AGENDA ITEM NO. 5.2

THE UNIVERSITY OF BRITISH COLUMBIA

REQUEST FOR DECISION

FORWARDED TO: BOARD OF GOVERNORS ON RECOMMENDATION OF PRESIDENT STEPHEN J. TOOPE

APPROVED FOR SUBMISSION:

_____
Stephen J. Toope

DATE: _____

PRESENTED BY: Pierre Ouillet, Vice President, Finance, Resources & Operations
David Woodson, Managing Director, Building Operations
John Metras, Managing Director, Infrastructure Development
Peter Smailes, Treasurer

DATE OF MEETING: June 8, 2011

SUBJECT: UBC Vancouver District Energy System
Steam to Hot Water Conversion – Phase 1

DECISION REQUESTED: **It is recommended that Board 2 + 3 approval be granted for Phase 1 of the Steam to Hot Water Conversion project subject to tenders for construction components being received at or below budget. Removal of this condition will be based on results from approximately 80% of tenders.**

Approval:

Capital Budget – Overall Project:	$ 84,800,000
Capital Budget – Phase 1	$5,891,020
Preliminary Operating Budget:	See Report
Proceed to Working Drawings	
Award of Construction Contracts	
Funding Release:	$ 5,891,020

Information:

Expenses to Date:	$62,700
Funding Releases to Date:	$2,350,000

FOR APPROVAL (FINANCE COMMITTEE):
Approve internal financing of up to $3.9 million. This loan will be the first installment of a maximum $74.8M loan to be repaid over a period of up to 30 years at a projected rate of 5.75%. Debt service will be funded via cost savings from the project.

EXECUTIVE SUMMARY:

Board 1 approval for the Vancouver Campus District Energy System Steam to Hot Water Conversion project was received in February 2011. This project, which involves the replacement of existing steam heating system infrastructure with a hot water district energy system, is an integral component of the strategy to achieve UBC Vancouver's greenhouse gas (GHG) emission reduction target of 33% by 2015. It also provides a platform for future "UBC as a Living Laboratory" demonstration projects. The preliminary capital cost for the overall project is $84.8 million. Funding for the project will come primarily from a loan ($74.8M) paid through the University operating budget. Debt repayment costs will be offset by operating and energy costs savings attributable to the project which are estimated at approximately $4.0 million per year. The UBC Infrastructure Impact Charge (IIC) fund will also contribute $10M to the project.

The project is planned for implementation in phases over the next 5 years. Board 2 + 3 approval is now being sought for Phase 1 which is scheduled to commence in June 2011. Phase 1 involves installation of hot water piping and energy transfer stations to serve 15 buildings surrounding the new Bioenergy plant on Lower Mall, including the University Services Building, the Totem Park student housing complex, the Horticulture greenhouses and the Frank Forward building. The total capital cost for Phase 1 is $5.9 million. This includes a base budget of $5.2 million plus a planned allocation of $690,000 to address orphaned process steam loads in Phase 1. Sufficient funds are also available in the base budget to allow partial piping installations for Phases 2 & 5 to be carried out in advance to coordinate with, and avoid disruption to, planned Public Realm projects. Funding for Phase 1 will come from IICs ($2M of the total $10M funding allocated for the project) with the remainder being debt financed.

ORIGIN OF REQUEST AND ADVANCED CONSULTATION

Background

This proposed conversion of the district energy system at the Vancouver campus from steam to hot water is an integral component of the strategy to achieve UBC Vancouver's greenhouse gas (GHG) emission reduction target of 33% by 2015. The project also addresses a fundamental need to replace aging steam infrastructure which has reached the end of its useful life.

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 for buildings that require steam for research or operational purposes.
- Represent one of the largest hot water conversions in North America:
  - 14 km pre-insulated hot water distribution piping
  - 131 energy transfer stations (ETS) in building mechanical rooms
  - New 52MW hot water peaking plant
- Cost approximately $84.8 million

Benefits of the conversion to hot water include:

- Reducing GHG emissions by 22% per year through increased energy efficiency.
- Replacing end-of-life, less efficient steam infrastructure with new, highly efficient hot water piping, heat exchangers and boilers that will serve the needs of our growing campus for generations to come.
- Generating approximately $4.0 million in average annual operational savings from reduced natural gas consumption, carbon liabilities (offsets & carbon tax), maintenance and personnel requirements.
- Providing an enabling platform for future "UBC as a Living Laboratory" demonstration projects (e.g. TRIUMF and Sewer waste heat recovery, Ocean thermal, Geothermal, Solar heating, thermal energy storage and distributed cogeneration) Note: the current steam system does not allow for integration of these options on the scale required by UBC as the temperature and pressure of the steam are too high.
- Facilitating commercial development of new products and technologies in partnership with industry and through linkages to key UBC resources (e.g. Clean Energy Research Centre, Inst. for Resources Environment & Sustainability, and University-Industry Liaison Office).

Many large institutions and cities around the world when faced with a similar decision regarding replacement of aging steam-based district energy infrastructure have opted to convert their systems to hot water to achieve the benefits noted above. Examples include Paris, Munich, Hamburg, Copenhagen, Univ. of Rochester and Stanford University. A larger list is included in Attachment 5.

Current Project Status

Since Board 1 approval of the overall project in February 2011, Kerr Wood Leidal + Associates Ltd Consulting Engineers has been engaged to undertake detailed design of the Phase 1 piping distribution system and energy transfer station installations. Board 2+3 approval is now sought in order to complete design and undertake construction of Phase 1.

DISCUSSION SUMMARY

Project Management

The project is being managed by UBC Project Services..

Consultants

FVB Energy Inc. is responsible for the schematic design of overall hot water system. Kerr Wood Leidal (KWL) Associates Ltd. Consulting Engineers has been commissioned to prepare the detailed design, working drawings and tender documentation for Phase 1.

Project Scope and Phased Implementation Strategy

This project involves the replacement of existing steam heating system infrastructure with infrastructure for a hot water district energy system. This will include installation of the following:

- 14 km of pre-insulated hot water distribution piping
- 131 energy transfer stations (ETS) in building mechanical rooms
- New 52 MW hot water peaking plant
- Onsite steam generation for buildings that require steam for research or operational purposes.

The scale of this project make it one of the largest hot water conversions in North America. In order minimize disruption and manage logistical and financial risks the project will be implemented in phases over a period of 5 years. The phasing will be as follows (see Attachment 2 for a map):

Phase 1 – Lower Mall Hot Water Conversion - Summer 2011 (subject of this approval request).
The first phase of the project will be to connect 15 buildings surrounding the Bioenergy plant on Lower Mall, including the University Services Building, the Totem student housing complex, the Horticulture greenhouses and the Frank Forward building. The reduced operating temperatures of the hot water system will allow for significant waste heat recovery from the Bioenergy plant starting in 2012 with backup and peaking provided by existing steam to hot water heat exchanger located in the University Services Building. Also included in the Phase 1 scope is an allocation to address orphaned process steam loads and partial piping installations for Phases 2 & 5 to be carried out in advance to coordinate with Public Realm projects.

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 on Main Mall to the Lower Mall hot water distribution system. Heating for the system will be provided from the Bioenergy plant with peaking capacity from the existing shell and tube heat exchangers located in select mechanical rooms. Phase 1, 2 and 3 will allow the hot water system concept to be evaluated in operation prior to construction of the hot water plant. This offers an exit strategy should unforeseen issues arise during initial implementation.

Phase 4 - New Hot Water Peaking Plant - Summer 2013
To meet the campus peak heating demand, a new 52 MW hot water boiler plant will be constructed. The team considered reusing the existing power house site. However, conversion of the existing powerhouse to hot water while maintaining service to the campus was determined to be too expensive and impractical. The new hot water plant will have a gross area of approximately 21,657 ft^2 (2,012m^2) and will house the major heating infrastructure for the campus including future clean energy technology. The building will be designed for a minimum LEED Gold certification. The plant will be located on a site on the north side of Thunderbird Boulevard between East Mall and Health Sciences Mall.

Phase 5 – West Mall Hot Water Conversion – Summer 2013
In Parallel to construction on the New Peaking Plant, phase 5 will connecting 9 buildings surrounding the intersection of West Mall and University BLVD to the Main Mall piping network and enable the future connection to Vanier and Ponderosa residences.

Phase 6 and 7 – North Campus Hot Water Conversion – Summer 2014
Encompassing the Vanier residences and the Museum of Anthropology on the west and the Chan Centre to the Student Union Building on the east, phase 6 and 7 will significantly expand the Main Mall heating network and allow for decommissioning of all steam infrastructure north of University Boulevard.

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. An appropriate contingency has been reserved for these buildings in the project budget.

Capital Budget – Overall Project

Component	Capital Cost
Phase 1 - Piping, energy transfer stations and building modifications	$5,030,000
Phase 2 - Piping, energy transfer stations and building modifications	$5,900,000
Phase 3 - Piping, energy transfer stations and building modifications	$5,680,000
Phase 4 - 52 MW New Hot Water Peaking Plant	$24,000,000
Phase 5 - Piping, energy transfer stations and building modifications	$6,350,000
Phase 6 - Piping, energy transfer stations and building modifications	$5,670,000
Phase 7 - Piping, energy transfer stations and building modifications	$7,800,000
Phase 8 - Piping, energy transfer stations and building modifications	$9,040,000
Phase 9 - Piping, energy transfer stations and building modifications	$8,000,000
Steam process loads 41 buildings (to be allocated across each phase)	$4,000,000
Math / Geography building heating conversion	$500,000
HST @ 3.4%	$2,786,980
Total Project Cost	**$84,756,980**

This budget includes all required design, construction and project delivery costs as well as contingency and retained risk allowances.

Phase 1 Capital Cost Breakdown

Component	Cost
Construction	$3,789,050
Planning & Design Fees	$440,500
Permits/PO Charges/Legal/Insurance	$25,250
Commissioning & Testing	$17,890
Project Management	$430,590
Contingency	$202,120
UBC Infrastructure Impact Charge (IIC)	$75,750
UBC Retained Risk Fee	$50,530
Sub-total	**$5,030,000**
HST @ 3.4%	$171,020
Phase 1 Base Cost	**$5,201,020**
Allocation for orphaned process steam loads	$690,000
Phase 2 & 5 partial piping install to coordinate with Public Realm work	Included above
Total Phase 1 Cost	**$5,891,020**

The Phase 1 scope includes a planned $690,000 allocation to address orphaned process steam loads. This is drawn from the $4 million line item noted in the Overall Project budget above. Sufficient funds are also available in the Phase 1 base budget to allow partial piping installations for Phases 2 & 5 to be carried out in advance to avoid disruption of planned Public Realm projects.

Operating Cost Savings

The project will provide operating savings over "business as usual" from 6 key areas shown in the table below. The savings valuation uses a discount rate of 5.75% which is equivalent to UBC's borrowing cost to reflect the financing risk associated with the project. The project risk has been assessed by risk adjusting each of the key saving cash flow streams and as such the discount rate is not risk adjusted for project risk. UBC has engaged Sauder School of Business faculty to conduct a review of the methodology applied to ensure it sufficiently addresses project risk.

Operational Savings Component	%	30 Year NPV
1) Energy Savings	33%	$ 27,355,191
2) Carbon savings	11%	$ 8,946,001
3) Water savings	2%	$ 1,922,244
4) Maintenance savings	8%	$ 6,344,037
5) Operator Savings	23%	$ 19,443,275
6) Capital avoidance (Powerhouse)*	23%	$ 19,592,360

*Powerhouse replacement is currently unbudgeted.

Total Operational Savings	100%	$ 83,603,108
Present Value of Project Capital Costs		$ 65,533,590
Total savings minus total costs		**$ 18,069,519**

The cost saving analysis shows that the hot water system will cost the University significantly less in operating and capital expenditures over a 30-year period as compared to the business as usual steam system.

The following assumptions were used to model the saving identified above.

Category	$ or %	Remarks
Interest rate	5.75%	UBC's current cost to borrow
Discount rate	5.75%	UBC's current cost to borrow
Inflation	2%	10 year historical average
Natural gas commodity cost	$5.24/GJ	Based on 5 year futures contract from Shell Oil updated on 10-27-2010
Natural gas delivery charge	$.78/GJ	Billed by Terasen gas
HST for natural gas	$0.20/GJ	3.4%
Total natural gas price	$6.22	Assumed constant for 5 years based on futures contract; onetime $0.8/GJ increase and then 2% inflation applied for subsequent 25 years.
Carbon taxes	$30/tonne	No future change
Carbon offsets	$25/tonne	No future change
HST for UBC	3.4%	No future change

Explanation of Savings

1) Energy Savings – Improved efficiency from the combination of new hot water boilers and distribution piping will save 24% (240,000 Giga Joules/yr) of the natural gas currently consumed by the steam powerhouse. Additionally, a water based distribution system will allow for enhanced heat recovery from the Bioenergy plant. The combined result is anticipated to be a reduction in natural gas consumption of 280,000 GJ/yr, which results in an annual savings of $1.47 million at the five year fixed commodity charge of $5.24/GJ.
2) Carbon Savings – As of 2012 UBC will pay $55/tonne ($2.74/ GJ) for carbon emissions. Reduced natural gas consumption will result in the elimination of 22% (14,000 tonnes in CO2e emission) and achieve $770,000/yr in carbon liability savings.
3) Water – Despite significant improvements, 136,000 cubic meters of water are annually required make up for condensate losses in the steam distribution system. This costs UBC $136,000 per year. Modern hot water systems are closed looped with leak detections systems to prevent water losses.
4) Ongoing Maintenance –This includes annual maintenance budgets for the powerhouse and the steam distribution/condensate return system plus third party estimates for the replacement of a significant portion of the campus' aging heat exchangers and domestic hot water tanks. In total the annual maintenance on the steam system is nearly $1 million/yr.
5) Operator requirements – The UBC steam plant is required by regulation to have two operators on site 24/7, hot water plants are safer to operate and the proposed plant will only require one operator 24/7. Additionally the steam distribution/condensate return system currently requires two separate crews of six to maintain. Hot water distribution requires significantly less maintenance and will free up valuable personnel.
6) Capital avoidance – This includes currently pending large ticket items such as: seismic upgrades to the powerhouse $4 million, replacement of boilers $18 million, boiler controls $1 million, de-aerator $1.6 million, back-up generator $0.75 million, water and diesel pumps $3 million, and diesel storage $1 million. Total capital cost is estimated at $33.6 million required in the next 20 years ($42 million including small ticket items such as heat exchangers and domestic hot water tanks). Note that the above-mentioned large ticket items are currently not funded.

Risks Mitigation Factors and Strategies

Risk	Mitigation factors/strategies
Decrease in price of natural gas	• A natural hedge exists to protect against the effects of lower gas prices. Annual operating budget for the hot water plant is based on assumed gas prices. Lower prices will result in annual budget savings. A decrease in price does not therefore materially impact Building Operations ability to repay the loan.
Reversal of carbon tax and offset requirements by Provincial government	• A natural hedge exists to protect against the effects of reduced carbon tax and offsets. Annual operating budget for the hot water plant is based on assumed tax/offset rates. Lower rates will result in annual budget savings and will not therefore materially impact Building Operations ability to repay the loan.

Capital cost increase due to cost escalation or unforeseen technical issues	• Project overages are insured through UBC Retained Risk policy. • 10% project contingency is incorporated in budget. • Phased implementation will allow capital cost assumptions to be tested in Phases 1-3 before major investment in hot water peaking plant is required. • Experienced consultants have been engaged to undertake design.
Unrealized operational labour savings	• Labour issues are minimal as staff reduction for hot water can be absorbed by staff increases already budgeted for the Bioenergy plant.
Energy savings assumption is incorrect	• Phased implementation will allow savings assumptions to be tested in Phases 1-3 before the hot water peaking plant is built.

Funding Sources

Total Project	
UBC Operating Budget (debt-financed from operational savings)	$74.8M
Infrastructure Impact Charges (IICs)	$10.0M
Total	$84.8M
Phase 1	
UBC Operating Budget (debt-financed from operational savings)	$3.9M
Infrastructure Impact Charges (IICs)	$2.0M
Total	$5.9M

Specific funding for Phase 1 will come from IICs ($2M of the $10M funding allocated for the project) with the remainder being debt financed.

Financing

Proposed debt financing for the overall project will be a loan of up to $74.8M amortized over 30 years with an average projected interest rate of 5.75% over the 5 year implementation period. A customized amortization schedule will be created to enable UBC Utilities to as closely as possible, match the annual debt service cost with expected cost savings out of its operating and commodity budgets. This methodology will allow for the natural ramp up in savings resulting in an average debt service amount of less than $1.5M in years one and two, $2-3M in years three and four and $5-6M for the remainder of the term. With the customized amortization schedule, the project can be repaid within UBC's projected business as usual utility budget within a 30 year period.

Specifically for Phase 1, proposed debt financing will be a loan of $3.9M from UBC Treasury with a projected interest rate of 5.75%. The $3.9M loan will be amortized over 30 years. Annual debt service of approximately $275,000 will be funded by cost savings associated with Phase 1 of the project.

The University will have sufficient liquidity to facilitate this Phase 1 loan internally using working capital. The risk that unforeseen circumstances negatively impact the University's liquidity can be mitigated by postponing latter phases of this project. The inclusion of this loan is within the University's mandated 5.5% debt burden ratio.

Schedule

The pending 2015 GHG reduction targets and the planned implementation of Public Realm work on Main Mall in 2011 make it necessary to commence the steam to hot water conversion project immediately. The proposed project schedule is shown below. Board 1 approval for the overall project was received in February 2011. The plan is to bring each annual package of project phases forward for separate Board 2 + 3 approvals.

Board of Governors (Board 1 – Overall Project)	Feb 2011
Board of Governors (Board 2+3 – Phase 1)	Jun 2011
Construction – Phase 1 (Lower Mall)	**Summer 2011**
Board of Governors (Board 2+3 – Phase 2 & 3)	Feb 2012
Construction – Phase 2 + 3 (Main Mall)	**Summer 2012**
Board of Governors (Board 2+3 – Phase 4 & 5)	Feb 2013
Construction – Phase 4 + 5 (Hot Water Plant + West Mall)	**Summer 2013**
Board of Governors (Board 2+3 – Phase 6 & 7)	Feb 2014
Construction – Phase 6 + 7 (North Campus)	**Summer 2014**
Board of Governors (Board 2+3 – Phase 8 & 9)	Feb 2015
Construction – Phase 8 + 9 (SE Campus)	**Summer 2015**

Attachments

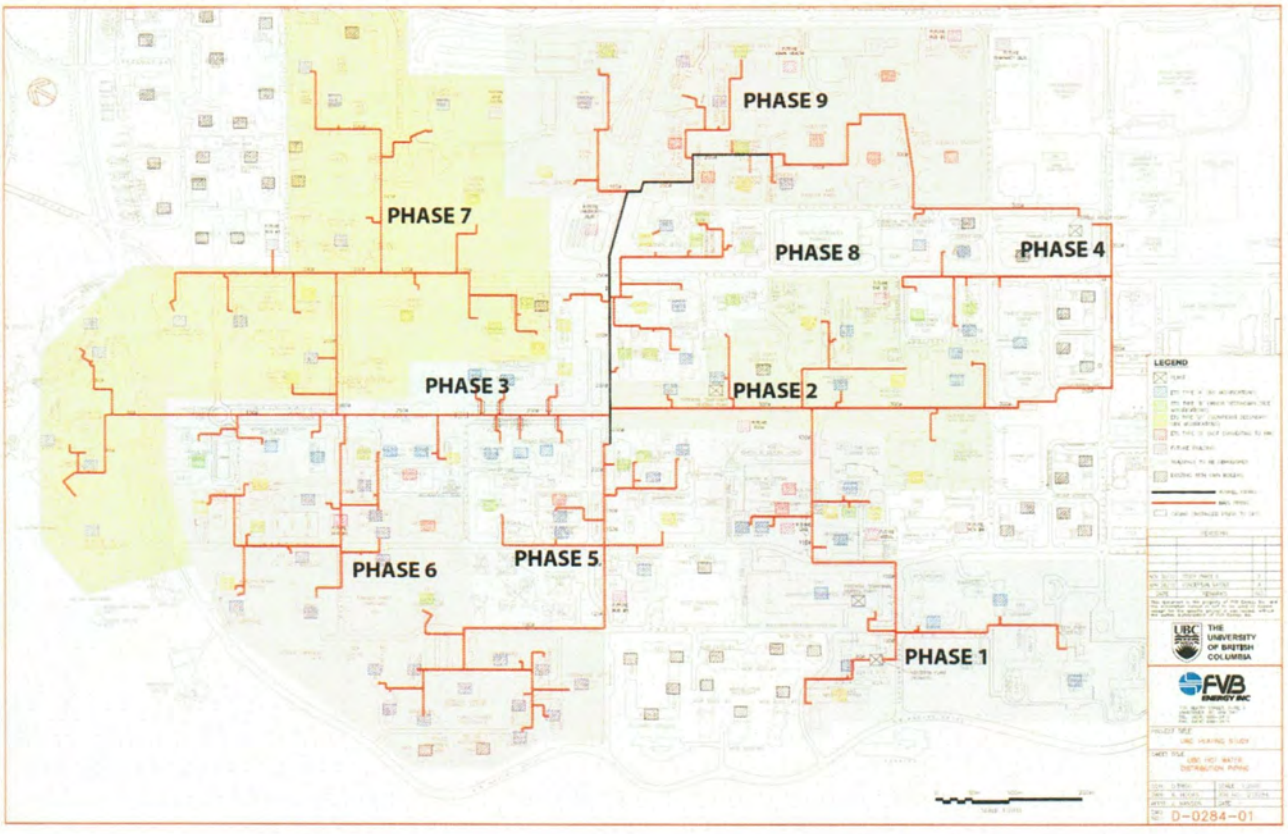
1. Previous Board History
2. Project Phasing Map
3. Capital Accountability Scope and Planning
4. Capital Accountability Budget and Funding
5. Steam to Hot Water Conversions Projects Around the World

Attachment 1

PREVIOUS BOARD HISTORY

Date:	February 7, 2011 – **Board 1**	
Resolution:	**Approval:**	
	Preliminary Capital Budget:	$84,800,000
	Preliminary Operating Budget:	See Report
	Schedule	
	Project in Principle	
	Location	
	Consultant	
	Program	
	Proceed to Schematic Design	
	Funding Release:	$2,350,000
	Information:	
	Expenses to Date:	$0

Project Phasing Map



Capital Accountability Scope and Planning

PROJECT NAME	
Project Name:	**Steam to Hot Water Conversion**
Department/Unit:	Building Operations
Sponsor:	Pierre Ouillet, VP FRO

CURRENT APPROVAL STATUS	Level	Approval Date
Executive:	3	5-Jan-11
Board:	1	7-Feb-11

PROJECT DESCRIPTION	
Development Type:	New Construction + Renovation
Facility Type:	Utility Infrastructure
Gross Building Area:	N/A
Capital Cost:	$84,800,000
Location/Site:	UBC Vancouver Campus
Primary Users:	Building Operations
	Institutional Buildings

PROJECT SCOPE
Scope Element
14 km hot water distribution piping
131 energy transfer stations in campus
1 peaking hot water plant

PROJECT RATIONALE & BENEFITS	
Need/Benefit Area	**Description**
Sustainability	Reduces campus GHG emissions by 22%/year. Key to achieve targeted 33% GHG reduction by 2015.
Operational	Replaces existing end-of-life, inefficient steam infrastructure that would need to be replaced anyway.
Economic	Reduces campus energy demand by 24%. Reduces operator cost requirement. Delivers net savings.
Learning & Research Environment	Provides platform for Living Lab projects not offered by steam system (eg. TRIUMF heat recovery).
Other Benefits:	Facilitates commercial development of new technologies in partnership with industry. Provides proven solutions for similar sized institutions and municipalities.

SCHEDULE

		Target	Actual
Board 1		Feb 2011	Feb 2011
Board 2*	Phase 1	Apr 2011	Jun 2011
Board 3 *	Phase 1	Jun 2011	Jun 2011
Construction Start	Phase 1	Jun 2011	
Substantial Completion	Phase 9	Aug 2015	
Board 4		Sep 2016	

* Board 2 & 3 approvals will be requested for the phases proposed to be undertaken in a given year.

SUSTAINABILITY GOALS

Indicator	Target	Actual
Certification:	LEED Gold (HW Plant)	
Energy Efficiency Level:	42% better than MNECB	
Energy Use Intensity:	TBD (kWh/ft2)	
GHG Reduction:	TBD % better than standard	
Const Waste Recycling	75% recycling rate	
Water Use Efficiency	TBD % better than standard	
Innovative Features:		

DEVELOPMENT PROCESS

Project Manager	UBC Project Services	Construction Manager	TBA
Consultant	FVB Energy / Kerr Wood Leidal	Infrastructure Development Rep	John Metras, Managing Director

	Date	Comments
AUDP Review		N/A
Dev. Review Committee		N/A
Public Open House		N/A
Development Permit		N/A
Building Permit	Jun 2011	

CAMPUS & COMMUNITY PLANNING COMMENTS

Capital Accountability Budget and Funding

PROJECT NAME

Project Name:	**Steam to Hot Water Conversion**
Department/Unit:	Building Operations
Sponsor:	Pierre Ouillet, VP FRO

CAPITAL BUDGET ($000s)

Capital Development Cost	$000s	$/GSF
Phase 1 - Piping, ETS and building mods	$ 5,030	n/a
Phase 2 - Piping, ETS and building mods	$ 5,900	
Phase 3- Piping, ETS and building mods	$ 5,680	
Phase 4 - 52MW New Hot Water Peaking Pla	$ 24,000	
Phase 5 - Piping, ETS and building mods	$ 6,350	
Phase 6 - Piping, ETS and building mods	$ 5,670	
Phase 7 - Piping, ETS and building mods	$ 7,800	
Phase 8 - Piping, ETS and building mods	$ 9,040	
Phase 9 - Piping, ETS and building mods	$ 8,000	
Steam process loads 41 buildings	$ 4,000	
Math/Geography building heating conversion	$ 500	
HST (3.4%)	$ 2,787	
Total Project Budget	**$ 84,757**	**n/a**

Capital Budget Notes: Budget includes all required design, construction and project delivery costs as well as contingency and retained risk

LIFE-CYCLE OPERATING BUDGET

Savings Component	%	30-Yr NPV ($000's)
Energy savings	33%	$27,355
Carbon savings	11%	$8,946
Water savings	2%	$1,922
Maintenance savings	8%	$6,344
Operator savings	23%	$19,443
Capital avoidance	23%	$19,592
Total Savings	**100%**	**$83,603**
PV of Capital Project		$65,534
Net Savings		**$18,070**

Assumptions:			
Interest rate	5.75%	Carbon Tax	$30/tonne
Inflation	2.0%	Carbon Offsets	$25/tonne
NG Commodity Cost	$5.24/GJ		
NG Delivered Cost	$6.22/GJ		

FUNDING AGREEMENTS ($000s)

Funding Source	Liability with:	Committed	Secured*
Donor Fundraising			
GPOF - Faculty/Unit	Building Ops	$ 74,800	
GPOF - Central Admin			
Provincial Govt			
Federal Govt (CFI/WED)			
IIC	Central Admin	$ 10,000	$ 10,000
Total		**$ 84,800**	**$ 10,000**

* Funding paid or firmly committed to be paid before end of construction

Funding Notes:

FINANCING AGREEMENTS ($000s)

Debt Serviced By:	Loan Amt*	Amort.	Int.	Ann. Payment
	$ -			
Building Operations	$ 74,800	30	5.75%	$ 5,290
	$ -			
Total	$ 74,800			$ 5,290

Debt Capacity Impact: Long term debt associated with this project

PROJECT REQUIREMENTS CHECKLIST & SIGN-OFF

CHECK	REQUIREMENT	NAME	SIGNATURE	DATE
	Programmatic need and benefit	Building Operations Managing Director	David Woodson	13-Jan-11
	Project scope and budget Project manager assignment Swing space requirements	Infrastructure Development Managing Director	John Metras	13-Jan-11
	Project site Development review process Sustainability measures	Campus & Community Planning Associate Vice President	Nancy Knight	13-Jan-11
	Classroom/teaching lab review	Classroom Services Director	N/A	
	Food, housing and child care	Student Housing & Hospitality Services Managing Director	N/A	
	Funding & financing agreements	Project Sponsor VP FRO	Pierre Ouillet	13-Jan-11
	Funding & financing agreements Debt capacity	Treasury Treasurer	Peter Smailes	13-Jan-11
	Fundraising plan	Development Office AVP, Development Services	N/A	
	Life-cycle operating costs	Building Operations Managing Director	David Woodson	13-Jan-11
	Security & access control Parking	University Community Services Managing Director	N/A	

Attachment 5

Steam to Hot Water Conversions Projects around the World

Steam System location	Heating Capacity (MW)	Conversion Status	Conversion Period
University of British Columbia	70	Proposed	2011-2015
Munich (Germany)	1250	In progress	2003-2012
Paris (France)	4285	In progress	2008-2030
Hamburg (Germany)	250	In progress	2002-2010
Kiel (Germany)	320	In progress	2002-2012
Salzburg (Austria)	170	Complete	2005-2009
Ulm (Germany)	150	In progress	2010-2017
Rock Island Arsenal (US)	130	Complete	1990-1995
Ft. Myer (US)	20	Complete	1995-1997
University of Rochester (US)	50	Complete	2005-2008
Copenhagen (Denmark)	900	In progress	2010-2025
Lakehead University (Canada)	25	Complete	2005-2008
Stanford University (US)	100	In progress	2010-2020
Auburn University (US)	5	Complete	2006-2009