

General Mills Operations, Inc.

COMPANY BACKGROUND



General Mills Incorporated is a worldwide leader in consumer food products, with more than 100 leading U.S. brands. The company had worldwide revenue of nearly \$15 billion in 2008. Since 1866, General Mills Inc. has grown to employ almost 30,000 people, with facilities in more than 100 countries.

The Carlisle, Iowa facility produces milled wheat flour and flour-based baking products, supplying both retail and food service industries. The facility has approximately 90 employees, producing more than 430 million pounds of flour products annually.



DAIN SPURGEON
MECHANICAL ENGINEERING, IOWA STATE UNIVERSITY



PROJECT BACKGROUND

General Mills Operations, Inc. has adopted a company wide effort to continually look for ways to conserve resources, reduce energy and water usage, minimize packaging, and reduce waste. The Carlisle facility has recently increased efforts to reduce energy use and lessen its environmental impact. The Pollution Prevention Intern Program is the most recent step in an effort to reduce energy use through changes to the compressed air system, which is a large user of energy within the plant.

INCENTIVES TO CHANGE

At the Carlisle facility, compressed air costs nearly \$80,000 annually. The objectives of the intern project will help satisfy the facility's goal to reduce overall energy consumption by 15 percent.

RESULTS

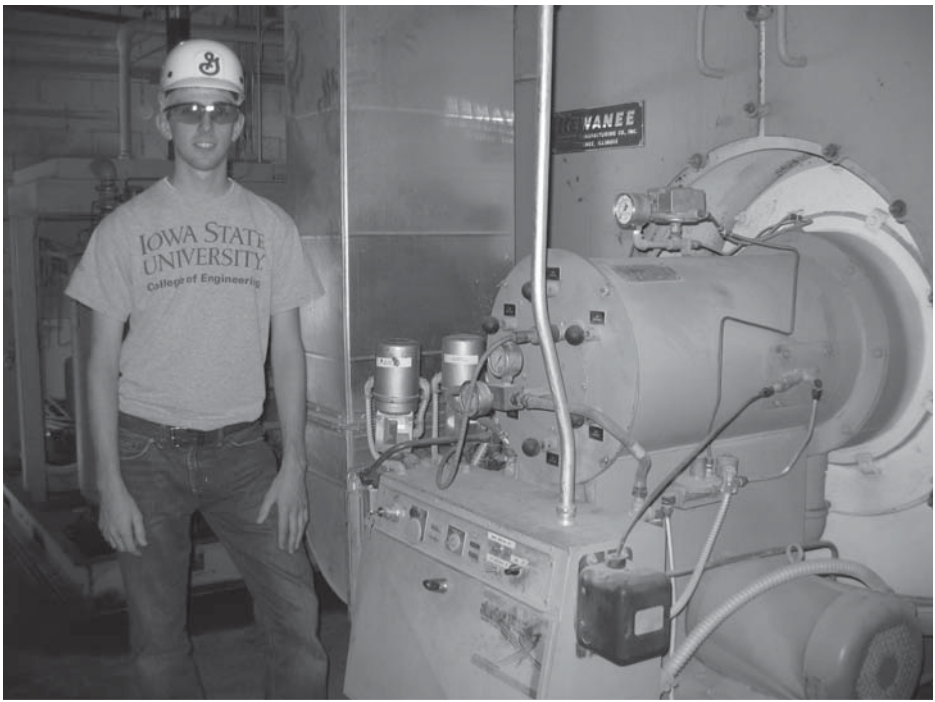
Compressed Air: In evaluating the uses and supply of compressed air in the facility, several recommendations for improvement were identified.

Nozzles: Several product packaging lines use compressed air extensively for machine cleaning and product pouch inflation. Testing of high efficiency nozzles was performed to evaluate their air savings and performance. Results showed an average reduction in air use of 66 percent. With 18 applications recommended for nozzles, up to 205 CFM of continuous air loss could be eliminated.

Leak Detection: Air leaks at the facility were estimated to account for almost 10 percent of the system capacity. Using an ultrasonic leak detector, 98 leaks were located, tagged, and logged to allow for repair. Continual leak detection and repair is an important part of an efficient compressed air system. Therefore, an ongoing leak detection program has been implemented with the help of maintenance staff.

Compressor Inlet Air Location: Temperatures within the plant's two compressor rooms averaged 10-30°F higher than the outdoor air temperature. For every 10°F reduction in inlet air temperature, a 2 percent savings in energy required can be achieved. Simple ducting to provide cooler ambient air will provide a savings of up to 29,500 kWh annually.

Compressor Relocation: Because of the separate locations of the plant's compressor rooms, proper control of the compressors has proven to be very difficult. Fluctuations between both sides of the



systems cause artificial demand and wasted energy. It has been proposed to create a new centralized compressor room, which will allow for proper control as well as easier maintenance and operation of the compressor system.

Waste Heat Recovery: Up to 93 percent of the electrical energy used by an air compressor is converted into wasted heat. Up to 90 percent of this heat is easily recoverable, which amounts to more than 2 billion Btu's annually for all three compressors. Recovery of this heat for use in supplemental heating of the facility's warehouse areas would provide substantial savings in natural gas used for space heating.

Boiler Retrofit: The facility's boiler currently operates inefficiently due to an old burner that is difficult to adjust. A new burner will provide annual fuel savings of nearly 5 percent due to improved air-to-fuel ratios during operation.



AIR POLLUTANTS DIVERTED IN TONS

Total for all sectors	
SO ₂	1.452
CO	0.276
NO _x	0.735
VOC	0.191
PM	0.039

GREEN HOUSE GASES DIVERTED IN TONS (CO₂ Equivalent)

Total for all sectors	
CO ₂	281.478
CH ₄	53.295
N ₂ O	0.238
CFC	3.469

PROJECT	ANNUAL COST SAVINGS	ENVIRONMENTAL RESULTS	STATUS
COMPRESSED AIR SYSTEM	\$25,500	447,827 KWH	IN PROGRESS
WASTE HEAT RECOVERY	\$23,065	21,760 THERMS	RECOMMENDED
BOILER	\$8,607	6,206 THERMS	RECOMMENDED