March 2002

OFFICE OF INDUSTRIAL TECHNOLOGIES
ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEPARTMENT OF ENERGY

Benefits

- 21 percent decrease in energy use and associated costs
- $750,150 one-time savings
- $1,129,900 annual savings
- $750,000 increase in productivity
- Reduced scrap generation
- Reduced waste product production

Application

Utica Corporation, a manufacturer of specialty forged parts for the aerospace and power generation industries, finds ways to save energy, waste, and labor while increasing productivity. The technologies demonstrated as a result of this project can be readily applied to other types of forging operations.

Utica Corporation Plant-Wide Energy Assessment Report Final Summary

Summary

Utica Corporation conducted a plant-wide energy assessment of the manufacturing processes and utilities at its facility in Whitesboro, New York. As a result of the assessment, Utica Corporation is now implementing 6 energy conservation projects that are projected to result in significant cost savings and efficiency improvement:

- $750,150 one-time savings
- $1,129,900 annual recurring savings
- 4,630,796 kWh net annual energy savings
- $750,000 increase in productivity

Implementation of the recommended projects will result in a 21 percent decrease in energy use and associated costs. A reduced scrap rate is also expected because new induction heaters and a gas-fired furnace will require less heating, causing fewer metallurgical defects. Improved visibility for workers resulting from the lighting retrofit should also reduce errors that lead to scrap generation.

Entrance to Utica Corporation's Whitesboro Plant

Company Background

Utica Corporation produces precision-forged titanium and nickel turbine blades, compressor blades, and fuel injectors for airborne and stationary gas turbines at the facility in Whitesboro, New York. All major aircraft jet engine manufacturers and major power plant manufacturers use Utica's products. Annual sales are approximately $42 million, and the company employs 400 people.

Utica uses electric rotary-hearth furnaces to heat the titanium and nickel rods to forging temperature (approximately 1,800°F for titanium and 2,200°F for nickel). After heating, workers remove the parts from the furnace and place them in a press for forging. Annual costs for electricity are slightly more than $1.3 million. The plant uses natural gas for space heating.

Utica processes nearly 400 tons of product annually, selling 250 tons of that to its customers. The balance of material is waste from trimming and grinding operations or from quality control rejections.

Assessment Overview

The plant-wide energy assessment at Utica concentrated on 8 areas: utility analysis, control system, furnace analysis, air compressors, motors and drives, lighting, cogeneration, and waste treatment. These areas are further detailed in the Implementation section below.

The assessment partners characterized the resulting energy conservation and process improvement opportunities as either process-related or utility-related. Process-related equipment refers to the equipment used to manufacture a product, including electric furnaces and forging presses. Utility, or plant-support equipment, includes air compressors, lighting, motors, HVAC, and other electrically driven items not directly associated with manufacturing processes. The team also reviewed personnel training procedures for potential effect on energy conservation and/or process efficiency. Assessment partners included Utica Corporation and Energy Research Company of Staten Island, New York. The U.S. Department of Energy's (DOE) Office of Industrial Technologies (OIT) co-sponsored the assessment. OIT supports plant-wide energy efficiency assessments that will lead to improvements in industrial efficiency, waste reduction, productivity, and global competitiveness for OIT's Industries of the Future.

Annual Energy Use and Projected Savings

	Annual Energy Use		Annual Energy Costs ($)	
	Electricity (kWh)	Gas (MMBtu)	Electricity	Gas
Before project implementation	19,497,764	NA	1,320,000	NA
After project implementation	15,306,784	2,750	1,036,269	16,500

Assessment Implementation

Utility analysis: The assessment team reviewed a 24-month period of electric and gas charges to determine usage trends, and performed a tariff analysis to determine the effect of equipment retrofits on electric cost savings. The team then integrated an hourly load curve resulting from the trend analysis with a tariff model; this integration helped them identify high-cost electrical consumption periods and provide an economic analysis of savings strategies based on relative effect on the electric-load curve.

An Existing Electric Furnace at Whitesboro

Control systems: The team reviewed hardware and software options for a central plant process-control system. Utica currently uses manual controls for process operations, but has decided to implement a controls system designed to improve production control and reduce energy use.

Furnace analysis: Utica has 15 electric furnaces of various sizes, with a combined capacity of more than one mW. The assessment explored 3 options for furnace improvement, including the installation of a direct gas-fired furnace, an induction furnace, and an automated system to control temperature and scheduling processes.

Air compressors: Utica currently uses three 350-hp, 100-psig air compressors. The assessment team reviewed the compressed air system for potential energy savings opportunities and explored the option of using gas-fired compressors.

Motors and drives: The assessment team took advantage of DOE's MotorMaster software to conduct a survey of electric motors.

Lighting: Partners conducted a survey of plant lighting.

Cogeneration: The team explored the possible use of cogeneration.

Waste treatment: Assessment partners reviewed waste treatment operations.

Results and Recommendations

The plant-wide energy assessment resulted in 6 project recommendations to save electric energy and to increase productivity. In addition, Utica obtained demand-side management, research, and development funding from New York State Energy Research and Development Authority (NYSERDA) to assist in implementing the recommendations. Table 2 shows summaries of the total potential benefits resulting from implementation of the assessment recommendations. In addition to the recurring benefits shown, Utica expects a one-time cash infusion of $720,000 from several sources, including vendor cost sharing, a county training grant, NYSERDA funding, and DOE plant-assessment funding.

Implementation of the assessment recommendations resulted in projected annual electrical energy savings, shown in Table 3.

Table 2. Estimated Annual Savings

Item	Estimated Savings ($)
Controls	143,018
Power-for-Jobs Tariff	132,000
Gas-fired furnace	58,000
Induction furnace	584,618[a]
Lighting retrofit	89,764
Boiler replacement	52,500
Waste treatment	70,000
Production increase	750,000
Total annual savings	**1,879,900**

[a] In addition to energy savings, estimated savings include labor savings of $544,200 and maintenance savings of $10,000.

Table 3. Projected Annual Electrical Energy Savings

Technology	Annual Electricity Savings (kWh)
Forge furnace controls	989,880
Air compressor controls	438,000
Motor controls	490,000
Lighting controls	Not estimated
Gas-fired furnace	833,961[b]
Induction furnace	498,648
Lighting retrofit	1,380,307
Total annual electrical savings	**4,630,796**

[b] Includes a debit for an annual increase of natural gas use equivalent to 439,350 kWh.

Overview of Specific Actions Identified in the Assessment

Asessment partners recommended that Utica:

Change tariff structure and take advantage of New York's Power-for-Jobs tariff. Utica's current electricity tariff structure is complex, which made the impact of electrical energy savings strategies difficult to determine without detailed modeling. Utica agreed to temporarily change its tariff structure to take

Existing Electric Furnace

advantage of electricity use that is frequently below a projected limit. The rate structure will probably change again when electricity competition becomes a reality. In addition to changing its tariff structure, Utica took advantage of government subsidies. The New York Power Authority (NYPA) offers a limited amount of reduced-cost electric power to companies that can maintain or increase employment levels. Utica was able to secure a 1,200 kW electric-load allocation commitment from NYPA under this program.

Improve process controls. The plant-wide energy assessment included a review of the design for a new main process control system. This "Energy and Productivity Control System" will improve process and utility equipment operation and provide information across Utica's existing communications network that will enable operators to manage energy use, enhance production control, and improve record-keeping. The system will control forge furnace batch time and temperature, along with air compressor operation. It will also schedule and monitor electric motors, solenoid valves, and press operations and provide indexing control of the existing furnaces. In addition, the main control system will monitor and control plant lighting, water consumption, and overall electricity use; this will reduce loads during high-cost periods of peak demand.

Install a new induction furnace. An induction heater will replace one of the electric furnaces for the upset presses. Benefits include reducing the energy required for production, increasing production, and eliminating unnecessary furnace time.

Install a new gas-fired furnace. For final forging operations, a direct-fired gas furnace will replace the existing electric resistance furnace.

Retrofit existing lighting. In addition to the changes in the central plant control system, Utica will either upgrade or replace nearly 1,300 lighting fixtures. Fixtures will be either upgraded to energy-efficient lamps and ballasts or replaced with new energy-efficient fixtures. The plant will apply this strategy to circuits operating 24 hours per day.

Gas Turbine Blades, Typical of Products from Utica

Install a gas heater. Utica's existing boiler has an overall thermal efficiency of only about 50 percent because of condensate in the return lines and inadequate insulation on the steam lines. A direct-fired natural gas air heater will replace the boiler. The system will vent hot air directly into the facility to provide space heating during winter months.

The information and control improvements made possible by the new Energy and Productivity Control System and by the installation of the induction heating furnaces will result in productivity benefits. The information and control technologies will improve the ability to manage and schedule furnace temperatures and product throughput. Induction heating equipment will facilitate a production increase by decreasing time required to heat billets used in the upset process, a current bottleneck in the production process. Approximately 70 percent of the facility's production flows through the upset processes. By eliminating the bottleneck at the upset presses and by utilizing custom control and scheduling software, an overall production increase of at least 2 percent, or $750,000 annually, is estimated.

Utica generates about 400 tons of hazardous waste acids per year. The company could reduce waste acids production to 150 tons annually by treating these acids with a filter press and neutralizing tank; such treatment will result in about $60,000 in cost savings from reduced waste production and transportation costs. The New York Department of Economic Development has provided a grant to install a treatment system. Utica has also applied for a $90,000 grant from the New York Environmental Bond Act for a waste water equalization tank that would save chemical costs and keep waste water effluent at permitted levels.

BestPractices is part of the Office of Industrial Technologies' (OIT's) Industries of the Future strategy, which helps the country's most energy-intensive industries improve their competitiveness. BestPractices brings together the best-available and emerging technologies and practices to help companies begin improving energy efficiency, environmental performance, and productivity right now.

BestPractices emphasizes plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. In addition, the Industrial Assessment Centers provide comprehensive industrial energy evaluations to small- and medium-size manufacturers.

Project Partners

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DOE/GO-102002-1494
March 2002