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West Virginia University

Industrial Assessment Center

U.S. DEPARTMENT OF ENERGY

Newsletter

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

Executive Information

The work described in this newsletter is for the period of 11/01/2021 to 01/31/2022 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 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.

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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 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 hand tools manufacturing plant, metals processing facility, metal packaging facility, gourmet salt-producing company and a metal stamping 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" .
- Ten 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.

Recommendations from On-site Assessments

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

Improve the Controls on the Compressor

The facility has three air compressors with 250 hp capacity. All three were running at the same time with partial load without unloading. As a result the system was using more energy than necessary. 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: 9,011,795 kWh/yr Electricity consumption, is reduced as a result 19,735,831 lbs of CO_2 emission is reduced.

Total Savings per year: Energy Cost Savings: $483,574/yr.

Implementation Cost: $656,566

Payback Period: 17 months.

IAC Assessment Recommendation (Ohio)

Install a Capacitor Bank to Reduce the Electrical Cost

The facility currently has lower power factor value of 84% which resulted in extra energy cost. Lower power factor means high kVAR that causes power loss in generation and transmission, for which utility companies charge the customers to compensate for these losses. The team proposed to install a capacitor bank that will improve power factor to 95% lower overall electrical energy costs.

Energy Savings per year: 398,903 kWh/yr Electricity consumption, and, 2,869 MMBtu/yr Natural Gas consumption is reduced, as a result 1,197,795 lbs of CO_2 emission is reduced.

Implementation Cost: $56,611

Total Savings per year: Energy Cost Savings: $31,769/yr

Payback Period: 22 months.

IAC Assessment Recommendation (West Virginia)

Stochiometric Air-Fuel Ratio for Forge Furnaces

From the data given by the plant personnel the current burning condition inside the forge furnace was found to be rich. Rich burning only uses excess natural gas without providing any additional benefits. Further due to rich burning environment there is a possibility of building up CO. Hence it was recommended to adjust air-fuel ratio in the furnaces to have stochiometric burning condition.

Energy Savings: 75,882 kWh/yr of Electricity consumption, and, 1,919 MMBtu/yr Natural Gas consumption is reduced, as a result 383,029 lbs of CO_2 emission is reduced.

Implementation Cost: $31,756

Total Savings per year: Energy Cost Savings: $20,729/yr

Payback Period: 19 months

IAC Assessment Recommendation (West Virginia)

Use Outside Air for Air Compressor Intake to Reduce HVAC Load

At present the facilities air compressors take inside air that are cooled and conditioned by HVAC units. If outside air is used for intake in the air compressors it will reduce the excess air that was conditioned by the HVAC units thus reducing their load. Moreover the outside air are generally colder air and denser which makes it easier for compression. Hence the air compressors will need less energy.

Energy Savings: 221,455 kWh/yr Electricity consumption is reduced as a result 484,986 lbs of CO_2 emission is reduced.

Implementation Cost: $47,991

Total Savings per year: Energy Cost Savings: $24,360

Payback Period: 24 months.

P2 Assessment Recommendation (West Virginia)

Evaporate wastewater from cutting fluid

The facility uses cutting fluids in their machine operation which are later disposed by a separate disposal company. The cutting fluid generally contains 90% of water. Therefore it was recommended for the facility to install a evaporator that will evaporate the water from cutting fluid thus reducing the quantity. So this will reduce the amount of waste as a cutting fluid and will also reduce the disposal cost.

Energy Savings: 736,270 kWh/yr Electricity consumption, and 5,981 MMBtu/yr Natural Gas consumption is reduced as a result 164,044 lbs of CO_2 emission is reduced.

Implementation Cost: $33,419

Total Savings per year: Energy Cost Savings: $14,763/yr

Payback Period: 27 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, and Ohio having the following NAICS codes.

NAICS Code	State
313110	NC
326299	OH
332216	WV
336370	WV
238210	WV
423510	WV
3119	WV
6111	WV
332710	WV
332812	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 student Ms. Hailee Hammerquist has joined WVU-IAC in November 2021.
- WVU-IAC students Ms. Roseline Mostafa, and Mr. Gage Donovan have received certificates from the DOE for successfully completing six industrial assessments.

Awards and Recognition:

- Dr. Bhaskaran Gopalakrishnan has received over 1,000 citations for his work in the field of Energy Efficiency, Energy Management, Waste Reduction, Manufacturing Systems, and Productivity Improvement.
- WVU-Industrial Assessment Center (WVU-IAC) received the 2021 "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.

Dr. Michael Muller, Field Manager for the IAC program handed the plaque to Dr. Bhaskaran Gopalakrishnan.

IAC Center of Excellence Awards 2021, and 2005.

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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