Presentation 2

**UBC Project Briefing for University Neighbourhoods Association Board of Directors**

UNA Board Meeting Date: Dec 14, 2010

Project Name: **UBC District Energy System – Steam to Hot Water Conversion**

## Project Summary

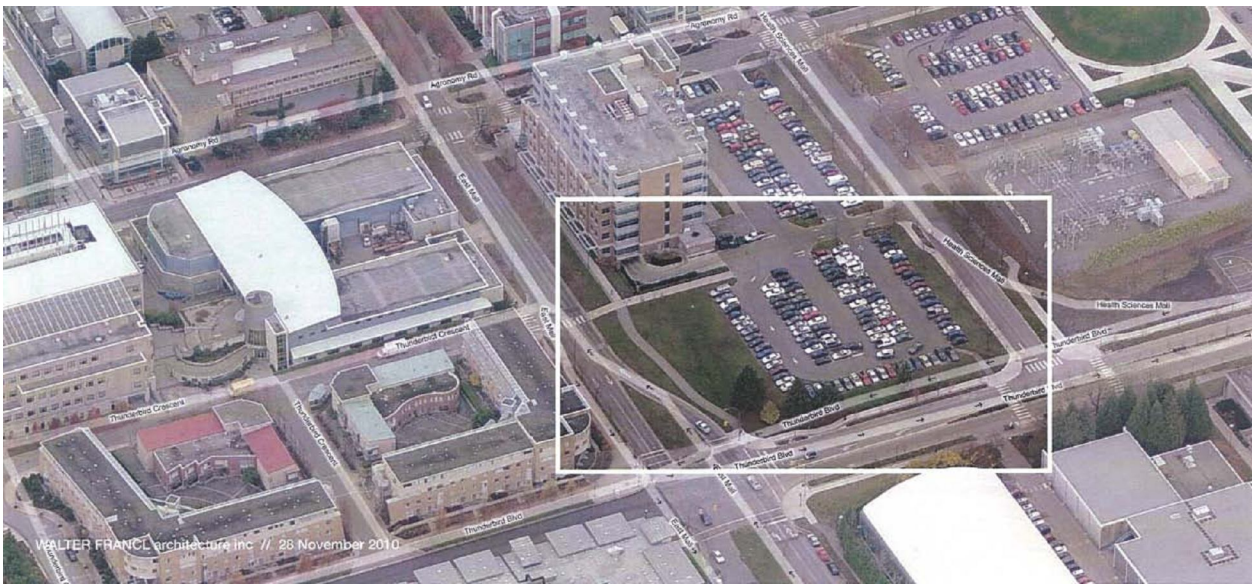
The proposed Steam to Hot Water Conversion project is an integral component of the strategy to achieve UBC Vancouver's greenhouse gas (GHG) emission reduction target of 33% by 2015.

The project, which is planned for implementation over the next 5 years, will:

- Replace existing steam heating system infrastructure (boilers, distribution piping, and building heat exchangers) with infrastructure for a hot water district energy system.
- Provide onsite steam generation equipment to buildings that require steam for research or operational purposes.
- Reduce energy demand by 24% and campus GHG emissions by 22%
- Provide a platform for future "UBC as a Living Laboratory" demonstration projects (e.g. TRIUMF waste heat recovery, Ocean thermal, and thermal energy storage)
- Provide proven solutions to similar sized institutions and municipalities to achieve emissions reduction targets.
- Represent the largest Hot Water Conversion in North America
  - 14 km pre-insulated hot water distribution piping
  - 131 energy transfer stations (ETS) in building mechanical rooms
  - New powerhouse and peaking plant
- Cost approximately $84.8 million (preliminary capital cost estimate)
- Generate approximately $4.0 million in average annual operational & energy costs savings from reduced natural gas consumption, carbon liabilities (offsets & carbon tax), maintenance and personnel requirements
- Cement UBC's reputation as a world leader in sustainability and energy management.

A key component of the project is the replacement of the existing Powerhouse central steam plant (located behind the Henry Angus building) with a new Hot Water Plant to be located on a site on the north side of Thunderbird Boulevard between East Mall and Health Sciences Mall (see attached map, photo and site layout). The specific orientation of the plant on this site will be planned to optimize the opportunity for future neighbouring building development as well as to allow efficient connection with underground utility services.

## Proposed Location of New Hot Water Plant

## New Hot Water Plant Site with Potential Site Layout


## Project Implementation: A Phased Approach

The Hot Water Conversion project will be carried out in nine distinct phases over the next five years. This approach, especially in the first few phases, will allow UBC to initiate the project and test some of the assumptions regarding the capital project costs and operational savings. Additionally, the phased approach will enable UBC to leverage opportunities to secure Federal and Provincial grant funding for clean energy infrastructure. The following is a summary of the proposed project phases:

**Phase 1 –** Lower Mall Hot Water Conversion **-** Summer 2011

The first phase of the project will be to connect 15 buildings surrounding the Bioenergy Research and demonstration project including the University Services Center (UBS), the Totem housing complex, Horticulture greenhouses and the Frank Forward building. The reduced operating temperatures of the hot water system will allow for significant waste capture from the Bioenergy plant starting in 2012 with backup and peaking provided by existing steam to hot water heat exchanger located in the USB building.

**Phase 2 and 3 –** Main Mall Hot Water Conversion – Summer 2012

Concurrent with the Main Mall public realm enhancement project scheduled to begin in the summer of 2012. The Main Mall hot water conversion will install distribution piping and connect all buildings to the Lower mall hot water loop. Heating for the system will be provided from the Nexterra plant with peaking capacity from the existing shell and tube heat exchangers located in select mechanical rooms.

**Phase 4 -** New Clean Energy Powerhouse and Peaking Plant **-** Summer 2013

To fully benefit from the hot water conversion, a building for future clean energy production and new hot water peaking boilers is required. Seismic and space constraints rule out any possibility of reusing the existing powerhouse. The site on the north side of Thunderbird Boulevard between East Mall and Health Sciences Mall (Site #5 circled on the attached map) is recommended from a planning, operating and life-cycle cost perspective.

The new building will have a gross area of approximately 21,657 $ft^2$ (2,012$m^2$) and will house the major heating infrastructure for the campus including future clean energy technology. The building will be designed to meet a minimum LEED Gold certification.

**Phase 5 –** Northwest Campus Hot Water Conversion – Summer 2013

Expanding on the Main Mall piping network, Phase 5 will include the northwestern part of campus from Vanier housing up to the Museum of Anthropology.

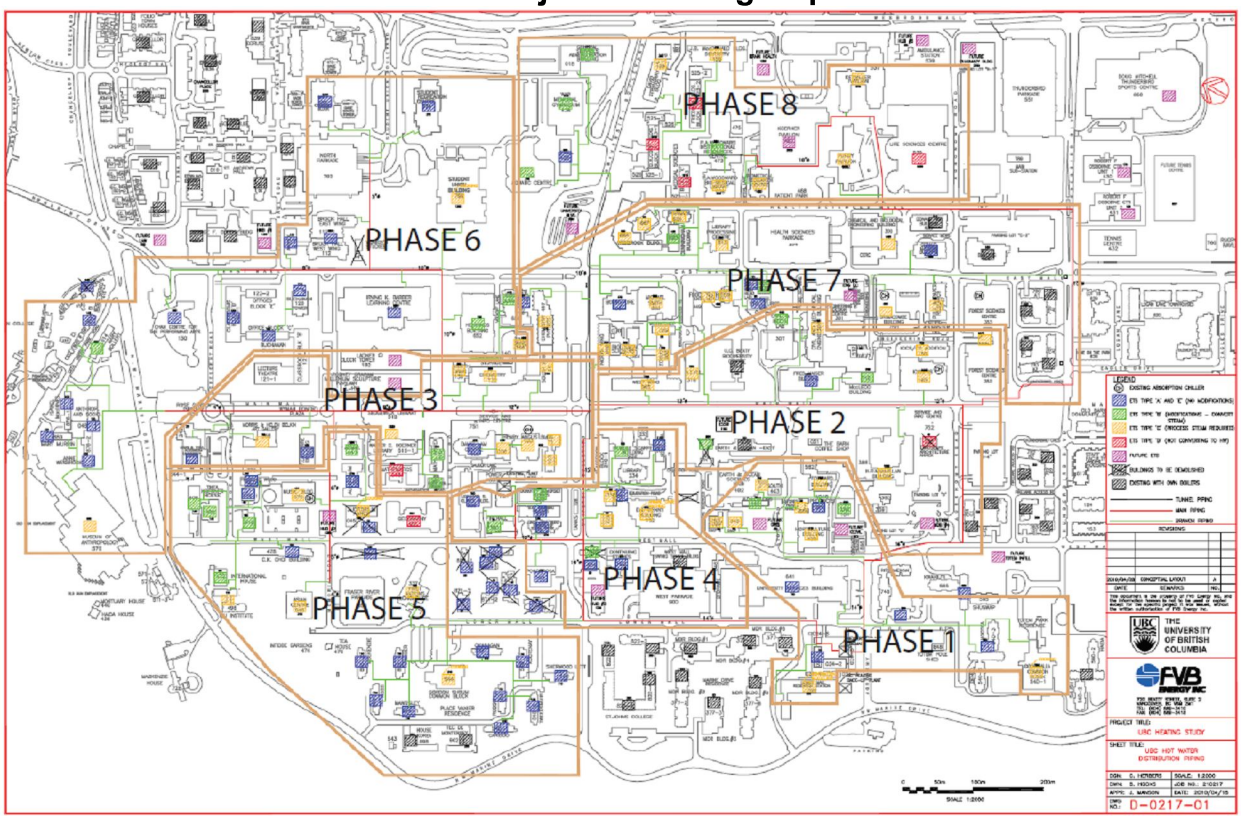
**Phase 6 and 7 –** Northeast Campus Hot Water Conversion – Summer 2014

Includes the Museum of Anthropology to the General Services Administration building and includes Gage towers.

**Phase 8 and 9 -** Southeast Campus Hot Water Conversion – Summer 2015

This is the last section of the campus to be converted; when complete the UBC steam plant will become redundant and decommissioned. The UBC Hospital and Life Sciences center are two buildings in particular that require large amounts of process steam for sterilization and HVAC equipment. Options for meeting these loads include installing clean steam generators in each building mechanical room or direct conversion with self standing autoclaves. A large contingency has been reserved for these buildings in the project budget.

## Steam to Hot Water Conversion Project – Phasing Map




## Current Project Status

A consulting firm with specific experience in steam to hot water conversion projects was engaged to undertake a high level pre-feasibility assessment and costing of the proposed project. This phase has been completed and forms the basis for the information contained in this document. This consultant is now engaged in preparing a full feasibility study, providing detailed information for the purposes of project planning and budgeting. Project management to date has been provided by UBC Project Services under the direction of a Smart Energy Systems steering committee. The steering committee is comprised of representatives from the key stakeholder groups including UBC Building Operations, UBC Campus Sustainability Office, UBC Infrastructure Development, UBC Institute for Resources, Environment and Sustainability, UBC Clean Energy Research Center, UBC Electrical and Computer Engineering and the University Neighbourhoods Association. The project was reviewed and approved by the UBC Property and Planning Advisory Committee on December 7, 2010.

## Frequently asked Questions

Some frequently asked questions about this type of facility are listed below. These are provided as a framework to commence discussion.

1. What emissions are generated from the plant?
   The peaking component of this facility will be natural gas fired boilers. The design will target emissions at or below 30 ppm NOx to comply with Metro Vancouver emission limits for natural gas boilers. The peaking component will be used to top-up the energy in the hot water loop. For example, the peaking plant will normally be off in the summer, with heat energy supplied to the hot water loop from alternate clean energy sources. This is a significant reduction from the current steam system which must remain on all year.

2. Is there an external fuel tank?
   A single above ground diesel fuel storage tank will be part of the project. This tank is required as emergency fuel, in the rare case that natural gas supply to the campus is interrupted. The tank will be seismically secured and double walled to contain any potential

leaks, with the space between the tank walls electronically monitored (ie leak detection). Secure bollards will be installed around the tank to protect from accidental vehicle damage and the entire storage tank installation will be fenced off. Diesel is recommended over gasoline or compressed natural gas (CNG) as a backup fuel because diesel is a far less volatile fuel and therefore the risk of a diesel tank explosion or fire is far lower than with the other fuels.

3. What are the noise levels associated with the plant?
   The noise generated in this type of facility would typically be attenuated via silencers and other mitigation measures that minimize the sound that actually emanates out of the plant structure. This facility is targeted to meet the 45 dBa typical background noise level on campus.

4. Will there be any additional traffic?
   The only additional traffic would be refueling of the back-up diesel storage tank. Given the size of the stored fuel volume and the amount of backup fuel typically used in plant operation, it is expected that the need to replenish the diesel tank will be infrequent

5. How safe is the plant?
   The plant will be staffed 24/7 and will have the most current technology in controls, software and integrated safety devices to ensure a safe and efficient operation. Plant construction and equipment will meet all health, safety and seismic code requirements.