

Environmental Sustainability and Recycling in Action: SPE's Global Plastics Environmental Conference 2006

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Sponsored by the Plastics Environmental Division of SPE, the Global Plastics Environmental Conference (GPEC) took place February 28–March 2 at Atlanta's Gateway Sheraton. The Conference theme—Environmental Sustainability and Recycling in Action—was underlined by the opening event, a tour of the Mohawk Industries' PET-recycling facility in Summerville, Georgia, where each year, 3.3 million soft-drink bottles are transformed into the polyester fiber from which high-quality residential and commercial carpeting is made.

Outstanding technical sessions included presentations from academia and industry covering six topic tracks: automotive; electronics; reclamation and supply; biobased and biodegradable materials; marketing and business—recycling, sustainability, and ELV (end-of-life vehicles); and regulatory (deposit laws, safety, and legislation). Plenary sessions, a student poster display, more than 20 exhibits by industry participants, and introduction of the Division's 2006 Environmental Award winners completed the Conference program.

High Energy Costs: The Future of Plastics

The plastics industry represents the fourth-largest manufacturing sector in the U.S. and continues to be a high-growth industry. Primarily dependent on petroleum-based feedstocks, it is affected by rising fossil-fuel prices and heightened concern over natural-gas supplies. Biobased and recyclable materials and plastics-recycling efforts are playing increasingly important roles as the industry seeks to face these challenges.

A Two-Headed Monster

Plenary speaker William R. Carteaux, president of the Society of the Plastics Industry (SPI), called it a “two-headed monster”: the requirement for natural gas as the major feedstock for plastic resins, and the high demand for natural gas to power plants that generate electricity. According to Mr. Carteaux, it is estimated that more than 80% of resin produced in the U.S. is made from natural gas

rather than from crude oil. When plants were constructed in the U.S. years ago for the cracking, or refining, process that converts raw material into resin, a plentiful supply of inexpensive natural gas was available, but since the year 2000, prices for natural gas have increased an astonishing 700% as suppliers struggle to meet demand. The U.S. manufacturing industry uses one-third of the nation's energy, and the plastics industry represents almost 10% of that total.

Why the strain on natural-gas supplies, and the resulting price increases? According to Mr. Cardeaux, U.S. government moratoriums have prevented the further development of natural-gas reserves in the outer continental shelf, while Clean-Air Act amendments enacted by the U.S. Congress in the year 2000 put restrictions on electricity-generating plants, with the effect that those plants are now powered almost exclusively by natural gas rather than coal. Ninety percent of electricity-generating facilities constructed in the last ten years are fueled by natural gas, said Mr. Cardeaux, squeezing the supply of natural gas and making it more expensive.

Competitive Problem

The average energy cost for all manufacturing in the U.S. is approximately \$5.58/million Btu. Yet energy costs for the manufacture of plastic and rubber products are almost double that, at \$10.90/million Btu. And while the U.S. once enjoyed the lowest-cost natural gas in the world, that is no longer the case. Lower natural-gas prices in countries around the world, notably China and India, help explain the U.S.'s current competitive disadvantage, said Mr. Cardeaux. The overall effect of higher natural-gas prices in the U.S. is that it has become increasingly difficult to compete with manufacturers in countries such as China and India.

Furthermore, reported Mr. Cardeaux, according to predictions from the U.S. Department of Energy's Information Administration Group, U.S. reliance on imported oil will escalate from its present 56% to 68% in the near future, and, correspondingly, natural-gas prices are expected to continue their upward spiral. Compounding the problem is that 400 million cubic feet/day of natural-gas production is expected to remain offline in the foreseeable future as a result of damage inflicted by the two major hurricanes that struck in the Gulf of Mexico in 2005.

From 1970 until the early 1990s, U.S. natural-gas supply and demand were “pretty much in check.” The shortfall began in the mid-1990s and continued to increase, until in 2005 the shortfall amounted to 5 trillion cubic feet; it is expected to grow by 2025 to 10 to 12 trillion cubic feet as a result of the increase in demand, said Mr. Carteaux.

Solutions

Opening currently restricted domestic sources of natural gas could go a long way toward reducing supply shortfalls, suggested Mr. Carteaux, as could streamlining the exhaustive permit process required of companies carrying out exploration for new sources of oil and natural gas. According to the February 2006 *Report to Congress*, of the U.S. Department of Interior, Minerals Management Service, there is enough oil and gas in the outer continental shelf to heat 100 million homes for 60 years or fuel 85 million cars for 35 years. “That’s a lot of oil and natural gas sitting out there, and if we had that 35-year time frame, it would certainly give us an opportunity to develop alternative sources as we go forward,” he said. The technology used in construction of the 4000 drilling platforms for oil and gas production in the Gulf of Mexico has proven to be extremely sound and environmentally safe: of the 3050 platforms that were in the direct path of the two hurricanes in 2005, only 108 were completely destroyed and 53 badly damaged. There were no significant incidents of oil spills or slicks, he noted.

No Quick Fix

Warning that there is no “quick fix,” Mr. Carteaux reviewed the following recommendations contained in the comprehensive energy bill passed by the U.S. Congress in June 2005. Its directives are expected to come to fruition between 2012 and 2015:

- 1) Reduce demand for natural gas through conservation and efficiency programs and incentives;
- 2) Enhance natural-gas infrastructure, e.g., by nationwide construction of liquid-natural-gas terminals and promotion of an Alaskan pipeline;
- 3) Promote nuclear power; and
- 4) Create a more diverse fuel mix by supporting clean coal gasification and alternative fuels.

More Opportunities

“I am sure there was discussion about these [opportunities] at this conference,” said Mr. Carteaux. Indeed, the GPEC heard suggestions to:

- 1) Encourage more economical and renewable biobased and biodegradable materials: these materials do not require fossil fuel-based resources to make resins, nor do they clog landfills, although in order to produce them, energy is still required, e.g., to power farm machinery;
- 2) Improve waste-to-energy efforts: 90 billion plastic bags are used in the U.S. each year, of which only about 5% are being recycled. (One plastic bag contains enough energy to power one 60-watt light bulb for 10 minutes.) Some 98 U.S. waste-to-energy facilities process 97,000 tons of trash daily in 29 states, creating enough electricity to save 1.4 million gallons of fuel per year.

A Query From the Audience

Question: What do you see SPI doing in regard to the recycling of postconsumer plastics? Recycled material brings to us [plastics processors] lower costs for materials. As economy of scale takes effect in the recycling industry, the volume of recycled materials available to processors goes up and the price paid for those materials comes down.

Answer: SPI is intensifying its efforts to promote recycling. For example, at NPE 2006 there will be a special pavilion where recycling equipment will be displayed. Additionally, one of SPI's biggest initiatives is the website, www.earth911.org, where recycling facilities within any geographical area in the world are listed. In cooperation with the “earth911” organization, SPI has begun an initiative in California to recycle plastic bags to be processed into plastic lumber. “This is the program we [at SPI] are pushing today,” Mr. Carteaux said.

He added that SPI is working to establish a pilot program with the Commissioner of the Environment in Chicago for bottle and trash recycling at that city's McCormick Center, with plans to expand the recycling initiative to include large exhibit halls and sports stadiums throughout the country. Recycling issues have become much more “center stage” at SPI, Mr. Carteaux said. SPI is cooperating with other associations, such as the Association of Postconsumer Plastic Recyclers, to promote plastics recycling.

From the EPA

Plenary speaker James C. Kenney, an environmental engineer with the U.S. Environmental Protection Agency (EPA), is involved in that organization's Vinyl Chloride Pilot Project. Begun five years ago, the project is based on "in-the-field" observations of EPA inspectors such as Mr. Kenney. Working in the field, inspectors became aware of the volatilization of certain chemicals from wastewater treatment, from the handling of hazardous wastes, and from production processes in general—things that were "going under the radar," he said. Although not intentional, he noted, they represented something that was not being accounted for.

Vinyl Chloride Emission-Reduction Strategies: How U.S. EPA Enforcers Working With Industry Achieve Results

Mr. Kenny assured his audience: "I don't mean to scare anybody... This [EPA project] is a collaborative process within the enforcement arena, which is perhaps different from your perspective of the way the EPA works." In fact, the agency's approach to the task of developing emission-reduction strategies involves developing a systematic means of quantifying areas of environmental impact and working with industry to solve them, he said.

Keep in mind, he advised, "we [the EPA] are not reinventing the regulations. We are requiring compliance with existing regulations. We are trying to creatively use policies that are already on the books to solve environmental problems."

The Vinyl Chloride Pilot Project requires compliance with existing permits and regulations; seeks injunctive relief, economic benefits, and civil penalties (where appropriate); and creatively uses existing EPA policies to seek additional emissions reductions. The project's methodology, Mr. Kenney said, is based in science and engineering. To date, EPA has assessed the compliance status of 83% of facilities engaged in the manufacture of PVC in the U.S. Beyond PVC and vinyl chloride, the EPA is addressing chemicals such as propylene dichloride, methylene chloride, and styrene.

Manufacturers' Responsibilities

Based on his work with the vinyl project, Mr. Kenney offered the following advice to manufacturers: With any chemical you may have in your manufacturing process, be knowledgeable as to how it is monitored under the U.S. government's Clean Air Act (CAA), Clean Water Act (CWA), and Resource Conservation Recovery Act (RCRA). Manufacturers must account for facility emissions and are responsible for reports to regulatory agencies. Mr. Kenney advised that the most common areas of concern to manufacturers in maintaining compliance with regulations are 1) leak detection and repair (CAA regulations), 2) sampling and analysis (CAA, CWA, and RCRA), and 3) surface impoundments (CAA, CWA, and RCRA).

EPA Objectives, Novel Ideas, and Environmental and Public Health Benefits

Two case studies of project programs were cited. The EPA's approach to the two companies: "We [the EPA] think you can reduce emissions; we challenge you to do better." In the first case, the company was able to apply \$900,000 of a \$1.1 million assessment to achieve a significant reduction in emissions—26 tons/year. In the second case, the company achieved an immediate 18-ton reduction of vinyl chloride emission levels and was granted a three-year incentive in which to fully comply with levels permitted under federal and state law.

"We look at what's best for the environment, what's best for the company, and at how we do this with the least amount of resources in the least amount of time, considering all parties involved," said Mr. Kenney. The goal of reducing the total amount of a chemical has led to development of novel settlement techniques for the EPA and industry. "It is an approach that combines concepts from innovative EPA programs with traditional enforcement concepts to obtain unprecedented environmental and public health benefits," the speaker said.

Conference Proceedings Available on CD

For those seeking detailed information on the most recent research and developments in renewable and biodegradable materials and processes, the proceedings of the Global Plastics Environmental Conference 2006 are available for

purchase on CD. Contact SPE's Customer Relations Department at 203-740-5403, or visit the website at www.4spe.org/training/products/1946.php.

Environmental Stewardship Award Winners 2006

Awards honoring corporations and institutions that have demonstrated environmental leadership and excellence were announced by Pallatheri Subramanian, Environmental Division awards chair. To qualify for a nomination, achievements must have been commercially adopted or accepted as a standard in the year 2005 and must illustrate significant leadership in promoting sound environmental practices and creating new markets that will benefit the environment.

• Environmental Stewardship Award

Wal-Mart Stores, Inc: NatureWorks PLA Packaging

Wal-Mart Stores, Inc., introduced the use of packaging made from NatureWorks PLA for the packaging of fresh-cut fruit, herbs, strawberries, and Brussels sprouts in its stores in November 2005. Replacing conventional packaging with NatureWorks PLA clear, thermoformed packaging for just four items (accounting for more than 114 million containers per year) means that Wal-Mart Stores saved the equivalent of 800,000 gallons of gasoline and avoided emission into the Earth's atmosphere of more than 11 million lbs of greenhouse gases. Wal-Mart's NatureWorks PLA packaging program will continue with the introduction of cut-vegetable containers, followed by gift and donut boxes and select tomato packages.

Wal-Mart Stores, Inc.

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• New Technologies in Processes Award

Spartech Corp.: Multilayer Barrier

Spartech Plastics' extruded thermoplastic sheet, Low E Poly, will be used to support the manufacture of twin-sheet thermoformed fuel cells in a number of nonautomotive applications. Low E Poly is a multilayer barrier sheet specifically engineered to meet emissions-performance criteria required by the California Air Resources Board

(CARB). As a result of the design flexibility, reduced tooling costs, and speed to market afforded by the use of the thermoforming process, OEMs such as John Deere and Polaris are welcoming Low E Poly as an important material contributing to their ability to meet CARB requirements for production of equipment for agricultural, power sports, and marine markets.

Spartech Corp.

(Award for Spartech Plastics PDC, Warsaw, Indiana)

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• New Technologies in Materials Award

Ciba Specialty Chemicals: EnviroCare

Used primarily for agricultural mulch film, Ciba's EnviroCare film becomes embrittled at the end of the growing season because of a combination of oxidation (initially triggered by heat) and biodegradation (called oxobiodegradation [ASTM 6954-04]). As a result of the embrittlement process, the film fragments into small pieces that can be easily mixed with the soil during routine cultivation, thus providing a desirable alternative to such waste-disposal practices as landfilling or burning. EnviroCare has been successfully tested on a commercial scale worldwide. Major crops for application of EnviroCare mulch films are maize, melons, tomatoes, and cotton. Sales of degradable mulch films are expected to increase significantly as the demand grows for sustainable cultivation.

Ciba Specialty Chemicals

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• New Technologies in Renewable Materials and Processes Award

Metabolix, Inc.: PHA Natural Plastics

Metabolix is commercializing a family of polymers, PHA natural plastics, made from renewable resources such as sugars and vegetable oils. This technology is also expected

to enable the production of these natural plastics from nonfood plant crops. Microbial strains are engineered to produce high levels of monomers using natural sugars and plant oils as feedstocks. The monomers are polymerized within the microbial cell; the cells are lysed open, and the polymer is extracted. Biological waste is removed and the polymer is purified. The material can be pelletized and compounded into formulations suitable for a broad range of applications.

Metabolix, Inc.

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• **Design for Sustainability Award**

Shaw Industries: EcoWorx

EcoWorx is a carpet tile-backing material constructed of thermoplastic polyolefin. In addition to being an alternative to PVC backing, EcoWorx weighs 40% less and maintains or improves all performance categories compared with PVC. Shaw Industries picks up and recycles all EcoWorx at the end of its life, at no charge to the customer. The material is returned and reintroduced into the manufacturing process, establishing sustainable design as standard business practice. Since its inception in 1999, EcoWorx has reduced raw materials used in manufacturing by 67.5 million lbs and saved 62 million lbs of material from disposal in landfills.

Shaw Industries

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• **Plastics Recycling Award**

Pot Recyclers Pty Ltd.: Polypropaclean

Pot Recyclers Pty Ltd. developed collection systems (including the reprocessing plant, equipment, and techniques) to divert an estimated 100 million polypropylene (PP) plant pots per year from landfills in western Australia. The company also developed "Polypropaclean," a chemical emulsion that removes

ingrained organic material from gardeners' discarded plant pots. The PP material is often heavily contaminated and oxidized. Many other PP products from the postconsumer waste stream are now being recovered and reprocessed using the company's system. Through its recycling program, Pot Recyclers Pty Ltd. supplies manufacturers with high-quality feedstock to replace virgin resin.

Pot Recyclers Pty Ltd.

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• **Emerging Technologies Award**

Soliant LLC: Reduced Emissions Paint Film

Soliant LLC produces a paint-film product that covers the entire surface of an automobile or light truck (with the exception of windows and lamp lens surfaces). Use of the paint film reduces air emissions by as much as 98% compared with traditional vehicle finishing using paint, according to an analysis conducted by environmental consultant MM&A LLC.

Soliant LLC

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• **Enabling Technologies Award**

AMUT North America: PET Recycling Plants for Postconsumer Containers

AMUT's PET-recycling technology is a highly efficient process for converting dirty postconsumer bottles into reusable PET flakes. The company began in 1958 as a manufacturer of extrusion machines, and in the 1980s undertook development of the recycling process to help clients lower operating costs by utilizing recycled, rather than virgin, material. Additionally, the recycling process makes it possible to divert waste from landfills and to avoid trucking and transporting of waste, and encourages local and state governments to take advantage of recycled plastics products that cost less than virgin PET pellets. The technology uses closed-loop water filtration to minimize water usage (approximately 1 qt of water is required to

produce 1 lb of recycled PET flake), greatly reducing the amount of chemicals required and the amount of wastewater produced. AMUT recycling technologies save millions of gallons of water each year, eliminate the need for tons of chemicals, and conserve energy.

AMUT S.P.A.

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Picture caption:

Dr. Klementina Khait, Plastics Environmental Division education chair and student poster chair, presented awards to three university students for their outstanding poster submissions. Pictured (left to right) are Mike Montpetit, GPEC 2006 conference chair; Napawan Kositruangchai, Michigan State University; Thitisilp Kijchavengkul, Michigan State University; Dr. Khait; and Brian Ray, Pittsburg State University.

