MOTOR CHALLENGE
Project Fact Sheet

A Technical Case Study

IMPROVING EFFICIENCY OF TUBE DRAWING BENCH REDUCES ENERGY USE BY 34%

BENEFITS

- Reduced total annual energy consumption by 34%
- Electrical, labor, and materials savings of $77,266
- Payback of 5 months
- Improved final product
- Identified future drawbench modifications

"We're saving money on power, generating less scrap, bypassing steps because of more efficient production, and we're achieving greater control over our finished product."

—David Dietz, GT plant engineer

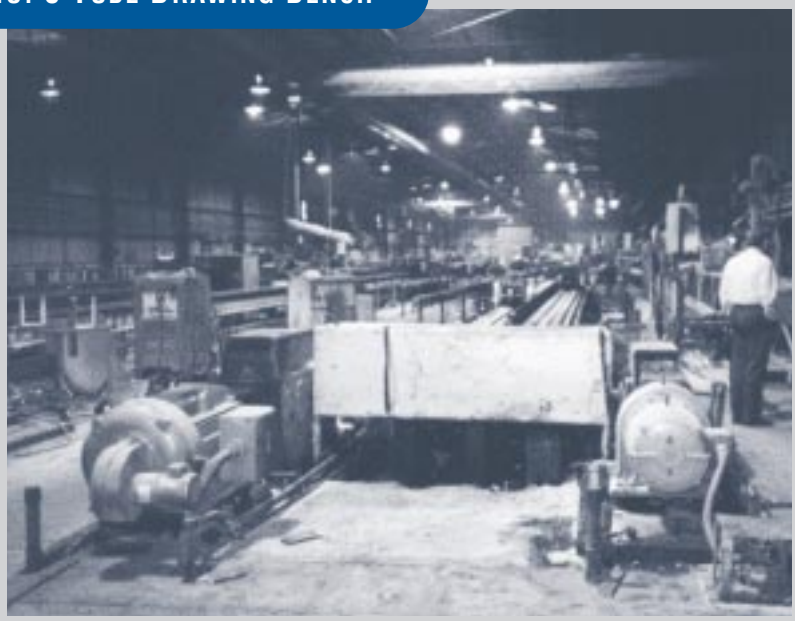
Project Summary

Greenville Tube Company (GT), a manufacturer of high-precision, small-diameter stainless steel tubing, conducted an in-house system performance optimization project to improve the efficiency of its No. 6 tube drawbench. This drawbench plays an integral role in the production process, but severely hindered the productivity and energy efficiency of the facility. GT evaluated the systemic problems in its production facility and replaced the original motor and inefficient eddy current clutch drive with an energy-efficient motor with vector control.

Company Background

GT's 100,000 square-foot plant in Clarksville, Arkansas, produces about 1 million linear feet of custom stainless steel tubing each month for its automotive, aerospace, food, medical equipment, pharmaceutical, and petrochemical industry customers. GT has carved a niche for itself as a reliable and flexible supplier for customers that experience costly downtime due to equipment failure and require a specific size and type of tubing quickly.

NO. 6 TUBE DRAWING BENCH



Project Description

The production process at the Clarksville facility consists of drawing stainless steel tubing through dies to reduce their diameter and/or wall thickness as specified by customers. This drawing process is carried out on a drawbench. Each tube typically goes through several "breaking" draws, which rapidly form the tube close to specified final dimensions. The No. 6 drawbench is the only one in the facility that performs "breaking" draws. Later, the tube undergoes a few final "finishing" draws to achieve the exact tube size desired.

Before this project, the No. 6 drawbench was powered by a 150-hp motor running at 1,770 rpm. The motor was coupled to a speed reducer (gear box) through an eddy current clutch. In an investigation aimed at halting nuisance tripping in GT's power distribution system, the Clarksville facility's plant engineer discovered a number of problems plaguing the No. 6 drawbench and determined that the 150-hp motor and eddy current clutch drive system were responsible for bottlenecking the production process. The drive motor, with a full load amp rating of 250, was at times drawing over 900 amps.

The engineer recommended the following solutions:

- Reduce the thermal load on the power distribution system to prevent the frequent overload trips.

- Increase the torque output to the drawbench, improve overall efficiency, and reduce energy consumption.

- Install a mechanism to improve the operator's low speed control over the motor, making a quick latch of the carriage easier to accomplish while maintaining high efficiency levels and improving final product quality.

A Showcase Demonstration team was established in 1994 to analyze the problem. Joining GT staff on the project were Baldor Electric Company and Evans Electric Motors, Inc., a Baldor distributor. DOE's Independent Performance Validation (IPV) team reviewed the results and conclusions of the project and provided technical assistance to validate the savings. In keeping with a systems approach, the team evaluated the entire drawbench drive system, not just the undersized motor that was bottlenecking the production process. This included closely observing the operation of several other machines at the facility operating with equipment similar to the No. 6 drawbench.

Due to the wide variability in tube diameter, wall thickness, material used, and order sizes received each week, a single representative GT product does not exist. To obtain hard data representative of actual operation, the IPV team randomly selected orders, then performed a detailed analysis of the intermediate steps to which the tubing would be subjected. The IPV team also conducted detailed interviews with GT's vice president, plant

manager, and the shop foreman. Finally, to measure the direct power savings resulting from the system modification, the IPV team compared the power requirement that the plant engineer measured in his initial study (the base case) against the measured modified system power requirements (the optimized case).

Results

The Showcase Demonstration team made the following changes:

- Replaced the magnetic starter and eddy current clutch with a Baldor vector controller and line reactor (the controller was installed in a NEMA 12 enclosure with an air conditioner).

- Replaced the 150-hp, 1,770 rpm motor with a high-efficiency 200-hp, 1,180 rpm Baldor Electric motor.

The No. 6 drawbench now requires less energy to draw a tube, even though the motor power was increased. The projected total annual operating time was also reduced by 623 hours, since the greater horsepower available enabled many of the tubes to be reduced to the desired size with a smaller number of breaking draws. The No. 6 drawbench was able to take over work previously done on other, less-efficient benches.

Benefits

GT realized substantial cost savings due to reduced energy consumption, reduced operating time, and increased efficiency as shown in the chart.

Annual Savings

Electricity	148,847 kWh	$7,056
Labor Hours	2,762 hours	$23,473
Stainless Steel		$41,322
Other Direct		$5,415
	Total	$77,266

Besides these savings, another benefit resulting from this project was identifying other good candidate benches for future drawbench modifications. Using the vector drive and the improved process control system also enabled the drawbench operator to control its speed more precisely, resulting in an improved final product.

Productivity Gains

An estimated 2,762 hours of labor per year will be saved as the result of these changes. GT personnel estimate that one draw was eliminated from 50 percent of the orders processed. Time is not only saved through the reduced amount of draws required to "break" a tube, but is also saved from the ancillary operations that are required by the drawing process, such as degreasing, cut-off, swaging, and annealing. Furthermore, assuming a labor rate of $8.50 per hour, the time reduction amounts to labor cost savings of $23,473 per year.

Energy Savings

The modifications reduced the No. 6 drawing bench's total annual energy consumption from 439,065 kWh to 290,218 kWh and reduced the total annual electricity costs associated with the No. 6 drawing bench by 34% from the base case cost of $20,812.

Waste Reductions

The reduced amount of draws necessary also saved an estimated $41,322 of stainless steel, as fewer draws equates to fewer swaged ends cut off after each draw.

Annual Emissions Reductions

Emission Type	Lbs Reduced
CO_2	92,842
Carbon equivalent	25,321
SO_x	318
NO_x	293
PM-10	7.6
VOC	1.5
CO	23

Implementation Costs and Payback

The expenditures necessary to carry out the project included:

New vector motor	$11,203
Enclosure and air conditioner	$18,982
Installation	$ 7,005
Total	$37,190

Based on the annual savings of $77,266, a simple payback for the modifications was achieved in just over 5 months.

MOTOR CHALLENGE

Motor Challenge, administered by the Office of Industrial Technologies, is a voluntary partnership program with U.S. industry to promote the use of energy-efficient electric motor systems. Thousands of industrial partners have joined Motor Challenge and are improving their competitiveness and efficiency, and, in turn, the Nation's.

Motor Challenge assists the OIT Industries of the Future by identifying near-term gains in energy efficiency these industries can achieve by adopting existing technologies.

Project Partners

Greenville Tube
Clarksville, AR

Baldor Electric Company
Fort Smith, AR

Evans Electric Motors
Fort Smith, AR

For Additional Information, Please Contact:

The OIT Information Clearinghouse
Phone: (800) 862-2086
Fax: (360) 586-8303
http://www.motor.doe.gov

Visit our home page at
www.oit.doe.gov

Please send any comments, questions, or suggestions to
webmaster.oit@ee.doe.gov

Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

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DOE/GO-10099-544
January 1999