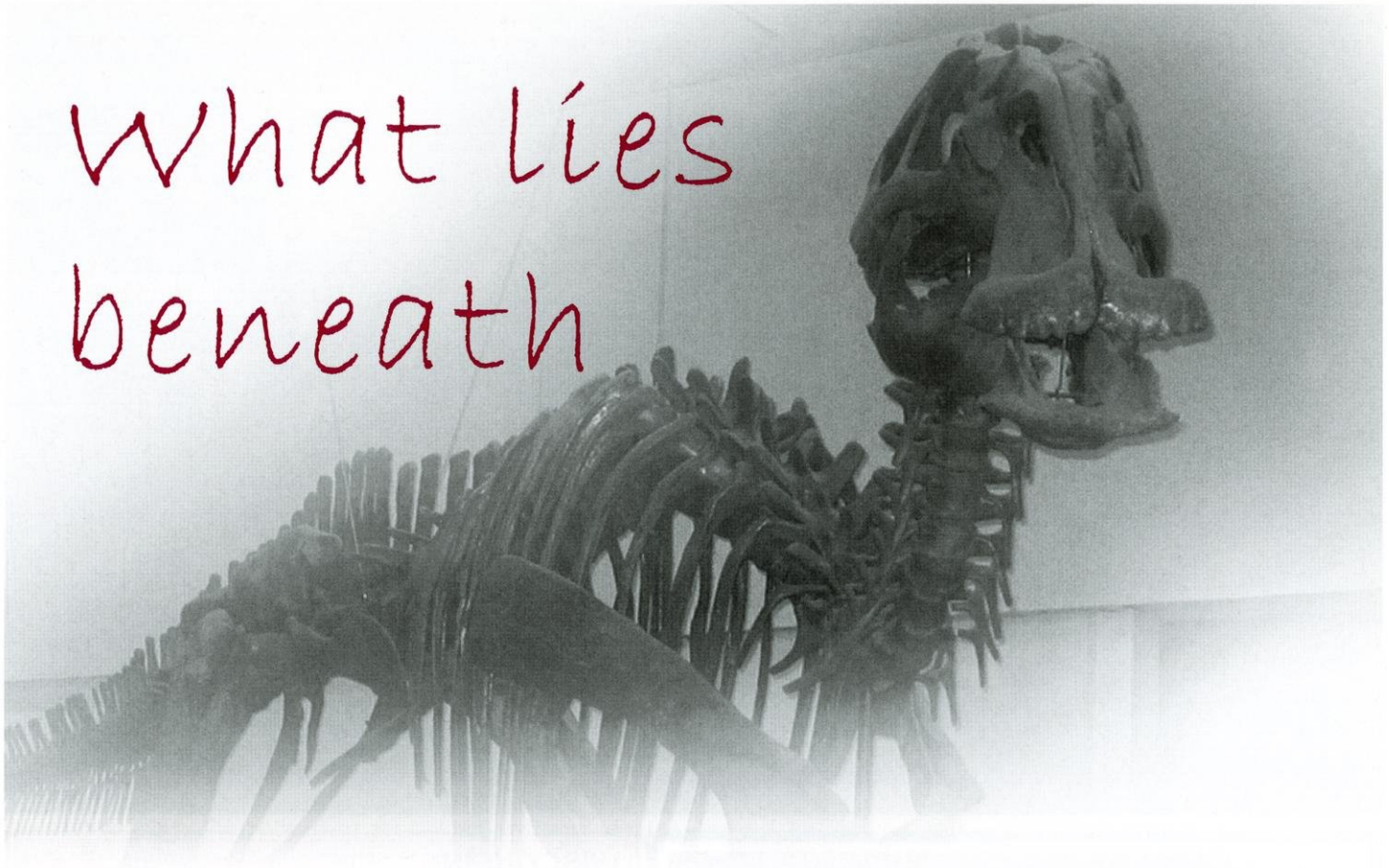


By Carly Mulliken

Mary Anderson has always tried to integrate her various interests, including Japanese culture and geology research, which is why it's not surprising that this geology professor was recently elected to the National Academy of Engineering.

The summer before she went to college, Anderson took a course in music theory to prepare for a possible music major. The class made it clear to her that she didn't have the innate musical ability needed to succeed, so she returned to her strong suit, science.

Anderson recalls her childhood interest in rocks, which was fostered by an earth science course during high school and which eventually led her to study geology.

"The course was taught only that one year, so it was fate that got me interested in [earth science] and when it was clear that I wasn't made out for music, I thought I would give geology a try," she says.

During her undergraduate career at New York State University at Buffalo, Anderson found a mentor who led her to fluvial geomorphology, the study of rivers and associated landforms. A famous book on fluvial geomorphology by Japanese author Marie Morisawa was a motivating factor as well.

Photo by Steve Ng & Ahmad Ariff Juhari

Mary Anderson, UW-Madison professor of geology.

"I've always been interested in Japan and this kind of clicked. I think subliminally there was a hope that I could follow in the footsteps of this famous Japanese woman," says Anderson.

After receiving a bachelor's degree in geology, Anderson moved on to Stanford University and earned a master's in geology, with a focus in fluvial geomorphology. Fate then brought her in contact with another mentor, who introduced her to hydrogeology--the study of the movement of groundwater. With a doctorate in hydrogeology from Stanford, Anderson was ready to begin her successful career as researcher and professor.

Anderson was hired at UW-Madison in 1975 after a two-year stint as an adjunct assistant professor of geology at Southampton College of Long Island University. After a few years at UW-Madison, she helped develop an ongoing research program at the Trout Lake basin in northern Wisconsin's Vilas County.

This research project has changed over the years. It began with a mission to study ecosystems based on data collected in the early part of the century. Later, the UW Center for Limnology, which focuses on the study of lakes, received long-term funding from the National Science Foundation to do research in northern Wisconsin. Anderson's predecessor in the geology department had a long standing interest in groundwater and lakes and helped her start what became a nationally recognized research program studying groundwater-lake systems.

"[We focus] mainly on groundwater-lake-wetland systems; northern Wisconsin is an ideal laboratory for this type of work."

Along with her research, Anderson also teaches as a professor of geology and geophysics and is a member of the Geological Engineering Program, an interdisciplinary program between the College of Engineering and the department of geology and geophysics. Anderson's specialty within this program is creating mathematical simulations of how groundwater moves in the sub-surface.

"Anyone studying hydrogeology has to have expertise in both geology and engineering. If you look at all the people in the world who study groundwater hydrology, roughly half of them come from a civil engineering background and half come from a geology background; it is a mix and continuum of interests. The science side of it feeds into the problems that engineers are interested in, such as the development of water supplies and remediation of contaminated groundwater," Anderson says.

When Anderson got the package in the mail announcing her election to the National Academy of Engineering, she first thought that it was a review for her to look over, but when she opened it she realized it was something different.

"My first reaction was disbelief, stunned, astonishment. And I am still stunned."

Anderson is currently on sabbatical from teaching but definitely not on break. She visited some colleagues in Japan this winter to follow up her long-standing interest in using heat as a groundwater tracer. Her sabbatical project involves using software to simulate heat flow through groundwater systems. And as if that weren't enough, she is also working on a revision of her 1992 textbook (which was translated into both Japanese and Chinese) and preparing a teaching module on heat flow for one of her graduate courses. Her duties as editor-in-chief of the international journal *Ground Water* also continue during her sabbatical.

"My first reaction was disbelief, stunned, astonishment. And I am still stunned."

-Mary Anderson

As a continuation of her interest in Japanese culture, Anderson studies aikido, a Japanese martial art. Between her sabbatical projects and other duties, she makes time for the activity, which she has practiced for 11 years.

"I needed to find something in my life that was just for me," she says. "I also wanted something that would get me out of the university; I wanted to meet people who did something other than geology and geophysics. A friend told me about aikido and I found an aikido group in Madison. I tried it out and realized 'this is it, I belong here."

Even though music was not her forte, Anderson and her husband actively support the arts, specifically the opera program in the UW-Madison School of Music and the American Players Theater in Spring Green, Wis.

If the National Academy of Engineers was looking for a well-rounded researcher whose broad interests help her think about the big picture, this new member certainly fits the bill. WE

Author Bio: This was Carly's final semester at UW-Madison. After graduation, she hopes to continue writing and make it her career.

Photo by Steve Ng & Ahmad Ariff Juhari

Professor Mary Anderson in front of the huge topographic globe at the geology museum. Go explore the museum for yourself at 1215 West Dayton Street.

It's not easy being green

Hydrogen economy not all it's cracked up to be

By Paul Kamenski and Matt Stauffer

There has been a lot of media attention on the possibility of a hydrogen-based "green energy" economy. Green energy is a term used for energy produced with entirely renewable fuels, without releasing harmful emissions including greenhouse gases. Although there is a lot of hype surrounding hydrogen, there are many inherent problems associated with switching to its large-scale use.

Sanford Klein, UW-Madison professor of mechanical engineering, points out three obstacles that advocates of the hydrogen economy have seemingly overlooked.

First, there is no naturally occurring hydrogen here on Earth. Sure there's plenty on the Sun, and Saturn has quite a bit as well, but none is available in pure form here on Earth. Hydrogen, therefore, has to be obtained from some other source. There are many hydrogen-rich materials such as coal, fossil fuels and even water. The problem is in extracting it from these parent sources. This extraction requires energy. Because no process is completely efficient, the more steps involved in reaching an end product, the greater the net energy loss.

Second, processes involved with hydrogen extraction could potentially produce environmentally unfriendly byproducts. Most current methods for producing hydrogen release greenhouse gases themselves. So even if the direct use of hydrogen would not produce harmful byproducts, the production process most likely would.

Finally, transporting hydrogen is another large obstacle that would need to be overcome. Hydrogen could be transported in pipelines like natural gas is, but this would be difficult due to hydrogen's very low density.

Most current methods for producing hydrogen release greenhouse gases themselves.

The compressors needed to compress the hydrogen gas into a liquid for transport at an acceptable pressure and temperature would use a huge amount of energy. In addition to paying for this expensive equipment, utilities also would have to lay pipelines all around the country, resulting in an enormous infrastructure change.

Hydrogen could also be transported using fuel tankers and trucks, just as petroleum is. However, this would not eliminate the need to compress the hydrogen into liquid form.

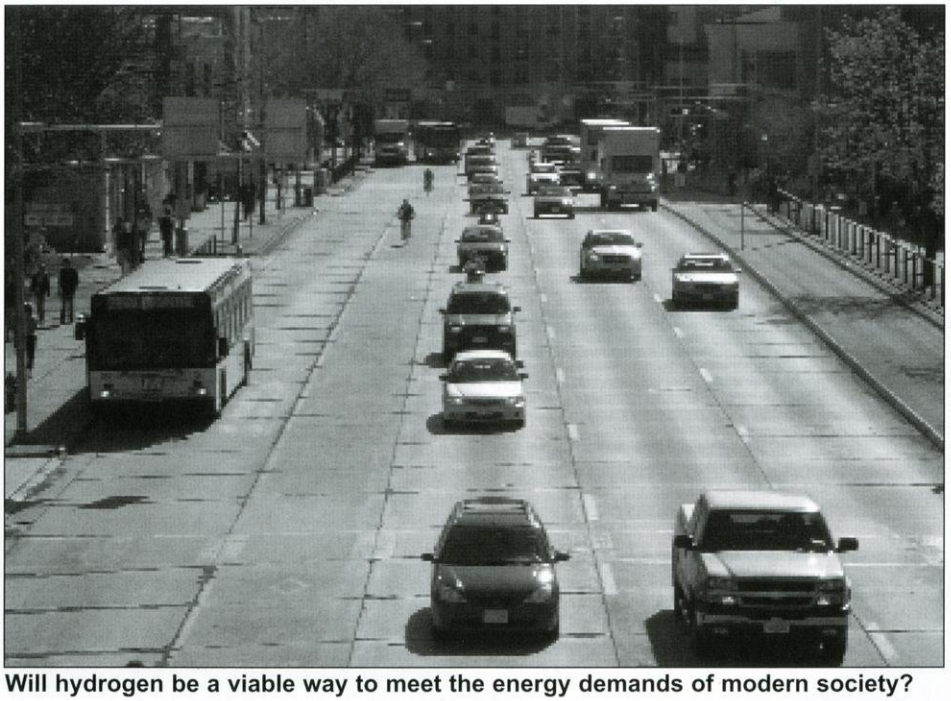


Photo by Muhamad Asyraf Yahaya and Amy Zou

Will hydrogen be a viable way to meet the energy demands of modern society?

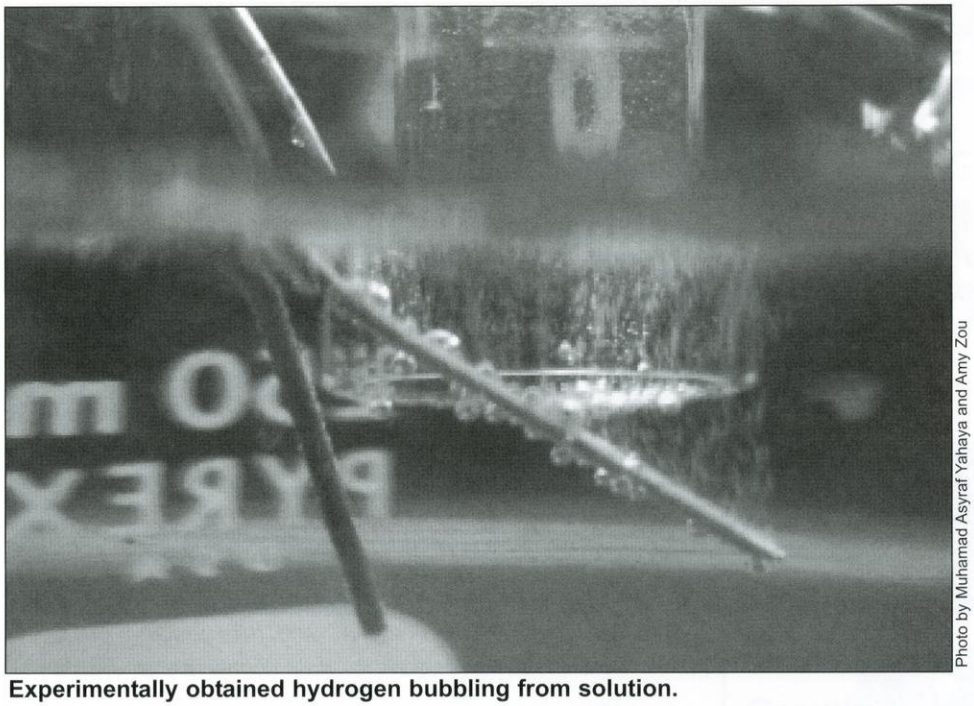


Photo by Muhamad Asyraf Yahaya and Amy Zou

Experimentally obtained hydrogen bubbling from solution.

Another option is to store hydrogen interstitially in solid sodium borohydride. All crystalline materials have finite gaps between adjacent atoms. Researchers are trying to find means of efficiently diffusing hydrogen into these empty spaces, creating a very high hydrogen storage density potential. This would result in a much easier form of fuel transportation. On the other hand, this infusion and extraction of hydrogen would require energy, taking away from this method's appeal.

"If we are going to do this we had better do it right the first time. This is a technical issue we are facing; therefore, the solution had better be decided based on technical terms, rather than political terms."
- John Perepezko

Critics summarize the problem thusly: We do not have any hydrogen and there is no reasonable method for storage or transportation. Furthermore, the infrastructure change needed for transportation and delivery would be tremendous.

"I know it's not a good idea, and I think the people doing it know it's not a good idea," Klein says. "That's what concerns me, because now it's an issue of ethics--engineering ethics."

When deciding which form of energy to pursue as the next major source, it is important to consider all aspects of the source before charging ahead. A complete cradle-to-grave analysis needs to be done in order to determine if the process is actually cost and energy efficient as well as environmentally friendly. Also, any proposals must include significant efforts to reduce energy consumption. As it stands, supply simply cannot meet demand in the long run.

"We will never run out of fuel because the last drop of fuel will be so expensive that no one will be able to afford it," Klein says.

Another UW-Madison professor agrees with the need for drastic change.

"Society is going to make a huge investment for a transformation of any sort to happen," John Perepezko, UW-Madison professor of materials science and engineering and engineering physics, says. Should change become necessary, Perepezko advocates thorough engineering analysis.

"If we are going to do this we had better do it right the first time. This is a technical issue we are facing; therefore, the solution had better be decided based on technical terms, rather than political terms." For instance, the decision to use a fuel such as ethanol must be based on its technical merits, rather than the advantages it would offer to farmers. Failing to do so could have serious and possibly irreversible effects.

Lots of money and attention is being put on hydrogen as a potential answer to our energy problem. According to Klein, hydrogen is not a viable solution because of the inherent problems associated with its production, transportation and storage. Perepezko and Klein agree that decisions to implement new energy infrastructure must be made based on good science and engineering analysis--and that they must be made soon. WE

Author Bios: Paul Kamenski is a sophomore majoring in materials science and engineering. Matt Stauffer is also a sophomore majoring in materials science and engineering.

Photo by Muhamad Asyraf Yahaya and Amy Zou

Test tube containing hydrogen gas released during chemical reaction.

FEATURE

America, we have a problem:

Apollo Alliance seeks to ease nation's energy woes

By Nate Holton

The price of oil is rising and will almost certainly continue to do so. The effects of global warming are beginning to overwhelm even the greatest skeptics with evidence of the damage that humans are doing to their planet. Meanwhile, U.S. foreign policy is deeply intertwined with America's dependence on foreign energy.

There are difficult problems with the sustainability of current energy policy in the United States. However, many organizations are working to find creative solutions to these problems. One such organization is the Apollo Alliance, a group that focuses on implementing new U.S. energy policies that stress efficiency, renewable resources and economic advancement.

On the weekend of March 3-5, Energy Action, a coalition of 30 organizations including the Apollo Alliance, held its first annual Midwest Student Clean Energy Conference.

The goal of the conference was to support and strengthen the student and youth clean energy movement in North America.

Through workshops on such skills as organization, outreach, running campus campaigns and taking advantage of media opportunities, over 300 young people from across the Midwest came together to learn about how they could give clean energy a larger role in the United States.

"The conference is all about students from across the Midwest learning the skills to become energy advocates on their campuses now and in the future," Wisconsin Public Interest Research Group (WISPIRG) member and conference organizer Rick LaTorra says.

Photo by Nick Gindt and Keith Doxtator

Listening to a lecture at the Midwest Student Clean Energy Conference held in March, a group of students discuss clean energy activism.

While the conference was primarily designed to build grassroots organization and action, the organizers enlisted several keynote speakers to highlight the big picture issues that proponents of clean energy face. One of the speakers was Joel Rogers, a UW-Madison professor of law, sociology and political science. Rogers is the founder and director of the Center on Wisconsin Strategy (COWS), a think tank that works to improve the economy and living standards in Wisconsin and nationally. COWS collaborated with the Institute for America's Future (IAF), another think tank, to create the Apollo Alliance. A major goal of Apollo is to make energy efficiency a prominent issue throughout the nation.

"If you can run your economy more efficiently, you're probably going to have more wealth in the end. No kidding, these are not exactly new thoughts," Rogers says. "But what we've succeeded at doing is getting a bunch of people who haven't said that before to say it and say it together. That's our big accomplishment."

The ideas laid out in the Apollo Alliances' "New Energy for America" report have gained the support of numerous environmental, labor and civil rights groups. This diverse range of support speaks to the potential these groups hope to see fulfilled with the implementation of the Apollo program.

The Apollo Alliance wants the federal government to dedicate $30 billion per year for 10 years toward a group of initiatives that would work to increase energy diversity, investment in the industries of the future, promotion of high performance building and the rebuilding of public infrastructure.

One of the features of the program that Rogers hopes to entice the public with is the claim that the tax revenue gained from the implementation of the program would balance out the $300 billion price tag. If Apollo's projections are accurate, then the program would literally pay for itself.

"Three hundred billion is nothing. This is a $12.5 trillion economy. Three hundred billion dollars is relatively small," Rogers says. "This country has an accumulated debt of about $70 trillion. You want to worry about money, worry about that."

So what would America stand to gain from this $300 billion dollar investment? According to Rogers, in addition to recovering the money invested, the Apollo Program would achieve such feats as the creation of 3.3 million jobs

and the stimulation of $1.4 trillion in new Gross Domestic Product.

Though these figures seem impressive, it is ultimately the program's effect on America's nonrenewable energy dependence and pollution that the people involved with Energy Action are concerned with. And though there is often a common perception that a focus on the environment requires an economic tradeoff, Rogers does not see this as the case with the Apollo program.

"Every businessperson knows that you've got to reduce waste in your own production system. They have to eliminate anything that they're producing or spending time on that is not producing any value. And that starts with waste that they have to clean," Rogers says. "So I just think of environmentalism now as low waste. We're just trying to build a nation with high living standards, high wages and low waste."

Indeed, there is a great amount of energy inefficiency throughout the United States. Outdated electrical infrastructure loses an unnecessary amount of electricity between the power plant and the home. Buildings filled with poor insulation, inefficient lighting and power-guzzling appliances waste much of the energy supplied to them. Cars, which often contain only one passenger, typically make use of only a small fraction of the energy contained in their nonrenewable fuel.

With global warming and the eventual end of oil becoming greater issues, groups like the Apollo Alliance are realizing that the United States must look for environmentally friendly and efficient ways of powering society.

The Apollo program includes initiatives that would attempt to address all of these issues. For example, it stresses the importance of renewable fuels for vehicle use.

"We need to make great incentives for people to use their cars efficiently," Matt Maryl, a research associate for COWS, says. "The era of two dollar gas is done. Five years from now, three dollar gas is going to be done. It's just going up more and more, and, as that happens, the relative cost of renewable fuels becomes much cheaper."

Energy inefficiency leads to unnecessary pollution and wasteful spending. The Apollo program is designed to curb both through such concepts as "smart" electrical grids that are capable of minimizing energy losses. Other measures include appropriate energy regulation, strong efficiency standards on home appliances and improvements to inefficient municipal water infrastructures. Also, the program would improve financing of "green" buildings, which require greater upfront costs but save money in the long term through efficient building, heating and lighting methods.

Furthermore, the program claims it would enhance the viability of environmentally-friendly energy producers by investing in and creating markets for bio-energy resources and renewable energy sources like geothermal, solar, and wind.

Experts believe that solar resources in particular have the potential to deliver a great deal of energy to the country. William Beckman, UW-Madison professor of mechanical engineering and director of the UW Solar Energy Laboratory, calculated that a 100-mile by 100-mile plot of Nevada land filled with solar panels that were 10 percent efficient would generate enough electricity to power the entire United States. Of course, inefficiencies in power lines and other real world issues make such a scenario unrealistic, but the example shows the magnitude of solar's potential.

Additionally, the photovoltaic cells used to generate electricity are far less efficient than solar heaters, which directly apply solar energy toward the heating of water.

"About one-third of the U.S household water heaters are electric. Well, I can guarantee that in today's price of electricity, you're better off with a solar water heater on your house," Beckman says.

The potential of the initiatives contained in the Apollo program could be significant. The program would, for example, place the nation on track to generate 20 percent of its electricity from renewable sources by 2020 and reduce carbon emissions by 23 percent at the end of its 10-year duration.

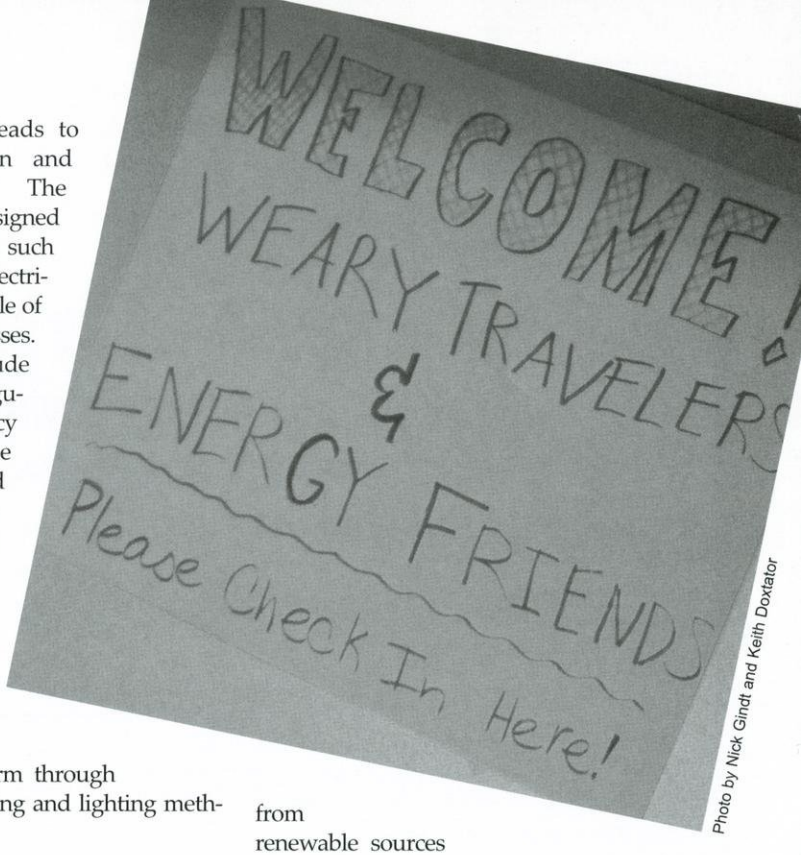


Photo by Nick Gindt and Keith Doxtator

Though state and local versions of the program are being implemented in numerous places around the country, there is much standing in the way of the $300 billion federal program. The focus on renewable sources of energy may concern the powerful oil industry, and the regulations contained in the program would cost corporations a significant amount of money to decrease their pollution.

However, the Apollo Alliance did extensive polling of public sentiment and found that Americans would overwhelmingly support it, even if it were to cost several times more than the current $300 billion price tag.

With the looming dangers of global warming and the eventual end of the world's oil supply, it is becoming more necessary for the United States to increase its energy efficiency, reduce its pollution and eliminate its dependence on foreign oil, Rogers says.

"You have to start now, you have to start training. Apollo is like training for the whole push. Apollo is not the end, Apollo is the beginning. In the long run, it's either going to be the end of the world or it's going to be the salvation of the world." WE

Author Bio: Nate Holton graduated in May with degrees in philosophy and mechanical engineering. He is now a first year law student.

Need a jump?

Students turn to caffeine as source of energy and alternative to sleep

By Kevin Jayne

When the alarm clock goes off to start another early morning, many students think to themselves, "How am I ever going to make it through the day?"

Ignoring the obvious option of returning to slumber, the next most inviting alternative is caffeine, a drug found in coffee, tea, soft drinks and even chocolate. In such a desperately fatigued state, the first thing many students do is brew a pot of coffee or grab a soda from the fridge in an effort to jumpstart their day. Of course, students do this to feel attentive and, more importantly, sharpen their minds for the school day.

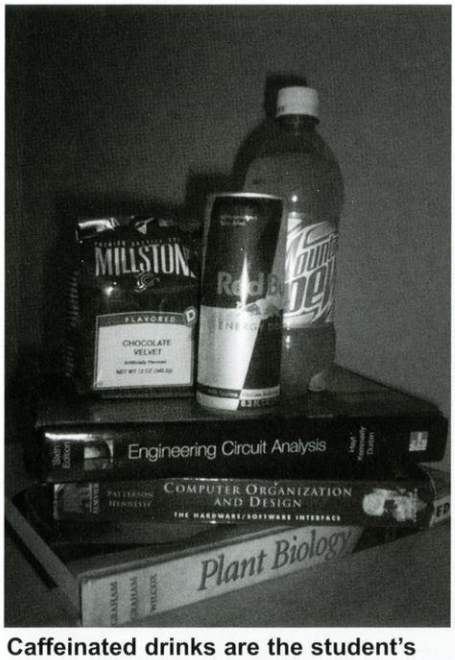


Photo by Jen Kovars and Noor Asyikin Che Mat Rosli

Caffeinated drinks are the student's solution to studying when the homework piles up.

"After a late night of studying there's just no way to make it through another long day without some help from caffeine," says engineering student and Wendt Library regular Phil Mauermann.

If this scenario sounds familiar, you are certainly not alone--nearly 90% of Americans rely on caffeine for a daily boost. But are there consequences to frequent consumption? Yes, like most drugs, there are positives and negatives associated with caffeine.

First, and most importantly, caffeine does indeed act as a stimulant, arousing the brain and making an exhausted mind feel alert, which aides in concentration for school related tasks. It does so by blocking adenosine receptors in the brain, which are typically linked to the feeling of drowsiness. The drug also causes the release of the hormone adrenaline, the "fight or flight" hormone, into the bloodstream to provide instant energy. Additionally, caffeine increases dopamine levels, activating the pleasure center of the brain, and increases the heart rate, which boosts blood flow to muscles. For those looking for energy before exercising, caffeine consumption can also play a part in raising metabolism. Finally, the increased brain activity has a direct correlation on memory performance, positively effecting short-term memory and reaction time.

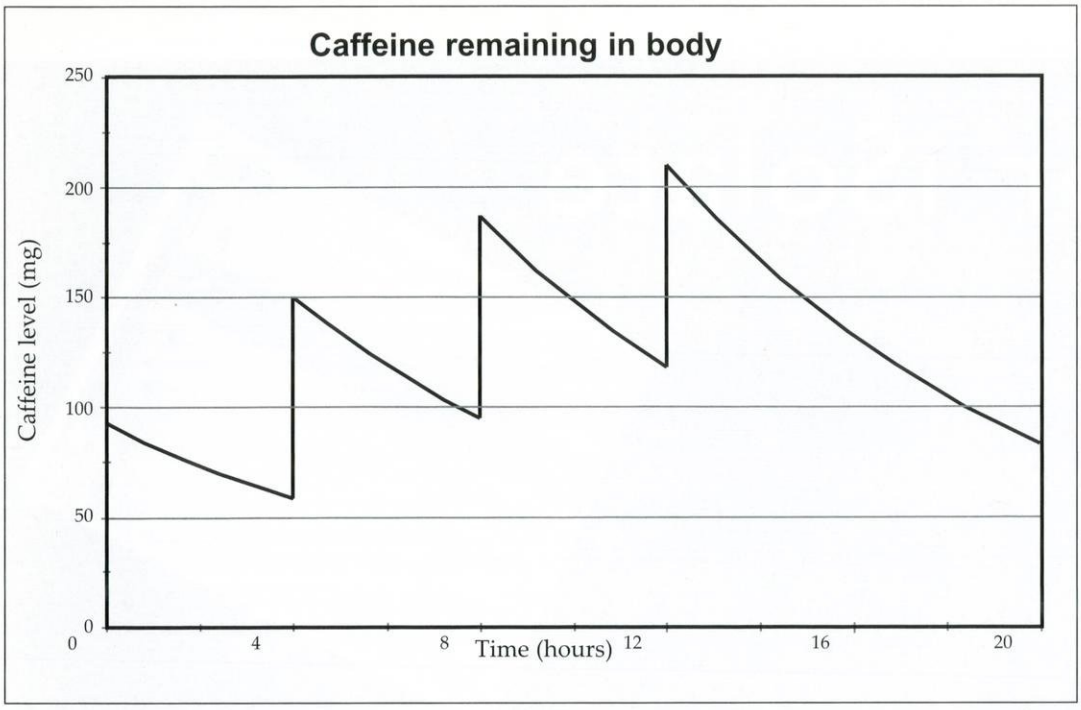
"The positive, of course, is that it's a stimulant. Scores show increased intellectual functions with a certain dose of caffeine, as well as better functioning in a number of other ways. Most measures of intellectual performance, including memory, will improve with appropriate caffeine use," Pete Anderson, UW-Madison professor of nutritional science, says.

However, caffeine use may create adverse effects as well. Caffeine users may feel alert at first, but this effect will eventually wear off. As this occurs, the loss of the adrenaline rush leaves a fatigued, drained body. Exhausted once again, the easiest way to regain energy is to supply the body with more of the drug.

Nearly 90% of Americans rely on caffeine for a daily boost.

Caffeine is not only used to provide a spark in the morning; it is also helpful for the late night crammer. While slamming a soda will indeed help a student stay alert in front of a textbook, it will also make sleep difficult afterwards. In fact, the half life of caffeine, that is, the time it takes for half the initial quantity to decay within the body, is about six hours. If a student is taking caffeine in the evening or at night, it will still be in his system as he goes to rest. In turn, it is more difficult to fall asleep--and the quality of sleep is poorer--than when the body is free of caffeine. Naturally, it takes more caffeine the following morning to provide the same effects.

Coincidentally--or as an engineering student, maybe not--yours truly has developed a dependency on caffeine. My drink of choice is invariably Mountain Dew, which contains approximately 92 milligrams of caffeine per 20-ounce bottle. After a late night, I will often drink four bottles the following day, for a total



Slamming a soda every four hours for the first twelve hours of your day leaves caffeine in your body when it comes time to sleep.

of 368 milligrams. Of course, this intake is spread throughout the day, as I consume them beginning at lunch time and through the evening. Knowing that caffeine "decays" exponentially within the body, it is possible to model the amount of caffeine in my blood throughout the day (and when I'm trying to sleep at night), offering an explanation to frequent sleep problems.

"The downside is that high amounts are going to have physical effects and may disrupt sleep patterns. There may also be a modest contribution to chronic disease risk, but a student's main concern pertains to sleep troubles. Caffeine is related to sleep quality, and a rough night of rest only leads to more caffeine consumption," Anderson says.

In time, this cycle of insufficient rest followed by caffeine intake creates an addiction where the body needs the drug just to keep up with normal functions. A caffeine addiction is not as powerful as other drug dependencies; it is often more psychological than physical. If a student is convinced she cannot start her day without a dose of caffeine, it is exceedingly difficult to cut back. However, developing a dependence on caffeine can lead to withdrawals, as well.

"There does seem to be a true dependency, accompanied by withdrawal symptoms, such as headaches. There is also the issue of tolerance, meaning you need increasingly larger doses to achieve the same effect," Anderson says. "The long term risks of dependency are debatable--there is no consensus on what they really are--though some studies have found a link to chronic disease. Certainly, the most documented issue is sleep disruption."

While we can't give ourselves a full night's rest all the time, relying on caffeine as a substitute for sleep is a risky idea. For this reason, those that find themselves dependent on the drug should make an effort to cut back. This may be easier said than done, given the positive effects of caffeine use.

"The best way to avoid this problem is to maintain a modest intake, being careful not to increase consumption. This can be difficult, as the tolerance effect creates a demand for more. There is no uniform cutoff on what constitutes too much caffeine, though a good estimate is two to four cups of coffee per day. It's important to remember that caffeine is a stimulant, but it does not replace sleep," Anderson says.

Caffeine has been a part of college for many years, and will continue to be as long as professors pile on assignments and students procrastinate. Caffeine is perfectly acceptable to use as a pick-me-up on those rough mornings, or when there are multiple exams to study for. However, it is crucial to manage caffeine intake to avoid the perils of dependency--advice that this writer should take note of as well. WE

Author Bio: Kevin Jayne is a junior studying mechanical engineering and technical communication. This is his second semester writing for Wisconsin Engineer.

iPod or iSolate

A look at iPod etiquette

By Nicole Rybeck

He's the perfect friend: sleek; fashionable; able to go wherever, whenever; willing to leave you alone when you're bored with him and always up for playing. If fact, you might be asking yourself why you haven't come across this impossibly ideal companion. Chances are you have. You've seen him everywhere. He's in all of your classes, hangs out with your friends and knows exactly what kind of music you listen to. This ideal companion is none other than your iPod.

It might seem like from the second you stepped on campus you were lost in a sea of Pod people. But iPod users can't be grouped into one uniform pool. There are so many types of iPods out these days that users' personalities are often reflected by the type of iPod they own. There are those who prefer the colorful whimsy of the iPod mini, the more spontaneous spirits who sport the iPod shuffle, the trend-setting owners of the iPod nano and the more traditional apple pie-sort who prefer the original model.

Though the iconic white ear buds are visible in every classroom, street corner and bus stop, some people who can afford the steep price tag still choose not to own an iPod. It would seem that the iPod has recently become a sort of personality test, applicable to both supporters and detractors.

But it has other functions as well. Consider the following situation--I'm sure we've all been there. Walking to class, you bump into an iPod-er you haven't seen in quite some time. You give her a hearty greeting and ask how life has been as of late. At this point, you expect your friend to remove one if not both ear buds. But to your amazement, she leaves both buds in! You're confused and a little offended. Christopher Guess, a first-year UW-Madison journalism student, explains that you've fallen victim to a common piece of iPod body language: the "Um … I can't hear you, sorry." But this is just one of several common behaviors.

"The removal of one ear bud is usually considered to transmit the curt message 'this will have to be quick,' " Guess says. "The highest approval in today's iSociety is the total removal of headphones, and especially if they are put away, as this states that 'my full attention is on you and what I'm doing right here.' These messages can provide a very powerful sense of body language and commitment to a person."

It appears that the iPod has become some sort of social shield. Maybe you run across an ex-boyfriend or girlfriend, a friend you don't especially care for or a friend-of-a-friend who you aren't sure whether to say "hi" to. The iPod may just have become the easiest way to avoid such awkward situations.

What is this doing to us as a society? Are we teaching ourselves that we can do the avoidance dance instead of dealing with problems as they are handed to us?

Guess seems to think so.

"The first major upheaval that the iPod has demonstrated is its ability to isolate. The vast amount of music, the length of time that it can play and the ... convenient size of the iPod allows [users] to shut people out with extreme ease," he says.

My iPod has become a sort of security blanket, helping me adapt to my stress-filled college days.

Some students avoid iPods because of the socio-economic messages they send. In recent years, our society has been less about "judging a book by its cover" and more about judging a person by their MP3 player.

"They really did make the perfect product," first-year zoology student Lauren Iwicki says. "There's your iPod for $300. But you can't just stop there. You need to buy the car charger [which costs] $20 to $40, the FM radio transmitter [which costs] $40, the case, the skins,

the specially designed speaker system. And come on, a replacement set of ear buds costs $40! By the time you leave the store, you're already spending $200 more than you intended! The marketing is genius, too. They make you think that they aren't just accessories, they're necessities."

To some people, the iPod might seem frivolous and overrated; to others, it has become a staple of their day-to-day lives. Over the course of just two years, I have become a Pod person. The iPod has become my sanctuary in a world of pop quizzes and term papers. I even have certain songs that I listen to on the way to exams. My iPod has become a sort of security blanket, helping me adapt to my stress-filled college days. Wake-up-late-run-to-class music might be hip-hop, whereas exhausted-walk-home-from-the-library-at-3 a.m. music might be a little more mellow.

While sometimes you might really need the stability of being able to turn on your iPod and find that one song you've been craving all day, other times, the iPod can be the spice in your life. Before coming to college, I heard so much talk of how crazy college kids are. When I want to get really crazy, I simply opt for the shuffle feature on my iPod.

This versatility is what attracts many users. "An iPod is no different from a portable CD player, a Walkman, or any other device. It is simply a way to take your entertainment with you," says sophomore economics student Keaton Miller. "My iPod gives me more choice; do I want to listen to the news over and over again while I'm sitting in the airport lobby, or would I rather hear John Denver talking about jet planes instead? Do I need to hear the person at the gym on the machine next to mine complain about some inane thing, or would I rather rock out to the Rolling Stones?"

While the user most of the time has complete control over their iPod, there is one circumstance where it will almost certainly kill your spirits. I can't tell you how many times I have been the victim of forgetting to charge my iPod. There is this absolute sinking feeling in your stomach when you realize that you won't be able to finish your run with Jay-Z or your jaunt to class with Dave Matthews. It can mean real devastation on those days that are already a little rough.

As nice of a security blanket as the iPod is, we need to keep in mind that it definitely isn't a replacement tool for people. Your iPod isn't going to kick around a soccer ball with you or give you a hug after a big test. I've started seeing increasing numbers of students walking to class with a friend with both of their ear buds in. A friend of mine was telling me just the other day how he and his roommate were walking to class together, and out of nowhere his roommate pulled out his iPod and started listening to music as they were talking. My friend told me that he was really caught off-guard and wondered if his company wasn't good enough.

We need to keep in mind that not everyone has the same outlook on iPod etiquette. While one person might be completely offended by someone leaving one ear bud in when they're walking to class together, another person might think nothing of it. To keep everyone satisfied, I propose we collaborate on a Ms. Manners-style list of iPod etiquette. I've given this some thought, and this is what I have to start with:

- Never listen to your iPod in lecture. I had a guy in my physics lecture last year who never took his ear buds out. I didn't know him, but I definitely had the preconceived idea that he needed a lesson in manners.

- If you're walking to class and can spare the time, take both ear buds out and talk to your friends when you see them. If you're hurrying (e.g. it's 9:54 and you have class at 9:55) pop out one ear bud and at least say "hi."

- If you get a phone call and you're listening to music, pause the song and give your phone conversationalist your full attention. It isn't fair to the person on the other line if you can't give them priority over a song. Just because they can't see you doesn't make it right.

Please help out the iPod etiquette cause by submitting your additional rules at http://wisconsinengineer.com/testad/contact. Until then, try turning off your iPod for a day and experiencing the world around you. You might be surprised to find that you forgot the noises of the outside world; find out what your playlist has been missing!

Author Bio: Nicole Rybeck is a sophomore majoring in industrial and systems engineering as well as French. She is currently serving as the vice president of leadership development for Polygon Engineering Student Council. This is her fourth article for Wisconsin Engineer.

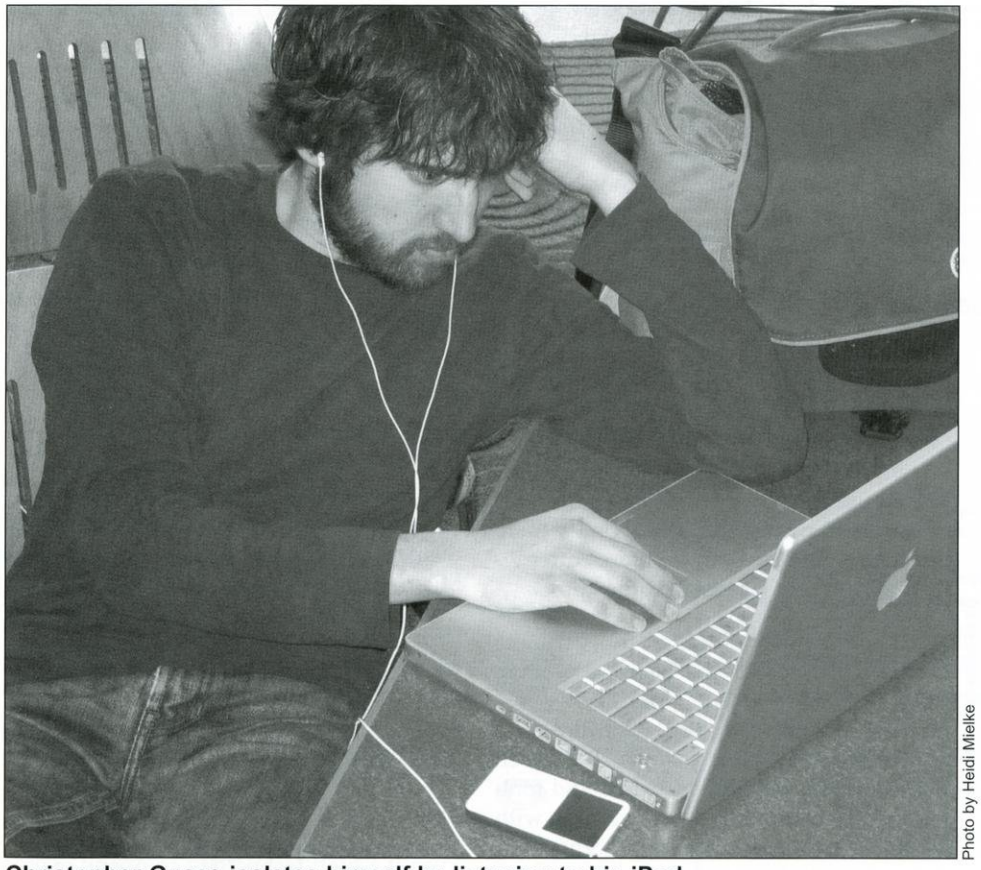


Photo by Heidi Mielke

Christopher Guess isolates himself by listening to his iPod.

IF YOU BUILD IT, THEY MIGHT COME?

There's more to selling a product than just development

Photo by Norikhwan Hamzah

By Nick O'Brien

A woman washes herself in the shower. As droplets fall from her face and run down the drain, an idea begins to form in her head, like a smile forms on a child's face at Chuck E. Cheese. She drops the soap, throws back the shower curtain and--before she drops the thought--sprints naked through her two room apartment, leaving behind a trail of wet footmarks on her carpeted floor.

She hurdles a full laundry basket, scrambles through a cluttered desk, grabs a pen and scribbles her ideas onto the page. She takes the time to write formulas, diagrams, dates, times and what her next steps will be. She needs to hire an attorney, get a patent, file as an LLC (limited liability company) and exit through a corporate buyout. She can see her future: long daunting hours of dull dirty work with glimpses and moments of true exuberance. She's excited about her plan: the dream of thousands of inventors--the next great high-technology business.

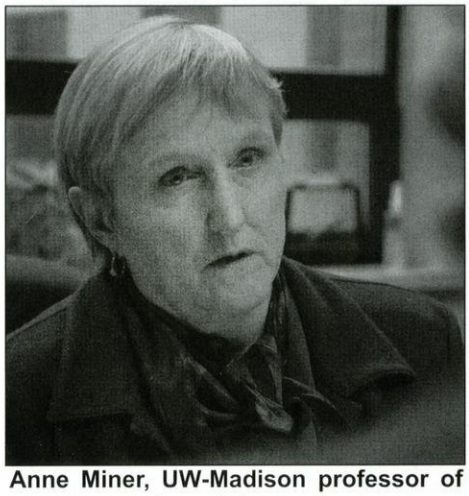


Photo by Norikhwan Hamzah

Anne Miner, UW-Madison professor of management and human resources, speaks to O'Brien about the complexities of high-technology business.

A high-technology company is a new company with a novel idea. Most businesses can be categorized as one of four different types: (1) old company with old technology, (2) old company with new technology, (3) new company with old technology and (4) new company with new technology. Most university business classes are oriented toward the first three, but recently there has been a push to establish more entrepreneurial courses that focus on the latter.

The incredible world of high-tech business is as unorthodox as the way the woman came up with her invention. Each week, thousands of inventors take their ideas and file for United States patents. But, even with a great idea, a broad patent and foolproof plan, many things can interfere with an inventor from ever earning a cent.

"The world of high-technology business is more like gardening than like building a bridge," Anne Miner, UW-Madison professor of management and human resources, says. "There are a lot of things to account for. There is the fact that the technology [has to] work, but even after that it [has to] be accepted socially. There's no blueprint, you put in the work and hope it grows."

High-technology companies are risky because of the large amount of capital that has to be invested before a product can hit the market. Companies regularly invest hundreds of thousands--and sometimes millions--of dollars to develop a fully functional prototype.

Oftentimes, it takes a lot of convincing to prove that a technology is worth the time and money. And although late-night infomercials may try to sell a methodology, there is no formula for creating the next Microsoft.

"I've been humbled many times. There have been companies I thought were interesting but would never make it [that] ended up doing pretty well; and then there have been others I thought would make it for sure, but didn't," Miner says. "Sometimes it's an issue of timing."

Even if a high-technology company makes it to the market there is no guarantee it will

remain intact. High-tech business are often bought and sold or dismantled completely.

Big corporations and companies are trying their best to keep pace with the trends of the economy. Just like train engines evolved from wood to coal to diesel, so too are many of our technologies. Even small consumer products, like razors, are changing rapidly. Five blades are now available, when just a few years ago it was two.

Big companies will often choose to buy out smaller ones that have knowledge in the market, capabilities to manufacture and established distribution channels. A buyout is a big company's way of staying current with the times. It allows them to enter new markets without wasting time and resources developing their own products or building new factories.

"Big companies will often use smaller companies as the testing site," Professor Miner says. "It is a way for them to see the value of a potential market."

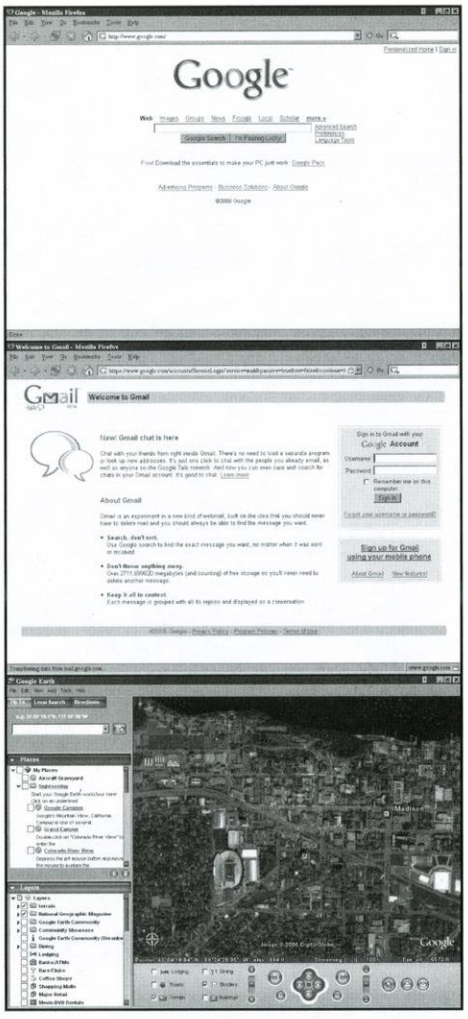
A very simple way to describe high-technology business comes from an idea called the S-Curve. The S-Curve is a theory within the world of technological management that simply states that technologies must, like nature, go through evolutionary steps. In the beginning, the S-Curve shows that there must be many new technologies within a given market. Through use, technological supremacy is achieved, and with it some companies die while others succeed.

A business can achieve market supremacy in several different ways. Having a dominant design, using creative marketing techniques or utilizing efficient internal management all contribute to a business's ability to gain a share of the market. According to the S-Curve, once the market has "chosen" an optimal technology, the businesses that best fit that mold remain, while their counterparts are forced to concede.

Additionally, S-Curve theory shows that it is not necessarily advantageous to be first to market, and that there is a finite number of favorable improvements for any given technology. For example, once Henry Ford established the Model T, he made no significant changes to the design for a few decades. Instead, he spent his money on improvements in manufacturing and distribution.

"One big myth of high-tech business is that it is best to be first; sometimes it's better to be late," Miner says. "Success comes from diagnosing capabilities and finding a way that they can control the landscape."

Google's late entry into the search engine market may have contributed to its overwhelming success.

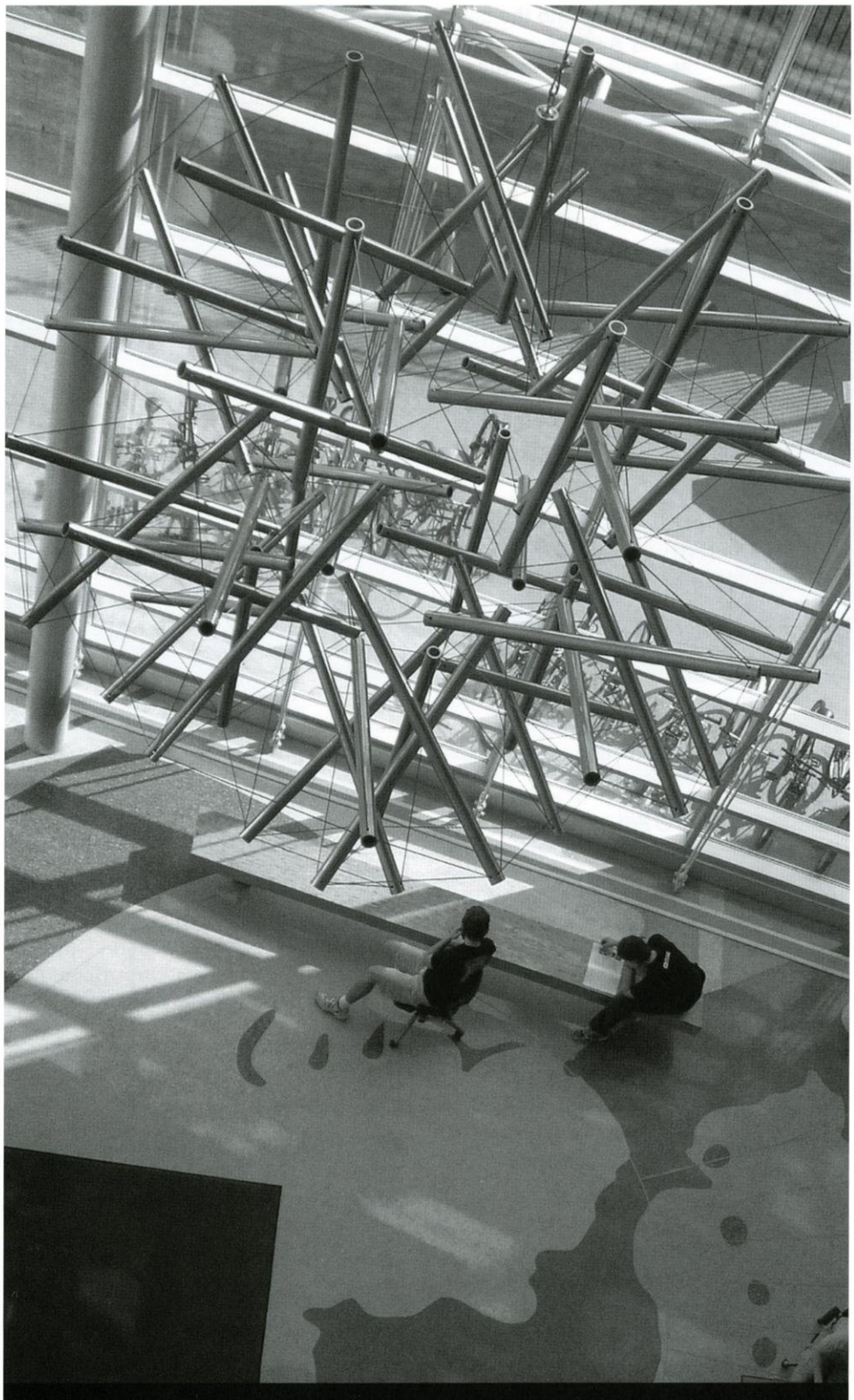


For example, Google was not the first Internet search engine available. When Google arrived at the scene, many thought the market for search engines was saturated. Through innovative thinking and new marketing techniques, Google was able to establish a position in the market, and ultimately become the most widely used search engine in the world.

On campus, there are many opportunities for student entrepreneurs to get involved in high-tech business. One of the best is the Steven G. Burrill competition. The competition is held every year in May and encourages business and engineering students to work together to not only develop a product, but also a marketing plan.

"Some would like to think that the trick is in the technology, but there is more to it than that," Miner says. "It truly is a social endeavor. It's like having a personal conversation with the world." WE

Author Bio: Nick O'Brien is a double major in chemical engineering and theatre and drama. He is thrilled to be in his third semester with the magazine.



Eyes on the prize:
Innovation Days winners give Top 10 tips

By Alauna Hersch

It's a cold and windy winter day in early February as you push through thick, ankle deep snow. The insides of your shoes start to feel a little wet, and you begin to realize how far you really are from the engineering campus. But, as you finally enter the Engineering Centers Building, you're immediately surrounded by the fresh air of innovation.

Stretching throughout the walls of the entrance are posters depicting numerous ideas for improving or creating a plethora of devices. These devices range from a solar energy collector to a grocery getter to a light target. As you walk through the halls you can feel the mounting anticipation as each group awaits their turn to reveal to the judges what months of preparation have produced. The creativity surrounding each product is undeniable and the attention to detail immaculate. For young inventors, the early days of February are not just ordinary days. They are Innovation Days.

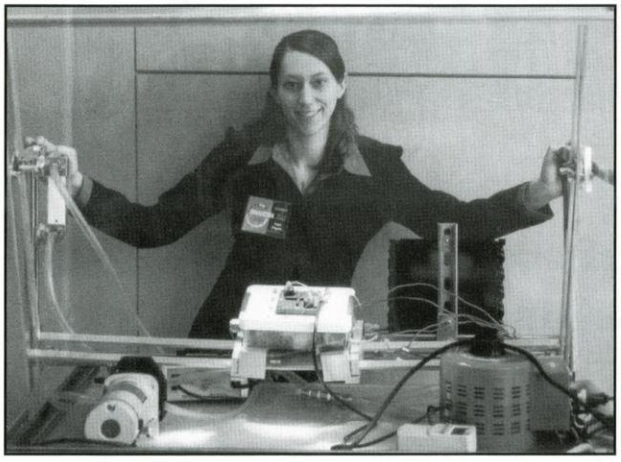
Innovation Days, which began at UW-Madison in 1995, starts every year on Thomas Edison's birthday and spans two days in early February. Undergraduates from all over campus compete as individuals or teams to come up with the next big thing. The incentive for these students? Up to $14,500 in prizes courtesy of the competition's sponsors.

Richard Schoofs, a chemical engineering alumnus, sponsors the Schoofs Prize for Creativity, which awards four winners with $10,000, $7,000, $4,000 and $1,000, respectively. Peter Tong, an electrical and computer engineering alumnus, sponsors the Tong Prototype Prize, which awards three individuals with $2,500, $1,250 and $700, respectively. The other available awards are the $1,000 Younkle Best Presentation Award and the $1,000 Sorenson Design Notebook Award.

In the 2006 competition, Angie Franzke, a senior majoring in mechanical engineering, entered two inventions: a concentrating solar collector and a self-leveling wheelchair tray. While the wheelchair tray faired well, the solar collector won Franzke first place in both the Schoofs Prize for Creativity and the Tong Prototype Prize.

"The concentrating solar collector is a natural way to generate hot water or electricity without the use of oil or gas," Franzke says.

Franzke credits her grandfather with first sparking her interest in engineering. When she was very young, she came across an unassembled garden hose holder. With great excitement and against her grandpa's advice, she began to assemble it without even glancing at the instructions. After successfully completing the project, her destiny in engineering was clear.



Courtesy UW-Madison College of Engineering

Angie Franzke, the winner of the 2005 Schoofs Prize, poses with her winning invention, the concentrating solar collector.

As you walk around to the different booths at Innovation Days, the months of sweat and hard work become extremely evident. The teams are full of individuals of all ages and backgrounds. Nick O'Brien, a junior double majoring in theater and chemical engineering, won the Younkle Best Presentation Award in 2006 and was a 2005 Schoofs Innovation Days champion with his team's FireSite invention. His advice, as a three-time participant in Innovation Days, is to enter early and often.

"I went from worst [for his 2004 entry, a light-up stocking] to first, and the experience of going through the competition really helped," he says.

Franzke agrees.

"If you have an idea, do it at whatever age. Even if you don't win, you'll learn a lot from the experience," she says.

But sometimes, coming up with the idea can be the most challenging part. After discussing their experiences with several past competitors, I picked up some key advice for brainstorming ideas (see sidebar).

Franzke also had some more general advice about the competition.

"Start early. You can design something, but building it is much different," she says. After you have etched out your idea, go for it and give it your all. It's also important to stay optimistic and be confident about your idea.

Regarding the night before the competition, the pregame strategies vary. O'Brien suggests a practice session.

"My team and I got together and went to a sorority house," he says. "We practiced our presentation four or five times and watched how the girls reacted. In my opinion, if you can talk in front of a group of sorority girls, you can talk in front of the judges." The technique seemed to work well for this group, considering they won the Younkle Best Presentation Award.

This year's big winner plans to put her winnings into a money market account. Franzke will probably use the money to help her pay for graduate school, where she may continue her work in renewable energy.

As you push open the thick Engineering Centers Building doors to leave, the cold wind whips sharply past your face. You begin trudging back through the snow, realizing once again how far you have to go. But this time your mind begins to wander. You ponder how great life would be if you could just jump into a nice warm shuttle box that could quickly fly you home. Hmm … could you be next year's Schoofs winner? WE

Author Bio: Alauna Hersch is a junior majoring in neurobiology. She plans to attend medical school after graduation.

Top ten ways to generate a great Innovation Days entry idea

1. Find an idea that your team is excited about--there are going to be some long nights ahead.
-Shawn Enright, fourth place, 2006 Schoofs Prize

2. "Look at nature and how problems have been overcome naturally, for example, the way a dragonfly flies around versus a bumble bee."
-Nick O'Brien, first place, 2005 Schoofs Prize

3. "We spent many meetings just brainstorming crazy ideas and writing them down and then discussing them later." -Jon Oiler, third place, 2006 Schoofs Prize

4. "Find a need that exists [and] think of a way to save lives [or] improve the efficiency of something." -Brad Hotle, fourth place, 2006 Schoofs Prize

5. "Talk to as many people in as many different professions as you can. Ask them what they need."
-Angie Franzke, first place, 2006 Schoofs Prize

6. "Use your Physics 202 book. Keep it and read it--all the rules of physics can be bent." -Nick O'Brien

7. "Play devil's advocate on your list of ideas. For example: 'We've invented X, now what can be better?' "
-Nick O'Brien

8. Bring a list of your ideas to someone in the profession and get their opinion. -Shawn Enright

9. "Watch science fiction movies and jot down your ideas as they come."
-Nick O'Brien

10. "Chew peppermint gum; it stimulates the brain!" -Alauna Hersch, yet to compete

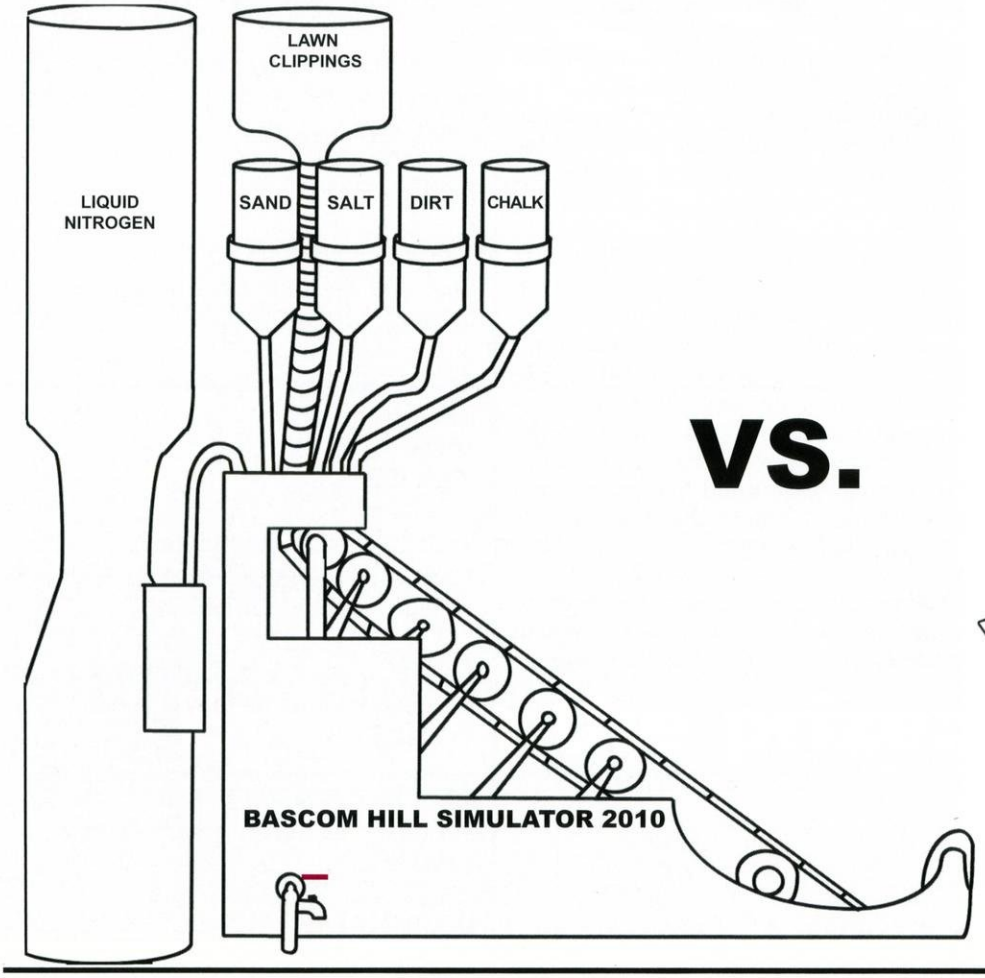
Just one more

The finest in eclectic humor

By Casey Weltzin and Kari Jordan

Top 10 things that are impossible for engineering students to comprehend:

1) Sherpa boots, aka Ugg boots, aka dead animal on feet.
2) Why women aren't governed by first order linear ODEs
3) How the Duck Hunt gun works
4) Foreign TA's accent
5) Quantum-mechanical infinite square wells
6) 45 minute long line at the new Subway
7) Non-paid internships
8) Basic math without a TI-89
9) Eight hours of sleep
10) Own strange obsession with mechanical pencils



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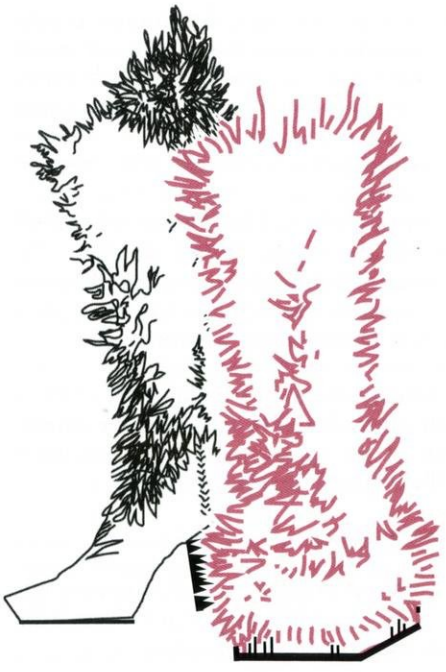

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