Enerficiency
CONSULTING

Energy Efficiency Opportunity Assessment
of
Corporate Buildings

District of Invermere

Prepared For: District of Invermere

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September, 2009

1. Introduction

An opportunity assessment is an initial survey of facilities and their energy bills in order to determine the potential scope of a comprehensive energy efficiency retrofit. The opportunity assessment includes a review of the energy bills, a short walk-through of key facilities, and discussions with staff. From the information gathered, broad estimates of potential energy savings and project costs are made, and a financial analysis is performed.

The purpose of the opportunity assessment is to indicate to staff and council/board the potential benefits, both financial and otherwise, from undertaking a comprehensive energy efficiency project. It should be understood that an opportunity assessment is NOT a comprehensive energy audit or study, and does not take the place of an engineering study. Rather, the opportunity assessment allows local governments to make informed decisions about if and how to proceed with more detailed assessments.

Comprehensive Energy Efficiency Retrofits

Energy efficiency retrofits projects provide a number of benefits to local governments. In addition to the savings in utility expenditures, there are potential benefits from improved occupant comfort, replacement of aging equipment, and reduced maintenance expenditures. There is also the opportunity to show leadership within the community in taking action on climate change, as well as working towards carbon neutral commitments made under the Climate Action Charter.

Often organizations only choose to undertake low cost, short payback measures, or to proceed slowly, one project at a time. A comprehensive retrofit aims to greatly improve the efficiency of all or most of the organization's facilities in a single project. Although this will require a larger capital investment and may have longer paybacks, there are many benefits to this approach, both financial and otherwise:

Financial implications. Energy efficiency projects are an investment opportunity for local governments. By delaying projects, or choosing only short payback measures, local governments miss out on these opportunities. Energy efficiency projects should be evaluated in financial terms, over the project life cycle. When you do so, implementation delays or reduced scope will result in a lower net present value. Comprehensive retrofits provide a greater financial return to the local government in the long run.

Economies of scale. Larger projects can result in lower costs. Large projects will gather more interest from contractors bidding the job, resulting in more competitive bids. Larger quantities of equipment (such as lamps and ballasts) will result in supplier discounts and a large project will result in lower consulting fees than multiple small projects. And although a comprehensive retrofit may require more staff time initially, it will mean less staff time is required over the long term in comparison to managing many small projects.

Equipment renewal. Replacing old inefficient equipment not only saves energy, it also upgrades equipment that may need to be replaced soon anyway. A good example is aging boiler plants. By using energy savings to pay for the upgrade, future capital expenditures can be avoided. Allowing for longer paybacks means more equipment renewal can be incorporated into the project.

Cash flow neutral. Energy efficiency projects are cash flow neutral. That means the cost of financing the project is covered by the reduction in operating costs. So a comprehensive retrofit project can be financed with no impact on local government budgets or taxpayers. Small projects tend to come out of current budgets, although they still result in lower operating costs down the road.

2. Facilities

This opportunity assessment examined 9 of Invermere's facilities. Energy consumption data and other information was provided by staff. All nine buildings had a quick walkthrough site visit to look for potential savings opportunities. The buildings are summarized below:

Building	Area (ft^2)	Annual Energy Cost
PW Yards & Buildings	6,147	$ 12,299
Old District Office (Wildsight)	1,820	$ 2,241
Library	3,744	$ 5,244
Courthouse	4,528	$ 9,785
District Office	3,062	$ 5,784
Firehall/Emerg	12,503	$ 17,459
Community Hall	10,000	$ 23,320
Downtown Washroom	540	$ 2,616
Sewage Plant	6,147	$ 20,285

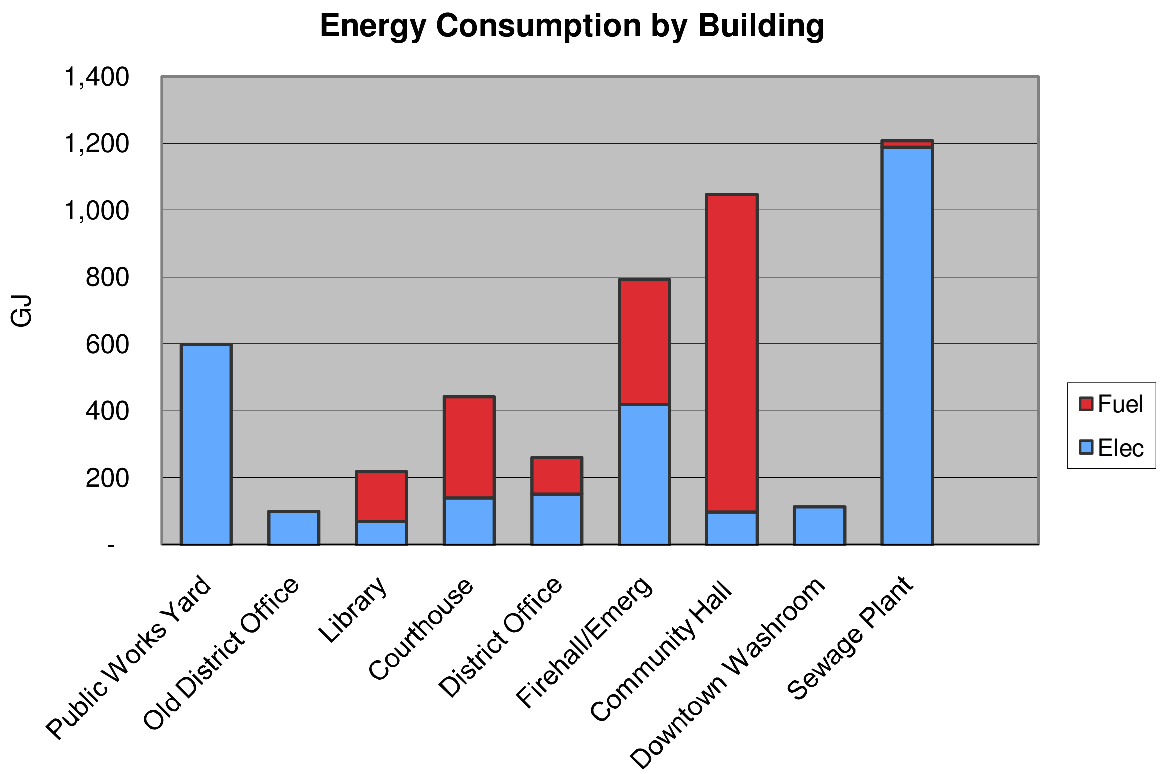
3. Current Energy Consumption and GHG Emissions

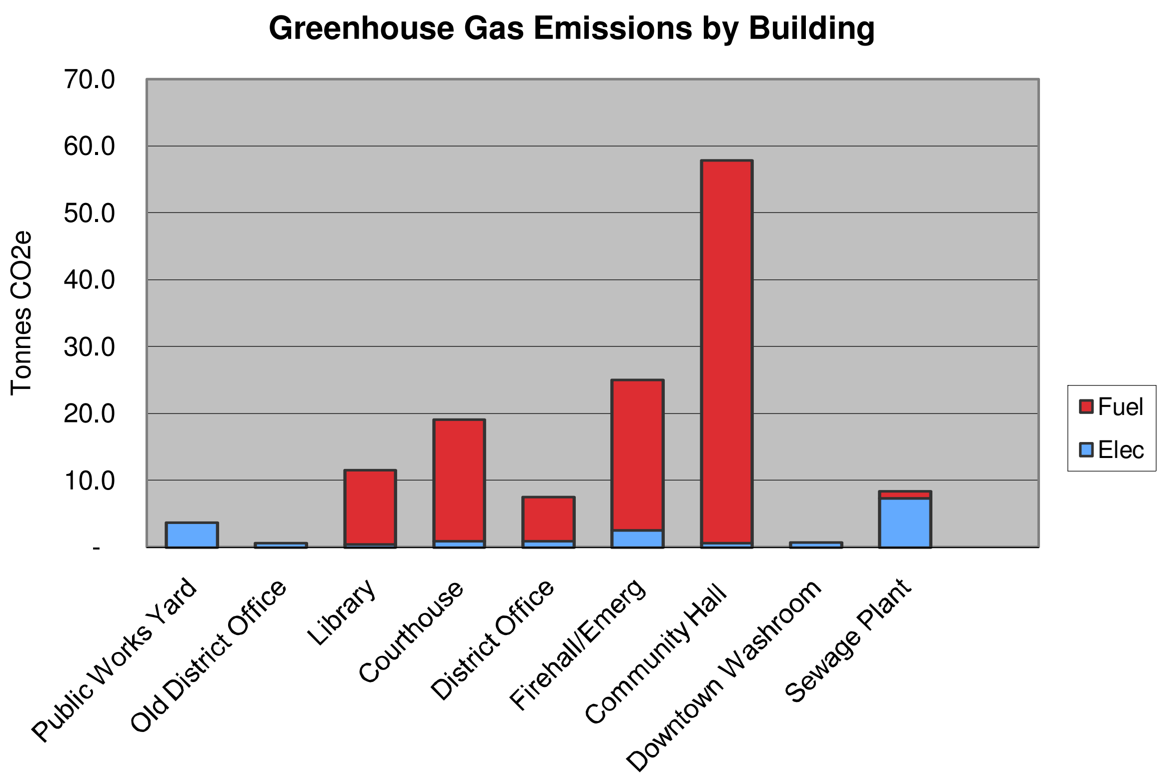
Total energy consumption for the facilities is 4,784 GJ and $99,000 annually. Electricity consumption is 801,000 kWh and $56,000, while fuel consumption is 1,900 GJ and $43,000. Five of the buildings use propane as the primary heating fuel, while one (Library) uses heating oil. The remaining three facilities have electric heat. Total greenhouse gas (GHG) emissions are 134 tonnes CO2e, 87% from fuel combustion.

The largest energy consumer is the Sewage Treatment Plant, accounting for roughly one quarter of consumption. However, most of its energy usage is process related. Of the other buildings, the Community Hall consumes 22% of total energy, while the Public Work yard and Courthouse are other significant energy consumers. The Community Hall produces by far the greatest amount of GHG emissions, accounting for 43% of the total. This is due to its large consumption of propane.

Energy intensity, in terms of consumption per unit area, is a useful way of comparing building to other similar facilities, although not applicable to all building types. The most energy intensive facility is the Downtown Washroom, which has an energy intensity of 58 $ekWh/ft^2$.

For the most part the remaining facilities do not have particularly high energy intensity. All but the Public Works yard have lower than typical energy consumption. The Library and Community Hall have very low electricity consumption, while the Community Hall does have fairly high fuel consumption.


Energy Consumption by Building
GJ
1,400
1,200
1,000
800
600
400
200
-
Fuel
Elec
Public Works Yard
Old District Office
Library
Courthouse
District Office
Firehall/Emerg
Community Hall
Downtown Washroom
Sewage Plant


Greenhouse Gas Emissions by Building
Tonnes CO2e
70.0
60.0
50.0
40.0
30.0
20.0
10.0
-
Fuel
Elec
Public Works Yard
Old District Office
Library
Courthouse
District Office
Firehall/Emerg
Community Hall
Downtown Washroom
Sewage Plant

4. Energy Efficiency Measures

Although energy intensity is not particularly high for the most part, there are still considerable opportunities for energy savings within the facilities. The following discussion is based on the site visits and the utility data provided. General opportunities applicable to a number of buildings are given in section 4.1, while other, more specific opportunities are give in section 4.2. More information on the buildings can be found in the appendix.

4.1 General Opportunities

Lighting
Many of the buildings still use fluorescent T12 lighting with magnetic ballasts in some or all areas. These should be upgraded to more efficient T8 lamps with electronic ballasts, which provide improved lighting quality as well as energy savings. Although some incandescent lights have been converted to compact fluorescents, others remain. These should be converted to CFLs wherever possible. Other lighting opportunities include occupancy sensors, LED exit lights, and reducing light levels in overlit areas.

Building Controls
Only the Courthouse has a computerized building automation system, and most of the buildings are too small or do not have complex enough equipment to justify such a system. Most heating/cooling equipment are furnaces or rooftop units, controlled by a zone thermostat. Where schedules are fairly regular, these should be controlled by a programmable thermostat. There are quite a few programmable thermostats in use in the facilities, although some of these were overridden. It is fairly common for programmable thermostats to be overridden or schedules to be changed by occupants, and all programmable thermostats should be checked regularly. Posting instructions on how to adjust temperatures temporarily without permanently overriding can be helpful. It may be useful to standardize on a single programmable thermostat for simplicity. Some features to look for are simple 7 day or 5+2 day programming, battery free operation, easy override, and instructions permanently printed on the thermostat case.

For buildings with sporadic occupancy, a standard thermostat can be more effective than a programmable one if it is easily accessible and occupants turn it down when the building is unoccupied. Posting instructions and marking the setback temperature on the thermostat help remind occupants to turn it down when they leave. Most standard thermostats are bi-metallic, which have a large deadband and can be inaccurate. Newer thermostats are electronic and have more precise temperature control, which can result in energy savings. If a programmable thermostat is used in a building with irregular occupancy, one strategy that can work is to set back the temperatures quite low over night (~15°C) and bring them up to a moderate setback (~18°) during the day. Users can then use the override to bring the temperature up to normal when the building is occupied.

Building Envelope
Unless windows are single glazed or there is little or no insulation, it is rarely cost effective to replace windows or add insulation to buildings due to the high cost of these retrofits. However, if work is being done on the building (e.g. roof replacement) it can be a good opportunity to increase the insulation. When windows need to be replaced, make sure they are replaced with low-e windows with thermally broken frames. It can also make sense to upgrade the building envelope in order to improve occupant comfort.

Older buildings often have leaky building envelopes. All weatherstripping on doors and windows should be checked and replaced where necessary. A comprehensive program of weatherstripping, caulking, and sealing the building envelope can reduce infiltration and heat loss, leading to energy savings.

4.2 Building Specific Opportunities

Public Works Yard

The Public Works yard has two buildings – a shop building and a small office. There is no insulation in the shop, and spray insulation could be added fairly easily.

Occupancy sensors should be used to control lights in the office and also in the shop bays.

If not already in place, a timeclock should be used to control the heat recovery ventilator in the office.

Old District Office (Wildsight Office)

The old district office is currently being used as an office for the Wildsight non-profit upstairs and as a senior's drop-in downstairs. Energy consumption is very low, due to the limited use downstairs and the diligent control of lights and thermostats by Wildsight. It is slated for demolition, perhaps as early as next year. Because of this, there is no point in retrofitting the lighting or installing programmable thermostats. It would be worthwhile to add weatherstripping to doors and windows, and to place a sign by the downstairs radiant heating thermostat, instructing users to turn it off during the summer.

Library

Some of the storm windows are broken/missing and should be replaced. In the long term it would be good if these were replaced with new energy efficient windows, but the high cost of window replacements make it unlikely to be cost effective.

The Library was recently retrofitted with T8 lamps and electronic ballasts. Light levels in the stack appears high and could perhaps be reduced, although the rest of the areas seem reasonable. The upstairs offices and food ban downstairs still use T12 lamps and magnetic ballasts and should be changed to T8/electronic.

The oil furnaces could be converted to air source heat pumps. There are already DX coils for cooling in the furnaces, and probably the outdoor condensing unit alone could be replaced, with the oil furnace remaining as backup heat in cold weather. A heat pump would significantly reduce energy costs as the equipment is not only efficient, but the cost of electricity is much lower than oil. GHGs would also be significantly reduced.

Courthouse

The cell block has no insulation and is very cold in winter. This should be insulated from the outside. Below each window there is an thin, uninsulated wood panel that should have insulation added to it.

This is the only building with a computerized control system, which appears to be operating correctly. However, the minimal usage may provide additional opportunities for scheduling and setbacks. A regular review of system programming is a good idea to ensure optimal operation.

The air handling units appear to have excessive vibration, and it may be advisable to have them checked.

District Office
The lighting uses T8 lamps but magnetic ballasts. Although replacing the ballasts with electronic ones would save energy, it would not likely be cost effective. Upon failure, ballasts should be replaced with electronic.

Light levels are very high. However, staff make use of the two level switching so as to only use half the lamps. Any areas that cannot be switched to reduce light levels should have the number of lamps reduced.

Although it would not be cost effective to replace the existing roof top units with heat pumps, it should be considered when it comes time to replace them. They are currently 10 years old and can be expected to last 15-20 years.

Firehall / Emergency Services
Light levels are excessive in the truck bays and the number of fixtures/lamps should be reduced. The lights were also on during the site visit, although there was nobody using them. Occupancy sensors could be used, although full coverage needs to be ensured and some permanent emergency lighting would be advisable.

Although there are already programmable t'stats for the two furnaces, they appear to have been overridden, likely due to the erratic hours of a firehall. A review of the programming, along with a sign with instructions, would be advisable.

Community Hall
The community hall is scheduled for replacement by a new community centre at some time in the future. However, this has been in planning for some time, and expectations are that the existing community hall will be used for at least another five years and possibly longer. But the uncertainty of future use will have to be considered in any energy efficiency upgrades.

The roof is to be replaced shortly, which would provide an opportunity to increase the insulation.

The high fuel consumption is largely due to the inefficiency of the heating system. Small steam systems are quite inefficient, as they operate at high temperatures (compared to hot water) and cannot be shut down easily. However, they are not easily replaced or upgraded. An automatic flue damper can be installed that will reduce off-cycle losses. This would also require the pilot lights to be replaced with electronic ignition. In summer the boiler should be shut down.

If it is determined that the building will remain for the long term, replacement of the heating system should be considered. Steam systems can sometimes be converted to hot water, re-using the existing steam piping and radiators. In this case a condensing boiler can greatly improve efficiency. Another alternative would be to install rooftop heat pump units as the primary heat source, with electric heat as the backup.

In the Judo centre heating is provided by propane heaters located in the space. This area was originally a garage and there is a possibility that fresh air requirements are very high due to vehicle exhaust. This should be looked into and outside air volumes reduced to amounts appropriate for the current use.

Downtown Washroom
Energy consumption is very high for the small size of this building, due to the uninsulated walls and control of the boiler.

As this building is occupied year round and has no insulation, this is a case where adding insulation is probably cost effective, as well as improving occupant comfort.

Control of the heating system could be improved. The thermostat is located in the mechanical room, where it is influenced by heat off the boiler and piping. It should be located in one of the washrooms, in a vandal-proof box. A programmable t'stat should be used to tunr down temperatures when the washroom is locked. When there is no call for heating, both the boiler and circulating pump should shut off (and the boiler allowed to cool down). Occupied space temperatures in the washroom should be kept as low as possible (~18°).

Sewage Plant
Although electricity consumption is high, this is a function of the aeration blowers, rather than the building. These currently always run at full load, but could likely be equipped with a variable speed drive to reduce flow at certain times.

Summary of Key Measures

Building	Recommended	Optional
PW Yards & Buildings	Lighting retrofit Occupancy sensors Timeclock for HRV Spray insulation in shop	
Old District Office (Wildsight)	Weatherstripping/sealing	Lighting retrofit
Library	Lighting retrofit Air-source heat pumps	Low-e windows
Courthouse	Additional insulation	
District Office		Lighting retrofit Air-source heat pumps
Firehall/Emerg	Lighting retrofit/redesign Occupancy sensors	
Community Hall	Add roof insulation Lighting retrofit Automatic flue damper/elec ignition Check outside air quantity	New heating system Window replacement
Downtown Washroom	Add wall/roof insulation Lighting retrofit Revise heating controls	
Sewage Plant	VSD on aeration blower	

5. Potential Energy Savings and Estimated Costs

Potential savings have been estimated based on utility bills and building descriptions, as well as the site visits performed. Savings are based on the recommended measures, without including the optional measures. Capital costs are estimated based on rule-of-thumb unit area and percentage costs. It is particularly difficult to estimate capital costs on small buildings, or where measures may be undertaken in-house by staff. **Both savings and costs should be considered rough estimates, intended to provide guidance prior to further analysis.**

Estimated Energy Savings Potential by Building

Building	Potential savings	
PW Yards & Buildings	20%	$ 2,460
Old District Office (Wildsight)	5%	$ 112
Library	45%	$ 2,405
Courthouse	18%	$ 1,801
District Office	-	$ -
Firehall/Emerg	8%	$ 1,334
Community Hall	15%	$ 3,387
Downtown Washroom	60%	$ 1,569
Sewage Plant	60%	$ 4,976
Total	**18%**	**$ 18,044**

** Note: No savings or costs have been included for the Library/Museum.

Potential savings for a comprehensive retrofit of these buildings is estimated at $18,044 annually, or 18%. The project would also save 25 tonnes of GHG emissions, or 19%, which can be valued at $25/tonne based on the cost of offsets committed to through the Climate Action Charter, for additional savings of $625. There may be additional savings from reduced operating and maintenance costs, but these have not been included at this time.

Capital cost for a project of this scope is estimated at $145,100, including 15% allowance for engineering and project management. However, incentives of up to $23,300 may be available from BC Hydro and the federal government. Additional funding may be available through other sources.

A preliminary financial analysis indicates a simple payback of 6.5 years. Net present value over a 20 year project life would be $98,000.

Financial Analysis	
Energy savings	$ 18,044
GHG savings	$ 625
Total savings	$ 18,669
Capital cost	$ 127,700
Eng. and project mgmt fees	$ 17,400
Incentives	($ 23,300)
Total cost	$ 121,800
Project term	20 years
Discount rate	6.00 %
Inflation	2.00 %
Simple payback	6.5 years
Net present value	**$98,300**

Although the payback on this project is fairly short, the City may want to extend the payback in order to achieve greater savings, include more equipment renewal, or include renewable energy technologies (such as solar water heating) in order to reduce GHG emissions.

6. Recommendations and Next Steps

This opportunity assessment has shown that there is considerable potential for energy savings, in spite of the relatively low energy intensity of many of the facilities. A comprehensive retrofit is financially viable, with an attractive financial return over the life of the project. In addition, a comprehensive energy retrofit provides an opportunity to improve occupant working conditions, replace aging equipment, reduce greenhouse gas emissions, and show leadership on climate change within the community.

If it is necessary to borrow funds in order to implement the recommended measures, it is important to remember that energy efficiency retrofits pay for themselves out of utility savings. Financing costs will be matched by reduced energy bills. This means that there is no impact on overall municipal budgets or on taxpayers.

Insulation is the largest component of the retrofit. Local contractors should be able to make recommendations and provide quotes.

Lighting retrofits are another major component of the recommended measures. Local lighting suppliers may be able to give more detailed recommendations and cost estimates, often at no charge. There are also firms that specialize in lighting energy efficiency retrofits, who will undertake a project in a turnkey fashion. Retrofitting all the lighting at once would be most cost effective.

Many of the measures do not necessarily require further analysis, and can be implemented by staff. These include programmable thermostats, occupancy sensors, window replacements, and weatherstripping/sealing.

An engineer with expertise in the operation of the sewage treatment plant should be consulted to assess the potential for installing a VSD on the aeration blower.

Recommended next steps:

- Review the life expectancy of the facilities and identify any other projects planned that may overlap with an energy retrofit..
- Have an engineer review the potential use of a VSD at the sewage treatment plant.
- Determine what work can be done in-house, and how the remaining work will be contracted out.
- Set aside sufficient budget to undertake the work, and determine how it will be financed.
- Confirm requirements for BC Hydro and federal government incentives, and investigate any other potential funding opportunities.

Appendix

Utility Summary
Building Reports

Invermere Utility Data

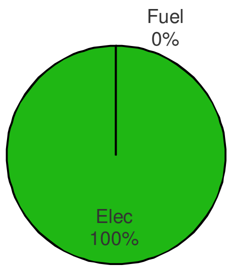
Building name	Area		Energy Consumption			Energy Cost			BEPI (ekWh/ft²)			GHGs (tonnes CO2eq)		
		Elec (kWh)	Elec (GJ)	Fuel (GJ)	Total (GJ)	Elec	Fuel	Total	Elec	Fuel	Total	Elec	Fuel	Total
Public Works Yard	6,147	166,548	600	-	600	$ 12,299	$ -	$ 12,299	27.1	-	27.1	3.7	-	3.7
Old District Office	1,820	27,793	100	-	100	$ 2,241	$ -	$ 2,241	15.3	-	15.3	0.6	-	0.6
Library	3,744	19,092	69	151	220	$ 1,336	$ 3,908	$ 5,244	5.1	11.2	16.3	0.4	11.1	11.5
Courthouse	4,528	39,199	141	302	443	$ 3,128	$ 6,657	$ 9,785	8.7	18.5	27.2	0.9	18.2	19.1
District Office	3,062	42,428	153	109	261	$ 3,386	$ 2,397	$ 5,784	13.9	9.8	23.7	0.9	6.5	7.5
Firehall/Emerg	12,503	116,537	420	373	792	$ 9,226	$ 8,234	$ 17,459	9.3	8.3	17.6	2.6	22.5	25.1
Community Hall	10,000	27,393	99	949	1,047	$ 2,211	$ 21,109	$ 23,320	2.7	26.4	29.1	0.6	57.2	57.8
Downtown Washroom	540	31,594	114	-	114	$ 2,616	$ -	$ 2,616	58.5	-	58.5	0.7	-	0.7
Sewage Plant	-	330,626	1,190	17	1,207	$ 19,902	$ 383	$ 20,285	#DIV/0!	#DIV/0!	#DIV/0!	7.3	1.0	8.3
Total	**42,344**	**801,210**	**-**	**1,900**	**4,784**	**$ 56,346**	**$ 42,688**	**$ 99,034**				**17.6**	**116.6**	**134.2**

Building: **PW Yards & Buildings**
Area: 6,147 ft²

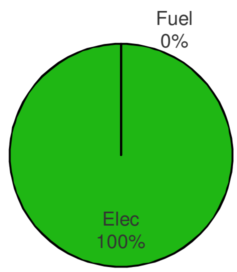
Consumption Data

Elec	166,548	kWh	$	12,299	3.7	tonnes CO2e
Fuel	-	GJ	$	-	-	tonnes CO2e
Total	600	GJ	$	12,299	3.7	tonnes CO2e

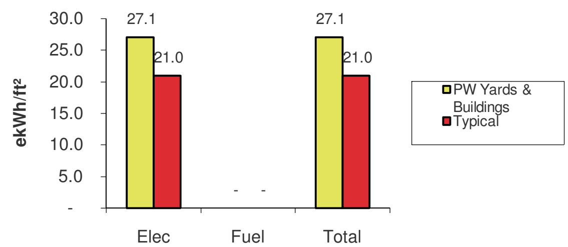
	PW Yards & Buildings		*Typical*	
Elec	27.1	ekWh/ft	21.0	ekWh/ft
Fuel	-	ekWh/ft	-	ekWh/ft
Total	27.1	ekWh/ft	21.0	ekWh/ft



Annual Energy Cost



GHG Emissions



Energy per ft² - PW Yards & Buildings vs Typical

Building description

The public works yard consists of two buildings. The shop building is a high level uninsulated concrete block building with bay doors. The doors have had styrofoam insulation added, with two new insulated doors on order. A small wood frame office building was built about 10 years ago, with office and meeting space. Consumption is higher than typical, largely due to the lack of insulation.

Hours of use: 8:00 - 4:30, M-F

Lighting
In the shop building lighting is fluorescent, with 8 foot T12 lamps and magnetic ballasts. Light levels are appropriate.

In the office building lighting is a mix of fluorescent and incandescent. Fluorescent lighting is T12 with magnetic ballasts. Incandescents are recessed flood lamps. Light levels are quite high.

Mechanical
The shop building is heated by electric unit heaters with manual t'stats. These were either turned off or down to 10 degC at the time of the site visit. Ceiling fans provide air circulation.

Heating in the office is by electric baseboards with manual t'stats. An HRV provides ventilation air.

Potential Measures

Lighting Strategies
* Install T8 fluorescent lamps.
* Replace magnetic ballasts with electronic ballasts.
* Reduce number of lamps and/or fixtures if over designed.
* Install compact fluorescent lamps to replace incandescent.
* Install occupant sensor controls to turn off lights when not required.

HVAC Energy Cost Savings Strategies
* Install programmable thermostats or timeclocks

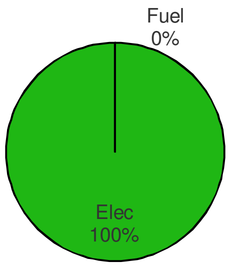
Building Envelope
* Install additional insulation in walls and/or roof

Other
* Install timeclock to control HRV.

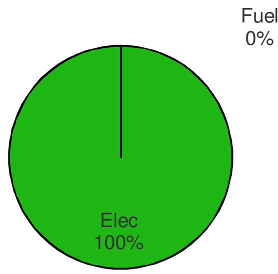
Building: **Old District Office (Wildsight)**
Area: 1,820 ft²

Consumption Data						
Elec	27,793	kWh	$	2,241	0.6	tonnes CO2e
Fuel	-	GJ	$	-	-	tonnes CO2e
Total	100	GJ	$	2,241	0.6	tonnes CO2e

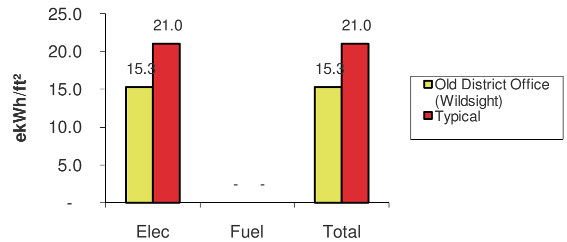
	d District Office (Wildsig		*Typical*	
Elec	15.3	ekWh/ft	21.0	ekWh/ft
Fuel	-	ekWh/ft	-	ekWh/ft
Total	15.3	ekWh/ft	21.0	ekWh/ft



Annual Energy Cost



GHG Emissions



Energy per ft² - Old District Office (Wildsight) vs Typical

Building description

This small two storey office building used to be the District office. Today it is occupied by the Wildsight non-profit and a Senior's drop-in. The building is wood frame construction, with double glazed windows in wood frames. Weatherstripping is in poor condition upstairs. Energy consumption is quite low. This building is slated for demolition in the near future.

Hours of use: 8:30 - 4:30, M-F upstairs (Wildsight), ~ 2 hrs/day downstairs (drop-in)

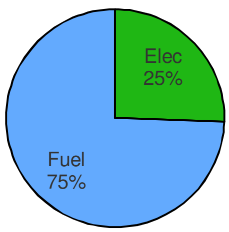
Lighting
Most lighting is fluorescent, with T12 lamps and magnetic ballasts. Upstairs, light levels are a bit low due to delamped fixtures. Downstairs light levels are excessive. There is one incandescent light.

Mechanical
Heating is provided by an electric furnace with DX split system cooling. There is also electric in-floor radiant heating in the basement. The furnace t'stat is kept quite low and turned down further at night. The radiant t'stat was at 68 degF.

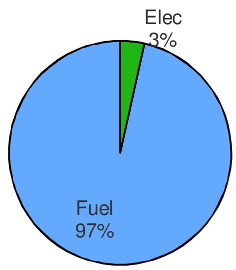
Potential Measures

Lighting Strategies
* Install T8 fluorescent lamps.
* Replace magnetic ballasts with electronic ballasts.
* Reduce number of lamps and/or fixtures if over designed.
* Install compact fluorescent lamps to replace incandescent.
HVAC Energy Cost Savings Strategies
* Install programmable thermostats or timeclocks
Building Envelope
* Install weather stripping, caulk around windows and doorways, check seals

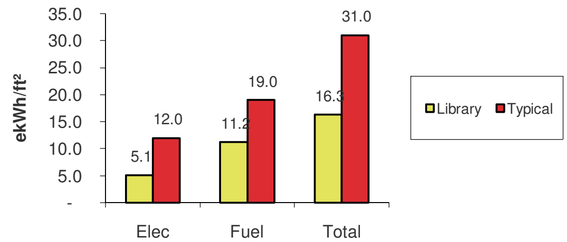
Building:	**Library**					
Area:	3,744	ft²				
Consumption Data						
Elec	19,092	kWh	$	1,336	0.4	tonnes CO2e
Fuel	151	GJ	$	3,908	11.1	tonnes CO2e
Total	220	GJ	$	5,244	11.5	tonnes CO2e
	Library				*Typical*	
Elec	5.1	ekWh/ft			12.0	ekWh/ft
Fuel	11.2	ekWh/ft			19.0	ekWh/ft
Total	16.3	ekWh/ft			31.0	ekWh/ft



Annual Energy Cost



GHG Emissions



Energy per ft² - Library vs Typical

Building description

Originally the RCMP building, this wood frame building was built in 1963. On the ground floor is the library with some office space upstairs, while the food bank has space downstairs. Windows are single glazed with a storm sash, some of which are in poor condition or missing. Energy consumption is quite low.

Hours of use: Tu - Sat, 6-8 hrs/day. Food bank Tu & Th only.

Lighting
Lighting in the library is new T8 fluorescent with elecronic ballasts. The office and food bank areas have older T12 fluorescent with magnetic ballasts. Light levels over the book stacks are very high, while reasonable in the rest of the building.

Mechanical
Heating and cooling is provided by two oil furnaces with DX split cooling. These are controlled by manual t'stats, which are not turned down at night.

Potential Measures

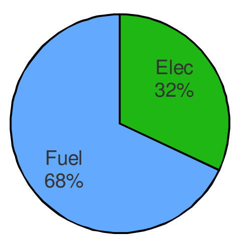
Lighting Strategies
* Install T8 fluorescent lamps.
* Replace magnetic ballasts with electronic ballasts.
* Reduce number of lamps and/or fixtures if over designed.

HVAC Energy Cost Savings Strategies
* Install programmable thermostats or timeclocks

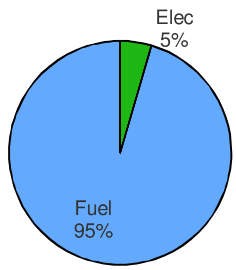
Building Envelope
* Install weather stripping, caulk around windows and doorways, check seals
* Install high efficiency double glazed low-e windows

Other
* Install air-source heat pumps

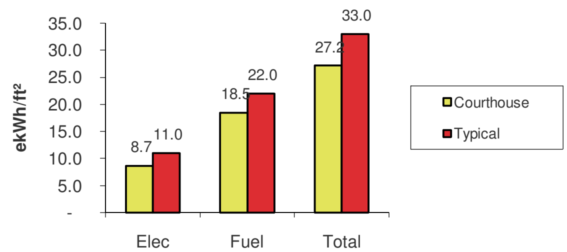
Building:	**Courthouse**					
Area:	4,528	ft²				
Consumption Data						
Elec	39,199	kWh	$	3,128	0.9	tonnes CO2e
Fuel	302	GJ	$	6,657	18.2	tonnes CO2e
Total	443	GJ	$	9,785	19.1	tonnes CO2e
	Courthouse				*Typical*	
Elec	8.7	ekWh/ft			11.0	ekWh/ft
Fuel	18.5	ekWh/ft			22.0	ekWh/ft
Total	27.2	ekWh/ft			33.0	ekWh/ft



Annual Energy Cost



GHG Emissions



Energy per ft² - Courthouse vs Typical

Building description

The courthouse is a single storey wood frame building built in 1981. It has double glazed windows with aluminum frames. Below each window is an uninsulated panel. There is no insulation in the cell block, and staff complain it can be very cold. In spite of this, energy consumption is lower than typical, due to the minimal usage.

Hours of use: Twice per month

Lighting
Lighting is fluorescent with T12 lamps and magnetic ballasts. Light levels seem reasonable. Exit lamps may be incandescent. Exterior lighting is on photocell.

Mechanical
There are two small air handling units with DX split cooling and propane fired duct heaters. AHU's have economizers. Additional heating is provided on the perimeter by electric baseboard heaters. All systems are controlled by a Delta building automation system.

The AHUs seemed to have a considerable amount of vibration, and should be checked.

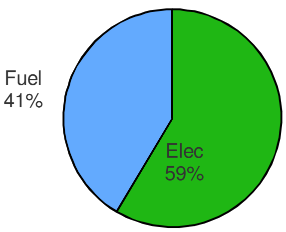
Potential Measures

Lighting Strategies
* Install T8 fluorescent lamps.
* Replace magnetic ballasts with electronic ballasts.

HVAC Energy Cost Savings Strategies
* Recommission controls to improve operation and introduce control strategies to schedule equipment, reset supply air and water temperatures, and optimally start and stop equipment.

Building Envelope
* Install additional insulation in walls and/or roof
* Check vibration on air handling units.

Building:	**District Office**					
Area:	3,062	ft²				
Consumption Data						
Elec	42,428	kWh	$	3,386	0.9	tonnes CO2e
Fuel	109	GJ	$	2,397	6.5	tonnes CO2e
Total	261	GJ	$	5,784	7.5	tonnes CO2e
	District Office				*Typical*	
Elec	13.9	ekWh/ft			14.0	ekWh/ft
Fuel	9.8	ekWh/ft			15.0	ekWh/ft
Total	23.7	ekWh/ft			29.0	ekWh/ft



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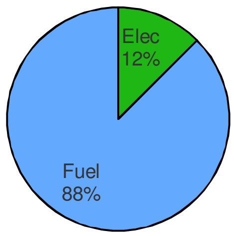

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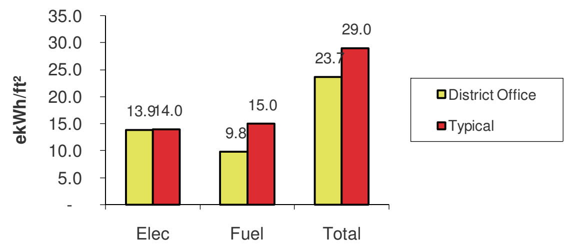


Energy per ft² - District Office vs Typical

Building description

The District office is a one storey building with a crawlspace used for storage, built in 1998. It is wood frame construction, with double glazed windows. Energy consumption is typical for electricity, and lower than average for fuel.

Hours of use: Business hours, M-F, plus ~ 5 meetings per month after hours

Lighting

Lighting is T8 fluorescent but with magnetic ballasts. Fixtures are 4 lamp, but can be switched to 2 lamps. Light levels are very bright with all four lamps, but staff generally only use two. Occupancy sensors are used in the copy room and individual offices. There are some incandecsent exterior lights, as well as HPS, all on photocell.

Mechanical

Heating and cooling is provided by propane rooftop units. These are controlled by programmable t'stats.

Potential Measures

Lighting Strategies

* Replace magnetic ballasts with electronic ballasts.
* Reduce number of lamps and/or fixtures if over designed.

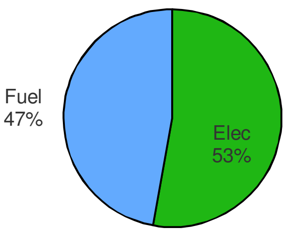
Building: **Firehall/Emerg**

Area:	12,503	ft²

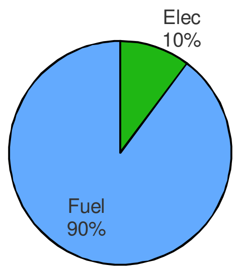
Consumption Data

Elec	116,537	kWh	$	9,226	2.6	tonnes CO2e
Fuel	373	GJ	$	8,234	22.5	tonnes CO2e
Total	792	GJ	$	17,459	25.1	tonnes CO2e

	Firehall/Emerg		*Typical*	
Elec	9.3	ekWh/ft	12.0	ekWh/ft
Fuel	8.3	ekWh/ft	17.0	ekWh/ft
Total	17.6	ekWh/ft	29.0	ekWh/ft



Annual Energy Cost



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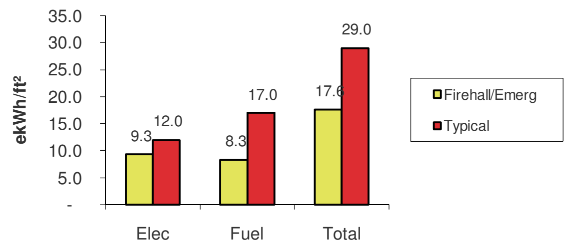


Energy per ft² - Firehall/Emerg vs Typical

Building description

The firehall/emergency services building was originally a school, but converted to a firehall within the last 10 years. It is insulated concrete block with a wood frame addition. Windows are double glazed, and bay doors are insulated. Doors are weatherstripped but in poor condition. Energy consumption is lower than typical, although firehalls can vary widely in energy use.

Hours of use: 1-2 days a week, plus callouts.

Lighting

Most lighting is fluorescent, with T8 lamps and electronic ballasts. Light levels are very high, and all lights were on in the truck bays. A few T12 lamps remain in storage areas. In the recreation lounge the lighting is predominantly CFLs. Exterior lighting is HPS.

Mechanical

Heating in the bays is by two propane furnaces. These have programmable t'stats but appear to be overridden. There is a propane fired rooftop unit that provides heating and cooling to the addition.

Potential Measures

Lighting Strategies

* Reduce number of lamps and/or fixtures if over designed.
* Install occupant sensor controls to turn off lights when not required.

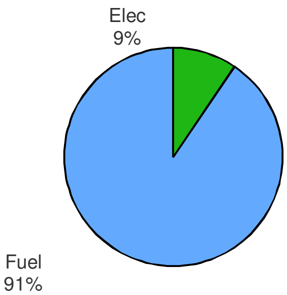
Other

Building:	**Community Hall**					
Area:	10,000	ft²				

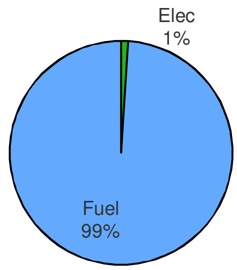
Consumption Data

Elec	27,393	kWh	$	2,211	0.6	tonnes CO2e
Fuel	949	GJ	$	21,109	57.2	tonnes CO2e
Total	1,047	GJ	$	23,320	57.8	tonnes CO2e

	Community Hall		*Typical*	
Elec	2.7	ekWh/ft	11.0	ekWh/ft
Fuel	26.4	ekWh/ft	22.0	ekWh/ft
Total	29.1	ekWh/ft	33.0	ekWh/ft



Annual Energy Cost



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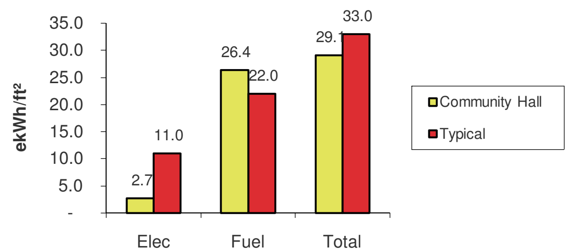


Energy per ft² - Community Hall vs Typical

Building description

The community hall is a multi-function facility aproximately 60 years old. The largest component is a high-ceiling hall, but it also contains a youth centre, judo centre, and search and rescue operation. Construction is wood frame. Windows are single-pane with storm windows. Energy consumption is very low in electrcity due to low usage, but somewhat high in fuel.

Hours of use: Sporadic, aprox. 2 days/week in hall. Youth centre used every day.

Lighting

Lighting in the hall and search & rescue has been retrofitted to T8 with electronic ballasts. The youth centre and judo centre still use T12 lamps and magnetic ballasts. There are some incandescent lights, including the exterior lights.

Mechanical

Heating in most areas is provided by a single low pressure steam boiler serving perimeter radiation. The propane boiler is atmospheric with pilot lights, and is quite old and inefficient. Space temperature is controlled by a programmable t'stat in the hall and manual t'stat in the youth centre.

Heating in the search and rescue and judo centre is by direct gas fired heaters mounted in the judo space. These are controlled by manual t'stats. They were originally intended for heating a truck bay, and may be oversized.

Potential Measures

Lighting Strategies

* Install T8 fluorescent lamps.
* Replace magnetic ballasts with electronic ballasts.
* Install compact fluorescent lamps to replace incandescent.
* Install occupant sensor controls to turn off lights when not required.

HVAC Energy Cost Savings Strategies

* Install higher efficiency gas boilers
* Install condensing boilers.
* Install automatic flue dampers, isolation valves, or circulation pumps and incorporate boiler staging to minimize losses.
* Install programmable thermostats or timeclocks

Building Envelope

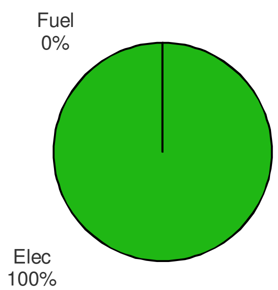
* Install high efficiency double glazed low-e windows
* Install additional insulation in walls and/or roof

Other

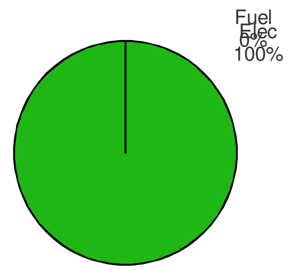
* New heating system
* Check OA quantities in Judo Centre

Building:	**Downtown Washroom**						
Area:	540	ft²					
Consumption Data							
Elec	31,594	kWh	$	2,616	0.7	tonnes CO2e	
Fuel	-	GJ	$	-	-	tonnes CO2e	
Total	114	GJ	$	2,616	0.7	tonnes CO2e	

	Downtown Washroom		*Typical*	
Elec	58.5	ekWh/ft	-	ekWh/ft
Fuel	-	ekWh/ft	-	ekWh/ft
Total	58.5	ekWh/ft	-	ekWh/ft



Annual Energy Cost



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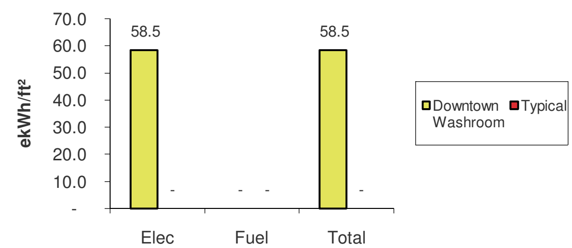


Energy per ft² - Downtown Washroom vs Typical

Building description

The downtown washroom is a public washroom built by Rotary in 1990. It is uninsulated concrete block, with no windows. Although there are no typical figures to compare to, energy consumption is very high for the size of the facility.

Hours of use: 7 am - 10 pm summer, 8:30 am - 6 pm winter

Lighting
Lighting is T12 fluorescent with magnetic ballasts. There are incandescent lamps in the mechanical room.

Mechanical
Heating is by underfloor hot water radiation. Water is supplied by a small electric boiler with a small circulating pump. Space temperature is controlled by a thermostat located in the mechanical room, set to 23°(although sign says leave at 25°). The boiler was on during the site visit, although it was a warm day.

Potential Measures

Lighting Strategies
* Install T8 fluorescent lamps.
* Replace magnetic ballasts with electronic ballasts.
* Install compact fluorescent lamps to replace incandescent.

HVAC Energy Cost Savings Strategies
* Recommission controls to improve operation and introduce control strategies to schedule equipment, reset supply air and water temperatures, and optimally start and stop equipment.
* Install programmable thermostats or timeclocks

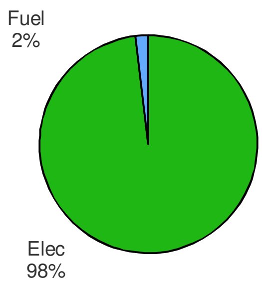
Building Envelope
* Install additional insulation in walls and/or roof

Building:	**Sewage Plant**					
Area:	-	ft²				

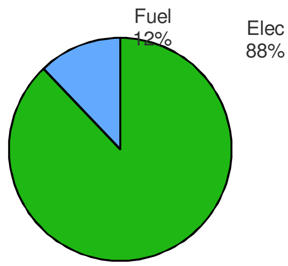
Consumption Data

Elec	330,626	kWh	$	19,902	7.3	tonnes CO2e
Fuel	17	GJ	$	383	1.0	tonnes CO2e
Total	1,207	GJ	$	20,285	8.3	tonnes CO2e

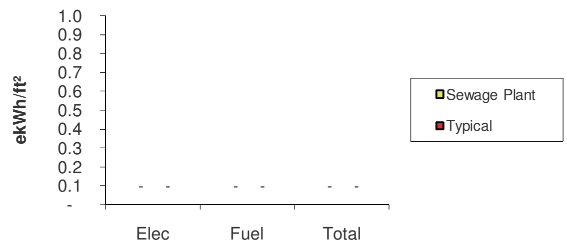
	Sewage Plant		*Typical*	
Elec	#DIV/0!	ekWh/ft	-	ekWh/ft
Fuel	#DIV/0!	ekWh/ft	-	ekWh/ft
Total	#DIV/0!	ekWh/ft	-	ekWh/ft



Annual Energy Cost



GHG Emissions



Energy per ft² - Sewage Plant vs Typical

Building description

The sewage treatment plant building is an uninsulated concrete block building that contains the air compresssors foir the aeration lagoon. Electricity consumption is very high, although it is almost all process load. Propane consumption is minimal.

Hours of use: Generally unoccupied.

Lighting
Lighting is incandescent with HPS exterior lights.

Mechanical
Heating is by a propane unit heater with the t'stat set to 10°. There are wall fans to bring in outside air for cooling.

There are two 50 HP air compressors for the lagoons. One of these runs at a time, with the other as backup.

Potential Measures

Lighting Strategies
* Install compact fluorescent lamps to replace incandescent.
HVAC Energy Cost Savings Strategies
* Install variable frequency drives on variable flow air systems

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