

Industries of the Future – West Virginia: Industrial Energy Efficiency Research at WVU

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West Virginia and Energy

- 2006 coal production totaled **159 million tons** ~ **10% of U.S. production** ~ **50% of U.S. exports¹**
- 99% of electricity generation is coal-based ~ **export 70% of power**
- Wind energy: 66 MW of installed power generation and the fastest growing energy resource in West Virginia

Industries of the Future – West Virginia (IOF-WV)

- Developed in 1997 as Nation's first state-level IOF program
- Collaboration between WVU, the WV Division of Energy, the WV Development Office and the U.S. Department of Energy
- Goal is to save energy, reduce waste, improve productivity in the country's most energy-intensive industries

The IOF-WV Team

- WVU research expertise:
 - Industrial energy assessment
 - Advanced materials and super alloys
 - Corrosion technologies
 - Polymer composites
 - Nanotechnologies
 - Optical coatings
 - Software development
 - Energy efficiency training
- State and Federal energy offices
- National laboratories
- Energy-intensive companies and industry associations

Sample IOF-WV Partners

■ Industry

- Wheeling-Nisshin, Nucor, Duraloy Technologies, Inc., Metaullics, Special Metals Corporation, Century Aluminum, Bayer, PPG, Recycled Energy Development, WOW Energy

■ National Laboratories

- Oak Ridge National Laboratory, National Energy Technology Laboratory

■ Industry Associations

- AISI, ILZRO, NACE International and WV Manufacturers Association

IOF-WV R&D Efforts

- ~175+ proposals - ~250 industrial partners - ~40 faculty researchers - ~200+ students - ~15 national laboratory colleagues!
- ~\$22 million in federal and state funding - ~ \$11 million in industry cost share - Total R&D value to the State of more than \$33 million!
- 4 Plant-Wide Energy Assessments (Bayer Material Science, Alcan/Pechiney, PPG, Arcelor Mittal - Weirton Steel)
- 8 Save Energy Now assessments (Bayer CropScience, DuPont-Belle, DuPont-Parkersburg, Dow (ex Union Carbide), Corhart Refractories, Quad/Graphics, Chemtura, Arcelor Mittal Steel-Weirton)

Energy Efficiency Research

■ Assessments

■ WVU Industrial Assessment Center

- Conducted 330+ industrial energy assessments
- The average recommended energy cost savings exceed \$75,000 per year per facility

- Plant-Wide Assessment at PPG identified energy savings measures worth \$2.2 million/year with a 14 month average payback period. \$1.7 million in savings to be implemented.

Energy Efficiency Research (Contd.)

- Glass Industry Assistance Program
 - Savings at Marble King of \$35,000 per year by installing recuperator, furnace doors, and other energy saving measures
- Corrosion Survey
 - Identify corrosion prevention methods that can be the subject of further research and testing determine their applicability to steel used in marine environments, harsh soil environments, and general construction applications
- Develop Novel Coating for SOFC Interconnects

Energy Efficiency Research (Contd.)

- Save Energy Now – West Virginia
 - Energy efficiency measures for host companies through reduced need for electricity, natural gas, and other fuels; one-on-one follow-up communications, training, and assistance on implementation strategies and quantification of resultant energy savings
- Development, Enhancement, and Training of GEPDSS Energy Profiler Decision Support Systems
 - Enhancement of computer model for sections of a galvanizing line that are affected by the use of different steel grades, especially the heating, soaking and rapid cooling sections of the pre-treatment furnace.

Energy Efficiency Research (Contd.)

- DOE project entitled “Multifunctional Metallic and Refractory Materials for Molten Metal Handling”
 - MSA 2020 Alloy Patent held by Metaullics Systems Company, L.P.
 - Weld Overlay Coating Process Patent held by WVU, Metaullics, ORNL
 - In-plant trials of hardware coated with MSA 2020 at Nucor-Arkansas, Nucor-Indiana, and Nucor-South Carolina
 - Software tool to evaluate energy and costs savings in galvanizing lines resulting from use of new materials
 - New Alloys and dross-cleaning procedures were developed for Galvalume process
 - High-temperature corrosion monitoring technology
 - Two new refractory materials for molten aluminum containment have been developed and successfully tested – Bonite and TCON
 - New Thermal Conductivity Technique Developed at ORNL Was Further Validated

IMF: Metallic Overlay



The 316L/2020 roll in maintenance stand prior to installation for in-line trial at Nucor's Crawfordsville Indiana, Plant

- MSA 2020 alloy made in powder form by Pyrotek-Metaullics
- Made into a MIG wire by Stoody
- Weld overlay directed by ORNL
- Machining by Duraloy
- Nucor Crawfordsville Test

IMF: Data Analysis with GEPDSS

- Specific energy consumption in MMBtu/ton for 8 lines
- Weeks of campaign and hours between shutdown and start of operation versus MMBtu/ton for a specific line
- Electricity and natural gas consumption in MMBtu/hr for 8 galvanizing lines during production and downtime for standardized production data
- Energy savings and dollar savings for 70 lines in U.S.
- Weeks of campaign and hours of shutdown versus Internal Rate of Return for a specific line and production data.

IMF: High-Temperature Electrochemical Method for Monitoring Molten Metal Corrosion

- Polarization, impedance, and cyclic voltammetry, etc. can be used to study high-temperature corrosion and dross formation
- Accurate predictions of lifetimes → improved preventative maintenance scheduling
- Understand rate-limiting steps in hardware degradation → development of improved materials
- Applicable to other liquid metal/immersed solid metal systems

For More Information

- IOF-WV website:

<http://www.iofww.nrcce.wvu.edu/>

- WVU IAC website:

<http://www2.cemr.wvu.edu/~wwwiac/>

Thank you!