A project to convert an existing lime kiln from oil to gas firing gave Sappi Skowhegan the opportunity to reduce energy costs in a big way. The LimeFire burner and LimeCool sector cooler were key to the conversion.

Sappi North America's mill in Skowhegan, Maine is a large, integrated complex with a unique hardwood and softwood pulp blend (Somerset Synergy) which is used by its three machines. Annual production is about 795,000 metric tonnes of paper.

Skowhegan is now running on natural gas instead of oil, a move that is forecast to save about 30% in energy costs in addition to reducing air emissions. The final stage of the energy project involved converting a 1970's vintage FLSmidth lime kiln and upgrading it with some of the latest technology from ANDRITZ.

The switch to natural gas in the kiln replaces the equivalent of 80,000-100,000 barrels of No. 6 fuel oil each year, according to Lance Bolduc, Recovery Manager. "ANDRITZ supplied a great cooler and a great burner," Bolduc says. "I am very happy with the design and performance."

Kiln conversion helps Skowhegan SAVE ENER

Best guarantee

The Skowhegan mill evaluated three suppliers for the kiln conversion project. "ANDRITZ was the only one who would guarantee NOx emissions at the production rate and quality that we required," Bolduc says. "That was the biggest reason we chose ANDRITZ."

ANDRITZ delivered the LimeCool cooler and shell section and the LimeFire multi-fuel burner, along with other items such as support rollers, crusher, conveyor, elevator, primary air fan, and the burner management system. In terms of support services, ANDRITZ also did some basic, process, and control engineering, as well as provided erection supervision and commissioning support.

Do no harm

"One of my main criteria for this project was that it would do no harm to the existing operation," Bolduc says. "We had a decent running kiln and we did not want to go backwards in any way. Same production. Same quality. Just do it with a lower cost fuel. We also wanted the flexibility to burn multiple fuels, so that we can select the lowest cost fuel in the future."

Concerned about neck-down design

"At the time we made the decision to go with the ANDRITZ 'neck-down' design, there was a lot of discussion internally," Bolduc says. "The retrofit takes the shell diameter of 11'6" (3.5 m) down to 6' 7" (2 m) at the coolers. Our biggest concern was having the space to get equipment in and out during our annual outage to clean the kiln and re-brick when necessary."

Robert Kenny, an Engineering Consultant who has worked at the Skowhegan mill for 16 years, remembers the discussions with ANDRITZ well. "The mill ended up going with ANDRITZ's design," Kenny says. "But, the thought was that it would add a couple of days to the annual outage because contractors would not be able to use their traditional equipment to work inside the kiln. It turned out that the extra time was not needed because the kiln was so clean."

More production: an added benefit

When you convert to natural gas, you decrease energy efficiency by about 10% because the heat value of gas is less than fuel oil. Sappi's goal was to convert to 100% natural gas without losing any production, so that is where the LimeCool unit comes in.

"One of the things we did was to visit several mills to evaluate sector coolers," says Gregory Hale, Sappi's Project Manager. "Competitive coolers were often failing due to thermal expansion. ANDRITZ coolers are robust enough to stand up to the harsh kiln environment."

▲ The Skowhegan kiln is inside a building. The switch to natural gas replaces the equivalent of 80,000-100,000 barrels of No. 6 fuel oil each year in the kiln.

"Before the conversion, we were running about 340-350 t/d of product," Bolduc says. "Our old satellite cooler was undersized. Lime coming out of the kiln was very hot which meant we were sending away thermal energy with the product. With LimeCool, we reduced the temperature of the lime by about 60% and the secondary air going back to the kiln is considerably hotter. Putting that thermal energy to work allows us to produce more lime at a lower overall energy cost."

Today, the kiln operates at 375 t/d. "The process guarantee from ANDRITZ was for 342 t/d, but we have been able to increase production because the kiln is running so well for us," Bolduc says. "That was an added benefit."

Very flexible burner

Sappi Skowhegan's operators have been very impressed with the new LimeFire multi-fuel burner and its flame shaping capabilities. "We used to constantly fight with our old lance burners," one operator says. "We would often experience flame impingement on the brick. The new burner is very predictable. I can go out and adjust the valves to get exactly the flame shape I want."

When the kiln started up, operators dialed in the shape they wanted and left it there. "The only time we play with it is during start-up after the annual outage when there is no product in the kiln," Bolduc says. "We make the flame a little bushier for the heat-up, then dial it back and don't touch it. The burner is outstanding."

Ahead of schedule

Conversion work started during the annual shutdown in October 2014. First mud to the kiln began to flow on October 31st. According to Robbie Diaz, ANDRITZ Project Manager, "We had a very good start-up and brought the kiln online two days ahead of schedule."

Diaz is complimentary of the project team from Skowhegan. "Sappi runs very professional projects," he says. "They are consistent in their attention to detail and quality. All of the departments – engineering, operations, maintenance, and quality – are active participants. With this kind of attention and support, everyone is motivated to do his or her best work."

"People talk all the time about teamwork," Hale of Sappi says. "We had a great group of people on this project with mill process engineers, ANDRITZ, operations, and maintenance. This has been outstanding. We could not ask for a better project."

◀ Gregory Hale, Sappi Project Manager

▲ Scott Thibodeau, Utility & Recovery Shift Supervisor (standing), discusses performance of the kiln with Steve Simpson, Senior Operator, in the control room.

▲ Lance Bolduc, Recovery Manager (left), is shown with Todd Lewick, Burner Project Manager for ANDRITZ, with LimeFire burner in background.

"The ROI on this project is significant," Bolduc says. "We did some other things during this project which have paid back as well. We can start up easier and we have the capacity to store more product to keep the kiln running at a stable production rate. We don't experience the swings that we used to. And, we have cut our purchased lime down to a point where I would be uncomfortable cutting it any more."

Magnificent!

One year after start-up, Tero Koskinen, ANDRITZ's Erection Supervisor, was in town to inspect the kiln during the annual outage. "The inside of the kiln and the new equipment looked brand new after one year," Koskinen says. "And when the Sappi Reliability Manager and I went into the LimeCool, the only thing he said was 'Magnificent!'. That is a real tribute to the way that Sappi operates the kiln. First class."

Bolduc says, "We had scheduled 60 hours for cleanout and completed the work in 20. We did not have to replace any of the burner end brick and lost only ¼-inch (7 mm) of refractory in a year. In the past, we would have to replace 20 feet (7 m) of brick every year because we would lose 2-3 inches (5-8 cm) of refractory at the burner end."

"I don't know of any mill we talked to that produces more lime after the natural gas conversion than they did before," Hale says. "We put in the LimeCool and LimeFire, fired the kiln harder than we had before, produced more product, and had almost no brick loss. This is outstanding."

Bolduc only expressed one concern, "After the first year of operation, we set the bar so high in terms of the kiln's performance, I only hope we can keep it that high!" he says.

Sappi, a global company headquartered in South Africa, acquired the Skowhegan mill in 1994. Sappi is a leading supplier of coated fine paper, pulp, and release paper in the United States- with a production capacity of 1.3 million tons annually. ▼