Minas Basin's green revolution

By Andrew Safer

A Nova Scotia company with an uncommon mix of business lines in power generation and paper production is becoming a nexus for new green technologies. Minas Basin Pulp and Power Company of Hantsport in the Annapolis Valley has set the bar high by committing to achieve a zero carbon footprint in its papermaking process. At the same time it is developing alternative energy from a variety of sources.

A green corporate culture, an appetite for calculated risk, and significant in-house engineering expertise are driving Minas, a company with 180 employees. Minas has a long history of producing its own power. Several years after the company opened its paper mill in 1927, the supply of electricity became unreliable. The company took matters into its own hands and built its own hydroelectric plant 25 kilometres away on the St. Croix River, as well as a transmission line to deliver the power to the mill. In 1935, two generators were added in the Avon River, and these produce 5 MW of power for the mill. Today, Minas can choose to use the electricity or sell it to the grid and receive revenue from Nova Scotia Power.

Due to sustainability initiatives, each year Minas Basin Pulp and Power:

- is eliminating the need to cut 1,500,000 trees
- uses 580,000,000 gallons less water
- is reducing air pollution by 2,300 tonnes
- saves 344 GW-hours of electricity (enough to power 38,000 homes)
- is eliminating the need for 250,000 cubic metres of landfill volume

Paper mill and recycling

The Hantsport paper mill produces 100,000 metric tonnes per year of linerboard (the outside and inside layers of a corrugated box) and paper for coreboard (rigid paper tubes for concrete forms, newsprint rolls, etc.). In the 1950s, the company introduced recycled fibre into its processes, and in 1995 Minas became the first paper mill in North America to use 100% recycled fibre.

Two and a half years ago, Minas purchased a paper mill in Newton Falls, New York, and has since converted it from exclusively 100% wood fibre to potentially using 100% recycled fiber. In addition, a dissolved air flotation unit was installed. It removes fibre and clay from the effluent and puts it back into the process along with water, enabling Minas to phase out the lagoons and settling ponds. Al Gore's new book, *Our Choice: A Plan to Solve the Climate Crisis*, was printed on coated freesheet produced at this mill.

A key driver in Minas' strategy to use 100% recycled fibre is Scotia Recycling. This affiliated company opened in 1976 in order to secure a supply of recycled fibre for the company's paper mill. Back then, recycled fibre constituted 10% of the input materials.

In addition to supplying Minas' paper mill, the recycled fibre is delivered to Minas' sister company, CKF, which is located near the mill and produces molded-pulp egg cartons, and paper plates.

Besides collecting various grades of paper, Scotia Recycling collects plastics and metal at its depots throughout Atlantic Canada. There are 13 baling facilities that prepare the materials for shipment to numerous locations or to its own Burnside processing facility in Dartmouth. Some of the materials are also sold internationally.

After Scotia Recycling began accepting corrugated cardboard for recycling, the Nova Scotia government banned this material from all landfills in the province in 1996.

A long-established pulp and paper company in Nova Scotia has become a hotbed of new green technologies. Minas Basin Pulp & Power is diversifying into recycling, tidal and wind power, and turning plastics into fuel.

Aerial view of Minas Basin plant (foreground) on the Avon River, part of the Minas Channel in the Bay of Fundy. Blaine MacCall

Tidal power and FORCE

Outside the paper business, Minas is leveraging its engineering capabilities in developing alternative energy initiatives in tidal, cogeneration (biomass), and wind power. The province of Nova Scotia's commitment to having a 25% renewable energy supply by 2015 underpins these efforts.

Together with Nova Scotia Power and Clean Current Power Systems of Vancouver, Minas is participating in an ambitious tidal energy demonstration project 10 kilometres west of Parrsboro (See CCE June-July 2008). The companies are part of the Fundy Ocean Research Centre for Energy (FORCE), a public/private partnership dedicated to studying the performance and interaction of tidal energy turbines within the Bay of Fundy environment. The Bay of

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Above: Minas' small hydroelectric power station on the Lower St. Croix River. Right: measuring wind power generating potential near the St. Croix. Far right: 1.2-MW tidal power generator from Marine Current Turbines that Minas Basin will install in Bay of Fundy.

Fundy is rated one of the world's best tidal energy sites; the potential resource in the Minas Passage area is estimated at 300 MW — enough to power about 100,000 homes.

Minas won the contract to lead the design and construction of the FORCE facility, which includes the underwater and power transmission facilities, as well as a research and visitor centre on land which is about to begin construction. This will be North America's first in-stream tidal energy demonstration facility where the performance of the units will be monitored. "Our goal is for Canada to be in first place in tidal energy in the world," says John Woods, P.Eng., who is vice president of energy development at Minas and the chair of FORCE.

For its own part in testing tidal technologies, Minas plans to install a 1.2-MW turbine supplied by U.K.-based Marine Current Turbines in the fall of 2011. Instead of using the conventional barrage method of generating tidal energy by creating a dam and then dealing with the associated issue of siltation, the demonstration project will feature in-stream turbines. Fixed to the ocean bottom, the turbines will face both the incoming and outgoing direction of the tides, requiring no directional control.

Compared to the barrage turbines, these larger-bladed turbines will turn slower (between 15 and 25 rpm). "Any size fish is expected to pass through without harm," says Woods. "We believe this demonstration project will show that."

Woods expects the turbine will produce enough electricity to power 800 homes. He adds that Minas may install additional turbines, noting that the demonstration project has received environmental approval for up to 5 MW.

Much of the engineering that these initiatives require is carried out by staff engineers, but Minas also contracts consulting engineers for specialized scopes of work, such as the tidal project. "Nobody (on staff) understands the bathymetry and currents of the Bay of Fundy," explains Scott Travers, P.Eng., president and chief operating officer at Minas. AECOM, Oceans Limited, Strum Engineering, Atlantic Marine Geological Consulting, Envirosphere, Seaforth Engineering and Dobbs Architects, are outside consultants helping on the tidal project.

Wind power, biomass and cogeneration

Since 2004, the company has also been assessing the feasibil-

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ity of wind power generation on properties adjacent to the St. Croix hydroelectric facility, and in New Ross, 50 kilometres away. Minas is using four anemometers and two directional vanes mounted on certified meteorological towers to log temperature and wind speed at various elevations, 24/7.

Staff engineers have extrapolated the amount of energy that would be generated at the centre line of the turbine installation. "We know exactly what we're dealing with," observes Travers, a mechanical engineer. Once Nova Scotia passes legislation that opens up the sale of energy to private parties, he expects that wind power generation will become economically feasible.

On another front, Travers reports that the company plans to convert the pulp and paper process steam plant from a Bunker C fuel oil-fired boiler to a wood-fired boiler, via a wood chip pile feed. The company is evaluating conventional stoker-type boilers but using wood flour — pulverized dry wood chips put through a hammer mill and reduced to dry powder. This method replicates the effect of a fluidized bed, Travers explains, because the increased surface area of the powder yields a higher-efficiency burn.

While this cogeneration system will use the plant's existing distribution system, "What would change," says Travers, "is the disappearance [from the plant's processes] of millions of litres of oil every year. That's a lot of carbon in the air!" The conversion will generate significant carbon credits, as each litre of oil fuel has 3 kilograms of carbon associated with it. It will also ensure that the company has a secure energy supply, while enabling Minas to become eco-certified by Environment Canada.

The company plans to hire one or two engineers for site coordination of the cogeneration project.

Diesel from plastics

While eliminating the use of fuel in the mill's steam plant, Minas is planning to produce diesel fuel in another process. The company has run trials at a facility in Germany that has a non-catalytic process to produce automotive-grade diesel from plastics. Travers explains that reverse polymerization brings the plastic waste to the desired temperature through a cracking process (as in an oil refinery), which taps off the distillates. He favours this process over one that uses a white-powder catalyst because it eliminates the need for an input chemical. Technical due diligence is ongoing.

In recognition of the company's commitment and achievements in the area of sustainability, in November Minas received the Maritime Business Ethics Award from the Better Business Bureau of the Maritime Provinces.

Minas' own engineering capacity is considerable. Reflecting on the skills required for the design, analysis, and optimization of power generation, for example, Woods notes that one of the in-house mechanical engineers has a Master's degree in Engineering Mathematics. "Electricity is 10% about metal, and 90% math. It's a product you have to use the moment you produce it."

Travers points out that when Minas' staff engineers decided to triple paper production in 1996, they designed, built, and commissioned the new production line in-house. "We took on more risk because we didn't get a guarantee that would have come with an off-the-shelf solution, but the cost was much lower, and we know our paper machine. We're very proud of our engineering capacity." CCE

Andrew Safer is a freelance writer based in St. John's, Nfld.