Energy and Water Conservation and Demand Management Plan

2014–2018

Executive Summary

Since the 1990s, environmental awareness, legislation and rising energy costs have combined to force all institutions to look carefully at the impact of their energy consumption on both the physical world and their balance sheet.

Humber's first response, the Energy Management Plan of 1998, resulted in a 20% decrease in energy use per square foot over the period of seven years (from 2005 to 2012).

Our new report, The Energy and Water Conservation and Demand Management Plan ("Energy Plan"), was developed as a result of the more recent Ontario Regulation 397/11 under the Green Energy Act. The plan seeks to extend the gains made by Humber while aligning tightly to one of our six values - "We preserve our collective future by embracing the social, ecological and economic impact of our decisions".

The Energy Plan begins with a review of current energy consumption at Humber College's two main campuses, with the objective of identifying areas of opportunity The utility consumption at North and Lakeshore were analyzed by the following categories:

- Energy Breakdown by Utility
- Utility Consumption profiles
- Benchmarking
- Energy Use by End-Use

The analysis shows that space heating, HVAC (heating, ventilation and air conditioning) systems and lighting account for approximately 80% of energy consumption at both campuses. Similarly, 80% of Humber's energy expenditures are attributed to electricity use. Energy conservation measures implemented to reduce electricity consumption will result in shorter payback periods.

From the Sustainability 5 year plan, the goals of the Energy Plan are to:

- Reduce total energy use per square foot by 40% by 2018/19 compared to 2005/6
- Reduce CO_2 emissions intensity by 40% by 2018/19 compared to 2005/6
- Reduce total water use per student by 40% by 2018/19 compared to 2005/6

The Energy Plan outlines the measures for achieving those goals and provides cost and savings estimates for the recommended measures. At the same time, the Energy Plan supports and complements the Humber Sustainability Strategic Plan while proposing to modify the culture at

Humber College to promote a sense of responsibility and aligned action among campus users including students, staff, faculty and administrators.

The focus of the energy plan for the next five years will be to continue to reduce total energy and water use as well as consider energy in our daily decision making. The five-year action plan includes an evaluation of potential energy and water saving initiatives which have been grouped into three categories:

- **Process Improvement**: complete regular reviews of energy consumption, incorporate energy efficiency into design of new buildings and major renovations.
- **Program Implementation**: continue development of submetering program, implement building commissioning and establish energy awareness programs.
- **Projects**: reduce plug loads, improve water efficiency, invest in lighting and HVAC systems upgrades

The energy savings initiatives detailed in this plan have been carefully selected to be achievable over the next five years. Progress will be monitored annually using well defined, clear metrics.

The Energy Plan will be further developed and updated every five years, as required by the Green Energy Act.

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Introduction

Ontario Regulation 397/11 under the Green Energy Act, requires that on or before July 1st 2014 a public agency shall prepare, publish, make available to the public and implement energy conservation and demand management plans or joint plans in accordance with sections 6 and 7 of the Act. This plan fulfills Humber's monitoring and reporting requirements outlined in the Green Energy Act, and also sets a direction with action steps to achieve it. Updates to the plan, including Humber's progress in meeting the goals are required every five years.

Humber College is not new to energy efficiency, our first Energy Management Action Plan was written in 1998, and since 2005 our energy use per square foot has fallen by 20% due to many successful energy conservation projects, freeing up over $1 million a year that can be used for other priorities. The Energy and Water Conservation and Demand Management Plan will outline a continued path to reduce usage, and increase savings even further. Greenhouse Gas emissions reductions are being treated as an offshoot of the energy efficiency upgrades.

The conservation and demand management plan has been influenced by the overarching sustainability policy from Humber's Strategic Plan 2013 – 2018 which has a specific success outcome that "Humber has embraced a comprehensive sustainability strategy that is embedded in our integrated planning and resource allocation model". Sustainability is also one of Humber's six values "We preserve our collective future by embracing the social, ecological and economic impact of our decisions"

Energy efficiency targets were set through the sustainability plan process in 2013, which involved extensive consultation with the Humber students, staff and faculty.

Objective: To reduce the energy needs required and the carbon emissions created by the college. Be one of the most energy efficient post-secondary institutions in Canada.

Water is also a very important commodity that needs to be closely managed. The price of water has been rising rapidly at 9% a year, so water costs are now almost as high as natural gas on an annual basis. Fortunately technology continues to develop and there remain opportunities for efficiency.

Humber College Current Energy Consumption

Humber College is comprised of two main campuses, North and Lakeshore. The following consumption information is taken from North Campus utility bills and submeters from the last 3 years. Taxes have been excluded from this analysis.

North Campus

	Usage	*Demand*	*Energy Cost*
Electricity	*21,877,100 kWh*	*46,632 kW*	*$1,629,368*
Natural Gas	*2,266,009 m^3*	*n/a*	*$343,023*
Water	*29,701,515 gal*	*n/a*	*$342,594*

Energy Use and Cost for 2012

	Usage	*Demand*	*Energy Cost*
Electricity	21,325,773 kWh	48,677kW	$1,555,254
Natural Gas	2,384,724 m^3	n/a	$435,990
Water	29,730,100 gal	n/a	$299,101

Energy Use and Cost for 2011

	Usage	*Demand*	*Energy Cost*
Electricity	21,709,462 kWh	49,670 kW	$1,637,868
Natural Gas	2,403,752 m^3	n/a	$473,200
Water	29,132,906 gal	n/a	$271,321

Energy Use and Cost for 2010

Consumption of all three utilities has remained relatively constant throughout these years, with yearly variations of less than five (5) percent. The energy cost for electricity held constant as well, with yearly variations of less than one (1) percent. The price of water has steadily increased from 0.9 cents/gal in 2010, to 1.15 cents/gal in 2012. This trend is expected to continue.

Energy Breakdown by Utility

The figures below represent a breakdown of electricity and natural gas consumption by total annual energy in gigajoules and total annual cost in dollars.

Figure i represents a breakdown of electricity and natural gas consumption (the average of 2010, 2011, 2012) by total annual energy in gigajoules. As shown, the consumption amounts of the two sources are relatively close, with a bit more than half being attributed to natural gas. *Figure ii* represents a breakdown of the two sources by energy cost. In contrast to the consumption, the majority of the energy cost (80%) is attributed to electricity. Currently electricity costs are approximately four times greater than natural gas.

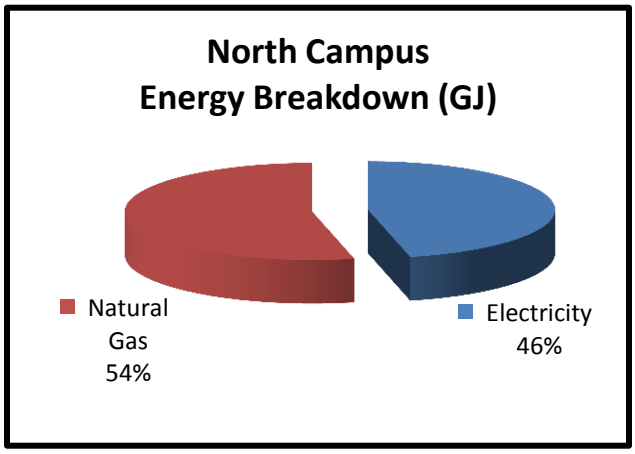


Figure i

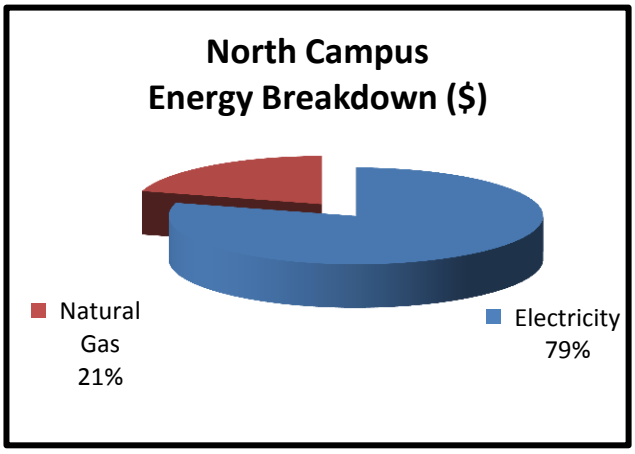
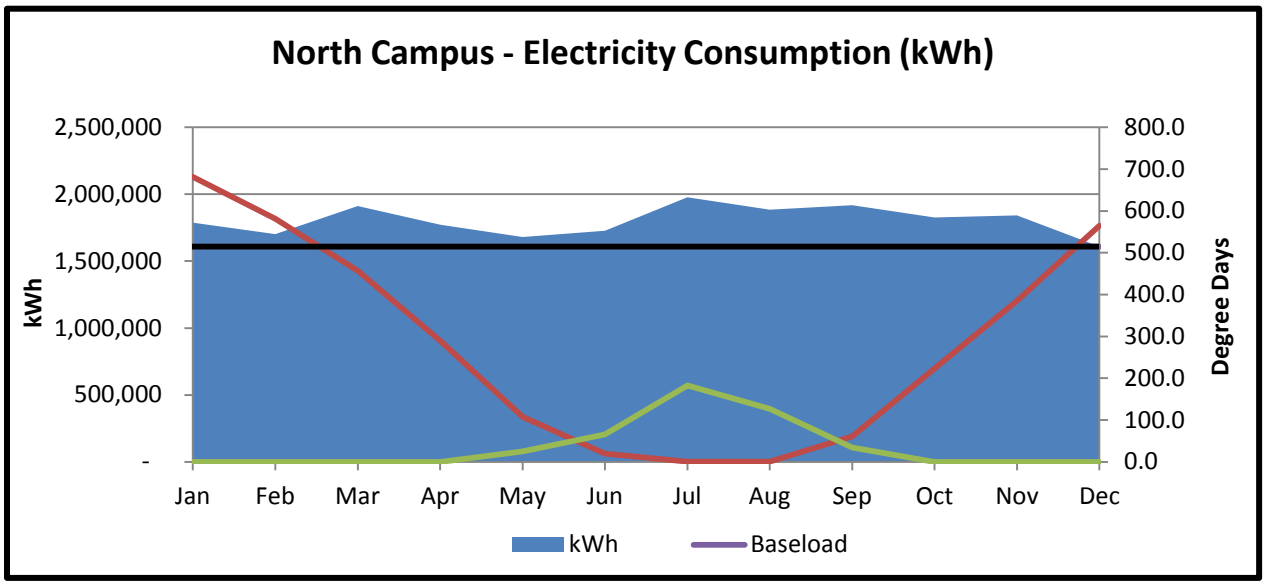


Figure ii

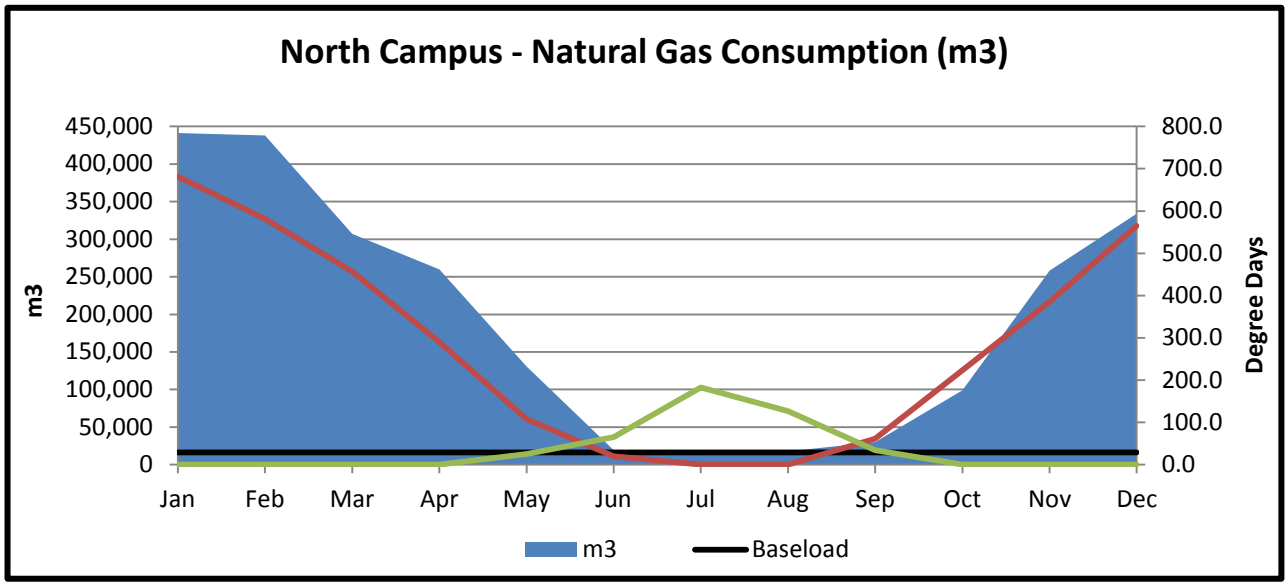
Utility Consumption Profiles

The graphs below represent Humber College's North campus annual utility consumption trends, averaging calendar years 2010, 2011, and 2012. These graphs plot four (4) variables:

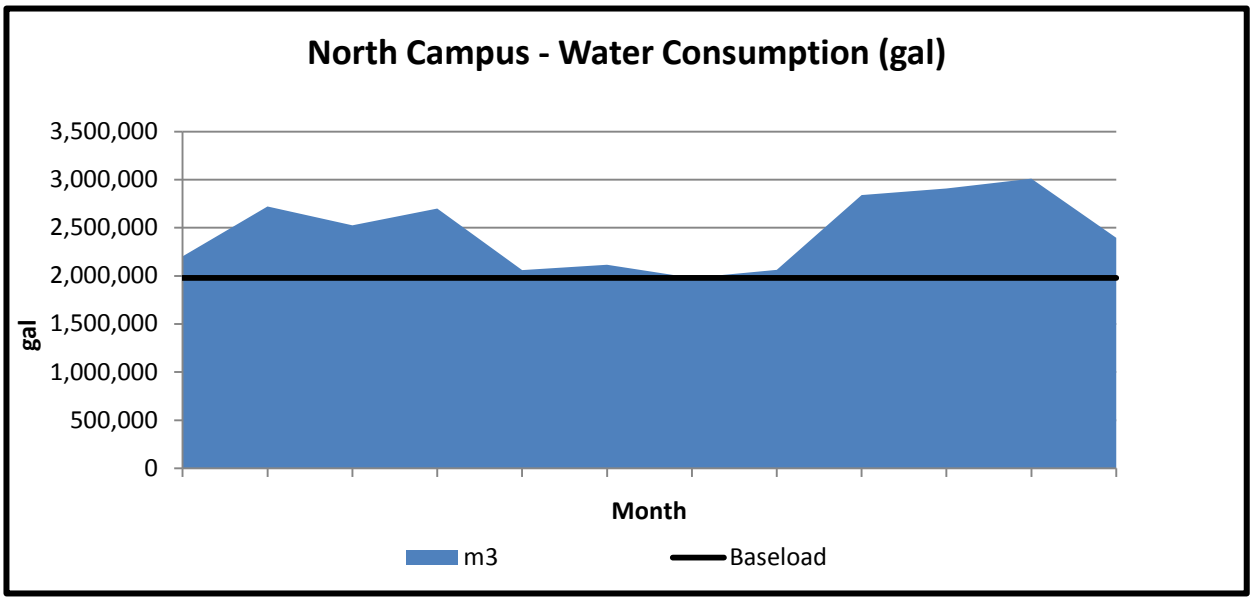
consumption, baseload, heating degree days (HDD), and cooling degree days (CDD). These variables are plotted against the twelve (12) calendar months. The consumption (in blue) represents the amount of utility that was used during a certain month. The baseload (black line) represents the minimum amount of utility used throughout all of the calendar months; note the baseload value is that of the month with the lowest consumption. Heating degree days (red line) represent the amount of days in a given month that the temperature is below 18 degrees Celsius; this value typically coincides with the heating load. Cooling degree days (green line) represent the amount of days in a given month that the temperature is above 18 degrees Celsius; this value typically coincides with the cooling load.



A typical commercial or residential annual electricity profile will peak in the summer months, coinciding with the cooling load. Contrarily, a typical college campus electricity profile will be the lowest in the summer months, due to decreased occupancy and use of the buildings. North campus' profile shows peaks in the summer, fall, and March, with a large baseload throughout the year. The dips in December and February coincide with periods of decreased occupancy- Christmas break and Reading Week. The baseload consumption includes end uses such as lighting, plug loads and ventilation. The fact that the baseload does not decrease in the summer months, as it is expected to with the decreased occupancy, shows that these systems (lighting, plug loads, ventilation) are not scaled back in the summer months because of some summer classes and office occupancy.



The natural gas profile coincides with the heating load. This is expected as natural gas boilers and rooftop units are the source for space heating. The small baseload during the summer months is attributed to natural gas domestic hot water heaters.



The water profile coincides with the yearly occupancy schedule. Dips in use occur during the summer and December/January; these are the periods when occupancy is lowest (summer

break and Christmas break). The baseload consumption accounts for consistent loads present through the year, such as plumbing fixture use (there is always a minimum number of occupants throughout the year, including full time staff), cleaning, and cooking.

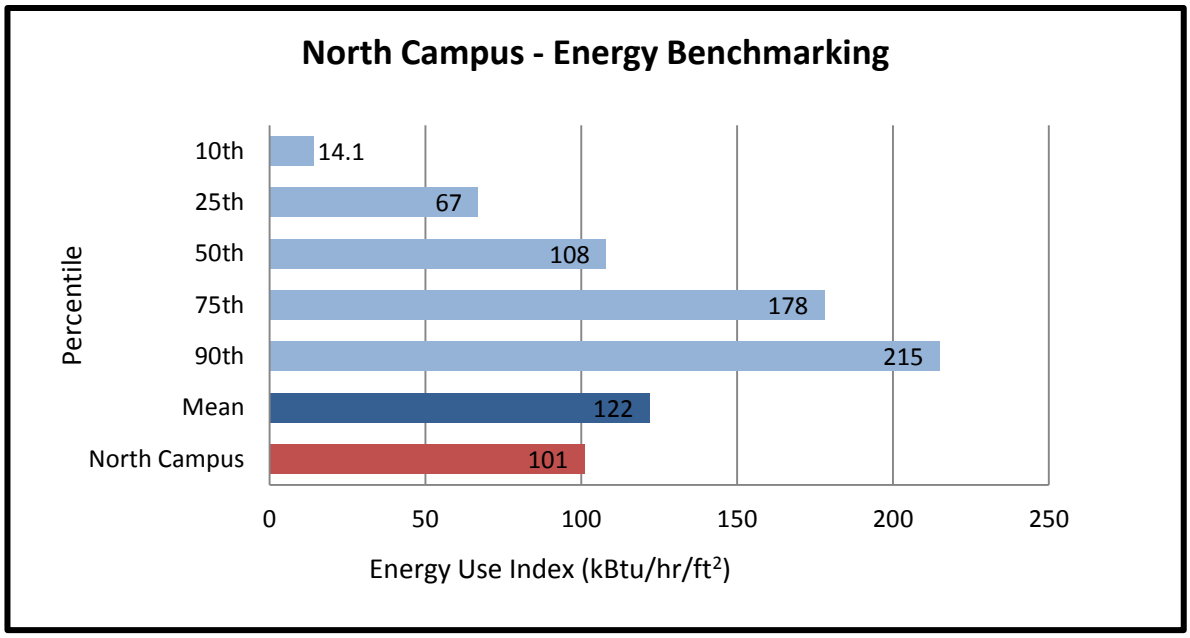
Benchmarking

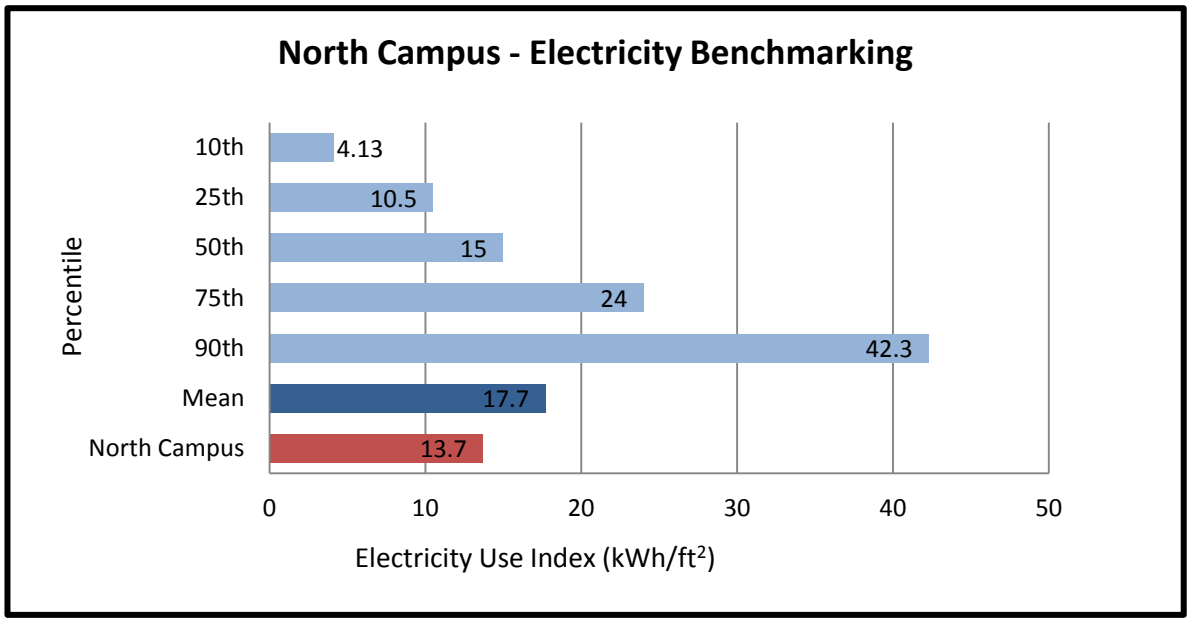
Energy use indices provide a way to compare and evaluate the building's energy consumption to buildings of the same typology. Two indices were calculated: the energy use index and the electricity use index. The Energy Use Index (EUI) expresses the campus' total energy consumption (electricity and natural gas) per square foot of building space. The Electricity Use Index expresses the campus' total electricity consumption per square foot of building space.

As there isn't sufficient measurement and monitoring in place to evaluate the campus on a building by building basis, the indices for the whole campus have been calculated.

Building	Floor Area (m^2)	Electricity 3 year avg. (kWh)	Gas (m^3)	Total (kBtu)	EUI (kBtu/yr/ft2)
North Campus	1,486,709	21,637,445	2,351,495	159,197,559	101

ASHRAE has published the Energy Use and Electricity Indices based on building use (2011 ASHRAE Handbook- HVAC Applications), which includes a 'college/university' category. The following graphs show Humber's North Campus Energy and Electricity indices, as compared to the ASHRAE benchmarking standards.





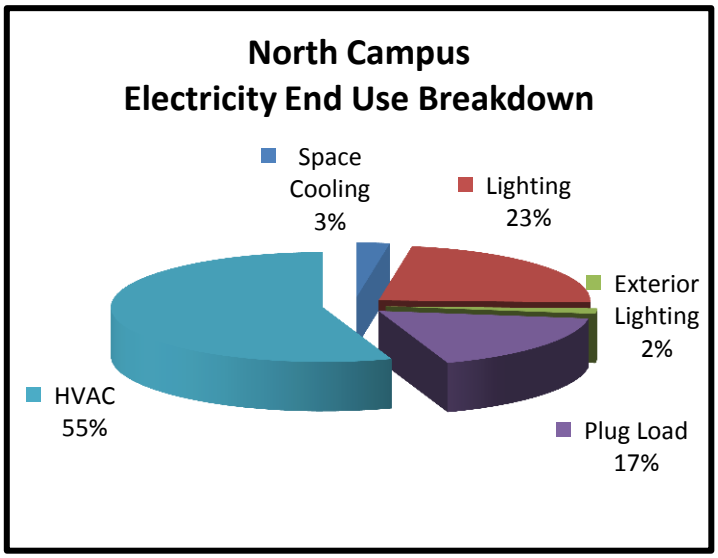
For both indices, North's consumption is about twenty percent lower than the mean. The campus falls within the 50th percentile range, indicating that its energy consumption relative to floor space is about average for similar post-secondary institution building types.

Energy Use by End-Use

Electricity End Use Breakdown

The major electrical end uses at North Campus are space cooling, lighting, plug loads, and heating, ventilation, and air conditioning (HVAC) systems. The HVAC end use includes the ventilation load from the air handling units, exhaust fans, roof top units and fan coils, as well as the pump load.

To calculate the amount of electricity consumed by the cooling load, May's electricity consumption was isolated, and used as the baseload value. The difference in consumption between the baseload value and the actual value for the summer months was concluded to be the cooling load. May was used to determine the baseload for two reasons: space cooling is negligible during this month, and it is the first month of the summer season, meaning the occupancy profile will be similar to that of the cooling season months.

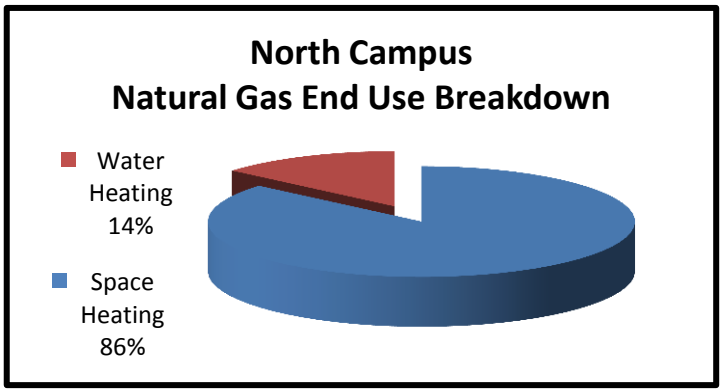


The mechanical systems load is significant, accounting for 55% of the total electricity load. Many of the ventilation and pump systems are over 45 years old, which could be one of the contributing factors to this end use. The plug and lighting loads account for 40% of the electricity. As mentioned, these end uses contribute to the baseload. By targeting these in the energy conservation measures, electricity decreases across the calendar year may be realized.

Natural Gas End Use Breakdown

Natural gas is used mainly for two applications, space heating and domestic hot water. While kitchen equipment also uses natural gas, national sources (Natural Resources Canada and U.S. Energy Information Administration) for energy consumption by end use, do not list kitchen equipment as a major end use for colleges.

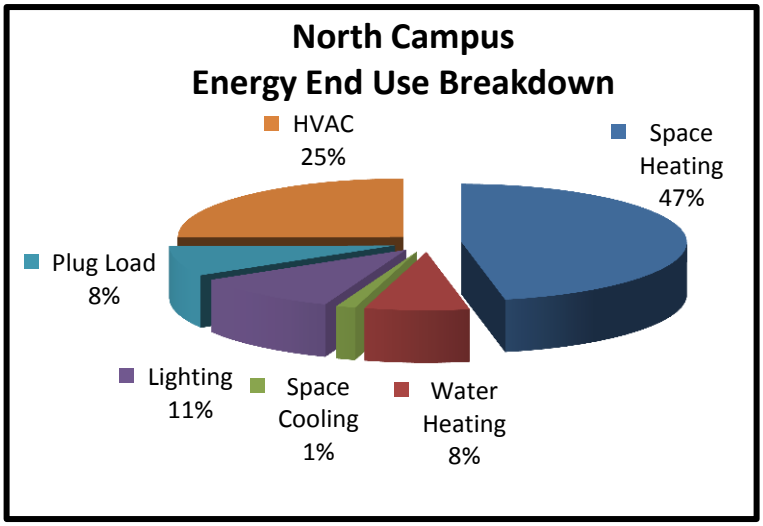
To calculate the amount of natural gas consumed by domestic water heating, September's natural gas consumption was isolated, and the average for calendar years 2010, 2011, and 2012, was used. September was isolated for two reasons; space heating is negligible during this month, and it is the start of the academic year, meaning full occupancy.



Space heating uses the majority of the total natural gas consumption, at 86%. This large space heating load is typical in climates such as Toronto's.

Energy End Use Breakdown

The energy end use breakdown combines the natural gas and electricity end uses to demonstrate the entire end use profile for North Campus. The largest end use is space heating, accounting for just under half of the total consumption. The mechanical load is significant, accounting for a quarter of the total energy consumption.



To realize maximized **cost savings,** the electricity end uses should be targeted. Unit for unit, electricity costs a significant amount more than natural gas. Shorter and more feasible payback periods for energy conservation measures will be those that reduce electricity consumption.

Lakeshore Campus

	Usage	Demand	Energy Cost
Electricity	7,944,251 kWh	17,391 kW	$575,599
Natural Gas	712,149 m^3	n/a	$101,688
Water	10,446,544 gal	n/a	$119,615

Energy Use and Cost for 2012

	Usage	Demand	Energy Cost
Electricity	8,157,205 kWh	19,281 kW	$589,897
Natural Gas	944,040 m^3	n/a	$141,798
Water	10,485,437 gal	n/a	$107,689

Energy Use and Cost for 2011

	Usage	Demand	Energy Cost
Electricity	7,557,096 kWh	17,352 kW	$548,992
Natural Gas	707,041 m^3	n/a	$123,090
Water	9,581,083 gal	n/a	$90,648

Energy Use and Cost for 2010

Consumption of electricity and natural gas was similar in years 2010 and 2012, with an increased consumption for both in 2011. Water consumption increased by nearly ten (10) percent from 2010 to 2011 as Building L came online; however, saw little variance between 2011 and 2012.

The energy cost for electricity held constant, with yearly variations of less than one (1) percent.

The price of water has steadily increased from 0.9 cents/gal in 2010, to 1.1 cents/gal in 2012. And remained 1.1 cents/gal in 2013.

Energy Breakdown by Utility

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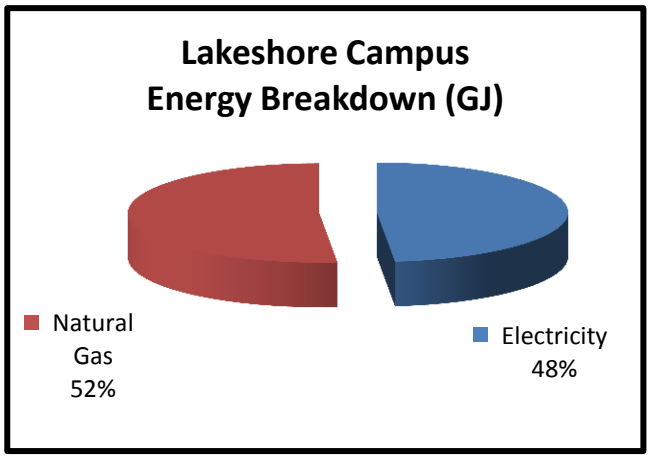

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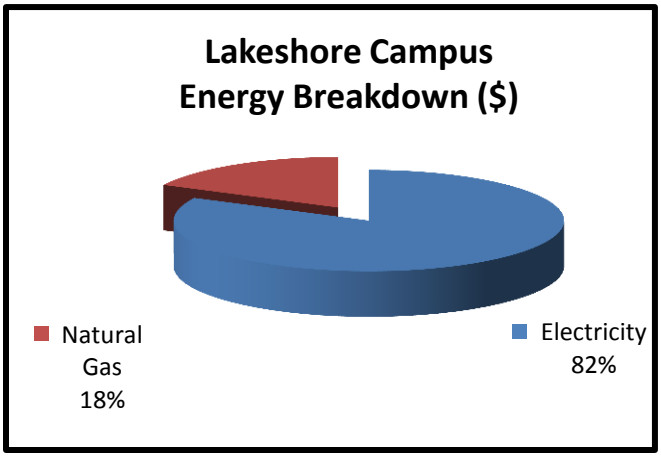

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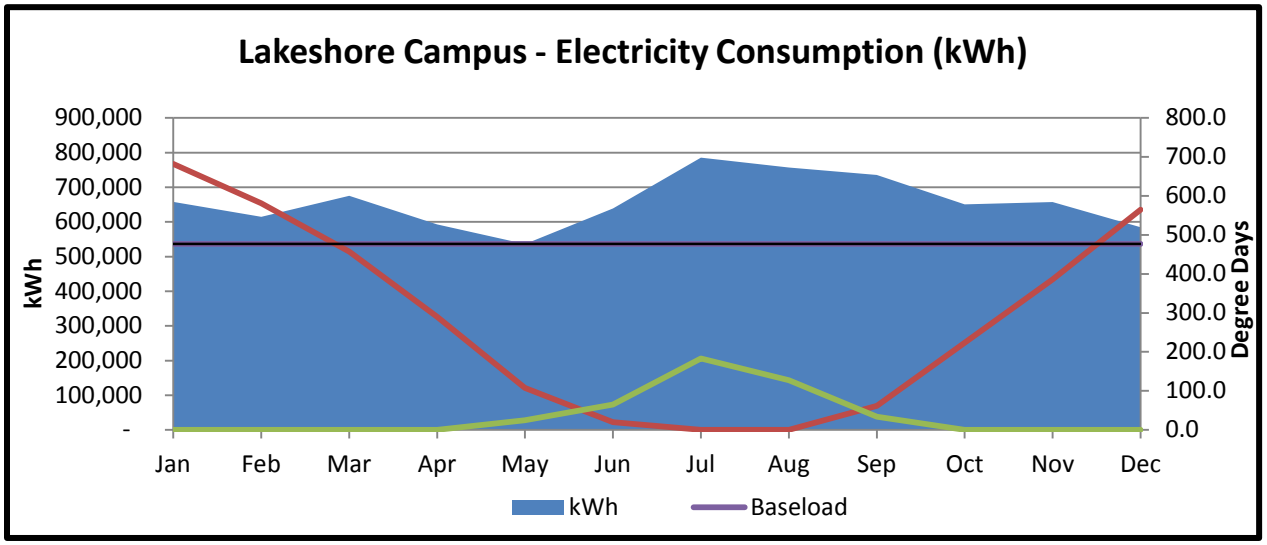
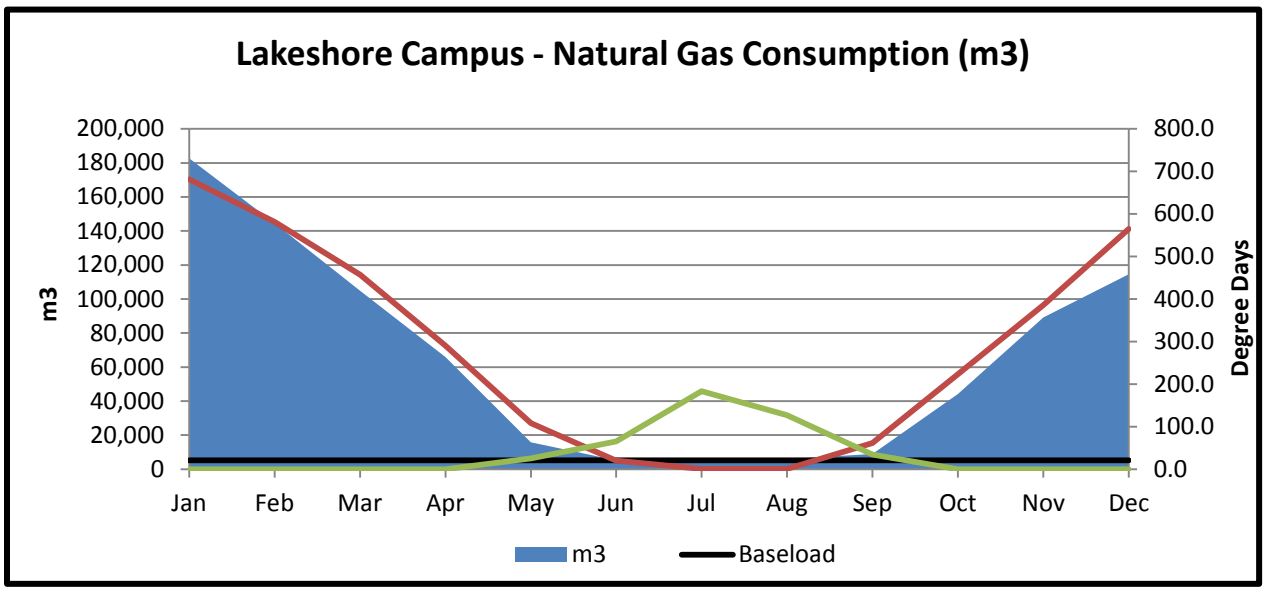
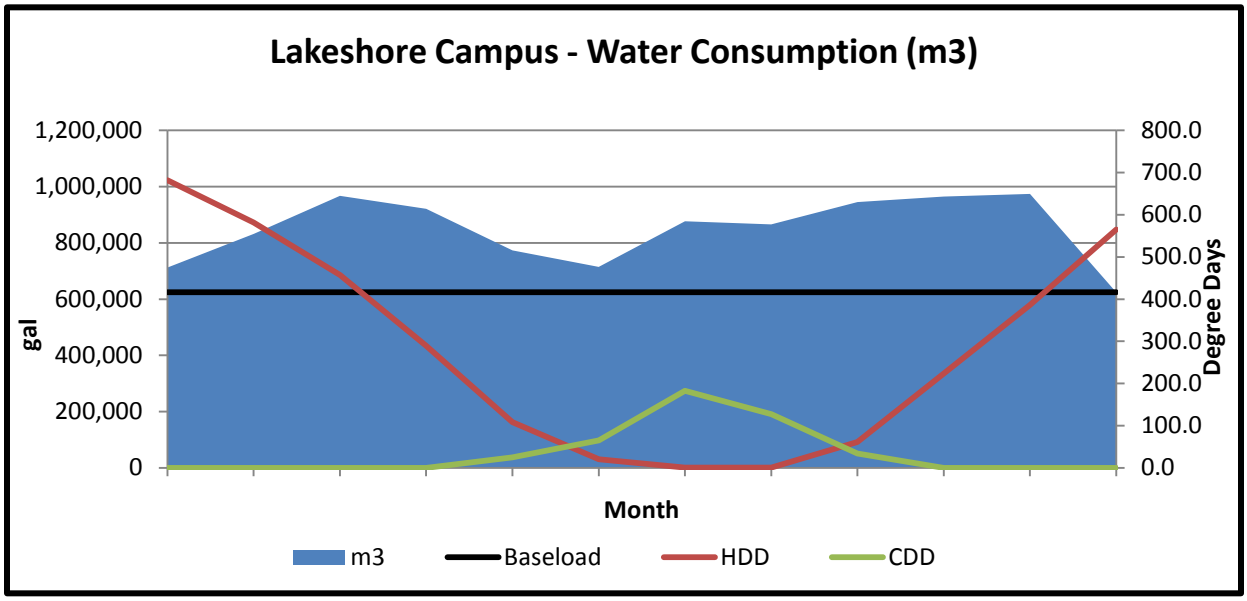


A typical commercial or residential annual electricity profile will peak in the summer months, coinciding with the cooling load. Contrarily, a typical college campus electricity profile will be the lowest in the summer months, due to decreased occupancy and use of the buildings. Lakeshore campus' profile shows peaks in the summer, fall, and March, with a large baseload throughout the year. The trend dips in December and February, which coincides with periods of decreased occupancy- Christmas break and Reading Week. The baseload consumption includes end uses such as lighting, plug loads and ventilation. The fact that the baseload does not decrease in the summer months, as it is expected to with the decreased occupancy, indicates that these systems (lighting, plug loads, ventilation) are not scaled back in the summer months because of some classes and office occupancy. This is an opportunity.



The natural gas profile coincides with the heating load. This is expected as natural gas boilers and rooftop units are the source for space heating. The small baseload during the summer months is attributed to natural gas domestic hot water heaters.



The water profile coincides with the yearly occupancy schedule. Dips in use occur during the summer and December/January; these are the periods when occupancy is lowest (summer break and Christmas break). The baseload consumption accounts for consistent loads present throughout the year, such as plumbing fixture use (there is always a minimum number of occupants, including full time staff), cleaning, and cooking.

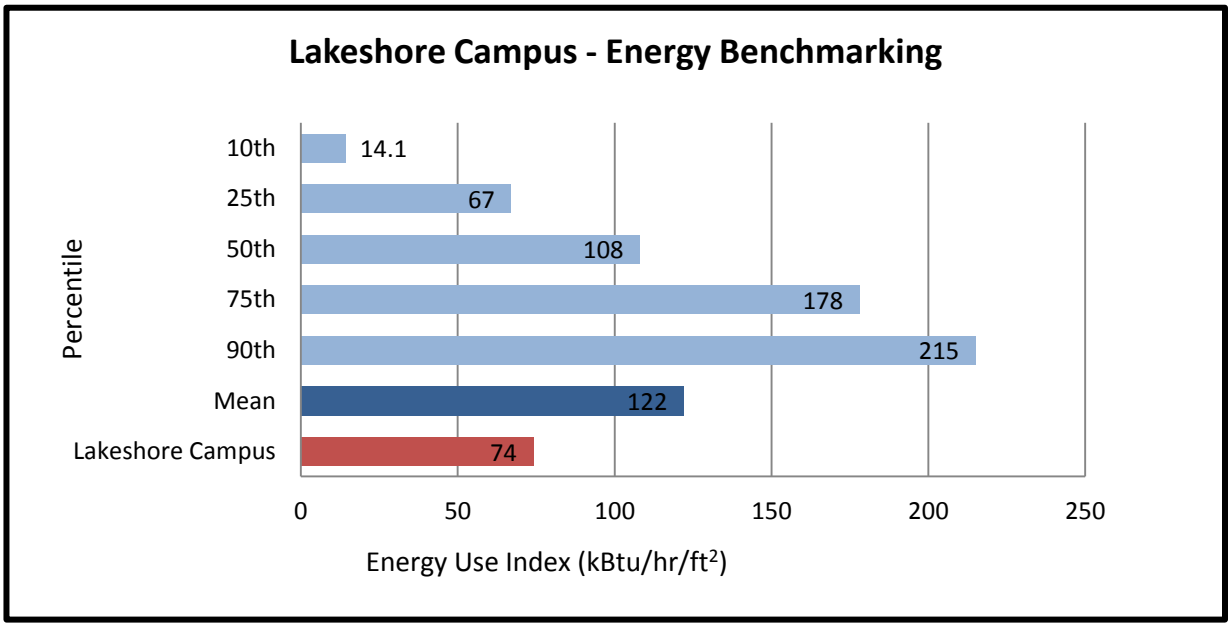
Benchmarking

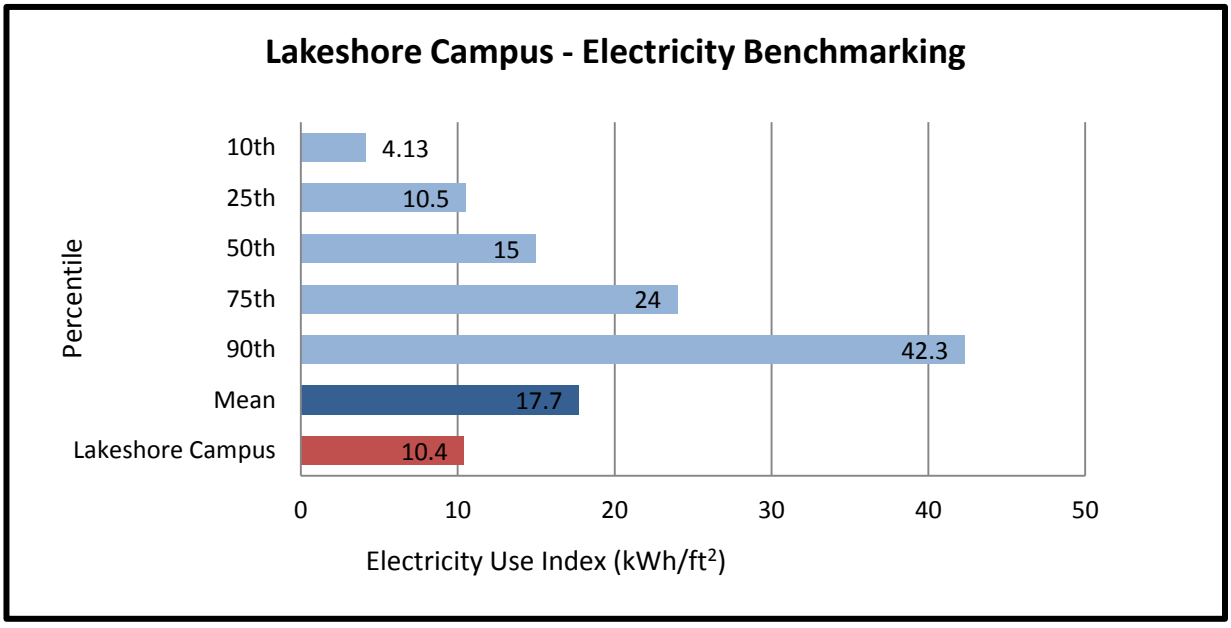
Energy use indices provide a way to compare and evaluate the building's energy consumption to buildings of the same typology. Two indices were calculated: the energy use index and the electricity use index. The Energy Use Index (EUI) expresses the campus' total energy consumption (electricity and natural gas) per square foot of building space. The Electricity Use Index expresses the campus' total electricity consumption per square foot of building space.

As there isn't sufficient measurement and monitoring in place to evaluate the campus on a building by building basis, the indices for the whole campus have been calculated.

Building	Floor Area (ft^2)	Electricity (kWh)	Gas (m^3)	Total (kBtu)	EUI (kBtu/yr/ft2)
Lakeshore Campus	754,542	7,886,184	787,743	55,506,066	74

ASHRAE has published the Energy Use and Electricity Indices based on building use (2011 ASHRAE Handbook- HVAC Applications), which includes a 'college/university' category. The following graphs show Lakeshore Campus' Energy and Electricity indices, as compared to the ASHRAE benchmarking standards.





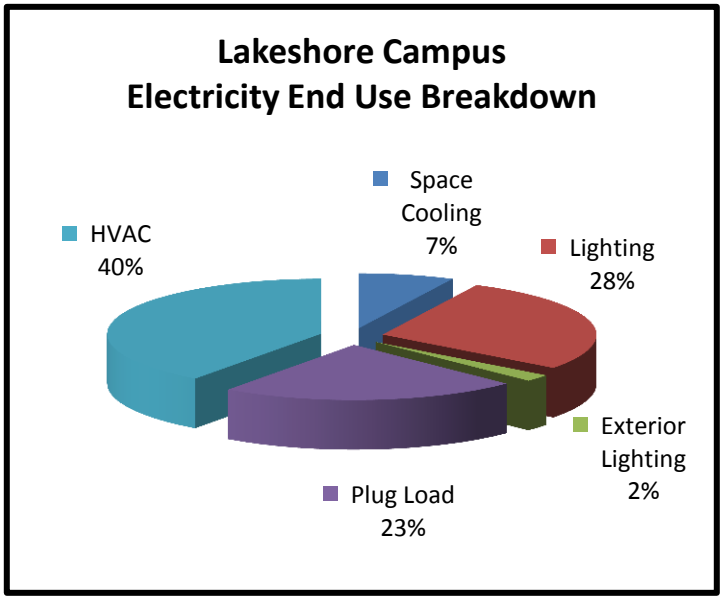
For both indices, Lakeshore's consumption is significantly lower than the mean. The campus falls with the 25th percentile range, indicating that its energy consumption per square foot is well below that of similar building types.

Energy Use by End-Use

Electricity End Use Breakdown

The major electrical end uses at Lakeshore Campus are space cooling, lighting, plug loads, and HVAC. The HVAC end use includes the ventilation load from the air handling units, exhaust fans, roof top units and fan coils, as well as the pump load.

To isolate the amount of electricity consumed by the cooling load, May's electricity consumption was isolated, and used as the baseload value. The difference in consumption between the baseload value and the actual value for the summer months was concluded to be the cooling load. May was used to determine the baseload for two reasons; space cooling is negligible during this month, and it is the first month of the summer season, meaning the occupancy profile will be similar to that of the cooling season months.



The plug load and lighting loads are significant, accounting for 23% and 28% of total electricity consumption. Approximately 40% of the plug load is attributed to the student residence. Reasons for this include the kitchen appliances found in each suite, including a large fridge and

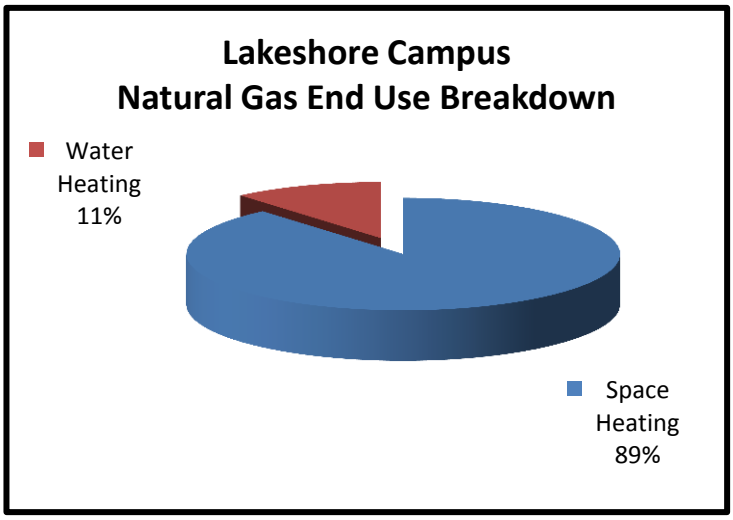
microwave, and computers (assumed one per student). Together, the plug and lighting loads of the entire campus account for 51% of the electricity. As mentioned, these end uses contribute to the baseload; by targeting these in the energy conservation measures, electricity consumption decreases across the calendar year may be realized.

Excluding Building A, the mechanical systems at Lakeshore Campus for the most part are newer and more efficient than those at North Campus; this is reflected in the decreased HVAC load, as compared to that of North.

Natural Gas End Use Breakdown

Natural gas is used mainly for two applications, space heating and domestic hot water heating. While kitchen equipment also uses natural gas, national sources (Natural Resources Canada and U.S. Energy Information Administration) for energy consumption by end use, do not list kitchen equipment as a major end use. As there is not sufficient monitoring on natural gas consumption of the kitchen equipment, it will be assumed negligible for the purposes of this analysis.

To calculate the amount of natural gas consumed by domestic water heating, September's natural gas consumption was isolated, and the average for calendar years 2010, 2011, and 2012, was used. September was isolated for two reasons; space heating is negligible during this month, and it is the start of the academic year, meaning full occupancy.

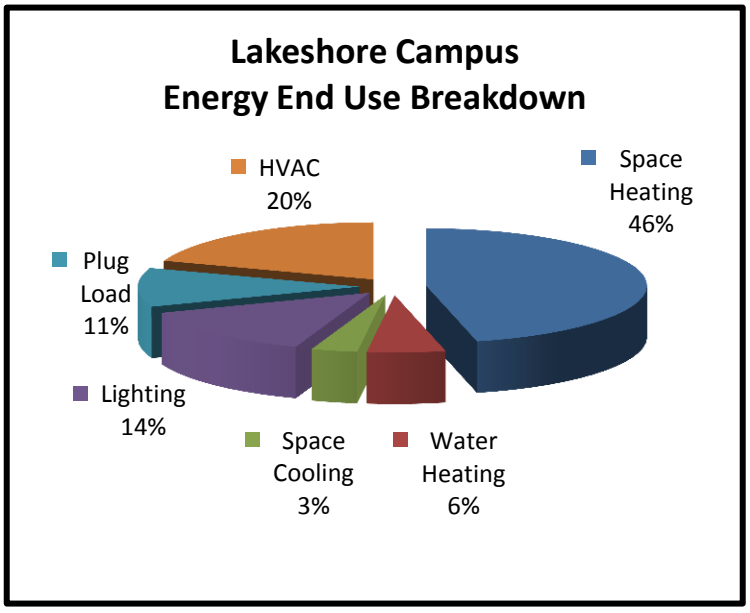


Space heating uses the majority of the total natural gas consumption, at 89%. This large space heating load is typical in climates such as Toronto's. The water heating load accounts for less

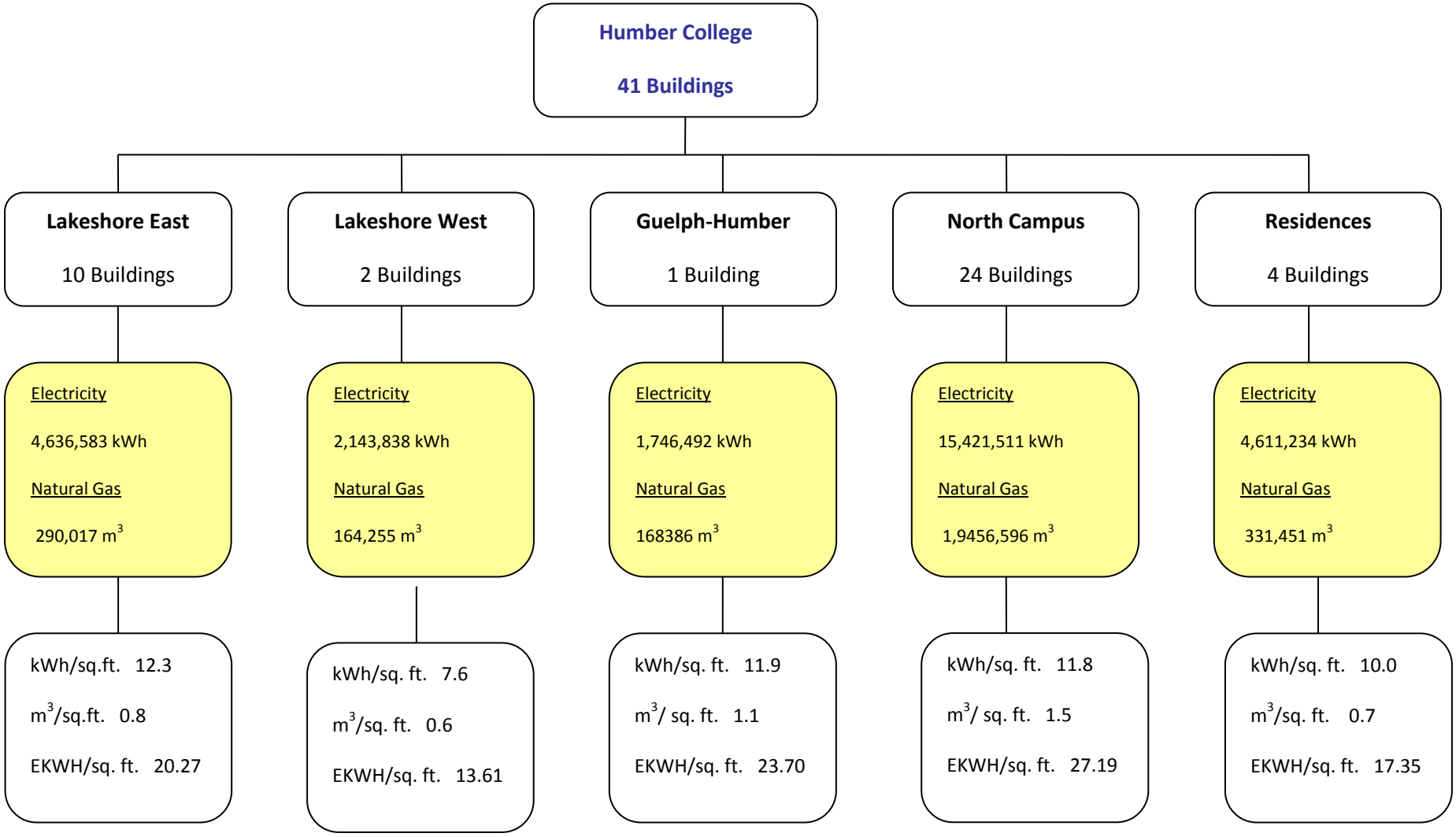
(percentage) wise of the total energy use on Lakeshore Campus than North Campus. This is in line with the fact that many of the buildings at Lakeshore use electric water heaters.

Energy End Use Breakdown

The energy end use breakdown combines the natural gas and electricity end uses to demonstrate the entire end use profile for Lakeshore Campus. The largest end use is space heating, accounted for just under half of the total consumption. The mechanical load is significant, accounting for a quarter of the total energy consumption.



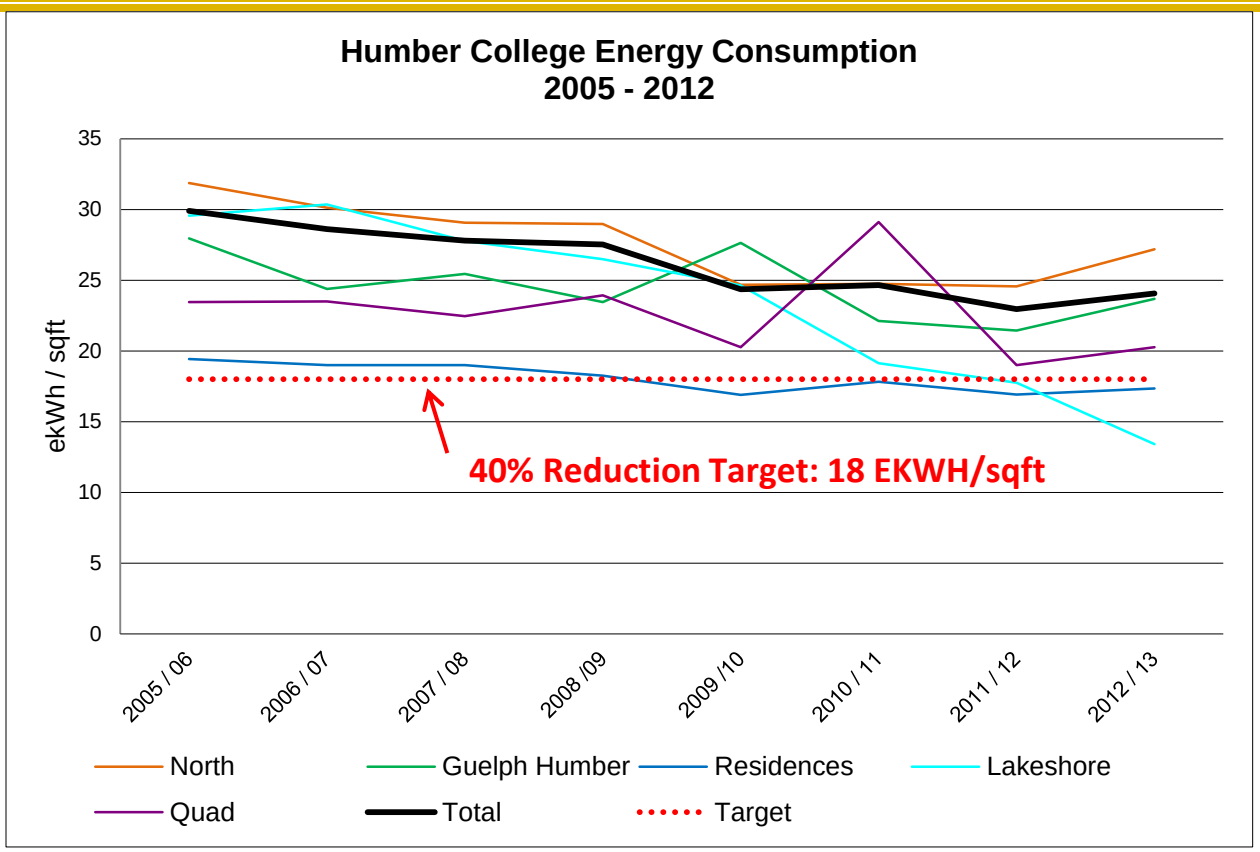
To realize maximized **Cost Savings,** the electricity end uses should be targeted. Unit for unit, electricity costs a significant amount more than natural gas. Shorter and more feasible payback periods for energy conservation measures will be those that reduce electricity consumption.


Humber College
41 Buildings
Lakeshore East
10 Buildings
Lakeshore West
2 Buildings
Guelph-Humber
1 Building
North Campus
24 Buildings
Residences
4 Buildings
Electricity
4,636,583 kWh
Natural Gas
290,017 m3
Electricity
2,143,838 kWh
Natural Gas
164,255 m3
Electricity
1,746,492 kWh
Natural Gas
168386 m3
Electricity
15,421,511 kWh
Natural Gas
1,9456,596 m3
Electricity
4,611,234 kWh
Natural Gas
331,451 m3
kWh/sq.ft. 12.3
m3/sq.ft. 0.8
EKWH/sq. ft. 20.27
kWh/sq. ft. 7.6
m3/sq. ft. 0.6
EKWH/sq. ft. 13.61
kWh/sq. ft. 11.9
m3/ sq. ft. 1.1
EKWH/sq. ft. 23.70
kWh/sq. ft. 11.8
m3/ sq. ft. 1.5
EKWH/sq. ft. 27.19
kWh/sq. ft. 10.0
m3/sq. ft. 0.7
EKWH/sq. ft. 17.35

Action Plan

Targets

Energy	Reduce total energy use by 40% by 2018/19 using 2005/6 baseline. 50% total energy use reduction by 2023/24. Metric: EKWH/sq. ft.
Greenhouse Gas Emissions	Reduce Scope 1 + 2 CO2 emissions intensity by 40% by 2018/9 using 2005 /6 baseline. 50% reduction by 2023/24. Metric: CO2 e/sq. ft.
Water	Reduce total water use per full time student equivalent (FTE) by 40% by 2018/19 using 2005/6 baseline. 50% reduction by 2023/24. Metric: Water use m^3/FTE



Five-year Action Plan

From January to March 2014 a complete energy audit was conducted across Humber's North and Lakeshore Campuses by Integral Group. The energy audit comprised of a detailed utility bill analysis, a walk-through of all spaces, and an evaluation of each potential energy and water saving initiative. The initiatives have been grouped into three categories:

Process Improvement

- Adopt specific energy use and cost metrics and utilize comparison benchmarking to set performance targets for each facility. Establish a process and schedule whereby the Managers, Maintenance and Operations regularly review their Energy Report Cards, and initiate action as needed.
  Assigned to: Associate Director, Facilities management Completion: December 2016

- Tie load profiling data from power meters into BAS for load shedding.
  Assigned to: Completion: March 2016

- Maintain market knowledge for better procurement decisions.
  Assigned to: Associate Director / Director, Facilities Management

- Ensure energy efficiency standards are incorporated into design of new facilities, and renovation of existing.
  Assigned to: Director, Facilities Management *Completion: Ongoing*

- Review preliminary designs for renovations and new construction and provide input for energy efficiency.
  Assigned to: Associate Director, Maintenance *Completion: Ongoing*

- Include energy efficiency in building envelope improvements – roofing, windows etc.
  Assigned to: Associate Director, Maintenance *Completion: Ongoing*

Program Implementation

- Continue development of facility wide submetering program to better understand where and how energy is used. Leverage previous investment and learn to take advantage of all the features of the system. Lakeshore C, D and E, North Residence R, A, LX,
  Enhanced submetering may save 2% of energy use per year
  Assigned to: Managers of Maintenance *Completion Dec 2016*

- New facilities will be put through a commissioning program with comprehensive testing to verify that systems and equipment perform to specifications.
  Assigned to: Associate Director *Completion: Ongoing*

- Implement a retro-commissioning program for existing buildings.
  Assume a rule of thumb on retro commissioning is 10% energy savings
  Potential savings: $350,000/year
  Assigned to: Associate Director *Completion: December 2018*

- Implement a building envelope performance program. By air sealing the building envelope less air needs to be conditioned, resulting in energy savings. Assume a rule of thumb 5% energy savings.
  Potential savings: $40,000/year
  Assigned to: Associate Director *Completion: December 2018*

- Establish ongoing "energy awareness" programs to promote a sense of responsibility and aligned action among all Humber students, faculty, staff and administrators. Investigate reflecting responsibility for controlling energy usage in job descriptions of accountable personnel.
  Potential savings: 3% of total energy costs per year.
  Assigned to: Sustainability Manager *Completion: Ongoing*

Projects

Water efficiency

- Investigate new water-efficient toilets that reduce water use from the current 6L per flush down to 4.8L or even 3L.
  Potential savings: $50,000/year
  18 million liters of water/year

- Investigate water-efficient urinals. Existing urinals use 3.8L per flush, new technology uses 0.5L per flush. Conduct a pilot project to adjust current flush valve down to 0.5L, if it doesn't work investigate changing the china.
  Potential savings: $32,000/year
  11 million liters of water/year

- Upgrade student Residence showerheads. Convert from existing 2.5 gallon per minute to 1.5 gallon per minute
  Potential savings: $33,000 / year
  11.7 million litres of water/year

- Replace water cooled equipment with DX units. Lakeshore Bell room, North LB
  Potential savings: $30,000 / year
  10 million liters of water/year

Lighting upgrades

- Lakeshore Campus potlight retrofit project. Replace existing 56W compact fluorescent potlights with 13W LED technology. Buildings C, D, E, F, H, I and J
  Potential savings: $10,900 energy + $10,000 maintenance = $20,900 / year
  110,000 kWh/year

- North Campus potlight retrofit project to LED
  Potential savings: $20,000 energy + $20,000 maintenance = $40,000 / year
  225,000 kWh/year

- Carrier Drive building corridor lighting upgrade from metal halide to LED

Not yet scoped out

- Washroom and cove lighting redesign from fluorescent to LED technology
  Potential savings: $5,000 per year
  60,000 kWh / year

- North Campus stairwell lighting retrofit from compact fluorescent to LED technology
  Potential savings: $10,000 per year + maintenance savings

  110,000 kWh / year

- Parking lot retrofits to LED technology all campuses
  Potential savings: $9,300 energy = $10,000 maintenance
  110,000 kWh

- Lighting redesign of classrooms and labs all campuses
  Potential savings: 2,000,000 kWh / year

Plug load

- Implement a project to install "smart" power bars in all offices that will reduce phantom loads when offices are unoccupied.
  Potential savings: $2,100/year
  25,000 kWh/year
  3.6 year payback

HVAC systems

- Variable air volume retrofit North Campus Building L 93,000 sq. ft. from a constant volume system.
  Potential savings: $50,000 / year
  600,000 kWh / year

- Variable air volume retrofit North Campus Building J 62,000 sq. ft. from a constant volume system.
  Potential savings: $30,000 / year
  400,000 kWh / year

- Variable air volume retrofit North Campus Building K 80,000 sq. ft. from a constant volume system.
  Potential savings: $30,000 / year
  400,000 kWh / year

- Kitchen hoods to be upgraded to variable air volume at all campuses, minimum 5 hoods
- Upgrade pipe insulation Lakeshore
  Potential savings: $6,500 / year

Other

- Automatic voltage regulation from 620V to 600V (Legend Power)
  Potential savings: 1% of total energy use
  $30,000 / year
  310,000 kWh/yr

- Building envelope upgrades (doors, windows, air sealing)
  Potential savings: $30,000 / year
  183,000 m3 / year

- Demand Management Program for load shedding
  Potential savings: Reduced costs during peak periods through time of use rates

- Install solar film in Lakeshore campus Building M, Student Residence, south side to reduce solar heat gain in summer, lowering air conditioning requirement
  Potential savings: unknown savings at this time, improves comfort

Summary Table

Measure	Savings (kWh)	Savings (Litres)	Savings (m3)	Potential Savings
Water				
Toilets		18,000,000		$50,000
Urinals		11,000,000		$32,000
Res Showerheads		11,700,000		$33,000
Disconnect water cooling		10,000,000		$30,000
Energy				
Potlights Lakeshore	110,000			$20,900
Potlights North	225,000			$40,000
Carrier Dr corridor lighting				
Washroom coves	60,000			$5,000
Stairwells	110,000			$20,000
Lighting redesign	2,000,000			
Parking Lots	110,000			$19,300
Plugload	25,000			$2,100
Building envelope			183,852	$40,000
Bldg L VAV	600,000			$50,000
Bldg J VAV	400,000			$30,000
Bldg K VAV	400,000			$30,000
Solar film Bldg M				
Kitchen hoods to VAV				

Upgrade pipe insulation				$6,500
Retro commissioning	1,707,665			$250,000
Energy metering	620,000			$65,000
Energy awareness campaign	930,000			$90,000
Automatic voltage regulation	310,000			$30,000
Total	7,607,000	50,700,000	183,852	$841,700

Baseline 28,614,366 kWh

This translates into a 3.1 reduction in EKWH / sqft

Impact of new construction

As defined in the Sustainability Plan, all future new construction will be designed and built to at least LEED Silver standard. The energy model for the LRC building at the North Campus built to these standards predicts energy use of 13 EKWH / sq. ft. Compare this to our 2012 intensity of 24 EKWH / sq. ft.

Based on the following approved new construction:

LRC	280,000 sq. f.t
Bldg F expansion	35,000 sq. ft.
Welcome Centre Lakeshore	42,000 sq. ft.
Bldg G Lakeshore	16,000 sq. ft.
Athletics Lakeshore	24,000 sq. ft.
Total	397,000 sq. ft. = 16% increase in sq. ft.

This translates into a reduction of 2.5 EKWH / sq. ft.

Targets

Effect of Conservation	= 3.1 EWKH / sq. ft.
Effect of known new construction	= 2.5 EKWH / sq. ft.
Total	= 5.6 EKWH / sq. ft.

Implementation

Monitoring and measurement

We will set monitoring and measurement up to track successes. Metrics have been very carefully defined to be clear and measurable.

Resource implications

One of the main limiting factors to implementing this plan is time for project scoping, development, and management.

Deferred maintenance

Most of the energy projects listed in this plan are not stand alone projects, but are impacted in some way by deferred maintenance projects. By leveraging renovation projects and equipment

well beyond its rated life, energy efficiency projects with longer financial paybacks can be completed, creating true win-win situations.

Summary

Humber College has already made significant strides towards improving energy efficiency, but the utility bill analysis shows room for further opportunities.

An energy and water reduction target has been set of 40% reduction by 2018 / 19. The energy savings initiatives detailed in this plan have been carefully selected to be achievable over the next five years. Results will be tracked using well defined, clear metrics.

Energy saving initiatives have been identified totaling	3.1 EKWH / sq. ft.
New construction will reduce our average by	2.5 EKWH / sq. ft.

For a total reduction of 5.6 EKWH / sq. ft.from current consumption. When added to the 6 EKWH already achieved from the 2005 / 6 baseline, this would meet our target of 40% reduction from the 2005 / 6 baseline, and represents a 23% reduction within the five years of this plan.