THE UNIVERSITY OF BRITISH COLUMBIA

BIOENERGY RESEARCH & DEMONSTRATION FACILITY

The Bioenergy Research and Demonstration Facility (BRDF), located at the UBC Vancouver campus, is an energy generation facility that processes renewable biomass sourced from urban wood waste to generate thermal energy for heating campus buildings. The building that houses the facility is built with mass timber and is one of the first industrial buildings in Canada to be constructed with CLT panel technology.

BRDF is a signature Campus as a Living Lab project, integrating UBC's core academic mandate of research and teaching with a campus energy supply system.

Bioenergy System

- The facility uses biomass in the form of chipped clean wood waste from furniture manufacturing, sawmill residuals and municipal trimmings.
- Biomass is gasified to produce a clean synthetic gas (syngas), which is combusted to generate steam for heating campus buildings.
- The facility also houses a cogeneration engine which uses a mix of natural gas and renewable natural gas (upgraded biogas) to generate electricity as well as steam and hot water through recovered heat.
- BRDF produces 6 MW of thermal energy from the thermal mode and 2.4 MW of thermal energy from heat recovery of the cogeneration engine, which accounts for 25% of total campus heating and hot water needs per year.
- The cogeneration engine produces 2.0 MW of electrical energy, which accounts for 5% of the total campus electricity requirements per year.
- The facility has contributed to a 14% reduction in UBC's total greenhouse gas emissions compared to 2007 levels.

Thermal system within the BRDF

Building Structure

- The mass timber structure is composed of exposed cross-laminated timber (CLT) panels for the walls, floors and roof, and glued-laminated timber (glulam) columns and beams attached through steel connectors.
- The steel connectors were designed to provide shear strength to the mass timber structure and enabled spans up to 24.5 m.
- The building sits on a slab-on-grade concrete foundation.

Glulam columns and beams with box connectors, and CLT roof

Design Features

- The building consists of the main process floor for the power plant and an upper floor area for the operations control office and a multi-purpose lab.
- Glass walls along the sides of the building allow for public viewing of the facility operation.
- Acoustic louvers in the building envelope provide natural ventilation of the internal areas.

Glass wall on south side of the building

Mass Timber Products

- The CLT panels were fabricated locally, mostly from regionally sourced 90% pine beetle-affected lumber.
- CLT panel properties include high shear strength, durable surfaces, a natural wood aesthetic, and sufficient thickness to assist with mitigating sound transmission.

Mass Timber Carbon Savings

Volume of wood products used:
698 cubic meters (24,632 cubic feet)

U.S. and Canadian forests grow this much wood in:
2 minutes

Carbon stored in the wood:
627 metric tons of carbon dioxide

Avoided greenhouse gas emissions:
243 metric tons of carbon dioxide

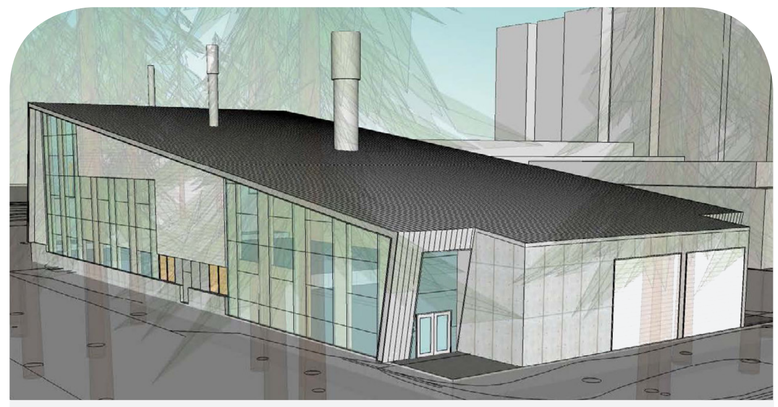
Total potential carbon benefit:
870 metric tons of carbon dioxide

Equivalent to:

184 cars off the road for a year

Energy to operate 92 homes for a year

Source: Canadian Wood Council Carbon Calculator



BRDF Building Stats

- Gross area: 1950 m^2
- Height: 13 m at highest point
- Mass timber: 698 m^3 of mass timber products
- Construction: September 2010 to March 2012
- Total project cost: C$27.4 M (2015)

Code Compliance

- FPInnovation's work on CLT standards and testing allowed BRDF to become the first North American industrial building constructed with CLT manufactured in BC.
- The design of the building met and exceeded the fire safety requirements of the 2006 BC Building Code.
- The building features a comprehensive fire alarm and automatic sprinkler system.

Construction

- Construction was expedited by prefabricated panels delivered 'just-in-time' from a local manufacturer.
- Standardized panels enabled efficient installation with a single crane and a small crew.
- The off-site fabrication of timber components minimized materials stored on site, reducing fire hazards.

Building construction and equipment installation

Social License

- The project required local community acceptance of the facility, which entailed multiple public engagement events prior to construction as well as a community engagement committee during the first year of operations.
- Since the facility is located adjacent to a residential neighbourhood, 24-hour air emission monitoring stations were installed to monitor air quality.

Partners

- Natural Resources Canada
- Western Economic Diversification Canada
- BC Innovative Clean Energy Fund
- Ministry of Forests, Mines and Lands
- FPInnovations
- Canadian Wood Council
- BC Bioenergy Network
- Sustainable Development Technology Canada
- BC Hydro
- Nexterra Systems Corp.
- GE Power

Images courtesy of Don Erhardt, Nexterra and UBC.

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