Conseil des Services du District de
Manitoulin-Sudbury
District Services Board

210 boul Mead Blvd
Espanola, ON P5E 1R9
Telephone/Téléphone: (705) 862-7850
Fax/Télécopieur: (705) 862-7805
http://www.msdsb.net

Report To:	Program Planning Committee
From:	Connie Morphet, Director of Finance and Administration Patrick Wittmann, Supervisor of Infrastructure and Asset Management
Date:	March 21, 2018
Re:	GreenON Social Housing Business Case – Issue Report

Overview of Funding Need

The buildings eligible for GreenON Social Housing Program funding within the service area have a high need for energy retrofit funding. There are many factors affecting the need for grant retrofit funding, but these three are the most obvious:

- The age of the building stock is such that energy efficiency was not a high priority during design and construction. The harsher winters have a greater impact on infrastructure, resulting in reduced longevity of infrastructure.
- The recent energy retrofit programs such as SHAIP, SHARP, etc. despite being intended for social housing buildings, left these properties ineligible.
- There are substantially more heating degree days in Northern Ontario, resulting in higher utility utilization and thus costs.

The building conditions are considered good, but the building elements are a priority for repair or replacement as they have reached the end of their useful life and are considered inefficient. This work is necessary to maintain tenant's quality of life and to prevent the building from becoming structurally or functionally unserviceable.

Requested Funding

The funding being requested by the Manitoulin-Sudbury DSB for 19 buildings is estimated at $3,528,561 (plus HST). **Appendix A** to this report provides the estimate of costs for all the requested projects. The rationale for the requests is simply that recent social housing retrofit programs have failed to consider these social housing buildings as eligible, resulting in a backlog of energy efficiency demand. The magnitude of funding required to reduce a significant amount of Greenhouse Gas (GHG) emissions is such that these projects cannot be accomplished without assistance from programs such as the GreenON fund.

The administrative costs to cover and implement the Program is 5% based on approval of 100% of the funding request: $176,428. The complete retrofit (including HST) and administration costs would be $4,163,701.

Service Managers are required to submit a business case to the Housing Services Corporation (HSC), which will be used to assign funding allocations. Service Managers that receive a funding allocation will then hold their own local competitive selection processes for their local housing providers. Based on any allocations approved, the DSB will determine which of the projects will proceed under the GreenON program funding.

An initial ranking was undertaken to prioritize the energy reduction projects based on Greenhouse Gas emissions reductions prior to energy audits. These calculations are a 'best effort estimate'. The Natural Resources Canada website provides a residential sector energy use and Greenhouse Gas emissions database to assist with the calculations.

Space heating is considered the greatest percentage of energy usage and thus the projects with the greatest reduction in heating demand rank highest in the proposal. The Canada Mortgage and Housing Corporation has provided targeted space heating energy savings values based on R-Value retrofits. The retrofit options for different levels of heating energy savings Table 1 provided the percentage of space heating energy savings for the purpose of calculating GHG emissions reductions.

The Statistics Canada Table 4-3 provides average household energy use by dwelling type per province. The value used as a baseline for the GHG emissions calculations was 13.3 MWh of energy used per apartment per year. The Hydro Emission Factor used is 856 Kg/MWh resulting in an average energy usage of 11,384 kg CO2 per apartment.

Although the demand for GHG reduction projects is high in the Manitoulin-Sudbury DSB service area, these 5 projects reduce the most Greenhouse Gases:

Building	Date Built and # of Units	Project	Estimated Cost	Greenhouse Gas reduction
Cedar Grove Chapleau	1978 (23 units)	Replace Roof	$1,515,242	94,502
Rainbow Apts. Espanola	1974 (29 units)	Pre-Fab Exterior	$375,000	54,994
C.A. MacMllian Webbwood	1981 (24 units)	Electric Heaters	$122,774	51,386
Meadowview Mindemoya	1980 (24 units)	Electric Heaters	$122,774	51,386
Villa Notre Dame St. Charles	1980 (23 Units)	Electric Heaters	$117,658	49,245

The DSB will submit all 19 projects for consideration to the GreenON Program however the top 5 projects that reduce the most Greenhouse Gases will be prioritized to maximise the DSB chances of receiving an allocation.

Once projects are selected, a concerted effort will be made to engage other funding sources and leverage utility retrofit programs. These programs often only cover a portion of retrofits.

This application should be considered as confirmation that none of these buildings has previously received and none are currently receiving Social Housing Apartment Retrofit Program (SHARP), Social Housing Apartment Investment Program (SHAIP), Social Housing Electricity Efficiency Program (SHEEP) or Municipal GHG Challenge Fund funding.

Proposed Retrofit Activities

The projects considered for funding are as follows:

- Window and door replacement
- Insulated roof replacement
- Insulated envelope replacement
- Heater replacement with control systems
- LED lighting replacement
- Attic Insulation upgrade
- Air handling unit
- Energy Audits

Greenhouse Gas savings calculations although desirable at the outset, will only be calculable during the energy audit phase for each project. An update can be provided at that time. Staff have included **Appendix B** as a sample Energy Audit for the Boards information.

Implementation Plan

The Manitoulin-Sudbury DSB will support the program to ensure project and program success through administrative assistance from DSB staff. An additional initiative will be the development of a report outlining the actual Greenhouse Gas emission reductions realized from the funded projects. These results will be shared amongst the Northern Ontario Service Deliverers Association (NOSDA) Housing Managers to assist with future retrofit decision making. Funded retrofit projects will be monitored through annual confirmation that affordability requirements are being maintained. The required data and information will be requested from the funded providers at standard intervals determined once the projects have been completed.

Investments in energy efficiency upgrades in these apartment buildings will reduce emissions and operating costs, improve the performance of social housing stock in Ontario, and enhance resident comfort. The retrofits will increase the long-term sustainability of existing social housing stock in Northern Ontario. The GHG retrofit sector will gain employment opportunities through the creation of local jobs.

Conclusion

Staff are recommending that the Program Planning Committee recommend to the Board that they approve the GreenON Social Housing Business Case - Issue Report as presented and direct staff to submit the business case within the required time lines along with all required supporting documentation.

Appendix A
GreenON – Details by buildings

Address and Provider Type (NP/LHC)	Date Built & # Units	Heating Type	Estimated Cost of Retrofits	Existing Equipment Conditions	Proposed Energy Efficiency Measures	How Retrofit will meet Program Objectives	Estimated Greenhouse Gas Reduction
Cedar Grove 101 Pine Street East, Chapleau. Non-Profit	**1978 23 Units**	**Electric**	**$1,515,242**	**Operating but at end of life**	**Replace deteriorated roof with new Energy star membrane roof, replace windows and doors, Air handling unit and control system, energy audit**	**GHG emission reduction due to energy efficient replacements.**	**94,502**
Rainbow Apts. 70 Barber St. Espanola DSB	**1974 29 Units**	**Natural Gas**	**$ 375,000**	**Operating but at end of life**	**Pre-Fab Exterior Energy Retrofit (PEER) Natural Resources Canada Pilot Project**	**Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems**	**54,994**
C.A. MacMllian 10 O'Neil St. Webbwood. DSB	**1981 24 Units**	**Electric**	**$ 122,774**	**Operating but at end of life**	**Convert to energy efficient electric heaters, install control measures and include all repair work. Convert to LED lighting**	**Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems**	**51,386**
Meadowview 29 Nixon St. Mindemoya DSB	**1980 24 Units**	**Electric**	**$ 122,774**	**Operating but at end of life**	**Convert to energy efficient electric heaters, install control measures and include all repair work. Convert to LED lighting**	**Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems**	**51,386**

Address and Provider Type (NP/LHC)	Date Built & # Units	Heating Type	Estimated Cost of Retrofits	Existing Equipment Conditions	Proposed Energy Efficiency Measures	How Retrofit will meet Program Objectives	Estimated Greenhouse Gas Reduction
Villa Notre 25 John St. Charles DSB	**1980 23 Units**	**Electric**	**$ 117,658**	**Operating but at end of life**	**Convert to energy efficient electric heaters, install control measures and include all repair work. Convert to LED lighting**	**Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems**	**49,245**
Bayside Apts. 3 Water St. Gore Bay DSB	**1976 22 Units**	**Electric**	**$ 112,543**	**Operating but at end of life**	**Convert to energy efficient electric heaters, install control measures and include all repair work. Convert to LED lighting**	**Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems**	**47,104**
Résidence des Pionniers St. Christophe Noëlville DSB	**1977 21 Units**	**Electric**	**$ 107,427**	**Operating but at end of life**	**Convert to energy efficient electric heaters, install control measures and include all repair work. Convert to LED lighting**	**Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems**	**44,963**
Evelyn McNenley 410 Bell Street, Massey DSB	**1976 21 Units**	**Electric**	**$ 107,427**	**Operating but at end of life**	**Convert to energy efficient electric heaters, install control measures and include all repair work. Convert to LED lighting**	**Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems**	**44,963**
Channelview 66 Robinson St. Little Current DSB	**1976 20 Units**	**Electric**	**$ 102,312**	**Operating but at end of life**	**Convert to energy efficient electric heaters, install control measures and include all repair work. Convert to LED lighting**	**Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems**	**42,822**

Address and Provider Type (NP/LHC)	Date Built & # Units	Heating Type	Estimated Cost of Retrofits	Existing Equipment Conditions	Proposed Energy Efficiency Measures	How Retrofit will meet Program Objectives	Estimated Greenhouse Gas Reduction
Villa Beauséjour 17 Stanhope St. Warren DSB	1981 19 Units	Electric	$ 97,196	Operating but at end of life	Convert to energy efficient electric heaters, install control measures and include all repair work. Convert to LED lighting	Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems	40,681
Millsite 14 Water S. Gore Bay Non-Profit	1989 25 Units	Electric	$ 155,750	Operating but at end of life	Replace windows	GHG emission reduction due to energy efficient replacements.	39,507
Chapleau Apts. 78 Pine Street, Chapleau DSB	1972 13 Units	Electric	$ 66,503	Operating but at end of life	Convert to energy efficient electric heaters, install control measures and include all repair work. Convert to LED lighting	Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems	27,834
Queensway Seniors Apts. 799 Queensway Espanola Non-Profit	1986 30 Units	Electric	$ 90,000	Operating but at end of life	Convert to energy efficient electric heaters including all repair work. Convert to LED lighting	GHG emission reduction due to energy efficient replacements.	26,305
Woods Lane 66 Meredith St. Gore Bay DSB	1968 10 Units	Electric	$ 51,156	Operating but at end of life	Convert to energy efficient electric heaters, install control measures and include all repair work. Convert to LED lighting	Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems	21,411

Address and Provider Type (NP/LHC)	Date Built & # Units	Heating Type	Estimated Cost of Retrofits	Existing Equipment Conditions	Proposed Energy Efficiency Measures	How Retrofit will meet Program Objectives	Estimated Greenhouse Gas Reduction
Bayview 76 Wellington Manitowaning DSB	**1975 16 Units**	**Electric**	**$ 81,849**	**Poorly insulated main floor exterior with failed envelope**	**Upgrade exterior insulation and envelope to remaining 50% of the building.**	**GHG emission reduction due to energy efficient replacements.**	**20,228**
Milltown Apts. 60 Barber St. Espanola DSB	**1973 10 Units**	**Natural Gas**	**$ 243,750**	**Operating but at end of life**	**Pre-Fab Exterior Energy Retrofit (PEER) Natural Resources Canada Pilot Project**	**Initial GHG emission reduction due to energy efficient replacements. Additional reductions via Control Systems**	**18,964**
Little Current Place 48 Meredith St. Little Current Non-Profit	**1990 16 Units**	**Electric**	**$ 13,000**	**Inadequate insulation**	**Upgrade Attic Insulation**	**GHG emission reduction due to energy efficient replacements.**	**10,114**
299 Queensway Espanola Non-Profit	**1987 6 Units**	**Electric**	**$ 23,100**	**Operating but at end of life**	**Convert to energy efficient electric heaters including all repair work. Convert to LED lighting**	**GHG emission reduction due to energy efficient replacements.**	**5,261**
309 Queensway Espanola Non-Profit	**1987 5 Units**	**Electric**	**$ 23,100**	**Operating but at end of life**	**Convert to energy efficient electric heaters including all repair work. Convert to LED lighting**	**GHG emission reduction due to energy efficient replacements.**	**4,384**

Total Retrofit costs	**$3,528,561**
HST at 13%	**$ 458,713**
Administrative at 5%	**$ 176,428**
Total Retrofit and administration costs	**$4,163,701**

Appendix B

Manitoulin-Sudbury District Services Board
17 Stanhope Ave.
Warren, ON
Hydro One Meter # J3442285
Patrick Wittmann

Derek Lalonde, C.E.T.
Account Manager
(705) 919-3264
Derek.Lalonde@logiccontrols.net
November 8, 2016

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INTRODUCTION

Logic Control Technologies offers an integrated approach to facility management from the design and construction to maintenance and lifecycle planning. With excess of 50 years' industry expertise in project management, compliance and safety, and professional advisory services. Our solutions are comprised of a wide range of hard and soft services that include energy management, strategic asset management, building security, automation and control, mechanical and electrical services.

These offerings can be bundled or provided as an integrated total facilities management approach to meet the specific needs of our customers across a number of sectors, including but not limited to, healthcare, education and government. We bring together the right products and the right people with the skills to help our customers achieve a comfortable environment that ensures the health and safety of the property and occupants are paramount while promoting building-wide energy efficiency.

The Author of this report, Derek Lalonde, holds a technology diploma in Electronic & Computer Engineering and has been a member of the Ontario Association of Certified Engineering Technicians and Technologists since 2005. Working with Fortune 100 Company, Honeywell, in their Automation and Control Solutions (ACS) division he has become proficient in facility systems and building optimization. Taking this facility knowledge to Honeywell's Public Private Partnership (PPP) division he managed 18 Ontario Provincial Police facilities throughout the province. Working closely with Honeywell's Energy Engineers, Derek coordinated efforts to monitor, report and improve datasets for Infrastructure Ontario on a monthly basis. Being born into the Espanola community he has given back through various volunteer programs throughout the years and is currently a volunteer firefighter for the Town of Espanola.

Manitoulin-Sudbury District Services Board has requested an energy assessment of the facility in their care at 17 Stanhope Ave., Warren. This will be the second energy report provide by Logic Controls to MSDSB in 2016. The primary purpose of the assessment is to provide a practicable solution to address the growing hydro costs associated with heating the 19 residential living spaces. The primary heat source is electric baseboard heat with non-programmable thermostats. The heaters are in fair to poor condition and are inefficient heating sources compared to compact solutions offered today. With Hydro costs on the rise this audit intends to provide a clear path to reduce overall hydro consumption. Currently, there is natural gas service to the facility. However, the natural gas service provider cannot accommodate an upgraded to accommodate the volume required to switch to natural gas the primary heating source at the time of this report. The Make-Up-Air (MUA) unit is aged significantly and currently is failing to prove beneficial during operation. As per investigation, the MUA has not been in operation for a minimum of two years. As a result, the operation and energy consumption are not captured within this report.

With energy and maintenance costs on the rise Supervisor of Infrastructure & Asset Management, Patrick Wittmann, has requested an assessment for Villa Beausejour at 17 Stanhope in Warren. The contents of this report will be leveraged to maximize capital spend and ensure the best allocation of resources to improve the ongoing operational budget and tenant comfort.

FACILITY OVERVIEW

Built in 1982, Villa Beausejour is a 19 Single Bedroom two story walk up multiunit dwelling that provides affordable housing to the local residents. Situated on the Highway 17 corridor the town of Warren is only 45 minutes from the City of Greater Sudbury. Units are provided with private full kitchen, washroom and balcony/patio access. Residents can also enjoy the convenience of onsite laundry facilities and use of a large lounge area and tenant parking.

The facility is in excellent condition largely in part to its solid concrete construction, the maintenance programs and associated capital investment programs. Each suite is equipped with vinyl windows, which have been replaced within the last 5 years and are in excellent condition. The Domestic Hot Water tank is natural gas fired appliance and supplies the entire complex. A water softener can also be located within the same mechanical room as the DHW tank and is running with no reported issues or visible deficiencies. Provided the install date and current condition the unit is projected to run beyond the next 5 years of operation.

EXISTING ELECTRICAL HEATING APPLIANCES

Units	Type	Location	Wattage (per unit)	Age (years)	Condition (good, fair, end of life)
19	750W baseboard heater	Bedroom	2,558	~ 30 years	Good – End of Life
19	2000W baseboard heater	Living Room	6,820	~ 30 years	Good – End of Life
19	500W baseboard heater	Washroom	1,705	~ 30 years	Good – End of Life
1	MUA unit	2nd Floor Laundry		~ 30 years	End of life
4	1250W baseboard heater	Hallways	4,263	~ 30 years	Good – End of Life
1	2500W baseboard heater	2nd floor Garbage Room	8,527	~ 30 years	Good – End of Life
1	1500W baseboard heater	Laundry Room	5,116	~ 30 years	Good – End of Life
1	1500W baseboard heater	Electrical Room	5,116	~ 30 years	Good – End of Life
1	1500W baseboard heater	Common Room	5,116	~ 30 years	Good – End of Life
1	2500W baseboard heater	Common Room	8,527	~ 30 years	Good – End of Life

EXISTING NATURAL GAS HEATING APPLIANCE

Location	Quantity	Brand	Model	Input BTU/ HR.	Efficiency
Domestic Hot Water Tank	1	Polaris	130-50-2NV	130,000	95%
Backup Generator	1	Eaton	EGENX20A	75.6 cubic ft./hr. (Half load) 140 cubic ft./hr. (Full Load)	N/A

BILLING PROFILE

Despite the facility being located within the Greater Sudbury Area the electrical provider for the area and facility is Hydro One. All energy costs associated with the facility are absorbed by Manitoulin-Sudbury District Services Board.

ELECTRICITY USAGE HISTORIC ANALYSIS

				Billing Breakout						
Bill Date	Billing Days	Avg. Daily Use (kWh)	Type of Read	Electricity	Delivery	Regulatory	Debt Retirement	Clean Energy Benefit	Taxes	Total Billable Amount
May-14	30	685	Actual	1983.82	841.64	122.41	143.92	-50.98	401.93	$3,442.74
Jun-14	34	369	Actual	1257.31	669.05	74.87	87.92	-56.39	271.59	$2,304.35
Jul-14	27	284	Estimate	764.43	466.28	45.88	53.76	-58.72	172.95	$1,444.85
Aug-14	36	213	Actual	764.43	435.96	46.69	53.76	-57.42	169.11	$1,412.53
Sep-14	28	226	Actual	627.07	418.34	38.48	44.24	-60.51	146.66	$1,214.28
Oct-14	31	302	Actual	934.11	574.68	56.86	65.52	-59.08	212.05	$1,784.14
Nov-14	28	471	Actual	1321.95	683.49	80.08	92.4	-55.93	283.13	$2,405.12
Dec-14	32	750	Actual	2460.75	892.96	145.39	168	-51.8	476.72	$4,092.02
Jan-15	34	821	Actual	2864.51	1064.92	169.1	195.44	-52.14	558.22	$4,800.05
Feb-15	28	866	Actual	2485.47	1050.98	146.84	169.68	-53.88	500.89	$4,299.98
Mar-15	29	1117	Actual	3325.95	1119.54	196.19	226.8	-50.94	632.9	$5,450.44
Apr-15	30	752	Actual	2312.43	955.78	136.69	157.92	-53.54	463.17	$3,972.45
May-15	32	588	Actual	1941.86	805.46	113.95	131.6	-53.97	389.08	$3,327.98
Jun-15	29	378	Actual	1193.6	781.06	66.54	76.72	-65.51	275.33	$2,327.74
Jul-15	31	248	Actual	832.8	578.49	46.69	53.76	-66.73	196.53	$1,641.54
Aug-15	32	200	Actual	692	550.84	38.96	44.8	-70.27	172.46	$1,428.79
Sep-15	29	204	Actual	639.2	566.72	36.06	41.44	-73.49	166.84	$1,376.77
Oct-15	33	264	Actual	947.2	668.14	52.99	61.04	-67.23	224.82	$1,886.96
Nov-15	30	272	Actual	892.7	800.81	49.61	57.12	-74.79	234.03	$1,959.48
Dec-15	27	681	Actual	2121.65	983.76	111.53	128.8	-61.64	434.95	$3,719.05
Jan-16	30	587	Actual	2028.85	1044.27	106.7	123.2	-63.62	429.39	$3,668.79
Feb-16	33	812	Actual	3096.05	1115.64	170.87	0	0	569.73	$4,952.29
Mar-16	27	827	Actual	2576.37	1324.48	142.35	0	0	525.62	$4,568.82
Apr-16	35	629	Actual	2539.25	1134.51	140.3	0	0	495.83	$4,309.89
May-16	36	498	Actual	2090.96	1427.32	118.08	0	0	472.73	$4,109.09

BASELOAD CALCULATION

We were able to compare correlations of Usage (kWh) with the HDD (Heating Degree Days) across a range of base temperatures in order to determine the entire buildings baseload; using 2 years of billing data in conjunction with the heating degree days for the area. Given our R2 calculations in the table below, we can assume that the building base temperature is 18.5 degrees. Therefore, any time the outside air temperature goes below 18.5 degrees, we start to lose the ability to maintain building heating requirements.

Month	17.5	18	18.5	19	19.5	Approx. Heat Use (kWh)
14-Apr	481	496	511	526	541	15,760
14-May	211	224	237	250	264	7,760
14-Jun	63	71	81	91	101	2,880
14-Jul	68	77	88	98	109	2,880
14-Aug	64	73	83	93	104	1,520
14-Sep	177	189	201	214	227	4,560
14-Oct	350	365	381	396	412	8,400
14-Nov	640	655	670	685	700	19,200
14-Dec	748	764	779	795	810	23,120
15-Jan	996	1012	1027	1043	1058	19,440
15-Feb	1014	1028	1042	1056	1070	27,600
15-Mar	747	763	778	794	809	17,760
15-Apr	430	445	460	475	490	14,000
15-May	178	190	202	215	229	6,160
15-Jun	77	87	97	108	119	2,880
15-Jul	47	54	61	70	78	1,600
15-Aug	50	58	68	76	87	480
15-Sep	88	97	107	116	127	3,920
15-Oct	376	391	406	422	438	3,360
15-Nov	470	485	500	515	530	13,600
15-Dec	585	601	616	632	647	12,800
16-Jan	848	864	879	895	910	22,000
16-Feb	827	842	856	871	885	17,520
16-Mar	633	648	664	679	695	17,200
16-Apr	517	532	546	561	576	13,120

Gradient	23.79818	23.60966	23.47282	23.31372	23.20131
Intercept	1009.456	782.1633	533.5297	292.361	29.32161
R2	0.900028	0.9001	0.900267	0.900036	0.899936

ELECTRICITY USAGE BREAKDOWN

Each of the 19 independent suites is accommodated with a 60amp service. From the service panel within the suite all electrical provisions for the Tennent is provided for the lighting, kitchen appliances, receptacles and electric heat. Unfortunately, due to the suites not being sub metered it is impossible to allocate an exact usage for each suite. We can make assumptions based off the building configuration and the historical electricity usage across any given billing period for a high level investigation. Outside of the suites the facility has general use receptacles, a sump pump, Water Softener, Exterior Lighting, Sidewalk Heaters, Laundry services on the 1st and 2nd floor, a hot water circulation pump, a heat trace for the pump system, car plugs for tenant use as well as various heaters in the hallways and utility rooms (9 total). An electric MUA unit is located on the second floor with a 200 amp disconnect in the same room. This unit has not been in operation for the last several years, with no record of the last known date of functionality.

REGRESSION ANALYSIS

Using a building base temperature of 18.5 degrees our scatter chart of kWh of usage vs heating degree days allows us to dissect our dataset in order to make some conclusions.

The intercept is suggesting that our building baseload is approximately 180 kWh per day. We can with further confirm this by taking our lowest usage month from our billing period divided by the amount of days for that period (Aug 2015| 5920/31=191 kWh). This leave us with a 10% margin for error which can be attributed to habitual and environmental causes (i.e. lighting, appliance changes, occupant turnover etc).

The higher R2 value of 0.91 signifies that this is a reliable and relatively predictable data set. However, as all tenant utility use is electric, with exception of DHW, it becomes increasingly difficult to isolate and make definitive assumptions. Using industry estimates and best practice methodologies the regression data suggests a comfortable and controlled living space, able to achieve and deliver occupant temperature setpoints in relatively quick manor.

A slope of 22.9 suggest that we see significant swings in usage, which we can confirm through our historical billing. Understanding that the only change with the building operations month to month is the amount of heating required, to lesser extent lighting usage, we can presume the increase can be mostly attributed to heating. Identifying that our building baseload is in the neighborhood of 180 kWh per day we can overlap this with our worst preforming month to get a worst case scenario for our current heating system.

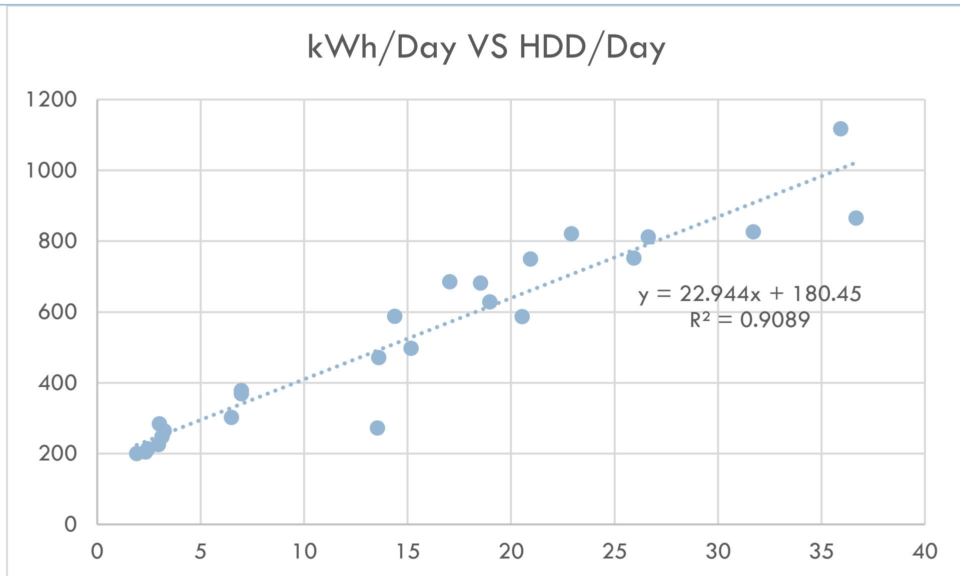
Worst Case Scenario (Highest historical usage Feb 2015 – 32,400 kWh)

32,400 kWh / 29 billing days = 1117.24 kWh / day

1117 kWh/day – 180 kWh building baseload = 937 kWh of heating

937 kWh @ 10.3¢ per day (Feb 15 price) = $96.51 approximate heating cost per day

This calculation is using historical worst case. This does not take into account rising electrical prices or an increase of tenant heat demands resulting from blocked heaters or open windows/doors.



Capital costs and savings:

After investigating the site we have come to the conclusion that all of the electric heating systems throughout the facility are original, placing them in the 30 year age range. We know that the windows have been replaced and doors have been upgraded since the original construction, making the building envelope tighter resulting is less heat waste. This now places all of the original heating systems throughout the tenant space oversized for their application. Immediate savings will be seen with the proper sizing of the heating systems to the spaces they are servicing.

ELECTRICITY SAVINGS OPPORTUNITIES

The approximate average consumption for heating (less the base load) for the past two years is 11,270 kWh per month.

Facility Layout:

135 feet long x 57 feet wide
First floor has 8 apartments
Second floor has 11 apartments
All windows were replaced within the past 4 or 5 years
Unsure if a building envelope upgrade was performed to upgrade the insulation.

Apartment Layout:

Bedroom:	10-1/2' x 10' 8' ceilings
Window Dimensions:	45" x 46"
Outside wall Dimensions:	10' wide x 8' high
New vinyl windows as per pictures	
750W baseboard rad as per pictures	
Living Room:	18' x 10' 8' ceilings
Window Dimensions:	60" x 62"
Patio Door:	32" x 78"
Outside wall Dimensions (Window):	10' wide x 8' high
Outside wall Dimensions (Door):	40" wide x 8' high
New vinyl windows as per pictures	
2000W baseboard rad as per pictures	
Washroom:	7-1/2' x 5' 8' Ceilings
500W baseboard rad as per pictures	
Kitchenette (off of living room):	92" x 81" 8' ceilings
Apartment Hallway:	123" x 41" 8' ceilings

Facility Service and Common Rooms

Hallway - First Floor	56" wide / 130' long 8' ceilings
West window Dimensions:	49" x 40"
West outside wall Dimensions:	56" wide x 8' high
1250W baseboard rad as per pictures	
Hallway - Second Floor	56" wide / 130' long 8' ceilings
West window Dimensions:	49" x 40"
West outside wall Dimensions:	56" wide x 8' high
1250W baseboard rad as per pictures	
East window Dimensions:	49" x 40"
East outside wall Dimensions:	56" wide x 8' high
1250W baseboard rad as per pictures	
East Staiwell	
1250W baseboard rad	
Second floor fan / garbage room	13' x 10' room + 15' x 4' hallway all 8' ceilings
No windows	
Outside wall	18' x 8' high cinder block
2500W baseboard rad as per pictures	
Laundry Room - First floor	11-1/2' x 9 ' + 13' x 3' hallway 8' ceilings
Window Dimensions:	45" x 46"
Outside wall Dimensions:	9' wide x 8' high
1500W baseboard rad as per pictures	
Electrical Room first floor	10' x 10' 8' ceilings
No windows	
Outside wall	10' x 8' high cinder block
1500W baseboard rad as per pictures	
Common Room - First Floor	21' x 14-1/2 ' + 4' x 10' + 66" x 90" 8' ceilings
Left window Dimensions:	45" x 46"
Left outside wall Dimensions:	11' wide x 8' high
1500W baseboard rad as per pictures	
Right window Dimensions:	60" x 61"
Right outside wall Dimensions:	10' wide x 8' high
2500W baseboard rad as per pictures	

MAKE-UP-AIR (MUA) UNIT REPLACEMENT

Replacing the aged and inefficient make up air unit will improve air circulation throughout the common space and will improve comfort and distribution of heat throughout the common areas. An improved MUA will improve resident comfort and reduce tenant heating demand. The MUA will pressurize the building and reduces cold spots along exterior walls and corners. Due to inefficiency and lack of intelligent control the unit has not been in use, in an effort to reduce tenant complaints.

The current MUA unit is electric and the resulting current draw and impact to overall usage is significant. It is highly recommended that this unit be replaced with a natural gas equivalent, providing the supplier is able to accommodate the supply demand of the new unit.

Estimated Total Project Cost **$20,000.00**

Equipment	BTU/hr. Input	Efficiency	Anticipated annual operating cost	Improvement Return
MUA	250,000	92%	6,767 cubic meters *See appendix for calculation	Improved air flow Improved equipment reliability Lower maintenance costs and part replacement Improvement to occupant comfort and energy management

The MUA as previously mentioned has not operated for some time and it is unknown how long the unit has been removed from operation.

The operation of the MUA unit is not captured in the gas utility bills of the past two years. Once in operation, the MUA would add an estimated 4568 cubic meters to the building's yearly gas consumption equating to $1,644.00 in annual costs. This option would realize a negative payback be compared to the Hydro cost

ELECTRIC HEATING UPGRADE

In an effort to reduce ongoing operating costs and minimize associated costs with a primary heat source conversion a viable solution would be to upgrade the heating system with new technology electric heating. The original building design and construction included electric heat as the primary heating source for the apartments. Since the original build the suites have been upgraded to reduce heat loss in several areas. These upgrades allow the in suite heaters to be reduced in size as they will no longer have to make up for this additional heat loss.

To maximize the full financial return of this installation an automation and control solution should be implemented to optimize consumption around things such as time of day scheduling, occupancy and open exterior windows and doors.

An electric heat installation is budgeted as:

Electric convector heaters with wall control with install	$28,446.64
Removal of existing electric devices and disposal	$3,300.00
Patching and Paint	$1,200.00
Electrical permits	$ 550.00
Estimated Project Total	**$33,496.00**

Upon completion of the heating calculations it was discovered that the heaters installed at the time of construction were not sized to properly accommodate the needs of the space. This sizing discrepancy will result in longer run times in some areas and short cycling in others. This behavior is not visible from the billing as the negative performance impacts would appear to cancel themselves out in a combined data set, such as the one we are working from.

Switching to this newer technology will help provide a better circulation of heat and improve the overall comfort and efficiency of the building heating system. As we do not have compartmentalized data we are unable to determine what the true effect will have on the overall ROI.

CALCULATION SUMMARY

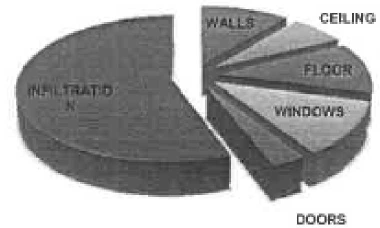
(values in watts)

Calcul No.
Calcul_1235_2016-07-20

Note:

Heat loss calculation was done with approximative dimensions and will have to be revised if any changes .

Walls	Ceiling	Floor	Windows	Doors	Infiltration	Ventilation	Stove	Total	Total needed
1827	1125	1919	1977	537	9352	0	0	16737	**17000**



CALCULATION DETAILS

(values in watts if not mentionned)

No.	Name	Type	Level	Temp. Int. °C	Area m^2	Area pi^2	Walls		Ceiling		Floor		Windows		Doors		Infiltration	Loss W/pi^2	Total	Wattage needed	Current	Difference
1	1st floor appt	Bedroom	Ground	22	9	100	124	R-20	0		124	R-6	163	R-2	0		372	8	782	1000	750	250
2	1st floor appt	Living room	Ground	22	17	180	115	R-20	0		223	R-6	293	R-2	268	R-0	669	9	1568	1750	2000	-250
3	1st floor appt	Bathroom	Ground	22	3	35	0	R-20	0		43	R-6	0		0		130	5	173	500	500	0
4	2nd floor appt	Bedroom	2	22	9	100	124	R-20	101	R-32	0		163	R-2	0		372	8	760	1000	750	250
5	2nd floor appt	Living room	2	22	17	180	115	R-20	182	R-32	0		293	R-2	268	R-0	669	8	1527	1750	2000	-250
6	2nd floor appt	Bathroom	2	22	3	35	0	R-20	35	R-32	0		0		0		130	5	165	500	500	0
7	Hallway 1st floor	Other	Ground	22	56	607	50	R-20	0		752	R-6	144	R-2	0		2256	5	3201	3250	1250	2000
8	Hallway 2nd floor	Other	2	22	56	607	100	R-20	614	R-32	0		308	R-2	0		2256	5	3276	3500	2500	1000
9	East Stairwel	Other	2	22	0	0	0	R-20	0	R-32	0		0		0		0	0	0	1250	1250	0
10	Garbage room 2nd floor	Other	2	22	335	3610	272	R-20	192	R-32	0		0		0		706	0	1170	1250	2500	-1250
11	Laundry room 1st floor	Other	Ground	22	132	1420	109	R-20	0		176	R-6	163	R-2	0		528	1	975	1000	1500	-500
12	Electrical room 1st floor	Other	Ground	22	9	100	151	R-20	0		124	R-6	0		0		372	6	647	750	1500	-750
13	Common room 1st floor	Other	Ground	22	36	385	668	R-20	0		477	R-6	451	R-2	0		894	6	2490	2500	4000	-1500

AUTOMATION AND CONTROL

Provided that the system installed currently is an aged electric system the Automation and Control option would be better explored once the heating appliances have been updated. The benefits of Automation and control would allow situations that invoke waste to be monitored and controlled to prevent excess waste of heat and overall energy use.

Alarms and notifications can be established to prevent over heating or cooling of spaces from either an additional heat source or from open exterior compartments for lengthy durations. Alarms can also be generated upon equipment failure.

Automation allows for superior data collection with trending and alarming capabilities, enabling the facility manager to identify waste in an effort to reduce waste. The budgeted numbers shown are for general installations. Final pricing can be potentially reduced further depending on the system being controlled (hydronic vs electric baseboard), whether the end devices are valves or heaters, complexity of the control strategy etc.

Material	$32,800.00
Installation	$8,500.00
Commissioning and training	$6,500.00
Design	$ 2,700
Estimated Project Total	**$50,000.00**

Energy savings between 5 – 30% can be realized when installing an automation system with enhanced control strategies.

CONCLUSIONS AND FINAL RECOMMENDATIONS

The facility at 17 Stanhope is an aged system and through building upgrade is currently not designed effectively to meet the heating need of the space. Investigations shows that the aged heaters are mostly likely original to the 1982 construction.

In addition, many of the occupants have been reported to observe a "set it and forget it" strategy for operating these units. The effects of the operating mentality and lack of ownership for energy consumption will be passed back to the building owner. Events such as open windows, overheating, not turning the heat down at night or during unoccupied periods will consume electricity with no associated gain.

Isolated room control operation leaves the Facility Manager in a compromising position as it becomes impossible to be aware and implement an energy strategy. Until the energy bill arrives the following month the Facility Manager may not even be aware that there is a problem. Events can also become saturated in data and remove all chances of correction. It is advised that in the event of a heating systems refresh project, technology should be implemented to control "bad" behaviors and optimize electricity use.

As the units are not individually metered it is impossible to tell the poor performers from the average. Thus making it impossible to accurately determine what the unit heating requirements are and how much is available for savings. However, we can reasonably predict initial savings associated with the new technology heating systems as this will improve the heat transfer throughout space and provide the opportunity to appropriately size the units to accommodate the space requirements. It is recommended that metering system be installed to help define, measure, analyze, improve, and control all electricity use to extract additional savings.

After reviewing the configuration and possible available options, it is our recommendation that the 17 Stanhope facility replace the existing electric radiators with new convection heaters. The current radiators are end of life and should be replaced under a single project to help minimize the associated costs and operational disruptions of replacing as they fail. Ideally, incorporated into the heaters would be the ability to lower the heating set points on extended periods of inactivity.

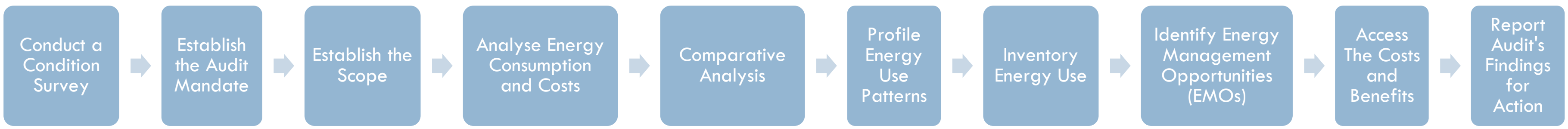
In addition, the Makeup Air unit is end of life and is currently electric. The savings would be significant if this could be changed to gas as compared to the same usage under electric operation. The MUA would provide a source of heat to the common space and slightly reduce the need for the independent room heat.

Metering is highly recommended at this location. As the facility uses a wide range of electric devices it is increasingly difficult to determine the areas of waste. Adding separate meters will allow ongoing operations to forecast budgets with more accuracy, identify in efficiencies, confirm and collaborate billing data.

Through the adoption of the aforementioned approaches you will be able to better improve your energy usage and position yourself through future expansion and management have the tools and data at your disposal to save money and time while providing your client base with dependable and comfortable accommodations.

APPENDIX

WORK FLOW



Make-Up-Air Fuel Cost Calculation

Annual Fuel Usage = unit cfm * (supply temp – avg. outside temp) * 1.08 * operating hours / Fuel Value * unit efficiency

1.08 is a constant arrived at by multiplying: 0.075 (air density) by 0.24 (specific heat) by 60 min/hr.

- **2050 * (20 - -4) * 1.08 * 5040 / 36409 * 0.92 = 6767 cubic meters**