October 2021

West Virginia University

Industrial Assessment Center

U.S. DEPARTMENT OF ENERGY

Newsletter

Executive Information

The work described in this newsletter is for the period of 08/01/2021 to 10/31/2021 based on the activities of the West Virginia University Industrial Assessment Center (WVU-IAC). The center supports and carries out activities that are funded by US DOE Industrial Assessment Center program, EPA's Pollution Prevention (P2) program and USDA's Rural Energy Audit Program. The center promotes "efficiency improvements" through structured on-sight assessments that target energy efficiency, environmental and process waste, lean and smart manufacturing. Technical assistance and training is also provided to the interested entities. Our clients range from local small businesses in the rural settings to small and medium sized enterprises (SME) across the state of WV.

Dr. Bhaskaran Gopalakrishnan along with the students at the industrial assessments.

Dr. Bhaskaran Gopalakrishnan [second from right] and Dr. Ashish Nimbarte [right] with the students of WVU-IAC.

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Inside this issue

Overview of Programs

IAC Program:

The Industrial Assessment Center at West Virginia University (WVU-IAC), is one of many centers around the country, funded by the U.S. Department of Energy to provide no-cost energy, waste, water, cyber security, and smart manufacturing assessments to small and mid- sized manufacturers. A team of students and professors collect data from facilities about various energy consuming equipment and model the facility in terms of energy and resource usage. Then, the WVU-IAC identifies the opportunities to save energy, reduce waste, and improve productivity through application of smart sensors and controls, and alleviate cyber security threats.

Small and medium sized manufacturers are eligible to receive a no-cost assessment provided by the WVU-IAC. The WVU-IAC team performs detailed process analysis to generate specific recommendations with cost and resource savings, implementation cost, and payback on investment. Within 60 days, the plant receives a confidential report detailing the analysis, findings and recommendations.

Eligibility for IAC Assessment:

- Within Standard Industrial Codes (SIC) 20-39 and NAICS 33-39
- Water and waste water treatment facility or institutional facility
- Within 3 to 4 hour drive from Morgantown
- Gross annual sales below $100 million
- Fewer than 500 employees at the plant site
- Annual utility bills more than $100,000 and less than $2.5 million
- No in-house professional staff to perform the assessment

More info about IAC Program

WV Office of Energy Sponsored Energy Assessments (WVOE):

This program caters to all businesses and government organizations in West Virginia. Activities include energy assessment and benchmarking. The assessments are provided at no cost to the businesses and organizations.

Recent assessments in West Virginia include those conducted for a textile-related manufacturing plant, glass manufacturing company, glassware manufacturing company, resource recovery facility and a CBD processing facility. We sincerely thank Ms. Karen Lasure, Program Manager at WVOE for continued support.

U.S. EPA Pollution Prevention (P2) Program:

Reduction of waste at the source level by providing Technical Assistance and Training is one of the most effective methods to assist facilities with identification, development and adoption of Pollution Prevention (P2) approaches.

The Industrial Management and Systems Engineering Program at West Virginia University offers Technical Assistance and Training Programs for the food and beverage manufacturing and processing facilities, and the Metal Manufacturing facilities in the state of West Virginia to assist facilities with identification, development and adoption of Pollution Prevention (P2) methods.

Technical Assistance program involves on-site P2 assessments. The project team makes a planned visit to the facility to assess and gather data on energy, water, material and manpower use. The data and inputs from the facility personnel is used to develop P2 recommendations. A detailed report based on the findings of the on-site visit are submitted to the facility within a few days from the on-site P2 assessment. The report contains several recommendations concerning

- Energy efficiency
- Water and material waste reduction

- Lean implementation
- Air Pollutants and Greenhouse Gas Evaluations

Training Workshops are organized to train businesses/facilities about the source reduction techniques to help them adopt and implement P2 approaches, and to increase the development, adoption, and market penetration of greener products and sustainable manufacturing practices.

- Participate in the Technical Assistance program and/or Training Workshops
- To learn more about the P2 program

USDA Program:

This program is specifically designed to provide energy efficiency assistance to agricultural producers and for -profit small businesses located in the rural parts of West Virginia. The project team conducts on-site energy audits specifically developed for agricultural producers and rural small businesses and a detailed energy assessment report is submitted to the client.

Eligibility: Rural agricultural producers and for-profit small business are eligible to receive energy audit through this program. A for-profit small business is defined as any business that employs less than 500 people in a designated rural area and makes under a certain revenue based upon the type of business.

Benefits: Our energy assessment recommendations can help save from 5 to 10 % of energy costs in areas of lighting, HVAC and building envelope thermographic analysis per year. The analysis of high energy consuming processes could result in even higher cost saving recommendations.
Using the energy assessment report, the clients can apply for financial assistance through USDA-REAP grants and guaranteed loans programs. The grants range from $1,500 to $250,000, and cannot exceed 25% of total project costs. The maximum guaranteed loan is $25 million, which may not exceed 75% of total project costs.

Audit costs: As a participant in this program the client is only expected to pay $125 for a full energy audit of their facility and will receive a comprehensive energy assessment report. This type of audit normally averages around $3,000 but funding from the USDA covers the majority of the cost.
More info about program

A Glimpse of this Cycle

- WVU-IAC receives a proposed $2.19 million in total project funding for the next five years to accomplish that and to train the energy workforce of tomorrow.
- WVU-IAC received the IAC 2021 "Center of Excellence Award" .
- Eight on-site assessments have been completed during this cycle under IAC, P2, and USDA programs.
- WVU-IAC students received certificates from U.S Department of Energy.
- WVU-IAC Ex-Research engineer and WVU alumnus Mr. Pradyumna Bettagere Jagadish started a new position as an Associate Energy Engineer at Enpowered Solutions.

Recommendations from On-site Assessments

The WVU-IAC has conducted several assessments at various manufacturing facilities in the states of West Virginia, Maryland, North Carolina, and Ohio. The team has given several energy efficiency, lean, waste, water and smart manufacturing recommendations to improve the functionality of the manufacturing facilities.

Sample Recommendations

IAC Assessment Recommendation (Maryland)

Upgrade Controls On Compressors

The facility has three air compressors among which two of them are 200 HP capacity and one is 100 HP capacity. Air compressor of 100 HP is equipped with variable speed drive. From the current consumption profile of both air compressors that the compressor is operating continuously without unloading. Installation of unloading controls, specifically on the 200 HP air compressor will enhance the energy efficiency of the air compressor. Also, the use of automatic sequencers will result in energy savings by operating only the minimum number of compressors required based on the pressure signal.

Energy Savings: 736,270 kWh/yr Electricity consumption, and 5,981 MMBtu/yr Natural Gas consumption is reduced as a result 2,288,284 lbs of CO_2 emission is reduced.

Total Savings per year: Energy Cost Savings: $96,204/yr.

Implementation Cost: $119,295

Payback Period: 15 months.

IAC Assessment Recommendation (West Virginia)

Optimize the Operation of Variable Frequency Drives on Baghouse Fans

The facility has one baghouse fan of capacity 125 HP that is made to operate at a fixed frequency of 50.5 Hz. It is desirable to have adjustable frequency drive on baghouse fans since the operational load is not constant on the baghouse fan. By operating the fan at a fixed frequency although a variable frequency drive (VFD) is installed on the system, the facility is not utilizing the advantages of a VFD. Hence, it is recommended to operate the motors at lower frequency when the requirement is low.

Energy Savings per year: 175,355 kWh/yr Electricity consumption is reduced as a result 384,027 lbs of CO_2 emission is reduced.

Implementation Cost: $12,340

Total Savings per year: Energy Cost Savings: $10,209/yr

Payback Period: 17 months.

IAC Assessment Recommendation (West Virginia)

Use High Efficiency Oxy-Fuel Technique

The facility has 10 natural gas furnace high capacity totaling up to 14.46 MMBtu/hr. It is recommended to use oxygen-fuel technique burning in the furnaces. The heat transfer rate due to radiation is a function of temperature difference between flame temperatures and the material being heated, each raised to the fourth power. Oxygen increases the flame temperature that greatly increases radiation from the flame, the already dominant mode of heat transfer which improves heat transfer in oxy-fuel combustion resulting in the natural gas savings and increase in efficiency.

Energy Savings: 105,148 kWh/hr Electricity consumption, and 26,064 MMBtu/yr Natural Gas consumption is reduced as a result 3,175,506 lbs of CO_2 emission is reduced.

Implementation Cost: $256,376

Total Savings per year: Energy Cost Savings: $97,798/ yr

Payback Period: 32 months

IAC Assessment Recommendation (West Virginia)

Recover the Exhaust Gas Heat from the Furnace to Preheat Combustion Air

The facility has 14 furnaces that has high stack temperatures. It is recommended to install a waste heat recovery system (heat exchanger, pressure controllers and ductworks) to recover the heat from the flue gases of these furnaces and redirect them to preheat the combustion air to offset the burner usage.

Energy Savings: 31,016 kWh/yr Electricity consumption, and 29,380 MMBtu/yr Natural Gas consumption is reduced as a result 3,387,865 lbs of CO_2 emission is reduced.

Implementation Cost: $178,981

Total Savings per year:$56,691/yr

Payback Period: 38 months.

USDA Assessment Recommendation (West Virginia)

Replace The Old Laundry Finishing Tunnel With An Energy Efficient Unit To Improve Productivity

The facility currently uses an old-fashioned laundry finishing tunnel that uses steam from the boilers to finish the clothes at the end of the laundry process. it is difficult to maintain the old laundry finishing tunnel due to the unavailability of parts. Hence the team recommends the facility to replace it with an energy efficient laundry dryer that runs on electricity and is more energy efficient.

Energy Savings: 64,182 kWh/yr Electricity consumption, and 1,805 MMBtu/yr Natural Gas consumptionis reduced as a result 227,342 lbs of CO_2 emission is reduced.

Implementation Cost: $33,114

Total Savings per year: Energy Cost Savings: $20,591/yr

Payback Period: 7 months.

Cyber Security

Cyber terrorism is a real and growing threat. Standards and guides have been developed, vetted, and widely accepted to assist with protection from cyber attacks. WVU-IAC has conducted cyber security assessment for one of the participating SMEs using the Industrial Control Systems Cyber Security Assessment Tool. The tool promotes awareness of cybersecurity risk areas associated with Industrial Control Systems (ICS) in industrial facilities. Tool includes 20 simple questions to characterize ICS and plant/facility operations and produces a preliminary assessment of risk (high, medium, or low). It also generates a customized list of action items to help improve preparedness for a cybersecurity event .

Recommendations given using CSET Tool

Area of concentration: People:

- Work with your vendor to determine how strong their internal security practices are and whether or not their remote access is a risk for your plant. Consider implementing an enhanced login procedure for vendors to be able to access systems remotely.
- Critical equipment should be protected with firewalls, secure hardware that does not allow for memory transfer with USBs or other external media devices, and alarms that sound when operating under unusual parameters.
- Speak with your vendors about their cybersecurity training, practices, and certifications. Consider adding a clause requiring cybersecurity training in future contracts with vendors.
- Develop training procedures for vendors who work on-site that inform them about cybersecurity best practices. You could also develop guidelines on what equipment vendors are allowed to bring into your facility/plant to increase on-site security.

Area of concentration: Process

- Work with your plant manager to create a central repository, containing information on all IT systems and ICS. Consider maintaining this resource offline, separate from the plant's IT system (i.e., on an isolated computer, on a mainframe, or in a physical file), to ensure that information remains accessible when the IT system is shutdown during a cyberattack or system outage.
- Explore which, if any, software programs have the ability to schedule automatic scanning of equipment and select those settings.
- Consider restricting the use of external media devices for cybersecurity issues to reduce contamination.

Area of concentration: Technology:

- Install firewalls to control data flow between different machinery components and ICS computers.
- Ensure that remote connections are made using a virtual private network or VPN. Consider implementing an enhanced login procedure for vendors to be able to access systems remotely.
- Regularly scan PCs for malware and viruses. For added protection, consider isolating the PCs from internet and email to avoid outside contamination .

Center Activities.

WVU-IAC has conducted assessments in West Virginia, North Carolina, Maryland, and Ohio having the following NAICS codes.

NAICS Code	State
311920	MD
562920	WV
327212	WV
327211	WV
313110	NC
326299	OH
812320	WV
325411	WV
322100	WV

Resources available for efficiency enhancement

1) AIRMASTER+
2) Pumping System Assessment Tool
3) Fan System Assessment Tool
4) Mechanical Insulation Assessment and Design Calculators
5) Steam System Tool Suite (SSTS)
6) Industries Facilities Scorecard
7) Plant Energy Profiler/Integrated Tool Suite (ePEP)
8) Combined Heat and Power(CHP) Application Tool
9) NOx and Energy Assessment Tool (NxEAT)

Student Activities:

- New students Mr. Prakash Bisht, Mr. Sabin Wagle and Ms. Kadee Mueller have joined WVU-IAC in September 2021.
- WVU-IAC student Ms. Roseline Mostafa, who has joined IAC in January 2021 has been promoted to Lead student, and Mr. Nahian Ismail Chowdhury, who has joined IAC in April 2021 has been promoted to Co-Lead student.
- Then WVU IAC Lead student Mr. Vivash Karki and Co-Lead student Mr. Saroj Lamichhane have graduated with a Master's Degree in Industrial Engineering. Vivash joined WVU-IAC in August 2019 and Saroj joined in January 2020.

Other Events

- Dr. Todd Rossi and Mr. Subhash Kungumaraj from Rutgers Center for Advanced Energy Systems (CAES) University, Field Manager for the DOE AMO Industrial Assessment Center (IAC) program, visited the WVU IAC on August 10th, 2021. They've interacted with WVU-IAC directors and students.

Awards and Recognition:

- WVU-IAC received the "Center of Excellence Award" from The Advanced Manufacturing Office (AMO) of the Office of Energy Efficiency and Renewable Energy (EERE), U.S. Department of Energy in recognition of the Industrial Assessment Center's Director and staff for its outstanding contributions to industrial energy efficiency.

Partners of WVU-IAC:

WV Office of Energy	USDA	EPA
WV ASHRAE	Oakridge National Laboratory	WV DEP
WV MEP	EEWV	

The Team of WVU-IAC

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