



Case Study:

Variable Frequency Drives Cut Energy Costs

Increasing prices and supply concerns have placed pressure on TXI and other companies to reduce energy consumption.

BY TOM HART, SIEMENS INDUSTRY, INC.



Siemens G150 variable frequency drive.

It's no secret that commodity prices in the cement and aggregate markets are sensitive to ever-fluctuating economic conditions. While cement and aggregate producers may have little control of external market variations, many are taking steps to lower operating costs to get a leg up on the competition.

Transportation, personnel, and other overhead costs are often targets for cuts. But one company has identified another "low-hanging fruit" to reduce operating costs and improve plant reliability at the same time.

In 2008, TXI Operations LP (TXI), a leading supplier of cement, aggregate, and consumer product building materials, began a company-wide initiative to enhance efficiency and reduce overall operating costs. TXI is the largest low-cost cement producer in Texas and has a significant presence in California. The company is also a leading low-cost aggregate supplier to Texas, Louisiana, and Oklahoma.

As part of the initiative, TXI took a hard look at its Mill Creek, Okla., crushed stone operation. Opened in 2002, the facility supplies crushed stone to the Dallas/Fort Worth and Beaumont markets primarily by rail. The Mill Creek operation boasts a very large stone reserve — with 5 million tons per year-plus of capacity expected to provide a 100 year lifecycle.

VFDs Replace Mechanical Flow System

Increasing energy prices and energy supply concerns have placed pressure on TXI and other companies to reduce energy consumption. On a national scale, the industrial sector consumes one-third of the energy in the US, making it a prime target for energy consumption reduction. And, since industrial electric motors represent the single largest consumer of energy in the industrial sector today (65 percent), TXI identified them for reductions.

Gary Allen, TXI crushed stone general operations manager, says the pumps controlling the water flow to wash the aggregate at the Mill Creek plant had been operating at fixed speeds since it was opened. Output flow was controlled manually via valves on the outlet lines, while the motor continued to run at full speed and amperage.

When considering the total cost of ownership for an industrial electric motor system, 95 to 99 percent of the cost is expended on motor energy requirements. As with TXI, many industrial motor systems have inefficient mechanical control methods. This means the motor operates at 100 percent speed, while the load does not necessarily require 100 percent output — needlessly wasting energy.

By optimizing the speed of motors to correspond to the load requirements, energy savings can be immediately

achieved. The most effective and efficient method of controlling motor speed is with energy-efficient variable frequency drives.

“Crushed stone plants are historically high movers of water,” Allen says. “With the original arrangement, we had to turn the whole system on to run even small amounts of water, with no way to decrease the cost of pumping. It left a big carbon footprint, consumed a lot of energy, and put a strain on the mechanical system.”

The cost-saving strategy to replace the “historic monster,” Allen says, was to rip out the electromechanical, fixed-speed flow control system and standardize on SINAMICS G150 variable frequency drives (VFDs) from Siemens Industry Inc.

The drive is enclosed, air-cooled, and designed for applications that do not require regeneration back into the power supply system. This compact, quiet drive includes an AC/AC power module with IGBT power semiconductors and an innovative cooling concept that provides low-loss operation for extremely high energy efficiency. All units include a controller (CU320) with a PRO-FIBUS port, an advanced operator panel (AOP30), and a terminal module (TM31) for digital and analog inputs and outputs.

The G150 is available in several versions covering a broad range of voltages and power ratings, with a wide variety of standard options that allow it to meet industry and site-specific needs. It is commonly found in applications that involve moving, conveying, pumping, or compressing solids, liquids, or gases. This includes variable torque applications such as pumps, fans, blowers, and compressors, as well as constant torque applications such as mixers, extruders, and mills.

TXI's variable frequency drive system, up and running since January 2011, consists of 10 G150 VFDs. Five of the drives provide controlled flow of up to 15,000 gallons per minute of fresh water to wash the aggregate. Four drives control the flow back to the water supply. One drive is available on an as-needed basis.

“We went to the G150 VFDs because we wanted to lower our carbon footprint and energy costs,” Allen says. “We knew there would be a distinct savings we could achieve by going to a variable frequency water supply versus mechanical.”

Siemens Partnership Brings Reliability

Allen says Siemens is a valued vendor at the facility, and the

TXI relationship with Siemens dates back approximately 10 years. “We learn from our other Siemens installations and use that knowledge to improve other operations, like Mill Creek.”

Mill Creek plant manager Ken Caldwell also has a long relationship with Siemens. He says an important part of the VFD system is the reliability of the drive software package that simplifies commissioning and configuration.

“The software helped us to utilize the horsepower as needed on our freshwater and return water pumps,” Caldwell says. “Before, we used an across-the-line starter that used a lot of amps and horsepower we didn't need. Now we can control and maintain the flow rate of the pumps.”

Change Paying Off

There have been no maintenance issues since the drives have been installed. Both Caldwell and Allen agree that not only are the drives reliable, but they also help the entire system stay operational.

“There is less strain mechanically on the pump, because we are not turning it at maximum RPM,” Caldwell says.

“We have five pumps that now only come on as needed,” Allen says. “As the demand for water increases, we are able to keep up with it. The system is more reliable, since we are not running all pumps all the time, and that greatly reduces the stress on the motor controller. If you have only 20 percent demand, you only need one pump out of five. Obviously, the reliability of the other four has to be pretty high.”

Caldwell and Allen say the drive installation has been a success, and that the energy savings have been significant over the past eight months.

“As every successful company must do in these times, we have a plan to not only reduce our carbon footprint, but to become more competitive,” Caldwell says. “We've been able to achieve both. The things we can do today to whittle down the low-hanging fruit, like installing the G150 VFDs, allows TXI to focus on the higher fruit down the road.”

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For more information, go to <http://www.usa.siemens.com/drivetechologies> and www.txi.com.

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TOTAL COST OF
OWNERSHIP FOR
AN INDUSTRIAL
ELECTRIC MOTOR
SYSTEM, 95 TO 99
PERCENT OF THE
COST IS EXPENDED
ON MOTOR
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