Strategic Energy Management Plan

UNBC

University of Northern British Columbia

June 26, 2013

Energy Manager:

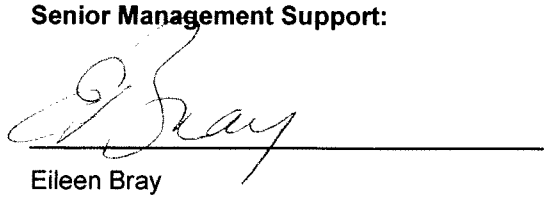
David Claus, P.Eng, D.Phil

Partnering with:

BC hydro

powersmart

Senior Management Support:



Eileen Bray
Vice President, Administration and Finance

Table of Contents

1. INTRODUCTION

As Canada's Green University™, the University of Northern British Columbia is committed to "green" and sustainable activities in every aspect of our operations. Using energy efficiently and using clean, renewable energy is considered by many to be a critical part of being green. With raised awareness of the environmental impacts of energy use, UNBC is committed to minimizing our environmental impact 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.

In June 2010, with funding from BC Hydro, UNBC hired a full-time Energy Manager to develop and carry out energy efficiency initiatives at the Prince George Campus, Terrace Campus, Quesnel River Research Centre, and BMO Centre in downtown Prince George. The Energy Manager has successfully implemented a number of energy efficiency projects over the past 3 years, bringing in $126,570 through BC Hydro incentives, and with total expected annual electricity savings greater than 1,000,000 kWh. In August 2012, UNBC hired an Energy Technician to take over the day to day energy management tasks.

In 2011 UNBC developed an Energy Policy outlining specific objectives related to energy reductions, renewable energy, and fossil fuel reductions. Compared to a 2009/2010 baseline, UNBC aims to:

1. Reduce electrical and thermal energy consumption by 10% by 2015
2. Provide 85% of core heating from renewable energy
3. Reduce fossil fuel consumption for heating by 80% by 2015

With the opening of the Bioenergy Facility in 2011, UNBC has provided 88% of the Prince George Campus core heating using renewable wood waste (hog fuel), offsetting over 71,000 GJ of natural gas this year. Over all of the UNBC campuses biomass provides 71% of the heating and has helped reduce fossil fuel consumption by approximately 72%.

1.1 Energy Manager Program

The BC Hydro Energy Manager program provides funding to public sector organizations to hire or designate someone as an Energy Manager. This funding is available for up to five years, and covers up to 75% of the cost of the salary. Funding is contingent upon meeting a number of requirements including meeting a specified energy savings target, submitting a Strategic Energy Management Plan, and completing quarterly presentations to UNBC and BC Hydro.

1.2 Purpose Statement

UNBC aims to reduce its energy consumption by 10% by 2015. This is measured using energy consumption per square meter of building space, and corrected for variations in weather. Based on the consumption in the 2009/2010 fiscal year, our conservation targets for FY2013 are 1,075,000 kWh for electricity and 7,000 GJ for heat. The BC Hydro Power Smart target for FY2013 requires implementing energy efficient projects saving 400,000 kWh annually. Achieving these targets not only involves implementing energy efficiency projects, but requires the participation and engagement of students, faculty, staff, and senior administration.

2. UNBC PROFILE

The University of Northern British Columbia was established in 1990 by the UNBC Act. The Prince George campus was constructed between1992-1994, and opened by Her Majesty Queen Elizabeth on August 15, 1994. The Bank of Montreal donated a downtown building to the University in 2005. A Terrace campus building was added in 2006, and the Quesnel River Research Centre came under the UNBC banner in 2002.

2.1 Organizational Profile

People

Sector Post-Secondary Education

Number of People 845 Faculty and Staff
4263 Occupants (students, daycare participants)

Campus Sites Prince George (16 buildings)
Downtown Bank of Montreal Building
Terrace Campus
Quesnel River Research Centre (4 buildings)

Operations

Energy Management Issues / Obstacles

- Organizational capacity – staff to carry out work scope
- Facilities staff changeover

Core Business Metrics

- Full Time Equivalent Students
- Gross Square Meters
- Classroom Hours
- Research Dollars

Annual Cycle

Business Year	April 1 - March 31
Budget Cycle	April 1 - March 31
Maintenance Cycle	April 1 - March 31

	2011/12	2012/13	2013/14	2014/15*
Maintenance Budget [1]	$1,372,059	$1,430,121	$1,476,971	$1,488,000
Energy Efficiency Projects Budget	$118,000	$174,000	$181,000	$200,000
Utilities Budget [2]	$2,893,131	$2,909,878	$2,873,257	$3,027,000
Operations Budget [3]	$62,773,519	$64,073,376	$64,649,805	$64,210,000
Other Incentives				
Capital Budget [4]	$91,350	$241,000	$241,653	$ 240,000

** Denotes projected budget amounts.*

The Energy Efficiency Projects budget is the actual amount spent in 2012/13. The amount listed for subsequent years is based on the projected spend from the Energy Conservation Revolving Loan described in section 0.

[1] "Building Renovations/Maintenance & Grounds" in the University budget
[2] "Utilities" in the University budget
[3] Total of "Labour" and "Other Operating Expenditures"
[4] "Routine Capital" funding, replaces "Annual Capital Allowance"

The capital budget listed above is the Routine Capital funding provided by the Provincial Government. It is used for capital improvements to extend the life of the physical plant, increase campus life safety and security, and for projects to reduce greenhouse gas emissions. This has been drastically reduced in recent years, from $1.4 million to $241,000 for this year. This is a challenge for funding energy efficiency projects; the University has responded by creating the Energy Conservation Revolving Loan, and will allocate savings from the utilities budget towards future projects.

The Operations budget of the University has been frozen for the current fiscal year. This constrains the Other Operating Expenditures, as labour costs include annual increases. All operating costs, including utilities, are being monitored very closely for any savings opportunities.

2.2 Energy Management Scope

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. Many of the regional operations of UNBC are housed at facilities operated by other institutions; while behaviour based conservation initiatives may be addressed to the staff at these sites, the facilities do not fall within the scope of the energy management program.

2.3 Facility Profile

The energy management scope covers a total of 22 buildings over four sites: the Prince George Campus, Terrace Campus, BMO Centre in downtown Prince George, and the Quesnel River Research Centre (QRRC) near Likely. Of the 22 buildings, 16 are located at the Prince George Campus and account for 98% of the total energy consumption.

The Prince George Campus is supplied with electricity from BC Hydro through three accounts: the Power Plant which is distributed to the main campus, the Bioenergy Plant, and the Northern Sport Centre (NSC).

Natural gas is supplied by Fortis BC to eight accounts: the Power Plant, Agora/Conference Centre, Bioenergy Plant, Enhanced Forestry Lab, Keyoh Residence, Neyoh Residence, Daycare, and NSC.

Hog Fuel for the Bioenergy plant is supplied by Lakeland Mills and currently sourced from the Isle Pierre Sawmill, which is approximately 50 kilometres from the Prince George Campus. The hog fuel is gasified and combusted in the Bioenergy plant to provide the majority of the heating for the district heating system that serves the nine buildings of the core campus. The natural gas supplied to the power plant is used by the back-up boilers to provide peak and back-up heat to the district heating system. Sub-meters are installed at each building to record the distribution of electricity, heating, and cooling.

The other three sites are supplied with electricity from BC Hydro. Natural Gas is supplied by Fortis BC to the BMO Centre and by Pacific Northern Gas to the Terrace Campus. The QRRC only uses electricity.

2.4 Key Performance Indicators

Key performance indicators are the identified variables that drive energy consumption. Floor area is one way of quantifying the size of the University, and it also directly relates to the amount of energy we consume. The number of students is the prime measure of the size of an institution, but it has less of an impact on the energy use. The annual weather (as measured by heating degree days) is the single largest driver of energy use for a northern campus such as UNBC. This is not a key performance indicator in the traditional sense as we do not have any direct control over it, but it is an important factor when reviewing energy consumption.

Table 1 Key Performance Indicators

	Totals				
	2012/2013	**2011/2012**	**2010/11**	**2009/10**	**2008/09**
Floor Area (average gross, m^2)	98,827	98,827	97,404	98,129	97,780
Students (Headcount Nov 1)	3,588	3,625	3,622	3,675	3,701
Weather (Heating Degree Days)	3,975	3,918	4,208	3,909	4,433

Floor area is computed as the average across all months of the gross campus area. Adjusting energy use for floor area yields a measure of the efficiency of the campus buildings; as new buildings are constructed the energy intensity in kWh/m^2 can still be compared against historical consumption levels.

Student numbers are based on the enrolment on November 1 of each year. An increase in enrolment would be expected to cause an increase in energy consumption. This is particularly the case when additional courses cause the normal operating hours of campus buildings to be extended. A more detailed measure of building occupancy (such as student and faculty hours) is being examined for future energy reporting, but currently the level of detail is insufficient to develop a correlation between full time equivalent (FTE) enrolment and energy consumption.

In northern British Columbia, outdoor air temperature is a variable that changes significantly throughout the year and impacts the amount of energy consumed. Heating degree days (HDD) and Cooling Degree Days (CDD) are measures of the amount of heating and cooling required as the temperature changes. HDDs are calculated when the average daily temperature is below the reference temperature, and are calculated as the difference between the two temperatures. In the case of UNBC the reference temperature for HDD is 15.5°C where heating is required below this temperature. CDDs are calculated as the difference between the two temperatures when the average daily temperature is above the reference temperature. The reference temperature for CDD is 13.5°C, meaning cooling is required above this temperature.

UNBC is a research intensive university, and our facilities include a research laboratory building, a teaching laboratory, a forestry research lab, and a building for the Northern Medical program. Research activity is a key measure of University performance, and research dollars awarded would be a natural performance measure. However, this does not take into account the wide range of energy intensity across research programs.

3. ENERGY COMMITMENTS AND TARGETS

The University of Northern British Columbia is committed to responsible energy use for all University owned and operated facilities while supporting its mandate of teaching and research. We acknowledge that students, staff and faculty all have a role to play in fostering a culture of energy conservation. To control costs and reduce the impact on the environment, UNBC will aim to reduce energy consumption and switch to renewable fuel sources.

UNBC has adopted an Energy Policy to reinforce our commitment to responsible energy use. The vision stems from our Green University strategy, as described below.

To maximize energy efficiencies of present UNBC energy systems

As a relatively new campus, built with energy efficiency in mind, UNBC has highly efficient systems. Not content to rest on our laurels, we will continue to optimize our operating practices, and seek out opportunities to increase the energy efficiency of our systems.

To replace fossil fuel sources with renewable energy sources

Renewable energy sources available to all of our campuses will be harnessed to support the research and teaching activities for which the University exists.

To develop sustainable energy demonstration and research facilities of particular value to northern and rural communities

The research activities of this University place a special emphasis on relevance to the wider community of which we are a part. Northern and rural communities face unique challenges, but are also often provided with significant renewable energy opportunities. UNBC will build on our history of integrating research, education and facility operations.

3.1 Energy Policy Targets

UNBC recognizes that utility rates are likely to increase, and that fossil fuel energy sources have a significant greenhouse gas contribution. To control costs and reduce the impact on the environment, UNBC will reduce energy consumption, and switch to renewable fuel sources wherever possible.

3.1.1 Overall Consumption

The electrical and thermal energy consumption of all UNBC campuses will be reduced by 10% by 2015 (relative to 2009/10).

Both electrical consumption and natural gas consumption will be reduced by 10%. Energy reductions will be calculated based on the energy intensity in kWh per square meter of building space. Energy intensity values will also be normalized for variations in weather.

For FY2013, the policy targets for electricity and heat are 193 kWh/m^2 and 285 kWh/m^2, respectively.

3.1.2 Fossil Fuel Reduction

UNBC consumes fossil fuels (natural gas, propane and diesel) for space heating at a number of sites. Fossil fuel consumption is not deemed to be sustainable, so we aim to reduce their consumption by 80% by 2015.

The baseline consumption is based on the 2009/2010 fiscal year, with consumption in subsequent years being corrected for weather and campus square footage.

The aim is to reduce fossil fuel consumption at all campuses, but the performance will be measured on an aggregate basis. The Bioenergy facility at the Prince George has already helped in reducing the fossil fuel consumption of the entire University by 72%. Conservation

projects that reduce the amount of thermal energy required will contribute to both this reduction target and the overall energy reduction target listed above.

The combustion of fossil fuels represents the major source of greenhouse gas (GHG) emissions for the University. By switching our thermal energy needs to non-fossil based energy sources we will dramatically reduce our GHG emissions.

3.1.3 Renewable Sources

UNBC aims to supply all of the Prince George campus energy needs through renewable sources. Wherever practical, this will involve on-site generation or conversion so that a high degree of monitoring and oversight can be maintained.

Renewable energy sources will be explored at all campuses, as each site has unique opportunities.

As we progress towards being a leader in renewable energy, we recognize that the first steps on this journey involve sub-metering to understand our current energy picture, and the application of conservation initiatives to reduce our energy requirements such that they can match the available renewable energy.

3.2 BC Hydro Energy Manager Target

As part of the Energy Management program through BC Hydro, electricity reduction targets are set annually. The electricity conservation target for FY2013 is 400,000 kWh annual savings through incentive projects, with a bonus target of 500,000 kWh savings.

4. ENERGY CONSUMPTION AND COSTS

UNBC operates in a northern climate with cold winters and long hours of summer sun. The winter months are when campus occupancy is highest, and also when the heating and lighting loads are greatest.

Campus facilities are mainly served with both electrical and natural gas from the provincial grids. A new Bioenergy facility was completed at the Prince George campus and commissioned in early 2011 to provide most of the space heating for the main campus from waste wood. This resulted in a dramatic reduction in fossil fuel consumption by the university compared to the 2009/2010 baseline.

4.1 Overall Utility Consumption and Costs

Table 2 lists the actual consumption and cost for each of the University utilities, based on invoiced amounts.

Table 2 ***UNBC Utility Breakdown***

Utility	Consumption		Cost
Electricity	18,480,910	kWh	$1,296,800
BioEnergy (Hog Fuel)	4,023	bdt	$290,880
Natural Gas	29,724	GJ	$289,141
BioEnergy (Pellets)	56	bdt	0
Water	79,112	m^3	$147,469
Propane	4,222	L	$3,416
Diesel	1,773	L	n/a
Total			**$2,027,706**

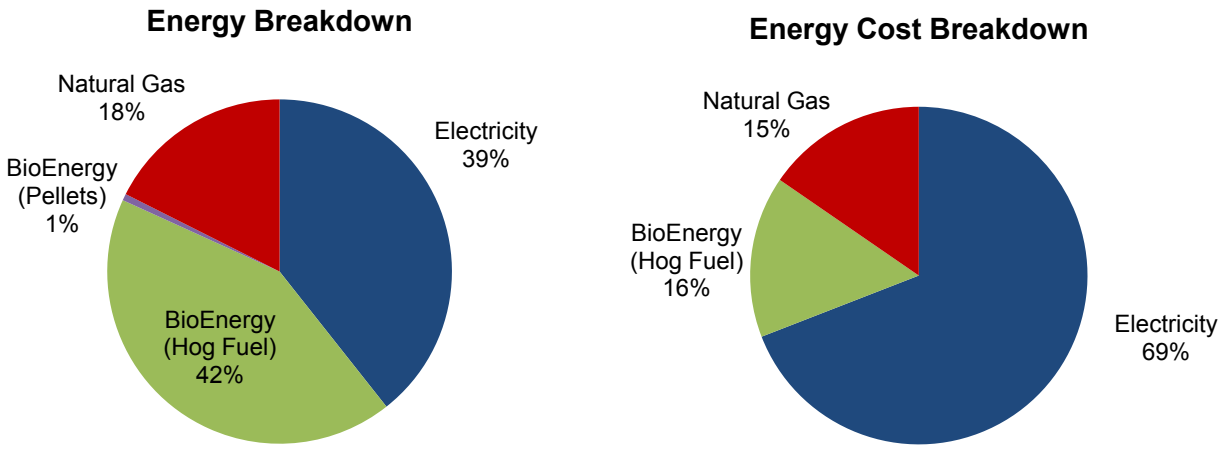


Figure 1 ***Utility Cost Breakdown for Apr 2012 - Mar 2013***

Diesel is used for the emergency electrical generators, and as a back-up fuel for the natural gas boilers in the Power Plant. Propane is used to heat the Maintenance Shop on the Prince George campus. 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.

Bio fuel in the form of wood waste (hog fuel) was added to the utility mix in November 2010 with the opening of the Bioenergy facility. Wood waste is supplied by a local company, Lakeland Mills, and is currently trucked to the UNBC Bioenergy facility from the Isle Pierre Sawmill. The average moisture content of the fuel is 35% and varies with wood species, beetle killed wood, and percentage of bark. Hog fuel is billed per Bone Dry Tonne (BDT), the dry weight of the fuel. The energy content of the hog fuel is estimated at 18.848 GJ/BDT.

Figure 1 shows the breakdown of primary energy use and utility cost breakdown. It is important to note that primary energy does not take into account losses due to efficiency and distribution. The efficiency of the Bioenergy plant is approximately 76% and the efficiency of the Power Plant boilers is 85%. Initial data suggests that the efficiency of the UNBC electricity distribution infrastructure is 98%.

Figure 1 shows a significant difference in energy costs between the three fuel sources. The average costs of electricity, natural gas, and bioenergy are 7.0 ¢/kWh, 3.5 ¢/kWh, and 2.0 ¢/kWh, respectively. The differences in energy prices indicate that greater savings can be seen per kWh of electricity reduction compared to thermal reductions. In actuality, electricity savings for the majority of the UNBC accounts are valued at 9.42 ¢/kWh, the 2012/2013 marginal rate of electricity. The marginal rate of electricity is applied based on the actual electrical consumption compared to the historical three-year average electrical consumption. If electricity use is below the baseline, the difference in electricity is credited at the marginal rate. If more electricity is used compared to the baseline, the difference is charged at the marginal rate.

4.2 Monthly Energy Consumption and Cost

Figure 2 shows the monthly breakdown of energy consumption and costs for the UNBC facilities. The total energy consumption is broken down further into electricity, bioenergy heat and natural gas heat. Similar to Figure 1, the cost of electricity dominates the total monthly energy costs.

The electricity consumption is relatively constant throughout the year, with a peak in July. July was the warmest month this fiscal year, and required more air conditioning than other summer months. The air conditioning for the Prince George Campus is primarily supplied by two centrifugal chillers that use electricity to chill water. These chillers are the largest point load of electricity on campus with a demand of approximately 500 kW. The chillers not only increase the amount of electricity being used, but also increase the monthly demand charge by approximately $4,500. During the shoulder seasons, the electricity billing period is one factor used in determining when to start-up and shut-down the chiller to avoid significant demand charges.

Monthly bioenergy and natural gas consumption and costs are also summarized in Figure 2. Both the bioenergy and natural gas consumption are highly correlated to the fluctuating outdoor air temperature, with the peak being seen in January when the temperature was the lowest. A significant amount of natural gas is required in the winter to meet the demand of individual buildings, and to supplement the Bioenergy facility district heating to meet peak loads during the coldest days. The peak load for the core campus (30 MMBtuh) is about twice the maximum output of the Bioenergy facility.

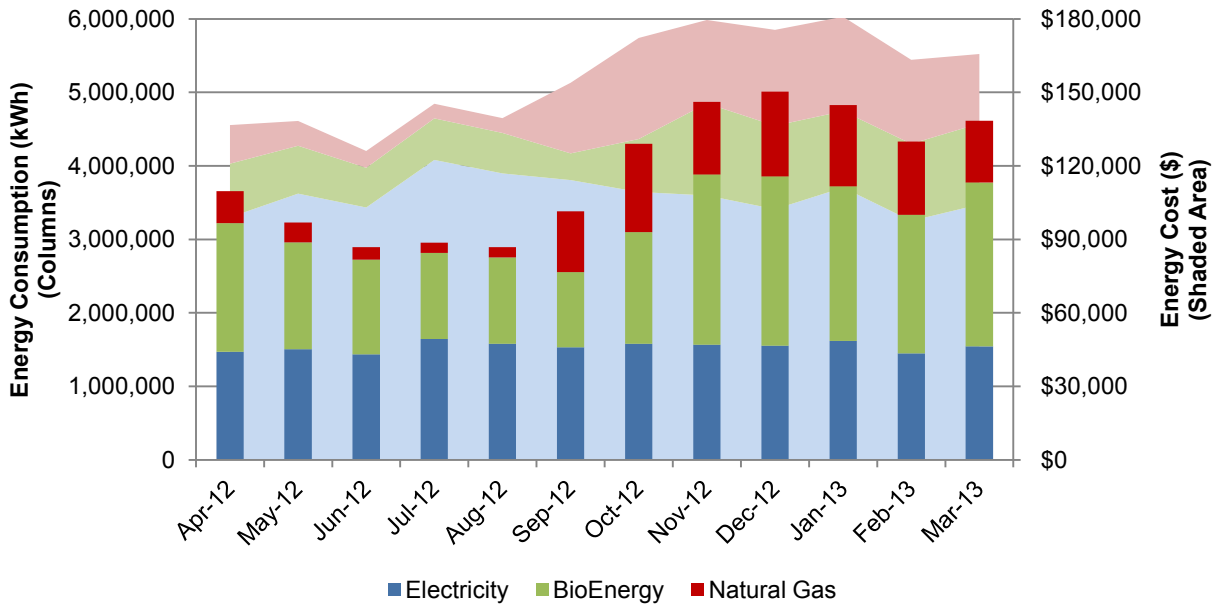


Figure 2 ***Aggregate Energy Consumption and Billing Summary***

4.3 Prince George Campus District Heating

The Prince George Main Campus of UNBC uses a piping system to distribute heat to nine (9) separate buildings. Prior to the Bioenergy Plant being built in 2010, this heat was supplied by four natural gas boilers located in the Power Plant. Since the opening of the Bioenergy Plant, the majority of the district heating is provided from the gasification of waste wood. The existing natural gas boilers are used to supplement the Bioenergy Plant on cold days, and to provide backup during downtime.

The Bioenergy and Power Plant heat output to the district heating loop for FY2013 can be seen in Figure 3. Over the past year the Bioenergy plant produced 61,000 GJ of heat from hog fuel which is equal to offsetting 71,800 GJ of natural gas. The input of hog fuel was 4,023 BDT with an energy content of approximately 75,800 GJ for a conversion efficiency of 80.5%. The Bioenergy plant also requires electricity and a small amount of natural gas to operate leading to an overall energy conversion efficiency of 76.3%.

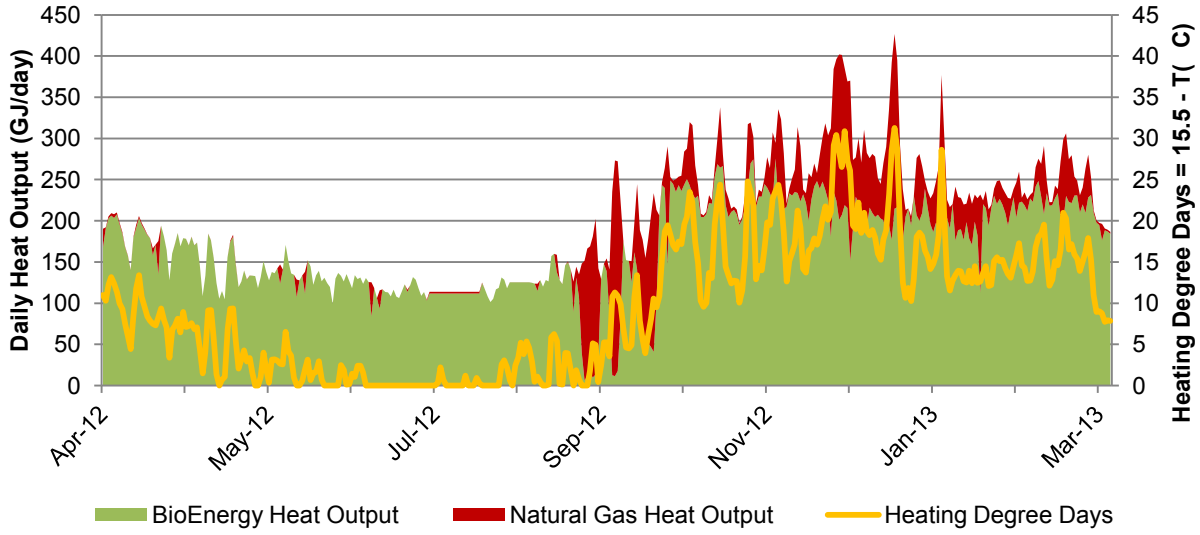


Figure 3 ***Bioenergy and Power Plant Heat Output***

Gas consumption in the Power Plant was 10,026 GJ over the past year. Natural gas was used in the back-up boilers to meet the peak heat demand over the winter from November to March, and to provide heat during Bioenergy downtime in September. With natural gas boiler efficiencies of approximately 85% the total energy output from the Bioenergy plant and Power Plant to the district heating system was approximately 69,500 GJ. Approximately 88% of the district heating energy was provided by biomass, and 12% was provided by natural gas. Figure 4 shows a simplified diagram of the energy inputs and outputs of the Bioenergy and Power Plant.

The operating budget for the Bioenergy system is drawn from natural gas savings. Costs that must be covered include hog fuel, operator salaries, building utilities and maintenance.

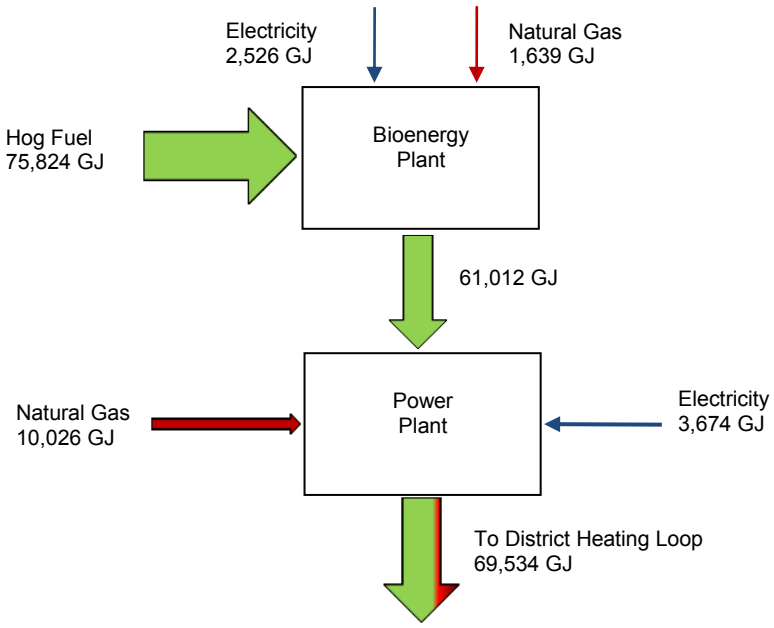


Figure 4 ***District Heating Flow Diagram***

4.4 Energy & Cost Intensity

The energy intensity of each building is reported in Figure 5, and broken down into electricity, gas, and bioenergy intensity. Over the past year, sub-meters were installed at the Prince George Campus to measure electricity, gas, district heating, and district cooling loads at the building level.

The district heating demand for the 8 core buildings and the Power Plant was estimated to be 57,820 GJ using sub-metered data. The heat demands for the Power Plant, Administration, Conference Centre, and Teaching and Learning Building were estimated for up to 6 months due to the sub-metering data being unavailable until September 2012. The heating intensities were adjusted to reflect the Bioenergy offset of natural gas and the Power Plant input of natural gas (81,805 GJ), where Bioenergy accounted for 88% and natural gas accounted for 12% of the district heating energy.

Similarly, the district cooling was calculated for each building and the electricity used to operate the Power Plant chiller was added to the individual building electrical consumptions.

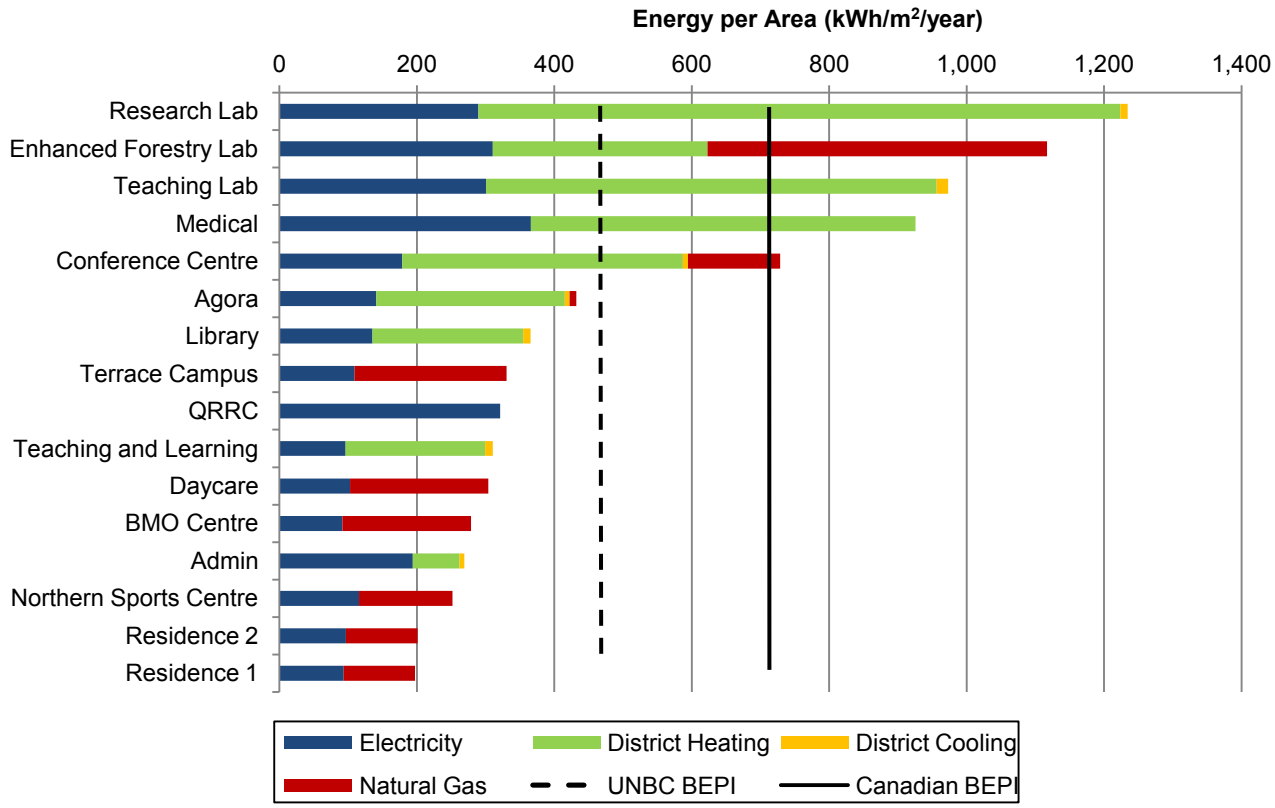


Figure 5 Energy Intensity by Building (Apr 2012 - Mar 2013)

The vertical solid line in Figure 5 is the 2003 Natural Resources Canada average intensity value for universities and colleges in Canada. The dashed line shows the UNBC average intensity is well below the Canadian average at 476 kWh/m^2. It is important to note that each building has a different use, and should be compared similar buildings (i.e. apartments, offices, recreational complex). Such baseline data is not always readily available, though it is anticipated that an updated Statistics Canada survey conducted in 2010 may make more current and specific baseline information available.

Figure 5 shows the four lab buildings as being the most energy intensive per square meter. This result is not surprising since lab buildings are not permitted to recirculate air flow resulting in a loss of heat as all of the heated air is exhausted. Night-time setbacks on the air-handlers and fine-tuning the operating schedules and ventilation rates are being examined for the Research Lab, Teaching Lab and Medical Building as part of the Phase 1 Continuous Optimization Program through BC Hydro. A 2nd year Environmental Engineering student studied the heat recovery systems in the lab buildings in Spring 2013, and concluded that a significant amount of heat is being recovered. A deeper analysis will have to be performed in order to optimize the heat recovery efficiency of these systems.

In terms of electricity intensity the Power Plant and Bioenergy Facility are using the most electricity per square meter (these are not shown in Figure 5, but are included in Table 3). This is because electrical equipment such as pumps, conveyors, and augers are required to produce heat from wood waste, and to distribute the heat in the form of hot water to the Prince George core campus. The Power Plant also pumps chilled water and domestic water to the campus. The electricity required for chilling was added to the buildings that require cooling during the summer months factoring in the coefficient of performance of the chiller. The district heating distribution loop was studied by a pair of students in 2011, but opportunities to optimize the pumping systems will require further research and analysis.

Excluding the two industrial plants, the four laboratories and QRRC used the most electricity per square meter. QRRC is a former fish hatchery, and still operates much of the pumping equipment that the fish rearing process required. In addition, QRRC uses electrical heating and does not use any natural gas or bioenergy.

Similar to the electricity consumption, per square meter, the four lab buildings are the largest consumers of heat, followed by the Conference Centre. It is clear that a better understanding of the current operating schedules and night time set-backs on the air handling units should be reviewed.

The Conference Centre used a surprisingly high amount of heating. The Conference Centre operates 18 hours per day, longer than most buildings on campus, since it includes a pub. Four air handlers totalling 30,000 cfm operate off the district heating loop on average 18 hours per day (including weekends). One additional natural gas air handler is located on the roof and supplies 4,000 cfm with a maximum heat input of 550,000 Btu/h. The Conference Centre is also located next to the Administration Building which is seen to use the lowest amount of heat per square meter. It is possible that the heat from the Conference Centre is passing through the hallways into the Administration Building. This anomaly will be investigated further once more data becomes available.

Table 3 summarizes the annual energy consumption, energy intensity and cost intensity for each building under the Energy Management program.

Table 3 Building Energy and Cost Intensity

	Building Area	Annual Consumption	Annual Cost	Energy Intensity	Cost Intensity
	m^2	kWh/year	$/year	kWh/m^2/year	$/$m^2$/year
Research Lab	7,581	9,026,667	290,905	1191	38
Enhanced Forestry Lab	931	1,039,953	34,152	1117	37
BioEnergy Plant	1,046	1,156,746	72,793	1106	70
Teaching Lab	7,921	7,467,168	270,624	943	34
Medical	4,468	4,018,433	158,585	899	35
Power Plant	1,253	1,104,101	69,587	881	56
Conference Centre	3,253	2,301,122	82,426	707	25
Agora	8,556	3,586,055	134,210	419	16
Library	11,754	4,174,401	165,999	355	14
Terrace Campus	1,314	433,003	33,539	330	26
QRRC	812	260,697	24,405	321	30
Daycare	639	194,191	9,290	304	15
Teaching and Learning	10,130	3,048,271	114,097	301	11
BMO Centre	1,320	367,816	22,216	279	17
Admin	9,162	2,435,913	137,524	266	15
Northern Sports Centre	13,485	3,394,802	180,508	252	13
Residence 2	7,425	1,492,336	75,187	201	10
Residence 1	7,425	1,465,292	73,566	197	10
Maintenance Building	352	29,905	3,417	85	10
Total	**98,827**	**46,996,872**	**1,880,237**	**476**	**19**

5. ENERGY INITIATIVES

UNBC has a history of responsible energy use. Facilities staff involved in plant operations and renovation projects are well versed in efficient operating practices and in the evolving energy efficient equipment landscape. The Energy Manager position was filled in June 2010; this has resulted in a renewed focus on tracking of energy use, developing an energy policy and conservation procedures, and planning efficiency upgrade projects.

5.1 FY2013 Energy Projects

Energy reduction targets are outlined both in the UNBC Energy Policy and the BC Hydro Power Smart Energy Manager contract deliverables. The Energy Policy aims for a reduction of energy consumption by 10% over a 5-year period from 2010 to 2015. In order to meet the Energy Policy goals, energy efficiency projects must be implemented each year, with annual electricity savings of approximately 400,000 kWh. The Energy Manager contract with BC Hydro Power Smart requires project implementations totalling 400,000 kWh of annual electricity savings for standard funding, and 500,000 kWh for bonus funding.

In order to achieve both of the UNBC and BC Hydro targets, a total of 10 projects were implemented in FY2013 and are summarized in Table 4. The completed projects consisted of lighting upgrades totalling 411,597 kWh of annual savings, and coil cleaning of 26 air handling units at the Prince George campus totalling 224,610 kWh of annual savings. Lighting was upgraded in 13 of the 22 buildings covered by the Energy Management scope, including QRRC and the Terrace Campus. In total, the ten projects are expected to save 636,207 kWh annually in electricity.

The overall cost of the projects was $277,808. All projects were partially funded under BC Hydro Power Smart programs, with $95,290 of incentives being received. At the marginal cost of electricity the annual savings will be approximately $59,859 leading to an overall payback of 3.0 years.

Table 4 FY2013 Energy Projects Summary

Completed Projects (FY2012/13)	Annual Energy Savings (kWh)	Capital Cost ($)	Incentive ($)	Annual Savings ($)	Date Completed	Payback (years)
QRRC Lighting	7,752	$4,960	$1,429	$730	Mar-13	4.8
EFL Cold Storage Lighting	1,181	$578	$139	$111	Jan-13	3.9
Canfor Theatre Lighting	55,239	$45,845	$18,339	$5,204	Dec-12	5.3
Warehouse Lighting	43,511	$7,201	$2,875	$4,099	Dec-12	1.1
NSC Lighting	181,898	$135,188	$41,160	$17,135	Sep-12	5.5
Coil Cleaning	224,610	$23,523	$9,684	$21,158	Sep-12	0.7
NUSC Event Space Lighting	12,304	$6,090	$2,474	$1,159	Jul-12	3.1
Common Area Residence Lighting	14,414	$17,216	$3,208	$1,358	Jul-12	10.3
Terrace Lighting	16,593	$14,396	$3,994	$1,488	Jun-12	7.0
Lecture Theatre Lighting	78,705	$22,811	$11,988	$7,414	Jun-12	1.5
TOTAL	**636,207**	**$277,808**	**$95,290**	**$59,859**		**3.0**

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

5.2 Planned Energy Projects and Initiatives

UNBC has a number of planned projects for the next fiscal year (FY2014) that are in progress, or have already been completed as summarized in Table 5.

Three projects have already been completed since the end of FY2013, including low-flow showerheads in both Residences, exterior bollard lighting, and daylight harvesting in the Agora.

The low-flow showerheads were installed in all 144 Residence suites, and are expected to save 1,400 GJ worth of natural gas over the course of the 8 month school year, equivalent to a 4.7% reduction in current natural gas consumption. Additional savings will be seen from reducing carbon offsets, and reducing water consumption. Total savings are expected to be $22,000 per year, for a project payback of a couple of weeks.

UNBC is in the process of replacing the exterior pathway lighting with LED retrofits. The first part of this project has been completed with the replacements of 39 bollards around the perimeter of the Agora, Teaching Lab, and Medical Building. The second part of this project will retrofit 90 exterior globe pathway lighting with LED lighting. The exterior lighting was in need of replacement due to safety and maintenance concerns. The new lighting will be more robust, and will provide safe lighting levels, while saving approximately $7,000 per year in electricity.

The Agora daylight harvesting project involved connecting much of the existing Agora lighting to the already installed daylight sensor located on the Research Lab to turn off all non-essential lighting when there is adequate natural light. The Agora has many windows and skylights, and does not require artificial lighting during daylight hours. This project is anticipated to save $1,700 in electricity per year.

Table 5 Planned Energy Projects for FY2014

Projects in Progress	Annual Energy Savings (kWh)	Capital Cost ($)	Incentive ($)	Annual Savings ($)	Completion Date	Simple Payback (years)
Residence Low-flow Showerheads	400,000	$975	0	$22,000	May-13	0.0
Exterior Lighting - Bollards	7,000	$44,000	$1,930	$669	May-13	62.9
Daylight Harvesting - Agora	17,000	0	0	$1,700	Jun-13	0.0
Botanical Garden Pump	8,000	$500	0	$800	Aug-13	0.6
Admin Atrium Lighting	4,000	0	0	$400	Aug-13	0.0
Exterior Lighting - Globes	59,000	$60,000	$16,270	$6,000	Aug-13	7.3
Medical Building Humidifier	500,000	$100,000	?	$50,000	Mar-14	2.0
Continuous Optimization - Phase 1	450,000	$90,000	0	$43,000	Sep-13 to Mar-15	2.1
TOTAL	**1,445,000**	**$295,475**	**$18,200**	**$124,569**		**2.2**

A couple of smaller projects are planned for FY2014, including installing a timer on the botanical garden pump to turn it off at night time, and installing extra LED lighting from a previous project in the Administration Atrium. Other projects that may be considered depending on FY2014 reduction targets are lighting controls and magnetic ballast replacements throughout campus.

A large project that is in the planning phase is the Medical Humidifier upgrade, based on preliminary work completed by a third-year Physics student for an Independent Study project. The current humidifier uses electricity to generate steam and humidify the air for the animal holding facility in the Medical Building. The cost of electricity exceeds the cost of bioenergy by approximately 350%, therefore cost savings can be achieved by switching from electricity to bioenergy. To switch fuels, the new system would require mechanically spraying water into the air and heating the air with bioenergy in order to reach the required temperature and humidity levels.

This project is expected to save 500,000 kWh per year in electricity, however, will increase the district heating load by a similar amount.

A full list of potential projects is included in the Appendix.

5.2.1 Continuous Optimization Program

UNBC is enrolled in BC Hydro's Continuous Optimization (C.Op) program for energy monitoring and retro-commissioning of existing buildings. The program at UNBC includes nine buildings over a period of six years. It provides a reference against which to measure energy savings, and focuses primarily on low cost operational improvements to a building's HVAC and lighting control systems. A program of re-commissioning represents a major opportunity for UNBC to reduce its energy consumption. The main campus infrastructure is reasonably efficient, and not yet nearing the end of its life, so a tune up is warranted, rather than wholesale replacement of equipment

UNBC is currently in its first Phase of C.Op which is focusing on the Agora, Teaching Lab, Research Lab, and Medical Building. Prism Engineering has been contracted to perform the Investigation, Hand-off, and Coaching phases of Phase 1 C.Op. Baseline data is currently being collected to develop baseline models for each building. In addition to data collection and analysis, a site inspection was performed in order to understand the energy consumption for these buildings. The Investigation Phase will be completed in September 2013, where low-to-no-cost energy initiatives will be recommended. UNBC will be required to complete the identified upgrade projects up to a maximum of $90,000 as long as the overall project payback is less than two years. The Implementation Phase will last until March 2015.

The Investigation phase of Phase 2 C.Op is expected to commence in August 2013, and will examine the Administration Building and Charles Jago Northern Sport Centre. Phase 3 C.Op will focus on the Conference Centre, Teaching & Learning Building, and Library, and will begin in 2014.

5.3 Energy Conservation Revolving Loan

In 2012 UNBC created an Energy Conservation Revolving Loan Fund (Loan Fund) to provide the capital required for energy efficiency upgrade projects. A portion of the energy 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 balancing the Energy Manager budget.

UNBC has made $250,000 available for funding energy efficiency projects through the Loan Fund. The Energy Management team is responsible for identifying or assessing energy savings projects to be funded by the Loan Fund. Projects should have a simple payback of 5 years or less, however, projects with paybacks greater than 5 years are considered on a case-to-case basis. Once projects are identified, the Energy Management team prepares business cases to be approved by the Director of Facilities Management, and the Vice President of Administration and Finance. Following project approval, the Energy Management team is responsible for managing project implementation, reporting on project completion, tracking savings, and coordinating repayments.

After a project is implemented, the energy savings are verified by the Energy Management Team. A Measurement and Verification (M&V) strategy is developed prior to project implementation in order to capture the energy consumption prior to and after the energy saving upgrade. The verified energy savings are used to calculate the repayment amount.

For each energy efficiency project funded by the Loan Fund, the loan amount depends on the capital costs, indirect costs (set at 40% of the capital cost), and any incentives received. If an energy project is managed by the Energy Management Team, but funded by a different UNBC utility account, the UNBC account holder is subject to pay the 40% indirect costs.

The loan is paid back through energy savings, and assessed an interest rate of 0.5% until payback is complete. This interest rate is to be adjusted in line with changes to the UNBC cost of borrowing. Energy savings are calculated using the marginal cost of energy at the time of project

implementation. Until the loan amount is paid back in full, payments are made quarterly and are set at 80% of the energy savings. After the loan is paid back, additional payments at 50% of the energy savings are paid for the persistence of the retrofit. With this repayment structure, the account holder benefits from an immediate 20% of the energy savings, increasing to 50% after the loan is repaid. Payments cease at the end of the project lifespan (typically 10 years).

To date, nine (9) energy savings projects costing a total of $157,400 have been funded by the Loan Fund. In addition to the capital cost, indirect costs of $86,900 were added to the loan costs to cover project management. The indirect costs were not withdrawn from the Loan Fund, but were added onto the loan amounts requiring repayment. Two (2) of the nine projects were funded by the Routine Capital Fund, and only required the repayment of the indirect costs for project management. All nine projects were partially funded by BC Hydro, with $81,800 of incentives being received. The 9 projects are projected to save just under 700,000 kWh, and approximately $65,400 per year in electricity.

5.3.1 Loan Projection

In order to help plan future energy conservation projects, project spending and savings were estimated for the next 5 years with the goal to spend as much as possible on energy conservation projects while maintaining a Loan Fund balance above -$250,000.

Figure 6 shows the balance of the Loan Fund over the next 5 years, as well as the capital funding, loan repayments, incentives, and savings (overall and net). The loan balance is expected to hover just above the $-250,000 mark to maximize additional project funding. By 2018 the Loan Fund is expected to add $1,400,000 into the energy management program resulting in electricity cost savings of $1,200,000, and incentive revenues of $440,000.

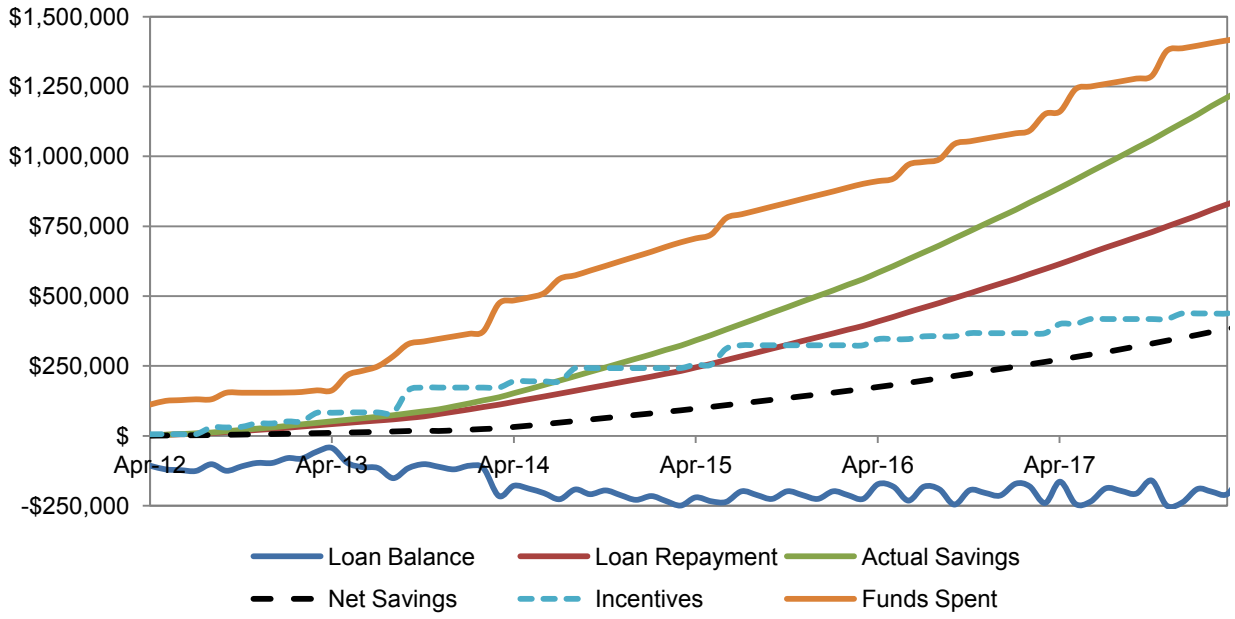


Figure 6 Energy Conservation Revolving Loan Fund Balance

A detailed breakdown of fund spending is summarized in Table 6. Total spending each year will be above $200,000 and up to $312,000. Planned projects for 2013/14 include the exterior lighting upgrade and the medical humidifier upgrade, with an extra $40,000 available for smaller projects such as magnetic ballast replacements and motion sensors. Starting in 2014/15, funds will be used to balance out the Energy Manager budget.

Based on the project funding summarized in Table 6 the projected energy savings were calculated with a 2 year payback for C.Op projects, and a 3.5 year payback for additional funded projects. With 3,000,000 kWh worth of projects being implemented over 5 years, UNBC will be capable of meeting and exceeding the current electricity consumption reduction targets as outlined in the 2011 Energy Policy as seen in Figure 7.

Table 6 Projected Loan Funding

Fiscal Year	C.Op Funding	Additional Project Funding	Energy Management Funding	Total Funds Spent
FY2013/2014	$122,000	$190,000	0	$312,000
FY2014/2015	$164,000	$35,000	$20,000	$219,000
FY2015/2016	$119,000	$50,000	$40,000	$209,000
FY2016/2017	$65,000	$135,000	$50,000	$250,000
FY2017/2018	$13,000	$150,000	$100,000	$263,000

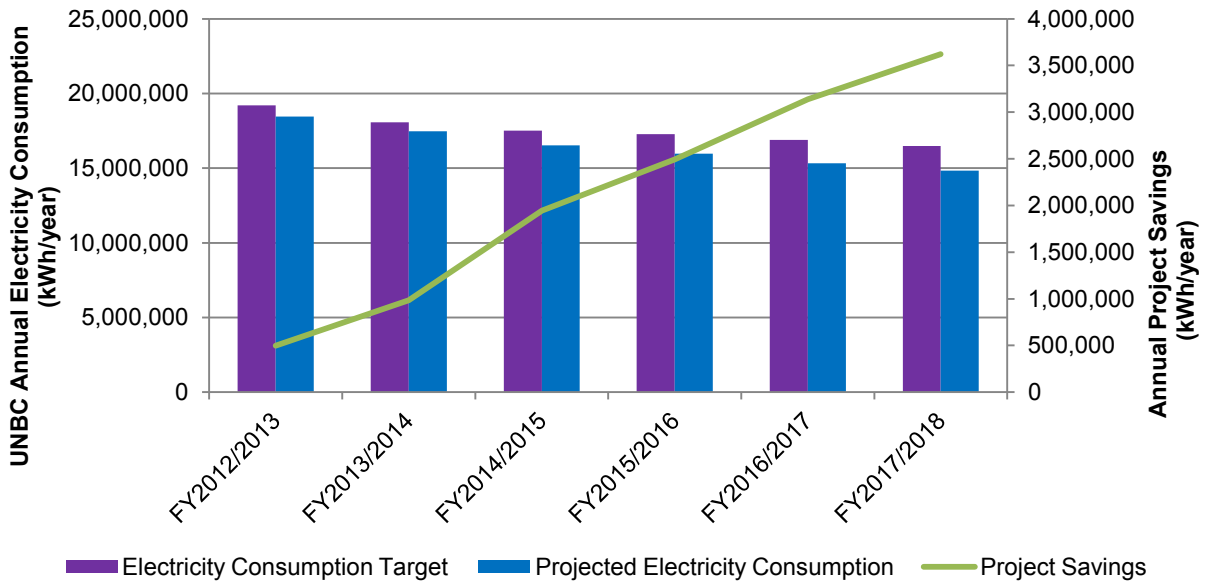


Figure 7 Loan Project Electricity Savings Projection

5.4 Sub-metering

UNBC has installed sub-meters in buildings throughout the Prince George campus to gain a better understanding of energy consumption at an individual building level. Electricity, hot water, cooling water, natural gas, and domestic water are being metered for most buildings on the Prince George Campus. Data from the sub-meters is logged every 15 minutes.

Sub-metering data is being used to develop energy baselines for each individual building in order to track energy performance, and help measure and verify energy savings from implemented energy savings projects. In addition, the sub-metering is being used for the billing of gas and water usage for ancillary buildings that are covered by the Main Campus accounts.

Pulse Energy has been contracted by UNBC to create a dashboard to display current and historical energy trends from the logged data. The dashboard can be viewed online via the following link. Pulse Energy will also be developing baseline models using the metered data.

https://my.pulseenergy.com/UniversityofNorthernBC/dashboard#/overview

5.5 Energy Management Assessment

As part of the Energy Manager requirements, UNBC participated in an Energy Management Assessment on March 20, 2013. The EMA identified areas where UNBC should focus for a balanced Energy Management program. The areas and actions identified in the EMA are summarized below:

1. Policy

   Regular reporting to senior management on progress towards energy efficiency objectives and expectations

2. Targets/Reporting

   Establish protocols that require operations personnel to troubleshoot energy variations.

3. Plans/Actions

   Establish energy efficient guidelines to be used in the selection and procurement of equipment

4. Teams/Committees

   Improve baseline understanding of energy consumption and opportunities for each major utility with operations, maintenance, and behavioural issues. Instruct personnel to make appropriate adjustments in energy-using equipment to maintain proper conditioned space.

5. Employee Awareness/Training

   Improve communication of energy conservation initiative to the broader organization and use available energy usage data in a meaningful format to raise energy awareness. Incent participation in the energy conservation initiative by providing recognition to contributions.

UNBC is committed to continually improving the Energy Management program, and will address the recommended action items from the EMA session. Particular focus will be placed on employee awareness and student engagement, through improved communication and reporting.

5.6 Student and Employee Engagement

At UNBC we recognize that achieving our energy goals requires the participation and engagement of students, faculty, staff, and senior administration. During FY2013, we aimed to improve employee and student engagement through a variety of different avenues including: participation in the Green Coffee Hour with the President, leading Bioenergy tours, encouraging conservation over the winter break, participation in the Residence Energy Challenge, surveying Residence occupants on energy consumption habits, displaying energy information outside the Green Centre, and employee emails providing updates on energy initiatives and savings.

Over the winter break, approximately 79,000 kWh of electricity and 370 GJ of heat were saved from turning off office equipment and air-handlers. The Residence Energy Challenge in March 2013 had a 25% participation rate, and resulted in 4,300 kWh of electricity savings. These two initiatives saved twice as much energy as last year.

A major focus will be placed on student and employee engagement during FY2014, to highlight the successes of the Energy Management program, and to encourage the formation of healthy and sustainable habits with regards to energy consumption.

6. ENERGY SAVINGS

The energy management goals are two-fold: to reduce energy consumption, and to save money on utilities. The two are linked, but the amount spent on utilities is dependent on both consumption and utility rates.

6.1 Electricity Savings

Compared to last year, UNBC decreased electricity consumption by 429,000 kWh or 2.3%. However, due to rate changes UNBC has spent almost $25,000 more on electricity than last year. A better estimation of savings considers both variations in rates and weather, and compares to historical baselines. The UNBC Energy Policy references the baseline year as 2009/2010 (prior to the Bioenergy Plant being built). Baselines were developed using historical data from 2009/2010 to predict electrical consumption based on HDD and CDD. Comparing the electricity consumption to the historical baseline consumption, approximately 1,557,000 kWh was saved in FY2013, for avoided cost savings of $159,000. The actual and avoided costs for each electricity account are summarized in Table 7.

Table 7 Actual and Avoided Electricity Savings

	2012/13		2011/12	2009/10	Compared to Baseline (Avoided)		Compared to Last Year (Actual)	
Account	Electricity Use	Electricity Cost	Electricity Use	Baseline Use	Electricity Savings	Cost Savings	Electricity Savings	Cost Savings
	kWh/year	$/year	kWh/year	kWh/year	kWh	$/year	kWh/year	$/year
Main Campus	15,693,186	$1,067,833	16,162,806	17,234,104	1,540,918	$155,230	469,620	-$17,009
Terrace	142,266	$15,417	145,350	163,350	21,084	$2,053	3,083	-$507
QRRC	260,697	$24,405	247,649	207,968	-52,728	-$2,763	-13,047	-$2,129
NSC	1,562,251	$119,201	1,628,887	1,598,463	36,212	$3,704	66,635	-$2,117
BMO	120,944	$13,100	103,200	132,267	11,323	$1,125	-17,745	-$2,677
Bioenergy	701,566	$56,844	622,042	701,566*	0	$0	-79,524	$0*
TOTAL	**18,480,910**	**$1,296,800**	**18,909,933**	**20,037,719**	**1,556,809**	**$159,349**	**429,023**	**-$24,439**

*The Bioenergy Plant electricity consumption depends on the Bioenergy heat production rate, therefore the cost of electricity and any savings associated with the Bioenergy Plant are included in the total cost of the district heating. There currently is no baseline for the Bioenergy Plant since it was built after the baseline period. Baseline consumption is assumed to be equal to the current electricity consumption, with zero savings compared to the baseline.

Figure 8 shows the monthly electricity consumption compared to the 2009/2010 baseline. Cumulative electricity savings were equivalent to 1 month worth of electricity, however due to the rate structure, the avoided cost savings were approximately 1.5 months worth of electricity cost.

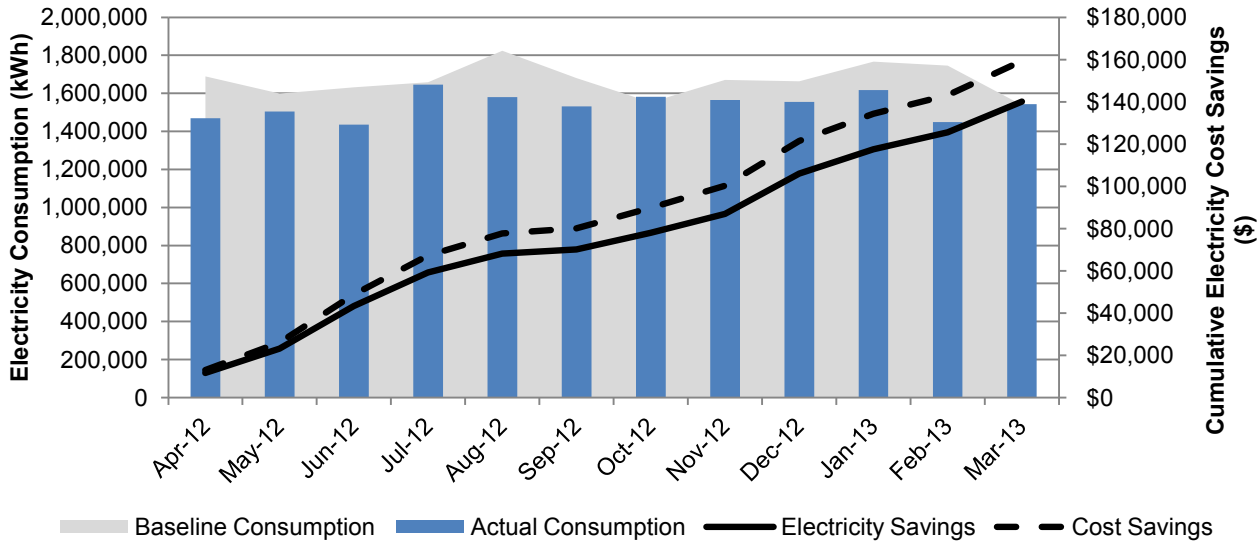


Figure 8 ***Annual Electrical Usage compared to Baseline***

The UNBC Energy Policy outlines a 2% electricity consumption reduction per year corrected for variations in weather. Figure 9 demonstrates how UNBC has exceeded the electricity reduction targets each year. In FY2013, the Policy target was exceeded by 3.1%.

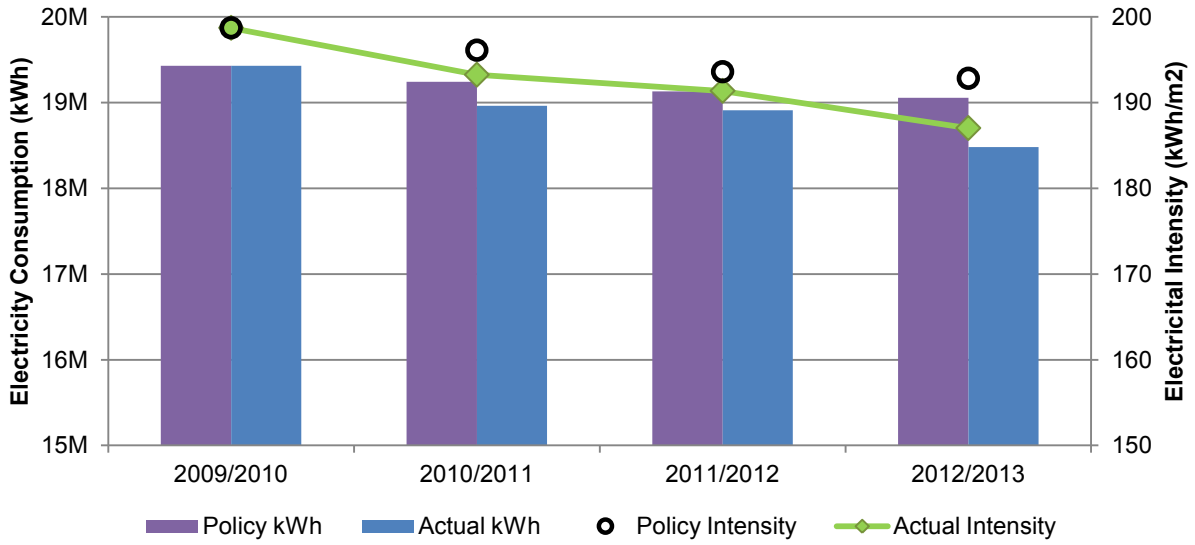


Figure 9 ***Electricity Intensity Compared to Target***

6.2 Bioenergy and Natural Gas Savings

UNBC has undertaken two biomass heating projects in recent years. The first is a wood pellet boiler to heat the Enhanced Forestry Laboratory, and the second is a Bioenergy facility to offset the campus natural gas consumption for heating. The Bioenergy system gasifies hog fuel and uses a flue gas boiler to transfer heat to hot water. The hot water from Bioenergy is pumped to the existing Power Plant where the heat is transferred to the campus district energy loop which distributes hot water to the core campus buildings.

The baseline for heating was developed before the Bioenergy facilities came online in 2009/10

and take into account the natural gas consumption as is relates to HDDs. Table 8 summarizes the heat consumption, and savings for FY2013. Approximately 28,486,000 kWh of heat was consumed over the past year costing a total of $580,021. Hog fuel provided 70% of the total heating, however, only represented 50% of the total cost of heating. Compared to last year, significant savings were seen for a number of accounts. Major savings were seen for the district heating system as more heat was being produced by the Bioenergy Plant, and half as much natural gas was consumed. In total the actual savings compared to last year was $362,000.

Table 8 Actual and Avoided Heat Savings

	2012/13		2011/12	2009/10	Compared to Baseline		Compared to Last Year	
Account	Heat Use	Heat Cost	Heat Use	Baseline Use	Heat Savings	Cost Savings	Heat Savings	Cost Savings
	kWh/year	$/year	kWh/year	kWh/year	kWh	$/year	kWh/year	$/year
Main District Heat	22,723,518	$456,122*	26,953,007	23,067,023	343,505	$6,049	4,229,489	$257,516*
NSC Natural NG	1,832,551	$61,307	2,330,473	1,875,569	43,018	$1,421	497,922	$24,933
Residence 2 NG	775,447	$27,033	902,170	923,589	148,142	$5,793	126,723	$6,633
Residence 1 NG	770,101	$26,845	1,351,812	880,410	110,309	$3,834	581,711	$24,066
Agora NG	512,387	$18,856	1,409,061	738,799	226,412	$8,171	896,674	$36,258
EFL NG	460,084	$14,565	494,274	460,084	0	$0	34,190	$5,057
Bio NG*	455,181	$15,949*	208,016	455,181	0	$0	-247,165	-$7,479*
EFL Bioenergy	290,803	$0	242,283	290,803	0	$0	-48,520	$0
Terrace NG	290,737	$18,122	365,903	388,754	98,017	$6,099	75,167	$5,379
BMO NG	246,872	$9,116	240,689	206,913	-39,959	-$969	-6,183	$610
Daycare NG	128,375	$4,896	148,854	124,168	-4,208	-$177	20,478	$1,280
TOTAL	**28,486,057**	**$580,021**	**34,646,543**	**29,411,293**	**925,236**	**$30,221**	**6,160,486**	**$361,732**

*The cost and savings for the Main District Heating include the Bioenergy Plant electricity and natural gas cost and savings.

Compared to the 2009/2010 baseline which takes into account weather variations, approximately 925,000 kWh of heat was saved, for cost savings of $30,000. A monthly breakdown of heat consumption compared to the 2009/2010 baseline, and cumulative savings can be seen in Figure 10.

In FY2013, UNBC used 325,000 kWh (1.2%) more heat than the Policy target. However, as seen in Figure 11, a significant reduction in heating consumption and intensity was seen compared to last year. An initial jump in intensity was observed in 2011/2012 due to the commissioning of the Bioenergy Plant. The district heating system operation is continually being optimized to avoid the waste of heating energy. With the implementation of low-flow showerheads in the Residence, along with savings from C.Op, the heating intensity will be closer to meeting the heating reduction Policy Target.

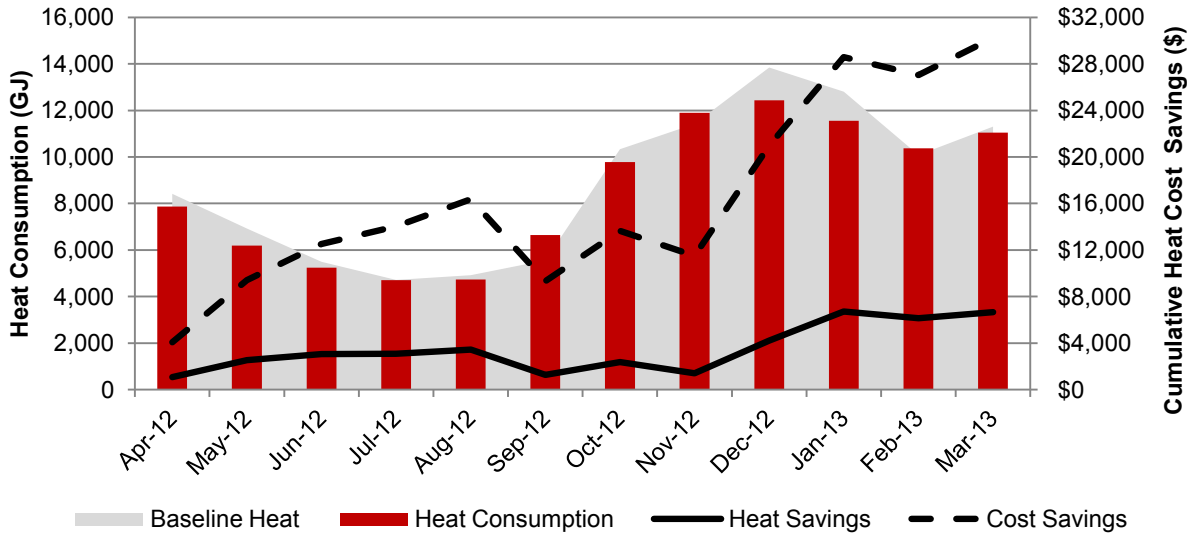


Figure 10 Annual Heating Demand Compared to Baseline

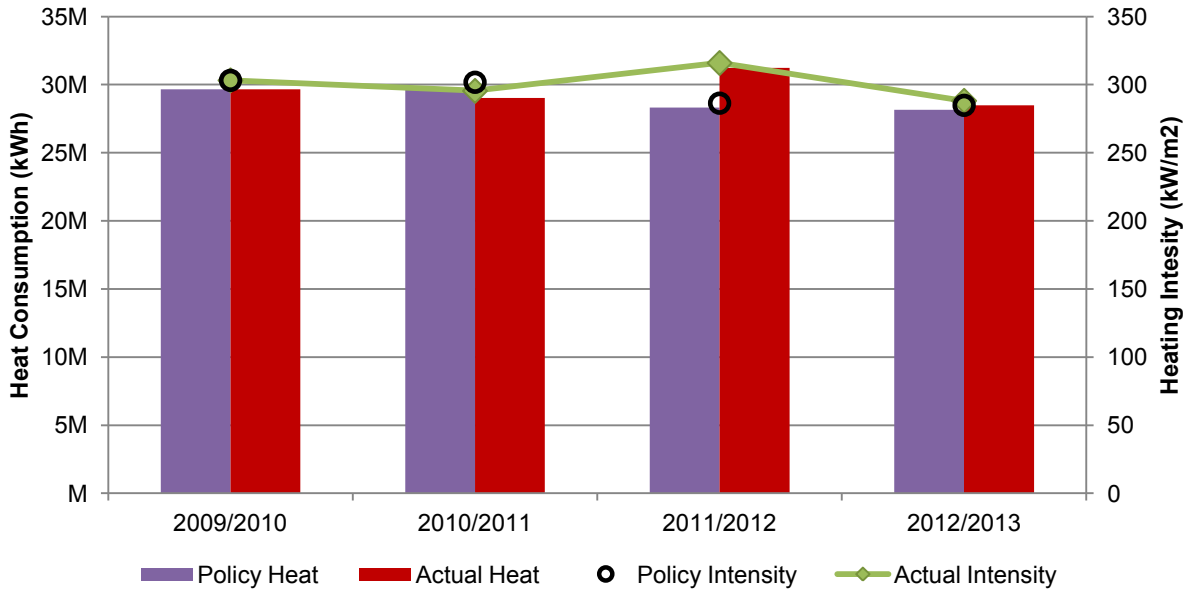


Figure 11 Heating Intensity Compared to Target

6.3 Greenhouse Gas Reductions

As part of the public sector within the province of British Columbia, UNBC is required to be carbon neutral. The University measures and reports its greenhouse gas emissions using SmartTOOL, through an initiative of the provincial government. This captures direct emissions from fuel combustion, indirect emissions through purchased electricity, and office paper. The reporting period for SmartTOOL is per calendar year, so that is what will be listed within this report (note that all other figures in this report relate to the fiscal year starting April 1).

The University is required to purchase carbon offsets from the Pacific Carbon Trust to reduce the net greenhouse gas emissions of the University to zero. These offsets currently cost $30/tonne.

The reporting framework for provincial greenhouse gas emissions includes CO_2 emissions from

wood as carbon neutral. They are included in the overall emissions totals, but are not assessed as an offset requirement.

Table 9 Greenhouse Gas Emissions (t CO_2e)

	2012	2011	2010
Scope 1 (Direct) Emissions			
Mobile Combustion (Fleet)	25	19	17
Stationary Combustion	5,182	5,363	5,186
Scope 2 (Indirect) Emissions			
Purchased Energy	461	470	470
Scope 3 (Business Travel and Office Paper) Emissions			
Office Paper	5	5	15
Total Emissions, Calendar Year	**5,673**	**5,857**	**5,689**
Carbon Neutral or Offset Exempt	**3,506**	**2,349**	**1**
Total for Offsets	**2,167**	**3,508**	**5,688**

7. ENERGY MANAGER RESULTS

Since the beginning of the Energy Management Program at UNBC in 2010, 23 energy projects have been completed for annual electricity savings of 1,000,000 kWh and annual natural gas savings of 300 GJ. To-date the electricity projects have saved $71,000, and have received incentive funding from BC Hydro totalling $126,570. Additional electricity savings have been observed compared to the historical baseline, and can be attributed to building operation modifications and behavioural changes associated with having a visible Energy Manager in the UNBC community. Figure 12 shows that the Energy Management Program has brought in more than $350,000 over the past three years. In addition to the $350,000, UNBC has received partial funding from BC Hydro for the Energy Manager salary.

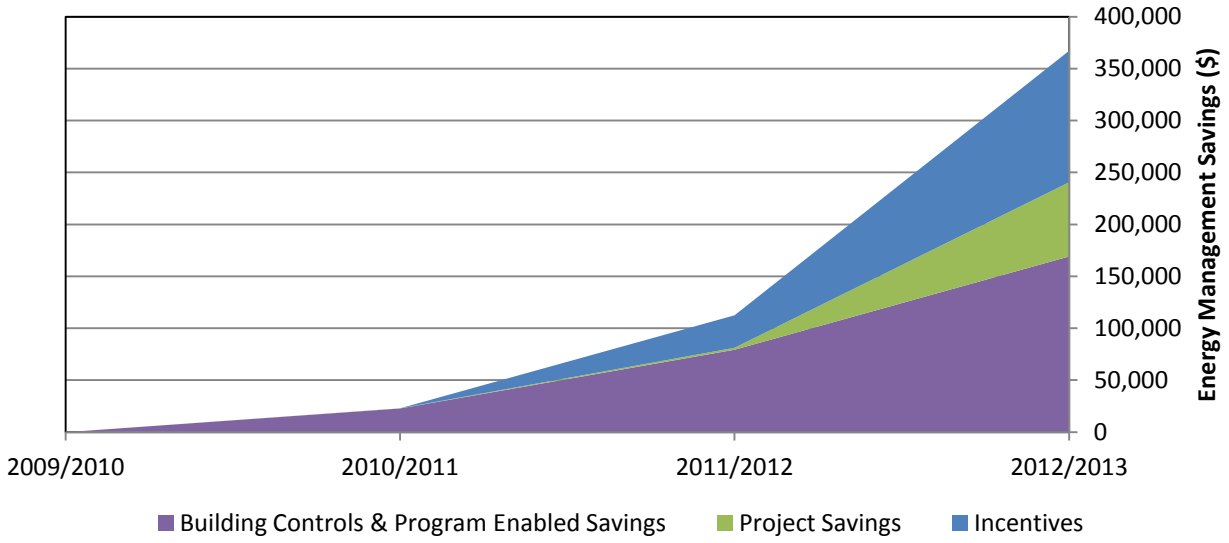


Figure 12 Energy Manager Results

With a major focus on electricity reduction projects, UNBC is exceeding both the targets outlined in the Energy Policy, and in the BC Hydro Power Smart Energy Manager contract. There will be a continued focus on electricity reduction projects to take advantage of BC Hydro program funding. While there is little to no outside funding available for projects that reduce natural gas consumption, UNBC is still committed to reducing its carbon footprint which will require a major focus to be placed on educating and engaging students and employees on ways to reduce energy consumption.

APPENDIX A – COMPLETED PROJECT LIST

Past/Completed Projects											
Project Name	**Description**	**Electrical Svgs (kWh)**	**Other Fuel Svgs**	**Total Svgs (Energy + Operational)**	**Total Cost**	**BC Hydro Incentive**	**Simple Pay Back**	**Status**	**Date Started**	**% Complete**	**Projected Completion Date**
Agora Daylight Harvesting	Connect non-essential Agora lighting to daylight sensor	17,000		1700		0	0.0	Complete - savings to be verified	Oct-11	95	Jun-13
Exterior Lighting (Bollards)	Replace exterior bollard lighting with LED/motion sensing models	7,000		669	43,615	1,930	62.3	Complete - incentive to be completed with globe lighting	Oct-12	90	May-13
Low-flow showerheads	Replace showerheads in Residence with low-flow models		1400 GJ	22,000	975	0	0.0	Complete - savings to be verified	Dec-12	95	May-13
QRRC lighting upgrade	Replace T12 fluorescent lighting with T8	7,752	0	730	4960	1429	4.8	Complete	Nov-12	100	Mar-13
EFL Lighting Retrofit	Replace T12 fluorescent lighting with T8	1,181		111	578	139	4.0	Complete	Jan-13	100	Jan-13
Canfor Theatre lighting - second round	Revisit the lighting provision for the lecture space	55,239	0	5,204	45,845	18,339	5.3	Complete	Aug-12	100	Dec-12
Warehouse lighting	Replace MH high bay fixtures in warehouse	43511		4099	7201	2875	1.1	Complete	Aug-12	100	Dec-12
NSC Soccer field	Replace MH fixtures with impact resistant LED	130,598		12,302	125,188	40,000	6.9	Complete	Jul-12	100	Sep-12
Building energy displays	Install monitors outside Green Centre to display energy related data							Complete	Aug-11	100	Sep-12
NSC Field house relamp	New lamps for T5HO over field house	51,300		4,832	10,000	1,160	1.8	Complete	Aug-12	100	Aug-12
Coil Cleaning	Nalco coil cleaning initiative	224,610		21,158	23,523	9,684	0.7	Complete	Aug-12	100	Aug-12
NUSC Event Space LED	Replace incandescent lighting with LED	12,304	0	1,159	6,090	2,474	3.1	Complete	Aug-11	100	Jul-12
Terrace lighting upgrade	Replace T12 fluorescent lighting with T8	16,593		1,488	14,396	3,994	7.0	Complete	Aug-11	100	Apr-12
Utility meter installation	Install sub-meters for gas, electric, heat, cooling, domestic water							Completing final meter programming	Jul-10	98	Jun-12
Utility Data Management	Prism Engineering to provide data analytics				9,000			Complete	Aug-11	100	May-12
Residence Lighting–Common	Replace T12 fluorescent lighting in residences with T8	14,414		1,358	17,216	3,208	10.3	Complete	Aug-11		Mar-12
Residence Lighting - Suites	T12 fluorescent to T8, Incandescents to CFLs	250,930	0	23,638	61,547	24,090	1.6	Complete	Aug-11	100	Mar-12
Theatre lighting	Replace incandescent lighting with LED	78,705		7,414	22,811	11,988		Complete	Dec-11	100	Apr-12
Medical AV Cooling	Install fans to take advantage of free cooling overnight	22,950		2,162	11,000	0	5.1	Complete	Nov-11	100	Apr-12
Admin Chiller	Replace water cooled centrifugal chiller with air cooled model	98,600	9600 Gal	13,400	70,000	0	5	Complete	Sep-11	100	Mar-12
Ice Mountain	Store ice/snow for summer cooling							Students complete feasibility study	Sep-11	100	Nov-11
Canfor Theatre Lighting	Replace incandescent lighting in Canfor Theatre with LED	3,700	0	349	6,000	0	2	Complete	Aug-10	100	Aug-10
Terrace Boiler	Replace aging natural gas boiler for Terrace campus	0	300	300	45,000	0	150	Complete	Aug-10	100	Oct-10
Green Centre Lights	New Green University Center offices - LED lighting	1,240		117	640	0	5.5	Complete	Nov-10	100	Jan-11
Winter Garden Lights	Convert to Hi-Bay LED	2,630		248	640	0	2.6	Complete	Dec-10	100	Jan-11
District Energy Pump Study	Review system flow dynamics and pumping requirements							Complete - requires further attention	Jan-10	100	May-11
NUSC Event Space- Round 1	Halogen to LED - testing 1 fixture	960		90	402	160	4.4	Complete			Mar-12
Rotunda Ramp	Halogen to LED	2,475		233	774	390	3.3	Complete			Aug-12
Rotunda Gallery	Halogen to LED	5,931		559	1,987	1,165	3.6	Complete			Aug-11
Agora North Entrance	Metal Halide to LED	999		94	476	244	5.1	Complete			Aug-11
Bookstore/Cafeteria Lighting	Replace halogen and incandescent lighting with LED	20,796		1,959	6,684	3,649		Complete		100	Aug-11
Thirsty Moose Lighting	Replace halogen and incandescent lighting with LED	6,034		568	2235	1582	1.1	Complete		100	Dec-10
Wind turbine	Preliminary investigation into installing wind generation on campus							Thorough report on renewable energy options			Sep-11
Totals		**1,077,452**	**1,700 GJ**	**127,942**	**494,193**	**126,570**	**2.9**				

Behavioural/ Education Programs									
Project Name	**Description**	**Electrical Svgs (kWh)**		**Total Svgs (Energy + Operational)**	**BC Hydro Incentive**	**Objectives**	**Date Started**	**% Complete**	**Projected Completion Date**
Residence competition	Two residence buildings compete to lower electrical consumption	2400		150	0	Raise conservation awareness in residences; reduce consumption	Oct-10	100	Apr-11
Residence competition	Two residence buildings compete to lower electrical consumption	4300		405	0	Raise conservation awareness in residences; reduce consumption	Oct-11	100	Nov-11
Wintergreen 2011	Promote turning off computer and HVAC during winter holidays	41200		3100	0	Save energy and raise awareness	Dec-11	100	Jan-12
Wintergreen 2012	Promote turning off computer and HVAC during winter holidays	79000	370 GJ	11000	0	Save energy and raise awareness	Dec-12	100	Jan-13
Totals		**47900**	**370 GJ**	**3655**					

APPENDIX B – POTENTIAL PROJECTS

Potential Projects											
Project Name	**Description**	**Potential Electrical Svgs (kWh)**	**Potential Other Fuel Svgs**	**Potential Total Svgs (Energy + Operational)**	**Projected Total Cost**	**Potential BC Hydro Incentive**	**Projected Simple Pay Back**	**Next Steps**	**Date Started**	**% Complete**	**Projected Completion Date**
Flue Gas Heat recovery	Recover latent heat from Bioenergy flue gases		8,000 GJ	80,000				Currently being studied by Environmental Engineering Master's student			
Power Plant Study	Determine efficiency of natural gas boilers, and opportunities to reduce improve efficiency (damper control, boiler sequencing)							Data and operations analysis			
District Heating Network Study	Study the district heating network to improve heating efficiency and reduce heat waste							Data and operations analysis			
Chiller optimization	Review setpoints for chillers and cooling tower	50,000		3,275	2,000		0.6	Preliminary system review and scope definition			
Heating and Cooling Policy	Implement heating and cooling policy and control strategy to maintain temperature band and minimize heating and cooling waste							Draft policy written, requires occupant consultaton and review			
Building Systems Scheduling	Optimize night setback hours for all buildings on campus	450,000	2,900 GJ	71,570	124,300		1.7	Review current building schedules			
Ventilation Review	Review ventilation standards, and modify ventilation rates as appropriate							Review standards and current ventilation rates			
Essential Lighting Review	Review current essential lighting and switch excess lighting to non-essential							Review lighting requirements for essential lighting			
Utilidor Lighting Controls	Switch portion of lighting to non-essential, and add occupancy sensors							Develop project design			
Restroom Lighting Controls	Motion sensors in restrooms							Find suitable locations, and estimate savings			
Stairway Lighting Controls	Motion sensors in stairwells							Estimate savings			
Residence Occupancy	Install occupancy sensors to reduce heating when unoccupied	430,000		25,800	200,000		7.8	Review with Residence Life personnel			
Residence Remodeling	Replace suite electric baseboard heaters with more efficient electric heating during remodeling							Keep updated with remodeling plans			
T8 Magnetic Ballasts	Convert campus T8 magnetic ballasts to electronic	138,600		15,000	100,000	33,000	4.5	Identify scope and costs			
Residence Behavior	Community-based social marketing aimed at forming positive behaviors relating to energy and water use							Determine best way to engage residence occupants			
Conference Centre Investigation	Investigate why the Conference Centre is using so much heat							Data and operation analysis			
Conference Centre Air Handler	Convert natural gas air handler to district heating system		1,600 GJ					Review feasibility			
Daycare Eco Audit	Eco Audit as part of Green Fund project							Audit being performed by summer student.			
Lab Heat recovery	Recover heat from Medical Building and Lab 8							Independent Study course starting Jan 2013			
Totals		**1,068,600**	**20,455 GJ**	**195,645**	**426,300**	**33,000**	**2.0**				
Approved Projects											
Continuous Optimization - Phase 2	Optimize building systems for NSC and Administration	370,000		37,000	129,150	55,150	2.0	Contracts signed	Aug-13		Mar-17
Continuous Optimization - Phase 3	Optimize building systems for Conference, Library, T&L	410,000		41,000	163,160	82,000	2.0	Prepare BC Hydro application in early 2014	Jul-14		Mar-18
Totals		**780,000**	**0**	**78,000**	**292,310**	**137,150**	**2.0**				
Projects In Progress											
Website Update	Update UNBC website to help communicate energy initiatives							Website editing training in process	Jun-13		On-going
Humidifier upgrade	Displace electric heating with hot water from Bioenergy	500,000		50,000	100,000	20,000	1.6	Student investigation complete	Sep-12	20	Mar-14
Botanical Gardens Pump Control	Add scheduler to pump, and tune VSD	8,000		800	500	0	0.6	Purchasing electrical equipment	Sep-12	40	Aug-13
Exterior Lighting (Globes)	Replace exterior globe lights with LED retrofit kits	59,000		6000	60000	16,270	7.3	Material purchased, labour RFP in process	Oct-12	10	Aug-13
Continuous Optimization - Phase 1	Optimize building systems for Agora, Teaching Lab, Research Lab, and Medical Building	470000		45000	178100	88100	2.0	Investigation Phase in process	Sep-12	10	Mar-16
Sustainable Communities Demonstration Project	Connect EFL, Residences and Daycare to Bioenergy plant, using either excess capacity from pellet boiler or flue gas heat recovery to provide hot water.		8,000 GJ	80,000	2,000,000		25.0	Initial design in progress. Next phases pending funding.	Oct-12		?
Totals		**567,000**	**8000 GJ**	**56,800**	**160,500**	**36,270**	**2.2**				

APPENDIX C – COMPLETED STUDIES BY BUILDING

Building	UNBC Energy Audit MCW Aug-09	Utility Data Management Prism Engineering May-12	Energy Management Information System Pulse Energy Jun-12	HVAC Coil Cleaning NALCO Aug-12	Continuous Optimization Phase 1 Prism Engineering Sep-12	Continuous Optimization Phase 2 Prism Engineering Aug-13	Continuous Optimization Phase 3 Jul-14	Student Studies/Projects
Administration	✓	✓	✓	✓		✓		
Agora	✓	✓	✓	✓	✓			
Bioenergy		✓	✓					Flue Gas Heat Recovery Study
Conference Centre	✓	✓	✓	✓			✓	
Daycare	✓	✓	✓					
EFL	✓	✓	✓					
Library	✓	✓	✓	✓			✓	
Maintenance	✓							
Medical	✓	✓	✓	✓	✓			Heat Recovery Study Humidifier Study
NSC		✓	✓			✓		
Power Plant	✓	✓	✓	✓				District Piping Network Study Renewable Energy Feasibility Study Ice Storage Study Thermal Storage Study
QRRC		✓						
Research Lab	✓	✓	✓	✓	✓			Heat Recovery Study
Residence	✓	✓	✓					Energy Use Survey
Teaching Lab	✓	✓	✓	✓	✓			Heat Recovery Study
Teaching & Learning	✓	✓	✓	✓			✓	
Terrace	✓	✓						

APPENDIX D – ENERGY TEAM AND STAKEHOLDERS

Name	Title	Email	Phone Number	Organization
David Claus	Assistant Director, Facilities Management, Energy Manager	david.claus@unbc.ca	250-960-5590	UNBC
Amanda Drew	Energy Technician	Amanda.drew@unbc.ca	250-960-5790	UNBC
Shelley Rennick	Director, Facilities Management	shelley.rennick@unbc.ca	250-960-6413	UNBC
Kevin Ericsson	Chief Engineer	kevin.ericsson@unbc.ca	250-960-7059	UNBC
Dale Martens	Assistant Chief Engineer	dale.martens@unbc.ca	250-960-6449	UNBC
Aaron Olsen	Maintenance and Project Supervisor	aaron.olsen@unbc.ca	250-960-6411	UNBC
Kyle Aben	UNBC Pacific Institute for Climate Solutions	kyle.aben@unbc.ca	250-960-6378	UNBC/PICS

Stakeholder Name	Title	Organization
George Iwama	President	UNBC
Blanca Schorcht	Dean of CASHS	UNBC
Daniel Ryan	Dean of CSAM	UNBC
Eileen Bray	Vice President Admin and Finance	UNBC
Rob van Adrichem	Vice President External Relations	UNBC
Shelley Rennick	Director, Facilities Management	UNBC
UNBC Students		UNBC
Potential Professors		UNBC
UNBC Faculty		UNBC
UNBC Staff		UNBC
Ron Mastromonaco	Key Account Manager	BC Hydro
Douglas Taber	Commercial Account Manager	FortisBC
Greg Stewart	President	Sinclar Group Forest Products
Northern Residents		
General Public		

Energy Manager: Please complete appropriate year below

- Note: All areas (in your contract Year) must be covered in order to receive 4th quarter payment

Year 2 +: Strategic Energy Management Plan requirements

6 Critical Elements must be included in the Strategic Energy Management Plan	**Page number where the element is addressed in the SEMP**	**Energy Manager evaluation**	**PSE Agrees**
1) A purpose statement which answers the following questions:		☐	☐
☐ a) What is your kWh reduction target?	p.1,5-6		
☐ b) What is the Key Performance Indicator for your organization?	p.1,3-4		
☐ c) Who do you need to engage to make your plan successful?	p.1,19		
2) A table that compares all your building in your portfolio	p.13	☐	☐
☐ a) BEPI- updated to the current year	p.11,13		
☐ b) Explanation of Top 10 worst performing buildings	p.11-12		
3) Explain what the opportunities are to become more efficient.		☐	☐
☐ a) Project List	p. 14-15,26-27		
☐ b) Initiative List: Behavioural and Organisational	p.19,26-27		
☐ c) Studies: Outline which buildings have had studies completed.	p. 28		
4) Outline the budget to implement projects		☐	☐
☐ a) If No Budget? Can't forecast your budget? You must explain why not and what you intend to do about getting a budget.	p.2-3,16-19		
5) Conclusion: How is your plan doing?		☐	☐
☐ a) Outlined kWh saved	p.20-23		
☐ b) Outlined GHG tons saved	p.23-24		
☐ c) Outlined total dollars saved to the organisation	p.21,25		
☐ d) Outlined avoided cost	p.20,22		
☐ e) Outlined total dollars saved	p.25		
☐			
6) Senior Management Support		☐	☐
☐ a) Approval of the SEMP : Signature on the SEMP	Coverpage		

Tracking:

	2nd Q Draft SEMP Submitted Date	Date PSE Coaching Comments Returned to EM	4th Q SEMP submitted date	Reviewed and Coaching comments returned to EM: Date	*If EM needed to resubmit :date	If PSE reviewed: Date
Energy Manager						
PSE						