Going Green

Cleaner doesn't have to cost more! See why making money doesn't have to hurt the environment

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While proponents of green chemistry say it's easy to be green, the color of money continues to scare off potential adopters. This report tells what you need to know to create profits while protecting the environment

'Green chemistry bashes that old myth that if it's cleaner, it's going to cost more.'
By Joy LePree

Green is a multi-tasking color. It represents both the environment and money &#151 two issues usually considered to be at odds with each other. In the chemical industry especially, traditional methods used to make a process or product more environmentally friendly have brought added costs. Recently, however, there has been a push for green chemistry, which according to organizations such as the EPA and the American Chemistry Council's Green Chemistry Institute reduces harmful effects while boosting the bottom line. Although chemical engineers have been slow to adopt related technologies, proponents of green chemistry say that once those in the industry understand the financial benefits, they will see why it's easy, if not better, to be green.

What Is Being Green?

According to the EPA, green chemistry is the use of chemistry for pollution prevention. More specifically, it is the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances. "In the early stages of green chemistry, we recognized that we needed to go to the molecular level and redesign chemistry in order to reach those goals," says Paul Anastas, director of ACS's Green Chemistry Institute (GCI). In a nutshell, this means that green chemistry is not about controlling pollution. Instead, it is about designing products and processes from the earliest stages to avoid using or making hazardous materials, chemicals and solvents. The real work behind green chemistry lies in the hands of the chemical engineers who create the processes that create our chemistry-related products. To be considered a true practitioner of green chemistry, the 12 Principles of Green Chemistry must be fully integrated into a company. See related article, "A Chemist's Dozen." "A lot of companies think they are practicing green chemistry, but they are really only taking a few steps toward sustainability. They aren't necessarily looking holistically at green chemistry from the perspective

of the 12 Principles," notes Julie Manley, senior industrial coordinator with the GCI's Pharmaceutical Roundtable, a collaboration of global pharmaceutical corporations committed to integrating green chemistry into their industry. "It is difficult, but it is necessary to go back as far as R&D to integrate green chemistry so that when a new process is developed, it is green the first time. There's an industry phrase, 'benign first time,' that sums up the true meaning of green chemistry."

Green Gets Red Light

Kermit the Frog used to say it's not easy being green. But for the chemical industry, it could be translated to it's not cheap being green. While benefits to the environment and a chemical firm's public façade are apparent, the cost is usually what prevents chemical manufacturers from adopting green chemistry. "No one is going to develop a new process unless there is significant ROI because there is always risk associated with a new process, particularly one that is radically different," says Dr. Everett Baucom, deputy director, NSF Science & Technology Center for Environmentally Responsible Solvents and Processes. "There is always the dilemma of deciding whether to put money into a current process or use it to develop a new one. Industry doesn't have unlimited funds to do research, so it's very difficult for a chemical company to invest in a new process." Prior to his work at the NSF, Baucom worked for DuPont where he helped develop a membrane technology used in a radically greener process to make chlorine and caustice. "The membrane process we developed has a 20 to 25 percent lower investment cost than building a plant based upon existing technology and a 15 to 20 percent lower operating cost because the new process was more efficient. Plus, it made a better product," he says. "It should have been adopted immediately, but 25 years later only half the world's capacity is in the membrane technology and the other half is still using the old technology despite the overwhelming advantages. It is the plants that were built after the membrane technology was developed that are using it. It was deemed too costly to change the process in existing plants, so they just keep plugging along the old way." He says this is just one example of the inertia that exists in the chemical process industry. And, he says, this attitude needs to change before green chemistry with all its environmental benefits is widely embraced in this country. However, proponents of green chemistry say that once it is embraced and put into action, it's actually more cost-efficient to be green. "When pharmaceutical companies begin to adopt green chemistry, they recognize the economic benefit," says Manley. "Green chemistry is driving towards the utilization of less hazardous materials, fewer reagents, fewer chemicals, etc., and therefore less byproducts. If you look at the components of green chemistry, it clearly saves money and time and that's an economic value."

Whipping Windex Into Shape

Running With a New Rubber

Anastas adds that green chemistry is by far more cost-effective than pollution controls. "Past approaches looked at products, process and operations and tried to use technology to make them less bad. All of those approaches cost money and didn't add value," he says. "Green chemistry looks at redesigning products and processes so that while reducing the impact on human health and the environment, you're also able to increase the performance and value-added properties of products and add efficiencies because there are fewer or no bad byproducts." However, a few remain uncertain as to whether investment costs are worth the payback. "The obvious benefits of green chemistry are good PR and the avoidance of fines for pollution offenses, but there's little industry data to indicate to what extent companies are benefiting financially," says Mitch Halpern, director of Kline & Co.'s Chemicals and Materials consulting practice. "We are proposing a study that will seek to determine how green chemistry practices impact the bottom line so that companies can make informed decisions. We would like to do an analysis of operations that are involved in the area and conduct research into where the profits are made and what the outlook is for corporate profits and environmentally friendliness to keep marching arm and arm down the aisle of peace, joy and happiness."

Giving Green a Push

Because the jury is still out on green chemistry's financial benefits, most chemical companies aren't willing to take a chance. However, green supporters are turning to academia and resource sharing in an effort to ease the individual financial burden. "It is in linking academia with industry where you will find the greatest and most expedited benefits because academia is doing a lot to advance green chemistry educationally and through their research," says Manley. "The roundtable (GCI's Pharmaceutical Roundtable) is providing funding for post-doctoral research to direct research that has applications in the pharmaceutical industry. Additionally, chemical engineers come out of school with knowledge of green chemistry and are ready, willing and able to provide alternatives during the design process." And, organizations such as Baucom's are pushing further down into the educational system with presentations and programs for K-12 to introduce the concept of green chemistry in an effort to drum up interest in environmentally friendly chemistry for future generations. Research and resource development is another area where interested parties are joining forces. "The roundtable strives to provide shared resources so that each company isn't individually investing in things like research or toolkits," explains Manley. "It is more economical to do it as a group." One of the items being jointly developed by the roundtable is a toolkit. Chemists can be instructed to develop a green process, but if they aren't given a mechanism to

measure processes or assistance with choosing one solvent over another, they won't know how to improve. Toolkits help in this area because they usually include a solvent selection guide, an acid/base selection guide and/or life cycle assessment tools. "Individual companies have their own toolkits to varying degrees," says Manley. "So we are developing a universal toolkit that contains consolidated knowledge of roundtable members. We are combining resources on pre-competitive challenges." Folks such as Anastas, Manley and Baucom hope that once chemists become fully aware of all the benefits of green chemistry that they will adopt it. "Only a small fraction of our chemical engineers understand the principles, approaches, techniques and benefits of green chemistry, but once they do, they will adopt it," says Anastas. "It's very beneficial because it advances environmental health issues at the same time that products and processes are being made, which is more profitable," he continues. "Green chemistry bashes that old myth that if it's cleaner, it's going to cost more, and that if it's going to make money, it's going to hurt the environment. True green chemistry creates profits and protects the environment." *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/editor-in-chief, at lisa.arrigo@advantagemedia.com.*

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