Nexterra’s biomass gasification systems are using waste biomass to provide heat and power at industrial and institutional sites throughout North America and beyond.
Nexterra Systems Corp. is unlike many gasification companies. For one, the Vancouver, British Columbia-based company is focused on smaller, “distributed,” or community scale, waste-to-energy plants that are less capital intensive and that have what the company characterizes as less fuel risk than large utility scale projects. Another characteristic that sets Nexterra apart is that it is focused on proving out its technology on a wide variety of renewable waste feedstocks. And, having several gasification systems already up and running also is making Nexterra stand out as a technology leader in an emerging industry.

Nexterra President and CEO Mike Scott is the first to admit, “We are not the company that is going to take a green garbage bag full of unsorted municipal trash and run it through our system.” That is not our focus.

“We are really looking at taking the byproduct wastes that have some energy value in them, processing them cost effectively and delivering best-in-class emissions using those waste feedstocks,” Scott says.

**TECHNOLOGY DEVELOPMENT**

Since the founding of the company in 2003, Nexterra has been focused on enhancing and commercializing gasification technology for thermal and co-generation applications. Engineers and scientists conduct research and testing at the company’s Product Development Centre in Kamloops, British Columbia.

Its gasification systems are designed to convert waste biomass fuels into clean-burning syngas that can be used as a direct substitute for natural gas and other fossil fuels in the production of heat, steam and/or power.

As Scott puts it, “Our goal is to establish the global standard for converting low-value, renewable waste feedstocks into higher-value energy fuels and chemicals at distributed scale.”

One of Nexterra’s newest projects was commissioned in September 2012 at the University of British Columbia (UBC) Vancouver campus. The project is a collaboration with GE Energy. It is an energy-from-waste combined-heat- and-power (CHP) system that combines Nexterra’s gasification and syngas conditioning technologies with one of GE’s high-efficiency Jenbacher internal combustion engines.

The engine is designed to produce 2 megawatts (MW) of clean, renewable electricity (enough to power approximately 1,500 homes) that will offset UBC’s existing power consumption or that can be sold to the grid. The UBC system also generates 3 MW of thermal energy that will replace up to 12 percent of UBC’s natural gas consumption.

The project, called the Bioenergy Research and Demonstration Facility, represents an important milestone for Nexterra in its efforts to upgrade its syngas and to higher-value gas.

“At UBC, we are for the first time taking the gas that we produce and we are cleaning it up,” Scott says, “removing the tars that are in the gas and making it suitable for firing in a high-efficiency internal combustion engine from GE.”

Mark Tonner, managing director of GE Canada’s energy financial services, remarked at the official opening of the
project, “With the track record at the Product Development Centre and the successful startup of GE’s cogeneration-qualified Jenbacher gas engine at UBC, Nexterra is well on the road to delivering a renewable biomass CHP solution.”

Eco-ignition refers to GE’s commitment to “providing innovative solutions that maximize resources, drive efficiencies and help make the world work better.”

The system at UBC provides between 25 and 26 percent gross electrical efficiency in Scott’s estimation. That is about 25 percent more efficient than a steam turbine used for the same scale operation, he says. The total system efficiency is 60 percent when the heat produced from the engine is factored in. Distributed scale applications for the technology require much less feedstock than a system producing energy for the much larger utility-scale system at UBC, according to Scott—10,000 to 100,000 metric tons versus one-half million to 1 million metric tons annually for a utility-scale plant. Scott says the amount of material required for a distributed plant can be sourced from locally available waste woody biomass. Since this equates to between only one and 20 truckloads per day, the system has minimal environmental impact and is readily available in most urban settings in North America, Europe and elsewhere in the developed world. He adds, “In cases where the biomass availability is somewhat constrained and emissions need to be low, our solution is ideal.”

DISTRIBUTED SCALE

Nexterra’s systems and solutions work best in applications that produce up to 10 to 15 MW of electricity or 40 to 100 MMBtu (million British thermal units) per hour of thermal energy, which is what Scott calls distributed scale. “We think this distributed scale—using locally available waste fuels and situated at our customer’s location—is a great solution, or at least a part of the solution of the renewable energy mix.”

In that size range, Scott says, “We like to become the global standard. We think we’ve got a good start on that. We are one of only a handful of biomass gasification companies in our size range in the world that has successfully operated commercial plants. Also, since our technology produces exceptionally low levels of air emissions, our systems can be sited in urban environments.”

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Nexterra initially focused on forest products companies in North America as the main market for its technology. Nexterra is now marketing its gasification systems to industrial, institutional and distributed scale, independent power producers. Ideal candidates for the gasification system, according to Scott, are district energy systems for public institutions, universities, hosptals, commercial facilities and planned residential communities.

“Our solution and our approach are ideally suited to handling variable waste feedstocks and still meeting strict emission standards,” says Scott. Some of the biomass feedstocks being used in Nexterra’s systems include wood from forest products industrial operations, such as bark/chips, hog fuel and sawdust; clean construction and demolition (C&D) wood; and municipal tree trimmings. At the University of North- ern British Columbia in Prince George, B.C., the system uses pine destroyed by the pine beetle.

Biosolids from sewage sludge also have been tested successfully at the Product Development Centre, reports Scott. Other potential feedstocks Nexterra’s system is exploring include refuse-derived fuel (RDF); poultry litter, compost material; switchgrass; sugarcane waste; known as “bagasse,” and agricultural residues.

“Nexterra is focused on expanding our technology to operate on other forms of waste feedstocks,” Scott says. “The suitability of a feedstock for gasif- ication will depend on its energy content, ash melting point and chemical composition,” he adds.

Scott describes the system’s feed- stock specification as being quite broad. Some pre-processing takes place to size the material to 3 inch minus in every direction as well as to remove rocks and metal. In terms of the C&D wood that is acceptable for the system, Scott says the main requirement is that it cannot contain creosols or arsenic compounds. The moisture content of the material can range from 10 to 60 percent.

There are limits on the amount of chlorine, sulfur and nitrogen that can be in the feedstock. Scott says the sys- tem can use a broad range of C&D ma- terial. Nexterra has proposed several systems in the U.K. that would use fuel from waste wood handling facilities that Scott considers to be fairly con- taminated. “Construction and demoli- tion debris is fine for the system, it just has emission controls implications,” Scott says.

With its gasification systems having been in operation since 2006 and with more than 100,000 hours of project run time, Scott says, “We’re one of the only games in town where you can actually go and see an operating facility with a happy customer.”

Scott says Nexterra’s successful in- stallations are a big selling point. “Our system works. It’s real. It is industry hardened and proven, and we’re very proud of what our team has accom- plished here.”

Scott says he wants to see other waste-conversion technology compa- nies succeed. “We were once one of the companies that didn’t have an operating plant. Now we have a fleet of suc- cessful systems at both industrial and institutional facilities,” he says. “But we need to see more companies suc- ceed because it is important that innova- tion continues.”

The author is managing editor of Renewable Energy from Waste magazine and can be contacted at ksmith@gie.net.

Projects in North America

Nexterra’s industrial-scale gasif- ers are operating at a number of institutions and industrial sites. These systems have logged more than 100,000 hours of successful operation to date. Customers and projects include:

- University of British Columbia combined-heat-and-power (CHP) project opened in Van- couver, British Columbia, in September 2012
- U.S. Department of Energy’s Oak Ridge National Lab, Oak Ridge, Tenn., completed Febru- ary 2012
- University of Northern British Columbia in Prince George, British Columbia, completed in 2010
- Kruger Products paper mill in New Westminster, British Co- lumbia, completed in 2009
- Dockside Green residential and commercial complex in Victoria, British Columbia, completed in 2009
- Tolko Industries plywood mill in Kamloops, British Columbia, completed in 2006
- Nearing completion of a system at the U.S. Department of Vet- erans Affairs Medical Center in Battle Creek, Mich., scheduled to open in 2013

The suitability of a feedstock for gasification will depend on its energy content, ash melting point and chemical composition; he adds.