



**THOMPSON
RIVERS
UNIVERSITY**

Energy Management Plan

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Introduction

Thompson Rivers University is committed to developing policies and best practices that support environmental stewardship and sustainability at the university's operations. Energy management is a continuous process of managing behavioural, organizational, and technical change to improve a buildings energy performance.

This document has been created as an implementation plan for Energy Conservation Measures (ECM) available on a campus-wide basis and in each of TRU's 23 buildings. These actions are identified and covered in detail in the 2018 SES Consulting ASHRAE Level 1 Energy Study Reports or the 2016 Stantec Building Energy Assessments (where indicated).

The total estimated savings identified for each building are attainable if all associated actions are implemented. These savings have been applied to the baseline numbers found in the SES or Stantec reports and are displayed as the natural gas and electricity targets.

Each ECM identifies the capital costs for completing the action, the simple payback period, and annual savings in cost, GJ's of natural gas use, kWh of electricity use, and greenhouse gases in tCO₂e. Should the status be approved, a person(s) of interest (POI) will be listed, as well as anticipated timelines for project initiation, installation, commissioning, etc.

Campus Totals

Cost	Annual Savings			
	\$	GJ	kWh	GHG
\$13,352,800	929,904	116,880	4,298,852	2,240

Notes:

- To meet BOMA requirements, an ASHRAE Level 1 Energy Assessment must be conducted on the building every five (5) years. and the Energy Management Plan must be reviewed and updated every three (3) years to capture the most up to date data, evaluate progress, and reassess goals and ECMs.
- In the case of BOMA Recertification, building managers are expected to demonstrate which ECMs listed in the previous Reduction Management Plan have been implemented since certification.

Campus Wide

Description	The following measures were deemed to be best analysed at the campus scale as they apply universally to a subset of buildings or the building stock in general.
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Campus Wide Conservation Opportunities

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Metering and Energy Monitoring Replace meters and connect them to a digital monitoring platform	\$25,000	2.7	\$9,400	400	61,900	20.6	90% Complete	Natalie Yao	Y
Air Gap Sealing Inspect and correct areas of infiltration on a regular basis	\$50,000	6.1	\$8,200	360	53,000	18.5	5 years	Norm Logan	Pending
Wifi Occupancy Sensing Use wifi infrastructure to enable and disable air handling units	\$100,000	4.6	\$21,700	1060	124,700	54.2	TBD	David Burkholder	Pending
Solar Photovoltaics For this project an approximate capacity of 1,500 kW can be installed	\$3,000,000	20.8	\$144,400		1,900,000	20.3	TBD	Natalie Yao	Pending
Load Shedding Employ a campus wide load shedding program to reduce demand peaks	\$80,000	4.1	\$19,700				Complete	Natalie Yao	Y
Notched Belt Replacement Switch v-type belt fans to notched belts to increase overall efficiency	\$10,000	1.9	\$5,300		69,400	0.7	20% completed. Reminder to be completed over 2 years	Tom O'Byrne	Y

Action

	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
House Attic Insulation Blow additional insulation into attics that are lacking. This will improve occupant comfort	\$16,000	29.1	\$550	40	1,600	2	5 years	Norm Logan	Pending
Exterior Lighting Replace halide fixtures with LED equivalents	\$40,000	3.2	\$12,600		166,400	1.8	90% complete	Gord Setka	Y
Solar Thermal Assumed 1,500 kW of solar thermal can be installed. Be sure to include a control recommissioning	\$4,000,000	19.2	\$208,500	17950		895.2		Natalie Yao	N

Totals

\$7,321,000 \$430,350 19,810 2,377,000 1,013

Recommended Best Practices

Scheduled Controls Recommissioning	Recommended every 3-5 years by Canmet ENERGY. TRU should create a list of buildings ranked by impact on overall energy consumption and prioritize recommissioning based on this potential.
Scheduled Air Balancing	It is recommended systems are balanced regularly in order to ensure that they are operating efficiently. At minimum, systems should be balanced every 10 years. From spot checks of documentation, it appears many of TRU's buildings are well past this deadline.
Integrate and Consolidate Digital Systems	Recommended TRU institute a method of integrating building control systems. It should be specified that different vendors must integrate with the top level of the system. Additionally, a standard should be written for the types of control sequences that must be applied when installing new systems, or upgrading existing ones.
Employ a Dedicated DDC Operator	Employing a dedicated DDC operator is a highly effective way to manage occupant comfort issues while continually improving energy efficiency.

Animal & Health Technology

Building Description	The Animal Health building is mostly comprised of classroom and lab facilities and also includes faculty offices. The building is home to the animal health technical program.				
Built In	2002	Number of Storeys	1	Sqft	12,702

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
34%	-21%	48%	47%	\$10,288.23



1,201
Natural Gas Target (GJ/ Yr)



204,134
Electricity Target (kWh/ Yr)

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Recommissioning To be completed every 3-5 years	\$20,000	3.8	\$5,300	400	8,800	20	3 Years	Tom O'Byrne	Pending
Electricity Commutated Motor Pump Retrofit Modulates the speed of the pump based on demand	\$4,000	11.1	\$360		4,700	0.1	5 Years	Gord Setka	Pending
Rooftop Unit Replacements Explore replacement of 8 ventilation units with a single high efficiency unit	\$70,000	15.2	\$4,600	710	-48,200	34.9	5 Years	Tom O'Byrne	Pending
Revise Zone Control Parameters* Provide a dedicated rooftop unit to serve the isolation room	\$74,500	8.8	\$9,011	901		45.1	5 Years	Tom O'Byrne	Pending

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Install Solar Photovoltaic System* Will offset a portion of the building electricity demand	\$98,100	4.7	\$21,009		219,000	5.7	TBD	Natalie Yao	Y
Install Solar Hot Water Heater* Will offset a portion of the building heating and DHM demand	\$62,700	60.3	\$1,040	104		5.2		Natalie Yao	N
									Y/N
									Y/N
									Y/N
									Y/N

Totals

\$329,300 \$41,320 2115 184,300 111

**Note: Further information for these actions can be found in the 2016 Stantec Reports*

Arts & Education

Building Description	The building is home to many Faculty of Arts classes and labs, as well as being home to teaching options like Early Childhood Education and Bachelor of Education (Elementary). There is a language lab, two computer labs, faculty and administrative offices.				
Built In	1991	Number of Storeys	3	Sqft	60,924

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
19%	3%	31%	30%	\$12,794.04

2,020

Natural Gas Target (GJ/ Yr)

745,261

Electricity Target (kWh/ Yr)

Action

	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Recommissioning To be completed every 3-5 years	\$31,000	3.4	\$9,000	690	16,000	34.6	3 Years	Tom O'Byrne	Y
Stairwell Heating Control Upgrade Integrate control of these units to the building automation system	\$5,000	7.8	\$640	60		3	TBD	Tom O'Byrne	Pending
Pump VFDs Install new VSDs on pumps	\$10,000	10.6	\$940		15,000	0.2	TBD	Gord Setka	Pending
DHW Heat Pumps Install a heat pump on an existing pump supply loop	\$12,000	5.2	\$2,300	230	5,100	11.4	TBD	Tom O'Byrne	Pending

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Replace "Bryan" Boilers with Condensing Boilers* Replace existing units with high efficiency condensing units	\$339,700	39.1	\$8,682	772		38.6	10 years	Tom O'Byrne	Y
Optimize Demand Control Ventilation and Install New Outdoor Air Dampers* Reduce ventilation rates in the building	\$34,300	6.3	\$5,444	772	26,143	39.3	3 years	Tom O'Byrne	Pending
Chiller/ Heat Pump Replacement* Retrofit existing units with more efficient units	\$270,000	55.7		60645	4,852	1.6	4 years	Tom O'Byrne	Pending
Install Premium Efficiency Pumps* Replace existing motors with premium efficiency alternatives	\$53,000	115	\$461		4,276	0.1	2 years	Tom O'Byrne	Pending
Replace Makeup Air Unit and Implement Heat Recovery* Existing unit should be replaced with a more efficient model	\$92,800	16.2	\$469	12974	5,726	23.8	8 Months	Tom O'Byrne	Y
Repair Vestibule Controls and Weather Proof External Doors* Resolve control issues and replace weather-stripping	\$19,000	37.5	\$510	45		2.3	4 Months	Dillon Alexan.	Y
Solar PV Installation* Will offset a portion of the buildings electricity demand	\$98,100	4.7	\$21,009		219,000	5.7	TBD	Natalie Yao	Pending

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Install Solar Hot Water Heater* Offset a portion of the buildings heating and domestic hot water demand from natural gas	\$97,980	94						Natalie Yao	N
									Y/N
									Y/N
									Y/N
									Y/N
Totals	\$964,900		\$49,455	76188	296,097	160.6			

*Note: Further information for these actions can be found in the 2016 Stantec Reports

Campus Activity Center

Building Description	Campus Activity Center (CAC). houses the student union, bookstore, classrooms, offices, a conference center, a pub, and a cafeteria.				
Built In	1992	Number of Storeys	3	Sqft	75,789

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
29%	22%	49%	45%	\$29,557.71



981
Natural Gas Target (GJ/ Yr)



1,021,367
Electricity Target (kWh/ Yr)

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Occupancy Counters Install occupancy counters and connect to HVAC system.	\$10,000	6.3	\$1,600	40	16,700	2.2	5 years	Gord Setka	Pending
Wifi Occupancy Sensing Install a Wi-Fi occupant density measurement device.	\$15,000	3.1	\$4,800	100	57,000	5.6	TBD	David Burkholder	Pending
Control Integration and Recommissioning Integrated these systems for interoperability.	\$100,000	6.5	\$15,300	330	176,800	18.3	3 Years	Tom O'Byrne	Y
Rooftop Unit Replacements Replace existing rooftop units with high efficiency reversible heat pumps & variable speed drives.	\$125,000	16.4	\$7,600	390	45,400	19.9	5 years	Tom O'Byrne	Pending

Totals

\$250,000 \$29,300 860 295,900 46

Clock Tower

Building Description	The clock tower is home to Alumni Theatre lecture hall, Journalism labs, TRU senior administration, TRU Research Innovation and Graduate Studies, Institutional Planning and Analysis, and the office of Advancement.				
Built In	1989	Number of Storeys	4	Sqft	32,023

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
35%	15%	51%	49%	\$9,286.64



Action

	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Recommissioning To be completed every 3-5 years	\$28,000	4.1	\$6,900	360	35,400	18.3	3 Years	Tom O'Byrne	Y
Connect DHW to BAS Connect for temperature and pump control	\$1,500	6.3	\$240		3,200		8 months	Tom O'Byrne	Y
Pneumatic Zone Control Upgrade Scheduled to be upgraded in 2017-18	\$7,100	10	\$710		4,400	1.5	2 years	Tom O'Byrne	Pending
ECM Pump Retrofit Install new EDM pumps to modulate the speed of the pump based on demand	\$4,000	21.1	\$190		2,500		1 year	Tom O'Byrne	Pending

Action

	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Rooftop Unit Replacement Replace with high-efficiency units that have heat pumps	\$15,000	15	\$1,000	200	-7,800	9.9	Complete	Tom O'Byrne	Y
Condensing Boiler Upgrade Upgrade boiler to a condensing unit, and update heating supply and return distributions	\$15,000	23.4	\$640	60		3	2 years	Tom O'Byrne	Pending
Heat Pump Heating Plan Upgrade Install an air source heat pump in the boiler room	\$40,000	18.2	\$2,200	400	-22,000	19.7	2 years	Tom O'Byrne	Y
Implement Demand and Control Ventilation for F-1 and 2* Reduces outdoor air supply	\$29,400	9.8	\$2,989	94	25,598	5.4	2 years	Tom O'Byrne	Pending
Install Premium Efficiency Motors* Replace existing motors with premium efficiency alternatives	\$63,500	44	\$1,461		10,554	0.3	5 years	Tom O'Byrne	Pending
Implement DDC Upgrade & Optimisation* Implement a new buildings control system to optimize system performance	\$329,500	140	\$2,350	93	17,743	5.1	7 years	Tom O'Byrne	Pending

Totals

\$533,000 \$18,680 1207 69,595 63.2

*Note: Further information for these actions can be found in the 2016 Stantec Reports

Culinary Arts

Building Description	This building is home to the culinary arts program, as well as administration areas, the Scratch Café and Market, kitchens, and dining areas.				
Built In	1970/ 1983	Number of Storeys	2	Sqft	20,010

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
34%	19%	41%	40%	\$22,411.51



1,986
Natural Gas Target (GJ/ Yr)



336,701
Electricity Target (kWh/ Yr)

Action

	Cost	Simple Return	Annual Savings			Timeline	POI	Status
			\$	GJ	kWh			
Controls Recommissioning To be completed every 3-5 years	\$39,000	3	\$12,900	690	64,800	35.1	Building to be replaced within 5 years Bryce Parks	N
BAS Upgrade for Meat Cutting RTU Connect rooftop unit serving the Meat Cutting area to the building automation system	\$4,000	8	\$500	30	2,700	1.5	Building to be replaced within 5 years Bryce Parks	N
Fan VSD Upgrade Install VSD on fans F-6 and F-13	\$8,000	6.2	\$1,300		16,500	0.2	Building to be replaced within 5 years Bryce Parks	N
ECM Pumps Install new ECM pumps to modulate the speed of the pump based on demand	\$4,000	21.1	\$190		2,500		Building to be replaced within 5 years Bryce Parks	N

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Commercial Kitchen DCV Install VSD on the kitchen fan with advanced commercial kitchen demand control ventilation	\$12,000	8	\$1,500	80	8,600	4.1	Building to be replaced within 5 years	Bryce Parks	N
Kitchen Ventilation Heat Recovery Install a specialized heat recovery system for the kitchen exhaust	\$15,000	6	\$2,500	210		10.5	Building to be replaced within 5 years	Bryce Parks	N
Air Sourced Heat Pump for DHW Install a DHW with integrated air source heat pump to recover heat from the air and reject it to the tank	\$7,000	3.5	\$2,000	370	-20,700	18.2	Building to be replaced within 5 years	Bryce Parks	N
Condensing Boiler Upgrades Install condensing boilers and reset heating water temperatures	\$32,000	15.2	\$2,100	180		9	Building to be replaced within 5 years	Bryce Parks	N
Heat Recovery Chiller Install a heat recovery chiller. During periods of heating and cooling, heat may be reclaimed	\$160,000	20.5	\$7,800	1300	-55,200	64.2	Building to be replaced within 5 years	Bryce Parks	N
Parallel to Series Heating Loop Retrofit plumbing and control to convert secondary loops to run in series	\$20,000	16.7	\$1,200	100		5	Building to be replaced within 5 years	Bryce Parks	N
Replace Air Handling and Makeup Air Units* Decommission current units and replace with high efficiency units	\$382,300	50.2	\$7,618	712	6,264	35.8	Building to be replaced within 5 years	Bryce Parks	N

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Replace Kitchen Exhaust System and Makeup Air Unit* Replace with a variable air system	\$172,400	193	\$892		11,151	0.3	Building to be replaced within 5 years	Bryce Parks	N
Install New Rooftop Unit* Replace with a high efficiency unit	\$54,000 [†]	30.8 [†]	\$1,756	34	11,055	2	Complete	Tom O'Byrne	Y
Implement Chiller Upgrade* Decommission old unit with new efficient unit	\$146,100	397.8	\$367		4,591	0.1	Building to be replaced within 5 years	Bryce Parks	N
Insulate Hot Water/ DHW Distribution Pipework* Insulate all pipes to reduce heat loss to the room	\$5,700	10.5	\$543	54		2.7	Building to be replaced within 5 years	Bryce Parks	N
Install Solar Photovoltaic System* Will offset a portion of the buildings electricity demand	\$98,100	4.7	\$21,009		219,000	5.7	Building to be replaced within 5 years	Bryce Parks	N

Totals

\$1,159,600 \$64,175 3760 271,261 194.4

† The Stantec Report lists conflicting numbers for this action. Please consult with Stantec to receive accurate values.

*Note: Further information for these actions are located in the 2016 Stantec Reports

Gymnasium

Building Description	The Gymnasium has a multi-use gym, change rooms, an exercise area, squash and handball courts (now used as storage), and offices. Following the opening of the Tournament Capital Centre in 2007, the Gymnasium now sees very little use. Facilities staff predict the building will be torn down within 10 years.				
Built In	1976	Number of Storeys		Sqft	39,837

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
14%	12%	29%	27%	\$5,178.81



370
Natural Gas Target (GJ/ Yr)



269,867
Electricity Target (kWh/ Yr)

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
AHU-3 Retrofit Convert constant volume mixing boxes to VAV mixing boxes; implement a VSD; implement controls upgrade	\$25,000	11.4	\$2,200	50	20,700	2.7	4 months	Tom O'Byrne	Y

Totals

\$25,000 \$2,200 50 20,700 2.7

House 1 - Faculty Association

Building Description	The Faculty Association contains a board room, offices, and a small kitchen.				
Built In	1945	Number of Storeys	2	Sqft	1,367

Total Estimated Savings*

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
49%	-33%	86%	83%	\$765.52



Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Upgrades Install a second thermostat on the second floor	\$1,500	11.5	\$130	10	200	0.5	7 months	Tom O'Byrne	Pending
Heat Pump Upgrade for AC Unit Replace existing unit with a reversible unit to supply heating and cooling	\$10,000	15.6	\$640	80	-4,600	3.9	3 years	Tom O'Byrne	Pending
									Y/N

Totals

\$11,500 \$770 90 -4,400 4.4

*Note: Energy monitoring is not available for this building. Usage is based on simulated consumption.

House 10- Horticulture

Building Description	The Horticulture center consists of two buildings connected on the ground floor. On the main level there is a classroom and lunchroom with a kitchen. There are offices on the second floor. There are three greenhouses, two of which are heated.				
Built In	1945	Number of Storeys	2	Sqft	8,117

Total Estimated Savings*

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
44%	-30%	61%	60%	\$6,574.77



429
Natural Gas Target (GJ/ Yr)



90,278
Electricity Target (kWh/ Yr)

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Upgrade Install thermostats on the second levels. Install occupancy sensors in the classroom and lunchroom	\$3,000	7.5	\$400	20	2,100	1	3 years	Tom O'Byrne	Pending
Greenhouse Controls Upgrade Install programmable thermostats in greenhouses and set the fan to auto	\$3,000	2.1	\$1,400	90	3,900	4.5	3 years	Tom O'Byrne	Pending
Greenhouse Lighting Upgrade Retrofit lamps with TLED lamps	\$3,000	8.3	\$360		4,800	0.1	3 years	Gord Setka	Pending
Heat Pump Upgrades for Condensing Unit Replace existing unit with a reversible unit to provide heating and cooling	\$20,000	15.4	\$1,300	170	-8,900	8.4	3 years	Tom O'Byrne	Pending

*Note: Energy monitoring is not available for this building. Usage is based on simulated consumption.

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Heat Pump Upgrades for Greenhouse Furnaces Upgrade gas furnaces with reversible air sourced heat pumps	\$20,000	6.5	\$3,100	410	-22,900	20.2	3 years	Tom O'Byrne	Pending
									Y/N
									Y/N
									Y/N
									Y/N
Totals	\$49,000		\$6,560	690	-21,000	34.2			

House 4- Sustainability

Building Description	House 4 is home to the sustainability offices.				
Built In	1945	Number of Storeys	2	Sqft	1,442

Total Estimated Savings*

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
49%	-36%	86%	83%	\$764.26



Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Upgrade Install a second thermostat on the second floor	\$1,500	11.5	\$130	10	200	0.5	TBD	Natalie Yao	Pending
Heat Pump Upgrade for Condensing Unit Replace the existing unit with a reversible unit to supply heating and cooling	\$10,000	15.9	\$630	80	-4,700	3.9	TBD	Natalie Yao	Pending
									Y/N

Totals

\$11,500 \$760 90 -4,500 4.4

*Note: Energy monitoring is not available for this building. Usage is based on simulated consumption.

House 5- Aboriginal Cultural Center

Building Description	Also known as the Gathering House, this building houses offices, a small kitchen, computer labs, a common area, and a gathering area.				
Built In	1945/ 2009	Number of Storeys	2	Sqft	2,777

Total Estimated Savings*

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
24%	-11%	48%	45%	\$805.33



Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Upgrade Install a second thermostat on the second floor and add an occupancy sensor	\$2,000	10.5	\$190	10	700	0.5	Building to be demolished	Bryce Parks	Pending
Heat Pump Upgrade for AC Unit Replace existing unit with a reversible unit to supply heating and cooling	\$10,000	16.4	\$610	80	-4,600	3.9	Building to be demolished	Bryce Parks	Pending
									Y/N

Totals

\$12,000
\$800
90
-\$3,900
4.4

**Note: Energy monitoring is not available for this building. Usage is based on simulated consumption.*

House 6 & 7- Research Center

Building Description	The 2nd floor of the East and West sections of this building contain offices, and either a kitchen or washroom. The 1st floors contain offices, lab rooms, a meeting room, and a central workspace. The basements each contain mechanical rooms, lab spaces, and offices. There is a new annex which has offices, a kitchen, meeting room, washrooms, and mechanical room.				
Built In	1945	Number of Storeys	2	Sqft	6,886

Total Estimated Savings*

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
37%	4%	63%	60%	\$1,928.08



Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Control Upgrades Install two additional thermostats on the second floor of each section	\$3,000	9.7	\$310	30	200	1.5	3 years	Tom O'Byrne	Pending
DHW Piping Insulation Insulate all exposed DHW pipes, fittings, and valves	\$500	25	\$20		200		6 months	Ben Wiebe	Pending
New DDC System Upgrade to new digital controls and integrate with building automation systems	\$15,000	15.6	\$960	50	5,700	2.6	3 years	Tom O'Byrne	Pending
AC-1 Reversible Heat Pump Replace with high efficiency packaged heat pump, variable speed fans, and full DDC control	\$10,000	15.2	\$660	80	-3,900	3.9	2 years	Tom O'Byrne	Pending
Totals	\$28,500		\$1,950	160	2,200	8			

*Note: Gas monitoring is not available for this building. Usage is based on simulated consumption.

House 8- Radio Station

Building Description	The first floor of the house contains a meeting area, and offices. The upper level has two sealed recording studios. The basement contains the music library and mechanical systems.				
Built In	1945	Number of Storeys	2	Sqft	1,410

Total Estimated Savings*

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
54%	-13%	96%	92%	\$958.80



Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Upgrade Install a second thermostat in at least on of the studios	\$2,000	7.4	\$270	20	400	1	1 year	Tom O'Byrne	Y
HRV for Recording Studios Install a small HRV to supply the recording studios, and set the furnace fan to auto mode	\$5,000	16.7	\$300	30	100	1.5	1 year	Tom O'Byrne	Y
Heat Pump Upgrade for AC Unit Replace existing unit with a heat pump to supply heating and cooling	\$8,000	20.5	\$390	50	-2,900	2.5	1 year	Tom O'Byrne	Y

Totals

\$15,000 \$960 100 -2,400 5

*Note: Energy monitoring is not available for this building. Usage is based on simulated consumption.

House 9- Welcome Center

Building Description	The Welcome Center contains an open seating area, meeting room, computer room, offices, and a small kitchen.				
Built In	1945	Number of Storeys	2	Sqft	2,937

Total Estimated Savings*

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
56%	-32%	91%	88%	\$1,820.94



Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
LED Retrofit Replace all halogen lamps with LED equivalent	\$1,500	6.8	\$220		2,900		1 year	Gord Setka	Pending
Heat Pump Upgrades Replace two existing units with reversible units to supply heating and cooling	\$20,000	12.5	\$1,600	210	-11,200	10.4	TBD	Tom O'Byrne	Pending
									Y/N

Totals

\$21,500 \$1,820 210 -8,300 10.4

*Note: Energy monitoring is not available for this building. Usage is based on simulated consumption.

House of Learning

Building Description	The House of Learning contains an auditorium, open study area, study rooms, offices, a café, and a loading bay.				
Built In	2011	Number of Storeys	4	Sqft	74,179

Total Estimated Savings*

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
18%	7%	47%	41%	\$9,643.27



452
Natural Gas Target (GJ/ Yr)



667,017
Electricity Target (kWh/ Yr)

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Energy Harvesting CO₂ and Temperature Sensors Replace sensors with energy harvesting sensors and recommission	\$10,000	5.3	\$1,900	80		4	5 years	Tom O'Byrne	Pending
Bay Door Heating Lockout Install bay door sensors to lock out space heating when open	\$1,000	10	\$100	10		0.5	5 years	Tom O'Byrne	Pending
Pump VSD Upgrades Install new VSD or ECM pumps to modulate speed based on demand	\$41,000	10.8	\$3,800		49,600	0.5	5 years	Tom O'Byrne	Pending
Active Heat Recovery Upgrade Install reversible heat recovery heat pumps	\$20,000	18.2	\$1,100	170	-10,000	8.4	5 years	Tom O'Byrne	Pending

*Note: Gas monitoring is not available for this building. Usage is based on simulated consumption.

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Tim Hortons Fan Coil Replacing Re-pipe the fan coil to be exclusively served by Heat Pump 3	\$10,000	8.3	\$1,200	180	-10,500	8.9	3 years	Tom O'Byrne	Pending
Integrate Lighting Control to BAS Integrate lighting control system with the buildings automation systems	\$5,000	3.1	\$1,600		21,500	0.2	5 years	Gord Setka	Pending
									Y/N
									Y/N
									Y/N

Totals

\$87,000 \$9,700 440 50,600 22.5

Human Resources

Building Description	This building contains the human resources offices, the safety management offices, media services, and REACH offices. There is also an open workspace, washrooms, and a small staff kitchen.				
Built In	1972	Number of Storeys	1	Sqft	5,683

Total Estimated Savings*

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
52%	-20%	79%	76%	\$3,580.29



Action

	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Recommissioning Integrate controllable equipment to building automation system. Recommission every 3-5 years	\$10,000	6.3	\$1,600	120	2,400	6	3 years	Tom O'Byrne	Pending
Hot Water Piping Insulation Insulate all exposed boiler and DHW pipes in the mechanical room	\$500	7.1	\$70	10		0.5	1 year	Ben Wiebe	Y
RTU Upgrade Install high efficiency reversible heat pumps and variable speed fans	\$2,500	13.2 [†]	\$1,900	250	-12,200	12.3	3 years	TBD	Pending

Totals

\$13,000 \$3,570 380 -9,800 18.8

*Notes: Energy monitoring is not available for this building. Usage is based on simulated consumption.

†Payback is based on the incremental cost of a high efficiency upgrade.

International Building

Building Description	The first three floors of this building house classrooms and offices, with a small observatory on the fourth floor. At the entrance there is an atrium type foyer, which serves as a general seating area.				
Built In	2005	Number of Storeys	4	Sqft	49,288

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
17%	12%	29%	27%	\$10,843.36



Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Recommissioning To be completed every 3-5 years	\$31,000	5.1	\$6,100	160	55,200	8.6	3 years	Tom O'Byrne	Pending
AHU 3 VSD Install VSDs on the supply fan motor. Apply a dynamic supply air pressure reset program	\$3,400	9.7	\$350		4,600		TBD	Tom O'Byrne	Pending
Small Condensing Boiler Addition Replace oversized boilers with a small unit	\$30,000	16.7	\$1,800	150		7.5	TBD	Tom O'Byrne	Pending

Totals

\$64,400 \$8,250 310 59,800 16.1

Library

Building Description	The library houses various types of study areas and offices.				
Built In	1975	Number of Storeys	2	Sqft	35,263

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
42%	13%	65%	62%	\$10,226.27



678

Natural Gas Target (GJ/ Yr)



192,608

Electricity Target (kWh/ Yr)

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Recommissioning To be completed every 3-5 years	\$16,000	4	\$4,000	260	13,200	13.1	3 Years	Tom O'Byrne	Pending
Wifi Occupancy Sensors Use a wifi sensory to determine whether spaces are occupied. Turn off equipment in unoccupied areas	\$15,000	6.5	\$2,300	120	10,700	6.1	TBD	David Burkholder	Pending
RTU Replacement Replace existing unit with high efficiency heat pumps and VSD controlled fans	\$50,000	16.7	\$3,000	320	-5,000	15.9	5 years	Tom O'Byrne	Pending
DHW Air-Sourced Heat Pumps Install a DHW with integrated air source heat pump	\$10,000	10.4	\$960		12,600	0.1	3 years	Tom O'Byrne	Pending

Totals \$91,000 \$10,260 700 31,500 35.2

Materials Distribution Center

Building Description	The original building houses the facilities offices, a warehouse, and a shipping area. Shipping and receiving offices are located in the warehouse. The addition houses carpentry, mechanical/ electrical workshop spaces, and some offices.				
Built In	2006/2013	Number of Storeys		Sqft	21,431

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
35%	-8%	46%	45%	\$17,787.73



Action

	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Recommissioning To be completed every 3-5 years	\$28,000	3	\$9,200	770	3,500	38.4	3 years	Tom O'Byrne	Pending
Connect DHW to BAS Connect DHW to BAS for temperature and pump control. Schedule pumps off at night	\$1,000	5.9	\$170		2,300		9 Months	Tom O'Byrne	Pending
TLED Upgrade of Warehouse Replace all linear fluorescents with TLEDs	\$9,000	10.2	\$880		12,500	0.1	3 years	Gord Setka	Pending
Enclosures for Warehouse Offices Build a roof and walls around the offices to retain heat while materials pass through	\$20,000	5.9	\$3,400	290	300	14.5	5 years	Tom O'Byrne	Pending

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Reversible Heat Pumps for AHU Replace unit with a reversible heat pump to supply heating and cooling	\$20,000	4.8	\$4,200	630		31	TBD	Tom O'Byrne	Pending
									Y/N
									Y/N
									Y/N
									Y/N
Totals	\$78,000		\$17,850	1690	18,600	84			

Old Main

Building Description	The building is divided into three blocks. Block A houses the law department, classrooms and offices. Block B houses classrooms and offices. Block C houses art classrooms, food court, and a theatre.				
Built In	1970/ 2014	Number of Storeys	4/2/1	Sqft	270,948

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
5%	-2%	13%	12%	\$8,128.44



Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Theatre Occupancy Counters Install occupancy sensors for control of HVAC terminal equipment	\$6,000	3.5	\$1,700	150		7.5	5 Months	Gord Setka	Y
Air Gap Sealing Seal leaks with weather stripping, caulking, roof and wall intersection sealing, and soffit sealing	\$5,000	3.8	\$1,300	50	10,200	2.6	TBD	Norm Logan	Pending
Rooftop Unit Replacement Replace units with high efficiency reversible heat pumps	\$75,000 [†]	13.6	\$5,500	860	-60,000	42.2	5 Years	Tom O'Byrne	Pending

Totals

\$86,000 \$8,500 1060 -49,800 52.3

[†]Note: the cost for this measure is only for the incremental cost for high efficiency units.

BC Center for Open Learning

Building Description	This building houses a data center on the first floor, and offices and common staff kitchen spaces on each level.				
Built In	2007	Number of Storeys	4	Sqft	41,301

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
7%	8%	41%	26%	\$8,673.21



Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Recommissioning To be completed every 3-5 years	\$25,000	5.4	\$4,600	30	55,000	2.1	3 years	Tom O'Byrne	Pending
Heat Pump Loops VFDs Install new VSD to modulate the speed of the pump based on demand	\$6,000	7.5	\$800		10,500	0.1	3 years	Tom O'Byrne	Pending
Water Source Heat Pump for DHW Replace gas heater with a water source DHW heat pump	\$5,000	12.2	\$410	50	-2,800	2.5	TBD	Ben Wiebe	Pending
Totals	\$36,000		\$5,810	80	62,700	4.7			

Sciences & Health Sciences

Building Description	The building incorporates two computer labs, study spaces, lecture and lab classrooms, lecture halls, faculty offices, research labs, and a coffee/ snack shop.				
Built In	1980	Number of Storeys	3	Sqft	111,137

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
22%	6%	40%	38%	\$23,338.77



2,336

Natural Gas Target (GJ/ Yr)



1,077,948

Electricity Target (kWh/ Yr)

Action

	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Recommissioning To be completed every 3-5 years	\$47,000	3	\$15,800	850	78,400	43.2	3 Years	Tom O'Byrne	Pending
DHW Heat Pump Install a water source DHW heat pump and integrate into the existing heat pump loop	\$20,000	9.1	\$2,200	280	4,300	13.9	2 years	Tom O'Byrne	Y
Heating Water- Parallel to Series Retrofit plumbing secondary loops to run in series. Eliminate pipe leakage	\$30,000	11.5	\$2,600	220		11	2 years	Ben Wiebe	Y
FH Exhaust Upgrade with Heat Recovery Redesign exhaust system to combine into a single common exhaust	\$230,000	36.5	\$6,300	490	7,900	24.5	TBD	Tom O'Byrne	Y

Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Replace Air Handling and Makeup Air Units* Replace units with high efficiency units	\$543,000	40	\$13,761	463	106,916	26	TBD	Tom O'Byrne	Pending
Implement Exhaust Heat Recovery* Replace existing exhaust fans with common exhaust fan/plenum. Install a runaround coil	\$190,700	48	\$3,953	326		16.3	TBD	Tom O'Byrne	Y
Replace Fluid Coolers and Heat Pumps* Replace existing cooling system with more efficient units	\$426,800	40	\$10,732		134,152	0.3	5 years	Tom O'Byrne	Pending
Insulate DHW Distribution Pipework* Insulate all exposed hot water piping in boiler room	\$5,700	5.9	\$970	54		2.7	5 years	Ben Wiebe	Pending
Install Solar Film on Glazing* Install a film on interior of glazing	\$240,100	48	\$4,978	187	38,831	10.4	TBD	Natalie Yao	Pending
Install Solar PV* Install PV panels on south facing roof	\$98,100	4	\$98,100		219,000	5.7	TBD	Natalie Yao	Pending
Condensing Boiler Install condensing boiler and reset heating water temperatures	\$30,000	16.7	\$1,800	150		7.5		Natalie Yao	N

Totals

\$1,861,400 \$167,494 3020 589,499 186

*Note: Further information for these actions can be found in the 2016 Stantec Reports

Trades & Technology Center

Building Description	This building houses workshops, various trades classrooms, common rooms, a café, and offices. Workshops include automotive, carpentry, electrical, and welding.				
Built In	1997	Number of Storeys	2	Sqft	109,878

Total Estimated Savings

Energy Footprint	Electricity	Natural Gas	Greenhouse Gases	Total Cost
29%	8%	40%	40%	\$47,247.54



Action

Action	Cost	Simple Return	Annual Savings				Timeline	POI	Status
			\$	GJ	kWh	GHG			
Controls Recommissioning To be completed every 3-5 years	\$95,000	3	\$31,400	2100	92,600	105.7	3 years	Tom O'Byrne	Pending
Recommission Welding Controls Install occupancy sensors and flow control dampers in each welding booth. Add a new VTD on the MUA serving the shop	\$56,000	12.7	\$4,400	270	17,500	13.7	3 years	Tom O'Byrne	Pending
Welding Heat Recovery Install a heat recovery system on welding exhaust fans	\$50,000	13.2	\$3,800	640	-47,500		5 years	Tom O'Byrne	Pending
Condensing Boiler Upgrade Replace two existing modular boilers with condensing boilers. Reset heating water temperatures	\$100,000	12.5	\$8,000	690		34.4	1 year	Tom O'Byrne	Y

Totals

\$301,000 \$47,600 3700 62,600 153.8