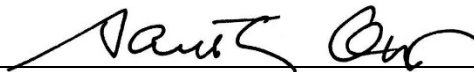


SUBJECT	BIOENERGY RESEARCH AND DEMONSTRATION FACILITY EXPANSION PROJECT
MEETING DATE	DECEMBER 5, 2017

Forwarded to the Board of Governors on the Recommendation of the President

**APPROVED FOR
SUBMISSION**



Santa J. Ono, President and Vice-Chancellor

DECISION REQUESTED	<p>IT IS HEREBY REQUESTED that <i>the UBC Board of Governors grant approval for BOARD 1 for the Bioenergy Research and Demonstration Facility Expansion project, with a funding release of \$500,000 to commence schematic design.</i></p> <table border="0"> <tr> <td>Preliminary Capital Budget</td> <td style="text-align: right;">\$14,850,000</td> </tr> <tr> <td>Preliminary Operating Budget</td> <td style="text-align: right;">See report</td> </tr> <tr> <td>Schedule</td> <td></td> </tr> <tr> <td>Project in Principle</td> <td></td> </tr> <tr> <td>Program</td> <td></td> </tr> <tr> <td>Consultant Selection</td> <td></td> </tr> <tr> <td>Proceed to Schematic Design</td> <td></td> </tr> <tr> <td>Funding Release</td> <td style="text-align: right;">\$500,000</td> </tr> <tr> <td colspan="2">Information</td> </tr> <tr> <td>Expenses to date</td> <td style="text-align: right;">\$0</td> </tr> <tr> <td>Funding released to date</td> <td style="text-align: right;">\$0</td> </tr> </table>	Preliminary Capital Budget	\$14,850,000	Preliminary Operating Budget	See report	Schedule		Project in Principle		Program		Consultant Selection		Proceed to Schematic Design		Funding Release	\$500,000	Information		Expenses to date	\$0	Funding released to date	\$0
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Report Date	November 8, 2017
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Presented By Andrew Simpson, Vice-President Finance & Operations
 Philip Steenkamp, Vice-President External Relations
 David Woodson, Managing Director, Energy and Water Services
 John Metras, Managing Director, Infrastructure Development
 Michael White, Associate Vice-President Campus + Community Planning
 Peter Smailes, Treasurer

EXECUTIVE SUMMARY

This core infrastructure project involves the addition of 12 MW of boiler capacity to the existing Bioenergy Research & Demonstration Facility (BRDF) to allow the campus hot water heating system to keep up with projected increased demand over the coming years from academic and student residence buildings. The expanded use of biomass as an energy source will provide additional heat at a lower cost than natural gas and will help UBC to diversify its fuel mix, allowing more effective management of the fuel cost risk as well as to help reduce the University’s carbon tax through lowered GHG emissions. It will also help UBC to advance towards its Climate Action Plan 2020 target of 67% GHG emission reduction over 2007 levels and provide continued research opportunities for UBC faculty and students.

The capital cost for the project is estimated at \$14.85M. The scope of work includes civil and structural modifications to the existing facility, removal of redundant equipment, significant mechanical and electrical upgrades, seismic modifications to reflect the altered layout of the building, addition of a significantly upgraded biofuel material handling system, and supply and installation of new boilers. No

expansion of the building footprint is necessary but a canopy will be added to accommodate the revised and expanded biofuel handling capacity of the project. A separately funded Canada Foundation for Innovation (CFI) “Biorefinery” research project is also planned to be integrated into the BRDF expansion.

The BRDF expansion is expected to result in operating cost savings of \$1.3M per year on average over 15 years in comparison to the business as usual (BAU) scenario. This savings is due to reduced fuel commodity costs and carbon tax/offsets by switching from natural gas to biomass as a fuel source.

The project will be partially funded through two different sources and partially financed. The first funding source is Infrastructure Impact Charges (IICs). The project has received a commitment for up to \$5M in funding from the IIC fund to reflect the fact that this project is accommodating growth in student housing. The second anticipated source of funding is the Province of BC’s Carbon Neutral Capital Program (CNCP). The CNCP has directed approximately \$1.66M per year to UBC in recent years and has notionally committed to continuing with this funding. The stated purpose of this funding is to reduce greenhouse gas-emissions. There is no other project on campus that can reduce this volume of GHG emissions (nearly 13,000 tonnes/year) in such a cost-effective manner. It is assumed that \$5M in CNCP funding will be allocated to the project (\$1.66M/year over three years). Finally, remaining funding requirements will be financed with an internal loan of an anticipated \$4.85M amortized over 15 years at 5.75% annual interest. The loan will be repaid by Energy & Water Services with operating savings over the business as usual scenario. Sufficient working capital liquidity is available to support this financing.

As reported to the Board of Governors in April 2017, the project is anticipated to be the most cost-effective over a 15 year operating period compared to any other options for either meeting the operational need for expanding the capacity of the campus heating system or for meeting the strategic GHG emission reduction target of the CAP 2020. The overall Net Present Value (NPV) of this option as evaluated by Treasury is now \$1.1M, compared to the \$6M presented in the earlier Board report, reflecting an updated capital cost estimate. The NPV from a UBC investment perspective is \$6.1M, taking into account Province of BC CNCP funding. The project team will continue to seek further external funding to minimize UBC investment requirement.

Design and construction of the project will be managed by UBC Project Services, the same group that managed the development of the original BRDF project. Executive 3 approval for the project was given on November 7, 2017. The project is being brought forward for Board 1 approval at this time with a view to the expanded plant being operational in August 2020.

INSTITUTIONAL STRATEGIC PRIORITIES SUPPORTED

- Learning
 Research
 Innovation
 Engagement
 International
 (Internal / External)
- or Operational

DESCRIPTION & RATIONALE

Facility Need

The primary driver for this project is the operational need of the campus hot water heating system to meet the anticipated thermal growth of the campus over the next 15 years. As the campus grows, the system capacity needs to grow accordingly. Further, in order to align with the strategic objective of the University to advance toward reducing its GHG emissions by 67% by 2020, and recognizing that natural gas combustion for space heating and domestic hot water is the single biggest source of those emissions, the options for adding capacity included

expanding the BRDF. As reported to the Board of Governors in April 2017, this option was determined to be the best from both a financial and environmental perspective.

Community Impact

While the broader positive impacts of assisting UBC in meeting its commitments related to climate change and the Climate Action Plan 2020 targets are significant, increasing the number of fuel trucks entering the campus will have some impacts on the campus and neighbouring communities. The impacts of this increase and potential mitigation measures will be analyzed and reported as the project progresses. The facility expansion will be designed to ensure continued compliance with Metro Vancouver air quality permit requirements including ongoing emissions monitoring and communication with the campus community. More information about public consultation is noted below.

Site

The Bioenergy Research and Demonstration Facility is an existing facility located at the corner of Lower Mall and Agronomy Road. There is no expansion to the footprint of the facility planned with this project although a canopy will be added to accommodate the additional fuel needs of the boilers.

Site Map



Project Scope

- The BRDF capacity expansion will include the following components:
- Removal of existing, unused equipment
- Civil and structural modifications
- Mechanical and electrical upgrades
- Seismic modifications to reflect the altered layout of the building
- Installation of new boilers
- Installation of a significantly upgraded materials handling system for the biofuel
- Addition of exterior canopy for the revised and expanded biofuel handling system

Project Management

UBC Project Services (Infrastructure Development) will provide project management services for this project. Project Services managed the original design and construction of the BRDF.

BENEFITS
Learning, Research,
Financial,
Sustainability &
Reputational

Cost-Effective Sustainability

This project will contribute towards meeting UBC’s Climate Action Plan 2020 objectives, reducing the GHG emissions of the campus by nearly 13,000 tonnes CO2e. In addition, the project team will work carefully to respect the sustainability objectives that were included in the original BRDF construction, noting that the original building achieved LEED Gold certification. The BRDF expansion is estimated to be the most cost-effective option for either meeting the operational need for increased campus heating system capacity or for meeting the strategic GHG emission reduction target of the CAP 2020.

Research Co-Location

This project is actively working with the research team for the “Biorefinery” CFI project to ensure that the two projects are well integrated. While the need for the BRDF expansion is being driven by operational necessity, the opportunity for co-locating research activities in the upgraded facility will be beneficial for both faculty, students and staff.

RISKS
Financial,
Operational &
Reputational

The key significant risks and associated mitigation strategies that have been identified for this project are as follows:

- Construction cost risks have been mitigated through provision of contingency and cost allowances as well as coverage under the Retained Risk policy though market conditions still contain risk until construction trades contracts are fixed.
- While the BRDF is a relatively new facility, integrating a renovation into a working building always includes a certain level of risk as does the concurrent inclusion of the CFI research project. Using some of the same project management staff that worked on the original project will help mitigate this risk.

- Not expanding the hot water heating capacity of the campus system represents an operational risk and the expansion of the BRDF, as indicated in the April 2017, report to the Board of Governors, represents the most cost-effective way to meet this operational need.
- As with any construction project and especially with a renovation, it is sometimes challenging to ensure that the project adheres to the schedule but the timing of this project and both the integration with the potential CFI project and the desire to meet the CAP2020 targets mean that it is particularly important. To mitigate this risk, the project team are looking at ways of compressing portions of the schedule as needed.
- Long term availability of biomass as a fuel source has previously been raised as a risk. A peer-reviewed fuel supply study was undertaken that shows that even if all anticipated biomass projects proceed within the Lower Mainland, many of which are at conceptual stages, the availability of biomass supply will still be nearly double what the industry requirement would be in 2035.
- There is a financial risk if forecast operating cost savings for the expanded facility are not fully realized. If this were to occur, Energy & Water Services would first seek further savings within its overall budget. This could be achieved through energy retrofit and efficiency programs currently underway.

COSTS Preliminary Capital Budget

Capital &
Lifecycle Operating

The total capital investment required for the project is currently estimated at \$14.85M. This estimated has been informed by a third-party engineering assessment of project scope requirements.

Project Capital Cost Breakdown	Total
Construction Costs	
Construction	\$6,974,000
Contingency	\$1,200,000
Cash Allowances	
FF+E	\$4,000,000
UBC IT	\$20,000
Soft Costs	
Design Consultants	\$943,000
Project Management	\$683,000
Permits	\$26,000
Insurance/Legal	\$19,000
Commissioning, Inspection & Testing	\$90,000
Building Subtotal	\$13,955,000
GST & Applicable PST	\$497,000
Building Total	\$14,452,000
Construction Period Financing	\$253,000
Retained Risk	\$140,000
Project Total	\$14,850,000

The projected capital cost has increased from the initial \$10.2M reported at the April 2017 Board. The extent of the modifications to the BRDF was not fully understood when the initial, early stage analysis was completed. A subsequent feasibility study by a third party consultant has made it clear that extensive demolition and reconstruction of one side of the existing facility will be necessary. This work added approximately \$1.5M to the construction cost. Also, it was initially assumed that the existing electro-static precipitator could be reused but the study revealed that a new one will be necessary and some unanticipated seismic upgrades due to these other changes will also be needed. This equipment and associated modifications added approximately \$2.0M. Some additional costs in other areas were also added, bringing the total cost estimate to \$14.85M.

Preliminary Operating Budget

The BRDF expansion is expected to result in operating cost savings of \$1.3M per year on average over 15 years in comparison to a business as usual scenario. This savings is due to reduced fuel commodity costs and carbon tax/offsets by switching from natural gas to biomass as a fuel source.

FINANCIAL
Funding Sources,
Impact on Liquidity

Planned funding sources for the project include:

Funding Source	Amount
UBC Infrastructure Impact Charges (IICs)	\$5,000,000
Province of BC Carbon Neutral Capital Program (\$1.66M/year over 3 years)	\$5,000,000
UBC Internal Loan (repaid from Energy & Water Services operating budget)	\$4,850,000
Total	\$14,850,000

The proposed \$4.85M loan from UBC Treasury will be amortized over 15 years at a 5.75% annual interest. Short-term bridge financing may be required to address multi-year timing of IIC and CNCP funding. Debt service will be paid by Energy & Water Services from savings achieved compared to a business as usual (BAU) situation. It is estimated that the average annual savings over the 15 years will be \$1.3M/year (it will take less than 4 years to repay). In the absolute worst case scenario the operating savings average \$0.6M per year, simply resulting in an increased number of years to pay the loan.

The savings are derived from a combination of the difference in commodity costs (biomass being cheaper than natural gas), and the carbon tax and carbon offset cost. While there are some new expenses above the BAU case generated from new annual maintenance for the extra boiler (and associated ancillary equipment), these are still significantly less than the BAU case.

UBC Treasury has rerun the peer-reviewed financial analysis that was completed for the April 2017 submission and noted that with a capital expenditure of \$14.85M, where the previous best and worst case NPVs were +\$18M and -\$3M with an expected case of +\$6M, the revised best and worst case NPVs are +\$12.9M and -\$5.7M with an expected case of +\$1.1M. Further, Treasury has highlighted

the NPV from a UBC investment perspective is +\$6.1M, taking into account Province of BC CNCP funding. The project team will continue to seek further external funding to minimize UBC investment requirement. Details on operating savings and NPV estimates for a range of business scenarios are provided in Attachment 1.

SCHEDULE
Implementation
Timeline

Considerations for the project schedule include the need to schedule the shutdown of the existing plant in order to accommodate the construction at a time that is away from peak heating season. The shutdown will be for six months in the summer of 2019. In addition, the potential CFI project will also need to follow a complementary schedule so as to have the shutdown period align well for that project too.

Milestone	Target Date
Board Feasibility (Executive 1+2 equivalent)	April 13, 2017
Executive 3	November 7, 2017
Board 1	December 5, 2017
Board 2	February 2018
Board 3	September 2018
Construction Start	September 2018
Occupancy Permit	March 2020
Board 4	April 2022

CONSULTATION
Relevant Units,
Internal & External
Constituencies

In April 2017, the results of the second phase of the Climate Action Plan 2020 (CAP 2020) were presented to the Board of Governors. One part of this update was the presentation of the more in-depth analysis of the energy supply options presented in the first phase. The analysis included a peer-reviewed assessment of fuel supply options which was broken into two parts – an examination of financial viability and an energy commodity study.

The results of the financial analysis presented at that time showed that biomass expansion had a positive NPV over 15 years against the natural gas base case, taking into account conservative estimates for both future natural gas and carbon tax pricing. The results of the fuel supply study show even if all of the anticipated biomass projects proceed within the Lower Mainland, many of which are at conceptual stages, the availability of biomass supply will still be nearly double what the industry requirement would be in 2035.

Based on this information, the Board of Governors gave approval to proceed with final due diligence on the expansion of the biomass facility. This approval to proceed was considered equivalent to Executive 1 and 2 approval.

Staff have proceeded with a feasibility study, preliminary community consultation and high level estimates of budget and schedule. The feasibility study has been conducted considering the inclusion of a separately funded Canada Foundation for Innovation (CFI) research project. The research and operational components of this “Biorefinery” CFI project will be fully integrated into the BRDF expansion.

A targeted stakeholder engagement process to support the continued development of the Climate Action Plan took place in June and July of 2017. This engagement was focused on gathering feedback from stakeholders on the potential expansion of the BRDF. Key stakeholders were invited to a series of meetings to determine what potential concerns and information needs the UBC community and general public could have when public consultation is held later in the process.

Issues of concern raised included potential disruptions to adjacent student residents and Building Operations activity; ongoing issues with obstructions created by the trucks when delivering fuel to the facility; impacts from a potential increase in truck traffic; and need to inform the Vancouver community broadly through the next phase of consultation pending Board 1 approval.

Information needs identified included those related to air quality and emissions from the facility; fuel delivery schedules and impacts; construction scheduling and impacts; and providing clear information on the public consultation process.

In total, feedback was received from 19 stakeholders at 4 meetings. Additional consultation will be held when the project’s scope and likely emissions profile and more precise fuel delivery needs are understood.

Additionally, on August 15, 2017, the project was presented to the Property and Planning Advisory Committee (PPAC). The committee passed a motion indicating support for the project.

Previous Report Date	April 13, 2017
Decision	For Information (Climate Action Plan 2020 and Campus Energy Update)
Action / Follow Up	Complete due diligence on the expansion of biomass boiler capacity to address immediate operational needs and move UBC closer to meeting its next GHG emission reduction target of 67% below 2007 levels.

Attachments

- 1) Operating Savings and Net Present Value Analysis

Attachment 1 – Operating Savings and Net Present Value Analysis

		Annual Operating Savings			Operating Capacity
		Natural Gas & Carbon			
		High	Expected	Low	
Biomass	Low	\$2.7	\$1.7	\$1.2	12MW
	Expected	\$2.5	\$1.5	\$1.0	
	High	\$2.2	\$1.2	\$0.8	
	Low	\$2.4	\$1.5	\$1.1	10.5MW
	Expected	\$2.2	\$1.30	\$0.9	
	High	\$2.0	\$1.1	\$0.7	
	Low	\$2.1	\$1.3	\$0.9	9MW
	Expected	\$1.9	\$1.1	\$0.8	
	High	\$1.7	\$0.9	\$0.6	

