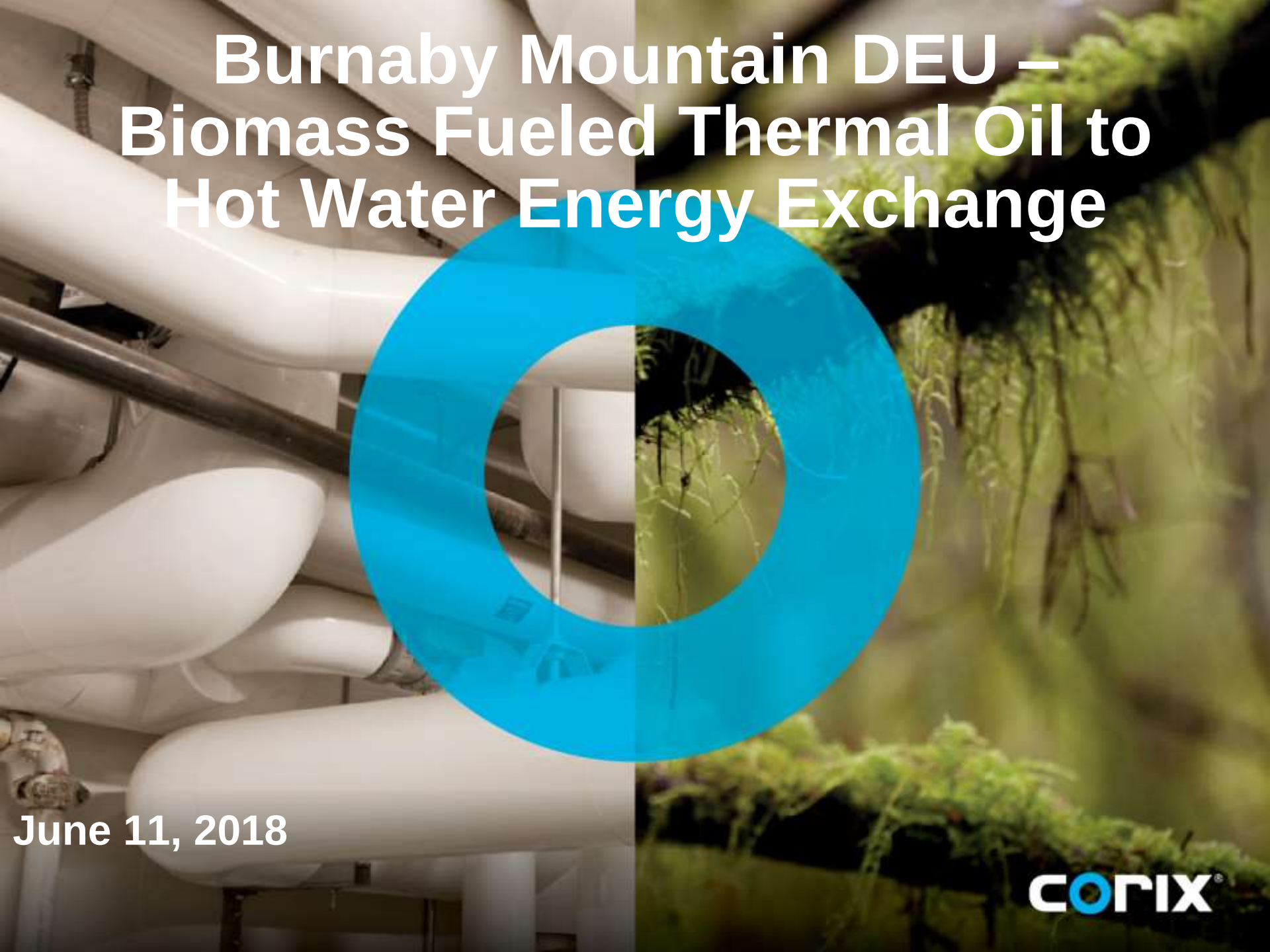
Burnaby Mountain DEU – Biomass Fueled Thermal Oil to Hot Water Energy Exchange



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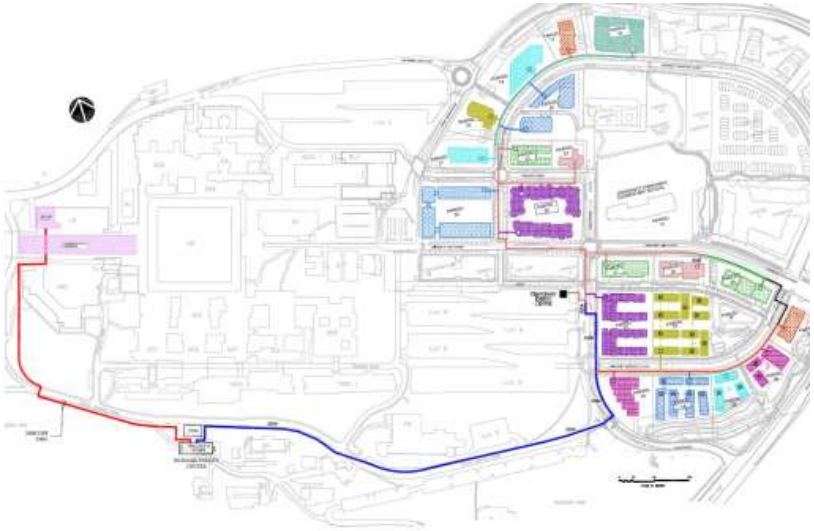
corix

Burnaby Mountain DEU

- Extension of an existing DEU at UniverCity residential community
- Low-carbon thermal energy system supplying Simon Fraser University and UniverCity residential community with thermal energy
- GHG emissions from existing heating plant reduced by 85%
- Capitalizing on economies scale to increase efficiencies and lower customer rates compared to individual systems



BMDEU Development Drivers

- GHG emission reduction on Burnaby Mountain - SFU's existing natural gas heating plant accounts for 80% SFU GHG emissions
- Replace SFU aging infrastructure
- Avoid use of electricity for heating at the UniverCity residential development
- Maximize economies of scale to benefit both SFU and UniverCity residents
- Minimize footprint required for energy centres

This resulted in one central energy facility supplying thermal energy needs to both customers.

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 (10 by the end of 2018)

Burnaby Mountain DEU

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

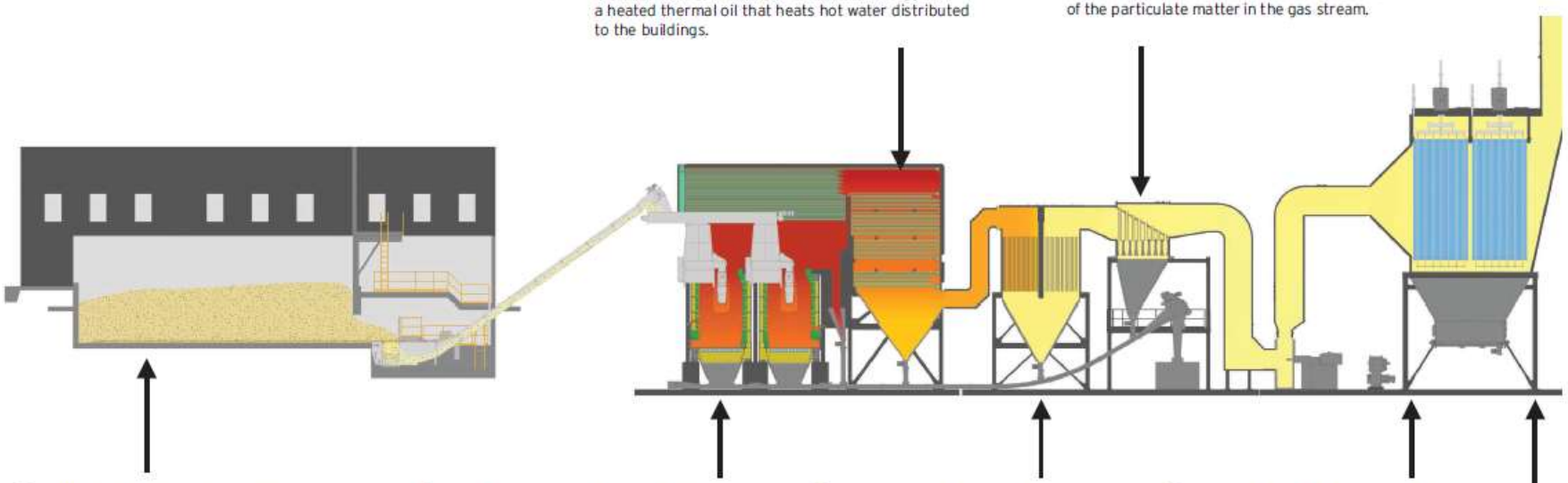
BMDEU Technology Objectives

- Maximize GHG emissions reduction (provide at least 80% of annual energy from renewable source)
- Meet different supply temperatures delivered to two customer groups (SFU operates at higher supply and return temperatures compared to UniverCity system)
- Maximize efficiencies – grate cooling water heat recovery, 2 stage flue gas heat recovery
- Minimize operational requirements – low pressure thermal oil system

Low Carbon Energy Source

Technology Process

How does the process work?



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.

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.

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%.

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.

6 Secondary Flue Gas Cleaning

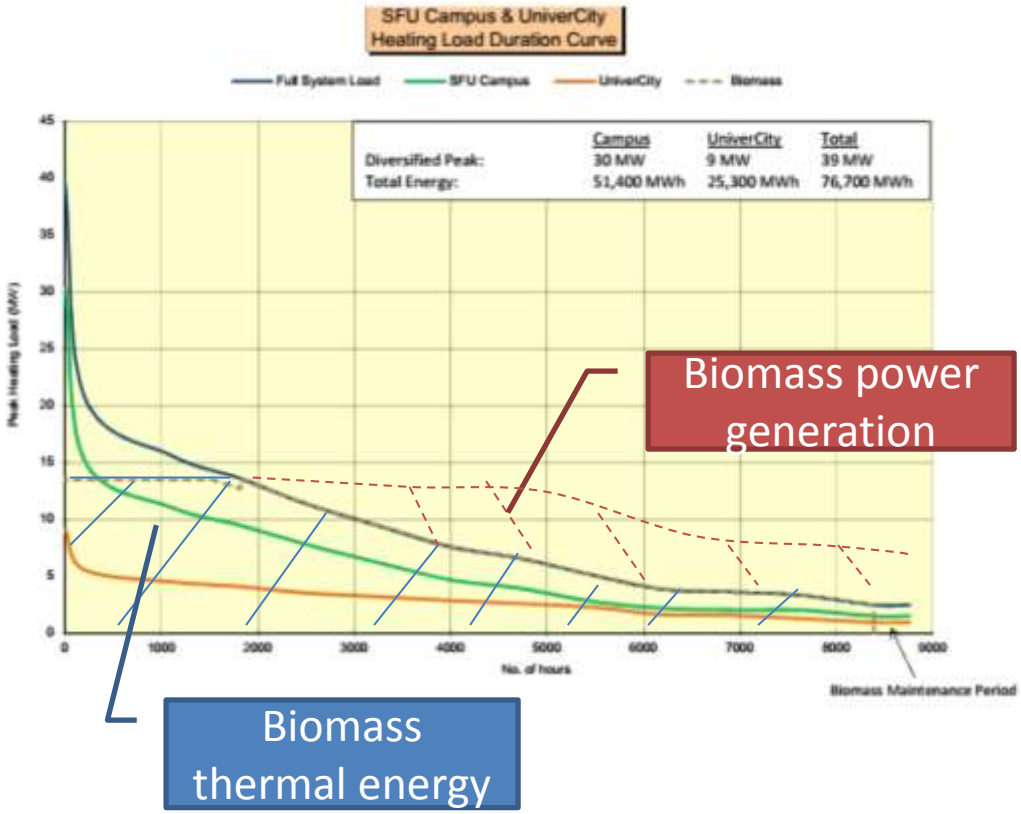
Filters out virtually all of the remaining particulate matter in the gas stream, achieving discharge levels below the Metro Vancouver mandate of 10 mg/m^3.

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.

Thermal Oil Use

- Lower operating pressure compared to hot water
- Opportunity to cogenerate electricity – ORC
  - During off-peak periods the electricity production would increase
  - Self-generation in combination with electric batteries
  - Electricity sale (SFU, BC Hydro)



Technology Performance

- Plant performance guarantees, Corix activities on site:

- Focus on preventative and scheduled maintenance
- Living Lab – linking operations and education; empirical data helping with future decisions and operational improvements (fuel testing, ash analysis, combustion process improvements)

Questions and Answers