

Energy Efficiency Programs in West Virginia: A Partnership Approach

Kathleen A. Cullen
Program Coordinator
WVU National Research Center for Coal &
Energy
Energy Efficiency Division
Morgantown, WV

Bhaskaran Gopalakrishnan
Professor
WVU College of Engineering & Mineral
Resources
Industrial Assessment Center
Morgantown, WV

Edward Crowe
Engineering Scientist
WVU National Research Center for Coal &
Energy
Energy Efficiency Division
Morgantown, WV

Subodh Chaudhari
Engineering Scientist
WVU College of Engineering & Mineral
Resources
Industrial Assessment Center
Morgantown, WV

ABSTRACT

West Virginia's successful energy efficiency program relies on the close working relationship between the West Virginia Division of Energy and West Virginia University's energy efficiency programs, Industries of the Future – West Virginia and WVU Industrial Assessment Center. These organizations work together to conduct the State's energy efficiency assistance programs that include R&D, assessments, and outreach, identify potential clients, and offer a wide range of services. The partnership has the capability to provide these services to facilities ranging in size from small commercial businesses to large manufacturing facilities. The partners have affiliations not only within industry but also with industry organizations, utilities, and national laboratories. This range of services creates a synergistic relationship that allows the WV team to obtain competitive awards that benefit the stakeholders. This paper will focus on how West Virginia has a successful industrial energy efficiency program with limited state funding and no surcharges on utility bills.

INTRODUCTION

West Virginia is an energy producing state with low energy prices, a declining manufacturing base, and an economy heavily dependent upon energy-related industries, e.g. coal, natural gas, and electricity. Rising energy prices, increasing global competition, and concern about potential CO₂ regulations have created an interest in the state for energy efficiency programs such as Industries of the Future – West Virginia. West Virginia's energy efficiency programs are in direct response to this interest and provide a much needed service to the State's manufacturers.

West Virginia's manufacturers are concentrated in energy intensive manufacturing industries. As Table 1 shows, West Virginia's manufacturing employment and Gross Domestic Product (GDP) are heavily skewed towards energy intensive industries - almost 80% of West Virginia's 2008 manufacturing employment and GDP are comprised of energy intensive manufacturing. Also, West Virginia's industrial energy intensity of 6,021¹ BTU per dollar is high when compared to the U.S. total of \$2,588¹ BTU per dollar. This is another indication of the important role that energy intensive manufacturing has in West Virginia's economy.

¹ <http://www.eia.doe.gov/states/seds.html>,
<http://bea.gov/regional/index.htm>

Table 1. West Virginia's 2008 Energy Intensive Employment and GDP

	Employment	GDP (M of current \$)
Total Manufacturing	58,866	5,707
Wood product manufacturing	7,186	267
Nonmetallic mineral product manufacturing	3,561	277
Primary metal manufacturing	6,119	505
Fabricated metal product manufacturing	6,761	561
Machinery manufacturing	2,200	125
Motor vehicles, trailers, and parts manufacturing	0	319
Food manufacturing	3,884	181
Paper manufacturing	677	46
Printing and related support activities	1,625	65
Chemical manufacturing	10,088	1,880
Plastics and rubber products manufacturing	3,750	286
Total Energy Intensive Manufacturing	45,851	4512
% of Total Manufacturing	77%	79%

Also, West Virginia is a state whose economy relies heavily on the fossil fuel and electricity generation industries. Over 90% of energy production in West Virginia is fossil fuel based². The State ranked 4th in the U.S. in 2008 in total energy production³. West Virginia's electric power industry emissions were 2.9% of that industry's national total in 2009⁴. West Virginia accounted for a total of 112.9 Million Metric Tons of CO₂ emissions in year 2008 or approximately 2% of the U.S. Total⁵. This is a concern for manufacturers due to pending CO₂ regulations because industrial end users dominate energy consumption in West Virginia at 47%⁶. This is where West Virginia's energy efficiency programs can offer a low-cost solution, helping companies increase energy efficiency and enhance sustainability.

² "State Ranking 1. Total Energy Production, 2008", U.S. Energy Information Administration, http://www.eia.gov/cfapps/state/state_energy_rankings.cfm?keyid=89&orderid=1

³ <http://www.eia.gov/state/>

⁴ <http://www.eia.gov/state/state-energy-profiles-data.cfm?sid=WV#undefined>

⁵ www.eia.doe.gov/oiaf/1605/gerpt/excel/tbl_statetotal.xls

⁶ <http://www.eia.gov/state/state-energy-profiles-data.cfm?sid=WV>

WEST VIRGINIA'S ENERGY EFFICIENCY PROGRAM

West Virginia's energy efficiency program is built upon relationships and partnerships among a variety of state and federal government agencies, university groups, national laboratories, and industry associations.

The West Virginia Division of Energy (WVDE) works with West Virginia University (WVU) to provide energy efficiency services to the State's industrial and commercial businesses. WVU, a land-grant university located in Morgantown, WV, has a strong commitment to public service and outreach and is committed to a cooperative community of partnerships (6). The WVDE has a close working relationship with the energy efficiency programs at WVU, especially Industries of the Future – West Virginia (IOF-WV) which is housed in the Energy Efficiency Division at the National Research Center for Coal & Energy and the WVU Industrial Assessment Center (IAC).

Through these partnerships, the WVDE is able to offer a variety of energy efficiency programs for a wide ranging clientele including industrial, commercial, and agricultural businesses and government buildings. This university/government partnership is extremely

important to the success of all of the energy efficiency programs. The organizations partner on assessment programs, R&D projects, technical training events, and marketing and outreach for energy efficiency. The WVDE support has been used to fund faculty researchers to develop proposals that lead to research projects that enhance the energy efficiency of manufacturing processes. Projects that resulted from this effort included “Multifunctional Metallic and Refractory Materials for Molten Metal Handling” which resulted in a patent for a high temperature electrochemical corrosion facility and a new software tool for the galvanizing industry (1). Figure 1 below shows the synergistic relationship between the organizations and the clients they serve in the state.

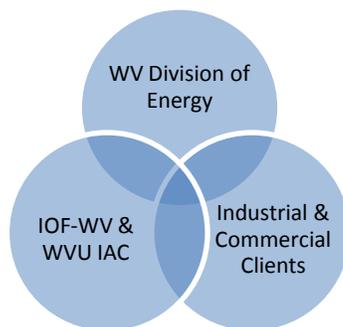


Figure 1. West Virginia’s Synergistic Energy Efficiency Partnership

Since the beginning, the West Virginia team has worked very closely with the U.S. DOE Industrial Technologies Program (ITP). The team worked with ITP to develop the first state-level Industries of the Future program in 1997 (2, 3) and that relationship has continued until today with the recent Save Energy Now Project. In addition, the WVU Industrial Assessment Center has been funded for over 19 years and has a close working relationship with DOE.

Although the U.S. DOE is still the primary funding source for WV’s energy efficiency efforts as Figure 3 shows, the team has worked to expand the resources and collaborate beyond the U.S. DOE and now works closely with the U.S. Department of Agriculture and the WV Department of Environmental Protection (WV DEP). Through the USDA, the WV team now

has the capability to conduct energy assessments for agricultural producers and small rural businesses which greatly expands our client base. In partnership with both the WVDE and the WV DEP, the WV team is part of a group that is developing a sustainable communities program in West Virginia called Energy, Environment, and Economics (E3).

The WV team has also developed relationships with national laboratories discussing research interests, partnership opportunities, and technical issues. The team has partnered with Oak Ridge National Laboratory, National Energy Technology Laboratory, and Argonne Laboratory on R&D projects. Our team makes visits to national laboratories and seeks their expertise on R&D topics and new initiatives such as the building energy efficiency program that is under development.

West Virginia’s industry partners include participants from all of West Virginia’s energy-intensive industries, both small and large, including aluminum manufacturers, steel manufacturers, chemicals and polymer manufacturers, glass manufacturers, wood products producers, metal casting companies, and other energy intensive manufacturers around the state. Each of these industry sectors have companies who have become industry leaders and promoted the programs among their competitors and suppliers. They are also the companies that have participated in assessment and R&D programs and actually saw results by implementing assessment recommendations and commercializing new products. Through our efforts with commercial operations, we have expanded our partners into new areas.

Industry associations are very important partners for the WV Team. The team utilizes industry associations to promote our energy efficiency activities and to make connections for potential sites for energy assessments and potential partners for R&D projects. The WV team has a close working relationship with West Virginia associations such as the West Virginia Manufacturers Association and the Chemical Alliance Zone as well as national and international industry organization such as the International Lead Zinc Research Organization. In addition, by working with industry

associations, the team has a partner that companies trust and that works very closely with them to identify their problems.

The West Virginia team also works with other assistance programs in the State such as the West Virginia Manufacturing Extension Partnership (WVMEP), the West Virginia Development Office (WVDO), and the WV DEP to inform companies about our energy efficiency services, identify companies in need, and help with implementation of assessment recommendations. The WVMEP and the assessment team closely partner on all of the assessment programs and partner in developing new innovative assistance programs such as West Virginia's Energy, Environment, and Economics (E3) program.

Funding Sources

Although, West Virginia does not have a constant stream of state funding for energy efficiency programs, the team has still managed to conduct a successful energy efficiency program. West Virginia's funding for its energy efficiency programs includes a limited amount of state funding, federal funding from a variety of agencies, foundations, and industry. The total dollar value over the last 14 years for all of the R&D, assessment, technical assistance, and outreach projects is \$37,870,663 of which \$27,557,514 is from state, federal, foundation, and industry funding with an additional \$10,313,149 in non federal cost share. Figure 2 outlines the funding picture over the past 14 years for West Virginia's energy efficiency activities (assessments, R&D, technical training, and outreach), showing that the majority of the funding has come from the U.S. DOE.

The partnership approach that West Virginia uses as discussed above includes partners from industry, academia, national laboratories, and industry associations. These partnerships that have been developed over the past 14 years allow the WV team to pull together a diverse group that is competitive when applying for R&D, assessment, and outreach funding.

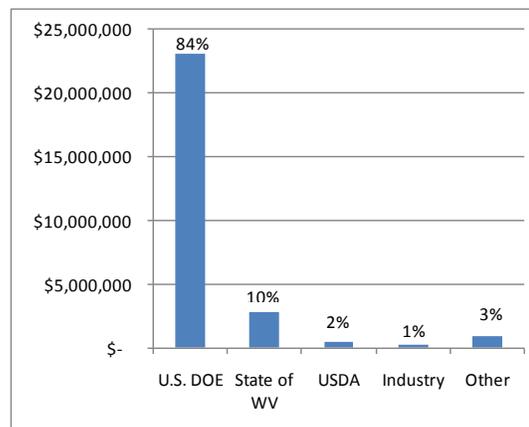


Figure 2. WVU's Energy Efficiency Funding Picture (1997 to 2011)

The State of West Virginia has provided a limited amount of state funding to the IOF-WV program through a direct line item in the WVDE's budget to coordinate the energy efficiency program. This funding provided support for the general operation of IOF-WV and for faculty to work with companies conducting energy assessments, developing R&D projects, and providing technical assistance. The funding has also been used to promote energy efficiency in the state and as a foundation to grow the program and funding from other sources.

When West Virginia's energy efficiency program, IOF-WV, first began in 1997, the majority of the funding came from the U.S. DOE Industrial Technologies Program (2, 3, 5). While that relationship still continues today, through the Save Energy Program the funding sources have expanded. Figure 3 shows that while the majority of funding over the last five years still comes from the U.S. DOE, that percentage has dropped when compared to Figure 2 and funding from other sources has risen accordingly. These new sources of federal funding include the U.S. Department of Agriculture, the U.S. Environmental Protection Agency, and the National Energy Technology Laboratory. The team is constantly seeking ways to expand funding. Proposals have been submitted to agencies and organizations such as the National Science Foundation, the National Park Service, Nine Sigma, and Petroleum Research Fund. In fact, a recent pre-proposal was submitted to the U.S. Department of

Defense in partnership with the WVU Forestry Department.

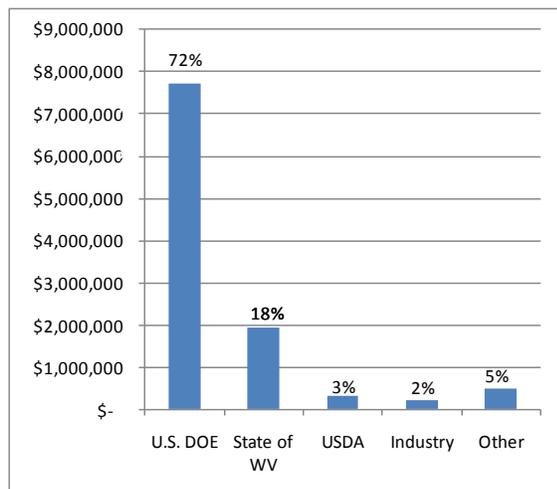


Figure 3. WVU's Energy Efficiency Funding Picture (2006 to 2011)

Funding has also been provided by foundations and industry. Foundations have supported specific projects related to helping companies become more energy efficient such as the International Lead Zinc Research Organization providing funding to develop a software tool for the galvanizing industry (1). Companies have provided funding for projects on topics of interest such as waste heat recovery studies at their manufacturing facilities. One example of industry support is Recycled Energy Development, LLC which has funded the WV team to conduct waste heat studies at manufacturing facilities.

In addition to the direct funding discussed above, West Virginia University supports the IOF-WV program during times when funding is limited. The WVU National Research Center for Coal & Energy (NRCCE) provides support for staff members to develop proposals and projects. The staff of the IOF-WV program are employees of the WVU NRCCE and their role is to develop and conduct energy efficiency projects, therefore, when direct state and federal funding is limited the IOF-WV staff are able to continue their efforts on a limited basis.

Range of Assistance

The West Virginia team provides a wide range of energy efficiency assistance including

energy assessments, R&D, technical workshops and seminars, symposiums, and general outreach to a variety of companies throughout the State and region. These energy efficiency programs include agency sponsored energy assessments, implementation assistance, special industry requests such as assessing waste heat recovery potential, and educational programs such as DOE BestPractices workshops, faculty developed seminars, and web-based instruction.

The WV team conducts energy assessments for small, medium, and large industrial facilities, commercial enterprises, agricultural producers, and government buildings. Each of these assessments requires a different set of criteria to meet the needs of the client as discussed below.

- **Walk-through Assessment** (low cost): The first step is to analyze the energy bills to gain an understanding of the energy use. Next a brief visual survey of the facility is conducted by the assessment team. This type of assessment does not include an analysis of the process or equipment. The subsequent report identifies no-cost and/or low-cost opportunities.
- **One Day Assessments** (typical audit): This type of audit conducts a detailed survey of utility bills and trends of energy consumption over at least the last twelve months. This provides an idea about the seasonal effects that the facility may incur in the energy consumption. A study is carried out considering the process in the facility and equipment ratings. With the help of maintenance and operations personnel, the assessment teams gather information on the utilization and load factors of the equipment. If possible, the team records data through the application of electronic data loggers. The operation practices, equipment ratings, set point data, allowable changes, and logged data together are analyzed to evaluate the energy efficiency of the facility. The assessment report details potential low cost as well as capital-intensive opportunities for further research and analysis.
- **Enhanced Assessments** (in-depth assessment): Unlike the standard assessment protocol discussed above, the enhanced

assessment process objective is the actual realization of energy savings and provides services at varying stages of the assessment process, namely, pre-assessment, assessment, and post-assessment with a strong focus on enhancing the implementation of energy efficiency measures. It includes the following activities:

- *Pre-assessment activities that focus on implementation.* These activities include interactive sessions (via e-mail or a phone) with plant personnel to familiarize them with the assessment process, BestPractices software tools, overview of energy systems, baseline energy use analysis. Development of an assessment plan for each plant is based on the process characteristics and energy usage at the facility
- *Extended time spent at the plant.* The assessment process focuses on energy analysis and diagnostics, interdependence between energy efficiency recommendations, and sensitivity analysis with respect to key products, processes, and system parameters governing energy savings. The extended time is realized in the form of additional visits to the plant, and/or a presentation to plant personnel.
- *Post-assessment follow-up and technical assistance to enhance the implementation rate.* The post assessment activities focus on enhancing the relationship with client companies and providing technical information, assistance in vendor evaluation, verification of energy savings, life cycle cost analysis of recommendations, implementation assistance, training, input on monitoring energy systems, tax incentives and rebate information for implementation, and discussion for removal of implementation barriers.
- **Technical Assistance Events:** Technical Assistance (TA) provides a more detailed analysis and business case development to facilitate the implementation of assessment recommendations. TA events will be

performed for past clients that have successfully implemented recommendations. The TA events provide additional implementation support to increase implementation of recommended savings opportunities over and above the past assessment implementation results. A TA event could include collaborations with state organizations, utilities, vendor analyses, identification of renewable energy opportunities, and enhancing the energy efficiency of the client. Some facilities may need the assessment team to take additional measurements and prepare a business case of a recommendation that is a large capital expenditure while others may want assistance in evaluation of a number of smaller recommendations. The assistance may include vendor analyses, equipment life cycle cost analysis, additional measurements to validate energy savings calculations, identifying potential sources of funding to assist with implementation such as tax incentives and loan programs, or training of personnel on how to run the facility efficiently.

The team also works with companies to identify R&D needs and develop R&D projects that will increase their energy efficiency, reduce waste, and increase their profitability. These projects may be long-term cutting-edge projects that provide novel research resulting in innovative technologies and new processes that make the manufacturing process more efficient. One successful research project was the “Multifunctional Metallic and Refractory Materials for Molten Metal Handling” project which resulted in a patent for a high temperature electrochemical corrosion facility and a new software tool for the galvanizing industry called “Galvanizing Energy Profiler and Decision Support System (GEPDSS)” (1). The team also conducts research projects that have a short timeframe for research with a more immediate impact. One example of a short term more immediate impact research project are the industry-funded studies of waste heat potential at select industrial sites.

To ensure that companies invest not only in the technical improvements but also the

knowledge and education of their employees, West Virginia offers training programs designed to provide the most up to date energy efficiency education. These training events include webinars, in-house develop trainings, and DOE BestPractices workshops. Through training, employees learn effective management of fans, pumps, steam, HVAC, or compressed air which they can then implement at their facility. Effective training is vital for continuous improvement and energy management. IOF-WV has also found training events to be an effective mechanism for developing contacts and partnerships which can lead to assessment opportunities and collaboration on R&D projects.

Sustainability of West Virginia's energy efficiency program will be accomplished through all of the different sources of support we offer: R&D, training, energy management, and continuous improvement. R&D has a long-term energy savings impact for industries. Training and energy management lead to culture changes in an organization where employees practice energy efficiency practices making the company more energy efficient over the long-term. All of this leads to a continuous improvement in energy efficiency and sustainability of energy savings.

WEST VIRGINIA'S ENERGY EFFICIENCY PROGRAMS

The array of energy efficiency programs provided to West Virginia's large, medium, and small manufacturers include:

Industries of the Future – West Virginia which is a partnership program that works with energy-intensive industries to increase energy efficiency, reduce waste and promote competitiveness. IOF-WV teams work with companies to assess high priority research needs and develop projects that improve energy efficiency and environmental performance. The team provides assistance to energy intensive industries through energy assessments, R&D, and in identifying and adopting new technologies that improve their energy and environmental performance (2, 3, 5).

Regional Save Energy Now Partnership is a regional system/partnership for delivery of "enhanced" industrial energy efficiency

assessment, implementation, and communication services within West Virginia, Ohio, Pennsylvania, Tennessee, Kentucky and Virginia. The project is implementing a comprehensive energy-reduction package that incorporates an enhanced energy assessment process that includes investment grade cost analysis, creation of the Regional Energy Efficiency Knowledge Center, and an Energy Management resource database. An Energy Management Demonstration project is in process at two representative companies to attain certification to Superior Energy Performance and the ISO 50001 standard for energy management. The team is also developing a Regional Industrial Energy Efficiency Marketing and Outreach Center to promote the project, showcase success stories, provide information to the media, and serve as the central point of contact for inquiries about industrial energy efficiency tools, services, and resources.

WVU Industrial Assessment Center provides energy assessments to eligible manufacturers within a 150 mile radius of West Virginia University. The IAC assessments focus on energy-intensive processes and are conducted by experienced engineering faculty and students from West Virginia University. Eligible companies are those that meet the following qualifications: within Standard Industrial Codes (SIC) 20-39; within 150 miles of West Virginia University in Morgantown, WV; gross annual sales below \$100 million; fewer than 500 employees at the plant site; annual utility bills more than \$100,000 and usually less than \$2.5 million; and no in-house professional staff to perform the assessment.

IOF-WV Energy Assessment Program provides full scale assessments for West Virginia manufacturing and commercial enterprises that do not fit within the criteria established by DOE for the Industrial Assessment Centers. These assessments include technical consultation to facilitate implementation of energy saving recommendations.

USDA - West Virginia Agricultural and Rural Small Business Energy Assessment Program is an energy assessment program specifically designed for agricultural producers

and rural small businesses in West Virginia. The audits are not as comprehensive and may only focus on one or two energy system at a manufacturing facility or lower cost opportunities at commercial businesses.

Energy, Environment, and Economics-West Virginia (E3-WV) Program provides technical assistance through energy assessments, lean manufacturing, and CO₂ reduction strategies for businesses throughout West Virginia. This state-wide program assists manufacturers by helping them become more energy efficient, and create and retain jobs. The WVU assessment team conducts the energy assessments and the WV MEP conducts the lean manufacturing audits, and carbon footprint analyses.

Projects with Industry is a state-wide program for industry that provides solutions to high energy costs, production efficiency improvements, and methods for energy recovery. A team of engineering students and experienced engineering faculty will conduct an assessment of your facility and make energy saving recommendations.

RESULTS

Energy Assessments

West Virginia's energy assessment program has been extremely active over the last 15 years. Table 2 shows that to date, the WVU assessment team has conducted over 650 through our various assessment programs.

Table 2. Assessment Breakdown

Assessment Program	No. of Assessments as of March 2011
Industrial Assessment Center*	423
IOF-WV Assessments	130
USDA Assessments	70
SEN Assessments*	7
Government Building Assessments	25
Total to date	655

*Some assessments may be conducted out of state

A typical assessment studies energy systems such as compressed air, motor driven systems, steam systems, lighting, demand monitoring, etc.

As a result of companies implementing recommendations such as these, savings from the 423 IAC assessments alone have saved 3,435,367 MMBtu/yr or \$18,369,070 per year. The WVU team has also conducted DOE plant wide energy assessments including one at the PPG facility in Natrium, WV. During this assessment, the team identified \$2.2 million in savings with \$1.7 million in energy savings actually implemented.

Key Results of R&D projects

Since IOF-WV was initiated in 1997, there have been over 50 R&D projects conducted by researchers at West Virginia University on topics such as materials, corrosion, nanopolymers, and laser glass cutting. These projects have resulted in significant improvements in energy efficiency for manufacturers. Some sample results are below:

- ***U.S. DOE sponsored Industrial Materials for the Future Project entitled “Multifunctional Metallic and Refractory Materials for Molten Metal Handling”*** developed new corrosion and wear resistant materials with greater than 5X lifetime improvements.
- ***U.S. DOE Industrial Technologies Program sponsored project entitled Life Improvement of Pot Hardware in Continuous Hot Dipping Processes”*** developed new materials for the 2012 XT bearings that resulted in at least six times of the service life than the conventional Stellite 6 bearings.

Education

Over the past ten years, West Virginia has hosted 25 different training events on a variety of energy efficiency topics. The BestPractices workshops have included one day and Qualified Specialist trainings on topics such as Process Heat, Steam, Pumps, and Fans. WVU experts have developed technical workshops on specific topics including waste heat recovery, lean manufacturing, and industrial energy efficiency measures. Web-based instruction is provided through webinars and general technical information on websites.

Industries of the Future - West Virginia
Creating Energy Advantages for West Virginia Industry

What is Industries of the Future - West Virginia?

Industries of the Future – West Virginia (IOF-WV) – is West Virginia’s industrial energy efficiency program. IOF-WV was the nation’s first state-level program to help manufacturers create financial savings through energy efficiency and was the model for more than 20 other state IOF programs nationwide. IOF-WV is a partnership program with the goal to save energy, reduce waste, and improve productivity in the country’s most energy-intensive industries. IOF-WV teams work with companies to assess high priority research needs and develop projects that improve energy efficiency and environmental performance.

IOF-WV:

- Is a Save Energy Now program partner with the U.S. Department of Energy
- Engages University research groups in innovative partnership projects to improve energy efficiency and environmental sustainability
- Conducts energy assessments, in partnership with the WVU Industrial Assessment Center, that maximize energy efficiency, reduce waste and improve productivity
- Provides technical assistance and information on energy efficiency vendors to companies implementing energy savings recommendations
- Conducts innovative facility-developed training programs and sponsors U.S. DOE BestPractices workshops on system-wide and component-specific topics to teach employees how to run plants more efficiently
- Provides information to industry about energy efficiency through annual symposia, project meetings, websites, and the monthly newsletter, *IOF-WV UpDate*

THINKING ABOUT WEST VIRGINIA'S ENERGY FUTURE: A READING LIST

- *A Business Plan for America's Energy Future*, prepared by the American Energy Innovation Council
- *Energy*, *Wall Street Journal Report*, September 13, 2010
 - *Power Investing*, by Liam Denning

Figure 4. IOF-WV Website

Marketing and Outreach

The West Virginia team continually works to market energy efficiency and our various programs through websites, presentations, newsletters, and news articles. Some highlights of our marketing and outreach activities:

- Over the past ten years, the team has made over 80 presentations on our various programs and the opportunities that exist through energy efficiency
- IOF-WV newsletter has been published each month for over 12 years (131 issues)
- Fifteen conferences and symposia have been held presenting various energy efficiency topics
- Eleven IOF-WV Days at the State Capitol (which is the energy efficiency day at the West Virginia Capitol in Charleston, WV) have been held during West Virginia’s legislative session. This event connects our industry clients with state legislators and gives them a venue to display their products as well as networking opportunities (4).
- Brochures have been developed describing our programs and how we can help companies save energy.
- Websites have been developed for the IOF-WV project, WVU IAC, the USDA project,

and the Save Energy Now project. These websites have had approximately 1.5 million hits over the last ten years. A snapshot of the IOF-WV website is in Figure 4.

Future Directions

West Virginia’s energy efficiency programs will continue to produce energy and cost savings for our manufacturing clients, but what does the future hold and how will companies continue to benefit. Companies that benefit from the savings are likely to invest in expanding their businesses in terms of personnel, infrastructure, and market share. This will result in job growth and economic development in the State as well as have a positive economic "ripple" effect on their supply chain. The future strategy for the continued growth of West Virginia’s energy efficiency programs includes securing funding from foundations, industry, and broader federal support, developing a fee for service program, offering new services such as building assessments, and hiring additional qualified energy experts.

Future Partners

The sustainability of West Virginia’s energy efficiency program and developing new sources

of funding depends upon not just working with our current team of partners, but also expanding our team. We need to look at including other Universities, energy assistance programs, economic development programs, utilities, energy service providers. The growth of the partnership will enhance our capabilities and foster new relationships with industry and among the assistance programs in the region. Companies will have immediate access to someone who can assist them, the project will expand the number of companies it can touch, and more opportunities will exist to sustain and grow the program. Also, by expanding the partnership, the team will have access to other sources of funding such as state funding, other federal funding, and funding by state and local organizations.

Another way to enhance the energy efficiency efforts at West Virginia University is to continue to expand the regional focus of the program as the SEN and IAC programs operate regionally. Both programs have clients in the surrounding states such as Ohio, Pennsylvania, and Kentucky. The SEN project actually has partners in the other states such as North Hampton Community College, PennTAP, GoSustainable, Tennessee Tech, and E3M that conduct assessments in their states. These partnerships allow the WV team to expand our focus beyond West Virginia and service more customers. In the future, a regional approach will be needed to help companies facing rising energy costs, offshore competition, and potential CO₂ regulations.

Continuation Funding

The path to continue a sustainable energy efficiency program is to work with the state to establish additional and continuous state support for energy efficiency activities in the state whether this is through a surcharge on utility bills, a voluntary program where utility customers can participate, or state funding for energy efficiency will be answered in the future. We will also expand our reach of the state agencies we work with such as our new partnership with the WV Department of Environmental Protection.

West Virginia has many excellent models of other state energy efficiency programs that are

state funded that we can use as case studies when discussing the best way to fund West Virginia's program and even use as models for some of our program elements. New York's program NYSEERDA, Wisconsin's Focus on Energy, and Vermont's Efficiency Vermont, are just a few programs. They are all funded by a surcharge on utility bills and they offer a range of services to all classes of customers.

Potential funding sources outside of state support include, fee for service; state-level assistance programs, utilities that have demand side management programs, DOE and other federal agencies, as well as Foundations such as the Benedum Foundation which funds projects in Pennsylvania and West Virginia.

The team will also work with the utilities in the state as they begin to establish demand side management and energy efficiency programs for their customers. American Electric Power is currently establishing this type of program for their West Virginia customers.

Another avenue of funding is to expand the agencies the team currently works with beyond the U.S. DOE. The project team has already initiated partnerships and funding streams from the USDA, U.S. Environmental Protection Agency and will continue to grow these partnerships and work to expand this list to include other agencies such as the U.S. Department of Defense.

The WV team will work with current partners to identify and become part of new initiatives as they are under development. One example is the E3 initiative. This is a new program under development by NIST, EPA, DOE, and SBA to develop community wide sustainability programs. The West Virginia team identified this as a new initiative and started to develop the framework for the program, partners such as the WVMEP, and funding sources. This program is now has a small amount of funding and the team is working to establish a larger stream of funding.

Continuous Improvement

The partnership approach to the IOF-WV program is designed to contribute to continuous improvement by incorporating the knowledge and experiences of plant personnel. It also emphasizes a collaborative approach specifically

aimed at building internal capability to find and eliminate wasted energy through the study and improvement of processes and energy systems, and the development of innovative technologies and processes through R&D. This is further enhanced by training and coaching in energy efficiency in addition to actively involving cross-functional teams in the study, change, and improvement of their product, process, and system parameters. The keys to the success of continuous improvement in energy efficiency are the support of upper management leadership, underlining the need for an infrastructure to support energy efficiency efforts, training, and providing simple but powerful methodologies and tools. The project is designed to foster a plant-wide sustainable energy efficiency culture incorporated within the corporate continuous improvement framework. The project team has already seen the potential when upper management becomes involved. The CEO of a West Virginia mini mill has been and continues to be actively involved in all aspects of the assessment process. This allows for a wider acceptance of the assessment recommendations and energy efficiency practices.

Future of Energy Efficiency

What does the future hold for energy assessments? The following provide some insight into the WVU team's thoughts on the role of energy assessments in the future.

- Through the enhanced assessment process and continuous improvement, companies raise energy efficiency to be part of their business strategic plan. This may eventually include the adoption of new enabling technologies such as wireless sensors, diagnostics, and real time data acquisition allowing companies to continuously monitor their own energy use.
- The broad acceptance and adoption of energy management strategies and the forthcoming ISO 50001 energy management standard will lead to continuous energy efficiency and energy intensity improvement as well as a reduction in operational costs and carbon emissions. This will require continuous monitoring and verification of energy performance improvements.

The energy efficiency activities conducted by the WV team have had a significant impact on West Virginia and the Region, resulting in significant energy benefits due to the on-going interactive relationships with industrial clients. The project team works with companies to conduct R&D projects and energy assessments, enhance implementation, foster a culture of energy management, and facilitate continuous improvement resulting in a reduction in energy intensity and carbon footprint while enhancing global competitiveness and increasing profits. Our goal is that all of the companies that participate in IOF-WV activities are efficient, sustainable, competitive manufacturers in the future and contribute to the national goals for energy efficiency.

REFERENCES

1. Gopalakrishnan, B., Chavan, R., Gupta, D., Alkadi, N., "Energy Consumption Modeling and Benchmarking in Continuous Galvanizing Lines", *International Journal of Energy Technology and Policy*, Vol. 7, No. 3, 2010.
2. Irwin, Carl. "The Industries of the Future", *West Virginia Executive*, pages 31-31, 154, Spring 2006.
3. Irwin, Carl. "Energy for State's Industry: When Less is More", *The State Journal*, page 23, October 5, 2007.
4. Irwin, Carl. "2011 IOF-WV Day at the Capitol – January 18, 2011", *IOF-WV UpDate*, Vol. 12, No. 2, February 2011.
5. Quinn, James. "States Industries of the Future" *Proceedings ACEEE Summer Study on Energy Efficiency in Industry*, 1999, Pages 397-408.
6. "About the Land-Grant System", WVU Extension, www.ext.wvu.edu/about_extension/land_grant_system.