JELD-WEN

PARKER WELLS
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY

GRINNELL

COMPANY BACKGROUND

JELD-WEN Door Systems is a manufacturer of interior and exterior doors. The plant is located in Grinnell, Iowa, and operates 16 hours a day, 5 days per week, with first and third shifts. The first shift consists of about 15 office employees and 180 floor employees and the third shift has about 100 employees. The facility is roughly 280,000 square feet in area and the plant is divided into three sections for interior doors, pre-hung doors, and exterior doors.

PROJECT BACKGROUND

The goal of the main project at JELD-WEN was to increase the efficiency of the compressed air system. It was known beforehand that leaks were an ongoing issue in the plant; and other factors, such as blow-off operations and low available air storage, also affected the system's efficiency and performance. The intern also examined peak demand loading. Lack of major spikes in demand led to investigation of motor efficiencies and other possible large power demanders.

INCENTIVES TO CHANGE

At JELD-WEN, management understands the importance of reducing waste and pollution, as previous programs and projects have demonstrated. High utility costs and demand charges provide additional incentive to make changes, as reductions in usage can result in significant savings for the company. Safety is the highest priority at JELD-WEN, so maintaining a workplace with minimal hazards is imperative.

RESULTS

Repair Compressed Air Leaks: A survey of leaks was performed to quantify current leak rates in the plant. Using an ultrasonic leak detector, 102 leaks were found, which accounted for approximately 32 percent of compressed air costs. Repairing these leaks could save the company approximately $17,621 per year in operating costs.

Leak Detection/Repair Maintenance Plan: Plans have been made for a more formal leak detection and repair program at the plant. The plan involves the purchase of an ultrasonic leak detector and a quarterly detection procedure for tagging and repairing leaks. It is also recommended that maintenance staff switch from using thread seal tape to a liquid sealant that will withstand vibrations for a longer period of time, provide a better seal, and possibly reduce the frequency of leak occurrences. An Excel file was created to record leak levels with an automatic output for air consumption and annual costs. Employing a plan such as this could save the company $11,750 per year. The payback for the recommended leak detector would be approximately 0.25 years.

Blow-Off Operation Changes: Blow-off operations can create a large amount of air demand, similar to leaks in the system. Significant savings can arise from replacing open pipes and drilled holes with engineered, low-consumption nozzles that draw in surrounding air to create a forceful airstream while using less costly, compressed air. By changing eight different operations in the plant, JELD-WEN could reduce annual operating costs by an estimated $13,997.

Storage/Pressure: Proper storage in a compressed air system is the key to performance and efficiency. Demand-side storage would help to even out the pressure change in the system by providing extra air for short periods of high demand. Once this has been implemented, maintenance could begin to reduce pressure in the system, which would lead to less waste from leaks and lower operating and maintenance costs. If additional storage reduced line pressure were implemented, the plant could save approximately $10,339 per year, with estimated payback at 1.4 years.

Replace Battery Chargers: Peak demand charges account for the majority of electrical utility costs at JELD-WEN, so reducing demand during operations could result in considerable savings. In the forklift battery charging station, 18 of the current chargers could be replaced by more efficient, high-frequency chargers, which would produce a 64 kW reduction in demand. Replacing the chargers could save $12,746 annually in demand charges alone, and $22,979 in energy costs, for a total annual savings of $35,725. The simple payback for the chargers would be approximately 1.4 years.

CONVENTIONAL AIR POLLUTANTS AND GREENHOUSE GASES DIVERTED IN STANDARD TONS

Total for all sectors					
CO_2	SO_2	CH_4	N_2O	CFC	PM_{10}
896.37	4.62	29.18	0.04	10.48	0.11

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
REPAIR COMPRESSED AIR LEAKS	$17,621	195,592 KWH	IN PROGRESS
LEAK DETECTION/REPAIR MAINTENANCE PLAN	$11,750	130,395 KWH	RECOMMENDED
BLOW-OFF OPERATION CHANGES	$13,997	155,366 KWH	RECOMMENDED
STORAGE / PRESSURE	$10,339	114,766 KWH	RECOMMENDED
REPLACE BATTERY CHARGERS	$35,725	255,068 KWH	RECOMMENDED