

# The Industries of the Future

Carl Irwin

**I**FIRST HEARD ABOUT THE US Department of Energy's *Industries of the Future* program 11 years ago, at an advanced materials meeting in Coco Beach, Florida at a presentation by Merrill Smith who, at the time, was representing the US DOE Office of Industrial Technologies (OIT). Smith says the goal of the IOF program is to improve energy efficiency in energy intensive industry sectors such as aluminum, steel, glass, chemicals, polymers, metal casting and forest products.

After her talk, I told her she really got my attention, because West Virginia has all those industries—and I just wondered where we pick up the money to help make them more efficient. She thought that was pretty funny.

She did tell me they had a well-defined process for working with the IOF industry sectors. They hold facilitated workshops to arrive at a 'vision' for each of the sectors, i.e. what is the desired 'picture' of that industry sector in the year 2020.

Once an industry vision was established, another series of workshops would be held to lay out a technology roadmap or plan for achieving the desired industry vision. The end result was a detailed, prioritized strategy describing projects that could potentially be competitively co-funded by the US government and the private sector. These visions and technical roadmaps are an incredibly rich resource of industry R&D programs and may be accessed on the Web site <http://www.eere.energy.gov/industry/>.

When West Virginia first became involved with the IOF program in 1997, Denise Swink was deputy assistant secretary for

Industrial Technologies and director of the OIT. She actually suggested the idea of a state-level IOF program to a couple of other states and they apparently didn't listen. We did—and West Virginia became the first state to initiate a state level IOF program. Since then, as many as 30 other states established some form of IOF program. One reason state IOF programs caught on is that individual strengths and needs of particular states could be built into their programs. For example, Tennessee has the Oak Ridge National Laboratory; Iowa has strong agriculture and bio-based industries; New Hampshire has research expertise in environmentally sustainable

Much has happened along West Virginia's journey with the IOF program. For starters, WVU's Carbon Products Consortium worked with the OIT to establish carbon products as a critical "crosscutting" technology for most of the IOF industry sectors, e.g. carbon anodes and graphite electrodes are used in making aluminum and steel, carbon vessels are used for containment of high-temperature molten metals and glass, graphite molds are used in the metal casting industry and carbon fibers are used in reinforced polymeric materials. In September 1998, the CPC group completed and presented to OIT the *Carbon Products Industry Vision for the Future: A World of Carbon Products*.



Carl Irwin, Kathleen Cullen and Mike Carr

Nothing has been more important to development of West Virginia's IOF program (IOF-WV) than our partnership with the West Virginia Development Office, in particular with Jeff Herholdt, manager of the WVDO's Energy Efficiency Program. Herholdt is our key link with national programs such as DOE's State Energy Program and with organizations such as the

National Association of State Energy Officials. On the state level, several of Herholdt's technical programs, e.g., Wood Industry Assistance, Glass Industry Assistance, Projects with Industry, WV Industrial Energy Assessment Program and the Industrial Gas Utilization Center, fall under the IOF-WV umbrella.

IOF-WV has partnered with several member companies of the West Virginia Manufacturers Association and enjoys a very cooperative relationship with Karen Price, WVMA President. In 1999, Brooks McCabe, West Virginia state senator, invited us to hold IOF-WV Day at the

technologies and Washington State has an extensive forest products industry including corporate headquarters for the Weyerhaeuser Corporation.

David Hardesty, WVU President, was present at the meeting with Swink when the idea of a state IOF was first discussed. He said, "Let's do it!" and we have had his strong backing ever since. Richard Bajura, director of the WVU National Research Center for Coal and Energy, has been very supportive and NRCCE continues to be the home base for WVU's participation in IOF-West Virginia (IOF-WV).

capitol and we have returned during every legislative session since then.

Supportive people in leadership positions in government and academia are important, but an industrial partnership program does not go far unless there is significant industry participation and involvement. Fortunately, West Virginia industry has people such as Ric Love of Century Aluminum, Beri Fox of Marble King, Tim Duke of Steel of West Virginia, Dick Bowlby of Burk Parsons Bowlby, the late Pat Minehardt of HK Engine Components (HK Casting), Earl Melby of DynaTech Adhesives, Doug Ritchie of SDR Plastics and Scott Goodrich of Alcan Rolled Products—just to mention a few of our key industrial partners.

At the first IOF-WV Symposium in 1997, Love met with a group involved in the national IOF aluminum program and soon after Century was invited to become a partner in an ongoing IOF project. This project led Love to team with Larry Banta, WVU mechanical and aerospace engineering professor and Jan Berkow of Applied Industrial Solutions on another successful IOF proposal to develop new diagnostic and control technologies for the aluminum smelting industry—a project that had a targeted energy savings at Century of \$15 million per year. Over the years Love has partnered with Oak Ridge National Laboratory on several projects and has reached out to other industry sectors such as glass and metal casting to develop crosscutting technology projects.

Beri Fox is the small company equivalent of Love. She is president and CEO of Marble King in Paden City, one of two US marble companies managing to survive in an era of low-cost imports and skyrocketing energy prices and outdated manufacturing equipment that should be replaced if finances permitted. However, Fox has worked extensively with IOF-WV energy assessment teams to reduce energy costs; she is enthusiastic about the potential of new technologies such as biomass gasification and is an outstanding glass industry spokesperson, as well as IOF-WV cheerleader.

The IOF-WV link to WVU is through faculty researchers who have the expertise and

commitment to conduct projects that help energy-intensive companies be more energy efficient and competitive. For example, in 1997, Ed Sneckenberger, WVU mechanical and aerospace engineering professor and his colleague, Dr. Steve Woodruff, a scientist at the US DOE National Energy Technology Laboratory, developed a laser cutting technique that has the potential to reduce waste material in the hand glass industry by up to one-third.

The IOF-WV program works closely with the WVU Industrial Assessment Center that recently was recognized as the No. 1 IAC among 26 others across the US. Bhaskaran Gopalakrishnan (better known to all as Gopala), industrial and management systems engineering profes-

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sor is director of the WVU IAC. Gopala and his student teams have conducted energy assessments at more than 390 companies—both large and small—and have identified approximately \$20 million of annual energy savings for companies in the mid-Atlantic/mid-West region. Actual implemented recommendations have saved these companies more than \$15 million annually—and the payback on investment is generally less than 24 months.

A materials development and testing project that includes a WVU research team led by Xingbo Liu, mechanical and aerospace engineering professor, materials experts at Oak Ridge National Laboratory, researchers at University of Missouri-Rolla and industry partners from 24 metals and refractory companies has the potential to save the domestic steel coating industry as much as \$1 billion per year if implemented throughout the industry.

Many IOF-WV research teams include very bright students who bring new ideas and enthusiasm for learning to the projects. For example, Philip Biedler, a

WVU Presidential scholar, developed innovative control systems to optimize plant performance when he was working on his doctorate with Banta on the Century Aluminum project. Biedler was doing post-doctoral work with Al Stiller, WVU chemical engineering professor, for two years and, in 2003, was hired as a senior scientist by Firefly Inc., a small R&D company developing high charge-density batteries. Jing Xu, a doctorate student is currently working with Liu and others on the steel industry project mentioned above. Her work is leading to a fundamental understanding that explains for the first time how corrosion degrades product quality and productivity in steel galvanizing lines. This knowledge will enable the development of new corrosion and wear resistant materials with greater than five times improvement in product quality and plant productivity.

An interesting concept currently being studied by an IOF-WV team involves “energy-intensive industry clusters.” David Knuth, executive director of the Marshall County Chamber of Commerce and recently retired from AEP, has convened an industry group including PPG

Industries, Bayer Polymers, Columbian Chemical, CII Carbon, Ormet Aluminum, AEP, two glass manufacturers and other nearby companies that use significant amounts of energy. The project, being conducted jointly with the National Energy Technology Laboratory, is to assess the technical and economic feasibility of a centrally located coal-based co-generation plant that would provide low-cost electricity, heat, steam and chemical feedstocks to the industry cluster. Richard Turton, WVU chemical engineering professor, is leading the assessment.

IOF-WVs path forward will include development of new products. For example, Rakesh Gupta, WVU chemical engineering professor and Ben Dawson-Andoh, WVU forestry professor, are working with an international group to develop new “green” approaches to making wood-polymer composites—a sector that is projected to grow at 12 percent a year during the next decade.

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Mel Croucher, director of the WVU Polymer Research Center, is coordinating WVU's participation in the Polymer Alliance Zone's MARCEE project. This project is providing national leadership in electronics and polymer recycling—that includes, among other approaches, commercialization of wood polymer composites.

Not all IOF-WV successes have required a funded research project. For example, under the leadership of Pat Minehardt and Bob Creese, WVU industrial and management systems engineering professor, a coalition of metal casting companies worked with the West Virginia state legislature and the West Virginia Department of Environmental Protection to implement a new policy permitting the beneficial reuse of spent foundry sand. This policy received recognition by the US EPA and has saved West Virginia companies more than \$1 million over the past few years.

IOF-WV's journey into the future will include partnerships that improve industrial energy and resource efficiencies, that create innovative products and processes, and that help energy-intensive manufacturing companies be more competitive. ■

*Feature Photographs Courtesy of IOF-WV*

*The tenth annual IOF-WV Symposium will be held this November in Charleston.*

prices in the PJM system which operates transmission lines in Delaware, Illinois, Maryland, New Jersey, Ohio, Pennsylvania, Virginia, West Virginia and the District of Columbia. PJM runs the largest competitive wholesale electricity market in the world. Popova developed new tools for predicting the patterns of electricity prices across space and time. Understanding those price patterns can make the difference between profit and loss for buyers and sellers of electric power.

Electrons are eternal. But computer and communications technologies, new forms of generation, heightened awareness with regard to environmental performance, and the inexorable march toward consumer

and downsizing the workforce, were initiated in 1993. Since then, coal mines that had been losing money for decades have become profitable.

The rapid development of the economy and expansion of the coal industry has giving rise for concern for the safety, health and protection of workers. Presently China has the highest mortality rate in the world for coal mine operations, the greater incidence occurring at the many thousands of small, unlicensed underground mines. The drive to increase the national coal production is increasing the demand for mine mechanization and better educated and trained personnel. This is resulting in improvements in mine safety and health conditions. As most accidents occur in manual coal production operations, it is anticipated that increasing mine mechanization will result in reduced mine accidents. The safety and health records for underground mines are generally considerably greater than surface mines. Under-reporting of serious and minor injuries has been a problem. The rapid expansion of the economy also resulted in the dramatic increase in village-owned enterprises (VTEs) which prompted greater attention by the Chinese government to working conditions and the environment. ■

choice means that the electric utility industry will be different. As Charles Bayless, President of WVU Institute of Technology and a member of the board of Dynegy, told an APERC audience, "The toothpaste is out of the tube."

Especially because it is a changing world, I remain truly thankful for the researchers with whom I work and for all those who keep this modern-age wonder of the world operating to make my mornings routine. Now where is that darn alarm snooze button? ■

In California, BP is offering a Solar Home Solutions package that enables customers to purchase a complete system along with monitoring equipment and access to available grants.

"We are pleased to announce a new partnership with Treasure Homes in California through which solar panels will be integrated into roof tiles enabling easy installation in customers' homes," explains Cox. "And we will begin to extend the global reach of this fast growing business into new markets such as China where we have agreed the formation of a joint venture with Sun-Oasis, providing access to the world's largest fast-growing market."

In Europe, BP is offering the Saturn module that is at the forefront of solar technology for power performance being among the highest power modules currently available in large quantities.

"We aim to be a leader in the solar industry in the drive to reduce the total installed costs of providing solar energy to levels at which it can compete strongly with oil, gas, coal and nuclear in the generation of electricity—something that is possible today in some markets (California peak, Japan, Hawaii)," states Cox.

She believes this is possible through continued innovation and technology gains across the Solar value chain, including lower cost panels, higher efficiency cells and more productive 'total system' installations.

"BP is creating a different kind of business—the first of its kind we think—the first of its kind for us—or for anyone," says Cox.

BP Alternative Energy will be based in Sunbury, Middlesex and initially employ some 2,500 people around the world. ■

*For more information, visit [www.bp.com](http://www.bp.com).*