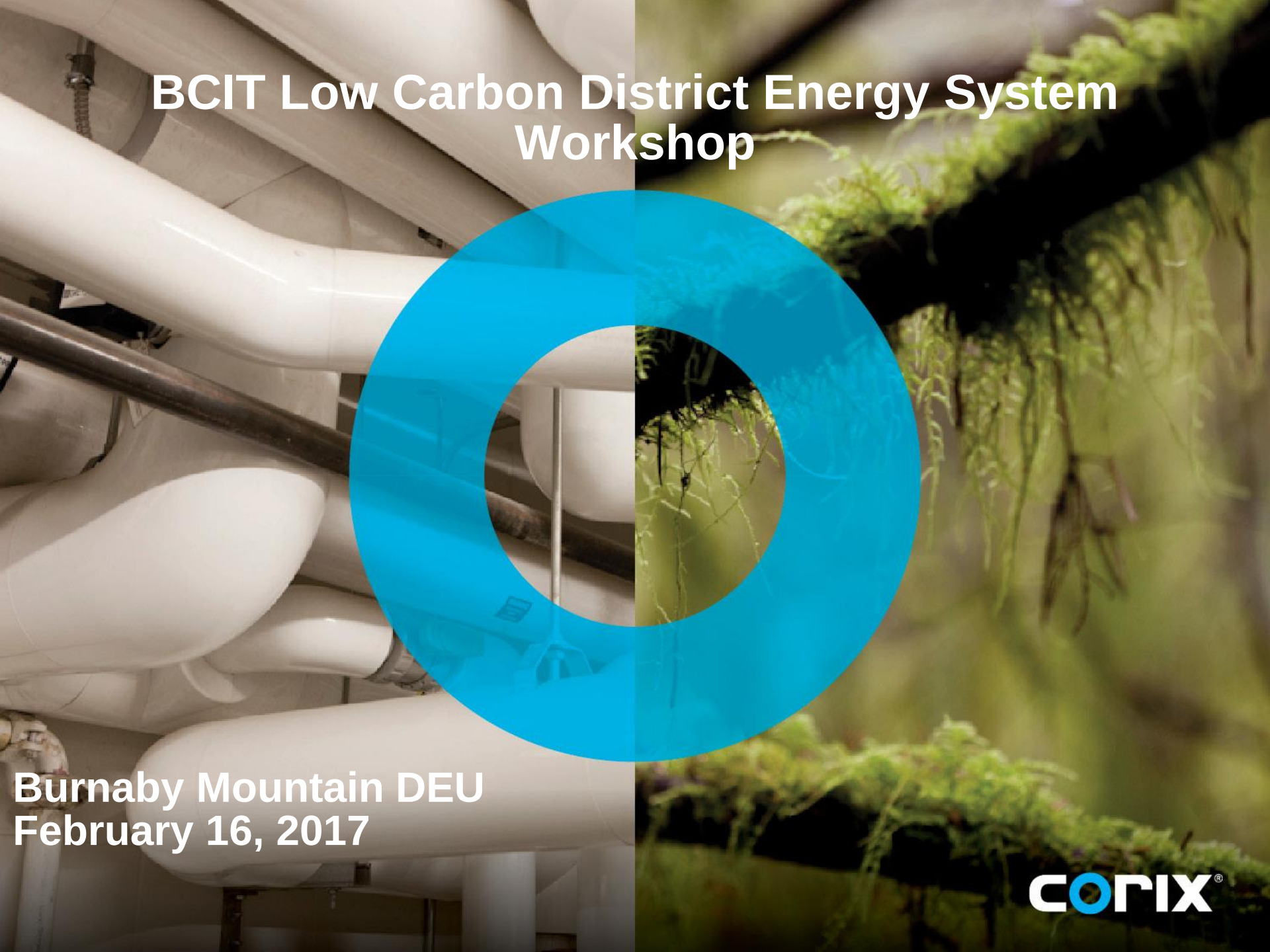
BCIT Low Carbon District Energy System Workshop



Burnaby Mountain DEU
February 16, 2017

corix®

Corix Overview

- A BC based community-focused provider of utility infrastructure services, management, and products located in 7 provinces and 27 states
- Own and operate over 1,200 utility systems, with over 2,100 employees
- We design, build, install, finance, own, and operate energy, water, and wastewater utility infrastructure
- We currently operates 13 district heating and cooling systems, 4 in Lower Mainland, that are delivered under various ownership models

Burnaby Mountain DEU Overview

What is the Burnaby Mountain District Energy Utility Project?

The proposed project will provide cost-effective, low carbon energy to the SFU campus and all new buildings at UniverCity, creating an 80% reduction in greenhouse gas emissions when compared to fossil fuel and electricity use.

Proposed Biomass Facility

It is an extension of the regulated district energy utility that currently provides energy for space heating and hot water to existing buildings at UniverCity.

The project will capitalize on economies of scale to increase efficiency and lower customer rates when compared to individual systems. The existing systems will connect to a central energy plant in order to heat SFU's Burnaby campus buildings and all future developments at UniverCity.

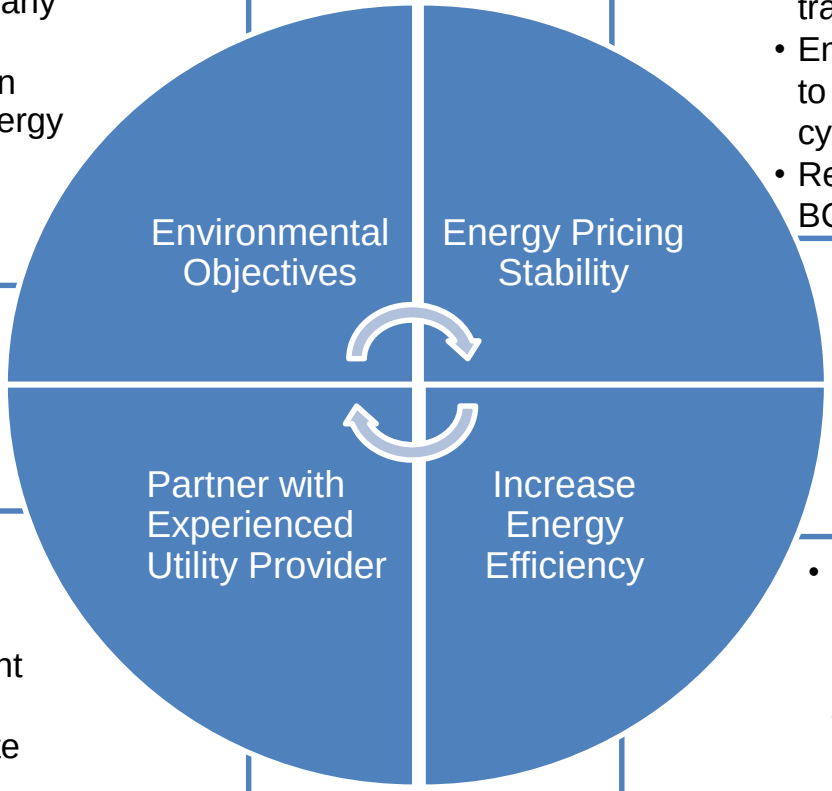
After extensive evaluation of alternative energy sources, biomass (wood waste) was selected as the preferred alternative energy source to achieve greenhouse gas reduction targets, while meeting the thermal energy needs of the growing Burnaby Mountain community.

The goal of the Burnaby Mountain project is to deliver maximum benefits to the Burnaby Mountain community and the environment. The project will also help the City of Burnaby in meeting its municipal greenhouse gas reduction targets.

Project Objectives

- GHG Reductions
- Flexible platform to incorporate best available technology at any point in time
- Reduce long term reliance on fossil fuels via renewable energy technologies

- Reduce the volatility of energy price from traditional sources
- Energy cost reductions to end users on life cycle basis
- Regulated Rates under BCUC oversight



- Proven track record in financing, building and operating DE systems
- Regulation by an independent public body
- Experience with public/private partnerships
- Customer service and system reliability 24/7

- Enhance efficiency and resiliency by integrating existing energy systems with the district energy infrastructure
- Increase energy efficiency in existing buildings

Burnaby Mountain DEU Development

We are Here

- 2 interim central energy plant using NG (2.3 MWt + new 6.0 MWt)
- 1.8 km of piping installed
- 7 buildings connected

Burnaby Mountain DEU

- Biomass based central energy plant - 13.5 MWt
- 8 MWt natural gas peaking and back-up for UniverCity
- 22 buildings and Campus connected
- 3.5 km of piping installed

Low Carbon Energy Source

Technology Process

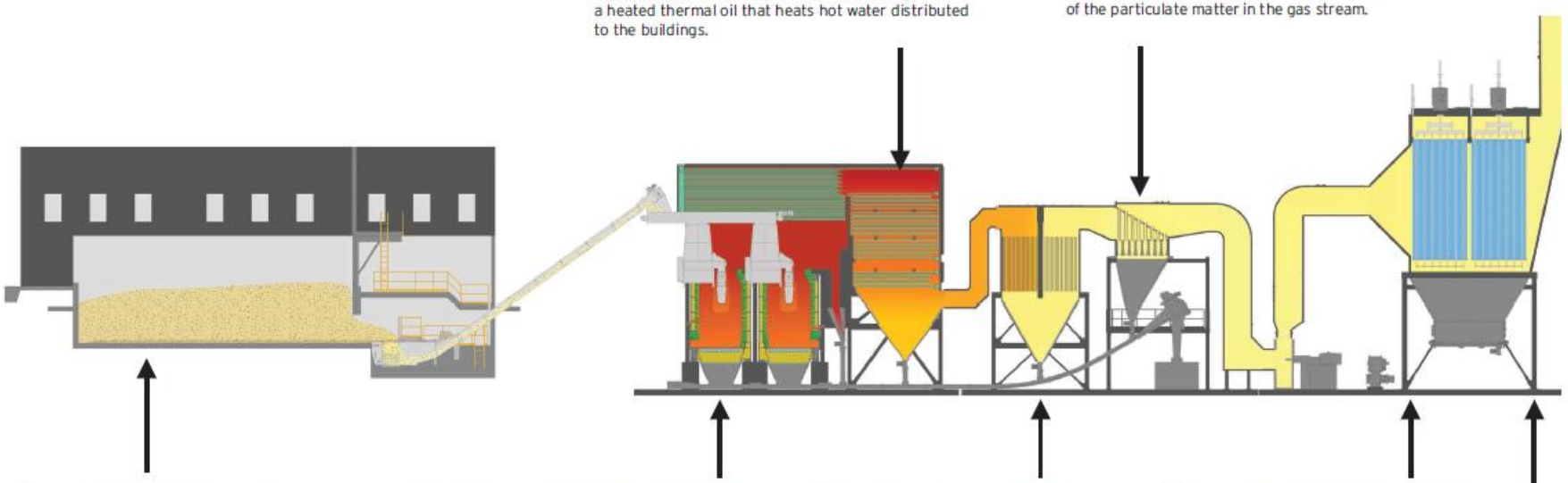
How does the process work?

3 Thermal Energy Exchange

The hot gas passes through a series of pipes across a thermal oil heat exchanger to transfer energy to a heated thermal oil that heats hot water distributed to the buildings.

5 Primary Flue Gas Cleaning

The combustion gases pass through a multiple cyclone tube collector for preliminary removal of the particulate matter in the gas stream.



1 Biomass Fuel Storage

Locally-sourced wood waste is stored in an enclosed fuel bin, sized to provide fuel for up to three days.

2 Biomass Combustion System

Biomass is delivered to two combustion cells and is combined with ideal volumes of air through a process of drying, gasification, and combustion, resulting in hot gas.

4 Hot Gas Energy Recovery

Leftover excess energy from the lower temperature gas is captured to pre-heat ambient air used in the combustion process. This recovered energy reduces the biomass fuel input requirement by 9%.

6 Secondary Flue Gas Cleaning

Filters out virtually all of the remaining particulate matter in the gas stream, achieving discharge levels below the Metro Vancouver mandate of 10 mg/m^3.

7 Final Energy Recovery

An economizer enables the final energy recovery from the gas flow. This will result in a further 9% reduction of the biomass fuel requirement of the system.

Technology Selection

Why Biomass?

SFU, SFU Community Trust, and CORIX completed the screening of several different, proven alternative energy technologies for the Burnaby Mountain District Energy Utility based on criteria identified for the project.

Project Evaluation Criteria

BENEFITS TO THE COMMUNITY	BENEFITS TO THE END-USER	VIABILITY OF SUSTAINABLE ENERGY PROJECT
• Greenhouse Gas Reduction • Use of Alternative Energy Sources • Location and Land Use • Long-Term Durability and Reliability	• Competitive Rates • Reliability • Modularity and Flexibility	• Fuel Availability Supply and Delivery • Appropriate Return on Investment • Regulatory Approval

The following technologies were evaluated:

- High-efficiency natural gas boilers
- Sewer heat recovery and ground source heat pumps
- Biomass
- Waste heat recovery
- Combined heat and power based on natural gas and biogas
- Solar and wind applications

Biomass was ultimately chosen as the preferred technology to meet the energy demand requirements of both the SFU campus and UniverCity.

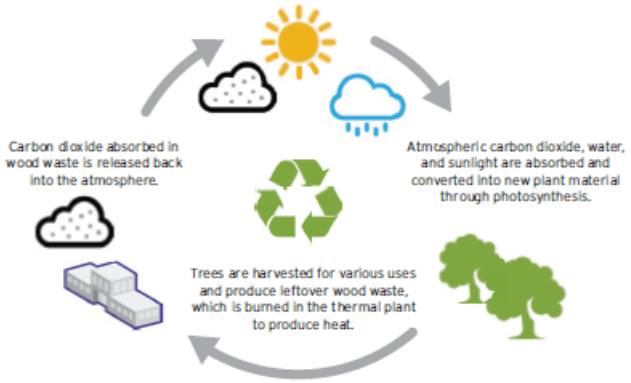
Biomass fuel for the project will be clean wood waste, such as wood chips, shavings, urban, and clean construction wood waste, and will be sourced locally and delivered to the site during off-peak traffic hours. The use of local wood waste supports Metro Vancouver's clean wood recycling policy by re-using clean construction and urban wood waste banned from Metro Vancouver landfills in 2015.

Environmental Considerations

Environment and Air Quality

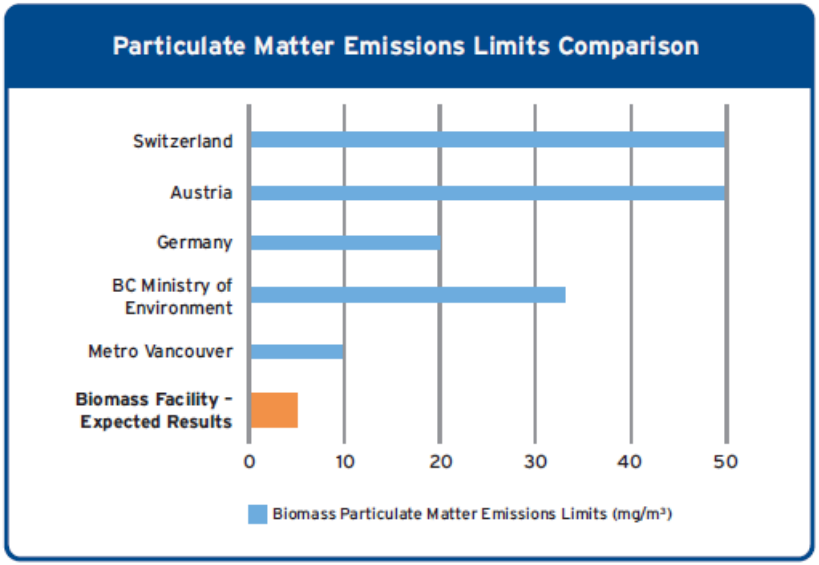
Once the project is fully implemented, the system will reduce an estimated 11,600 tonnes of CO_2 annually, representing an 80% reduction in greenhouse gas emissions when compared to fossil fuel and electricity use.

Using wood waste for energy has a positive impact on controlling climate change. While fossil fuel combustion takes carbon from underground and puts it into the atmosphere in the form of carbon dioxide (CO_2), which is the primary cause of climate change, biomass combustion recycles the carbon that was already in the natural carbon cycle, not adding any additional CO_2 to the atmosphere.



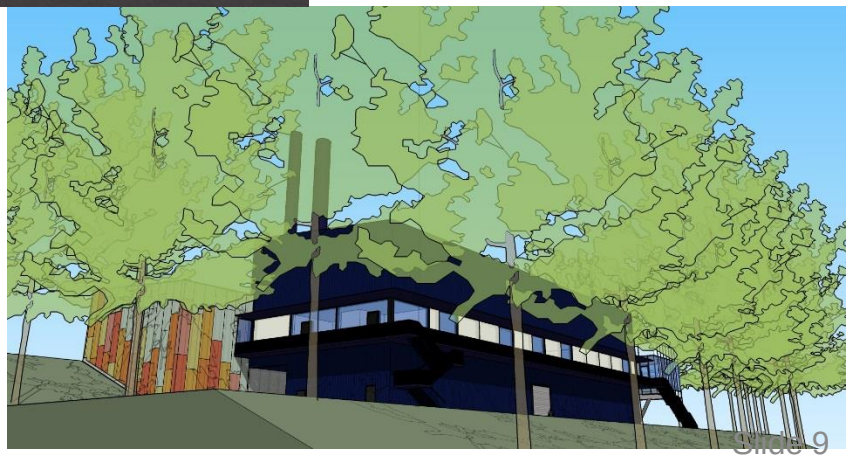
Metro Vancouver has set some of the most stringent limits for particulate matter emissions in the world.

Air emissions from the biomass facility will meet or exceed Metro Vancouver's bylaw requirements and will be continuously monitored.

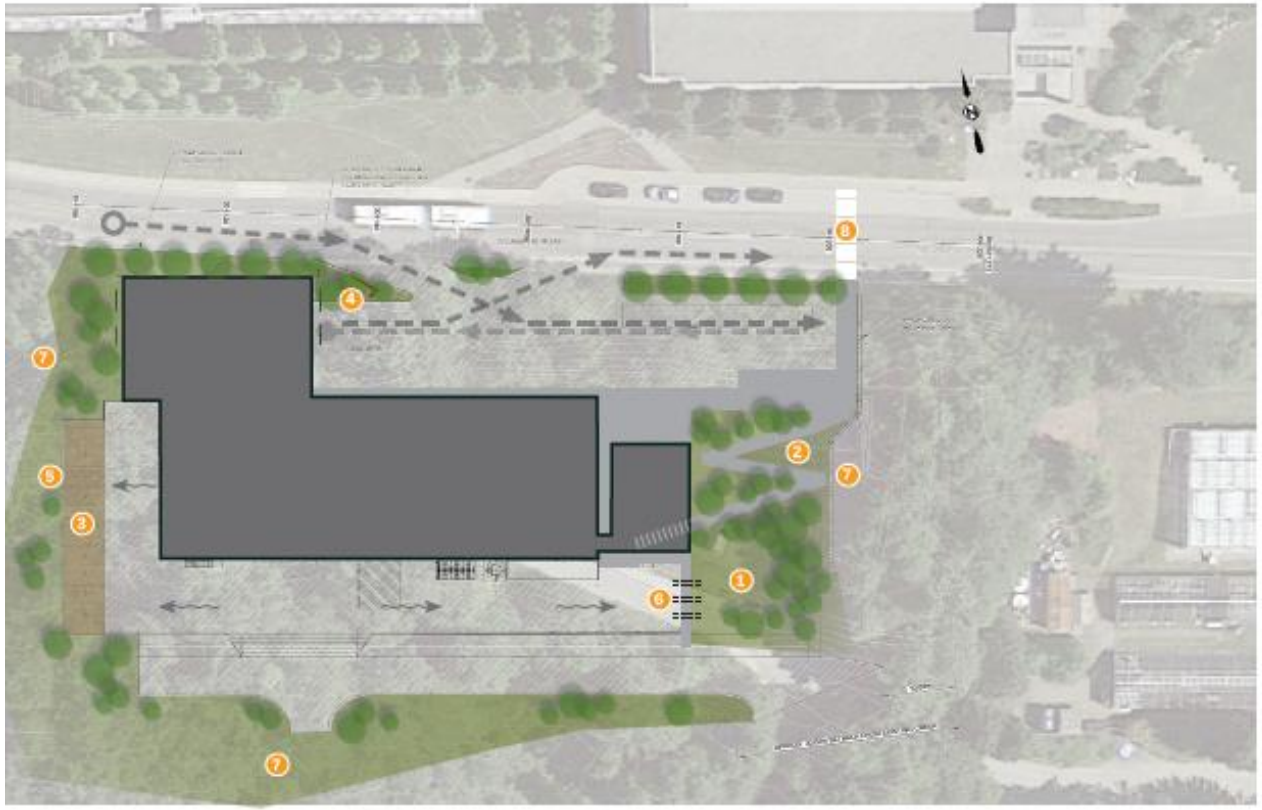


Source of Comparison Data: BC Ministry of Environment, 2008. Emissions from Wood-Fired Combustion Equipment: http://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/pulp-paper-wood/emissions_report_08.pdf

Proposed Design Concept



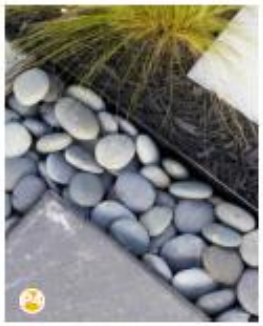
Proposed Design Concept



PRECEDENTS

1. BioRetention Pond
2. Accessible Ramp w/ Guardrail; Concrete Finish - TBD
3. Permeable Pavers
4. Corten/Weatherd Steel Feature Signage
5. Curb Cuts Allowing Overflow to Percolate Through Site
6. Trench Features for Directing Surface Flowthrough
7. Edge Restoration w/ Native Planting; Extent TBD
8. Designated Crosswalk

Proposed Design Concept



PRECEDENTS

- BioRetention Pond
- Boulder Retaining
- Gabion Terrace
- Permeable Paving That Meets Accessibility Requirements
- Accessible Ramp w/ Guardrail; Concrete Finish - TBD
- Green Roof; Application & Mix TBD

Project Timelines

Timelines and Approval Process

Feasibility Assessment and Approval Processes	Neighbourhood Utility Service Construction	SFU Project Development	Permanent Biomass Solution Approvals	Burnaby Mountain District Energy Utility Implementation
• CORIX and the SFU Community Trust completed feasibility studies and signed an agreement for the development of the Neighbourhood Utility Service. • First Public Consultation held in December 2009 to introduce preliminary design. • Second Public Consultation held in March 2010 regarding proposed energy sources. • British Columbia Utilities Commission granted approval for the implementation of the Neighbourhood Utility Service in May 2011.	• New buildings in UniverCity are connected to the first phase of the Neighbourhood Utility Service.	• SFU Board of Governors and Ministerial approval granted for the Project.	• **Third Public Consultation regarding implementation of permanent biomass solution in November 2016.** • **British Columbia Utilities Commission approval.** • **Metro Vancouver/City of Burnaby permit approval.** • **The permanent biomass plant construction on SFU land will begin by early 2018.**	• Design, construction and ongoing operation. • Biomass plant commissioning Q1 of 2019. • Connection of SFU Burnaby campus buildings. • UniverCity development fully built out in 2022.
(2009 - 2011)	(2011 -)	(2011 - 2016)	(2016 - 2019)	(2017 -)
COMPLETED	ONGOING	APPROVAL	**WE ARE HERE**	CONTINUOUS

Questions and Answers