

Energy Matters

U.S. Department of Energy, Industrial Technologies Program



Features

Harrison Steel Leverages DOE and EPA Programs to Maximize Energy Efficiency Efforts

Through partnerships with the U.S. Department of Energy's Industrial Technologies Program's (ITP's) *Save Energy Now* LEADER Program and the U.S. Environmental Protection Agency's ENERGY STAR® for Industry Program, the Harrison Steel...

[READ MORE, PAGE 2](#)

ITP Brings Together Industrial Stakeholders at Gulf Coast Industrial Energy Efficiency Forum

On May 20–21, 2010, the U.S. Department of Energy's Industrial Technologies Program (ITP) and the Industrial Energy Technology Conference co-hosted the Gulf Coast Industrial Energy Efficiency Forum (the Forum) in New Orleans, Louisiana. The fourth...

[READ MORE, PAGE 4](#)

Alabama Jump Starts Its *Save Energy Now* Program and a New E3 Initiative by Leveraging Federal Grants

Alabama has been providing energy assessments to reduce consumption in local industries since 2005. As industry in Alabama has grown, the Energy Division of the Alabama Department of Economic and Community Affairs (ADECA) has realized the increasing...

[READ MORE, PAGE 5](#)

ITP's Industrial Assessment Center Program

Funded by the U.S. Department of Energy's Industrial Technologies Program (ITP), the Industrial Assessment Center program has been providing small- and medium-sized industrial plants with energy assessments to identify opportunities to improve...

[READ MORE, PAGE 7](#)

Also in This Issue

Success in Industry

Alcoa, Inc.	9
Alexandria Extrusion Co.	9

States & Utilities Corner

<i>Assessment-to-Implementation</i>	
<i>Best Practices Workshop</i>	10
Southeast Plants & SEP	11

Tools of the Trade

DC Energy Profiler Tool Suite	11
-------------------------------	----

Research & Development

Server Technology	13
-------------------	----

Markets & Trends

Toward a Carbon Economy	14
-------------------------	----

Ask the Energy Expert

SEP at Dow	19
------------	----

International

21

Funding Resources

21

Training Opportunities

22

Look for Us...

23

Program Contacts

23

Features

Harrison Steel Leverages DOE and EPA Programs to Maximize Energy Efficiency Efforts

Through partnerships with the U.S. Department of Energy's Industrial Technologies Program's (ITP's) *Save Energy Now* LEADER Program and the U.S. Environmental Protection Agency's ENERGY STAR® for Industry Program, the Harrison Steel Casting Company (Harrison Steel) has achieved significant energy savings by leveraging the two programs to capitalize on its energy efficiency efforts.

Harrison Steel, a producer of highly engineered carbon and low/medium alloy steel castings, is a preferred supplier to some of the biggest names in the agriculture, heavy equipment, energy, military, mining, and oil and gas industries. As a metal casting company, Harrison Steel—like many other steel foundries of its size—experiences very slim profit margins. Reducing operating costs through reductions in energy usage is one way companies like Harrison Steel can help increase that margin and gain a competitive edge, which is why it chose to make significant energy efficiency changes in order to improve its bottom line. In 2006, Harrison Steel's manufacturing facilities received an energy audit from Jack Staley of Balance Engineering that revealed a number of ways the company could pursue its newfound drive for improved efficiency.

With energy costs typically equaling about 5–8% of sales, Harrison Steel understood the value of increasing profits by implementing energy efficiency projects.¹

These investments in energy efficiency add to the company's bottom-line without having to increase product sales volume. For example, using profit margins similar to that of Harrison Steel, a company that cuts energy spending by \$66,000 through efficiency measures would have to increase its total sales by \$1,000,000 in order to achieve the same financial impact.

Since its initial energy audit in 2006, Harrison Steel has made headway in undertaking a number of energy projects that were recommended as potential cost and energy savers. One project was to upgrade to natural gas burners used for preheating ladles before putting molten metal into them. Harrison Steel chose to implement this project because of its capacity to reduce operating expenses while only costing approximately \$17,500 to implement.

The existing burners before the upgrade were old and obsolete, using a less-than-optimal air and gas mixture and producing a poor flame shape. The estimated energy savings from merely improving the burners is an impressive \$73,857 per year.² This means the repayment period for the project was less than three months. To achieve the same annual affect through increasing sales, Harrison Steel would have had to generate an additional \$1,119,045 (Figure 1 displays the project's estimated return on investment over the next five years). A second project the company is currently undertaking is a variable speed drive project for its well pump. This upgrade

EPA's ENERGY STAR for Industry Program aims to help companies develop and improve energy management. The program provides its partners with guidance to develop strong energy management plans and establish corporate energy management programs and practices.

will allow the company to actually slow down the pump to control the plant water pressure rather than using pressure demand valves to throttle while the machine is running at full speed. This variable speed drive upgrade will cost \$25,000 to implement and will save the company approximately \$16,800 per year

in electricity costs.³ (Figure 2 displays the project's estimated return on investment over the next five years). Harrison Steel has also been able to eliminate over 100 air leaks. Overall, these projects have produced an estimated \$105,600 in annual energy savings, all with

ITP's Save Energy Now LEADER Program aims to help industrial companies reduce their energy intensity. The program supplies technical assistance, tools, and training to help industry successfully implement energy management strategies, as well as efficiency improvements to industrial systems and processes.

payback periods of less than 18 months.⁴ After capturing the savings from these projects, which focused on the lowest-hanging fruit, Harrison Steel realized it needed to get serious about developing an in-house energy management team and working with other organizations to continue achieving energy savings.

Partnering with ENERGY STAR

Harrison Steel initially became aware of EPA's ENERGY STAR for Industry Program—a voluntary government partnership program aimed at helping companies develop and improve energy management—through the American Foundry Society's work with ENERGY STAR. Teaming with ENERGY STAR was a logical decision for Harrison Steel, as the program focuses on providing its partners with the guidance needed to develop strong energy management plans and establish corporate energy management programs and practices. Harrison Steel saw this as a natural progression in its mission to further improve its efficiency. In the fall of 2009, Harrison Steel began its partnership with ENERGY STAR, using the opportunity as a way to not only build a sustainable

energy management framework, but to also make its efforts more personal to employees, as opposed to just a list of engineering items to complete.

To date, Harrison Steel has experienced two main benefits from its partnership with ENERGY STAR. First, the partnership has enabled the company to interact one-on-one with its Strategic Energy Advisor—a consultant assigned to work with the company to help it form an effective Energy Team and to aid partners in achieving the most from ENERGY STAR’s assistance. Second, the company has gained valuable insight from ENERGY STAR Web Conferences that offer opportunities to network with and learn from other professionals involved in energy management at organizations with similar goals and challenges. Through the formation of its Energy Team, Harrison Steel was able to finally complete a lighting project it had considered implementing for years—a recommendation stemming from its 2006 energy audit that the company could not get approval for without assistance from ENERGY STAR. The additional focus afforded by Harrison Steel’s Energy Team added the impetus needed to drive the project through the approval process.

Partnering with *Save Energy Now*

During this time, Harrison Steel also discovered ITP’s *Save Energy Now LEADER* Program—a national initiative to drive a reduction in industrial energy intensity 25% in 10 years. Harrison Steel quickly recognized the added value *Save Energy Now LEADER* could offer its company. By examining ITP’s online materials, Harrison Steel realized the program provides technical expertise, as well as a strong background in understanding and controlling energy consumption through engineering and other technical means. Harrison Steel saw the potential and appreciated the value of applying these technical tools to its energy systems. In the spring of 2010, Harrison Steel signed the *Save Energy Now LEADER* Pledge. The company immediately benefitted from joining the LEADER initiative and found it complementary to the work the company had been doing

with ENERGY STAR. ENERGY STAR helped Harrison Steel improve its energy management program and *Save Energy Now LEADER* supplied technical assistance to successfully implement efficiency improvements to its industrial systems and processes.

Harrison Steel instantly took advantage of the materials found on ITP’s Web site, such as information on improving energy efficiency through upgrading existing standard belts to newer v-belts for belt-driven equipment, like fans. Harrison Steel’s Energy Team also utilized ITP’s online materials to gain insight and instruction that may facilitate implementation of a future combustion-efficiency project for heat treatment furnaces.

Integrating the assistance provided by ENERGY STAR and *Save Energy Now LEADER* are now an important feature in Harrison Steel’s efforts to continue improving its energy efficiency. The company quickly discovered that ENERGY STAR for Industry shines in terms of energy management, including energy team support and motivating brand, and *Save Energy Now LEADER* adds value by providing the engineering tools for achieving implementation. By partnering with both programs, Harrison Steel has found itself equipped with the full spectrum of tools needed to plan and achieve significant energy savings.

Industrial companies interested in reducing energy consumption and associated costs can examine partnership opportunities with Save Energy Now LEADER and ENERGY STAR for Industry by visiting their Web sites at <http://www1.eere.energy.gov/industry/saveenergynow/> and http://www.energystar.gov/index.cfm?c=industry.bus_industry.

Endnotes

- ¹ Discussion with Jeremy Allyn on July 21, 2010.
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- ⁴ Discussion with Jeremy Allyn on July 21, 2010.

Figure 1. Preheating Ladles Project Estimates

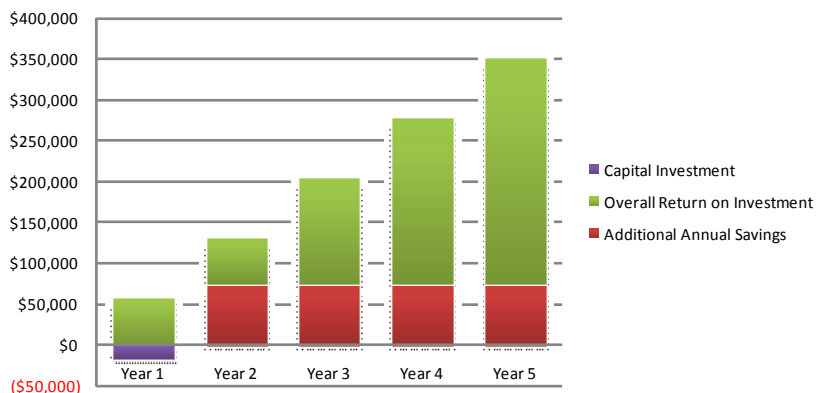
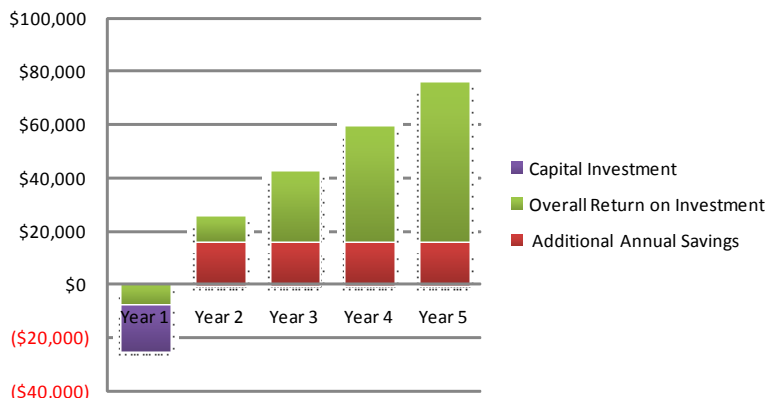


Figure 2. Variable Speed Drive Project Estimates



ITP Brings Together Industrial Stakeholders at Gulf Coast Industrial Energy Efficiency Forum

On May 20–21, 2010, the U.S. Department of Energy's Industrial Technologies Program (ITP) and the Industrial Energy Technology Conference co-hosted the Gulf Coast Industrial Energy Efficiency Forum (the Forum) in New Orleans, Louisiana. The fourth in a series of regional technical events hosted by ITP, the Forum sought to connect industrial manufacturers that have planned or pending energy efficiency or environmental projects with organizations that have the resources to implement those projects. Approximately 200 representatives from U.S. industry, utilities, federal and state government, energy service companies, academia, and industry associations were in attendance. The Forum featured a *Save Energy Now* LEADER Pledge Signing Event, an Energy Saver and Energy Champion Awards Ceremony, a Senior Executive Roundtable, a discussion about Southeast Energy Efficiency Alliance's Industrial Coalition, and an industrial Business Exchange.

Save Energy Now LEADER Pledge Signing Event

The Forum kicked off with the *Save Energy Now* LEADER Pledge Signing Event where five companies—Alcoa, CalPortland, Eastman, Lufkin Industries, and Raytheon—formally pledged to reduce their facilities' energy intensity 25% over the next 10 years. Through ITP's *Save Energy Now* initiative, these newly signed LEADER Companies will receive personalized attention, tailored technical assistance, and priority access to ITP's suite of resources, which will guide them through the critical steps necessary to becoming more energy efficient and achieving their energy-reduction targets.

Energy Saver and Energy Champion Awards Ceremony

The Energy Saver and Energy Champion Awards Ceremony recognized 151 U.S. manufacturers for their significant achievements in industrial energy efficiency. Award recipients were plants and companies that had actively pursued energy-saving opportunities identified during a 2009 *Save Energy Now* energy assessment, which has led to more than \$32 million in cost savings and 4 trillion British thermal units (Btu) in total energy savings over the past year. ITP distinguished 95 plants with the Energy Saver award and 56 plants with the Energy Champion award. Energy Savers are plants that had more than 75,000 million Btu total energy savings or more than 7.5% total energy savings, and Energy Champions are plants that had more than 250,000 million Btu total energy savings or more than 15% total energy savings. Since 2007, there have been a total

of 509 awardees with total energy savings of 27 trillion Btu or the equivalent of \$189 million.

Senior Executive Roundtable

Event participants had the chance to attend the Senior Executive Roundtable where former ITP Program Manager Doug Kaempf and fellow panelists—Chairman Lambert Boissiere III of Louisiana Public Service Commission; Neal Elliott of the American Council for an Energy-Efficient Economy; Bruce Lung of the Alliance to Save Energy; Fred Schoeneborn of FCS Consulting Services, Inc.; and Robert Tonti of Rain CII—discussed national and local industrial energy efficiency efforts. The session was moderated by David Dismukes of the Center for Energy Studies at Louisiana State University.

Panelists focused their discussion on the challenges facing U.S. industry, both domestically and globally. The importance of developing new, energy efficient technologies to assist in modernizing the United State's industrial manufacturing infrastructure was stressed, noting the potential it would have to facilitate a competitive base in which U.S. industry could compete globally.

Panelists also discussed industry's need to address its own internal barriers to energy efficiency and project implementation. They emphasized the importance of communicating to plant management that 'energy matters' and is, in fact, a core business function. They encouraged plant employees to make a business case for energy and place it in the forefront of management thinking, highlighting its potential for return capital. Additionally, they called attention to holding plant management accountable for energy savings and project implementation.

Other important topics of discussion included the need to motivate employees and provide technical people with the resources and knowledge needed to make a case for energy efficiency and to build networks—especially with those in their organization who can help them sell their energy successes to management.

In addition to management and personnel engagement, panelists highlighted the importance of diversifying renewable energy portfolios in the region, keeping up-to-date on regulatory issues



Industrial manufacturers from the Gulf region commit to reducing their energy intensity 25% in 10 years.

(such as greenhouse gas emissions), environmental permitting awareness, and the potential for waste heat recovery.

Southeast Energy Efficiency Alliance's Industrial Coalition

This session provided an overview of the Southeast Energy Efficiency Alliance's (SEEA's) Industrial Coalition program. SEEA's Executive Director Ben Taube discussed various aspects of the program, which is a regional collaborative effort to support energy efficiency in the manufacturing sector. Mr. Taube also offered a roadmap to help others replicate these efforts in other areas, and underscored the importance of industrial partnerships, stressing the need to link resources in order to drive market transformation toward embracing energy efficiency.

Business Exchange

During the Business Exchange portion of the event, resource providers shared information with manufacturers about their

industrial energy efficiency programs in an open exchange environment. Utilities, government agencies, energy service companies, private organizations, industry associations, energy efficiency associations, and nonprofit organizations discussed how they could help industrial participants identify, fund, or implement industrial energy efficiency projects. The exchange provided a forum for industrial participants to learn about regional resources available to them and afforded resource providers with an opportunity to engage with their end users and gain a more comprehensive understanding of industry's needs and the ways in which they can address those needs in the future.



Companies that achieved notable energy savings were formally recognized for their accomplishments during the awards ceremony.

Alabama Jump Starts Its *Save Energy Now* Program and a New E3 Initiative by Leveraging Federal Grants

Alabama has been providing energy assessments to reduce consumption in local industries since 2005. As industry in Alabama has grown, the Energy Division of the Alabama Department of Economic and Community Affairs (ADECA) has realized the increasing importance of industrial energy efficiency, and has leveraged both state and federal support in recent years to support local industry in their efforts to reduce energy consumption. ADECA was awarded a 3-year U.S. Department of Energy (DOE) Industrial Technologies Program (ITP) *Save Energy Now* grant in 2009 to jump-start a self-sustainable state program. ADECA is collaborating with the Alabama Technology Network (ATN) and the Alabama Industrial Assessment Center (AIAC) to provide energy and lean assessments to Alabama manufacturers as one of the primary objectives of the program. ADECA and its partners are also using the grant to support the Alabama E3 (Economy, Energy, Environment) initiative, which helps communities work with their manufacturing base, providing customized, hands-on assessments of production processes to reduce energy, minimize carbon footprint, prevent pollution, increase productivity, and drive innovation. Alabama's

E3 program—one of the first E3 pilot programs in the nation—is currently focusing on the automotive supply chain. ATN is an important partner in Alabama's E3 efforts and has been working with manufacturers to help them become more competitive. Through their efforts, they came to the realization that companies succeed in implementing energy efficiency projects if services are considered in a comprehensive way rather than simply pointing to solutions. ATN has also concluded that the best solutions are often in the integration of services, such as economic, environmental, and energy services. The close partnership between ADECA, ATN, and AIAC, and their involvement in Alabama's *Save Energy Now* and E3 programs, are allowing complementing principles and practices to thrive, ensuring that both are operating a best practice program.

Leveraging Grant Funds to Expand Alabama's *Save Energy Now* Program

By building this strong network of support for delivering industrial energy efficiency savings, Alabama's *Save Energy Now* program has been able to hit the ground running. ATN will perform 15 Practical Energy Assessments for Alabama manufacturers (primarily automotive suppliers) and is providing another 17 Lean Assessments, all in conjunction with 17 additional energy assessments that will be



How Alabama is Leveraging Grant Funds for Industrial Energy Efficiency

2009 Tennessee Valley Authority (TVA) Grant	Will provide Practical Energy trainings for TVA clients
2009 State Energy Program-American Recovery and Reinvestment Act of 2009 Grant	Creating a \$25 million Energy Revolving Loan Program for industry
	Will hold 40 Kaizen implementation events
2009 State Energy Sector Partnership-American Recovery and Reinvestment Act of 2009 Grant	Will provide Practical Energy trainings Tuscaloosa region
	Will hold DOE Qualified Specialist Training
2009 DOE/ITP Save Energy Now Award	Will provide 66 training programs and 8 demonstrations over the 3-year funding period
	10 of 32 ATN and AIAC assessments completed with \$424,336 in identified potential annual savings
2009 Department of Labor Grant	Will provide workforce support for E3 program

completed by AIAC under the grant. To date, ATN has completed 6 of the 15 Practical Energy Assessments and AIAC has completed 4 of its 17 anticipated annual energy assessments. In conjunction with each of these 10 completed assessments, ATN has completed an accompanying Lean Assessment. Energy cost savings identified across the six Practical Energy Assessments total more than \$265,000, and \$159,336.

Alabama is not only utilizing its *Save Energy Now* award to launch a state industrial energy efficiency program, but is working to expand the program by leveraging state, federal, and local funding. ATN recently secured \$140,000 in funding from the Tennessee Valley Authority (TVA) to provide Practical Energy training programs for TVA utility clients. In addition, ADECA has been able to secure State Energy Program *American Recovery and Reinvestment Act of 2009* funding in order to provide 40 Kaizen implementation events, focusing on improving a manufacturer's productivity, and to establish a \$25 million Alabama Energy Revolving Loan Program. This will allow manufacturers to follow up on findings from the assessments performed through Alabama's *Save Energy Now* program. ATN also recently received State Energy Sector Partnership (SESP) funding to support Practical Energy training programs for manufacturers in the Tuscaloosa region, and AIAC received SESP funding to support a DOE Qualified Specialist (QS) training in conjunction with Alabama Power Company (APCo). The QS training will be offered under Alabama's *Save Energy Now* program. AIAC and APCo were successful in securing a supplemental award to provide a broader range of training courses. Together, these projects compliment and strengthen the Alabama *Save Energy Now* program.

Alabama's E3 Program

Alabama's E3 program is managed by ATN, which is funded by the State of Alabama and the U.S. Department of Commerce's National Institute of Standards and Technology Manufacturing Extension Partnership. The program offers clients integrated

solutions that ensure sustainable manufacturing, by not only offering traditional lean but also considering energy use and environmental wastes, which can make up 40% of cost savings for a company. The E3 program is one of the first E3 pilot programs in the nation. Alabama has engaged more than 20 partners from federal, state, and local agencies that are critical to the success of the program. The partners offer a tactical advantage for long-term program stability in terms of service, delivery, and political support. ATN's success in receiving the funding for the workforce component of the program was impacted by the strength of the partnership. This is a very positive and unique feature of the Alabama E3 program. It is a comprehensive program that includes four components:

1. Lean, energy, and environmental assessments
2. Lean and green implementation projects based on the results of the assessments
3. "Green" skills training:
 - Level One training for all employees to introduce them to sustainability and make them aware of their roles and responsibilities in saving energy and reducing wastes in their companies
 - Level Two training for certain employees based on the individual needs of the companies (Practical Energy, Waste Reduction, certifications, ISO 14001, etc.)
4. Counseling and assistance from the Small Business Administration (SBA) and Small Business Development Centers to help eligible companies access affordable funding/financing (e.g., Alabama Energy Revolving Loan, SBA loans, etc.) to support new systems/equipment necessary to reduce energy and reduce costs.

The Alabama E3 program is currently focused on improving energy efficiency among automotive suppliers for Alabama's three main auto manufacturers—Mercedes, Hyundai, and Honda. To date, the E3 program has successfully completed three lean and green projects with ZF Industries (gearbox manufacturer), Electrofil (electrical component), and Fleetwood Metals (a metal stamping and welding company). Improving these companies'

productivity and cost competitiveness benefits both the suppliers and the manufacturers. By becoming more competitive, the automotive manufacturers are able to become more profitable, thereby strengthening the Alabama economy. By making an effort to help the automotive suppliers, the E3 program will improve the economy of the state as a whole, in addition to supporting state energy and environmental goals.

The initial assessment and lean and green project funds for the E3 program focused on automotive manufacturers, totaling more than more than \$800,000. ADECA has also secured a \$578,000 grant for the workforce component of E3 through the U.S. Department of Labor.

At this year's Gulf Coast Industrial Energy Efficiency Forum, five Alabama companies were recognized by ITP for their energy-saving achievements—vonGal Corporation, 3M, EGS Electrical Group, Rusken Packaging, and W.R. Grace and Company. Both Alabama's *Save Energy Now* and E3 programs offer opportunities for even more Alabama manufacturers to join this list. The expanding number of training and assessment resources offered through these programs allows Alabama's industry to work with the state in new and effective ways to improve energy efficiency and competitiveness. Alabama's early *Save Energy Now* program successes indicate promising results for the future of industrial energy efficiency in the state and offer an excellent model to be replicated in other parts of the nation.

ITP's Industrial Assessment Center Program

Training Ground for the Next Generation of Energy Engineers

Funded by the U.S. Department of Energy's Industrial Technologies Program (ITP), the Industrial Assessment Center program has been providing small- and medium-sized industrial plants with energy assessments to identify opportunities to improve productivity, reduce waste, and save energy for over 30 years. Assessments are performed at no-cost to the manufacturer by local teams of engineering faculty and students from 26 participating universities across the United States. The assessment begins with a university-based IAC team conducting a survey of the eligible plant, followed by a 1- or 2-day site visit where engineering measurements are taken as the basis for assessment recommendations. Following the site visit, the team performs a detailed analysis for specific recommendations with related estimates of costs, performance, and payback times. Within 60 days, a confidential report detailing the analysis, findings, and recommendations is sent to the plant. Follow-up calls are made to the plant manager within six months to verify recommendations that will be implemented.

Industry Benefits

IACs offer an extremely valuable service to small- and mid-sized manufacturers—providing expertise to a segment of the manufacturing industry that do not possess the resources to analyze and quantify energy savings within their plants. In doing such, the IACs are helping to increase the competitiveness of the American manufacturing industry. Plants that have taken advantage of the free, no-obligation assessments have realized direct energy- and resource-saving benefits.

Not only does the IAC program supply industry with the opportunity to improve energy, performance, and productivity, but it also provides a longer-term benefit—a trained workforce

of energy-savvy engineers who will contribute to improving industrial energy efficiency throughout their careers. More than an energy program, IAC is a workforce development program that serves to fulfill the majority of the spectrum for a new energy workforce. Through partnerships with the 26 participating universities across the nation, IACs are helping to advance the science and knowledge base of energy efficiency. In addition to gaining hands-on field experience performing assessments, numerous IAC students and directors publish papers in various journals and present their work at conferences. IACs are not supported to perform research; however, individuals independently explore many topics and problems after directly encountering them on assessments. IAC produces outstanding engineers that are ready for careers in project engineering and management, product research and development, energy consulting and engineering services, energy-related design and construction, training and outreach, as well as energy policy. To date, over 2,855 engineering students have participated in the program.¹ IAC graduates are well-known for their expertise in industrial energy efficiency and are in such high demand that most leave the program with numerous job offers in hand.

Alumni Successes

One former student, Vitelio Silva, completed 25 assessments during his 2 years at the University of Florida IAC program.² As the Lead Student Engineer, Mr. Silva coordinated teams and conducted engineering and economic analyses for many recommendations that resulted in energy efficiency, waste management, and productivity savings opportunities worth more than \$3.5 million.³ Additionally, he was speaker and co-author

of the research paper, “A New Approach to Motors Efficiency Estimation in an Industrial Energy Management System,” which was presented at the 2007 World Energy Engineering Congress in Atlanta, Georgia. Upon graduation, Mr. Silva was hired by Johnson Controls, Inc. as a Senior Performance Assurance Engineer. In less than two years, he has coordinated, verified, and reported more than \$9.5 million in project savings and cost avoidance, in addition to conducting performance measurement and verification services, including \$73 million in performance contract guarantees and \$3.3 million in service agreements.⁴ The training and hands-on experience Mr. Silva gained through the IAC program enabled him to be productive from his first day on the job, allowing him to excel in his current position at Johnson Controls, Inc.

Another alumnus, Matan Marom, spent five years at the Syracuse University IAC. During his time in the program, Mr. Marom, participated in 36 assessments and developed an in-depth automation program, along with other students.⁵ The program, designed and built on a VBA backbone in Excel, performs calculations and generates a formatted, editable Microsoft Word document that includes common assessment recommendations (ARs) and serves as a reliable starting point for writing distinctive, more challenging ARs. After graduation, Mr. Marom went to work for global energy provider Schneider Electric as an Application Engineer. Mr. Marom’s supervisor immediately recognized the value of his IAC experience, which he demonstrated in a recent project. Mr. Marom developed and managed an in-depth energy study at Oak Ridge National Laboratory (ORNL) that was designed to identify cost-effective energy-saving resource-reducing strategies throughout the lab. The study resulted in \$1,687,000 in recommended energy- and cost-savings for ORNL.⁶ The IAC program allowed Mr. Marom to gain a solid background and foundation for his current position where he has added significant value to the company.

In addition to performing in key positions within large organizations, numerous IAC alumni are starting their own energy service companies. Cascade Energy Engineering, Inc., a firm specializing in industrial energy efficiency consulting, was founded by Oregon State University IAC alumni Marcus Wilcox; Energy & Resource Solutions, Inc., an energy engineering and consulting firm, was founded by University of Massachusetts alumni Gary Epstein; and Red Wolf Associates, a firm that provides engineering services and analysis solutions to industrial, commercial, nonprofit, and government facilities, was founded by North Carolina State University alumni Joe Sinodis and Nathan Block—just to name a few.⁷

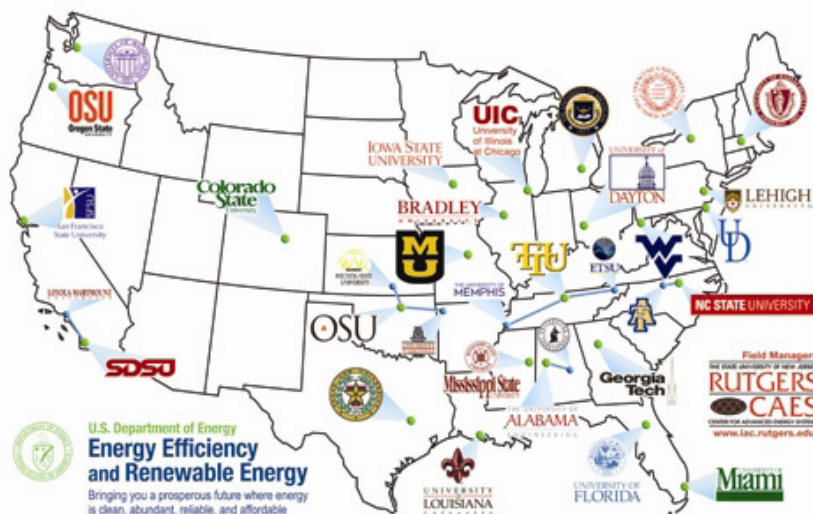
Conclusion

ITP’s IAC program is a tremendous opportunity for college engineering students interested in entering an energy-related field. It offers immense experience for undergraduate and graduate students looking to gain real world perspective and practical understanding of manufacturing processes in a variety of industries. IACs are producing the next generation of highly competent energy engineers, which is evident when looking at the accomplishments of current alumni.

To learn more about the IAC program, visit ITP’s Web site at http://www.eere.energy.gov/industry/bestpractices/about_iac.html. For more information about exciting IAC student and alumni achievements, visit the IAC Student and Alumni Web site at <http://www.iacforum.org/iac/app>.

Endnotes

- ¹ http://www1.eere.energy.gov/industry/about/pdfs/impacts2008_appendix4.pdf
- ² http://www1.eere.energy.gov/industry/bestpractices/pdfs/vitelio_silva_case_study.pdf
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- ⁶ http://www1.eere.energy.gov/industry/bestpractices/pdfs/matan_marom_case_study.pdf
- ⁷ http://www1.eere.energy.gov/industry/bestpractices/about_iac.html



Success in Industry

Alcoa's Long-Term Commitment to Energy Efficiency

As the world leader in the production and management of primary aluminum, fabricated aluminum, and alumina combined, Alcoa Inc. of Pittsburgh, Pennsylvania, is an active participant in all major aspects of the industry—technology, mining, refining, smelting, fabricating, and recycling. Alcoa employs approximately 23,000 people throughout the United States. In addition to inventing the modern-day aluminum industry, Alcoa innovation has been behind major milestones in the aerospace, automotive, packaging, building and construction, commercial transportation, consumer electronics, and industrial markets over the past 120 years.

Sustainability is an integral part of Alcoa's operating practices and the product design and engineering it provides to customers. Alcoa has been a member of the Dow Jones Sustainability Index for eight consecutive years, and approximately 75% of all the aluminum produced since 1888 is still in active use today. To help achieve its aggressive efficiency goals, Alcoa has built and maintained a solid relationship with the U.S. Department of Energy (DOE). Alcoa first teamed with DOE in 1999 and began identifying energy-reduction opportunities. Since then, Alcoa has successfully used DOE tools and resources to improve energy



efficiency. For example, the company has conducted energy assessments at individual Alcoa plants, hosted training to educate Alcoa employees about energy conservation, showcased and demonstrated technologies, and worked with DOE to establish an Energy Efficiency Network within the company in 2002.

“We are really becoming reinvigorated in the energy efficiency process, focusing on our people as much as the technology” said Walter Brockway, PE, CEM, Alcoa's Manager of Global Energy Efficiency. “Our efforts are focused on using our global reach and coordination of resources to pull together people in different regions around the world to share information about energy efficiency.”

In May 2010, Alcoa joined the *Save Energy Now* initiative as a LEADER, pledging to reduce its energy intensity 25% over the next 10 years. As a company that spends more than \$2 billion on energy, the 25% reduction in energy intensity means that Alcoa has the potential to save more than \$500 million annually on their energy spending.

For more information about Alcoa's energy efficiency efforts, contact Walter Brockway, PE, CEM, at (865) 594-4624 or e-mail Walter.Brockway@alcoa.com.

Aluminum Extrusion Company Completes Energy Efficient Lighting Project

An interesting challenge presented itself for Alexandria Extrusion Company (AEC)—how to make its Alexandria, Minnesota, manufacturing facility (known as “one of the brightest facilities in the industry”) more energy efficient when it comes to lighting? The answer: work with the U.S. Department of Energy's *Save Energy Now* initiative.

Lighting has always been a unique aspect of AEC's production areas. The importance of detail in the aluminum extrusion

industry drives the need for great lighting. Accordingly, energy efficient lighting recommendations that were made during an Energy Savings Assessment (ESA) from the University of Alabama Industrial Assessment Center (IAC) caused some concern at first. However, after evaluating the brightness levels the new lights would provide, the decision to move ahead with the changes was apparent.

Conversion to the energy efficient lighting was quick and relatively easy, according to AEC Director of Operations Brad Hoven. AEC was able to maintain the same level of brightness in its factory that it had with its previous lighting system, and the return on investment will be realized in a relatively short period of time, with long-term energy savings following. The conversion to energy efficient lighting resulted in a substantial rebate from Alexandria Light & Power as part of its Bright Energy Solutions cash-incentive program. The estimated energy savings are more than 1.3 million kilowatt hours (kWhs) and 154 kW of demand, providing an estimated cost savings of more than \$70,000 per year.



AEC continued to work with the IAC to review efficiency opportunities throughout the facility, including the extrusion presses and precision machining areas, along with other areas including the shipping and handling areas where its customers' precision custom extrusions are packaged for delivery. The IAC was able to make additional improvement suggestions following the additional ESAs, but these recommendations were mostly minor because AEC was deemed to have the correct processes, equipment, and programs already in place, proving that the company has taken improving its energy efficiency quite seriously.

For more information about Alexandria Extrusion Company, visit its Web site at www.alexandrialextrusion.com or contact Steve Schabel at (320) 762-6741 or sschabel@alex-extrusion.com.

States & Utilities Corner

Learning from Success

Assessment-to-Implementation Best Practices Workshop

On July 16, 2010, the Industrial Technologies Program co-hosted *Learning from Success: Assessment-to-Implementation Best Practices Workshop* with the American Public Power Association (APPA) and Oak Ridge National Laboratory. This 24-person workshop featured people from identified industrial assessment programs that have high implementation records, as well as a handful of representatives from companies that have successfully implemented assessment recommendations. This facilitated meeting will lead to the development of a guidebook that assessment-conducting organizations can use to establish and enhance their internal programs. The meeting was held at APPA's headquarters in Washington, D.C.

Meeting participants heard presentations from Chris Goff of the Southern California Gas Company, John Nicol of Focus on Energy, and Steve Fugarazzo of Raytheon Company that laid the foundation for the workshop's facilitated sessions. An editorial advisory committee was formed for utilities and state energy offices that were unable to attend the workshop, but still wished to participate. The committee provided final input on the guidebook, along with those who attended the workshop. The guidebook is scheduled to be made available in mid-September.



Southeast Plants to Demonstrate Superior Energy Performance Initiative

As part of the Superior Energy Performance (SEP) initiative, the Industrial Technologies Program (ITP) recently initiated a series of training sessions for seven manufacturers in the Southeast region of the United States that are working to demonstrate energy management systems that meet the highest standards. The Southeast Energy Management Demonstration kicked off June 14–16 at the Georgia Institute of Technology in Atlanta.

SEP provides industrial facilities with a road map for achieving continual improvement in energy efficiency while maintaining competitiveness. The initiative will contribute toward a national energy efficiency goal to reduce industrial energy intensity by 25% over the next decade. The seven demonstration facilities—Nissan North America, Volvo Trucks, Cooper Tire & Rubber Co., Bridgestone America Tire Organization, Spirax Sarco, Eaton Corporation, and Schneider Electric—will be working to meet future energy challenges by developing a set of skills and best practices to more effectively manage and maximize value from their energy resources through the SEP initiative.

The Energy Management Demonstration equips facilities with resources to reduce energy use and carbon emissions, including energy management training and coaching to implement the forthcoming international energy management standard (ISO 50001), energy assessments, and other U.S. Department of Energy technical assistance. Participating plants receive tailored

assistance from demonstration support teams to implement ISO 50001, an energy management system. The demonstration support teams are pulled from various organizations, such as the Industrial Assessment Centers, the National Institute of Standards and Technology Manufacturing Extension Partners, and private consultants. These teams partner with manufacturing facility energy teams to complete ongoing deliverables that lead to conformance with ISO 50001 and meeting SEP performance goals.

By demonstrating their success at meeting these SEP program requirements, the manufacturing facilities will showcase their ability to better manage their energy use, improve energy performance, and apply an accredited methodology for measuring and validating energy efficiency and energy intensity improvements.

As part of the SEP certification process, auditors will review records related to each plant's conformance to ISO 50001 and a minimum of 48 months of plant energy consumption data to demonstrate a minimum improvement of 5% in energy intensity over a 3-year period.

For more information about SEP, visit <http://www.superiorenergyperformance.net>. Visit ITP's Web site to learn more about the Energy Management Demonstrations project: <http://www1.eere.energy.gov/industry/energymanagementdemonstrations/>.

Tools of the Trade

DC Pro Tool Suite

The Data Center Energy Profiler (DC Pro) Tool Suite, developed by the U.S. Department of Energy's Industrial Technologies Program (ITP), is a compilation of three free online software tools that provide data center owners and operators with the opportunity to see how their facilities are consuming energy and to assess potential energy- and cost-saving opportunities. The Environmental Protection Agency estimates that by 2011, energy consumption in data centers could reach over 100 billion kilowatt hours, which equates to \$7.4 billion annually in electricity costs. DC Pro can help mitigate this consumption.

DC Pro is broken down into two categories of tools—a Profiling Tool, which is Web-based and provides an analysis of the user's facility, and two assessment tools, which use Excel programs and provide thorough evaluations of energy-saving opportunities for specific areas of a data center.

DC Pro is comprehensive and efficient, and users can complete a data center profile in less than one day. Once a user finishes a DC Pro case, he/she is provided with a detailed report that highlights various aspects of energy use in a data center, including energy purchases, energy consumption, and potential savings (energy



and cost). The report also provides an energy usage comparison between a user's data center and various other data centers so that users can see where their data centers are thriving, failing, and/or on par with data center norms. Finally, the report gives users a list of actions and resources to help them take the next step toward energy savings.

DC Pro Profiling Tool

The Profiling Tool is the first step toward identifying potential saving methods and reducing energy use. A tutorial is provided to help make the profiling go smoothly, and once users input data about their facilities, a report is created of energy-saving opportunities. The entire process only takes users about one hour to complete.

Inputs

To receive a DC Pro assessment, users must input the following information:

- Facility description
- Utility costs/bill data
- System information on information technology, cooling, power, and on-site generation.

Users are able to skip some sections, as necessary, when providing data center information. However, the accuracy of the profile correlates directly with the exactness and totality of the inputs. Users can save their work at any time, and in a case where not all information is known or adjustments are made to data centers, users can update their work for a more accurate report.

Outputs

Based on a user's inputs, the Profiling Tool creates a report and displays the following information:

- Synopsis of energy purchases
- Summary of energy use and reduction potential
- Recommendations for next steps to improve energy efficiency
- Comparison analysis.

DC Pro System Assessment Tools

Along with the Profiling Tool, DC Pro has two assessment tools that can provide a more accurate evaluation of a data center's energy use. The assessment tools measure the energy consumption in a center's air or electrical system, and because they use Excel programs to create the report, the information can be saved to the user's computer and accessed easily for future updates.

Air-Management Tool

The Air-Management Tool assists with energy and thermal management and requires users to fill in data on four spreadsheets. Upon completion of the spreadsheets, users will receive air-management recommendations, potential for reducing supply airflow rate and increasing supply air temperature, and an estimate of the percentage of energy reduction for fans and chillers.

Electrical Systems Tool

Designed to help with electrical efficiency, this tool recognizes possible savings options through the electrical power chain of a data center. By providing energy use information, basic configuration, and efficiency information on electrical systems, this tool will quote prospective savings made by taking electrical system efficiency actions.

As a whole, the DC Pro Tool Suite helps users to realize where their data centers are and where they can be in terms of energy consumption. DC Pro gives users options to their centers' energy efficiency and guides them to the ITP resources that can help with the implementation of such options.

For more details on DC Pro and to download the tool suite, visit the DC Pro Web page at <http://www1.eere.energy.gov/industry/datacenters/software.html>. Additional software tools that will help you identify and analyze energy system savings opportunities in your plant or industrial facility are also available for download on ITP's Web site at <http://www1.eere.energy.gov/industry/bestpractices/software.html>.

Research & Development

SeaMicro® Breakthrough in Server Technology Improves Energy Efficiency of U.S. Data Centers

Information technology and telecommunications facilities account for 3% of energy use within the United States. The expected growth is estimated to require two new power plants a year in order to maintain an adequate power supply.¹ The increase in server demand has been met systematically by industry; however, in order to keep pace, the speed of servers must increase as well. Unfortunately, increasing processing speeds traditionally requires increasing the clock-frequency of the processors. Until recently, this posed no real problem for chip manufacturers, but has now led to two key issues—efficiency issues with metal-oxide semiconductor materials and massive heat dissipation. These two problems have led to radical changes within the market. For the first time, power management has become a focus and computational efficiency has regained a central role in computer architecture design.² In other words, designing a system that works smarter but not harder will rule the market.

The U.S. Department of Energy's (DOE's) Industrial Technologies Program (ITP) is working with U.S. computer data centers to reduce data center energy consumption 10% by 2011. To help achieve this goal, ITP offers a number of free tools and resources on its Web site that data center managers and operators can access to help reduce energy use in their facilities. Besides offering tools and resources, ITP also provides technical assistance through their *Save Energy Now* initiative, which promotes the reduction of industrial energy intensity by 25% in 10 years.³ Further, through ITP's Energy Efficient Information and Communication Technology (ICT) Recovery Act solicitation process, 14 projects were awarded \$47 million to research, develop, and demonstrate new technologies that improve energy efficiency in the growing ICT sector. Energy Secretary Steven Chu commented that "these Recovery Act projects will improve the efficiency of a strong and growing sector of the American economy." One company, SeaMicro®, was awarded \$9.3 million to accelerate an innovative, energy-saving server. Built on a systems architecture design by Lawrence Berkeley National Laboratory (LBNL), the company has managed to step-up production of its server technology by 12 months.⁴

SeaMicro®, a Santa Clara, California, company, was founded in July 2007 and is headed-up by Andrew Feldman and Gary Lauterbach. In just three years, the company has been able to

develop a server that will change data centers and the industry forever. Feldman commented that today's servers, with all their bells and whistles, are like "taking the space shuttle to the grocery store."⁵ Today's servers are so inefficient when it comes to being properly utilized. This misalignment between the server and the work load is the root of the power consumption problem.⁶ Traditionally, servers are designed to handle the largest amount of workload possible even though they hardly ever see that much need for long periods of time. Therefore, designing a server that can modify its workload capability in real time would be a big step forward. This line of thinking, along with the help of DOE and LBNL, eventually led to the radical server design.

The big breakthrough was the design of the new architecture by LBNL, which uses hundreds of low-power processor chips that all work together through a networking technology process known as "fabric," which provides 1.28 terabit throughput. SeaMicro® took the design a few steps further and implemented a patented technique of virtualizing the internal components, which eliminates 90% of the system board, thereby yielding a server that takes up 75% less space.⁷ The secret to this is an application-specific integrated circuit chip that virtualizes disk access and Ethernet networking. When combined with Dynamic Compute Allocation Technology—a combination of central processing unit management and load balancing that spreads system resources across the server—the typical server is shrunk from the size of a pizza box to that of a credit card.⁸

The removal of internal components—such as chipsets and memory and peripheral input/output—has significantly reduced the size of the server, which also reduces the energy consumption of the system board by two-thirds. The removed components, traditionally more power-hungry than the processor, account for the significant drop in power draw, while also enabling a design that is drastically smaller. The impact of this design change is immense as it allows for larger data centers that require less space and less energy use for operation, as well as cooling. To top it all off, the client is provided optimized throughput. If anything, this could be categorized as a win-win-win situation.

The final secret for SeaMicro® is the Atom processor, which is

compatible with x86-64 architecture, consumes two kilowatts under real work loads, and has 3.2 times the performance per watt than Xeon or Opteron core processors (Intel's traditional server processors). The Atom processor was designed by Intel as a low-voltage processor to be used in mobile devices and later scaled up to netbooks. Its role as a server processor was never a consideration, until now. According to Feldman, "the single-core Atom offers the best bang for the buck."⁹

As for the SeaMicro® server, SM10000 consists of 512 1.6-gigahertz Intel Atom processors, which runs unmodified Windows or Linux applications. It has space for up to 64 Serial Advanced Technology Attachment solid-state or hard-disk drives. It is expected to be available for sale at the end of July 2010 for \$139,000 in its base configuration.¹⁰

Finally, as commented by Energy Secretary Steven Chu, "The expected growth of these industries means that new technologies adopted today will yield benefits for many years to come."¹¹ Hopefully, viewing energy consumption as an unacceptable sacrifice to performance will become a trend that continues to grow.

Endnotes

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Markets & Trends

Toward a Carbon Economy

Individual sectors of the economy have long recognized the importance of carbon and carbon-based materials to their activities, competitiveness, and profitability. However, it wasn't until recently that it became clear that carbon will be a major consideration, and perhaps one of a select few key considerations, for industry and the economy in general, both in the United States and abroad.

The importance of carbon can be broken down into three main areas:

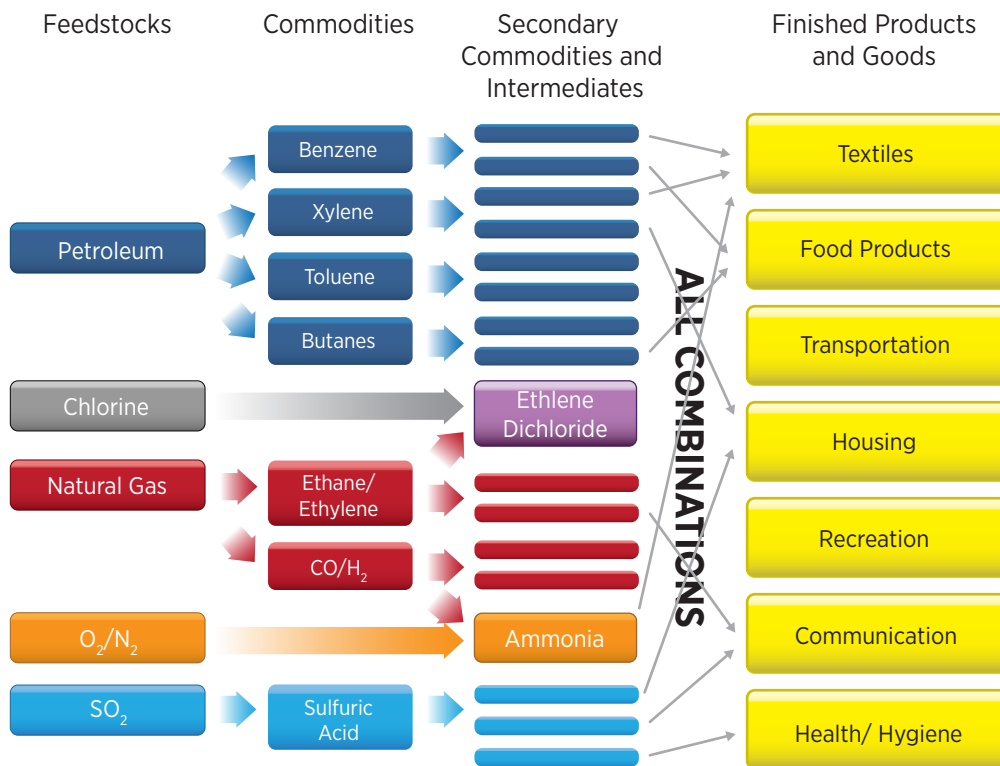
- Carbon as a raw material/feedstock basic commodity
- Carbon as a material for emerging technologies and applications
- Carbon as a measure of cost, a medium for exchange, and a key environmental metric.

This article seeks to explore and explain the growing importance carbon has in each of these areas, and how this growth indicates that carbon will be a primary consideration in the economy of the future.

Carbon Feedstocks

Carbon's classic function has been as a basic feedstock for the chemicals, refining, and forest products industries, in addition to others. These industries take basic materials (like crude oil, natural gas, and forest and agricultural matter) and convert and transform them into commodities and intermediate chemicals for distribution to other industrial sectors, or into final products for consumer use. Five of the major historical feedstocks for the chemicals and allied industries (including refining) have been petroleum, natural gas, oxygen and nitrogen, chlorine, and sulfur dioxide. Refining and combining these feedstock lines produce most major consumer end products, including textiles; food production, safety, and packaging; transportation; housing materials; recreation; communications; and health and hygiene. Petroleum and natural gas are the two main sources for carbon and are necessary for the production of most of the downstream products (as depicted in Figure 1).

Figure 1. Major Chemical Chains



Data source: Pacific Northwest National Laboratory and the National Renewable Energy Laboratory, August 2004, Top Value Added Chemicals From Biomass Volume I: Results of Screening for Potential Candidates from Sugars and Synthesis Gas.

Though recent estimates of the United State’s natural gas supply have increased due to exploration and technology, petroleum resources are not increasing as fast—domestic production peaked in 1970 and worldwide production is expected to peak in the next 0–25 years (see Markets and Trends: M. King Hubbert and U.S. Oil Production, *Energy Matters*: Spring 2010). This means that petroleum will become increasingly scarce, increasingly expensive, and will eventually become unavailable. Thus, alternative carbon sources must be considered. Taking the lead demonstrated by the forest products industry, much of this alternative supply will come from renewable biomass. In 2003, the United States consumed approximately 190 million dry tons of biomass from agricultural and forest land for biofuels and

bioproducts, providing 3% of our energy consumption. The U.S. Department of Energy (DOE) estimates that under reasonable conditions, at full production, sometime in the mid-21st century the United States will be able to produce 1,366 million dry tons of biomass annually, in addition to food, feed, and export needs.¹ Maximum available production could easily exceed this with technology developments (like algae for biofuel/biomass production) and greater changes to land management.

It is the carbon content of this biomass and its applicability to many uses that make it the valuable feedstock of the future. Industries most dependent on petroleum feedstock include the utilities/power production (combustion for electricity),

Figure 2. Potential, Conservative Mid-21st Century U.S. Biomass Production



Source: U.S. Department of Energy (April 2005). Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply. http://www1.eere.energy.gov/biomass/pdfs/final_billionton_vision_report2.pdf.

transportation fuels (conversion to liquid fuels), and chemicals products (transformation into end products) sectors. The sooner these alternative biomass technologies and alternative feedstocks/chemical chains can be developed and commercialized, the less negative the impact will be on these sectors and the more competitive U.S. industry will be.

Emerging Technologies and Applications

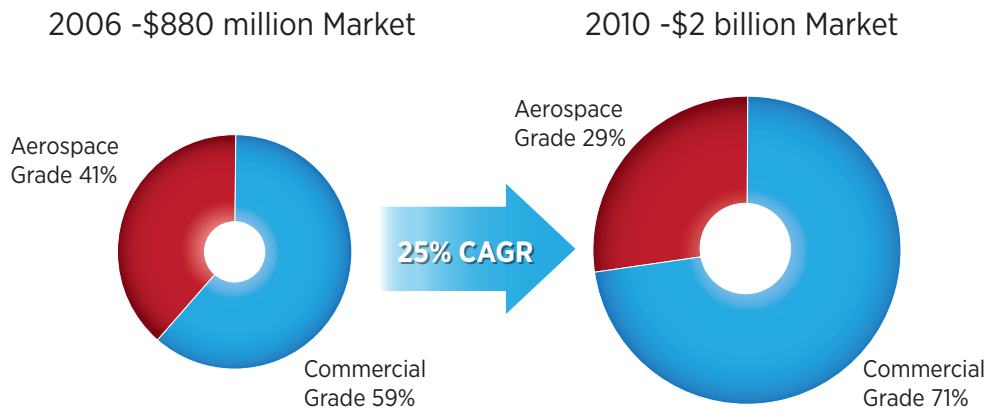
In addition to its use as a basic feedstock, carbon has numerous applications in carbon fibers (CFs) and related materials for the transportation, military, and packaging sectors, among others.

About 70–80% of the CF market is for industrial purposes, and that market has been growing at 10–15% in recent years (the market for aircraft parts is growing fastest at 15–24%).² Industrial and aerospace applications started to really take off in the mid 2000s and are expected to grow to approximately 135,000 tons per year by 2013.³

There are many emerging applications for CF and related materials, including

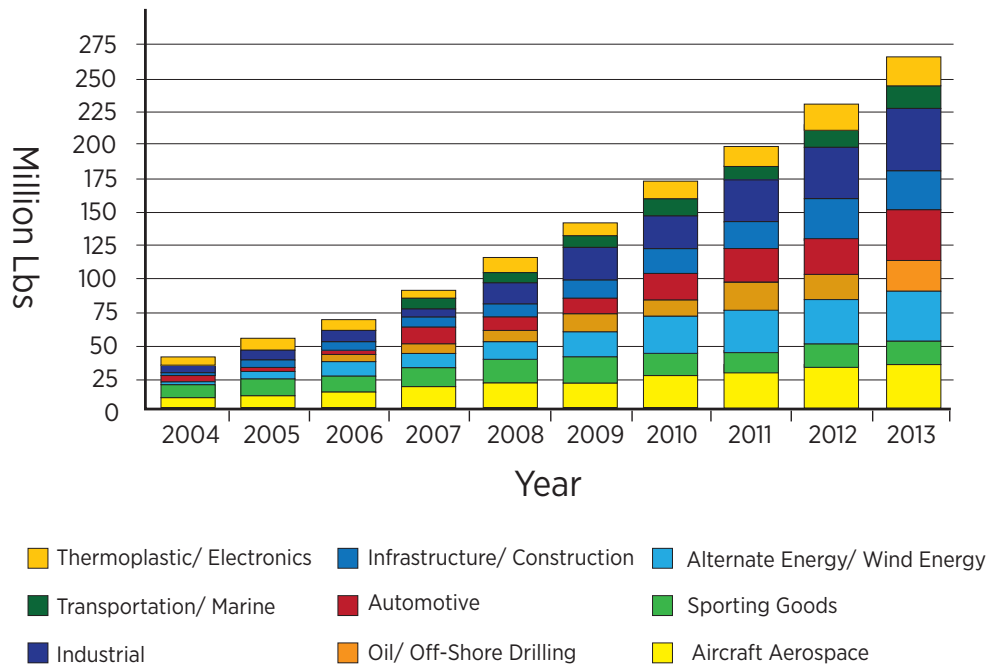
- **Alternative Energy**—wind turbine structural materials; pipeline and storage systems for compressed natural gas, fuel

Figure 3. CF Market Value



Source: Zoltek. *The Future of Carbon Fiber*. <http://www.zoltek.com/carbonfiber/future.php>.

Figure 4. CF Market Size



Source: Zoltek. *The Future of Carbon Fiber*. <http://www.zoltek.com/carbonfiber/future.php>.

transportation, and fuel cells

- **Fuel Efficient Automobiles**—high-performance automobiles, expanding to include production series cars in both car parts and body panels
- **Construction and Infrastructure**—strengthening material in light-weight, pre-cast concrete, and in earthquake protection structures
- **Oil Exploration**—on deep sea drilling platforms, for buoyancy, umbilical lines, chokes, kill lines, and drill pipes
- **High-performance Materials**—for medical applications or electronics.⁴

In addition to the largely structural function CF plays in these sectors, other high-performance applications have been developed for carbon in other forms—namely, carbon nanotubes/nanomaterials and graphene. These technologies will be key to the electronics sector and to manufacturing in general (through nanomanufacturing and related processes). Some main applications/technologies being developed for nanotubes/nanomaterials include^{5,6}

- Nanotube inks (direct printing of electronics)
- Nanotube super capacitor batteries (efficient electrode materials; other structural and non-structural elements)
- Buckypaper (armor and electronic displays)
- Structural and non-structural nanocomposites (high-strength, advanced optical/electrical/magnetic properties)
- Solar cells (improved energy capture, conversion, and storage)
- Chemical filters or storage materials (high-capacity and high-specificity).

Graphene is a very recent development for carbon. It has been identified by name since 1987, but recent breakthroughs in understanding, characterization, production, and manipulation have started to make graphene into a viable industrial material. Graphene has the potential to replace silicon as the major component in integrated circuits, which will provide many benefits to the industry in terms of performance. Graphene also has the potential to be valuable in more general applications like electronic displays (along with nanotubes). Graphene is still so new that the limits to its possible applications are still undefined, but its unique properties and impressive capabilities indicate that it will be in high demand.^{7,8} These applications will all drive demand for carbon, both in raw form and in refined forms needed for specific industries (like potentially single-crystals for electronics). This means that prices for raw carbon-containing materials will increase unless new sources, new refining, and new recycling/reprocessing technologies are developed.

Greenhouse Gas Emissions and Carbon Pricing

The final step in the carbon lifecycle is often combustion into carbon dioxide (CO₂), carbon monoxide, or other gasses that are then emitted into the atmosphere. Not only is this a potential waste (in terms of carbon that could be recycled into feedstock), but carbon emissions are an increasing concern in terms of pollution and greenhouse gas (GHG) effects. Though the United States hasn't signed on to the Kyoto Protocol, it has indicated awareness of the importance of carbon pollution, and has made some progress toward addressing the issue domestically. The first efforts have been through voluntary or mandatory reporting of GHG emissions.

Voluntary Reporting

There are many voluntary carbon registries in the United States. These registries track carbon emissions or emissions mitigation projects and serve as an exchange in the effort to reduce overall emissions. Some of the major voluntary registries include Voluntary Carbon Registry, the Chicago Climate Exchange, the Climate Action Reserve, and the American Carbon Registry⁹, the Climate Registry¹⁰, the California Climate Action Registry, and DOE's 1605(b) Voluntary Reporting Program.¹¹

Mandatory Reporting

In response to the fiscal year (FY) 2008 Consolidated Appropriations Act (H.R. 2764; Public Law 110–161), the U.S. Environmental Protection Agency (EPA) has issued regulations (40 CFR Part 98) that require reporting of GHG emissions from large sources and suppliers in the United States. Part 98's goal is to collect emissions data to inform future policy decisions.¹² The major requirements for reporting include

- Suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 metric tons or more per year
- Oil and natural gas industries, industries that emit fluorinated GHGs, and facilities that inject and store CO₂ underground for the purposes of geologic sequestration or enhanced oil and gas recovery
- Magnesium production, underground coal mines, industrial wastewater treatment, and industrial landfills
- Excluded: ethanol production and food processing, and suppliers of coal
- First reports are due in March 2011.

California requires reporting of GHGs by major sources in the California Global Warming Solutions Act. The Air Resources Board approved the regulation in December 2007, which went

into effect January 2009.¹³

Second efforts are through the United State's potential to enact a carbon cap and trade system in the future. The United States already has cap and trade-like regulation for acid rain (nitrogen oxide [NO_x] and sulfur dioxide, nationally) and NO_x (regionally), which has been cited as being very effective, but it doesn't yet have one that covers carbon emissions. Proponents of such a system, including Paul Krugman, anticipate that the carbon cap and trade system would have similar positive effects on CO₂ emissions as the previous systems did on acid rain.¹⁴ In June 2009, H.R. 2454: American Clean Energy and Security Act of 2009 (a.k.a. Waxman-Markey Climate Change Bill) passed the House, but since then has not made progress in the Senate.¹⁵ Pressures for other legislation have taken precedence, but it is still possible (though unlikely) that it will be passed.^{16, 17}

In the meantime, EPA has concluded that CO₂ emissions endanger human health and welfare under the Clean Air Act (they were required to make a finding for or against by a 2007 Supreme Court ruling). This finding will be the basis to craft regulations of

CO₂ emissions, though it is being challenged in court.^{18,19}

Reporting and exchanging of carbon emissions and mitigation projects, cap and trade systems, and other emissions regulations put a price on carbon emissions, and thus, put a price on carbon and the efficiency in which it is used in industrial settings.

Conclusion

In the preceding sections, it has been made clear that carbon is becoming a more important feedstock/raw material; that more and more applications are being developed for it every day; that it is likely to have significant or key impacts on major industries like chemicals, power and fuel production, electronics, and manufacturing in general; and that systems are under development where carbon is traded, priced, and taxed or capped to control and reduce its impact on the environment and human quality of life. In these ways, carbon is becoming the major metric or currency for industrial operations and we are transitioning toward a carbon economy.

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Ask the Energy Expert

Testing the Elements of Superior Energy Performance

Dow Improves the Energy Efficiency of Its Texas City Operations by Applying SEP Standards

Dear Energy Expert:

Your company is testing the elements of the Superior Energy Performance energy management certification program. What challenges or benefits have you experienced by implementing a new energy management standard into your existing corporate energy management system?

The Dow Chemical Company (Dow) is a provider of plastics, chemicals, and agricultural products. Dow connects chemistry and innovation with the principles of sustainability to help address many of the world's most challenging problems. The company's diversified industry-leading portfolio of specialty chemical, advanced materials, agrosiences, and plastics businesses delivers a wide range of technology-based products and solutions to customers. Dow's products have presence in approximately 160 countries and in high-growth sectors, such as electronics, water, energy, and coatings. In 2009, Dow had annual sales of \$45 billion and employed approximately 52,000 people worldwide.

Background

Dow has long championed energy efficiency and has institutionalized a corporate energy management system into its operations. The company has achieved remarkable success, improving its energy efficiency 38% since 1990, corporate-wide. As a founding and active member of the U.S. Council for Energy-Efficient Manufacturing—a group charged with developing Superior Energy Performance (SEP), a forthcoming American National Standards Institute-accredited energy management certification program—it naturally followed that Dow would join in piloting the standards of the program (the next and current phase of the SEP project). Dow chose its Texas City, Texas, operations to participate—an integrated site with numerous systems tied together, representing approximately \$50 million in annual energy costs. This balanced well for SEP, as some of the other pilots are smaller projects, running at about \$10 million in annual costs. For Dow, integrating a new—but

not wholly different—energy management standard has been the main adjustment.

Integrating SEP Standards

In general, a crucial component to successfully implementing a new energy management system is strong leadership commitment. Leadership support is imperative to a company's success, as they set the tone for resources, programs, and adopting SEP. One of the challenges we experienced at the Texas City plant was not lack of leadership support, but that the implementation occurred during a time of significant organizational change. However, having a seasoned energy champion on-site helped us maintain momentum and focus during the critical implementation phase. Although Dow has long recognized the importance and benefits of energy efficiency and has operated under a corporate energy management system for many years, our Texas City plant found new benefits in adopting the specific elements of the SEP program. Through application of the standard requirements (MSE 2000), SEP has given us a more complete approach, down to our plant-level operations. It has helped us translate our corporate requirements into site-specific best practices.

SEP offers flexibility in its implementation to accommodate plants that have a mature program in place and have harvested most of the available energy-saving opportunities, as well as those who may be starting the journey or still have ample improvement opportunities.

In Texas City, we felt that the SEP performance improvement approach would enhance the energy efficiency initiatives already in place. We implemented two projects during the SEP implementation effort. The first project was actually initiated prior to SEP implementation, but was identified as having energy efficiency benefits as well. The project installed feed pre-heat on a distillation column utilizing the hot bottoms stream from another distillation column. The original intent of the project was





to address a production bottleneck. By applying SEP's approach to the process, we were able to identify the energy efficiency improvements. This project met Dow's internal rate of return.

The second project involved our isopropanol processes. A recent upgrade of the process control system presented the opportunity to implement advanced controls to the process. The SEP significant energy user concept helped identify the controls that would have the biggest impact on energy efficiency. We identified an opportunity to optimize the amount of sparged steam into the hydrolysis process. We executed a six sigma project and were able to find the optimal sparge steam ratio. A benefit of SEP is that it is not prescriptive or overly burdensome, and we've applied it to our unique needs. It didn't necessarily take away from our existing program, because anyone can benefit from SEP's comprehensive, best practices approach.

Projects were also implemented in the site utilities area. The SEP concept of establishing a baseline helped identify an opportunity to improve the efficiency of a steam turbine generator. Over time, steam turbine efficiencies degrade over extended run times. Monitoring steam turbine efficiency versus baseline data helped justify an overhaul of the machine.

A similar review of boiler data revealed a subtle decline in boiler efficiency. A simple maintenance project to wash the economizer tubes during the next scheduled outage resulted in measureable improvement in boiler efficiency. SEP has been a flexible, results-driven approach that has worked well for scheduled efficiency upgrades, but has also worked for conditions-based upgrades as well.

Conclusion

We believe SEP will have a positive response with industry. It has worked well in Texas City, helping us improve the way in which we manage the energy performance. Dow has a long history of integrating energy management into its corporate culture, but anyone can realize benefits from implementing SEP. When the ISO50001 standard is finalized, we will only have to make minor tweaks to our system. Companies that participate in SEP are provided a road map for achieving continual improvement in energy efficiency.

Ask the Energy Expert is an ongoing column with the intent of providing information and solutions for industry's most pressing questions. This issue's Energy Expert is **Joe Almaguer, Global Energy Efficiency Leader at The Dow Chemical Company.**

Save Energy Now LEADER Mannington Mills Delivers Webcast on the Role of an Energy Manager

Mannington Mills—manufacturer of residential and commercial resilient, laminate, hardwood, and porcelain tile floors—has partnered with the U.S. Department of Energy's Industrial Technologies Program (ITP) as a *Save Energy Now* LEADER, pledging to reduce its industrial energy intensity 25% over the next 10 years.

On July 1, 2010, Richard Miller, corporate energy manager at Mannington Mills, delivered a Thursday Webcast for Industry presentation on the "Role of an Energy Manager." During the Webcast, Miller touched on

- Energy benchmarking
- Goal setting
- Monitoring and verification of energy flows
- Training and communications
- Carbon footprint reduction initiatives.

The Fall 2010 issue's *Ask the Energy Expert* column will feature energy-saving recommendations by Miller.

Learn more about Mannington Mills at <http://www.mannington.com/>.

Access ITP Thursday Webcast for Industry presentations at http://www1.eere.energy.gov/industry/resources/thursday_webcasts.html.

International

On June 18, 2010, James Quinn and Joe Cresko of the U.S. Department of Energy's (DOE's) Industrial Technologies Program (ITP) participated in the International Energy Agency Excess Heat Recovery Workshop in Lausanne, Switzerland, to discuss ideas, current programs and projects, and share perspectives on industrial excess heat recovery, with the goal of forming an Annex on international industrial excess heat recovery. The Annex would serve as a forum for sharing information on state-of-the-art technologies that utilize excess heat in industrial processes, and address barriers in the technologies' use to ultimately reduce process energy usage. Industry energy experts representing Canada, Sweden, France, Switzerland, the United Kingdom, and several other countries were in attendance. For more information on the workshop and the initiative, please visit <http://www.iea-iets.org/>.

At the DOE-sponsored Clean Energy Ministerial in Washington, D.C., on July 19–20, 2010, ministers and key stakeholders from around the world launched the new public-private Global Superior Energy Performance (GSEP) partnership to accelerate energy efficiency improvements in commercial buildings and industrial facilities, which currently account for 60% of global energy use. GSEP will leverage funding from the U.S. State Department to cut global energy use, reduce greenhouse gas (GHG) emissions and pollution, save money, and create jobs. GSEP will provide a certifiable process for companies to measure, reduce, and verify their energy consumption and GHG emissions over time, incentivizing positive change with an internationally-recognized certification program. In addition, GSEP participants will share tools, trainings, and best practices for tracking and accelerating energy-performance improvements, both within their sector and

across industry sectors. As part of the program, eight companies representing over \$600 billion in annual sales and one university will pilot the program. GSEP originated from Superior Energy Performance (SEP), a forthcoming American National Standards Institute-accredited energy management certification program currently under development by the U.S. Council for Energy-Efficient Manufacturing (U.S. CEEM). ITP has partnered with U.S. CEEM and have been working on efforts to drive energy management and continuous energy improvement in U.S. industry for several years.

Governments participating in GSEP include Canada, the European Commission, France, India, Japan, Korea, Mexico, Russia, South Africa, Sweden, and the United States. Pilot participants include 3M Company, Cleveland Clinic, Dow Chemical Company, Grubb & Ellis Company, Marriott International, Inc., Massachusetts Institute of Technology, Nissan, Target Corporation, and Walmart Stores, Inc. Initial participants in the sectoral task groups include JFE Steel Corporation and Tokyo Electric Power Company.

For more information on the Clean Energy Ministerial and its activities, please visit www.cleanenergyministerial.org.

On July 20, 2010, DOE Secretary Steven Chu, along with Brazilian Minister of Mines and Energy, Márcio Pereira Zimmerman, signed a joint U.S.-Brazil Binational Energy Working Group Action Plan in efforts to promote the development and deployment of clean technologies. The plan includes efforts to improve industrial energy efficiency by promoting energy audits, exchanging information on best practices, and holding workshops to apply industrial efficiency in both countries.

Funding Resources

The Office of Energy Efficiency and Renewable Energy (EERE) works with business, industry, universities, and others to increase the use of renewable energy and energy efficiency technologies. One way EERE encourages the growth of these technologies is by offering financial assistance opportunities for their development and demonstration. Visit the **EERE Financial Opportunities Web site** at <http://www1.eere.energy.gov/financing/> to learn about the EERE funding and award process, types of EERE financial assistance, and how to apply.

The Industrial Technologies Program (ITP) is dynamic and offers many opportunities and activities for manufacturers who want to reduce their energy use and improve productivity. Competitive solicitations are the principal mechanism used by ITP to contract for cost-shared research and development. Solicitations reflect the priorities of the program and selection of projects follows merit-based criteria that emphasize projected energy, environmental, and economic benefits. Visit the **ITP Solicitations page** at <http://www1.eere.energy.gov/industry/financial/solicitations.html> for active and future solicitations.

Training Opportunities

September 8, 2010

Fundamental of Compressed Air (Level 1) [Portland, Indiana]. This is a 1-day introductory workshop designed to teach facility engineers, operators, and maintenance staff how to achieve 15–25% cost savings through more effective production and use of compressed air. Contact: Monica Cannaley; 317-275-6822; mcannale@purdue.edu.

September 13–15, 2010

Specialist Qualification: Steam Systems [Naperville, Illinois]. This 2 ½-day training is for steam service providers who are interested in becoming proficient in using the BestPractices Steam tools. Contact: Kathy Farmer; 630-305-1503; kfarmer@nalco.com.

September 14, 2010

Steam Systems Management [Pocatello, Idaho]. This 1-day course covers the operation of typical steam systems and discusses methods of system efficiency improvement. Registration Contact: 208-841-2406; <http://www.enlightentraining.com/>.

September 16, 2010

Steam Systems Management [Fort Wayne, Indiana]. This 1-day course covers the operation of typical steam systems and discusses methods of system efficiency improvement. Contact: Monica Cannaley; 317-275-6822; mcannale@purdue.edu.

September 21, 2010

Fundamental of Compressed Air (Level 1) [Dayton, Ohio]. This is a 1-day introductory workshop designed to teach facility engineers, operators, and maintenance staff how to achieve 15–25% cost savings through more effective production and use of compressed air. Contact: Larry Boyd; 216-323-1898; boyd@energyinohio.com.

September 21, 2010

Fundamental of Compressed Air (Level 1) [Salt Lake City, Utah]. This is a 1-day introductory workshop designed to teach facility engineers, operators, and maintenance staff how to achieve 15–25% cost savings through more effective production and use of compressed air. Contact: Paul Greenwood; 801-639-5648; pgreenwood@nexant.com.

September 22, 2010

Process Heating Systems Management [Downey, California]. This 1-day workshop includes an introduction to process heating and process heating equipment, such as furnaces, ovens, dryers, heaters, and kilns used by the industry. Contact: Larry Bennett; 562-803-7570; lbennett@semprautilities.com.

September 27, 2010

ASHRAE/DOE Save Energy Now Data Centers Workshop [Albuquerque, New Mexico]. This 1-day course will provide information on energy efficiency strategies to improve data center energy performance. Contact: Allison Young - Labs 21; 703-841-5484; labs21@i2sl.org.

September 28–October 1, 2010

Specialist Qualification: AIRMaster+ [South Burlington, Vermont]. This 3 ½-day intensive training explains how AIRMaster+ works, how to collect field data, enter data, and interpret the results. Contact: Peter Wilhovsky; 888-921-5990 x1328; pwilhovsky@veic.org.

October 6, 2010

Process Heating Systems Management [Glendale, Wisconsin]. This 1-day workshop includes an introduction to process heating and process heating equipment, such as furnaces, ovens, dryers, heaters, and kilns used by the industry. Contact: Robin Smith; 414-763-9952; rsmith100@gmail.com.

October 12–14, 2010

Specialist Qualification: Process Heating [Chesterfield, Missouri]. This 2 ½-day workshop has been developed to qualify industry professionals on the use of the Process Heating Analysis and Survey Tool (PHAST). Contact: Deepak Gupta; 573-986-4921; dgupta@semo.edu.

October 13, 2010

Steam Systems Management [Eau Claire, Wisconsin]. This 1-day course covers the operation of typical steam systems and discusses methods of system efficiency improvement. Contact: Robin Smith; 414-763-9952; rsmith100@gmail.com.

October 13, 2010

Pump Systems Management [Fort Wayne, Indiana]. This 1-day workshop discusses performance problems encountered in everyday applications and presents the Pump System Assessment Tool (PSAT). Contact: Monica Cannaley; 317-275-6822; mcannale@purdue.edu.

November 8-10, 2010

Specialist Qualification: Fan Systems [St. Louis, Missouri]. This 2 ½-day workshop has been developed to qualify industrial professionals on the use of the Fan System Assessment Tool (FSAT). Contact: Deepak Gupta; 573-986-4921; dgupta@semo.edu.

November 9-11, 2010

Specialist Qualification: Steam Systems [Raleigh, North Carolina]. This 2½-day training is for steam service providers who are interested in becoming proficient in using the BestPractices Steam tools. Contact: Isaac Panzarella; 919-515-0354; ipanzarella@ncsu.edu.

November 17, 2010

Motor Systems Management [Downey, California]. This 1-day workshop covers motor systems management including applications, inventory tracking, maintenance, replacement decisions, repair, and the impact and maintenance of power quality. Contact: Larry Bennett; 562-803-7570; lbennett@semprautilities.com.

November 17, 2010

Fundamentals of Compressed Air (Level 1) [Fort Wayne, Indiana]. This is a 1-day introductory workshop designed to teach facility engineers, operators, and maintenance staff how to achieve 15–25% cost savings through more effective production and use of compressed air. Contact: Monica Cannaley; 317-275-6822; mcannale@purdue.edu.

For more information on training opportunities offered by the Industrial Technologies Program, as well as a current calendar of available training sessions, please visit <http://www1.eere.energy.gov/industry/bestpractices/training.html>.

Look for Us...

ITP Calendar of Events

September 2010

15: [Industrial Energy Efficiency Programs for Utilities: A Workshop, co-sponsored by the American Public Power Association](#)

Industrial Technologies Program Contacts

Click below to request more information about ITP and the services we provide.

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