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West Virginia University

Industrial Assessment Center

U.S. DEPARTMENT OF ENERGY

Newsletter

Dr. Bhaskaran Gopalakrishnan along with the students at

Executive Information

The work described in this newsletter is for the period of 07/01/2023 to 11/30/2023 based on the activities of the West Virginia University Industrial Assessment Center (WVU-IAC). The WVU-IAC supports and carries out activities that are funded by US DOE Industrial Assessment Center 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, decarbonization, resiliency planning, electrification and smart manufacturing assessments to small and mid- sized manufacturers. 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.

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The newsletter is prepared by Mr. Nagendra Sanka 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 Office of Manufacturing and Energy Supply Chain MESE) 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.

A Glimpse of this Cycle

- Ten 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.
- Dr. Bhaskaran Gopalakrishnan, Director, WVU-IAC received an award for 2023 AEE Regional Award for Energy Professional Development in the MidAtlantic & Southeast US.

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 (Virginia)

Reduce Outside Ventilation Air for All Exhaust, Truck Test Area, and Paint Booth Exhaust
The facility currently comprises five Air Rotation Units (ARUs) and one paint booth burner, all of which intake outside air. The exhaust system for the truck test area utilizes a combination of outside air and return air. During winter, these units draw in cold fresh air from the outside. The primary function of the ARUs and paint booth burner unit is to compensate for the air that has been exhausted by various exhaust systems within the plant and paint booth. Maintaining constant pressure in the paint booth necessitates coordinated operation between the paint booth ventilation and ARU systems. However, the crucial aspect of air balance in ARU systems is at times overlooked. Regular monitoring and rebalancing of the system are essential to ensure each area receives the appropriate amount of air. Based on the assessment team's recommendations, it is advised to decrease the outside ventilation air for all exhaust, including the truck test area, and also reduce the percentage of fresh air intake in the paint booth exhaust. This adjustment aims to mitigate the heating and cooling load on the facility.

Energy Savings per year: 7,969 kWh/yr electricity consumption, and, 441 MMBtu/yr natural gas consumption is reduced, as a result 50,005 lbs of CO_2 emission is reduced.

Implementation Cost: $13,814

Total Savings per year: Energy Cost Savings: $5,594/yr

Payback Period: 30 months.

IAC Assessment Recommendation (Ohio)

Replace the Diaphragm Pumps with Electric Pumps

The plant uses pumps, which expend energy to raise, transport, or compress fluids. They operate by some mechanism (typically reciprocating or rotary) and consume energy to perform mechanical work in moving the fluid. The assessment team has recommended utilizing diaphragm pumps with more energy-efficient electric pumps. This action will reduce compressor energy usage and thus result in energy cost savings. Additionally, diaphragm pumps are known for their precise metering capabilities, enhancing the overall efficiency and accuracy of fluid transfer processes in the plant.

Energy Savings: 73,674 kWh/yr of electricity consumption, and, 251 MMBtu/yr natural gas consumption is reduced, as a result 88,777 lbs of CO_2 emission is reduced.

Implementation Cost: $14,800

Total Savings per year: Energy Cost Savings: $73,674/yr

Payback Period: 31 months.

IOF Assessment Recommendation (West Virginia)

Replace Existing Heating Units with More Efficient Units

The current facility utilizes a 20-kW heating unit that has been operational for 20 years. The team recommends installing a more energy-efficient heating unit to cut down on energy consumption costs and retire the existing system. While the cooling system is a decade old, its efficiency may not match the latest models available. Over time, the Energy Efficiency Ratio (EER) and efficiency of heating units degrade, making timely replacement crucial to avoid costly repairs and increased electricity bills. The estimated base efficiency of the existing heating unit with heating coils from 20 years ago is approximately 95%. The assessment team recommended to replace the existing heaters units with energy efficient air conditioning units to save energy usage costs.

Energy Savings: 43,458 kWh/yr Electricity consumption, and, 148 MMBtu/yr Natural Gas consumption is reduced as a result 95,173 lbs of CO_2 emission is reduced.

Implementation Cost: $6,130

Total Savings per year: Energy Cost Savings: $5,337/yr

Payback Period: 60 months.

Assessment Recommendation (West Virginia)

Recover More Condensate from the Condensate Recovery System

The facility has three natural gas-fired steam boilers, with two primarily in use, having input capacities of 6.30 MMBtu and 4.20 MMBtu. A combustion analyzer was employed to assess boiler performance, measuring combustion efficiency, stack temperature, and oxygen content in flue gas. The current condensate recovery system is at 60%, with existing leaks hindering optimal recovery. Repairs could increase recovery to 80%, resulting in a 20% fractional increase. This enhanced condensate recovery aims to yield energy savings by reducing the need to heat make-up water and lowering chemical treatment costs. The assessment team recommended to Recover more condensate liquid which is currently being lost through leaks by repairing all the leaks and using the existing condensate recovery system. The potential savings are due to the reduced energy for heating of make-up water, the cost of the water, and for reduced chemical treatment costs.

Energy Savings: 817 MMBtu/yr Natural Gas consumption and 1,135,338 gallon/yr of water is reduced as a result 8,319 lbs of CO_2 emission is reduced.

Implementation Cost: $75,000

Total Savings per year: Energy Cost Savings: $17,471/yr

Payback Period: 52 months.

IAC Assessment Recommendation (Virginia)

Use Cooling Tower for Free Cooling instead of Chiller When Possible

Currently, the facility is using two chillers, with one serving as a backup unit. The primary chiller operates throughout the production time of 16.5 hours per shift, specifically for space cooling. The assessment team has recommended utilizing a cooling tower for free cooling whenever possible. Cooling towers are employed to dissipate heat from air conditioning or industrial process systems. While many air conditioning systems operate only during the summer cooling season, there are numerous air conditioning and process systems that require cooling year-round. In some cases, the entire cooling system is necessary to operate during the winter.

Energy Savings: 16,407 kWh/yr electricity consumption, and, 56 MMBtu/yr natural gas consumption is reduced, as a result 10,648 lbs of CO_2 emission is reduced.

Implementation Cost: $6,000

Total Savings per year: Energy Cost Savings: 1,242/yr

Payback Period: 58 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, Virginia, Ohio having the following NAICS codes.

State	NAICS Code
VA	336120
OH	326299
WV	321912
WV	332999
WV	445110
WV	3363
WV	33332
WV	337110

State	NAICS Code
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 was selected as a recipient of this year's Award by DOE for Outstanding Achievement in Energy Engineering by an Industrial Assessment Center . Roseline Mostafa is pursuing her PhD in Industrial Engineering under the guidance of Dr. Bhaskaran Gopalakrishnan, working in the area of aggregate planning subject to real time utility rates in a deregulated environment.
- New student Mr. Samuel Moses has joined WVU-IAC in July 2023.
- WVU IAC student Mr. Md Rassel Sarker, who joined IAC in May 2022 has been promoted to Co-Lead student in August 2023.
- WVU-IAC welcomes graduate student Mr. Bibek Prajapati, Mr. Nishan Adhikari, Mr. John Recktenwald and for the Fall 2023.
- WVU-IAC student Mr. Nahian Ismail Chowdhury graduated with a Master's degree in Industrial Engineering in May 2023. Gage joined WVU-IAC in April 2021.
- Mr. Sabin Wagle successfully completed his thesis defense on Synergistic Analysis of Equest Based Building Energy Modeling and Benchmarking.
- Mr. Prakash Bisht successfully completed his thesis defense on Parametric Energy Efficiency Impact Analysis of Industrial Process Heating using MEASUR.
- WVU-IAC student Mr. Sabin Wagle, and Mr. Prakash Bisht graduated with a Master's degree in Industrial Engineering in August 2023.

Partners of WVU-IAC:

Federal & State Organizations :

WV Office of Energy USDA Oak Ridge National Laboratory Lawrence Berkeley National Lab

Industry Partners:

Lehigh University IAC ILZRO Volvo Group Legrand Blenko Glass Paul Wissmach Glass Simonton Windows & Doors Wheeling Nippon Steel and others.

Local entities, energy service providers and other organizations.

WVMA WVU Industrial Extension Baltimore Gas and Electric and others .

The Team of WVU-IAC

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