



FY2018 Strategic Energy Management Plan

August 8, 2017









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1. INTRODUCTION

As Canada's Green University[™], the University of Northern British Columbia (UNBC) is committed to minimizing its environmental impact and operating costs by reducing energy consumption through energy efficiency projects, student engagement, and awareness campaigns; and showcasing renewable and efficient energy systems that are of particular interest to northern and remote communities. This commitment continues to be demonstrated with the recent expansion of the award winning Bioenergy system, and the ongoing efforts of the energy management team in reducing energy consumption. To-date, UNBC has achieved a 26% reduction in electricity use, a 71% reduction in natural gas consumption (and greenhouse gas emissions), and an 18% reduction in utility costs compared to 2010.

The energy management (EM) program at UNBC has been strongly supported by BC Hydro for the past 7 years. BC Hydro provides 50% of the funding for a dedicated Energy Manager, as well as incentives to implement energy efficiency and conservation projects. To-date, BC Hydro has contributed over \$1 million to UNBC's EM program, which has facilitated over 30 projects that have saved UNBC roughly \$1 million in electricity costs. This year, UNBC intends to claim 883,000 kWh towards their BC Hydro Energy Manager target.

In addition to the BC Hydro targets, UNBC has outlined long-term energy reduction targets: a 25% reduction in energy use, and an 85% reduction in natural gas use by 2020, (compared to 2010 levels). To work towards the 2020 reduction targets, UNBC has developed a project plan for the next couple years which is outlined in this report. Funding for the identified projects is committed through the UNBC Energy Conservation Revolving Loan Fund, and funding partnerships will be pursued with BC Hydro and the Carbon Neutral Capital Program. In addition to the planned projects, UNBC will continue to engage the UNBC community to maximize conservation and awareness.

Through the EM program, and the switch from fossil fuels to bioenergy, UNBC has avoided the purchase of roughly \$3.5 million worth of energy over the past 7 years. Including the \$1.2 million brought in through incentives and salary reimbursements, UNBC's commitment to sustainable operations can be valued at \$4.7 million.

2. ENERGY MANAGEMENT AT UNBC

The energy management portfolio includes all facilities where UNBC has direct operational control. This permits changes to the operating procedures, equipment upgrades, and other capital expenditures. In total, the energy management scope covers 22 buildings over four sites: the Prince George Campus, Terrace Campus, BMO Centre in downtown Prince George, and the Quesnel River Research Centre (QRRC). Of the 22 buildings, 16 are located at the Prince George Campus, account for 98% of the total energy consumption, and house roughly 95% of the population.

2.1. ENERGY CONSUMPTION AND COST

UNBC uses a mix of different energy sources, primarily electricity, bioenergy, and natural gas. Diesel and propane represent less than 1% of the total UNBC energy consumption and cost. Fuel for vehicles and mobile equipment is not included within the scope of the energy management program. Table 1 lists the actual consumption and cost for each utility based on invoiced amounts.

	Anı Consu	Annual Cost	
Electricity	14,760,626	kWh	\$1,164,000
Bioenergy (Hog Fuel)	3,911	bdt	\$252,700
Natural Gas	30,400	GJ	\$259,500
Bioenergy (Pellets)	123	bdt	\$2,500
Propane	7,904	L	\$7,200
Total			\$1,685,900

Table 1 - FY2017 Utility Breakdown

Figure 1 shows the breakdown of energy consumption in FY2017. Electricity accounted for 33% of our total energy consumption, and heat generated from hog fuel (sawmill wood waste), natural gas, and wood pellets accounted for the remaining 67%. Of the heat, 71% was generated from bioenergy. The Prince George campus operates two bioenergy systems: a 4.4MW Bioenergy Plant that uses hog fuel to make hot water for the main campus district heating loop; and a 400kW Wood Pellet Plant that uses wood pellets to produce low-temperature water for our Neyoh Residence and the J.K. Barber Enhanced Forestry Lab. Natural gas is used to back-up the bioenergy systems on the Prince George campus, and to heat buildings not served by the district heating loops.





Although electricity accounted for only 33% of the energy consumption, it represented 69% of our total energy cost, due to the relatively high marginal rate of electricity, see Table 2. Electricity costs 2 to 5 times the cost of natural gas per unit of energy, and 10 times the cost of hog fuel. This, however, is based on primary energy and does not take into account efficiency losses when converting natural gas or bioenergy into useable heat.

Table 2 – FY2017 Marginal Energy Rates

Energy Source	Account(s)	Marginal Rate (c/kWh)
Electricity	ВМО	12.73
	NSC/Bioenergy Plant	11.51
	Prince George Campus/QRRC	11.34
	Terrace	9.92
Natural Gas	Terrace	5.99
	Daycare/Bio Plant/BMO	3.52
	Residence 2/Agora/EFL	3.24
	Prince George Campus	2.53
	NSC	2.52
Bioenergy (Hog Fuel)	Prince George Campus	1.26
Bioenergy (Pellets)	Prince George Campus	0.40

2.1.1. BIOENERGY AND DISTRICT HEATING

The Prince George Campus has two district heating systems: the main district heating (DH) system serves nine buildings and is anchored by the Bioenergy Plant and backed up by the natural gas boilers in the Power Plant; and the Low-temperature district heating system currently serves 2 buildings and is anchored by the Wood Pellet Plant and backed up by the main district heating system. The Low-temperature DH system was commissioned in September 2016, and the Wood Pellet Plant was re-commissioned in November 2016. The system will be further expanded in FY2018 to include the second Residence building and the Childcare Centre.

The two DH systems are integrated at the Bioenergy Plant allowing the new Low-temperature DH system to use excess capacity from the Bioenergy Plant as back-up. If extra capacity from the Bioenergy Plant is not available, the extra heat is provided by the back-up natural gas boilers in the Power Plant.

The breakdown of fuel used for the Main DH and Low-temperature DH systems for FY2017 is displayed in Figure 2. In total, 3,911 bone dry tonnes (bdt) of hog fuel were used by the Bioenergy Plant, 123 bdt of wood pellets were used by the Wood Pellet Plant, and 15,200 GJ of natural gas was used by the natural gas boilers.



Low-Temperature District Heating Breakdown



Figure 2 - District Heating Fuel Breakdown

2.1.2. ENERGY CONSUMPTION BY BUILDING

In 2012, UNBC installed submeters throughout the Prince George Campus to measure electricity, hot water, chilled water, natural gas, and domestic water at the building level. The submetered data allows us to monitor energy consumption, identify areas of improvement, and verify savings from implemented projects.

Figure 3 shows the breakdown of energy consumption by building. The energy is broken down into electricity; main district heating (Main DH) served by the Bioenergy Plant and back up by the natural gas boilers; cooling from the central chillers; natural gas; and low temperature district heating (Low Temp DH) served by the Wood Pellet Plant and backed up by the Main DH.



Figure 3 – FY2017 Breakdown by Building

Figure 3 shows the magnitude of the energy used by each building, however, does not show how the buildings are performing compared to each other. In order to determine performance of our buildings, we correct for building floor area and compare the buildings with similar purposes as seen in Table 3.

As displayed in Figure 3 and Table 3 the laboratory buildings are the highest consumers of energy both in terms of total energy and energy intensity. Laboratories account for 41% or our energy consumption, but only 21% of the total floor space. Lab buildings operate 24 hours a day and condition 100% outdoor air since recirculation of air is prohibited, resulting in high energy demands. The Enhanced Forestry Lab (EFL) greenhouse is the highest in terms of energy used per square meter due to the large heating requirements of the space and the poor insulation due to the amount of glass.

Table 3 – FY2017 Energy Intensity and Cost Intensity by Building

	Building Area	Annual Consumption	Annual Cost	Energy Intensity	Cost Intensity
Building	m²	kWh/year	\$/year	kWh/m²/year	\$/m ² /year
Laboratories					
Enhanced Forestry Lab	931	1,538,386	\$44,348	1652	48
Medical	4,468	4,326,132	\$132,638	968	30
Research Lab	7,581	6,968,478	\$218,972	919	29
Teaching Lab	7,921	5,307,867	\$198,248	670	25
Subtotal	20,901	18,140,862	\$594,206	868	28
Industrial					
Bioenergy Plant	1,046	896,864	\$68,160	857	65
Power Plant	1,253	1,021,378	\$70,467	815	56
Subtotal	2,299	1,918,242	\$138,627	834	60
Administrative					
Conference Centre	3,253	2,200,415	\$67,245	676	21
Agora	8,556	4,047,709	\$123,381	473	14
Teaching and Learning	10,130	4,459,522	\$127,478	440	13
Library	11,754	4,230,711	\$161,111	360	14
Terrace Campus	1,314	430,280	\$35,616	327	27
BMO Centre	1,320	424,174	\$24,891	321	19
Childcare Centre	639	189,514	\$9,002	297	14
QRRC	812	239,018	\$26,110	294	32
Admin	9,161	2,383,906	\$115,946	260	13
Subtotal	46,939	18,605,249	\$690,780	396	15
Recreational/Accommod	ations/Other				
Northern Sports Centre	13,485	2,709,614	\$140,607	201	10
Residence 1	7,425	1,562,448	\$40,408	210	5
Residence 2	7,425	1,393,074	\$74,040	188	10
Maintenance Building	352	55,984	\$7,186	159	20
Subtotal	28,687	5,721,120	\$262,241	199	9
Total	98,826	44,385,473	\$1,685,854	449	17

The average Building Energy Performance Index (BEPI) for UNBC in FY2017 was 449 kWh/year/m²: a 7% increase from last year. The increase in BEPI was due to FY2017 being significantly colder than FY2016, approximately 16% colder.

Compared to other institutions, the UNBC BEPI of 449 kWh/year/m² was significantly below the outdated 719 kWh/year/m² reported by Natural Resources Canada for Canadian universities and colleges in 2003. Though there are more recent Canadian BEPIs being reported, there has been little updated data for universities and colleges. Additionally, the different breakdowns in building functions (laboratories, administrative, etc), and differences in climates can make comparing any average BEPI difficult. For example, Prism Engineering compared the Energy Intensity for 6

different colleges and found an average intensity of 266 kWh/m²/year. However, all 6 institutions are located in the Lower Mainland and Vancouver Island where the climate is milder than Northern BC. Furthermore, none of the 6 institutions are research intensive, whereas UNBC has several Lab buildings which significantly increase the average BEPI. That said, UNBC's average electricity BEPI was 145 kWh/m²/year, only slighty higher than the Prism benchmark average of 134 kWh/m²/year.

2.2. ENERGY MANAGEMENT BUDGET

Partial funding for the EM program at UNBC is provided by BC Hydro. Up to \$50,000 of the Energy Manager salary is funded by BC Hydro's Energy Manager Program. In addition, UNBC applies, each year, for incentive funding from BC Hydro to help implement electricity efficiency projects. UNBC also receives funding from the Ministry of Advanced Education Carbon Neutral Capital Program (AVED CNCP) to implement greenhouse gas reduction projects. The remainder of the project funding comes primarily from UNBC's Energy Conservation Revolving Loan Fund and Routine Capital funding.

2.2.1. ENERGY CONSERVATION REVOLVING LOAN FUND

The Energy Conservation Revolving Loan Fund (Loan Fund) was created in 2012 when \$250,000 was made available to fund energy efficiency upgrade projects. After a project is implemented, a portion of the energy cost savings are used to repay the loan, and then used to provide a sustainable source of funding for the energy management program including future upgrade projects and eventually the Energy Manager salary.

Most energy projects are financed through the UNBC Energy Conservation Revolving Loan Fund, with incentives, and outside funding being added to the fund as they are received.

By the end of FY2017, the Loan Fund facilitated over \$1,000,000 of spending towards energy efficiency projects. A summary of the Revolving Loan cash flow can be seen in Figure 4. The implemented projects have saved roughly \$870,000 in utility costs, with net utility savings of \$369,000 after loan repayments.



Figure 4 - Revolving Loan Summary

2.3. ENERGY COMMITMENTS AND TARGETS

UNBC has developed a new Energy Policy to replace the previous 2011 policy. New energy targets have been established, which set the following goals:

- 1. Reduce electrical and thermal energy consumption (combined) by 25% by 2020;
- 2. Reduce fossil fuel consumption for heating by 85% by 2020.

Reductions are based on a comparison with the 2009/2010 baselines which are corrected for building floor space and variations in weather.

Target achievement not only involves implementing energy efficiency projects, but requires the participation, engagement, and support of students, faculty, staff, and senior administration. To help reach the above target, UNBC will claim 883,000 kWh worth of energy efficiency projects in FY2018 as part of the Energy Manager Program, and has committed to completing employee engagement programs supported by BC Hydro.

3. ENERGY INITIATIVES

The EM program keeps a detailed list of energy projects to meet its energy reduction targets. The list is updated and prioritized regularly to address the operational issues and requirements of the campuses as they arise. In addition, projects are planned and scheduled based on internal capacity, and the availability of funding.

A full list of completed and in-progress projects and studies is included in the Appendix.

3.1. FY2018

In FY2018, UNBC will complete projects projected to save 788,000 kWh of electricity annually resulting in a 4% reduction of electricity use. Of the implemented projects, 438,000 kWh of savings will count towards the BC Hydro Energy Manager target as summarized in Table 4. The additional 350,000 kWh of savings will be from converting the electric baseboard in the Keyoh Residence to hydronic radiators in summer 2017.

	Annual			Incent	ives	
Project	BC Hydro Number	Electricity Savings (kWh/y)	Project Cost (\$)	BC Hydro	CNCP	Payback (y)
Power Plant Lighting	BCH-04146	28,000	\$11,900	\$12 020	\$0	37
Utilidor Lighting	001104140	63,000	\$24,100	ψ12,020	ΨΟ	0.7
Library Lighting 1 st Floor	BCH-04148	141,000	\$85,500	\$22,638	\$35,385	2.8
Conference Lighting	BCH-04149	69,000	\$60,000	\$12,499	\$30,000	3.4
Daycare Lighting		16,000	\$8,100			
Research Lab Stairs/bathroom	BCH-04147	22,000	\$16,800	\$11,394	\$0	4.5
Power Plant Highbay		43,000	\$12,200			
NSC Soccer Field Lighting Controls	BCH-04240	55,000	\$25,000	\$8,119		4.4
Recycling Room Lighting	PSPX170052	1,000	\$600	\$172		6.1
Subtotal		438,000	\$244,200	\$66,842	\$65,385	3.6

Table 4 - FY2	018 BC Hydro	Incentive Proj	ect Summary
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UNBC intends to claim savings for two Program Enabled projects that were completed in FY2017: the Residence 1 Baseboard conversion; and the Administration building LED lighting retrofit. In total, we expect to claim 883,000 kWh of annual savings towards our BC Hydro Energy Manager target.

In addition to the electricity reduction projects, we will be completing the final phase of the Sustainable Communities Demonstration Project (SCDP) which will see our Keyoh Residence and Childcare Centre being connected to the new low-temperature district heating loop supplied by our Wood Pellet Plant. We will also continue our efforts to optimize the operation of our heating systems with the goal of maximizing the heat coming from the Bioenergy Plant, reducing heat losses, and minimizing our back-up natural gas consumption.

3.1.1. LED LIGHTING RETROFITS

The Prince George campus is undergoing extensive lighting upgrades to replace magneticballasted linear fluorescent fixtures from the original campus built over 20 years ago. The magnetic ballasts are starting to fail resulting in inoperable lights, however, even working ballasts are responsible for flickering lights, humming, and high energy consumption.

In FY2018, retrofits will be occurring in 5 of the 6 original buildings: the Conference Centre/NUSC, Power Plant, Agora (utilidor), Geoffrey R. Weller Library (1st floor), and Research Lab (restrooms and stairwells). In addition, the lighting will be upgraded in the Childcare Centre.

3.1.2. NORTHERN SPORT CENTRE SOCCER FIELD LIGHTING CONTROLS

The soccer field lighting in the NSC was upgraded to LEDs in 2012. The LED fixtures that were chosen have experienced several issues with the drivers, and colour shifting, and are therefore being replaced for the second time under warranty. Since the 110 fixtures will be replaced, we have decided to upgrade the fixtures to include wireless control capability. The new fixtures will be connected to a wireless control system that will allow for zoning and control of the 4 quarters of the two soccer fields including motion sensing and dimming. The new system will maximize energy savings by lighting each zone only when occupied. In addition, the fixtures will be dimmed to a set level to ensure adequate lighting and equal operating hours.

3.1.3. KEYOH RESIDENCE BASEBOARD CONVERSION

In summer 2017, the second residence building will be renovated. As part of the renovation, all heating will be converted to hydronic heating supplied by our new low-temperature district heating loop. The Loan fund will contribute \$100,000 to convert the electric baseboard heaters to hydronic radiators which is expected to save roughly 350,000 kWh of electricity annually.

3.1.4. CONTINUOUS OPTIMIZATION

In FY2018, we will wrap up the final implementation phase of the Continuous Optimization Program which includes low-cost scheduling and controls upgrades to the Library, Conference Centre, and Teaching and Learning Building. The measures in these three buildings are expected to save 627,000 kWh of electricity, and 6,048 GJ of district heat annually. The savings were claimed in FY2017, as the project was substantially complete.

3.1.5. ENERGY WISE

UNBC is an active participant in the BC Hydro Energy Wise Network. As part of the network, we will complete three employee engagement campaigns in FY2018, with the help of the UNBC Green Team, to promote energy conservation on campus.

3.1.6. ENERGY MANAGEMENT ASSESSMENT (EMA)

UNBC will complete an EMA in December 2017 when new priorities will be identified and outlined to improve the Energy Management program. The last EMA session was completed in September 2015, where recommended actions included: solidifying a long-term energy policy; setting energy intensity reduction targets for each key area; outlining a project plan; leveraging site managers to increase participation in conservation efforts; and improving the awareness of the executive management. UNBC continues to make progress in each key action area.

3.2. FY2019

In FY2019 we will continue the replacement of magnetic-ballasted lighting from the original campus. The focus will be to complete the Library, Administration building (Charles J McCaffray Hall), and Agora. In addition, we will upgrade the HVAC system in our server room, investigate opportunities for free cooling around our central chilled water system, and design a heat recovery system for our Bioenergy Plant. The projects outlined in Table 5 will reduce electricity consumption by 2.5% compared to FY2010.

Project	Annual Electricity Savings (kWh/y)	Project Cost (\$)	Incentives (\$)	Payback (y)
Library Lighting 2 nd , 3 rd , 4 th Floor	220,000	\$130,000		9
Admin 1 st Floor Lighting	36,000	\$40,000		16
Agora Lighting	111,000	\$120,000		15
EFL Grow Lights	56,000	\$50,000		13
Server Room HVAC	72,000	\$100,000	\$63,000	7
Subtotal	495,000	\$440,000	\$63,000	11

Table 5 - FY2019 Project List

CNCP funding and BC Hydro Custom Incentive funding is expected for the FY2019 projects. The remaining costs will be covered by the Loan Fund.

3.3. FY2020

In FY2020, we will replace the remaining magnetic-ballasted fixtures in the Research Lab which will complete the original campus lighting upgrades.

The FY2020 year will see the opportunity for funding of larger projects, such as flue-gas heat recovery for the Bioenergy Plant, since the Loan Fund will be well established after being in operation for seven years. A refined list of projects will be formed over the upcoming year, and will be included in next year's report.

4. ENERGY PERFORMANCE

To assess energy performance, we compare monthly energy consumption for each utility account to a FY2010 baseline. Baselines were developed comparing the FY2010 utility data to the degrees of heating and/or degrees of cooling required based on the outdoor air temperature. Outdoor air temperature is the largest driver of energy consumption at UNBC. Occupancy is a driver for the two Residence buildings, but has proven to be insignificant for the other buildings. Figure 5 shows the annual energy intensities compared to the FY2010 baseline intensity which corrects for variations in weather. Overall, UNBC has achieved a 10% reduction in energy use compared to FY2010.

Figure 5 also shows how UNBC has successfully reduced its natural gas consumption by 71%. The natural gas reduction started in FY2011 when the 4.4 MW Bioenergy Plant was commissioned and started providing heat to the Prince George Campus. The Bioenergy Plant now meets, on average, 85% of the annual heating requirements of the buildings connected to the main district heating loop. In the fall of FY2017, the Low-temperature DH loop, anchored by the Wood Pellet Plant, was commissioned, displacing natural gas at the Neyoh Residence and the EFL greenhouse. In FY2018, the Keyoh Residence and the Childcare Centre will be converted to hot water systems and connected to the Low-temperature DH system. Once these buildings are connected, only 3 of our 22 buildings will use natural gas as their primary means of heating.





UNBC has seen an overall reduction of 18% in utility costs since FY2010, as shown in Figure 6. Compared to the baseline energy cost, UNBC has seen a utility cost reduction of 32%.

The significant overall cost reduction is due to the commissioning of the Bioenergy Plant in FY2011. The hog fuel used by the Bioenergy Plant is roughly half of the cost of the equivalent amount of natural gas. In addition, UNBC started purchasing natural gas for its two largest accounts from Shell Canada in FY2015, which has lowered natural gas costs by \$55,000 to-date.

Though UNBC has achieved a 26% reduction in electricity use, the increasing rates of electricity have lead to a 13% cost increase. However, compared to the baseline electricity cost (if we had not reduced our electricity consumption), our electricity costs have decreased by 31%.





4.1. ELECTRICITY SAVINGS

Since FY2010, UNBC has reduced electricity consumption by 26% as shown in Figure 7. Compared to last year, UNBC decreased electricity consumption by 1,179,000 kWh or 7%. This significant decrease in consumption is due primarily to the strong focus on electricity reduction projects. In late FY2016 and early FY2017 many projects were completed including: Continuous Optimization on the Northern Sport Centre, Charles J. McCaffray Hall (Administration Building), and Medical Building; exterior lighting upgrades; and the Neyoh electric baseboard conversion. In total, these project were expected to save over 1,000,000 kWh annually.



Figure 7 - Historical Electricity Consumption

UNBC saved \$42,000 in electricity costs compared to last year. However, compared to the baseline cost, UNBC avoided \$525,000 in electricity costs. Since FY2010, UNBC has avoided the purchase of \$1.6 million worth of electricity due to its efficiency and conservation efforts.

4.2. HEAT SAVINGS

Since FY2010, UNBC has successfully reduced natural gas consumption by 71%, by converting to bioenergy on the Prince George Campus. However, with the start-up of the Bioenergy Plant, our total purchased heat increased slightly, and has just returned to FY2010 levels, as seen in Figure 8. The term "purchased heat" refers to the energy content of the purchased natural gas, hog fuel and wood pellets used to produce heat. An energy density of 18.848 GJ/bdt was used to calculate the energy content of the purchased bioenergy.

The reason for the increase in purchased heat is due to the difference in efficiencies between the Bioenergy Plant and the natural gas boilers that originally provided the heat to the Main district heating loop. In FY2010, the natural gas boilers provided all of the heat to the Main DH loop, and ran relatively efficiently. As Bioenergy has replaced the use of the natural gas boilers, when the boilers are needed as back-up they operate at a lower firing rate, likely resulting in a lower efficiency. In addition, the efficiency of the Bioenergy Plant is slightly lower than the NG boilers at full capacity, and can vary widely depending on the moisture content of the fuel, the time between boiler cleanings, and operator interventions.





Comparing to FY2012 when the Bioenergy Plant came online, we have seen an 11% decrease in purchased heat, roughly 13,000 GJ. This is closer inline to expected savings of 9,000 GJ from completed heat reduction projects such as Continuous Optimization, low-flow showerheads in the Residences, and the Power Plant air handler controls upgrade. Similarly, the submeter heat data from the buildings on the Prince George Campus show a 23% reduction in heating since they were installed in 2012.

Since the commissioning of the Bioenergy Plant, UNBC has cut heating costs by \$1.9 million. The hog fuel used by the Bioenergy Plant is roughly half of the cost of the equivalent amount of natural gas. In addition, UNBC started purchasing natural gas at the market price for its two largest accounts in FY2015, which has lowered natural gas costs by \$55,000 to date.

5. SUMMARY

Over the past 7 years, the UNBC EM program has brought in \$667,000 in incentives and \$574,000 in salary reimbursements, and has implemented projects which have saved roughly \$1,200,000 in utility costs. Including the savings attributed to the Bioenergy Plant and Wood Pellet Plant, UNBC has saved a total of \$3,484,000 on utilities. Figure 9 shows the breakdown of the close to \$5 million value of UNBC's sustainable operations.



Figure 9 - Energy Management and Utility Savings

APPENDIX A – COMPLETED PROJECT LIST

	Project	Campus	BC Hydro Project	Electricity Savings (kWb/y)	Electricity Demand Savings (kW/month)	Natural Gas Savings (G.I/y)	District Heat Savings	Cost (\$)	BC Hydro Incentive	Fortis Incentive	CNCP Funding	Revolving Loan Contribution	Total Savings Last year (\$)	Total Savings	Completion
1	Canfor Theatre Lighting (Round 1)	Main	-	3 700	1	0	0	6 000	0	0	(v)	(•)	401	2 464	Aug-10
2	Terrace Boiler Replacement	Terrace	-	0,700	0	300	0	45,000	0	0	0	0	5 2 1 9	34 228	Oct-10
3	Green Centre Lighting	Main	-	1 240	0	000	0	640	0	0	0	0	135	807	Jan-11
4	Wintergarden Lights	Main	-	2.630	1	0	0	640	0	0	0	0	245	1,499	Jan-11
5	Agora North Entrance Lighting	Main	PSPX110586	999	0	0	0	476	218	0	0	0	60	388	Apr-11
6	Rotunda Gallery Lighting	Main	PSPX110587	5.931	1	0	0	1.987	1,165	0	0	0	553	3,295	May-11
7	Rotunda Gallery Ramp Lighting	Main	PSPX111364	2,475	1	0	0	774	390	0	0	0	231	1.375	May-11
8	NUSC Event Space (Round 1)	Main	PSPX111455	960	1	0	0	402	160	0	0	0	145	814	May-11
9	Thirsty Moose Lighting	Main	PSPX101130	6.034	2	0	0	2.311	1.412	0	0	0	655	3.718	Sep-11
10	Bookstore/Cafeteria Lighting	Main	PSPX100434	20,796	7	0	0	6,684	3,258	0	0	6.684	2,256	12,551	Dec-11
11	Admin Chiller for electrical vault	Main	-	98.600	11	0	0	70.000	0	0	0	0	7.569	44.210	Mar-12
12	T&L Davlight Harvesting	Main	-	9.519	2	0	0	0	0	0	0	0	862	4.856	Mar-12
13	Medical AV free cooling	Main	-	22.950	3	0	0	11.000	0	0	0	0	1.762	10,178	Apr-12
14	Residence Lighting	Main	SUCH11-965	284.000	0	0	0	61,547	24.090	0	0	61.547	17.106	104.118	Mav-12
15	NUSC Event Space	Main	PSPX110510	11.344	7	0	0	6.090	2.474	0	0	6.090	1.710	8.520	Jun-12
16	Lecture Theatre Lighting	Main	PSPX113112	78,705	26	0	0	22.811	11.988	0	0	22.811	8.540	44.849	Jun-12
17	Terrace Campus lighting upgrade	Terrace	PSPX153073	16,599	0	0	0	14.805	3.994	0	0	14.396	1.950	8.608	Jun-12
18	Residence Lighting	Main	PSPX112054	14.414	0	0	0	17.216	3.208	0	0	17.216	868	5.174	Jul-12
19	Coil Cleaning	Main	SUCH12-1077	195.000	39	0	0	23.523	9.684	0	0	23.523	17.328	92.471	Aug-12
20	NSC Soccer Field and Gvm	NSC	SUCH12-1103	182.000	56	0	0	135,188	41,160	0	0	0	19.533	99.287	Sep-12
21	Canfor/Warehouse	Main	SUCH12-1112	99.000	22	0	0	53.046	21,214	0	0	0	9,158	46.096	Dec-12
22	EFL Cold Storage Lighting	Main	PSPX130081	1.181	0	0	0	578	139	0	0	0	119	579	Jan-13
23	QRRC Lighting Upgrade	QRRC	PSPX112392	7.752	3	0	0	5.129	1.258	0	0	5.129	826	3.609	Mar-13
24	Agora Davlight Harvesting	Main	-	24.600	6	0	0	0	.,	0	0	0	2.295	10.588	Jun-13
25	Residence Low-flow showerheads	Main	-	0	0	1.400	0	696	0	0	0	696	12.607	48,226	Jul-13
26	Admin Daylight Harvesting	Main	-	33,000	8	0	0	0		0	0	0	3,079	13,981	Jul-13
27	Exterior Lighting - globes	Main	BCH-00377	66,000	0	0	0	106,629	18,152	0	0	42,936	4,365	19,300	Nov-13
28	Teaching Lab Pot lights/Agora exterior	Main	-	15,868	0	0	0	6,950	0	0	0	6,950	1,237	4,209	May-14
29	Teaching Lab Pot lights/Agora exterior	Main	BCH-01166	59.000	13	0	0	26,433	2.935	0	0	26.433	7.440	16.414	Feb-15
30	Medical Humidifier	Main	BCH-01716	476,000	66	0	-280	151,240	74,941	0	0	151,240	52,083	115,943	Feb-15
31	Teaching Lab Penthouse Lighting	Main	PSPX142369	1,022	0	0	0	781	105	0	0	781	166	360	Feb-15
32	Reef Tank Lighting	Main	-	2,300	0	0	0	1,664	0	0	0	700	255	568	Feb-15
33	Power Plant AHU controls	Main	-	40,000	6	450	0	68,430	0	25,811	48,661	19,769	7,818	15,847	Mar-15
34	Research Lab C.Op	Main	BCH-02086	214,000	0	0	1,146	58,598	0	0	0	58,598	30,505	58,224	May-15
35	Agora C.Op	Main	BCH-02087	218,000	0	0	1,031	59,694	0	0	0	59,694	29,956	57,256	May-15
36	Teaching Lab C.Op	Main	BCH-02088	264,000	0	0	3,228	72,290	0	0	0	72,290	52,514	99,186	May-15
37	Conference/NUSC Solar PV	Main	-	5,000	5	0	0	30,287	0	0	0	5,986	1,247	1,874	Sep-15
38	Workplace Conservation Awareness	Main	BCH-02090	304,636	0	0	0	5,311	4,935	0	0	0	33,641	39,289	Jan-16
39	Workplace Conservation Awareness	NSC	BCH-02090	32,222	0	0	0	0	0	0	0	0	3,612	4,219	Jan-16
40	Workplace Conservation Awareness	QRRC	BCH-02090	4,303	0	0	0	0	0	0	0	0	480	560	Jan-16
41	Workplace Conservation Awareness	Terrace	BCH-02090	2,821	0	0	0	0	0	0	0	0	325	378	Jan-16
42	Workplace Conservation Awareness	Bio	BCH-02090	13,240	0	0	0	0	0	0	0	0	1,484	1,734	Jan-16
43	Main campus streetlights/wallpacks	Main	BCH-02693	167,000	0	0	0	164,188	45,160	0	44,700	118,107	18,442	21,538	Jan-16
44	NSC Exterior lighting	NSC	BCH-02694	86,000	0	0	0	60,027	20,717	0	0	60,027	9,642	11,260	Jan-16
45	Conf/NUSC Air Handler HW conversion	Main	-	0	0	846	-816	6,368	0	0	6,368	0	925	1,322	Jan-16
46	Medical C.Op	Main	BCH-02089	48,000	0	0	207	1,284	0	0	0	0	7,140	7,140	Mar-16
47	NSC C.Op	NSC	BCH-03368	453,000	0	1,922	0	27,028	0	0	0	22,702	65,578	65,578	Mar-16
48	Admin C.Op	Main	BCH-03370	144,000	0	0	741	-13,627	0	0	0	5,119	22,405	22,405	Mar-16
49	Energy Wise FY2017	Main	BCH-03654	0	0	0	0	270	267	0	0	0	0	0	Apr-16
50	Terrace exterior lighting (PSPX)	Terrace	PSPX111693	504	0	0	0	162	77	0	0	162	53	53	Apr-16
51	Terrace Exterior Lighting	Terrace	-	4,896	0	0	0	9,073	0	0	0	1,811	517	517	Apr-16

	Project	Campus	BC Hydro Project Number	Electricity Savings (kWh/y)	Electricity Demand Savings (kW/month)	Natural Gas Savings (GJ/y)	District Heat Savings (GJ/y)	Cost (\$)	BC Hydro Incentive (\$)	Fortis Incentive (\$)	CNCP Funding (\$)	Revolving Loan Contribution (\$)	Total Savings Last year (\$)	Total Savings to-date (\$)	Completion Date
52	Main campus wallpacks	Main	BCH-03047	53,000	0	0	0	20,411	8,073	0	0	10,515	3,505	3,505	Aug-16
53	Residence 1 Heating System Conversion	Main	Program Enabled	386,700	69	3,000	-4,500	500,000	0	0	0	100,000	26,057	26,057	Aug-16
54	Residence 1 Heating System Conversion	Bio	Program Enabled	-37,200	-4	0	0	0	0	0	0	0	-2,870	-2,870	Aug-16
55	Corner Store Reno	Main	PSPX153444	1,230	0	0	0	2,047	333	0	0	0	116	116	Aug-16
56	BMO Boiler Replacement	BMO	-	0	0	0	0	0	0	4,050	0	0	0	0	Oct-16
57	Admin Lighting Upgrade	Main	Program Enabled	118,000	17	0	0	103,498	0	0	40,952	0	0	0	Mar-17
	Total			4,266,971	368	7,918	757	1,955,587	301,507	29,861	140,681	921,911	493,849	1,198,472	

APPENDIX B – PROJECTS IN PROGRESS

	Project	Campus	BC Hydro Project Number	Estimated Electricity Savings (kWh/y)	Estimated Electricity Demand Savings (kW/month)	Estimated Natural Gas Savings (GJ/y)	Estimated District Heat Savings (GJ/y)	Budget Cost (\$)	BC Hydro Incentive (\$)	Fortis Incentive (\$)	CNCP Funding (\$)	Revolving Loan Contribution (\$)	Expected Completion Date
58	Library C.Op	Main	BCH-04061	407,000	0	0	2,809	37,000	0		0	20,000	Jul-17
59	Conf/NUSC C.Op	Main	BCH-04062	61,000	0	0	1,244	11,000	0	0	0	5,000	Jul-17
60	T&L C.Op	Main	BCH-04063	159,000	0	0	1,995	26,500	0	0	0	13,000	Jul-17
61	Power Plant/Utilidor Lighting	Main	BCH-04146	91,000	12.7	0	0	36,000	12,020	0	0	36,000	Mar-18
62	Daycare/Research Lab	Main	BCH-04147	81,000	14.0	0	0	37,200	11,394	0	0	37,200	Mar-18
63	Library Lighting -1st Floor	Main	BCH-04148	141,000	23.1	0	0	76,000	22,638	0	35,385	40,615	Aug-17
64	Conf/NUSC Lighting	Main	BCH-04149	69,000	12.2	0	0	56,700	12,449	0	30,000	26,700	Aug-17
65	Soccer Field lighting controls	NSC	BCH-04240	55,000	3	0	0	25,000	8,119	0	0	25,000	Oct-17
66	Recycling Room Lighting	Main	PSPX170052	1,030	0.3	0	0	632	173	0	0	632	Oct-17
67	Residence 2 Heating System conversion	Main	FY2019 Program Enabled	350,000	66.7	2000	-3,500	500,000	0	0	0	100,000	Aug-17
68	Power Plant Boiler Bypass	Main	-	0	0.0	0	9,000	50,000	0	0	0	0	Sep-17
	Total			1,415,030	132	2,000	11,548	856,032	66,793	0	65,385	304,147	

APPENDIX C – COMPLETED STUDIES

				BC Hydro	Revolving Loan	CNCP Funding	
Study	Campus	BC Hydro Project Number	Cost (\$)	Incentive (\$)	Contribution (\$)	(\$)	Completion Date
Renewable energy study	Main	-	5,000	0	0	0	Sep-11
Ice Mountain study	Main	-	0	0	0	0	Nov-11
Anaerobic Digester study (ENVS417)	Main	-	0	0	0	0	Dec-12
Medical Humidifier study (PHYS402)	Main	-	0	0	0	0	Dec-12
Lab Heat Recovery study (ENSC499)	Main	-	0	0	0	0	Apr-13
C.Op Investigation - Research Lab	Main	COP10-416	16,028	15,768	16,028	0	Oct-13
C.Op Investigation - Agora	Main	COP10-419	15,891	15,587	15,891	0	Oct-13
C.Op Investigation - Teaching Lab	Main	COP10-420	16,442	16,175	16,442	0	Oct-13
C.Op Investigation - Medical	Main	COP10-421	12,922	12,713	12,922	0	Oct-13
C.Op Investigation - Admin	Main	COP10-415	18,418	18,119	18,418	0	Aug-14
C.Op Investigation - NSC	NSC	COP10-414	20,665	20,330	20,665	0	Aug-14
C.Op Handoff - Research Lab	Main	COP10-416	2,643	2,600	2,643	0	Jul-15
C.Op Handoff - Agora	Main	COP10-419	2,562	2,520	2,562	0	Jul-15
C.Op Handoff - Teaching Lab	Main	COP10-420	2,562	2,520	2,562	0	Jul-15
Bioenergy Heat Recovery study (ENVS417)	Main	-	0	0	0	0	Dec-15
C.Op Investigation - Library	Main	COP10-417	19,740	19,420	19,740	0	May-16
C.Op Investigation - Conference/NUSC	Main	COP10-418	11,482	11,295	11,482	0	May-16
C.Op Investigation - T&L	Main	COP10-422	14,861	14,620	14,861	0	May-16
C.Op Handoff - Medical	Main	COP10-421	4,361	4,290	4,361	0	Jul-16
C.Op Handoff - Admin	Main	COP10-415	2,767	2,723	2,767	0	Jul-16
C.Op Handoff - NSC	NSC	COP10-414	2,863	2,817	2,863	0	Jul-16
C.Op Coaching - Research Lab	Main	COP10-416	3,384	3,329	3,384	0	Nov-16
C.Op Coaching - Agora	Main	COP10-419	8,484	4,312	8,484	0	Nov-16
C.Op Coaching - Teaching Lab	Main	COP10-420	6,616	4,308	6,616	0	Nov-16
Boiler Power/Plant Controls Study	Main	-	24,433	0	0	24,433	Mar-17
Total			212,124	173,444	182,691	24,433	

APPENDIX D – STUDIES IN PROGRESS

		BC Hydro Project		BC Hydro	Revolving Loan		
Project	Campus	Number	Cost (\$)	Incentive (\$)	Contribution (\$)	CNCP Funding (\$)	Completion Date
C.Op Handoff - Library	Main	COP10-417	2,79	5 2750	2,795	0	Aug-17
C.Op Handoff - Conference/NUSC	Main	COP10-418	2,79	5 2750	2,795	0	Aug-17
C.Op Handoff - T&L	Main	COP10-422	2,79	5 2750	2,795	0	Aug-17
C.Op Coaching - Medical	Main	COP10-421	4,396	6 4325	4,396	0	Sep-17
C.Op Coaching - Admin	Main	COP10-415	4,390	6 4325	4,396	0	Sep-17
C.Op Coaching - Library	Main	COP10-417	4,390	6 4325	4,396	0	Sep-17
District Cold Water free cooling	Main	-	20,000) 0	0	0	Mar-18
Server Room free cooling	Main	-	10,000) 0	0	0	Mar-18
C.Op Coaching - Conference/NUSC	Main	COP10-418	3,50	7 3450	3,507	0	Sep-18
C.Op Coaching - T&L	Main	COP10-422	3,50	7 3450	3,507	0	Sep-18
C.Op Coaching - NSC	NSC	COP10-414	3,50	7 3450	3,507	0	Sep-18
Total			62,09	31,575	32,096	0	