Rental Apartment Efficiency Program ("RAP")

Energy Assessment Report Prepared for:
Curt Millar
Vancouver No. 1 Apartments Partnership

The Impala

8735 Selkirk St Vancouver
July 2021
RAP5a_001202

Summary

The upgrades identified for this building are expected to result in the following incentives, costs, savings and return on investment (ROI). Note this includes very significant savings in water bills in addition to energy.

Total Incentives	Net Cost after incentive	Annual cost savings	ROI*
$9,300	$55,700	$6,200	30%

The upgrades include the following items:

Upgrade	Incentive	Net Cost after incentive	Annualized cost savings **	ROI*
High-Efficiency Combo SH+DWH	$7,200	$52,800	$4,840	28%
Hydronic Performance Additive	$576	$1,381	$1,110	111%
DHW Recirculation Control	$1,500	$1,500	$210	23%

The costs, savings and associated ROIs shown above are **estimates only** based on typical site conditions. The presence of hazardous materials has not been determined and the cost estimates do not include removal or abatement. The RAP Program can provide free professional support through the implementation process for those upgrades that you choose to proceed with.

CMHC Energy Efficient Properties: Significant reductions in mortgage insurance are available to you simply by proving you have implemented energy savings such as those in this report. For details see Appendix F.

Energy Star Portfolio Manager: Free online service from the Canadian Government to track your gas and electric savings without shuffling paper, also compares your performance to nearby buildings. Energy Star awards for your building may be available in the near future. For details see Appendix F.

Next Step: We'll contact you shortly to arrange a phone meeting to discuss the opportunities outlined in the report; or feel free to contact us in the meantime. We're eager to help you get started saving money and energy.

Chris Lum, P.Eng. 604-561-8159

*ROI illustrates the internal rate of return and is based on the *incremental* costs and savings, i.e. the costs/savings from new high efficiency components vs. new standard efficiency components (where existing equipment is at or near end of expected life). Speak with FRESCo for further details.

** Annualized cost savings include savings from utility bills and savings from replacement with longer life equipment

Summary of Appendices

Appendix A: "Building Upgrades" provides details on the building upgrades proposed. It outlines the estimated savings of each type of upgrade as well as the incentives and costs. A brief description of each upgrade measure is included.

Appendix B: "High Efficiency vs. Standard Efficiency Boilers" explains how new condensing boilers with better controls reduce gas consumption and costs.

Appendix C: "Mechanical equipment" provides an overview of the building's mechanical systems.

Appendix D: "Background and Building Description" provides the assessment background and presents a table of details on the building.

Appendix E: "Review of Energy Consumption" presents breakdowns of energy consumption in recent years.

Appendix F: "FortisBC Incentive Programs" lists all incentive programs from FortisBC, and indicates which are applicable.

Appendix A – Building Upgrades

The table below provides an outline of the costs and savings associated with each upgrade measure. All figures are estimates and are expected to vary within a range of +/-30%.

Upgrade	Annual Savings					Costs			Business Case	
	Gas (GJ)	Electric (kWh)	Water Savings (L)	O&M**	Total Savings	Pre-incentive Cost	Incentive	Cost after incentive	Life	ROI*
High-Efficiency Combo SH+DWH	563	-	-	-	$4,840	$60,000	$7,200	$52,800	20	28%
Hydronic Performance Additive	130	-	-	-	$1,110	$1,957	$576	$1,381	5	111%
DHW Recirculation Control	25	-	-	-	$210	$3,000	$1,500	$1,500	15	23%
Alternatives if boiler not replaced										
Pipe Insulation	31	-	-	-	$270	$350	$140	$210	30	178%

Upgrades with worthwhile savings now or in future, but costs not estimated				
Upgrade	**Incentive**	**Annual kWh Savings**	**Annual GJ Savings**	**Annual Savings (including water)**
Roof Insulation Upgrade	-	-	96	$820
Heat Recovery Ventilators	-	-	296	$2,540
Front Load Washers - Common	-	159	1	$30
Baseboard Cleaning and Reflectors	*Not calculable within this assessment*			
DDC Control System Optimization	*Not calculable within this assessment*			

*ROI illustrates the internal rate of return and is based on the incremental costs and savings, i.e. the costs/savings from new high efficiency components vs. standard efficiency components (where existing equipment is at or near end of expected life). Speak with FRESCo for further details.
** "Operation & Maintenance" includes annualized savings from replacement with longer life equipment.

Efficient Water Fixtures:

Typical older showerhead; consumes many times as much water, often with poor pressure and poor aesthetics

New high efficiency shower heads: good pressure (built in regulators), hand held or wall mounted, well accepted by tenants in hundreds of rental buildings

The RAP program supplies and installs water efficient showerheads and aerators within eligible rental suites at no cost. Water-efficient devices **reduce water and sewer costs and reduce natural gas costs related to domestic hot water heating**. Typical older fixtures use between 2.5 gallons per minute (GPM) and 5GPM. Water-efficient showerheads and aerators reduce that consumption to 1.5GPM.

While some "low-flow" showerheads, particularly older models, had low pressure and low levels of customer satisfaction, newer models are now widely used that have strong, consistent pressure and high levels of customer satisfaction.

Boiler Upgrade (Heat & Hot Water): *High efficiency condensing system for both space heat and domestic hot water.*

Existing space heat boiler; low efficiency

Example of upgraded condensing boilers

The existing space heat boiler is about 25 years old and is approaching the typical expected life of 25 years. When it does need to be replaced, a single high efficiency system is often used to supply both space heat and domestic hot water, and the calculation here assumes this is the case. Modern condensing boilers provide control systems, which will further improve efficiency with features such as outdoor air temperature reset, automatic warm weather shut down and pump control.

The existing boiler appears to be larger than required. The figures presented here assume the replacement boiler would be smaller but still able to supply the maximum heating and hot water demand. More accurate sizing of the boiler can be performed by FRESCo as part of implementation support services. No cost has been assumed for asbestos; if removal is required and a quote is available, this can be updated.

If equipment fails unexpectedly it needs to be replaced rapidly to maintain services to tenants. This usually results in the installation of a lower efficiency unit as expediency often becomes more important than long-term cost-effectiveness. The owner is then "locked in" to poor value and higher gas consumption for a long period of time.

Image of the heat exchanger from within the flue stack; corrosion evident, likely from condensation.

Upon the decision to install and commission a new high efficiency condensing boiler, a 1 year post-installation recommissioning should be conducted to ensure boiler controls are setup and configured to achieve improvements in tenant comfort, maintenance and energy savings.

Pipe Insulation: ***(Alternative to boiler replacement - normally this is completed in a boiler upgrade.)***
Pipe insulation is missing in the mechanical room. Installing insulation on the pipes will reduce energy consumption.

Hydronic Additive for Boiler Water
A **rebate is available** from FortisBC to encourage the use of Hydronic Additive to reduce gas and electric bills. This additive is a chemical added to the boiler water in the same way as the commonly used corrosion inhibitors. It reduces viscosity of the boiler water, allowing greater heat transfer for increased boiler efficiency, and also lowers pump electrical bill consumption by reducing the friction of water flowing in the pipes. Numerous third-party studies have shown gas savings in the range of 8% to 12% in typical apartment buildings which lack controls, and 12 to 15% ones with condensing boilers and controls. The product is used in around 1,000 buildings in North America including BC Housing, private rental MURBS, Vancouver Airport, and Telus. Additional services are available in conjunction with the Hydronic Additive which offer system flushing, annual checks and filter changes without an upfront capital charge.

Domestic Hot Water Recirculation Control
The existing domestic hot water recirculation pump runs continuously. This measure proposes adding controls to the recirculation pump to save energy and potentially extend the life of the recirculation pipes.

A recent study by RDH, commissioned by FortisBC, found that there were 9% savings in gas from a promoted recirculation control product. The actual amount of this which goes to offset heat to the building varies according to where the recirculation pipes run, and whether or not they are insulated; normally they are not insulated and run close to drywall, therefore the gas “savings” might not be realized as most of the “waste” heat actually heats the building during the heating season. In addition, it was found to have an average of 93% savings in electricity for the recirc pump.
Regardless of energy savings, there may be significant savings from extending the life of the domestic hot water recirculation pipes. These are often the first pipes to start leaking in the building, as the pumps are typically very oversized, flow rates are many times higher than necessary, and they unnecessarily operate around the clock.

Rebates are available up to $1,500 towards the cost of the controls.

Baseboard radiator reflectors and cleaning: *Adding reflectors to the radiators and vacuuming the fins will save energy.*

Residents, particularly the elderly, often appreciate the extra heating effect and reduced allergens. Baseboard fins become clogged with dust and hair which restricts air flow and they should be cleaned every year to maximize efficiency. The top professional property managers hire experienced crews to clean all radiators at once. Suite access time is minimized by combining with annual fire inspections. If cleaning is left as an ad-hoc task during move-outs it is often not done at all and baseboards remain clogged and inefficient for years. Annual cleaning will also encourage residents to keep furniture from blocking radiators. The increased heating effectiveness gives tenants a perception of greater comfort and increases efficiency by allowing the boiler to run cooler. Although BC does not currently have incentives for radiator reflectors, they are approved by the Ontario Energy Board with incentives based on a conservative 10% savings of the heating load.

Front Load Washing Machines:
The existing machines are top loading and inefficient. Higher efficiency laundry equipment reduces electricity, natural gas and water costs by roughly half and are well established in the market. Faster washer spin extracts more water for savings in dryer electricity. Upgrading machines also gives the opportunity to switch from coin to card operation; many owners are doing this to reduce the risk of break-ins and to increase convenience to tenants.

Top loading washers; inefficient with gas, electricity and water use

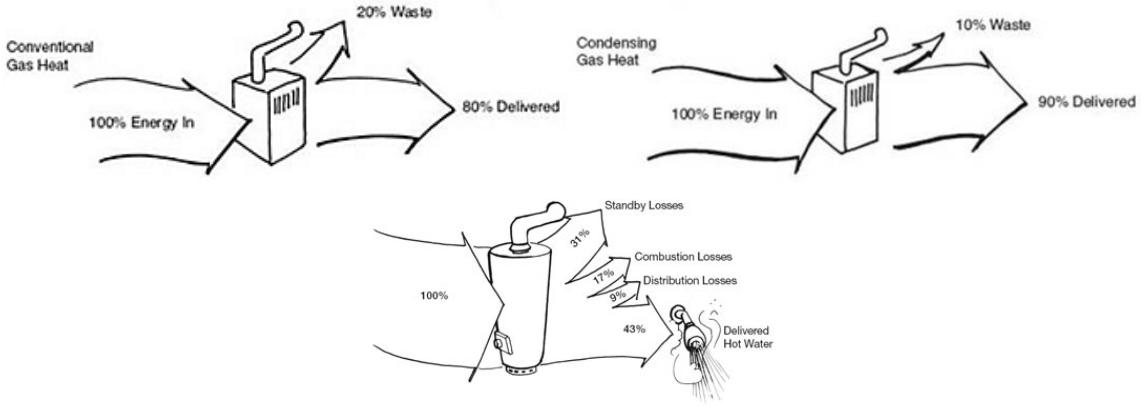
DDC Control System Optimization: The building is controlled by DDC via a KMC Controls system. A thorough analysis of energy saving opportunities through control optimization is not within the scope of this energy assessment. Areas of potential improvement include: boiler primary and secondary loop temperature optimization; and domestic hot water production timing.

Heat recovery ventilators (HRV) for individual suites
The only mechanical ventilation are the bathroom fans. These likely provide on the order of 50CFM. The ducts are likely only 4", restricted by decades of dust and debris, and in some cases by pest habitation or seized dampers. Opening windows wider, replacing the fans with stronger ones, and/or running them 24/7 may reduce potential moisture problems but will increase energy consumption through loss of heated air. It is possible to bring in cold fresh air without wasting this energy. "Heat recovery" ventilators recover the heat of outgoing air to warm up the incoming fresh air. "Alternating flow regenerators" are very small (coffee can size) fan units which can be located in different rooms. One will bring in fresh air and warm it while the other exhausts air for a minute or so. Then they will alternate to reverse roles. They require a penetration cut through the wall – existing bathroom or kitchen penetrations may be used in some cases.

Compact through wall ventilation heat recovery unit (About the size of a coffee can.)

Appendix B: High Efficiency vs. Standard Efficiency Boilers

High efficiency “condensing” boilers and domestic hot water (DHW) heaters achieve their superior performance by extracting energy in the humidity of the exhaust. This "condensing" of the exhaust vapor is what gives them their name. In contrast, standard efficiency boilers need to maintain a higher temperature specifically to prevent condensation, which is highly corrosive and would quickly destroy the internal components. The higher operating temperature of standard efficiency boilers, together with the loss of energy through hot humid exhaust, results in lower efficiency. High efficiency boilers also use fans for air intake, allowing a much more precise control the fuel to air mixture. Standard efficiency (atmospheric or natural draft) boilers function at atmospheric pressure, using the natural convection of the rising flue gasses to draw fresh combustion air in through the bottom, in the same manner as a simple barbecue. The disadvantage of this is that when they are not firing, air continues to circulate through the boiler resulting in heat loss up the flue. High efficiency boilers also feature accurate modulating valves and can turn down to a very low firing level. The standard efficiency boilers are generally two-stage boilers, meaning that they operate only at a fixed high or fixed low output. This is similar to a car with a gas pedal with only two settings; it stresses the equipment and is less efficient. The "low" output, is still rather high and can lead to short cycling, which results in poor combustion, low efficiency and excessive wear and tear on the boiler, system pumps and piping.



Even though condensing boilers will not condense during the coldest periods due to the higher required water temperature, the efficiency provided is still higher than other types of boilers. However, during most of the heating season the water temperatures can be low enough to allow condensation. This catapults the efficiency beyond that which is capable from any other type of boiler and is where the significant savings are obtained. Building upgrades such as insulation, draft sealing and thermally isolated double pane windows further reduce heat loss and allow condensing boilers to extend their range of higher efficiency operation.

FortisBC has analyzed large numbers of apartment buildings that have received their incentives for replacing older standard efficiency boilers with high efficiency condensing boilers. They found participants realized 23% gas savings on average (much of this is likely due to other things like improved controls on the new boilers).

In general, the primary advantage of standard efficiency boilers is lower up-front cost, in part because they are similar to the older boilers and use the same type of venting. High efficiency boilers do cost more, partially due to necessary upgrades to the venting. Fortunately, FortisBC offers rebates on qualifying high efficiency boilers, which helps mitigate the additional costs.

Note that there is sometimes confusion with the terminology of the different types of boilers so the following clarifications are offered;

- “Low efficiency" are natural draft or atmospheric boilers (no incentives are available for these)
- “Mid efficiency” are forced-draft or power-burner boilers (a nominal incentive is available from FortisBC). They are slightly lower cost than high efficiency but still require expensive venting retrofits.
- “High efficiency” are condensing boilers (high incentives from FortisBC) and result in greatly improved ROI.

Appendix C: Mechanical Equipment

The building is heated by hot water baseboards and a low efficiency hot water boiler plant. Ventilation is by bathroom and kitchen hood fans. Domestic hot water (DHW) is provided by a gas fired central system.

Mechanical Equipment

Description/Area	Type	Manufacturer	Model	Year	Qty	Gas max BTU/hr. input	Gas Rated Efficiency
SH Boiler	Atmospheric	Allied Engineering	AAE-720	1996	1	720,000	80%
DHW tank heater	Atmospheric tank type	AO Smith	BTRC199	2010	2	199,000	80%

Space Heat (SH)

The existing boiler plant is a lower efficiency type. At approximately 25 years old, it is approaching the typical life expectancy of 25 years. Although it could last longer with rebuilds and part replacements, ongoing repair costs could eventually exceed the cost of replacement.

It is controlled by Direct Digital Controls (DDC) by KMC Controls which does not have modern internet security and is prone to security threats.

Existing SH boiler

Domestic Hot Water (DHW)

Existing DHW tank heaters

Domestic hot water is provided by two tank type heaters. At approximately 11 years old, they are considered at or near the end of their useful life expectancy. The typical lifespan for this type of equipment is 5-10 years.

Pipe Insulation

Pipe insulation in the mechanical room is mostly missing. Insulating the pipes would save a modest amount of gas cost.

Uninsulated pipes within mechanical room

Laundry Machines

Top Loading Washers

The washers are lower efficiency top loading type. Dryers are electric powered.

Appendix D: Background and Building Description

Background
This energy assessment site visit and report were completed by Chris Lum.

Envelope
This building was built to a lower standard than today's, and therefore uses more energy for space heating. There are likely many opportunities for improved sealing, which could be found with a closer inspection and/or a blower door test. When the roof requires replacement, a significant improvement in insulation may be cost effective.

Building Details

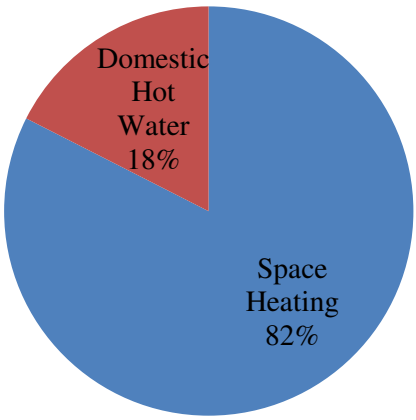
Item	Detail
Building Name	The Impala
Building Address	8735 Selkirk St Vancouver
Total Floor Area (sqft)	20,182
Number of Floors	3
Number of apartments	16
Number of current occupants	24
Construction Type	Wood frame
Year of Construction	1970
Heating	Atmospheric
Ventilation	Individual bathroom exhaust only
Domestic Hot Water	Atmospheric tank type
Natural gas cost per GJ	$10.41
Natural gas rate	2
Premise number	130420386
FortisBC Key Account Manager/Energy Solutions Manager (for account related inquiries)	Mel Tugade Office: 604-592-7907 Mel.Tugade@fortisbc.com

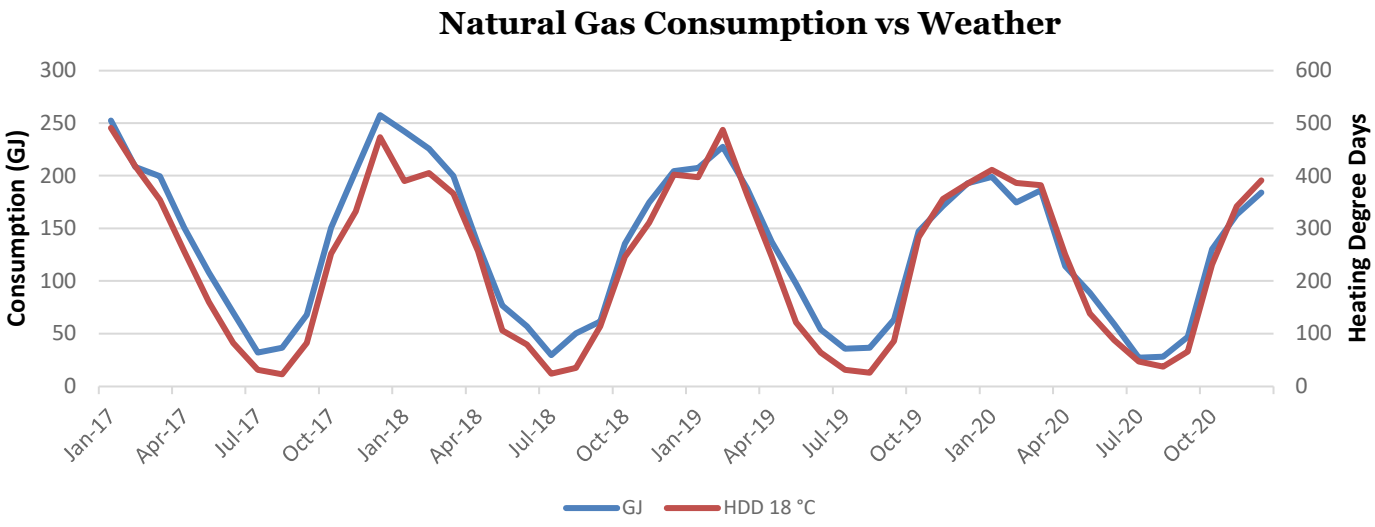
Appendix E: Review of Energy Consumption

Natural Gas Usage Breakdown

	Total	Space Heating	Domestic Hot Water
Annual GJs	1,572	1,297	275
Annual Cost	$13,503	$11,139	$2,364
Percent	100%	82%	18%

The values above are estimated.





Since gas is used for space heating the gas curve (blue) is roughly matched to the shape of the weather curve (red). The height of the blue curve in July and August is an indication of domestic hot water consumption (because no space heating is required), as well as summer space heating (waste).

Winters where blue is closer to or above red (higher consumption relative to weather) may have had irregular boiler control, or may be from times before upgrades in roof insulation or windows.

Appendix F: FortisBC Incentive Programs

FortisBC has a variety of rebate offerings for commercial buildings. Relevant rebates are incorporated into this report. Other programs may be applicable to other buildings in your portfolio.

Program	Description	Estimated Incentive available
Efficient Boiler Program	Rebates for qualifying high-efficiency boilers.	Up to $45,000 per condensing boiler. Up to $20,000 per mid efficiency boiler.
Efficient Water Heater Program	Rebates for qualifying high-efficiency domestic water heaters.	Up to $15,000 per appliance
Condensing Make Up Air/Air Handling/Roof top unit Program	Rebates for qualifying condensing Make Up Air/Air Handling/Rooftop units	Up to $9,000 per unit
HVAC Controls Rebate Program	Rebates for hydronic additives, DHW recirculation controls	Varies. Please speak with your FortisBC representative for more information if this program is applicable.
Efficiency a la Carte Program (Commercial Foodservice Equipment)	Rebates for high- efficiency kitchen appliances.	Up to $4,500 per appliance
Commercial Custom Design Program – Retrofits	Rebates for energy studies and customized capital incentives proportional to anticipated gas savings.	Varies. Please speak with your FortisBC representative for more information if this program is applicable.

CMHC Energy Efficient Properties: Significant reductions in mortgage insurance are available to you simply by proving you have implemented energy savings such as those in this report. The Canadian Mortgage and Housing Corporation (CMHC) offers the reductions through a very simple streamlined application. The more invested, and the more energy saved, the larger the reduction. (Up to the lessor of the value of the capital invested in energy measures and the overall percentage reduction in energy consumption up to a maximum of 15%.) All property mortgages in Canada require insurance from CMHC. Completion of the upgrades must be verified by a qualified third party which must be a Professional Engineer or Certified Engineering Technologist.

Energy Star Portfolio Manager: This free service from the Canadian Government provides awards and an on-line "dashboard" for building owners or property managers to track energy costs. It allows verification of savings from energy upgrades such as those promoted in this assessment. FortisBC and BCHydro give automatic updates so once signed up bills appear without any data entry on your part. Variations in weather are compensated with live weather station data so you don't need to guess at the effects. You can compare your buildings to similar ones nearby or rank within your ownership portfolio for targeted investment. Energy Star may soon award recognition of achievement for savings in apartment buildings (this is a new feature.) For ease of use, Portfolio Manager setup can be performed by authorized or experienced third parties.

Assumptions for Internal Rate of Return (ROI) Estimate

- Energy prices increase at 3%/year.
- Hot water tank replacement costs increase at 2%/year.
- Mechanical equipment lasts 20 years
- Cost assumptions for boiler upgrades reflect industry commercial rates for material and labour.

Notes:

- ROI illustrates the internal rate of return and is based on the *incremental* costs and savings, i.e. the costs/savings from new high efficiency components vs. new standard efficiency components (where existing equipment is at or near end of expected life). Speak with FRESCo for further details.
- ** Annualized cost savings include savings from utility bills and savings from replacement with longer life equipment
- Figures have been rounded and as a result the totals may not reflect the sum or each item.
- Figures provided are estimates; savings are not guaranteed.
- Considerations other than estimated costs and savings may be relevant; contact Fisher Resource Efficiency Solutions Company Ltd. ("FRESCo") to discuss the various options.
- FRESCo does not advocate for any particular building upgrade option or contractor. If a participant is interested in pursuing a building upgrade FRESCo can provide implementation support for major measures, but the owner is responsible for deciding whether/how to move forward with a building upgrade.
- FRESCo has not designed any of the upgrades being considered. If a participant moves forward with a building upgrade it is the responsibility of each contractor carrying out the upgrades to ensure that the work meets all requirements (e.g. code restrictions, manufacturer specifications). FRESCo does not make any representations or warranties regarding any of the upgrades considered and is not liable for any losses, should any occur, as a result of any upgrades that are implemented.
- Not all factors may be incorporated into the analysis presented above; the participant should do their due diligence before making any decisions.