CAREER CURRENTS

NEED
National Energy Education Development

This Issue:

Working with the Grid

According to Katherine Hamilton, president of the GridWise Alliance, creating a "smart grid" to replace the aging infrastructure of our current electric grid system would result in huge job creation:

"It's time that we created a smart grid to meet America's growing power needs and to increase the reliability, safety, and national security of our power generating and transmitting system. If we can invest $16 billion into the smart grid over a four-year period, we would stimulate as much as $64 billion in investments from utilities and others who are building a smart grid. This would create about 280,000 jobs over the four-year period. Our recent report shows that just in the first year of this effort, as many as 150,000 new jobs would be created, and these are the shovel-ready jobs to put people to work right away. During the first 10 years of development of the smart grid, we envision about 140,000 very high-paying, very high-value jobs. We don't even know exactly all of the other offshoot industries that are going to occur by doing a smart grid."

Get Ready To Plug Into The "Smart Grid"

Shortly before taking office in early January, President Obama said that an economic stimulus package should include building a new electricity "smart grid." It's a term you probably have heard before, but will certainly be hearing a lot more about in the coming years because of the urgent need to upgrade and improve America's system of moving electricity along long-distance transmission lines to consumers in homes, businesses and industries.

The existing electric grid in the U.S. has worked well for many years, but the tremendous increase in the use of electricity has put a burden on the system that makes major changes essential. This "new and improved" electricity grid will work more efficiently and meet the needs of today's digital age while minimizing its impact on the environment.

The U.S. Department of Energy estimates that if the country's electric grid were just 5 percent more efficient, the energy savings would be as much as permanently eliminating the fuel and greenhouse gas emissions from 53 million cars.

To appreciate what the smart grid can do for our society, just consider that many energy experts liken it to the Internet and how that changed the way we live. An electric grid that is designed and built to meet the needs of today's society can have as dramatic an impact on each of us. It will deliver electricity from suppliers to consumers using the latest digital technology to increase its reliability, save energy, and reduce costs.

By upgrading distribution and long distance transmission grids, the new grid will greatly improve current operations while creating new markets for alternative energy systems. The result will be a more efficient, reliable and safe way of producing and delivering electricity around the country while creating tens of thousands of new jobs.

The smart grid system includes a variety of technologies that will help consumers lower their power usage during peak periods, allow power producers to expand their use of photovoltaics, wind and other renewable energy technologies, provide system back-up to eliminate power outages during peak times, and save money while reducing carbon dioxide emissions.

Though the need for a new and smarter electric grid has been called for many times over the years, a number of factors are making it clear that the time has come to move forward now. The aging infrastructure of the current grid has weakened its reliability at a time of rising energy costs and growing environmental concerns. Renewable energy technologies have matured to the point where they are more feasible and economical for widespread use, and national security concerns make a modern grid essential in today's world.

(continued on page 2)

Spotlight on . . .

The GridWise Alliance, founded in 2003, is a coalition of more than 75 public and private stakeholders who work in a consensus basis to advocate for a smarter grid for the public good. The Alliance has a vision of an electric grid that has two way communications, control, and data from power plant all the way to the customer meter.

The Alliance provides a forum where members representing a broad range of interests in the electricity sector can meet, exchange ideas, and work cooperatively on a common set of issues, with the goal of moving our industrial-age electric grid into the information age. The Alliance has four established Work Groups through which all its members may participate in the decisions, positions, and projects of the Alliance. In addition, the Alliance provides its members with the opportunities to interact with senior policy makers on both the federal and state level who, together with industry, will transform the nation's electric power system.

The GridWise Alliance represents a broad range of the energy supply chain from utilities to large tech companies to academia to venture capitalists to emerging tech companies. All of these interests can agree on policy that affect everyone on the electric grid even when their technical and business goals may be quite different. The Alliance is building strategic alliances with organizations that may have a similar element of interest. For example, the Alliance recently signed an agreement with the Electric Drive Transportation Association to work together on smart grid issues that impact electric cars.

The Alliance members recognize the importance of change when it comes to our electrical grid. In 2007, the Alliance worked to include a smart grid title in the Energy Independence and Security Act of 2007. In 2009, President Obama signed the American Recovery and Reinvestment Act of 2009 that sets aside nearly $4.5 billion dollars for smart grid projects. The next steps will be to ensure that smart grid is part of other energy and climate legislation.

The GridWise Alliance is growing every day with organizations seeking to be included in the smart grid policy debate. The Alliance is nearly daily quoted in newspapers, magazines, and on the Internet. They expect that interest to continue growing as the Alliance helps transform the grid into a smart grid.

For more information on the Gridwise Alliance, visit www.gridwise.org/.

Smart Grid (continued from page 1)

Efficiently managing energy use with the latest technologies will provide many benefits for homeowners and other consumers. It may also reduce the need for additional sources of power generation and increase the use of renewable energy and energy-efficiency technologies..

One of the biggest benefits to consumers will be the two-way interaction with the utility company. On a hot summer day when air-conditioning is pushing the power generation to its limits, the utility company can contact consumers to alert them to the need to reduce energy use by putting off washing dishes, for example, until that evening. The power producer will also know when there is an outage or power interruption long before the homeowner has to call to tell them the power is out. But even better, a smart grid can get information on consumer energy use before problems arise and take steps to resolve potential problems before they happen.

By integrating renewable energy systems and energy-efficiency technologies into an efficient electricity transmission system, a smart grid can save money, operate more reliably, reduce its impact on the environment, and handle the growing power needs of today's digital world.

The NEED Project
NATIONAL ENERGY EDUCATION DEVELOPMENT
P.O. Box 10101, Manassas, VA 20108
Phone: 800-875-5029
Fax: 800-847-1820
Email: info@need.org
Web: www.need.org

The NEED Project is a 501(c)(3) nonprofit education association providing professional development, innovative materials correlated to the National Science Education Content Standards, ongoing support, and recognition to educators nationwide.

NEWSLETTER STAFF
Mary Spruill
Executive Director
Hallie Mills
Curriculum Director
Ken Sheinkopf
Editor

Career Currents provides educators and students with resources to introduce energy careers. Each issue focuses on a different sector of the energy industry. No single issue is meant to be all-inclusive to either the sector profiled or all careers in energy.

America's Electric Grid

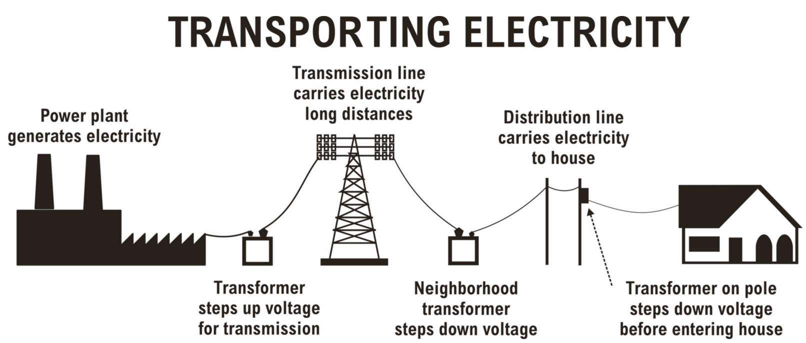
When you walk into a room and flip the switch on the wall, the lights come right on, just as you expected. But did you ever think how the electricity got to your house to give you the power for those lights and the many electrical appliances and products you use at home, ranging from your DVD player to your refrigerator?

Today there are more than 9,000 electric utility companies and other generating units all over America that produce and distribute more than one million megawatts of electricity to homes, businesses, and other energy users.

To get that electricity to its users, there are more than 300,000 miles of high-voltage electric transmission lines across the U.S. They take the electricity produced at power plants to transformers that step up the voltage to reduce energy loss while it travels along the grid to where it is going to be used. Before coming into your home, another transformer steps down the power down to 120 volts so it can operate your lights and appliances and other electrical needs. And most remarkably of all, this entire process – from generation at the power plant to the trip along the lines to its availability for use in your home – takes just a fraction of a second!

These transformer lines – whether they are located on poles above ground or buried underground – make up the most visible part of what is called the "electric grid." The grid consists of the power generators, the power lines that transmit electricity to your home, the needed components that make it all work, and your family and the other homes and businesses in your community that use electricity.

The process starts at the power plant that serves your community, and ends with wires running from the lines into your home. Outside your home is a meter with a digital read-out or a series of dials that measure the flow of energy to determine how much electricity you're using. Of course, there are many more parts to this process, ranging from substations and wires for different phases of current to safety devices and redundant lines along the grid to ensure that power is available at all times. You can see why the U.S. National Academy of Engineering has called America's electric grid "the greatest engineering achievement of the 20th century."



But while this basic system of electricity transmission has worked well since the late 1880s, the increase in electric use in recent years has put a strain on the country's electric grid. The grid we use today was designed and put into place in the 1950s and 1960s, with much of the equipment planned to handle far smaller electrical use. More than 40 years later, a great deal of the equipment is reaching the end of its lifespan. At the same time, our electricity use has increased tremendously, putting a huge load on the system. Just look around your home at the TV sets, CD and DVD players, computers, lamps, air conditioners, and all the other appliances found in the typical home today, and you'll see a tremendous demand for electricity far above the basic lights and products used in homes back when today's system was set up.

The surge in demand for electricity has far exceeded the creation of new transmission facilities and equipment over the years. Compounding the problem is the fact that about two-thirds of the electricity produced in our power plants never reaches potential users because of losses in energy conversion and transmission. Because of the complexity and importance of the country's electric grid, many new governmental regulations increase the time needed to plan and install additional equipment to meet today's demands.

In the past few years, many parts of the country have experienced brief "brown-outs" or longer periods of power outages, increasing public concern about the future of the system we use today. Think about this: right now, our electric grid is actually 99.97 percent reliable, meaning the power is usually there when we want it. But that very tiny percentage of time when the grid isn't working at its full capability costs consumers an estimated $150 billion each year, including stoppages in automated equipment, computers that crash, and even the brief interruptions in the flow of energy and information in today's digital world that affect our work and our leisure activities.

For many years, America's electric grid has been a shining example of our technology and ability, and a major part of the country's prosperity, comfort and security. To meet the country's growing electricity needs today and in the future, changes are needed in how the grid operates and the equipment and technologies it uses.

Information for students on electricity and electricity distribution can be found in NEED's Energy Infobooks, available for primary, elementary, intermediate, and secondary levels. Teachers can download the Infobooks and copy pages for use in their classrooms. The Infobooks can be found at the Energy Infobooks section of the NEED website (www.need.org/EnergyInfobooks.php).

Q&A

Katherine Hamilton, the GridWise Alliance

Katherine Hamilton is president of the GridWise Alliance, a Washington, D.C.-based consortium of public and private stakeholders who share the vision of a "smart grid" and a more resilient, secure and reliable energy system. A native of Lynchburg, VA, she holds degrees in creative writing from Cornell University and in French from the Sorbonne in Paris.

Tell us a little about your job and what you do.

I wear a lot of hats here – I run an organization with 78 member companies where I'm not really the boss but the head of a coalition that works on a consensus basis to bring all our members together to support smart grid policies. I am a registered lobbyist, so I take those policy ideas to Congress to help them write energy laws. I am the face of the organization, so I represent our companies when I meet with other business groups or the government. I give lots of speeches to groups that are interested in learning more about the smart grid.

What was your first job when you finished school?

There wasn't much of a job market in my hometown when I finished college, so I headed off to Washington to find work. I spent some time as a paralegal before getting work as an apprentice engineer with Virginia Power (now called Dominion). I took engineering classes at night, which helped with my work as a distribution engineer. When someone needed electricity for their home or business, I designed their system—calculating the amount of energy they would need, measuring the distance from the power lines to their building, drawing the new lines on a drafting table, and then marking the streets or ground with paint to show construction crews where to work. Even now, there are buildings I drive by 20 years later that still have electricity from a system I designed.

What subjects did you study that helped you prepare for work in the energy field?

Since I had no idea what I wanted to be after college, it was important that I took a variety of classes. I loved my English classes and thought I would write children's books. Those writing skills I developed have been critical to every job I've had. Being able to read and understand all kinds of materials and then learning to write well are two skills important to any field.

What is a typical day at work like for you?

Each day is unique, but I get many calls from newspapers or magazines from people trying to learn about smart grid so that they can publish stories. I often go up to Capitol Hill to meet with lawmakers about energy issues. I recently testified in the Senate about smart grid. I spend a lot of time reading reports and writing about smart grid. The members of our coalition have many phone calls and meetings that I participate in. I also spend a lot of time meeting with other organizations to figure out how we can all work together to make our country's energy system better.

What is the most rewarding part of your job?

I really like it when someone says that what I do is valuable to them. That's how I want all of our members to feel – that being a part of the GridWise Alliance is important to them.

What challenges do you face in your work?

When both parents have jobs, one of the tricks is to balance home and work. With four kids, I want to spend plenty of time with them, while still running a productive organization.

What advice would you give to a young person wanting to work in the energy field?

This is a great time for engineers. We need them badly, and there are many opportunities for all kinds of engineering specialties. But don't forget to learn the basic reading and writing skills. Calculators and computers can do the technical work for you, but good communications skills take a lot of practice. Don't worry if you don't know what you want to do when you get out of college—follow your heart to make sure what you decide is what you really want—and use your head to make sure you are making a smart choice. Don't think you have to do just one thing all your life. Calculators and computers can do the technical work for you, but you still need to be good communicators. And one other bit of advice – follow your heart, follow good instincts, and try to make smart choices. You've got unlimited opportunities so go out there and take advantage of them.

Q&A

Terry Mohn, San Diego Gas & Electric and Southern California Gas Co.

Terry Mohn is a technology strategist with the San Diego Gas and Electric Company and Southern California Gas Company, based in San Diego. A native of Corvallis, OR, he graduated from the Oregon Institute of Technology with a degree in computer science engineering technology.

Tell us a little about your job and what you do.

I'm responsible for the development and execution of business strategy to operate the business efficiently through the application of technology. I specialize in the business integration of technologies, primarily supporting smart grid, home automation systems, communication systems, distribution automation, smart metering, demand response, and control systems.

How did you decide to go to work in the energy field?

I wanted to move from Oregon to San Diego so I came down here and got a job with a company developing software. After a while, I moved to the medical field, and I did that for about five years, then wanted to try something new so I got in the telecommunications field. I had enough of that, so over several years, I started three new companies, and after selling them, Sempra Utilities asked me to come on board and help reinvigorate their IT department, and I've been doing this for the past six years.

What technology have you used that has helped you the most in your work?

The most exciting tool I work with is my brain. While that would be hard for a student to replicate, the message is clear. The best tool to help is your imagination. Yes, there are a lot of commercial tools available or will be out soon that can help a person in their work, but the real secret is what do you do with the tools you develop in school to transform your particular job. The way you use technology is a key to problem solving, but, commercial tools are just instruments.

What is a typical day at work like for you?

What's great about my business is that I'm always talking to people, and it's exciting to talk to my business colleagues about the challenges they face in their work or to talk to the practitioners who have the solutions to our business problems. My job is to put both groups together. I am on the phone or in meetings constantly. In a typical day, I talk to people who have business problems so that I can uncover some solutions.

What is the most rewarding part of your job?

There's no doubt about the answer to this one. It's the ability to work with people who are just beginning in this field or who are even studying engineering in school, and seeing them light up with excitement when they see how they can make a difference. I work closely with university students and set up summer internships, and spend a lot of time explaining to students how the utility industry faces a major challenge in recruiting new workers because students think of the field as being old-fashioned and not offering much of a challenge. I set up "sandbox" programs to show the students how there is a challenge here that takes a lot of effort to solve, and once they better understand the utility field and the overall energy world today, they usually say they wish they were working in these fields right now.

What advice would you give to a young person wanting to work in the energy field?

I think one thing is that people skills are so important. Students absolutely must do well in science and math – the essential components of critical decision-making. Having a broad background in other subjects is helpful as well. For example, a solid knowledge of the arts and history gives outside-the-box thinking skills. Pair this with the critical-thinking skills you get from science and math and you're ready to contribute your very first day on the job.

What would you tell a student about choosing a career in the energy field?

I believe that the energy sector has the greatest amount of opportunity for new ideas. We have too much aging in this field right now – aging in the infrastructure, and aging in the people. A huge number of people in the energy field are heading toward retirement in the next five years or so, and this will create an enormous gap in the workforce, affecting how businesses will be run. New people coming into the field can be an important part of this change.

Q&A

Steve Hauser, Gridpoint, Inc.

Steve Hauser is Vice President of Strategy for Gridpoint, Inc., a smart grid company in Washington, D.C., that provides a software platform for integrating all distributed assets involved in the grid. A native of Spokane, WA., he has a bachelor's degree in engineering physics from Oregon State University and a master's in chemical engineering from the University of Washington.

Tell us a little about your job and what you do.

With building a smarter grid such an emerging priority across the industry, I built on the experience and relationships I had from many years of working in the energy industry. I started and ran the GridWise Alliance, and then about 2 years ago brought my expertise to Gridpoint to help position them as a leading smart grid solution provider. Currently I work with high-level policy makers in Washington, D.C., to develop the market, change policies, educate consumers, and work with stakeholders to help them understand the value of a smart grid to the economy and to consumers.

What was your first job after you finished school?

My first real industry job was working for an Oregon company that designed and manufactured heat exchangers for large industrial use. A year later, I went to work at the Pacific Northwest National Lab, and I spent most of the next 30 years working for Department of Energy labs.

How did you decide to work in the energy field?

It was the timing. I graduated college the year Jimmy Carter was elected president and this was the height of the energy independence movement. A year later he created the Solar Energy Research Institute and since I had learned to design solar ponds as a senior project, I was convinced that renewable energy would be my career.

What is a typical day at work like for you?

I interact with people all the time. There are usually dozens of emails, a couple of dozen phone calls, meetings with staffers on Capitol Hill or at DOE, with reporters, with utility companies or environmental groups or technology companies. I'm constantly interacting with fairly high-level decision-makers around the entire industry, and use these meetings to help people understand the importance of a smart grid.

What is the most rewarding part of your job?

Seeing energy policy change, whether on the national or state level. You should have seen me after President Bush signed the energy bill last year. We all worked extremely hard to get smart grid into the bill, and I felt like breaking out the champagne when it passed and he signed it. I couldn't believe we actually did it. It made all our hard work worthwhile.

What challenges do you face at work?

The basic thing I have to deal with on a daily basis is getting people to shift the way they think about energy and our power grid. I think it is probably similar to what went on in the early days of the Internet when industry folks were trying to convince retailers that the Internet was a good way to do business. Can you imagine telling one of the major booksellers, for example, that in just a few years, they'd be making most of their money by selling books on the web instead of at their stores? Well, the whole concept of how we get energy is going to be changing just as radically, and one of my jobs is to give people glimpses of what this will mean to them.

What advice would you give to a young person wanting to work in this field?

Be flexible. Don't get too hung up today on deciding what you want to be when you're 50 years old. Try things that seem to be what you like and get ready to become passionate about the work when the right thing comes along. Students need to take advantage of diversity to learn and discover when they're young, and be ready to get involved in the right thing when it becomes clear to them.

What else would you like to say about working in the electricity field?

Society is getting more and more interested and involved in the critical role of our electric grid in our lives. The politicians, business leaders and others throughout our society are finally realizing that we can't just keep spewing carbon into the environment or use all the water we want without worrying about it or keep building transmission lines and power plants the way we've always done it. It's time we all take a smart look at how we provide energy for our economy. The time is ripe for innovation, new ideas, and smart people. There's going to be a lot of excitement in this decade that we haven't seen in past decades.

NEED Annual Educator Survey

Return this survey by June 1st to be entered in a drawing for a free NEED science kit!

Name ____________________ State ________
School Name ____________________ Phone Number (____)____________
Fax Number (____)____________ Email____________________
Number of students taught this year ____Subject(s) ____________Grade(s) Taught ________
When/How did you find out about NEED? ____________________
Do you teach energy in the classroom, as an extracurricular topic, or both? Explain. ____________
Does using the NEED curriculum increase your knowledge and understanding of energy? ____________
Does using the NEED curriculum increase your students' knowledge and understanding of energy? Please elaborate.
____
Is the content level of NEED materials too low, too high, or generally on target____________
Do you like the student work pages in the Student Guide, or would you prefer them in the Teacher Guide so you can make copies? ____________________
What other resources would be helpful to you for your class?
____
Did you use NEED materials during the 2008-09 school year? If yes, circle below. If no, why not?
____

Biodiesel
Blueprint for Success
Conservation Contract
Current Energy Affair
ElectroWorks
Energy Analysis
Energy Around the World
Energy Carnival
Energy Enigma
Energy Fair
Energy Flows
Energy House
Energy in the Balance
Energy Jeopardy
Energy Management Kits
Energy Math Challenge
Energy on Public Lands
Energy on Stage
Energy Rock Performances
Energy Source Expo
EnergyWorks
Ethanol
Exploring Energy
Exploring Magnets
Fossil Fuels to Products
Games & Icebreakers
Global Trading Game
Great Energy Debate Game
Greek Mythology
H_2Educate
Infobooks & Activities
Marine Energy
Mission Possible
Mystery World Tour
NEED Songbook
Ocean Energy
Primary Science of Energy
Primary Stories & More
Projects & Activities
Saving Energy Expo
Science of Energy
Solar Kits & Activities
Talking Trash/Museum
The Future Is Today
ThermoDynamics
This Mine of Mine
Transparent Energy
Transportation Debate
Transportation Fuels Expo
Transportation Rock
Today in Energy
U.S. Energy Geography
What Car Will You Drive?
Wind Kits & Activities
Yesterday in Energy

Do you need more NEED materials in Spanish? If so, which ones?____________________
Do you use the activities in the *Energy Exchange* newsletter? yes no
Do you find the *Career Currents* newsletter valuable? yes no
Did you like the new look of the newsletters? yes no
Would you like to receive the newsletters electronically? yes (be sure to include email above) no
Are there NEED activities or subject areas you would like to see developed? If so, please elaborate.
____
What sections of the NEED website do you use the most? ____________________
What additional resources would you like to see on the NEED website, www.need.org? ____________
If you win the NEED drawing, which NEED kit would you like to receive?____________________

Please attach additional pages if more space is needed.

Thank you! Your feedback is very valuable to us.

Please copy this page and return it with any additional pages to NEED at 8408 Kao Circle, Manassas, VA 20110, or fax to 800-847-1820 or email to info@need.org

Photo: National Renewable Energy Laboratory

In this issue:
Understanding America's electric grid -- how it works today and what it will be like when it becomes a true "smart grid" . . . spotlight on the GridWise Alliance . . . interviews with three electric industry leaders . . . and NEED's annual educator survey.

NEED NEWS

NEED's staff, sponsors and partners have enjoyed working with you during the 2008-2009 school year. We have many terrific new things planned for the 2009-2010 school year and hope that you'll share your great ideas and success with us. Visit www.need.org over the summer for workshops, new curriculum offerings, and more resources.

NEED is proud to launch its new Hydropower Curriculum Module. Thanks to the support of the Hydropower Research Foundation and the National Hydropower Association, the curriculum materials and workshops have been very successful. The Teacher and Student Guides can be downloaded at www.need.org/.

Coming this summer: EIA's all-new energy education site, perfect for high school! The Energy Kid's Page is also getting a makeover. It'll be easier to use and easier on the eyes, with the same great content. Visit www.eia.doe.gov/kids for all the great new information.

NONPROFIT
ORGANIZATION
U.S. POSTAGE
PAID
PERMIT #201
DULLES VA

The NEED Project
P.O. Box 10101
Manassas, VA 20108
Phone: 713-257-1117
Fax: 703-257-0037