PLANTS MANUFACTURING CONCRETE PRODUCTS CAN BE VERY ENERGY INTENSIVE DUE TO THE CURING, DUST COLLECTING, MIXING, SHAPING, AND CONSOLIDATION PRODUCTION PROCESSES. THESE TASKS ARE SUPPORTED BY INDUSTRIAL KILNS, COMPRESSORS, FANS, PUMPS AND SOPHISTICATED VIBRATION EQUIPMENT. IF A CONCRETE PLANT IS EXPANDED OR CONVERTED FROM A WET CAST TO A DRY CAST PROCESS, IT IS IMPORTANT TO ASSESS THE PROCESS AND MOTOR SYSTEMS TO ENSURE THEY CAN ADEQUATELY AND EFFICIENTLY SUPPORT THE NEW PRODUCTION PARAMETERS.

Concrete Pipe Manufacturer Increases Production and Saves Energy by Designing New Plant

Early in the design of their new concrete pipe manufacturing plant in Chowchilla, California, Piranha Pipe and Precast (formerly Clovis Concrete Pipe) decided to implement several energy-efficient features. A steady increase in demand for the company's products and the need to remain competitive guided the company's decision to design and build a new plant. However, because of increasing energy costs, Piranha's management also decided to design the plant for optimal energy efficiency. The resulting facility is a 25,000 square foot complex with state of the art equipment, including a 50-hp variable speed drive (VSD) compressor, forty skylights reducing lighting demand, an automated process control system staggering energy-intensive tasks and an advanced curing process requiring less energy than conventional processes.

To help make their new plant more efficient, the company turned to a statewide investor-owned utility sponsored energy efficiency program, Savings by Design (SBD), to assess the proposed facility. The company's objective was to create a facility producing 125 yards/day of dry cast and 25 yards/day of wet cast pipes to meet demand. The company's builders worked with PG&E representatives before construction began, exploring ways to make the plant as energy efficient as possible. They generated a plant-wide approach enabling them to design and build a highly efficient facility.

The New Chowchilla Concrete Plant

The recommendations in the SBD report focused on three essential areas: compressed air, lighting and curing. To adequately serve the dry cast process, Piranha Pipe personnel recognized that the compressed air demand at the new facility would be greater than what was required at their previous location. The

old facility required a 10-hp compressor to support the pneumatic tools. However, because of the dust collection, mixing, and vibrating tasks that exist in the dry cast process, the new plant's air demand and pressure level would be substantially greater than at the Clovis facility.

One of the options under consideration for plant-wide controls was a PLC (programmable logic control)-based automation system. The SBD analysis showed with this automated control package, the plant's air demand could be adequately supported by a 50-hp VSD compressor, instead of a fixed speed, 60-hp unit that was envisioned if more standard controls were installed. This is because the automated control system could stagger certain tasks so the compressed air applications did not operate simultaneously. This reduced peak air demand from 250 scfm to 175 scfm.

To discharge condensate efficiently from the compressed air system, the SBD report advised using zero-loss condensate drains instead of solenoid-operated ones. Although zero-loss condensate drains are more costly, they actually cost less over the life of the drain because they waste much less compressed air than solenoid-operated ones when discharging condensate.

The SBD evaluation then showed that with proper amount of high efficiency metal halide lighting and skylights, Piranha Pipe could operate effectively with 10% less lighting kW than originally planned A conventional estimate called for 30 kW worth of lighting in the new facility. However, the installation of single step, on/off controls and forty 3' by 10' skylights covering 4.8% of the building's total area allowed lighting to be automatically turned off during the day. This saved an additional 51,446 kWh in energy use annually and about 27 kW in on-peak demand on average.

Finally, the report showed if Piranha installed a vapor mist curing system and used a fast-curing concrete instead of regular concrete, the production process would require less curing, saving natural gas. The recommended concrete, Idrosilex Pronto, is a pre-blended powder composed of a cement-based compound, graded aggregates, and synthetic resins that sets more quickly than conventional concrete. This type of concrete improves the plant's energy efficiency because Piranha does not have to heat up its two kilns while the concrete is curing.

When describing the new facility, co-owner, Anita Simpson said, "everything is going really smoothly because all applications [mixer, pipe machine] are getting air without problems. The new compressor even fits so well that we hardly notice that it's there."

Project Successes and Lessons

Piranha Pipe has built an innovative and energy efficient concrete plant with the support from PG&E's SBD engineers. Based on Piranha's experience since the project's completion, they have met the estimated annual energy cost savings of $23,300 and the estimated annual energy use savings of 120,000 kWh and 9,634 therms, respectively. Now, Piranha's plant uses a smaller compressor, less lighting and doesn't have to heat its kilns for as long as it would have, had they not designed their plant in an energy efficient manner. This has enabled the company to earn a $14,000 rebate from PG&E. With total costs of $119,000 above the cost of a less efficiently designed plant, the project achieved a simple payback of 5.4 years. In addition, production capacity is 500% greater than the output level at the previous facility and products from the new facility include a more diverse product mix, enabling Piranha to reach other markets.

Cement and Concrete: What is the Difference?

Cement is the binding agent in the masonry products of concrete and mortar. Limestone is mined, crushed, mixed with other ingredients, and heated to make cement. The terms cement and concrete should not be used interchangeably – concrete only contains 10-15% cement, with the remainder being aggregate (gravel, crushed stone and sand) and water.