JOHN DEERE DAVENPORT WORKS

AARON STRAND
MECHANICAL ENGINEERING
UNIVERSITY OF WISCONSIN-PLATTEVILLE

COMPANY BACKGROUND

John Deere Davenport Works is approximately 2.2 million square feet, located on a property of 883 acres just north of Davenport, Iowa. This land includes the production plant, a training center and a shipping facility. Davenport Works employs a total of 1,400 employees who operate five product lines: skidders, wheeled feller-bunchers, four-wheel-drive loaders, articulated dump trucks and motor graders. In a separate building, the cab division produces cabs for these product lines as well as backhoes, tracked feller-bunchers, loaders and knuckle-boom loaders.

PROJECT BACKGROUND

The intern worked to analyze and optimize electricity use at John Deere Davenport Works plant. The first priority was to produce an inventory of all electric motors in use at the plant in order to identify energy savings opportunities. Improvements included upgrading to premium efficient motors, upgrading traditional V-belt drives to synchronous belt drives, and turning off equipment when not in use.

INCENTIVES TO CHANGE

John Deere corporate goals call for a 15 percent reduction in greenhouse gas emissions by 2018. The intern's approach and priorities were designed to work towards meeting the stated goal by reducing electrical energy use. The opportunities described here translate directly into reduced greenhouse gas emissions and overhead costs, and the realization of John Deere corporate goals.

RESULTS

Heating and Ventilation (HV) Units-Synchronous Belts: The galleries contain 72 HV-units. In most HV-units a 15-horsepower motor powers the air return, and another 30-horsepower motor powers the air supply. Reducing the run-time or speed is not an option for energy savings, because lowered air exchange rates would compromise indoor air quality. The blowers are driven through V-belt drives. Synchronous belts would have less resistance to bending due to their thinner profile, and provide positive engagement with the rotating sheaves to eliminate belt slip under load. A synchronous belt upgrade has an industry-accepted efficiency gain of 5 percent.

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}
1070.00	5.76	40.00	0.53	13.10	2.74	0.085	0.14

HV Units-Premium Efficiency Motors: Many motors are high or premium efficiency, but some of the remaining older motors have high annual run time and are less efficient to operate. Payback periods are longer for motor upgrades, so it is recommended to upgrade equipment with premium efficiency motors when existing motors wear out.

Compressed Air System: Compressed air is used for many processes throughout the plant. A new high efficiency rotary screw compressor and three centrifugal compressors provide plant air. Numerous air leaks were observed around the plant. An ongoing leak detection program with a goal to eliminate half of existing air leakage could result in significant energy savings.

Paint System Belts and Motors: The plant is currently installing a new paint system, which will run in addition to the existing system for the near future. Upgrading V-belt drives to synchronous belt drives on fans and blowers, and upgrading to premium efficiency motors as existing motors are replaced would increase the efficiency of the current system.

Exhaust Fans: Two 20-hp fans used for exhausting engine fumes were found to run excessively. Turning off these two fans for one shift daily when not in use could save 94,000 kwh annually.

Shot Blast Motors: The shot blast units clean and surface prep cut steel parts before fabrication. Many of the motors on this equipment are low efficiency. No existing motors justify immediate replacement, but upgrading to premium efficiency motors when replacement becomes necessary would reduce energy usage.

Machining Centers: The fabrication areas include many machining centers in a range of sizes and capacities. Most centers do not run three shifts, but equipment is not completely powered down when not in use. Hydraulic pumps and related equipment continue to run when machines are idle. Shutting off hydraulics when not in use provides a great opportunity for energy savings.

Personnel Fans: There are many fans throughout the plant to provide localized air circulation for employee comfort. A single 1/4-hp fan does not consume a great deal of power, but more than 800 small fans are in use which may not be shut off when workers leave. Encouraging employees to turn off fans and other equipment would provide immediate savings and help to instill a company culture that promotes further energy savings.

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
HV UNITS-SYNCHRONOUS BELTS	$ 40,300	794,000 KWH	RECOMMENDED
HV UNITS-PREMIUM EFFICIENCY MOTORS	$7,460	147,000 KWH	RECOMMENDED
COMPRESSED AIR SYSTEM	$20,370	401,000 KWH	RECOMMENDED
PAINT SYSTEM BELTS AND MOTORS	$4,458	87,740 KWH	RECOMMENDED
EXHAUST FANS	$4,775	94,000 KWH	IMPLEMENTED
SHOT BLAST MOTORS	$1,005	19,775 KWH	RECOMMENDED
MACHINING CENTERS	$19,297	379,860 KWH	RECOMMENDED
PERSONNEL FANS	$8,770	172,490 KWH	RECOMMENDED