

Energy Savings Opportunities Galvanized Steel Manufacturing

The Industrial Assessment Center (IAC) at West Virginia University (WVU) discovered opportunities to decrease energy usage and enhance corporate competitiveness. This facility is a galvanized steel manufacturing facility located in Pittsburgh, Pennsylvania. The assessment team focused on the galvanizing process as well as the energy support systems. The recommendations at this facility may serve as a template for potential savings at similar facilities.

Company Background

Steel Dynamics, Inc., a manufacturing facility located in Pittsburgh, Pennsylvania, is a leading manufacturer of galvanized steel products.

Summary

As a result of the energy assessment, energy efficiency recommendations were made for reducing cost and improving productivity. The following energy saving opportunities were identified at the facility:

- Replace existing burners with energy efficient self-recuperative burners.
- Installation of an air-curtain on the annealing furnace opening.
- Retrofit transformer type welder with inverter arc welder.
- Installation of photosensors for lights.
- Replacement of existing lighting with LEDs with occupancy sensors in designated areas.
- Improvement of controls on the compressor.
- Recycle water used for reducing section pyrometer.
- Establish a repair/replace decision policy for the motor management



system.

- Replacement of drive belts on motors with energy-efficient cog belts.
- Reduction of compressor setpoint for all compressors.

Seven of the nine recommendations made by the team were planned to be implemented, resulting in the reduction of energy consumption by 933,983 kWh of electricity and an annual cost saving of \$65,032. Additionally, the recommendations save water/sewer which results in annual cost savings of \$8,651.

Energy Conservation Analysis

In general, the management and employees at the facility are “energy conservation” oriented and follow many good practices to save energy. For example, the plant used LED lighting in production areas, vibration testing on the motors was conducted every month, and effective waste heat recovery was practiced. The assessment team was pleased with the level of energy efficiency awareness amongst plant personnel.

The recommendations identified by the team were discussed with the plant personnel on the assessment day. The plant

personnel were encouraged to contact IAC-WVU for further discussions and/or clarification required with respect to the implementation of the assessment recommendations.

Benefits at a Glance

The implemented measures will result in annual electricity savings of 903,177 kWh, and annual cost savings of \$71,466. Average Payback is 24 months. Implemented recommendations will reduce carbon dioxide emissions by 1,977,958 pounds.

Lighting and Occupancy sensors

The assessment team suggested installing occupancy sensors in designated areas. The plant personnel appreciated the value in the efficient use of occupancy sensors for lighting. Occupancy sensors reduce the electrical usage for lighting during unoccupied periods and hence are expected to contribute towards a productive workforce, while simultaneously saving energy. Implementing occupancy sensors in the facility has increased the efficiency of the lighting system, reducing energy usage.

Process Equipment

Reducing the pressure delivered to compressed air consuming equipment and processes lowers the volume of air consumed by the system. The assessment team measured the air pressure at different locations in the facility using pressure transducers. This recommendation has reduced the facility's compressed air usage significantly, yielding significant energy savings.

Similarly, improving the controls on the compressor and having adequate storage can decrease the unloading value for a longer amount of time. The assessment team used AIRMaster+ for estimating the full load amperage. This recommendation will add to the efficiency of the system and makes it easier for the compressor to unload.

Recycled Water

Recycling the water used for cooling the pyrometer in the reducing section pyrometer has resulted in significant water savings.

Welding Equipment

Inverter arc type welding uses inverter power sources that are multi-functional, lighter, more flexible, and provide a superior arc. Welding power sources use electricity when welding (arc-on) and idling. Modern inverter power sources have energy conversion efficiencies near 90 percent.

This recommendation would result in a power source that is far more portable and easier to operate, multi-functional rather than mono-functional, create superior arcs and combine higher-quality welds with longer arc-on times.

Preventive Maintenance Savings

Electrical motors are widely used equipment in manufacturing facilities. The assessment team recommended the development of a repair/replacement policy for motors.

By implementing a repair versus replace policy effectively using DOE Best Practices tool Motormaster+, the average energy consumption of the motors can be reduced over time.

Replacing the drive belts on the motors with high-efficiency cog belts on motors with a horsepower rating of greater than or equal to 3-hp will help minimize the losses of energy within the electric motors. Cog belts have less slippage and can bend easily causing less energy loss through the drive shaft inside the motor.

Assessment Savings Tabulated

The following table presents the annual cost savings that have resulted in Steel Dynamics Inc. due to the planned implementation of recommendations. The energy conservation opportunities that were identified in the assessment and were implemented will reduce annual electric usage by 903,177 kWh. This translates into an annual cost savings of \$71,466 and an annual reduction in CO₂ emissions of 1,977,958 pounds.

Implementation of Recommendations

Planned Assessment Recommendations	Annual Conservation (kWh)	Total Annual Savings (\$)	Capital Costs (\$)	Simple Payback (months)
Retrofit Welder Technology from Transformer Type to Inverter Arc	404,838	28,868	78,000	33
Replace the Existing Lighting with LED and Install Occupancy Sensors in Designated Areas	229,141	17,233	58,107	40
Improve the Controls on the Compressor	160,732	9,387	4,000	6
Recycle Water used for Reducing Section Pyrometer	-	8,651	4,100	6
Establish Repair/Replace Decision Policy through Motor Management System	73,660	4,849	738	2
Reduce Compressor Pressure Set Point	21,603	1,540	100	1
Replace Drive Belts on Motors with Energy Efficient Cog Belts	13,203	938	0	0
Total	903,177	71,466	145,045	24