Transformation Engineering Instantly Cuts Electrical Usage by 26% with Devonshire Power Control Energy Management System

Transformation Engineering, Inc.® (TE) is a high-end machining and fabricating business that produces precision-machined parts for missiles and submarine systems, energy generation, manufacturing processes, structural components, and other industry and government projects. Located in Flagstaff, Arizona, TE is known for its mastery with aluminum, but the company has also established itself as an expert with more exotic materials such as titanium, boron, carbon fiber, and silicon-based compounds.

“When someone has a unique need for a fabrication that doesn’t exist, and no one is quite sure about how to create it, they come to us,” says Scott Thibault, Chief Operations Manager. “We have enough in-house experience and technical knowledge so that we can almost always figure out something that works!” he adds with a laugh.

The Challenge

Because of its focus on specialized solutions, TE is able to garner high-dollar contracts from government and large industries. But the company still has to answer to a bottom line and the consortium of investors that comprises its primary ownership. As such, cutting costs is an important goal.

For TE, the largest expense after payroll is electricity, which is not surprising considering the large, energy-hungry machine tools in constant use. In addition to the more traditional lathes and other devices, there are three large extrusion machines that can handle the more exotic materials that TE regularly works with. All use prodigious amounts of energy.

Like other manufacturers, TE must routinely shut down its equipment in order to set up new jigs and reconfigure everything for the next phase of a project. Unfortunately, the complex nature of the typical TE project make this a much more common occurrence than usual.

The problem is that large machines make huge demands on the electrical supply when they start up. This is not a problem for smaller businesses and households, but large industrial motors often waste a tremendous amount of energy when they fire up.

Motor control circuits are designed to alleviate some of these issues, but their focus is on protecting the motors from overheating, not saving energy. TE knew it was losing money on wasted energy, but a solution wasn't obvious.

Searching for a Solution

"It really frustrated us to know that so much of our revenue was literally going to waste as useless heat" says Elliot Marshall, Chief Operating Officer. "We figured there had to be a solution to this problem, but everything we initially looked at offered only marginal gains in efficiency, and not enough to justify the down time necessary to implement" he added.

Senior Management decided to push forward with an all-out effort to search for an answer. Chief Technology Officer Daryl Connelly was tasked with searching for an effective solution. "It actually wasn't as bad as looking for a needle in a haystack" he explained. "I had an idea of where to focus my information gathering. From there, it was just a matter of narrowing the trail."

The trail eventually led to an online discussion forum for energy producers, and the topic of interest was how to help companies like TE. The name Devonshire Power Control® (Devonshire) came up a few times. It turned out to be the answer Connelly was looking for.

Devonshire Power Control

Connelly contacted Devonshire, who arranged for a Sales Engineer to visit Transformation Engineering. Over a three day period, the engineer combed through the entire facility, created diagrams, made calculations, and finally presented Connelly and the rest of the senior management team with a proposal. The proposed solution would be based around the Spartan control system, Devonshire's flagship solution.

It was felt that this would be the best answer to the range of challenges present in the TE facility. Basically, the Spartan product is a centrally-managed power conditioning system that controls the current and voltage phase relationships during the startup of a motor, so that the maximum amount of energy is transformed into useful work, instead of being lost as heat.

A central processing unit monitors power coming into the facility, as well as the voltage and current going to each motor. A proprietary module containing a microprocessor-controlled network is placed inline of the three-phase power feed to each motor. The module receives instructions from the central processing unit and can instantly manipulate the current, voltage, and phase relationships of the power feed, based upon continuous measurements made by the central processing unit. The result is the optimal mix of all three factors during the start up of each motor.

Putting the Solution to Work

Devonshire has installed hundreds of systems of various sizes in numerous critical operations, so the company is well aware of how important it is to have a minimal impact on a customer's daily operations. To this end, the field installation teams have honed their ability to build the bulk of a new system around an existing operation while it is still running. At TE, the team spent approximately two weeks installing the central processing unit and tying it into each of the new motor modules, as well as testing the system.

When the time for final tie-in arrived, Connelly worked with the Devonshire team to pick an opportune time frame where the entire operation could be shut down. As with most customers, this was during the overnight hours, which is not a problem for the Devonshire team. Armed with a finalized game plan—and lots of coffee—they coordinated the shut down of the entire facility, then got to work tying in the feed lines to the motor modules. Once this was done, the team fired up the central processing unit and ran it through a series of calibration tests that confirmed it was ready to go online. This was followed by some static tests of the modules to make sure the microprocessors were communicating correctly with the central unit. Devonshire was also able to run some simulation tests that showed the modules were ready to handle the actual load of the motors.

The entire process was completed by the time the initial rays of light were glowing over the Arizona desert. As the team ticked off the final items on its checklist, the system was quietly sitting in standby mode and was now ready to be run through its first real startup sequence.

At 6:42 a.m., the first of the three extrusion machines were started up. The central processing unit logged the process, recording how it was shifting voltage, current, and phase components microsecond by microsecond. The machine came to life with a noticeable increase in speed and "vitality," which is how one of the TE workers described it. By 7:00, everything was up and running, and the familiar humming was once again part of the TE environment.

Payoff

TE had to wait only one month—until the next bill from the electric utility—to see the results. Because the machinery is metered and billed separately from the rest of the facility, it was easy to quantify the difference from just the machinery without other factors such as air conditioning skewing the results.

The savings were significant, much to everyone's satisfaction: a solid 26 percent reduction in electrical costs. The improvement was irrefutable. And, similar savings were reported for the following four months, varying between 24 and 27 percent. The differences were attributable to the demands from the specific projects, and not variations in the operation of the Spartan system.

A further benefit was realized as TE workers observed a significant reduction in heat produced by the motors. This was an ongoing effect, as the central processing unit continually monitors the electrical load on each motor and instantly compensates for varying loads, thus keeping the motors operating within their most efficient parameters. As any engineer will tell you, greater efficiency equals less wasted heat. The TE team is confident this will result in greater lifespan for the motors, which can cost up to $7,500 each to replace in today's dollars.

"There's no question that this is a significant and dramatic improvement," said Connelly. "With results like this, the Spartan system will pay for itself in a relatively short time, and the savings will remain in our pocket after that."