PRINCE GEORGE SHOWGUIDE

CANADIAN BIOMASS

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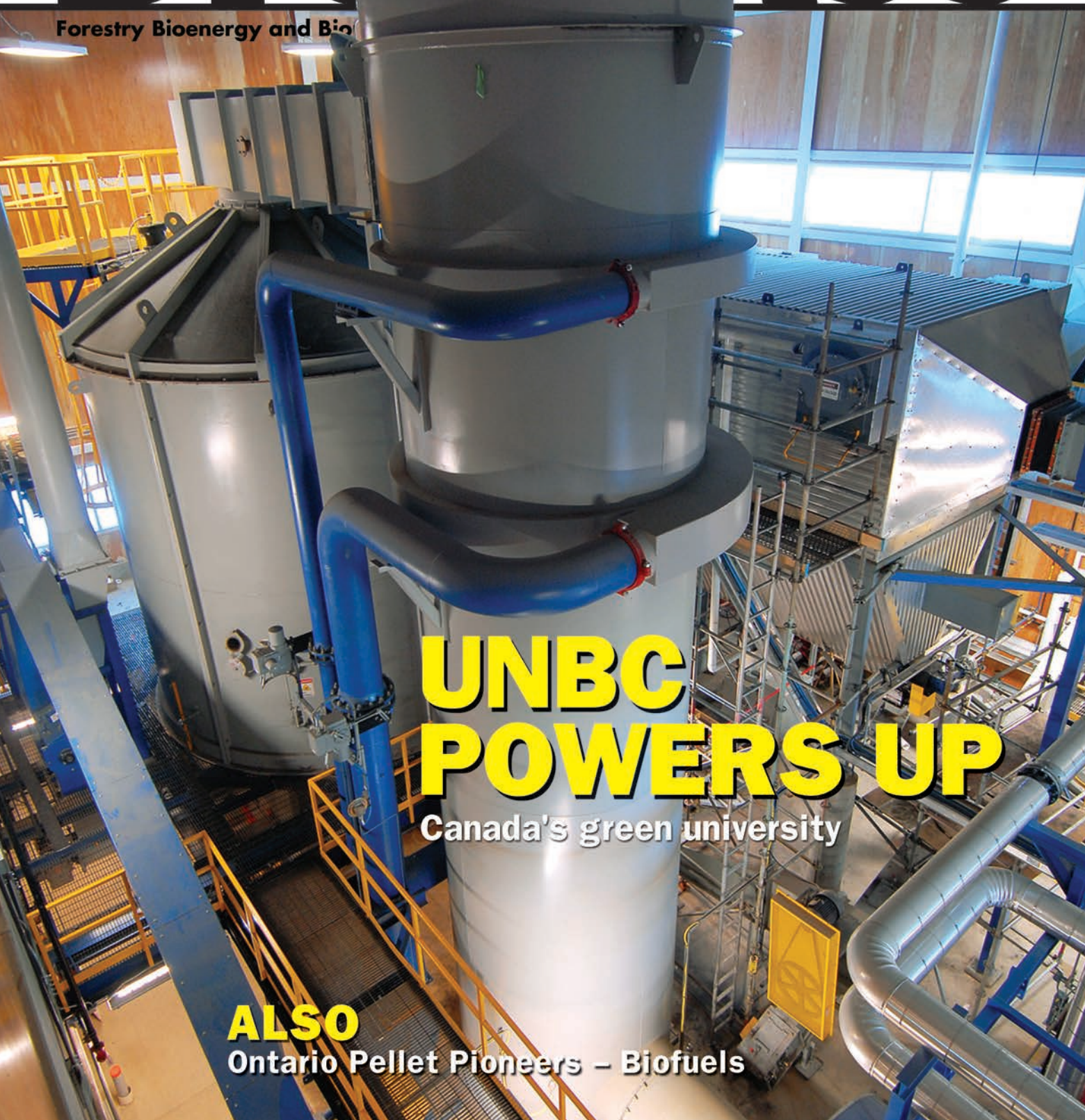
Forestry Bioenergy and Bio



UNBC POWERS UP

Canada's green university

ALSO

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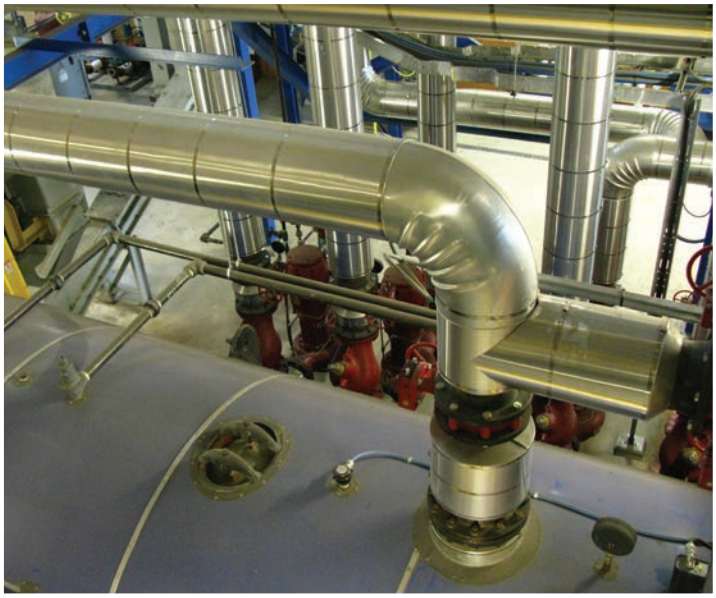
I.K. BARBER
Enhanced Forestry
Laboratory



Green Education

How the University of Northern British Columbia quickly came to embody its own slogan – "Canada's Green University."

By David Manly

USING biomass to produce its own heat and power is a natural fit for the University of Northern British Columbia. Located in Prince George, the university is close to vast tracts of pristine forests and a host of forestry operations. Although the school is a long way from being energy self-sufficient, the process is in full swing.

Back in 2007, the university committed to becoming a leader in renewable energy in the province through the introduction of a multi-year green energy plan. Soon after, it implemented two projects – a wood pellet boiler and a wood residue gasification system.

ONE SMALL CHANGE

Danielle Smyth, sustainability manager at the University of Northern British Columbia (UNBC), says the shift towards green heat and power was not due to some large initiative, but something much simpler. It came about, she says, primarily because a large number of the university's students were enrolled in environmental programs.

"We have always had some strength in our research and teaching in the areas of environmental issues, sustainability, ecological issues and resource-based economy," says Smyth. "We're in a place that has an intersection of relying on our natural resources for jobs, but also needing to balance that with sustainability and ensuring that we have resources long-term."

This manifested itself in the formulation of a green energy plan in 2007, when area wood pellet producers first approached the university to create a pilot wood pellet-heating project. In 2009, the first university-owned and -operated biomass-heating system in Canada was installed, which was designed to provide all the heat necessary for the Enhanced Forestry Lab greenhouse.

David Claus, the assistant director of facilities for UNBC, says

LEFT MAIN: The wood pellet biomass boiler is the first university owned and operational system in Canada and is used to heat the I.K. Barber Enhanced Forest Laboratory.

INSETS: (from left to right) The gasifier produces syngas to heat water for the campus; UNBC receives a mix of wood types in their residues; the pellet system was step one of UNBC's green energy plan.

With the implementation of the gasification system, the bioenergy plant will offset about 85% of the natural gas heating requirement of the university.

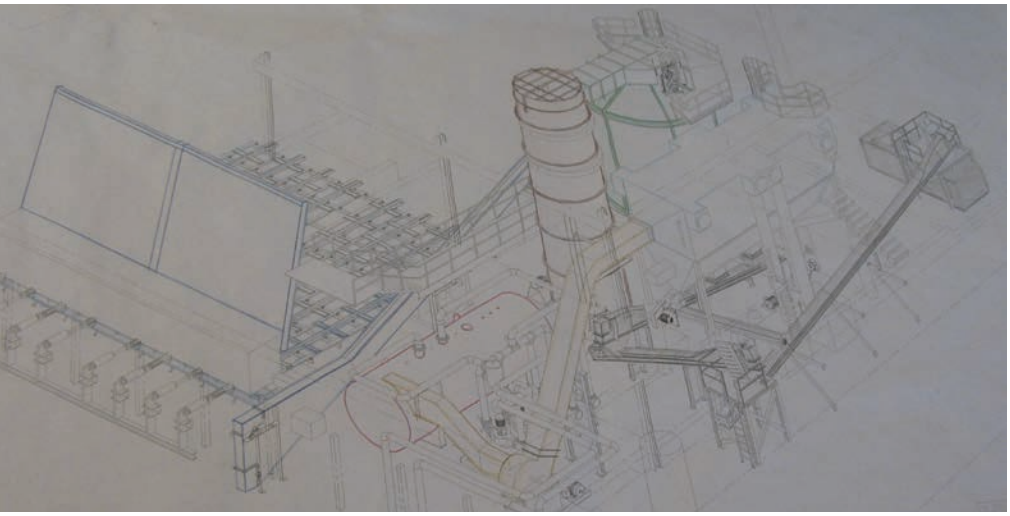
that the boiler has a 400 kW peak capacity using pellets from Pacific Bioenergy in Prince George, but the output for the relatively small system fluctuates depending on the season.

"While running, the pellet system is providing all the heat for the building, and most days, the heat demand of the building is not high enough for it to reach its max output capacity."

HEATING UP

After the success of the wood pellet system, the university decided to take another step and find a technology provider that could produce energy from wood residues. Vancouver-based Nexterra Systems Corp. was selected. Following that, $15.7 million was raised from three sources – the Knowledge Infrastructure Program, the Public Sector Energy Conservation Agreement and the Innovative Clean Energy Fund, with the project becoming operational in January 2011.

The goal of the system was to displace a significant portion of the natural gas used for heating the core UNBC campus through local wood residues from a five-year supply plan with Lakeland Mills, a sawmilling company in Prince George. The residues vary in content depending on what the



The $15.7-million gasification system became operational in January 2011 with the equipment supplied by Nexterra Systems Corp.

David Claus says that the gasifier uses local wood residues from a local mill.

supplier is sawing, which gives the university a large variety of test material to determine which mix works best.

"The gasification process had a number of things going for it," says Claus. "It was developed in B.C. and it was all part of the plan: the pellet system was Phase 1, the biomass gasification system was Phase 2 and we have a plan in mind to go to a Phase 3, which would generate electricity."

One option for Phase 3 that is being considered is the process that the University of British Columbia is using – diverting the syngas accumulated from the top of the gasifier, cleaning it and generating electricity via an internal combustion engine. However, that is only one option for the problem and still very early in the planning stages.

One area of research that the university is also looking into is heat recovery, as the gasifier radiates significant amounts of heat while in operation. If this heat were captured, it could be used to heat other buildings, such as the student residences, says Claus. However, there are still challenges

that must be overcome to accomplish that.

"The way we utilize that heat is we pipe it throughout the district heating system on buildings across campus, and that heating system operates at 115 C (240 F)," he added. "And in order to utilize any waste heat that we recover from the gasifier, we would have to raise the temperature of the heat to a higher temperature than the water loop, which would require an additional input of energy."

Another issue would be how often the heat would be needed during the summer, when the gasifier is not running at full capacity.

Still, even in the current configuration, the gasification system saves the equivalent of around 63,000 GJ of fossil fuels, or the energy required to drive a car around the world 391 times.

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STUDENT POWER

At UNBC, there are a vast number of other green initiatives that do not have to do with energy generation. The students and faculty simply want to create a greener and more environmentally friendly environment, says Danielle Smyth, sustainability manager at the University of Northern British Columbia (UNBC).

"There is a compost and food-scrap program that has been maintained and operated by students since 1995," she added. "And the compost is used in the organic garden located near our student residences and throughout our campus grounds."

One of UNBC's largest initiatives is the "Green Fund," which is a funding program for projects carried out by staff, faculty or students of the university. The program receives $50,000 per academic year to distribute, and interested individuals can apply.

According to Smyth, 10 projects have been funded since the fund's inception in 2009, with students and staff outfitting residences with recycling bins, conducting research on renewable energy on campus and helping students plan, create and build a new geodesic dome greenhouse.

All of these initiatives were put in place because there was a distinct lack of outreach and programs that would help students become more engaged in their studies and in helping the environment.

"I think what we've realized from these projects, as well as our green energy initiatives," says Smyth, "is that this topic of renewable energy and sustainability is of interest to students. And maybe they aren't getting these opportunities in the classroom, so they are seeking out other opportunities such as directed studies and internships."

There are also a variety of student-directed research projects on topics such as renewable energy, sustainability and optimization, all of which could be used to make UNBC a greener place to be.

GREEN EDUCATION
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ENERGY DISTRIBUTION

At UNBC, the total amount of energy used per year is approximately 179,000 GJ, with 60% provided by natural gas and the rest from electricity via BC Hydro. But, with the implementation of the gasifier, the bioenergy plant replaces about 85% of the natural gas used for district heating, says Claus.

"The other 15% is used for peak load, for when it is too cold for the bioenergy plant to supply all the heat, and also during the two one-week shutdowns per year. During those times, we will take heat from the original natural gas boilers."

Claus does not see the natural gas boilers going anywhere anytime soon, as the university still needs a back-up system in place for the core buildings. As well, there are several areas of the campus that are not connected to the bioenergy loop yet and still require natural gas for heat and/or fuel.

"When you buy natural gas, pretty much your entire energy dollar is spent on fuel with fairly low maintenance and operation costs. When you make the shift towards biomass, your fuel costs typically go down, but your maintenance and operational costs go up."

And in the warm summer months, when little heat is needed, the biomass solution begins to make less economical sense when compared to natural gas. The reduced energy needs of a building in the summer may mean that the fuel cost savings are insufficient to offset the maintenance and operational costs that are constant through those months.

GOING OFF-GRID

In the future, UNBC would like to continue to operate and improve both the pellet system and the gasifier, as well as continue the education and research mandates already in place. In addition, there has been a push towards creating an electrically self-sufficient university.

To do so, says Claus, would require further expansion of the biomass system to include up to 2 MW of power generation. And once the university figures out how to create such an isolated and self-sufficient system, it can be put into use for remote communities all across British Columbia and the rest of Canada. •