Fleming College

LEARN | BELONG | BECOME

Energy Conservation and Demand Management Plan

July 1st, 2014

Table of Contents

1. Background

Fleming College

The college has more than 5,900 full-time and 10,000 part-time students with campuses located in Peterborough, Lindsay, Haliburton and Cobourg. These campuses make up just less than 853,000 square feet that the college operates.

Fleming College has something to offer to all students – post-graduate programs, apprenticeships, diploma programs and certificates as well as part-time or continuing education courses and online courses. This range of choices allows for greater flexibility and accessibility to better meet the diverse needs of our students.

The college utilizes three sources of energy: electricity, natural gas and propane. A summary of our energy use for the past five years can be seen in figure 1.

Figure 1: Fleming Energy Consumption

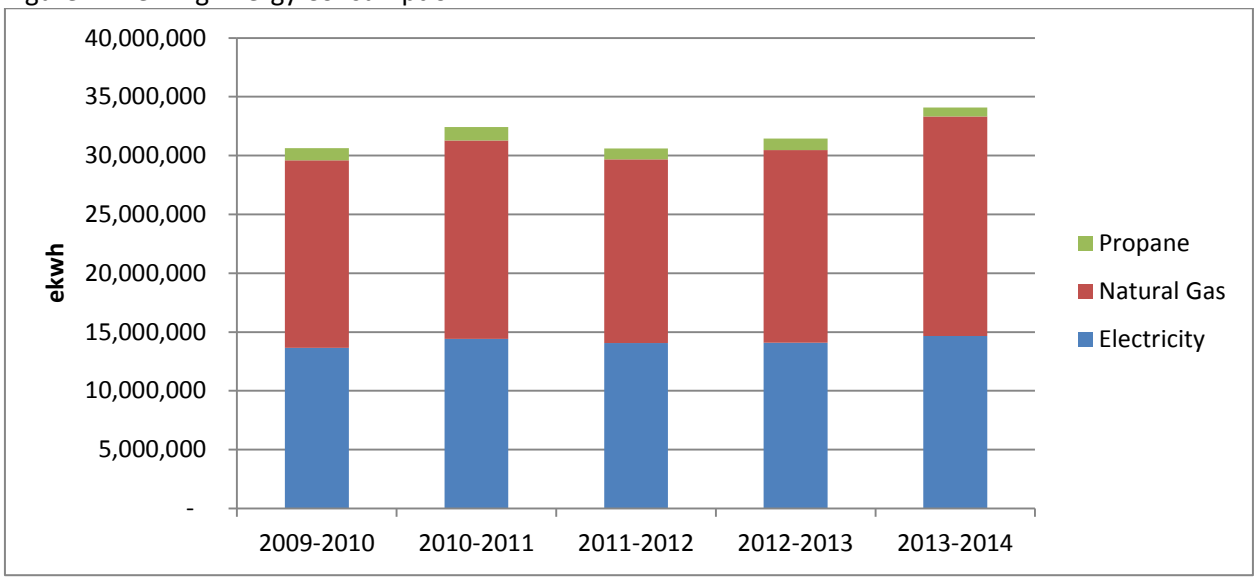


Figure 2: Fleming Energy Intensity vs. BPS 2011 Benchmarking Data (Colleges)

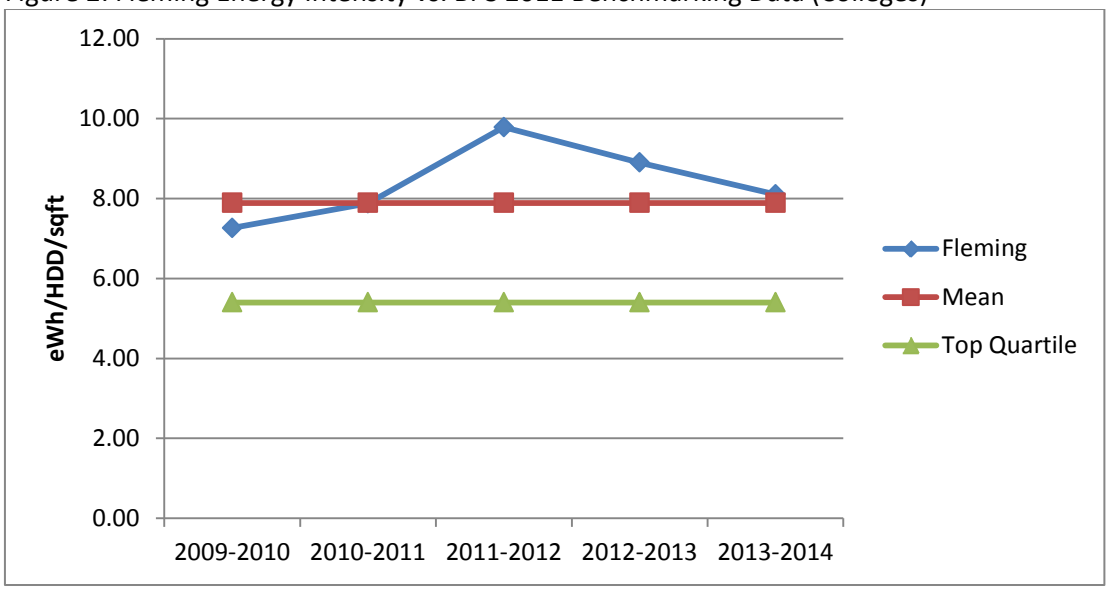
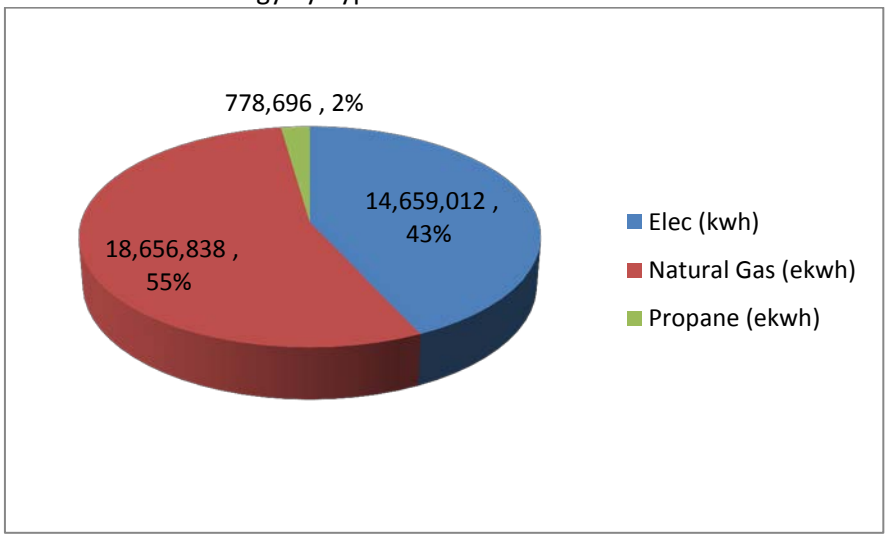


Figure 3: 2013-2014 Energy by Type



2. Purpose

The third of the six Strategic Priorities in the Fleming College 2010-2015 Strategic Plan is “Leading in Sustainability”. Strategy 3.2 to achieve this goal is to “Reduce waste and the College’s carbon footprint so that Fleming’s results meet or exceed provincial and national standards for postsecondary institutions.” Energy is a large contributor to the College’s carbon footprint. Strategy 3.1 is to “Develop and implement a five-year Fleming College Sustainability Plan that includes objectives, benchmarks and public reporting.” The 2013-2018 Sustainability Plan has been created and is currently being implemented.

The Energy Management Plan is to compliment and support the Sustainability Plan, specifically goal 3 to "Reduce negative environmental impact of Fleming operations." Also to address Energy specific issues outside of Sustainability, such as procurement. The Metrics and Targets established in the Sustainability Plan regarding energy and water are as follows:

- Reduce total annual potable water consumption per square foot by 10% across all campuses
- Reduce total annual energy consumption per square foot by 15% across all campuses
- Reduce total annual greenhouse gas emissions per weighted campus user by 10%

Energy Management planning is intended to be a process of "continuous improvement". A closed-loop feedback approach is most effective in demonstrating results that will justify further investment in efficiency.

Plan: Ensure budgets, resources, and timelines are established to meet the targets and objectives of the plan. Include tracking and monitoring processes within the processes within the plan to ensure effective reporting to management.

Do: Execute the plan by deploying the resources and budgets, prepare status reports, and implement communication strategy.

Check: Measure and monitor performance of projects and programs against the desired outcomes as planned and report to management and course corrections.

Act: Analyze the variances to the plan and their causes. Recommend improvements, course corrections, and modifications to the plan.

Utilities account for a significant portion of the Facilities Operational Budget, approximately $1.8 million in the 2012/2013 fiscal year. Also energy prices continue to increase. Prices are largely outside of the College's control. However, the College does have control of how much energy is consumed.

3. Energy Management Coordinator

The Energy Management Coordinator is a critical component of a successful energy program. The Energy Management Coordinator will help Fleming College achieve its goals by establishing energy performance as a core value.

The Energy Management Coordinator is not required to be an expert in energy and technical systems. Success of the Energy Management Coordinator relies on understanding of how energy management will help Fleming achieve its financial and sustainable goals and objectives.

The Energy Management Coordinator's key duties include:

- Coordinating the overall energy program
- Acting as the point of contact for senior management
- Increasing the visibility of energy management within the organization
- Drafting an Energy Plan

- Assessing the potential value of improved energy management
- Creating and leading the Energy Team
- Securing sufficient resources to implement strategic energy management
- Assuring accountability and commitment from core parts of the organization
- Identifying opportunities for improvement and ensuring implementation (including staff training)
- Measuring, tracking, evaluating, and communicating results
- Obtaining recognition for achievements

The Energy Management Coordinator will report directly to the Director, College Facilities, to ensure formalization of the commitment to continuous improvement.

4. Energy Team

Decisions affecting energy use are made every day by the entire College community. The energy team will aid in integration of energy management.

In addition to planning and implementing specific improvements, the team will measure and track energy performance and communicate with employees and other stakeholders. The Energy Management Coordinator will lead the Energy Team, which may include representative(s) from operational areas that significantly impact energy use:

- Facilities
- Purchasing
- Health and Safety
- Academic Operations
- Information Technology
- Sustainability

5. Energy Conservation Plan

The Energy Plan will provide the foundation for successful energy management. It will formalize the Executive Leadership Teams (ELT) commitment and articulate Fleming's commitment to energy efficiency for students, employees, the College community, and other stakeholders.

The Energy Plan shall:

- State a clear, measurable objective that reflects Fleming's commitment, culture and priorities.
- Establish accountability — Institute a chain-of-command, define roles, and provide the authority for personnel to implement the energy management plan.

- Ensure continuous improvement — Include provisions for evaluating and updating the plan to reflect changing needs and priorities.
- Promote goals — Provide a context for setting performance goals by linking energy goals to the Strategic Plan, and overall financial and environmental goals of the College.
- The Energy Plan shall be reviewed by ELT.
- Communications to all staff and employees, including detail that covers day-to-day operations, shall be frequent, encouraging mass involvement.
- Establish a utilities commodity purchasing strategy – Including an evaluation of risk tolerance.

6. Objectives & Targets

Establishing objectives and targets are a key to the planning component of the continuous improvement process. The Metrics and Targets established in the 2013-2018 Sustainability Plan regarding energy and water are as follows:

- Reduce total annual potable water consumption per square foot by 10% across all campuses
- Reduce total annual energy consumption per square foot by 15% across all campuses
- Reduce total annual greenhouse gas emissions per weighted campus user by 10%

6.1. Baselines

Measuring energy performance at a specific time establishes a baseline and provides the starting point for setting goals and evaluating future efforts and overall performance. Baselines will be established for all College sites.

Data collection at each site shall aid in development of:

- Establishment of base year — either weather-normalized, or an average of several historical years.
- Metrics — units of measurements shall be selected that effectively and appropriately express energy performance. (e.g. ENERGY STAR benchmark score, Btu/square foot, Btu/ product, total energy cost/square foot).
- Results — performance results will be published to facilities, ancillary managers, and other key stakeholders.

6.2. Set Goals

Performance goals drive energy management activities and promote continuous improvement. Setting clear and measurable goals will be critical for understanding intended results, developing effective strategies, and reaping financial gains. Energy performance goals shall be formally reviewed by ELT on an annual basis, as a mission for the entire College community.

The Energy Management Coordinator in conjunction with the Energy Team shall develop goals, College wide, focusing on:

- Setting the tone for improvement throughout the organization
- Measuring the success of the energy management program
- Enabling the Energy Team to identify progress and setbacks at a facility level
- Fostering ownership of energy management, creating a sense of purpose, and motivating staff
- Demonstrating commitment to reducing environmental impacts

Creating schedules for upgrade activities and identify milestones

Short-term goals

Annual goals will provide the necessary markers for tracking and reporting progress on a regular and on-going basis.

Long-term goals

Long-term goals will be specific and compliment the College Strategic plan, and facilities business plan.

7. Gathering and Tracking Data

Evaluating energy performance requires quality information on how, when, and where energy is being used. Collecting and tracking this information is necessary for establishing baselines and managing energy use. The following processes are a key to measuring the success of the plan, and are part of the check portion of the continuous improvement loop.

7.1. Data Collection

Data must be complete and accurate, as it will be used for analysis and goal setting. The utility bills are considered the most accurate source of data.

The level and scope of data collection will vary from site to site; submeters will be implemented whenever feasible.

Energy purchased (electricity, gas, propane) will be tracked as physical units (kWh, mMBtu, Mcf, etc.), and on a cost basis.

Energy use will be documented, and reside in a central, corporate location (Finance, Energy coordinator).

Additional data will also be collected (hours of operation, building size, use etc.) for the purposes of benchmarking.

7.2. Tracking System

A system for tracking performance will be implemented, inclusive of:

- Scope — design, level, and detail of information that will be tracked, and the frequency of data collection shall be defined.
- Maintenance — tracking system will be easy to use, update, and maintain.
- Reporting and communicating — tracking system will assist in communicating energy performance to other parts of the organization and help motivate change. Formats that express energy performance information in ways that are easily understandable across the organization shall be employed.

7.3. Real Time Monitoring

Ontario Colleges Facilities Management Association (OCFMA) had an initiative to have real time utility monitoring for all of the colleges to track and measure energy conservation projects, as well as to facilitate group purchasing strategies. All of the data from the colleges was hosted at Seneca, and the system was called the Real Time Operating System (RTOS). Fleming College brought their first meters online in 2010. The college currently only has real time monitoring for electricity. Below is a summary of our current metering:

Campus	Main Meter	Submeters
Brealey Main	Desbiens Wing	Desbiens 1 & 2
	Main Campus	A, B, CD Blocks, CIM Wing
Brealey Residence	Building 1	Buildings 2, 3, 4, 5, and 6
Haliburton	Main Building	None
Frost*	Main Building	10 metres in NR Wing

*not connected to RTOS

The RTOS is in the process of transitioning to the College's Energy Management Information System (CEMIS). This data will now be hosted at Colleges Ontario and the software is being upgraded. KTTC has a very comprehensive metering system that will be added to the system.

7.4. Benchmarking

Facility or organizational performance shall be benchmarked to:

- Past performance — A comparison of current versus historical performance.
- Industry average — Based on an established performance metric, such as the recognized average performance of a peer group (EPA).
- Best Practices — A qualitative comparison against certain, established practices considered to be the best in the industry.

7.5. Data Analysis

Collected data shall be analyzed to determine energy use trends to gain a better understanding of the factors that affect energy performance, and identify steps for reducing energy consumption.

The following analyses shall be utilized as follows:

Quantitative Reviews

- Use profiles — energy consumption peaks and valleys will be identified, to determine how they relate to operations or key events.
- Compare performance — use and performance data of similar facilities shall be compared across the College.
- Financial impact analysis — Areas of high-cost energy use shall be identified.
- Data gaps — areas where more information is needed shall be identified.

Qualitative Reviews

- Interviews, consultations — Informed opinions from colleagues shall be sought, specific anecdotes and lessons learned, systems-specific information (e.g., HVAC, lighting, refrigeration), and in-house audits or surveys shall be performed.
- Policies and procedures — organizational policies and operating procedures shall be reviewed to determine their impact on energy use.

7.6. Internal Reporting

7.6.1. Monthly Scorecard

Distribute a monthly scorecard that reports on the status of the Energy and Water sustainability goals. The scorecard would be distributed to the Director of Facilities, Facility Managers, and Sustainability Operations Lead. The following metrics would be scored:

- Total Energy (ekwh/sqft) or (ekwh/HDD/sqft)
- Electrical Energy (kwh/sqft) or (ekwh/HDD/sqft)
- Fossil Fuels Energy (ekwh/sqft) or (ekwh/HDD/sqft)
- Water (m3/sqft)

These metrics would be a 12 month rolling average. Therefore, it is one year worth of consumption divided by the area's square footage. For example, for the December 2013 scorecard it would be the consumption from January 2013 to December 2013, the January 2014 scorecard would be February 2013 to January 2014 consumption, and so on.

The following scoring system would be applied:

 Meeting or exceeding target.

 Greater than target but less than the previous year.

Greater than previous year.

7.6.2. Quarterly Reporting

The quarterly report would be distributed to the Director of Facilities, Facility Managers, and Sustainability Operations Lead. The report would include the current energy and water status to the established targets, and a summary of current initiatives.

7.6.3. Annual Reporting

The annual report would be distributed to the Director of Facilities, Facility Managers, Sustainability Operations Lead and ELT. The report would include the current energy and water status to the established targets, and a summary of current initiatives.

7.7. Public Reporting

7.7.1. Ontario Regulation 397/11

Ontario Regulation 397/11 made under the Green Energy Act, 2009, requires public agencies to prepare and publish an energy conservation and demand management plan that is composed of two parts as follows:

1. A summary of the public agency's annual energy consumption and greenhouse gas emissions for its operations.
2. A description of previous, current and proposed measures for conserving and otherwise reducing the amount of energy consumed by the public agency's operations and for managing the public agency's demand for energy, including a forecast of the expected results of current and proposed measures.

The first submission of Part 1 was required by July 1st, 2013, and then is required to be submitted on an annual basis. Part 2 is required July 1st, 2014.

7.7.2. AASHE's Sustainability Tracking, Assessment and Rating System (STARS)

STARS Overview

"The Sustainability Tracking, Assessment & Rating System™ (STARS®) is a transparent, self-reporting framework for colleges and universities to measure their sustainability performance. STARS is intended to engage and recognize the full spectrum of colleges and universities—from community colleges to research universities, and from institutions just starting their sustainability programs to long-time campus sustainability leaders. STARS encompasses long-term sustainability goals for already high-achieving institutions as well as

entry points of recognition for institutions that are taking first steps toward sustainability. STARS is designed to:

- Provide a framework for understanding sustainability in all sectors of higher education.
- Enable meaningful comparisons over time and across institutions using a common set of measurements developed with broad participation from the campus sustainability community.
- Create incentives for continual improvement toward sustainability.
- Facilitate information sharing about higher education sustainability practices and performance.
- Build a stronger, more diverse campus sustainability community."

https://stars.aashe.org/pages/engage/stars-overview.html

On March 20th, 2013 Fleming College summited their STARS submission, and achieved a rating of bronze. The submission can be viewed on the AASHE STARS website at:

https://stars.aashe.org/institutions/fleming-college-on/report/2013-03-20/

The STARS program is comprised of credits in three areas; Education & Research, Operations, and Planning, Administration & Engagement. Energy and Water fall under the area of Operations. For the Energy category 3.33 of 16.50 credits were obtained. Energy is also a large contributor to the Climate category which did not achieve any of the 16.50 credits available. In the Water category 7.50 of 10.00 credits were obtained. For credit details please referred to the submission link above

7.8. Renewable Energy

7.8.1. Frost Campus Windmill

In late 2003 a 10kW Bergey Windpower BWC EXEL-S windpower generator was donated to Fleming College. The estimated annual energy generated for the windmill is 10,500 kWh.

BWC EXCEL Specifications

Performance

Start-up Wind Speed	3.1 m/s (7.0 mph)
Cut-In Wind Speed	3.5 m/s (8.0 mph)
Rated Wind Speed	12.4 m/s (28.0 mph)
Cut-Out Wind Speed	none
Furling Wind Speed	15.7 m/s (35.0 mph)
Maximum Design Wind Speed	54 m/s (120 mph)
Rated Power	10 kW
Rotor Speed	0-350 RPM

Mechanical

Type	3 Blade Upwind
Rotor Diameter	7.0 m (23.0 ft)

Weight	463 KG (1020 lbs)
Blade Pitch Control	POWERFLEX
Overspeed Protection	AUTOFURL
Temperature Range	-40 to 60 °C (-40 to 140 °F)
Electrical	
Output Form	240 VAC, 1Φ, 60 Hz
Generator	Permanent Magnet Alternator
Output Control System	POWERSYNC Inverter

7.8.2. Frost Campus Ground Source Heat

In 2004 a new 42,000 square foot wing was constructed at the Frost Campus. The wing is heated and cooled by a ground source energy system that consists of the following:

- 66 drilled wells, each well is 400 feet deep
- 58 water to air heat pumps, with a capacity of 144.8 tons
- 2 water to water heat pumps, 60 tons each, provides heat to a heat recovery ventilator, perimeter in floor heating, snow melt, as well as preheat the domestic hot water
- 2 - 25 HP pumps controlled by VFDs circulate the fluid trough the ground and heat pump loop

8. Measures

8.1. Technical Assessments & Audits

Periodic assessment of the performance of equipment, processes, and systems will identify opportunities for improvement.

Energy audits are comprehensive reviews conducted by energy professionals and/or engineers that evaluate the actual performance of a facility's systems and equipment against their designed performance level or against best available technology. The difference between these is the potential for energy savings.

Technical assessments and audits will be conducted as follows:

- Assembly of an audit team — Expertise will cover all energy-using systems, processes, and equipment. Facilities personnel, system specialists, and external support will be considered to provide an objective perspective or specific expertise.
- Planning and development of an audit strategy — systems will be identified and prioritized for evaluation, team members assigned to tasks, and completion dates scheduled for the activities.

- Audit report — Based on the audit results, a detailed summary of actual steps taken to reduce energy use will be documented. The report shall recommend actions from simple adjustments in operation to equipment replacement. Estimates of resource requirements for completing actions shall be included.

8.2. Action Plan

A detailed action plan will be created to ensure a systematic process to implement energy performance measures. The action plan shall be regularly updated, at a minimum on an annual basis, to reflect recent achievements, changes in performance, and shifting priorities.

The action plan shall be reviewed by ELT annually. The Energy Team will communicate the action plan to the College community.

The action plan will include:

- Technical assessments and audit results, identifying gaps between current performance and goals.
- Steps necessary for upgrading and moving facilities from current performance to the desired level of performance as defined by the goals.
- Creation of performance targets for facilities, departments, and other operation of the College, to track progress towards achieving goals.
- Timelines for actions, including regular meetings among key personnel to evaluate progress, completion dates, milestones and expected outcomes.
- Tracking system to track and monitor the progress of action items. This system shall track and measure energy use and project/program activities.
- Roles and responsibilities of departments and individuals, both internal and external.
- Communications plan.
- Orientation/training plan for new employees, contractors, external partners.
- Marketing plan/campaigns/events.
- Measurement of results and scorecards.
- Knowledge and Management Information Systems, supporting Best practices, technologies and procedures.
- Incentives and recognition.
- Regular review of the action plan.

Preferred State	Present State	Measures	Cost Estimate	Savings Estimate	Lifespan of Measure
Awareness					
Staff and students aware of energy initiatives and make an effort to conserve energy	No promotion of energy efforts	Create an energy awareness program with the Office of Sustainability	None	Qualitative	Ongoing
Lighting					
Motion sensors control lights in corridors, with daylight harvesting	Majority of corridor lights are controlled by motion sensors, only a couple of areas utilize daylight harvesting	Install motion sensors for corridor lighting, include daylight harvesting where applicable	TBD	TBD	TBD
All T12 fixtures upgraded to a more efficient technology	405 T12 fixtures in classrooms in Brealey, more in offices at Brealey and Frost	Replace T12 fixtures with 25W T8 or LED	$11,643.03 for T8 parts	$7,110.18	46,000 hrs
Standardize to T8 25W Long life	Currently T8 32W are used.	Only order 25W T8 Long life. They last 46,000 hrs therefore reduce maintenance labour	Additional $2.64 per lamp	$3.53 per lamp	46,000 hrs
Upgrade High Bay applications to LED	Drive Shed, Eng Commons, Drill and Heavy Equipment Shops are 400W MH	Replace 400W MH with 174W LED	$280/fixture	TBD	TBD

Preferred State	Present State	Measures	Cost Estimate	Savings Estimate	Lifespan of Measure
Outdoor lighting LED or solar LED	Most outdoor lights are currently MH or HS	Upgrade outdoor lighting to LED or solar LED	TBD	TBD	TBD
All PAR Lamps retrofitted to LED	75W PAR lamps installed in Frost 250 lecture theater	Replace 36 PAR lamps in Frost 250 lecture theater with 13W LED	$1,595.16	$4,260/year	Complete
HVAC					
Maximum heat recovery from Glass Blowing Furnaces	Heat recovery system in place, but not functioning optimally with new more efficient glass blowing equipment.	Review Heat recovery system design	TBD	TBD	TBD
On demand kitchen hood ventilation performing as designed	VFD's in bypass and system not performing optimally, installation issues have been identified	Recommission systems	TBD	TBD	TBD
All buildings on the Building Automation System (BAS)	Haliburton, Brealey Main Campus and Residence and Frost Main Campus are on the BAS	Install BAS controls for Frost Outbuildings	$93,000	$41,700	Aug 2014
Supply minimum required air volume to LRC, Library and LSS by units 15 and 16	Air volume for units is controlled by Variable Inlet Vanes that are current seized, therefore supplying constant volume	Install VFD's on Units 15 and 16	$19,090		Complete

Preferred State	Present State	Measures	Cost Estimate	Savings Estimate	Lifespan of Measure
All units have a unoccupied mode with winter set points	Brealey units 10, 11, 13, 14, and 15 do not have a unoccupied mode and run 24/7	Program unoccupied mode for units 10, 11, 13, 14, and 15	TBD	TBD	TBD
Exhaust fans only run when areas are occupied	Some washroom exhaust fans at Frost are controlled by occupancy sensors, but most run 24/7 including the fan for Breaktime	Install occupancy sensors or timers on exhaust fans	TBD	TBD	TBD
HVAC equipment and systems operating optimally	Over time building uses change, spaces are reconfigured, equipment is added, possibly rendering previous systems and settings ineffective	Recommission HVAC systems	TBD	TBD	TBD
Standard winter and summer temperature set points	Temperatures are set based on complaints	Establish standard winter and summer temperature set points	TBD	TBD	TBD
Hot deck and cold deck temperatures reset with OA temperature	Some units hot deck and cold deck are set with pot switch	Modify units to accept a signal from the BAS to set hot deck and cold deck temperatures	TBD	TBD	TBD

Preferred State	Present State	Measures	Cost Estimate	Savings Estimate	Lifespan of Measure
Brealey Residences boilers temperature reset with OA temperature	Brealey Residences boilers temperature set to a fixed temperature	Utilize BAS or boiler controls to reset temperature with OA temperature	TBD	TBD	TBD
Building Envelope					
Minimal energy lost through gaps in the building envelope	Significant energy lost through building envelop	Perform Thermal imaging audit to determine areas to be addressed and payback	TBD	TBD	TBD
Brealey dock door closed when not required	Dock door is constantly left open and wasting energy	Install light curtain and timer to close door when not in use	TBD	TBD	TBD
Monitoring					
Real time monitoring for electricity where infrastructure is already in place	Brealey Campus and Haliburton are currently monitored with the Colleges Energy Management Information System (CEMIS)	Frost Main campus, NR Wing, Drill installed metres monitored on CEMIS	Ethernet Card for NR Wing: $1300	TBD	TBD

Preferred State	Present State	Measures	Cost Estimate	Savings Estimate	Lifespan of Measure
Have electrical meters at the Brealey Campus that are capable of storing 30 days worth of data, and power quality event capturing.	Brealey Campus has two main hydro feeds that are metered by two SquareD Circuit Monitor 2000 (CM2000)	Upgrade Brealey electrical meters to ION7650 and ION7330. The meters have already been purchased.	Installation only: Does not require a power outage.	TBD	TBD
Real time monitoring for Frost Outbuildings Electricity (NR Law, Heavy, Residence, Field House)	One Hydro One bill for the entire Frost Campus with no real time monitoring for the outbuildings	Install electrical metres in NR Law, Heavy, and Residence, and Field House.	Residence: $8,444 NR Law, Heavy, Field House: $20,000	TBD	TBD
Real time monitoring for Natural Gas	Bills are used for Natural Gas tracking, only 1 actual reading every 2 months	Install real time natural gas meters	$800-1400/meter for Enbridge, + pulse counter + drop	TBD	TBD
Have CUSUM model developed to identify positive and negative trend in energy consumption and budgeting	No modeling to predict energy use or trends in energy consumption	Utilize CEMIS for modeling real time data	TBD	TBD	TBD
Perform weather normalization analysis and identify trends.	All utility invoices are entered into Excel Spread Sheets making it difficult analyze the data and identify trends.	Implement Utility Tracking system that includes weather normalization. (Energy Star Portfolio Manager? Archibus?)	TBD	TBD	TBD
Share real time energy use in an engaging manor.	No ability to convey real time energy use to stakeholders.	Energy Dashboard	TBD	TBD	TBD

Preferred State	Present State	Measures	Cost Estimate	Savings Estimate	Lifespan of Measure
Targets for week nights, weekends and holidays for electricity consumption.	Only attempt to reduce during downtime is currently limited to HVAC scheduling	Identify and document addition loads that could be reduced. Standardize shutdown of those loads. Ie cafeteria	None	TBD	TBD
Water					
Real time monitoring for Water	Bills are used for water tracking, only 1 actual reading every 2 months	Install real time water meters	TBD	TBD	TBD
Urinals only flush when used	BR Level 2 washroom (every 17 mins) and FR Drill currently have timed flush valves	Replace flush timed flush valves	TBD	TBD	TBD
Aerators on washroom taps to reduce flow	Some taps have aerators, most do not	Install aerators	TBD	TBD	TBD

9. References

2013-2018 Fleming College Sustainability Plan (2012). Peterborough, ON: Author.

Copeland, Laura. (2014, 06, 26). Sustainable Building Program seeking partner projects. Retrieved from http://flemingcollege.ca/news/sustainable-building-program-seeking-partner-projects/

Sir Sandford Fleming College 2010-2015 Strategic Plan (2010). Peterborough, ON: Author.