

UNBC Biomass Gasification System Q&A**1. What is the UNBC Biomass Gasification Project?**

The UNBC biomass gasification project is a \$14.7 million state-of-the-art bioenergy system that converts local wood residue into a clean burning gas commonly known as “syngas” that is used to displace 85% of the natural gas used to heat the university campus. The new plant, which uses Nexterra’s biomass gasification technology, can generate enough energy to heat the equivalent of 700 BC homes. It will reduce UNBC’s energy costs by \$500,000 per year, lower UNBC’s greenhouse gas emissions, shift the Prince George campus from fossil fuels to locally sourced renewable biomass and serve as a living laboratory for bioenergy learning and research.

2. Why is UNBC pursuing bioenergy?

UNBC intends to be British Columbia’s model for green energy and to be the first university in Canada to implement major physical plant changes to become carbon neutral and operate on renewable energy. UNBC’s bioenergy initiatives will reduce the University’s greenhouse gas emissions and fossil fuel consumption and help the University meet its current and future energy needs. At the same time, these initiatives will contribute to research and development, training, student/public education and the development of bioenergy projects for northern communities.

3. What biomass technology did UNBC choose?

UNBC chose a 2nd generation Nexterra gasification system which converts biomass such as wood residues into clean burning “syngas”. Nexterra’s gasification systems are commercially proven and are in operation at industrial and institutional facilities in North America. Nexterra is working with General Electric, the US Department of Energy, Fortis BC and other companies to develop advanced biomass heat, power and synthetic fuel applications. Nexterra is a world-leading BC-based cleantech company that was recently included in Deloitte’s “Fast 50” list of the fastest growing technology companies in Canada. Nexterra has 70 direct employees and has helped created hundreds of jobs in BC through subcontract manufacturing across the Province.

4. What is biomass gasification?

Nexterra’s gasification process uses heat to convert biomass into a clean burning “syngas”. The process is self-sustaining and does not require an external source of energy. Syngas is a highly versatile fuel that can be used as a substitute for natural gas, fuel oil or propane to produce process heat, steam, hot water and/or electricity using conventional energy recovery equipment. It can also be upgraded to produce pipeline grade renewable methane and other high value synthetic fuels.

5. How does the system work at UNBC?

Sawmill residue from Lakeland Mills of Prince George is delivered by truck to the fuel storage area, which can hold up to 60 tonnes of fuel. In a typical year, the UNBC Bioenergy Plant will consume about 6,000 dry tonnes of fuel, equivalent to about 430 truckloads of fuel per year – a little more than one truckload per day.

Wood fuel is fed into the gasifier where it undergoes several stages of thermal conversion including drying, pyrolysis (chemical change brought about by heat) and gasification. The resulting syngas is then conveyed into an oxidizer where it is fully combusted. The resulting flue gas is then directed to a boiler to produce hot water. Hot water from the boiler is conveyed via underground pipes to provide heat and water for the buildings on campus. The cool water is returned to the boiler to start the heating process again.

After exiting the boiler the flue gas is cleaned in an electrostatic precipitator that filters out any particulate matter before being released to the atmosphere. The particulate emissions from the UNBC gasification plant are equivalent to heating systems that burn natural gas.

6. How long did it take to install the system?

It took approximately 14 months to install the system.

7. What are the economic benefits from this project?

This project has resulted in millions of dollars of direct and indirect investment and job creation in northern BC and across the Province. The UNBC gasification system was engineered, designed, supplied and installed by Nexterra. Nexterra does all engineering, design and project management in-house and outsources fabrication and installation services to BC companies across the Province. Subcontractors included local Prince George firms such as IDL Projects, Northweld Mechanical Installations, Houle Electric, Wainbee and Lakeland Mills. Many of the subcontract fabrication firms are companies that have traditionally serviced the forest products and mining industries and are now manufacturing gasification systems for Nexterra's North American customers.

The UNBC project is also a showcase of BC cleantech/bioenergy innovation that can be replicated at other universities, hospitals and municipalities across BC and internationally.

8. Where will the fuel come from?

Lakeland Mills, a family-owned sawmill in Prince George, will supply bark and sawdust to UNBC under a long term fuel contract.

9. How will the system impact the local air quality?

One of the most significant innovations and competitive advantages associated with Nexterra's biomass gasification technology is its ultra-low air emissions.

The UNBC system will not have a negative impact on local air quality. It will produce emissions similar to those of a natural gas-fired energy system.

A third party engineering study that compared air emissions from Nexterra's gasification technology with emissions from 18 conventional biomass combustion systems concluded that Nexterra's technology is significantly cleaner. Key findings include:

- Carbon Monoxide (CO): 50 times less than traditional wood combustion
- Volatile Organic Compounds (VOC): 33 times less than traditional wood combustion
- Particulate Matter (PM): Equivalent to natural gas
- Nitrogen Oxide (NOx) with Abatement: 5 times less than traditional wood combustion systems using NOx control

This superior emission profile makes Nexterra gasification systems much better suited for urban and suburban environments than biomass combustion systems.

10. What are the advantages of Nexterra's biomass gasification systems?

Nexterra's gasification systems are a step-change improvement over the combustion equipment typically found in the forest products industry. Nexterra's systems offer the following advantages:

- Lower air emissions
- Greater fuel flexibility
- Superior operational versatility
- Higher efficiency for power generation applications
- Syngas versatility and capacity to produce synthetic methane
- Lower lifecycle costs

11. Why does biomass gasification make sense for public institutions?

For public institutions such as universities and hospitals, their central heating plants are typically major consumers of fossil fuels (natural gas, fuel oil and coal). These institutions are also big consumers of grid-based power. Switching from fossil fuels to carbon-neutral biomass can help these institutions reduce fuel costs by up to 60% and reduce fossil fuel consumption and greenhouse gas emissions by up to 85%.

Bioenergy is a low cost source of renewable energy that is widely available and can provide a continuous supply of heat or electricity. Biomass gasification is the only form of bioenergy that will not negatively impact local air quality.

12. Why is biomass carbon neutral?

Biomass is considered carbon neutral by the UN Intergovernmental Panel on Climate Change, US Environmental Protection Agency and Environment Canada.

Plants and trees absorb carbon dioxide as they grow, and then naturally release it into the atmosphere when they die and decay or burn; therefore, when biomass or syngas derived from biomass is used to displace fossil fuels it reduces greenhouse gas emissions. It is important to note that Nexterra projects utilize residual biomass and not trees harvested specifically for the purpose of energy production.

13. Who is Nexterra?

Nexterra is an award winning, BC-based company and a world leading supplier of biomass gasification systems for generating heat and power. Nexterra's biomass gasification systems enable industrial and institutional customers to generate clean, low cost renewable heat, power and synthetic gas from biomass fuels.

Nexterra sells its systems into the global market for bioenergy technology and equipment, which is valued at more than \$10 billion annually. Nexterra's gasification technology is packaged with fuel handling and energy conversion equipment and sold to universities, hospitals, military bases, industrial plants and municipalities. Customers include the US Dept of Energy, University of Montana, University of South Carolina, University of British Columbia, Fortis BC, Corix Utilities, Dockside Green Power, Johnson Controls, Kruger Products and Tolko Industries.

Nexterra has strategic alliances with General Electric (advanced power generation), Fortis BC (thermal systems for BC hospitals and syngas for pipeline applications), Andritz and Synagro (biosolids gasification systems for municipalities), University of BC (advance power applications) and Johnson Controls (channel partner for US public sector market).

Nexterra has 70 direct employees and has helped create hundreds of jobs through its subcontract manufacturing supply chain across the Province. Nexterra's head office is in Vancouver, with sales offices in Philadelphia, Atlanta and Brazil. Nexterra's Product Development Centre is located in Kamloops, BC. In 2010, Nexterra was named a Deloitte "Fast 50" company as one of the fastest growing technology companies in Canada.

In addition to its commercially proven thermal gasification system, Nexterra is developing a number of advanced applications of its technology for power generation, combined heat and power, as well as pipeline grade "green" gas made from wood residue. Nexterra is majority-owned by Calgary-based ARC Financial, one of the largest energy-focused private equity firms in North America.