Efficiency NB's industrial program is designed to help accelerate industry investments. By using energy-reducing practices and new equipment that lowers energy intensity, industry members can better manage their energy costs over the long term while improving their competitiveness. For more information on Efficiency NB visit www.efficiencynb.ca.

Twin Rivers Paper Company Inc. of Plaster Rock, NB received financial incentives from Efficiency NB to complete energy and engineering audits of its operations, and technical assistance to implement energy-efficiency measures. The company has invested about $14 million in boiler, kiln and heat recovery projects, an investment that is expected to be paid back in less than five years.

"Efficiency NB is fantastic to work with and they're very proactive. We're so busy day-to-day so ENB gave us the push we needed."
—Paul McKinley, General Manager

For more information on Twin Rivers' energy-efficiency projects, contact:

Earle Fawcett, Maintenance Superintendent
Twin Rivers Paper Company Inc.
Tel: 506-356-4117
Web site: http://www.twinriverspaper.com/

Read the related case study on Twin Rivers Edmundston operations at: http://www.efficiencynb.ca/cms/uploaded_files/9WITQ45EOB/73/docs/large_industry_case_study_twin_rivers_en.pdf.

Saving energy, saving jobs:

Energy-efficiency projects help keep the Twin Rivers Plaster Rock lumber mill operating

Twin Rivers Plaster Rock lumber mill. Photo courtesy of Twin Rivers. Plaster Rock produces dimension lumber and studs for residential and commercial construction applications. By-product softwood chips and biomass are used internally at its pulp and cogeneration operations in Edmundston, providing a secure source of SFI® certified wood fiber.

Soaring oil costs. A global economic downturn. Creditor protection. By 2008, the financial situation at the Twin Rivers Plaster Rock lumber mill was anything but stable. In early 2008, with the mill closed, the company decided to study the possibility of installing a new biomass boiler using Efficiency NB's Business Case incentive. The study would examine the detailed feasibility of installing a new biomass boiler to eliminate oil use and cost. The outcome of the study would determine whether the mill would remain shut indefinitely or be the basis of a modernization investment by the company resulting in the re-opening of the mill.

The good news for the company and the mill's employees was that the result was positive. Working in partnership with Efficiency NB, the company was able to build a solid project business case and develop additional energy savings projects resulting in a modernized, highly energy efficient and competitive operation with substantially reduced energy costs.

Efficiency NB (ENB) & Twin Rivers

ENB entered the picture in 2008. "We had presented upper management with the broad scope of the projects—originally estimated at $18 million—but needed to narrow the costs," Fawcett says. "It was around this time that a friend of mine at an engineering firm (Stantec) mentioned Efficiency NB," says Fawcett. Fawcett's manager, Paul McKinley, General Manager for Twin River Lumber Division, gave him the go ahead to contact them. Efficiency NB came to the mill when it was shut down and made a presentation about the Large Industry Program to Paul & Earl. The company ended up signing an agreement with Efficiency and formally entered the Program.

Efficiency NB ended up providing half of the cost for an engineering study under its Business Case incentive to enable Twin River to build a detailed business case and savings measurement plan for the boiler project and supported additional studies to identify additional ways to the lower energy costs. All told, the study helped to identify additional savings and the mill found ways to lower the overall capital costs for the boiler and kiln modernization project to $14 million. "Once we knew those costs, management was much more receptive and the process began." says Fawcett. The study was completed in early summer 2008 and by July of 2008, the Board of Directors of the company approved a modernization project involving $10.5 million for a new biomass boiler and an additional $4 million for installing 2 new kilns and upgrades to the sawmill.

Mill employees acted as the construction contractor for the project thereby bringing people back to work in the region and reducing the overall project cost. Although the mill was, for all intents and purposes, closed, a skeleton staff, along with local contractors, continued to work on energy-efficiency upgrades that included a new biomass boiler, replacing old kilns, and installing heat recovery systems.

McKinley says that the energy savings provided by these projects have made the company more competitive. "Our oil costs were reaching $3 million annually and the savings have made our operations financially sustainable," ENB, he says, was a big reason for the success of the projects. "ENB and Peter Bassett in particular [ENB's senior energy advisor] have been a tremendous help to our company. They helped us scope out the projects and build a good business case, showed us how to improve efficiency on the new kilns we were buying, and gave us the push that we needed.". "We fully re-opened the operation again in November 2009."

High Efficiency Biomass Boiler

In the "*old days*", biomass was viewed as a waste and no financial value was ascribed to it. In today's world, with the closure of so many sawmills in the province, biomass has become a critical resource for pulp mill operations. Therefore, all of the biomass that is not burned on-site at Plaster Rock is sold to the Twin River Edmundston pulp mill operation generating important revenue for Plaster Rock as well as providing a cost effective biomass source for Edmundston. These new economic conditions create an important driver for maximizing the efficiency of biomass use at Plaster Rock. The company therefore chose a high efficiency biomass boiler and incorporated further enhancements to achieve even higher overall energy efficiency.

At the heart of the Twin Rivers upgrades was the purchase of a high-efficiency biomass boiler. The new boiler replaces oil-fired boilers as well as four Dutch oven biomass boilers that were more than 60 years old. Ron Beaulieu, Twin Rivers' then manager of energy projects, explains that the system runs on mill waste, mostly bark from the sawmill. The amount of bark produced from the sawmill is about twice as much as the new boiler needs, so the excess is sent to the company's Edmundston mill to be used in their 38MW cogeneration plant.

From the fuel bin, which holds up to 350 green tonnes of bark, the bark is fed into the combustor. The combustor step grate has three zones—one to condition or dry the fuel, one to gasify the fuel, and the third to burn leftover carbons. "The step grate design allows for maximum efficiency because it limits the air intake at the critical burning stage and adds air later to reduce emissions," says Fawcett. Beaulieu says that, due to the gasification system, the boiler doesn't need an electrostatic precipitator to control emissions. "This reduces our costs and means that the system only produces about 1.5% ash from the biomass combustion," he says. Flue gases from the combustor heat water to generate steam. An economomizer preheats the boiler feedwater and reduces the temperature of the flue gas, which is then sent through a multi-clone dust collector to remove particulate matter.

(Possible insert of graphical image)

In order to further increase the efficiency of the new biomass boiler, the company worked with Efficiency NB to study the possibility for recovering heat that is normally rejected from the boiler grate cooling system and re-use that heat in infloor heating tubes in the fuel bins, to condition the fuel by removing moisture and preheating the biomass before it enters the boiler. The result of the study was positive and the company proceeded to incorporate this energy efficient element into the project. This results in further increases to overall boiler efficiency thereby decreasing the amount of biomass required for steam generation.

But Twin Rivers didn't stop there. Senior management had the vision of further improving the energy economics of the mill in the future through power generation. The Business Case had examined different scenarios for the boiler project with and without power generation. Although current economics are not attractive for generating power, senior management opted to spend an additional *$600,000* to expand the boiler capacity so that, in the future, a steam turbine could be added to produce electricity. "We went from a 100-pound pressure capacity in the boiler to 600 pounds and added a super heater inside the boiler," says McKinley. "There's a gap in that section so it would be relatively easy to open up the side wall and interconnect it with a steam turbine." This additional provision will permit future generation of approximately 5 to 7 MW of power when the economics become favorable.

The payback on the boiler is estimated to be about three years. "The financial savings were the driving force behind the project," he says, adding that the company is no longer burning some 5.5 million litres of bunker C oil each year. The avoided annual GHG emissions are in the order of about 17,000 tonnes of CO_2 equivalent. Should a Canadian or North American carbon market emerge in the future, those reductions could be sold as credits.

Boiler start-up

Energy Efficient Kilns

Upgrading the kilns proved challenging in more ways than one. “Energy efficient kilns are expensive and are not an industry standard when combined with a biomass boiler,” says Fawcett. “For years, biomass has been seen as a waste product from sawmill operations and the kiln manufacturer we had originally selected didn’t have a design that would work for us.”

Beaulieu explains how their old kiln process worked. “There are two massive doors at the end of the building,” he says. “Lumber would be piled inside for drying but when we needed to empty it, we’d have to turn the heat off. That interrupted the drying cycle and cooled everything off, so our drying efficiency was very bad.”

Meanwhile, Efficient NB had been reviewing a University of Laval study on kiln efficiency and passed the study on to Twin Rivers. The university had experimented with a heat recovery system on a large kiln application, a move that was highly innovative for the industry. Twin Rivers then approached a second kiln manufacturer (MEC) with the study and worked with them to incorporate a heat recovery system into their kiln design. Beaulieu recalls that the kiln manufacturer had never seen anything like it. “The study gave the steam consumption on different kilns per 1,000 foot of production and where heat energy is specifically used during the whole drying process. It also provided a list of things that could minimize steam consumption in the kilns,” he says. For instance, the study found that building a common wall within a kiln would minimize heat losses when the doors were opened to remove the lumber. MEC used those guidelines to manufacture the new kilns. Fawcett says that the main benefit of the new kilns has been the heat recovery. “We use recovered heat from kiln exhaust using a heat exchanger to heat incoming air, thus reduce the amount of steam required by the kiln and consequently reduce process steam and related biomass at the boiler.”

Heat recovery from exhaust on roof of new kilns

But Twin Rivers didn't stop there. Traditionally, companies use process steam to heat the rails entering the kilns in winter. The company carried out a study, supported by Efficiency NB to examine the use of flash steam from the condenser at the kilns as a heat source for rail heating. Normally, this flash steam is vented to atmosphere. "The rail heating system at the kiln uses heat from the condensate and flash steam," Fawcett explains. "A closed loop glycol system with a heat exchanger is used with no process steam required. Rail heating from the kiln condensate also makes the kilns more efficient," he says. The company also purchased and installed a weigh scale system, modified by MEC, to assist in optimal kiln performance. Variable frequency drive fan motors are used for exhaust and circulation and to control the drying process.

Measuring the Savings

As the adage goes, you can't manage what you can't measure, so Efficiency NB provided Twin Rivers with customized technical support to develop a monitoring and verification plan to be able to continue to operate the new systems at maximum efficiency by making their performance visible to operators.

The Plaster Rock monitoring plan is relatively simple. A moisture meter inside the biomass fuel bin tracks the drying cycle and is connected to the company's existing software that tracks fuel usage. All of the monitoring systems were done in consultation with Efficiency NB, which also referred Twin Rivers to other experts in the field.

"Normally, when you figure out how much fuel you consume, you also measure the steam output and then perform calculations to determine how many tonnes of biomass you had to burn to generate that heat. There are a lot of variables," explains Beaulieu, "and we would have had to do continuous oven tests to get the right information."

Instead, Twin Rivers made use of its existing metering screws (screws that push the biomass into the combustion unit), which count the number of rotations of the screws. Combined with the moisture meter, the screw rotations allow staff to calculate how much fuel is going into the boiler. "By knowing how many green tonnes of dry fuel we're using and the average moisture content, we can monitor over consistent conditions and will know immediately if something is wrong or different in the boiler." Fifty percent of the costs incurred by the company for instruments and meters required to measure energy performance were covered under Efficiency NB's *Savings Measurement Incentive*.

The company also monitors the heat exchange unit on the roof of the new kilns. "We record the outside air temperature and the temperature of the incoming air into the heat exchanger so that we can verify the heat we're actually capturing," he says. "It's not so much about measuring heat as how much heat energy you've saved."

Other Challenges and Benefits

Ongoing training is necessary for the kiln operators, as factors change weekly in the drying process. Training for the boiler engineers was not as critical, but it was important for the engineers to know how to adjust the boiler for changing heating and weather conditions.

"You can show people all the textbooks you want, but if someone has been operating the same system for years and then you throw in a new one without proper training, they're going to maintain some of their old habits," says McKinley.

Beaulieu agrees. "We used to struggle with not having enough steam, or so much capacity that we were venting in places where we weren't before. We went from a situation where staff had to use a pitch fork inside the boiler to move the material around to a state-of-the-art combustor, which is a very different animal," he explains. "Although there are a lot of readjustments that are required with the new boilers and kilns, they're much nicer problems and we know we're not going to be short on steam."

Aside from the financial benefits, Fawcett says that mill productivity has increased as a result of the improvements. "All of these issues contribute to maintaining our jobs and the local area economy." Not only is the mill's future more secure, but Twin Rivers used mostly local contractors to carry out the upgrades. "We created jobs and saved a ton of money that way," says Fawcett.

Energy Management Culture

According to Fawcett, "The changes in our mill have given our company new life. Employees were fully involved in the construction and start up and most were eager to learn the new processes, which resulted in a very positive work atmosphere."

McKinley is proud that the company is making much better use of what was once considered a waste product. “We used to send the bark to landfill, but then the cogeneration facility was built at the Edmundston plant. Suddenly, we had a market for the bark that we couldn’t use in our biomass boiler,” he says. “Before, we would burn whatever we could, we couldn’t have cared less about it, but now we want to be the most efficient at using biomass. The less we use here the more we can sell to the pulp mill in Edmundston and the less they have to purchase from outside sources.”

What’s next?

If Twin Rivers adds a steam turbine to its biomass boiler, the company could, in future, produce electricity that could either be used on-site or sold back to the provincial grid. “The steam turbine will depend on the provincial rate for electricity, but there’s a strong possibility that we’ll be able to do it in the next two to three years,” says Beaulieu.

McKinley knows that other energy-efficiency measures are just waiting in the wings. “There’s probably a lot we can do about our electric bill,” The company is currently about to commence a study to examine the optimization kiln fans to eliminate unnecessary use of the fans during the drying cycle. Efficiency NB brought this concept to the company through its work with FP Innovations. Substantial opportunity exists in kiln drying operations to cut electricity costs through kiln fan optimization. Additionally, the company is looking at conducting an EMIS Audit to look at further controlling energy use by making energy more visible to people in the operation. “This whole project has gotten people thinking and has reinforced the notion that energy efficiency is great for business and the environment,” says McKinley.