

Cranking up *the* HEAT

Award-winning Canadian company burning biomass to produce syngas that fires industrial plants and public institutions.



Nexterra's gasification project for Tolko Industries in Kamloops, B.C.

by Andrew Topf

Combustion has been used to power industrial furnaces for centuries, dating as far back as the first silver-smiths in China.

The Chinese and other ancient cultures burned wood in kilns to bake pottery and shape metals, with wood fuel later replaced by coal, natural gas and fuel oil to extract metals from ore (smelting) and as a heat source in oil refineries and chemical plants.

Now a Canadian company is putting a modern twist on an ancient idea by burning biomass, otherwise known as waste wood, to power industrial plants and public institutions; the technology could one day serve as a viable complement to petrochemicals.

Using a technology called biomass gasification, B.C.-based Nexterra Energy Corp. converts wood waste into clean-burning "syngas" that can be burned to produce steam, fired directly into industrial boilers or lime kilns, or fired into combustion engines to produce electricity or petrochemical byproducts – although the latter is still in its infancy.

In business since 2003, the company won an Award for Technology Innovation and Application at the recent Globe 2008 trade show and conference in Vancouver.

The gasification process differs from conventional combustion in that the amount of oxygen is controlled to produce the syngas, rather than allowing most of the wood to burn up and produce smoke and particulates that need to be

scrubbed out of the flue gas.

"In combustion when you're burning the wood you're providing as much oxygen to the combustion process so there's complete and full combustion of the fuel," explained Nexterra president and CEO Jonathan Rhone. "In gasification we only provide about 30 percent of the oxygen required for full combustion. That means we starve the oxygen in the gasification chamber so only a very small portion of the fuel actually burns and the heat from that limited combustion converts the rest of the fuel into a syngas."

Rhone said conventional combustion suffers from a number of problems, including the fact it produces a lot of waste, it is only about 20 percent efficient, and it is tough to scale down, meaning the plant either needs a very large source of fuel nearby, or faces high transportation costs to truck it in.

Gasification, by contrast, is cleaner, more efficient, and more versatile, said Rhone, noting the technology can produce heat and electricity for facilities using up to 10 megawatts of power annually – as a comparison, the average saw-mill uses 2 to 5 mw.

"We can scale this down under 10 mw and still be economic," he said.

The gasification process is started with fuel oil and natural gas but once the system is going it's self-sustaining, meaning no external fossil fuel source is required. It burns 24/7 and requires minimal operator intervention.

Rhone said particulate emissions are extremely low compared to traditional combustion because the wood is not com-

pletely burned. A small amount of ash residue is normally landfilled on-site or trucked away.

"We can achieve virtually a natural gas particulate emissions standard using conventional dust-collection equipment," said Rhone, adding the process also produces lower NO_x (nitrogen oxide) emissions than conventional combustion.

The company is working closely with the forest products industry to offer solid wood processing and pulp and paper plants the opportunity to convert from natural gas to biomass, a conversion that can deliver considerable cost savings.

In 2006 Nexterra successfully commissioned a turnkey gasification project for Tolko Industries at a plywood mill near Kamloops, B.C. The system converts hog fuel produced at the mill into syngas, which displaces 235,000 gigajoules of natural gas previously used to dry veneer and to produce hot water for log conditioning. The system saves the mill about \$1.5 million in annual fuel costs, according to Nexterra, and cuts its greenhouse emissions by 12,000 tonnes.

Rhone said Nexterra also sees considerable potential in public buildings like hospitals and universities, which run on central heating and can be relatively easily switched over from natural gas to biomass.

The company recently implemented a gasification system for the University of South Carolina to convert hogfuel obtained from a nearby mill into thermal energy to heat and power the campus. It is also working with the Dockside Green Development in Victoria, B.C. to install a biomass gasification system that will provide heat and hot water for the complex, which is being hailed as a signature example of "green building" practices. The wood fuel is to be collected from nearby land-clearing and tree trimmings, which Rhone noted is a growing market for bio-

mass collection.

"It's very important to nail the (source) down but it's certainly a changing market and there's more sources than were available in the past," he said. "It's all driven by the cost of conventional energy."

Indeed, with the price of natural gas running at \$9-\$10 a gigajoule, compared to \$1-\$3/GJ for hogfuel, bark or wood waste, the cost of installing a gasification system can be recouped in a few years, Rhone remarked.

When Nexterra began five years ago it didn't envision its technology being used for power generation, but again, with the cost of fossil fuels continually rising, Rhone said some clients could end up selling surplus power from gasification into the electricity grid.

The company recently formed a partnership with Calgary-based Pristine Power to develop a series of "cookie cutter" 10 mw power plants that could be replicated across northern B.C. The plants fit into the British Columbia government's call for a proportion of the province's power to be produced through bio-energy.

The demand for renewable fuels has driven other uses for Nexterra's technology. Syngas can be refined to the point where it is fired directly into combustion engines to produce electricity, and while it's still in the early stages, Rhone said Nexterra is working with major engine manufacturers to develop this technology.

"We believe it's potentially a transformative technology in the power industry," he said.

Looking further ahead, highly advanced gasification applications can take the syngas and convert it into ethanol and refined fuels, or even plastics.

"That's where the future of the industry is going," said Rhone.

Nexterra Energy Corp.

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Locally sourced wood waste is loaded into the fuel bin, conveyed to a metering bin and then bottom-fed through the fuel feed cone. The material is then distributed across the top of the fuel pile into the gasification chamber. The wood is converted into synthetic gas ("syngas") that can be used like natural gas.