RENEWABLE Energy FROM WASTE

INSIDE:

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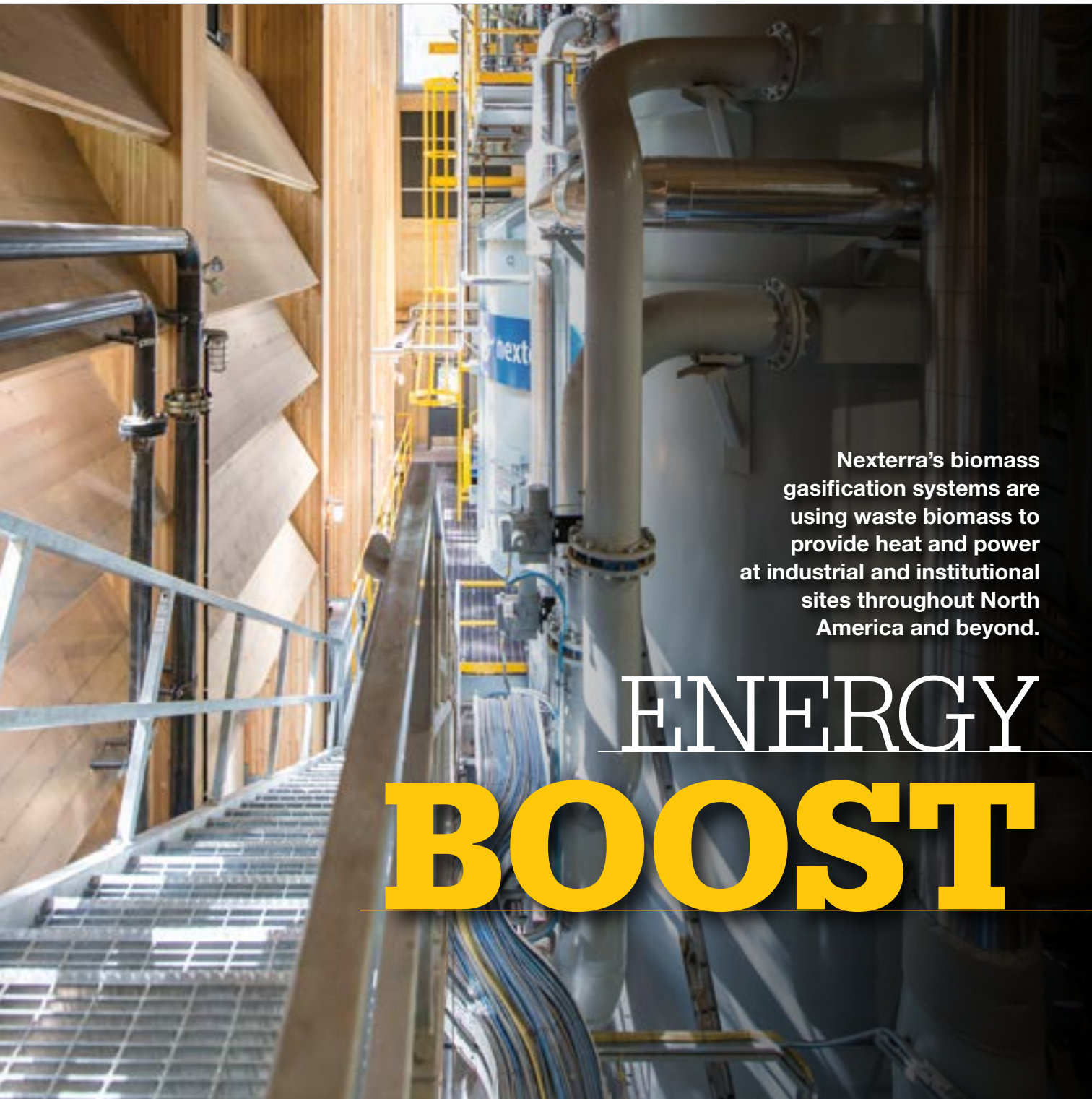

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ENERGY BOOST

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// BY KRISTIN SMITH

ENERGY BOOST

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 cogeneration 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 ecomagination-qualified Jenbacher gas engine at UBC, Nexterra is well on the road to delivering a renewable biomass CHP solution that meets the demanding real-world reliability requirements of district energy providers and distributed power producers worldwide."

Ecomagination 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 production from the engine is factored in.

"If you can produce a gas that is suitable for use in the engine, you can get that efficiency bump which results in an energy boost," says Scott. "The engine is a fantastic conversion device, but taking the variable waste feedstock and turning it into something that is consistent enough, that's clean enough and reliable enough in this high-efficiency engine is challenging."

Scott says dozens of efforts to do this around the world have been attempted. "Some of them have produced power, but to the best of our knowledge, GE's knowledge and others, no one has found a way to deliver a system that is reliable enough to meet the demands of power generators."

The target, says Scott, is to deliver a system that can operate 7,500 to 8,000 hours per year, or 87 to 92 percent of the year, similar to what Nexterra has achieved at its other projects. "The other attempts, mostly in Europe, have been unable to do that," he says. "We are very optimistic that we are going to be the ones to deliver reliable clean syngas that will fire an engine on a consistent and reliable basis."

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'd 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."

Distributed scale applications for the technology require much less feedstock than a system producing energy for the much larger utility scale system 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."

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, hospitals, 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 Northern 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 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 gasification will depend on its energy content, ash melting point and chemical composition," he adds.

Scott describes the system's feedstock specification as being quite broad. Some preprocessing 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 system can use a broad range of C&D material. Nexterra has proposed several systems in the U.K. that would use fuel from waste wood handling facilities that Scott considers to be fairly contaminated. "Construction and demolition 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 installations 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 accomplished here."

Scott says he wants to see other waste-conversion technology companies succeed. "We were once one of the companies that didn't have an operating plant. Now we have a fleet of successful systems at both industrial and institutional facilities," he says. "But we'd love to see more companies succeed because it is important that innovation continues." e

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PROJECTS IN NORTH AMERICA

Nexterra's industrial-scale gasifiers 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 Vancouver, British Columbia, in September 2012
- U.S. Department of Energy's Oak Ridge National Lab, Oak Ridge, Tenn., completed February 2012
- University of Northern British Columbia in Prince George, British Columbia, completed in 2010
- Kruger Products paper mill in New Westminster, British Columbia, 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 Veterans Affairs Medical Center in Battle Creek, Mich., scheduled to open in 2013