EATON CORPORATION

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COMPANY BACKGROUND

Eaton Corporation is a leading global manufacturer specializing in electrical and industrial products. The electrical sector produces circuit breakers, switchgear, and related electrical products, while the industrial sector creates hydraulic, aerospace, and vehicle products. The Shenandoah, Iowa, plant is part of Eaton Corporation's vehicle group and supplies transmissions for several major manufacturers of heavy-duty trucks.

PROJECT BACKGROUND

Heat-treat furnaces in the Shenandoah plant, used to treat parts for the transmissions, have been in use since production began at the plant more than 40 years ago. Aging has resulted in reduced efficiency and more energy (natural gas) required for operation. The intern researched ways to improve the operating efficiency of the furnaces to reduce natural gas usage and overall emissions at the plant.

INCENTIVES TO CHANGE

Eaton Corporation has a high commitment to sustainable practices and strives to exceed environmental goals whenever possible. To achieve this goal, the company has a focus on reducing the use of natural resources, including natural gas. The furnaces used in the heat-treat process account for a major portion of natural gas used at the plant. Increasing the operating efficiency of the furnaces will reduce consumption of natural gas and help the company achieve their environmental goals.

RESULTS

Prioritizing Furnace Usage: The intern collected data to calculate the efficiency of each individual furnace. The data shows that while the furnaces are all the same make and model, they are not operating at the same level of efficiency. Staging the furnace usage based on operating efficiency would keep the most efficient furnace operating full-time and allow the less efficient machines to be turned down to 'idle' when not in use. This process modification could result in an annual savings of $3,610.

Additional savings could be achieved by determining an ideal idling temperature for the furnaces. This would minimize gas usage in idle mode yet allow the furnace to reach full-temperature in a short amount of time to meet production demands. Heat-recovery from the furnace exhaust could also provide additional savings and should be evaluated once operating efficiency is optimized.

Replacing Outer Doors: The outer doors of the furnaces are not sealing properly and a large amount of heat is lost around the seals. Replacing the outer doors is very costly and numerous variables can affect the energy usage, therefore the actual savings is not quantifiable at this time. The company has begun to replace the outer doors and metering is in place to quantify the reduction in natural gas usage and actual cost savings associated with this improvement.

Investigating Furnaces: Since all of Eaton's furnaces are the same make and model, theoretically they all have the capacity to operate at the same efficiency. Improvements being addressed to correct the variances include re-insulating, and optimizing the air-to-gas mixture. The expected annual savings is $21,590.

Dedicated Air Line: Opportunities to reduce energy usage at the plant were also identified in the compressed air system. Installing a dedicated air line directly to the furnaces would enable a reduction in the overall air pressure supplied to the remaining plant systems.

Compressor Heat Recovery: Recovering the heat from the air compressors for use elsewhere in the process could save approximately 69,230 therms annually.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN METRIC TONS

TOTAL FOR ALL SECTORS							
CO_2	SO_2	CH_4	N_2O	CFC	NO_X	VOC	PM_{10}
3.01	0.09	4.98	0.02	0.04	0.01	0.02	0.01

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
PRIORITIZING FURNACE USAGE	$3,610	9,110 THERMS	IMPLEMENTED
REPLACING OUTER DOORS	UNKNOWN	UNKNOWN	IN PROGRESS
OPTIMIZING FURNACES	$21,590	54,530 THERMS	FURTHER RESEARCH NEEDED
DEDICATED AIR LINE	$6,500	138,500 KWH	RECOMMENDED
COMPRESSOR HEAT RECOVERY	$27,388	69,230 THERMS	FURTHER RESEARCH NEEDED