July 2022

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 04/01/2022 to 06/30/2022 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 onsite 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.

Website: WVU-IAC
Email: Dr. Bhaskaran Gopalakrishnan, Director, WVU-IAC
bgopalak@mail.wvu.edu
Dr. Ashish Nimbarte, Assistant Director, WVU-IAC
ashish.nimbarte@mail.wvu.edu

The newsletter is prepared by Mr. Raghu Vamshi Sunkasari in collaboration with the WVU-IAC students and Directors. The WVU-IAC is located in the Statler College of Engineering at WVU.

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 Advanced Manufacturing Office(AMO) of the Office of Energy Efficiency & Renewable Energy(EERE) within U.S. Department of Energy(DOE) 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 local supermarket chain, automotive filter and module manufacturing facility, a specialty fasteners manufacturing facility, cabinet manufacturing facility, outdoor recreational goods distribution center, natural gas compression facility, an educational institution, a brewery, an economic development agency, a distillery, a wooden case and cabinets manufacturing facility and a natural gas production related metal fabrication manufacturing 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 the following:

- 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

- Sixteen on-site assessments have been completed during this cycle under IAC, USDA, E3 and site visit programs.
- WVU-IAC students received certificates from U.S Department of Energy.
- WVU-IAC alumnus Mr. Gage Donovan started a new position as an Energy Efficiency Engineer at Resource Innovations.

Recommendations from On-site Assessments

The WVU-IAC has conducted several assessments at various manufacturing facilities in the states of West Virginia, Virginia and Pennsylvania. 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 (Pennsylvania)

Replace Transformer-Rectifier Arc Welders with Inverter Arc Welders

Currently, the company uses older technology, arc welders to do metal inert gas (MIG) welding and tungsten inert gas (TIG) welding in their manufacturing process. Older arc welder power sources use transformer-rectifier equipment with huge step-down transformers, which makes them hefty and susceptible to overheating. The assessment team recommended that transformer-rectifier arc welders be upgraded with inverter arc welders. Manufacturers say that inverter-based arc welders are more efficient than transformer-rectifier-based arc welders and hence save energy.

Energy Savings: 237,656 kWh/yr electricity consumption, and, 2,016 MMBtu/yr natural gas consumption is reduced, as a result 748,275 lbs of CO_2 emission is reduced.

Implementation Cost: $149,526

Total Savings per year: Energy Cost Savings: $53,742/yr

Payback Period: 34 months.

IAC Assessment Recommendation (Pennsylvania)

Improve the Controls on the Air Compressor

There are three air compressors at the plant. To meet the needs of the plant, two air compressors, each with a capacity of 75 HP, are in operation, while a third, with a capacity of 50 HP, is used as a backup. All of the compressors were operating at partial load without being unloaded at the same time. As a result, the system was consuming more energy than was required. So the assessment team recommended to use sequencer in the air compressors to run the minimum number of air compressors with full load to save energy.

Energy Savings per year: 150,664 kWh/yr electricity consumption, and, 2,347 MMBtu/yr natural gas consumption is reduced, as a result 595,165 lbs of CO_2 emission is reduced.

Implementation Cost: $64,984

Total Savings per year: Energy Cost Savings: $22,747/yr

Payback Period: 34 months.

IAC Assessment Recommendation (Pennsylvania)

Install Isolation Valves to Isolate Some Plant Areas from the Compressors

In three major zones, the facility has six air compressors. It is technically possible to cut off some production areas from the compressed air supply during these non-production hours without causing any equipment failure, according to discussions with plant staff. On the production floor, this compressed air was distributed to 5 locations (MSC - Warehouse, Assembly, Fab and Paint, Recon/PDI Building, and Building #2). Compressed air is necessary for some weekend activities, primarily for maintenance. In order to lower current energy consumptions, the assessment team recommended installing isolation valves to isolate specific process areas from the compressed air supply during non-production periods.

Energy Savings: 1,578,334 kWh/yr of electricity consumption, and, 12,666 MMBtu/yr natural gas consumption is reduced, as a result 4,887,809 lbs of CO_2 emission is reduced.

Implementation Cost: $148,862

Total Savings per year: Energy Cost Savings: $697,095/yr

Payback Period: 31 months.

USDA Assessment Recommendation (West Virginia)

Tightening the Building Envelope

A building envelope is the separation of a structure's interior and exterior. Following a discussion with plant personnel on the day of the assessment, it was discovered that the walls and roof were insulated in 1986 with rigid foam of 2 and 3 inch thickness, respectively, and that the front door and kitchen windows are single paned. Tightening the building envelope by insulating the walls and roof and replacing single pane glass in doors and windows with double pane glass will reduce heat loss in the winter and cooling loss in the summer, lowering heating and cooling expenses for the property.

Energy Savings: 49,020 kWh/yr Electricity consumption, and, 144 MMBtu/yr Natural Gas consumption is reduced as a result 123,626 lbs of CO_2 emission is reduced.

Implementation Cost: $28,355

Total Savings per year: Energy Cost Savings: $5,766 /yr

Payback Period: 60 months.

Assessment Recommendation (West Virginia)

Worker Heat Stress Reduction Through Proper Ventilation System Design

During the summer, the temperature inside the facility rises to roughly 110 degree F - 120 degree F. This causes heat stress and uncomfortable working conditions for the workers.The issue is caused by a lack of air flow inside the facility and the uninsulated hot surfaces of the furnace, which are raising the temperature of the surrounding air via convection. Installing exhaust fans on existing ventilation louvers to guarantee adequate air flow inside the facility. Furthermore, insulating the hot furnace surfaces to decrease heat loss, which is responsible for increasing the surrounding temperature, resulting in natural gas savings for operating the furnaces. The temperature in the Targeted Area, where workers are currently suffering from heat stress, will most likely drop to roughly 80 degrees F as a result of these activities.

Implementation Cost: $211,970

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, Virginia, and Pennsylvania having the following NAICS codes.

NAICS Code	State
PA	332111
PA	324191
PA	423810
VA	314110
WV	445110
WV	3363
WV	33332
WV	337110

NAICS Code	State
WV	486210
WV	561
WV	312120
WV	926110
WV	312140
WV	493110
WV	337110
WV	3329

- WVU-IAC has been designated by the DOE as a mentor IAC to the Industrial Assessment Center at the University of Louisville. Over the past year, the WVU-IAC has assisted the Louisville IAC as they began developing their new center. WVU-IAC is pleased to respond to recent queries from the Industrial Assessment Centers at Arizona State University, University of Connecticut, and University of Syracuse.

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:

- WVU-IAC lead student Ms. Roseline Mostafa participated in the "**Application of Energy Efficiency and Women in Energy Leadership: U.S. Department of Energy's Industrial Assessment Center (IAC) Program**" seminar on June 30 2022. Roseline is one of the speakers in the second part of the session titled "**Energy Efficiency And Women In Leadership In The IAC**". In this session Roseline talked about her experience at WVU-IAC, leadership role as a lead student at IAC, energy equity, the role of IAC in providing leadership opportunities to the students and how WE2 program helped her with mentoring and its influence on the leadership role at IAC . She also answered the questions of the audience during the interactive question and answer session.
- New student Mr. Md Rassel Sarker has joined WVU-IAC in May 2022.
- WVU IAC student Mr. Sabin Wagle, who joined IAC in August 2021 has been promoted to Co-Lead student in May 2022.
- WVU-IAC welcomes graduate student Ms. Fabiha Islam for the Summer 2022.
- WVU-IAC student Mr. Gage Donovan graduated with a Master's degree in Industrial Engineering in April 2022. Gage joined WVU-IAC in August 2019.
- WVU-IAC student Ms. Hailee Hammerquist graduated with a Bachelor's degree in Environmental and Energy Resources Management in April 2022. Hailee joined WVU-IAC in November 2021.
- Then WVU-IAC Co-Lead student Mr. Nahian Ismail Chowdhury joined Volvo Group Trucks as an Environment and Energy Intern this Summer of 2022. Nahian joined the IAC in April 2021. Nahian will be working on decarbonization projects for Volvo, as a part of his MS thesis.

Partners of WVU-IAC:

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

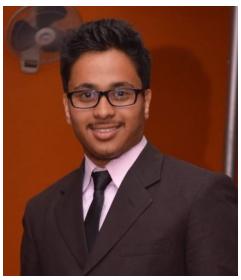
The Team of WVU-IAC

Dr. Bhaskaran Gopalakrishnan
Director, WVU-IAC
Website: Dr. Gopala
Email: bgopalak@mail.wvu.edu
Phone Number: 304-293-9434

Dr. Ashish D. Nimbarte
Asst. Director, WVU-IAC
Website: Dr. Nimbarte
Email: ashish.nimbarte@mail.wvu.edu
Phone Number: 304-293-9473

Students

Ms. Roseline Mostafa
Lead Student



Mr. Sabin Wagle
Co– Lead Student

Ms. Fabiha Islam

Mr. Prakash Bisht

Mr. Raghu Vamshi Sunkasari

Mr. Md Rassel Sarker