Running on Empty?

Experts square off on what must happen to overcome today's energy crisis

The chemical industry's natural gas bill rose from $5 billion in 1999 to $20 billion last year, cutting into money for new plants, jobs and research. But analysts say chemical engineers have what it takes to overcome today's energy crisis

By Joy LePree As the energy challenge escalates to a near crisis state, the chemical industry is feeling a major pinch. While the ramifications of the high price of fuel and natural gas are frightening for this energy-intensive sector of the manufacturing industry chemical plants are moving overseas and hundreds of thousands of chemical industry jobs have been lost chemical engineers are somewhat lucky because they hold the key that unlocks the door to their industry's salvation. Overcoming the problem requires the development of new sources of energy that mandate changes in chemical processing. Fortunately, chemical engineers possess the knowledge and expertise that can mastermind the solutions that will help their industry and the world beat the odds. Chemical industry organizations are also large and powerful enough to sway the government to initiate policies that can help provide relief.

Dire Straits

While the high cost of energy, especially natural gas, in the U.S. affects every American in the form of record-breaking heating bills and fast-climbing price tags on just about every manufactured product, it is especially troubling for the chemical industry. According to Jack Gerard, president and CEO of the American Chemistry Council (ACC), the chemical industry uses 2.5 trillion cubic feet of natural gas each year. This is more than 10 percent of the nation's total consumption, making the chemical industry the largest industrial user of natural gas. While some of this is used to fuel and heat chemical facilities, a large percentage is used as a raw material. "Natural gas is to chemical manufacturing as flour is to baking," said Gerard during testimony before the House of Representatives' Subcommittee on Energy & Mineral Resources during a legislative hearing on the Outer Continental Shelf Natural Gas Relief Act last November. "Unlike other industrial users, which consume natural gas for fuel and power, we also use it as a starting block for our products and processes," says ACC Chief Economist Kevin Swift. "In some cases, like ethanol processing, we use it directly. In other cases, we take natural gas, break it down and, through processing, it ends up in products like shampoo and telecommunications equipment. Ninety-six percent of manufactured goods contain chemistry, and chemistry contains natural gas. Therefore, almost everything you touch and see is made from natural gas." Last year, the nation's natural gas bill topped $200 billion. The chemical industry's share was more than $20 billion, according to ACC estimates. By comparison, in 1999 when gas sold for $2 to $3 per million BTUs, the nation spent just over $50 billion and the chemical industry's bill was $5 billion. Obviously, this steep increase isn't good for the industry. The extra money spent on natural gas is money that hasn't been invested in research, building new plants or creating new jobs. According to John Chen, president of the

American Institute of Chemical Engineers (AIChE), the number of new petrochemical plants being built in the U.S. is drastically slipping. “The plants are moving overseas,” he says. “In 2003, the Middle East accounted for 42 percent of the new petrochemical plants, the Asia-Pacific region about 28 percent, Europe about 28 percent and the U.S., only 2 percent. That’s scary to me,” he says. “But who can blame them, they are chasing the natural gas feedstock.” In March, the U.S. price of natural gas was near $7 per million BTUs. In Saudi Arabia, it was 75 cents, says Swift. Chen isn’t the only one to notice the loss of U.S. chemical plants. A May 2005 Business Week article, titled “No Longer the Lab of the World: U.S. chemical plants are closing in droves as production heads abroad,” states that “of the 120 chemical plants being built around the world with price tags of $1 billion or more, just one a 1,725-acre polyvinyl chloride plant in Plaquemine, LA is in the U.S.” To bring the point home, Gerard tells the story of a $4 billion Dow Chemical plant being built in Oman. “That plant will employ 1,000 people in high-paying R&D, engineering and operations jobs. Until three years ago, that new plant and those 1,000 jobs were going to be built in Freeport, TX. Andrew Liveris, president and CEO of Dow Chemical, said the high cost of natural gas here now 12 times higher than it costs on the Arabian Peninsula is why Dow moved the project.”

Time & Money: Two Big Stumbling B

When completely viable solutions abou
alternative sources of energy, the ques
comes to mind is why isn’t U.S. industry
embracing them? Two words: time and
get any or all of these ideas into play, it
quite a bit of time to develop these tech
the point of providing real relief. And, of
research and development comes with
price tag. Most experts feel that the che
industry wields enough power to sway t
government to increase access to sour
natural gas and oil in the deep waters o
Continental Shelf in an effort to supply
to the industry and the country during th
takes to fully develop alternatives. “The
recent estimates show that there’s enou
gas in the Outer Continental Shelf to he
million homes for 60 years or fuel 85 m
for 35 years. Another estimate says the
115 billion barrels of oil and 633 cubic f
natural gas out there,” says William Ca
president and CEO of the Society of the
Industry. “You can see there’s a lot of y
usage that, if we can get to it, can be us
we are developing alternative fuel sour
American Chemistry Council (ACC) is a
the government to fund incentives for in
energy technology to diversify the natio
portfolio. “Technologies such as gasific
the potential, over time, to fundamental
the way the nation makes and uses ene
Jack Gerard, ACC president and CEO
testimony before the House of Represe
Subcommittee on Energy & Mineral Re

during a legislative hearing on the Oute
Continental Shelf Natural Gas Relief Ac
“Given gasification’s strategic potential,
believes it is especially critical for the D
design a successful gasification comme
program and for Congress to fully fund
program.”

Moves like this one have resulted in more than 100,000 well-paying jobs in the chemical industry disappearing, due in large part to a hidden “energy tax,” says Swift. These ramifications have hit the plastics sector especially hard, says William Carteaux, president and CEO of the Society of the Plastics Industry (SPI). “In addition to losing facilities and jobs, the plastics industry has lost over $14.5 billion in business between 2000 and 2005 due to the high cost of natural gas, which we also use as a feedstock,” he says. “In eight to 10 years we won’t have any industry left.”

Shining Armor

While no one denies the harsh impact the rising cost of energy has had on the industry, some feel chemical engineers will become their own knights in shining armor. “No other social or technical challenge will impact the chemical enterprise, chemical professional and the well being of nations as much as the energy challenge we currently face. However, no group is as well suited to contribute possible solutions to the challenge of the energy supply, production, use and conservation as chemical engineers,” says Chen. “While it may seem philosophical or boastful, our enhanced technical background sets us apart from others and when you throw in the fact that our livelihood depends on energy, you have a group of people that are motivated to use their knowledge to work through this situation.” While it can’t hurt to use that knowledge to continue refining processes and making energy-conscious changes to plant infrastructure the U.S. chemical industry reduced its energy consumption by 6 percent in 2004 and improved its energy efficiency by 46 percent since 1974, says the ACC it’s not enough. Those chemical engineering degrees must be put to good use developing alternative sources of energy. One of the most viable solutions to generating energy to fuel the plant’s processes is co-generation, according to Chen. “A chemical plant needs energy and feedstock. Energy is most often used in two forms electricity to drive motors and heat to heat the reactors, columns and such,” he explains. “When a utility makes electricity by burning coal, natural gas or oil, about two-thirds of that energy is lost. It is thrown away because it is heat, and power stations can’t use the heat. But if the electricity was generated by the chemical plant, they could use the electricity they generate to power the plant and use the heat for their other processes.” Waste-to-energy is a solution supported by the SPI. “If you look at one plastic grocery bag, there’s enough potential power in it to light a 60-watt light bulb for 10 minutes,” says Carteaux. “There’s a lot of plastic grocery bags in this country. The U.S. certainly isn’t where it needs to be in waste-to-energy technology. Currently, there are 98 to 100 U.S. facilities processing 97 thousand tons of trash daily in 29 states. That generates about 28 hundred megawatts of electricity, saving 1.4 billion gallons of fuel. If more waste-to-energy facilities existed, we could use the generated electricity to provide hot water and heat for homes and businesses. And it would help stop filling the landfills.” Another highly viable solution is synthetic gas. Gasification technology converts coal and biomass under heat and pressure into a

high-quality gas. Since the raw material isn't burned, gasification produces little pollution and is exceptionally versatile. The gas it produces can be used to heat homes and businesses and make low-sulfur diesel fuel, fertilizer and chemicals. "Gasification technology has the potential to become the foundation for the nation's future energy infrastructure," said Gerard before the House. "The U.S. has the world's largest proven and potential supplies of coal and biomass. On a BTU basis, U.S. coal reserves are the equal of world petroleum reserves." Not only does the U.S. have the raw materials it is often referred to as the Saudi Arabia of coal but the technology already exists on a small scale. Eastman Chemical has been running a plant in Tennessee on syn gas for more than 20 years. Jeffrey Siirola, fellow of Eastman Chemical Co. and a former AIChE president, says Eastman originally began using syn gas to fuel a high-temperature process furnace in the 1930s before natural gas lines existed in the state. The technology was put to bed in the '50s when natural gas arrived. However, in the '70s the natural gas supply was cut off during an unusually cold winter. "The plant was in serious trouble, and we began thinking about using gasification technology since natural gas might not be reliable in the future," he says. "We went from thinking about using syn gas for the furnace to thinking about using it to actually make the chemical that we made in the furnaces. So, in the end, we built more coal gas fires, not for energy, but for raw material, and we made those chemicals by a totally different chemistry. We've been doing it since the early '80s and we've been very successful. Our reliability is about 99 percent, and gasification has proven to be a very clean technology for making chemicals." He adds that because of the success and the availability of coal and other biomass products in this country, many chemical companies are evaluating these opportunities. "I don't know when it will happen, but it's no longer a question of 'if.' The question really is: When can we build more gasifiers for energy as well as for raw materials? Most likely chemical companies will start using it as a raw material, but you'll also see power companies building gasifiers for power generation," says Siirola. All in all, overcoming the energy challenge isn't going to be easy for the chemical industry. "For us, the energy challenge is intertwined with the raw materials challenge," says Siirola. "When you change the raw material in chemistry, you have to change the processes, the technology and the chemistry. It can and will happen, but it's going to be a period of drastic change." ***Joy LePree*** *is a contributing writer for Chem.Info. She has worked as a journalist for 13 years, covering a variety of issues and trends involving chemicals, processing, engineering and maintenance. To share your comments about the content of this article, send an e-mail to Lisa Arrigo, editorial director, at* larrigo@reedbusiness.com *[1].*

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