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Energy Efficiency Opportunity Assessment
of
Corporate Buildings

Tumbler Ridge

Prepared by: Enerficiency Consulting
458 Abbs Road
Gibsons, BC V0N 1V0
604 - 886 - 9864

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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 10 of Tumbler Ridge's facilities. Energy consumption data and other information was provided by staff. All the 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
Town Hall	9,684	$ 10,581
Public Works	8,285	$ 15,186
Community Centre/Aquatic	89,000	$193,327
Fire Hall	4,842	$ 9,349
Bay 5 Fire Dept	1,000	$ 2,273
Recycling building	2,400	$ 2,928
Sewage treatment	-	$ 52,726
Water pump 7/8	-	$ 39,485
Claude Galibois School	25,000	$ 10,042
Golf clubhouse	5,800	$ 8,070

** Note: Energy costs are estimated based on typical utility costs.

3. Current Energy Consumption and GHG Emissions

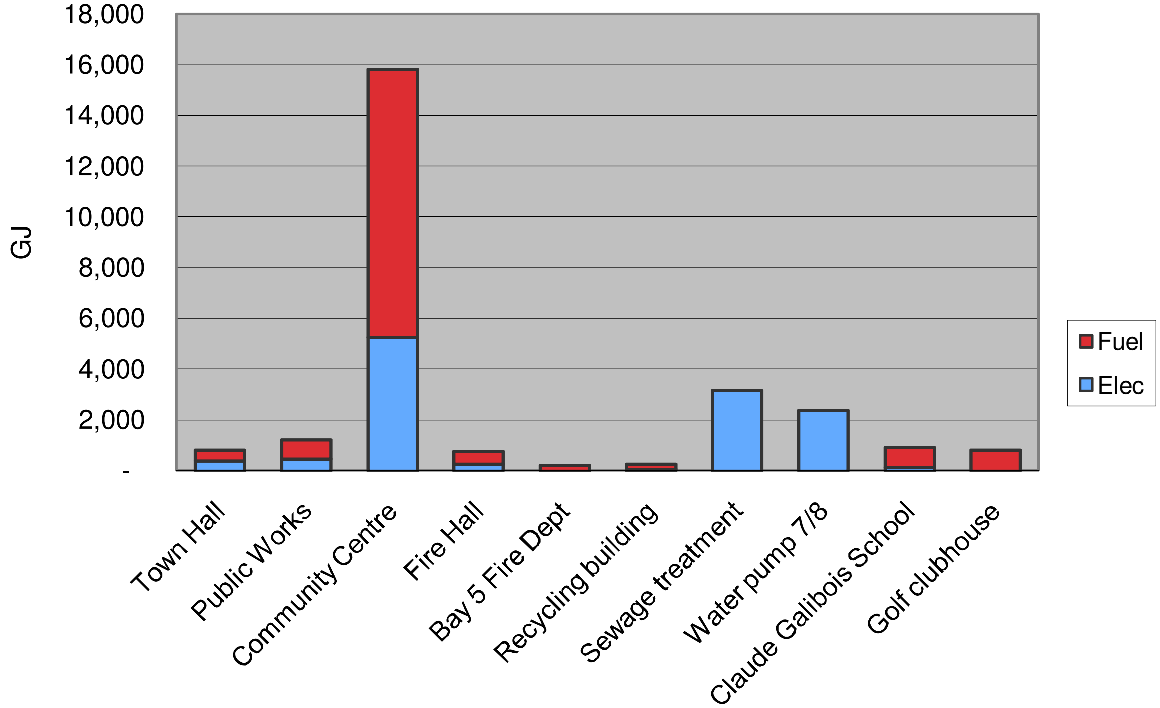
Total energy consumption for the facilities is 26,365 GJ and $343,967 annually. Electricity consumption is 3,346,289 kWh and $200,777 , while fuel consumption is 14,319 GJ and $143,190 . Eight of the buildings use natural gas as the primary heating fuel, while two (Sewage Treatment and Pump 7/8) use electricity. Total greenhouse gas (GHG) emissions are 804 tonnes CO_2e, 91% from fuel combustion.

The largest energy consumer is the Community Centre, accounting for 60% of consumption. The next largest consumers are the Sewage Treatment Plant and Pumps 7/8, although most of their energy usage is process related. The Community Centre also produces by far the greatest amount of GHG emissions, accounting for 70% of the total. Although the Sewage Treatment Plant and Pumps 7/8 are large energy consumers, they produce relatively few GHG emissions, as their consumption is all electric.

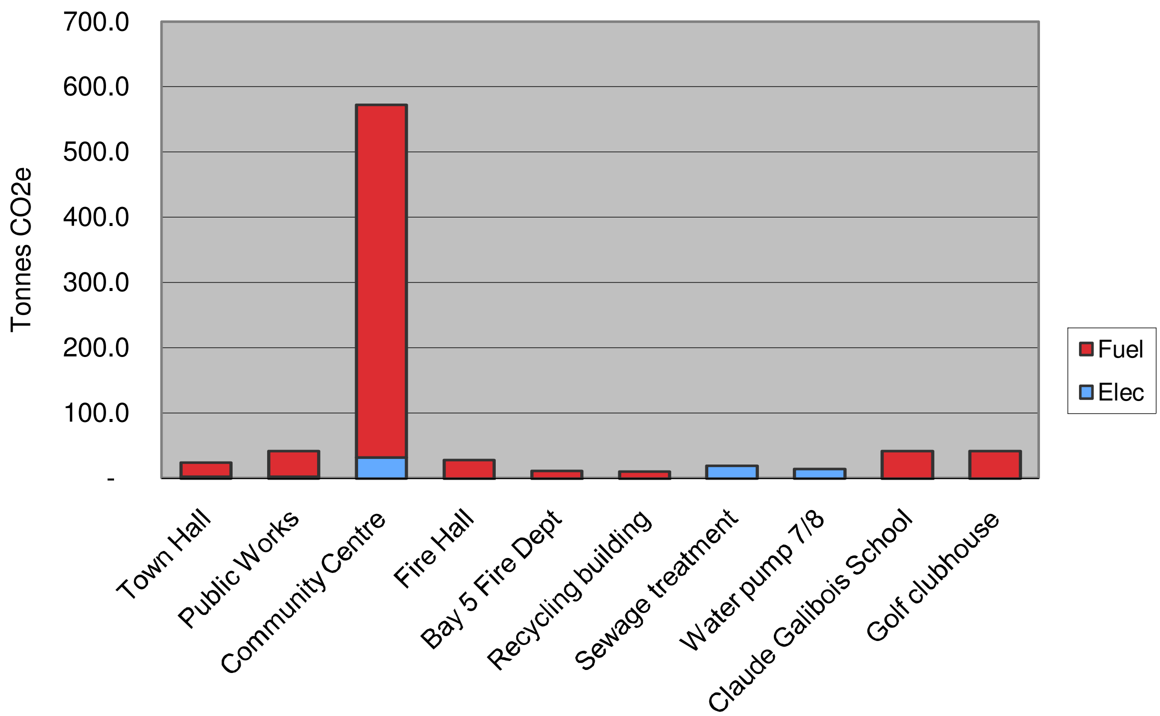
Energy intensity, in terms of consumption per unit area, is a useful way of comparing building to other similar facilities, although not applicable to all building types. The most energy intensive facility is the Bay 5 Fire Department, which has an energy intensity of 61 $ekWh/ft^2$.

For the most part the remaining facilities have fairly typical energy intensity. The Fire Hall does have quite high gas consumption, and the Community Centre has very low electricity consumption.

Energy Consumption by Building



Greenhouse Gas Emissions by Building



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 or T5 lamps with electronic ballasts, which provide improved lighting quality as well as energy savings. Although T8 is usually used as a retrofit due to it lower cost, the District has expressed interest in standardizing on T5. While T5 is slightly more efficient, care must be taken to ensure they perform well in existing fixtures, which have been designed for wider lamps. When doing retrofits, be sure that techniques other than a simple one-for-one lamp replacement are employed. One-for-one lamp replacements often lead to overlit spaces and reduced energy savings. The number of lamps and choice of ballast factor should be based on the required light levels. Tandem ballasting can also be used to reduce costs.

Although some incandescent lights have been converted to compact fluorescents, others remain. These should be converted to CFLs wherever possible. LED lamps, which have very long life expectancy, can also be used although they cost considerably more. Metal halide lighting can be upgraded to pulse start metal halide or converted to T5 fluorescent high bay lighting. Other lighting opportunities include occupancy sensors, LED exit lights, and reducing light levels in overlit areas.

Building Controls

Only the Community Centre 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

Town Hall
The wall mount electric heaters have an internal thermostat, and cannot be converted to programmable thermostat cost effectively. However, it may be possible to control the circuit at the electrical panel, switching heat off after hours. The rooftop units will continue to maintain night temperatures in the space.

Public Works
The existing gas unit heaters in the shop area are old, inefficient, and in poor condition. These should be replaced with new high efficiency unit heaters, controlled by programmable t'stats. One unit heater is not working, so it may only be necessary to replace two of them, and simply remove the third, if this will provide sufficient capacity. Once the new units are in place, these should be the primary heating for the shop. If possible, the underfloor electric should be turned off and not used.

The equipment shed is primarily used for storage. It should be possible to turn the temperature down further than the 12° it is currently kept at, perhaps to 7°C. If work is being done in the building, the thermostat can be turned up to bring on the gas radiant heaters, and turned back down when they leave. Clear instructions by the thermostat should be sufficient.

Community Centre
The community centre is already quite efficient, with a new boiler plant and ice plant. However, the boilers were not condensing at the time of the site visit due to too high a return temperature. Adjusting supply temperatures based on outside air temperature may help with condensing under low load situations, but it may also be necessary to vary flows with variable speed drives. The pump flows and piping system should be reviewed and changed as necessary to ensure condensing.

The Dryotron mechanical dehumidification unit is not being used, but the fan was running. Apparently this is because of overheating problems. Mechanical dehumidification significantly reduces energy consumption and should be used if possible. It may be necessary to install a condenser to reject excess heat in warmer weather. Alternatively, the Drytron could only be used in cooler weather, and outside air used for dehumidification at other times. This may result in higher relative humidity levels. If the Dryotron is no longer to be used at all, the fan should be shut off. Whatever option is chosen, the controls should be carefully programmed to reflect that operating strategy, as pool water temperatures, air temperatures, relative humidity, and outside air control are all critical to energy consumption in pools.

Although pool air volumes are usually set based on circulation and ventilation requirements, they can usually be reduced when the facility is unoccupied. A variable speed drive should be installed on the main air handler to allow lower volumes at night. Ventilation can also be reduced during unoccupied periods.

Pool pump flows can also be set back at night in most cases. Variable speed drives should be installed on those circulation pumps that are applicable.

Pools are a good application for solar water heating, and the Peace River region has good solar energy potential. This is being considered and should be investigated further.

According to staff the variable speed drives on the brine pumps are not used to control volume. If this is the case volume control based on ice temperature should be considered.

A low-e ceiling could be considered for the arena and curling rink.

Fire Hall
The boiler was not condensing at the time of the site visit due to too high a return temperature. Adjusting supply temperatures based on outside air temperature should help with condensing under low load situations.

Heat in the hose tower is controlled by a manual thermostat. A humidistat could be added to keep heat on when relative humidity is high and lower it when RH is low.

Bay 5 Fire Department
The gas unit heater is old and inefficient. It should be replaced with a new high efficiency unit heater. The thermostat should also be replaced, as it appears to be out of calibration.

There was a smell of gas during the site visit, indicating a potential gas leak. This is likely the cause of the very high gas consumption and should be checked into.

Recycling Building
Although the Recycling Building is new and has an efficient condensing boiler, it gas consumption is fairly high. This is likely due to use of the snow melting system. A timeclock should be added to turn off the snow melting system at night and only bring it on shortly before opening. There is also the ability within the existing boiler controls to turn down the indoor temperature at night. Make sure sufficient lead time is allowed to bring temperatures back up in the morning, as in-floor heating systems take longer to warm up.

Sewage Treatment
The aeration blowers run a full volume at all times, with manual inlet throttling. These can usually be installed with variable speed drives, controlled by DO sensors.

Water Pump 7/8
The water pumps run at full volume when on. Although cycling on and off is an efficient operating method and makes sense for this type of pumping operation, it appears that a pressure reducing valve may be limiting flow. If this is the case, it should be possible to trim the pump impeller to provide the correct flow without the PRV. The PRV would still remain in place for surge protection.

Claude Galibois School
The furnaces currently have no controls to reduce temperatures at night. Because of the temperature requirements of the dinosaur artefacts, there may be little potential to do so. However, the temperature requirements of all rooms should be reviewed, and programmable thermostats used where it is possible to turn temperatures down. Outside air dampers can also be closed at night and outside air quantities should be reviewed and adjusted to reflect current usage, as school outside air requirements are relatively high.

Ductwork in the crawlspace should be insulated, if in fact it does not already have insulation.

Where windows have been boarded over, insulation should be added to reduce heat loss.

Summary of Key Measures

Building	Recommended	Optional
Town Hall	Lighting retrofit Reduce light levels Shut off elec heat at night	
Public Works	Lighting retrofit Reduce light levels New high efficiency unit heaters Programmable t'stats Weatherstripping/sealing	
Community Centre/Aquatic	Lighting retrofit Review boiler operation VSDs on pool pumps VSDs on pool supply fan Utilize mechanical dehumidification	Low-e ceiling Condenser for Dryotron Variable brine pumping Solar pool water heating
Fire Hall	Lighting retrofit Programmable t'stats Revise HW supply temperatures	Humidity control of hose tower heat
Bay 5 Fire Dept	Lighting retrofit New high efficiency unit heater Check for gas leak	
Recycling building	Timeclock for snow melt Night setback of temperatures	
Sewage treatment	Lighting retrofit VSD on aeration blower	
Water pump 7/8	Lighting retrofit Reduce temp setpoint Trim pump impeller	
Claude Galibois School	Lighting retrofit Programmable t'stats Outside air controls/quantities Insulate boarded up windows	Insulate ductwork, if not already
Golf clubhouse	Lighting retrofit Programmable t'stats	

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	
Town Hall	9%	$ 941
Public Works	18%	$ 2,750
Community Centre/Aquatic	7%	$ 14,038
Fire Hall	13%	$ 1,216
Bay 5 Fire Dept	47%	$ 1,072
Recycling building	15%	$ 444
Sewage treatment	10%	$ 5,273
Water pump 7/8	5%	$ 1,974
Claude Galibois School	9%	$ 883
Golf clubhouse	8%	$ 646
Total	**8%**	**$ 29,236**

Potential savings for a comprehensive retrofit of these buildings is estimated at $29,236 annually, or 8%. The project would also save 64 tonnes of GHG emissions, or 8%, which can be valued at $25/tonne based on the cost of offsets committed to through the Climate Action Charter, for additional savings of $1,609 . 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 $414,663 , including 15% allowance for engineering and project management. However, incentives of up to $51,900 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 11.8 years. Net present value over a 20 year project life would be $11,832 .

Financial Analysis	
Energy savings	$29,236
GHG savings	$1,609
Total savings	$30,845
Capital cost	$364,903
Eng. and project mgmt fees	$49,760
Incentives	($51,900)
Total cost	$362,763
Project term	20 years
Discount rate	8.00%
Inflation	2.00%
Simple payback	11.8 years
Net present value	$11,832

Although the payback on this project is fairly long, it still pays back over the life cycle. And there are many other benefits in terms of equipment renewal and GHG reductions. Tumbler Ridge 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.

6. Recommendations and Next Steps

This opportunity assessment has shown that there is potential for energy savings, in spite of the relatively low energy intensity of many of the facilities. A comprehensive retrofit is financially viable, although the payback is long. 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.

Lighting retrofits are the largest 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. Staff, using external consulting expertise if necessary, should review the Community Centre mechanical systems to determine how best to ensure the boilers condense at all times and the applicability of variable speed drives.

An engineer with expertise in the operation of the water pumping stations and sewage treatment plant should be consulted to assess the potential for impeller trimming and variable speed drives.

Recommended next steps:

- Review the life expectancy of the facilities and identify any other projects planned that may overlap with an energy retrofit..
- Review the potential measures at the Community Centre, water pump stations, and 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

Tumbler Ridge Utility Data

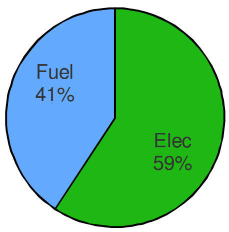
Building name	Area	Energy Consumption				Energy Cost			BEPI (ekWh/ft²)			GHGs (tonnes CO2eq)		
		Elec (kWh)	Elec (GJ)	Fuel (GJ)	Total (GJ)	Elec	Fuel	Total	Elec	Fuel	Total	Elec	Fuel	Total
Town Hall	9,684	104,520	376	431	807	$ 6,271	$ 4,310	$ 10,581	10.8	12.4	23.2	2.3	22.0	24.3
Public Works	8,285	125,440	452	766	1,218	$ 7,526	$ 7,660	$ 15,186	15.1	25.7	40.8	2.8	39.1	41.8
Community Centre	89,000	1,457,280	5,246	10,589	15,835	$ 87,437	$ 105,890	$ 193,327	16.4	33.1	49.4	32.1	540.0	572.1
Fire Hall	4,842	69,147	249	520	769	$ 4,149	$ 5,200	$ 9,349	14.3	29.8	44.1	1.5	26.5	28.0
Bay 5 Fire Dept	1,000	2,882	10	210	220	$ 173	$ 2,100	$ 2,273	2.9	58.3	61.2	0.1	10.7	10.8
Recycling building	2,400	15,140	55	202	256	$ 908	$ 2,020	$ 2,928	6.3	23.4	29.7	0.3	10.3	10.6
Sewage treatment	-	878,760	3,164	-	3,163	$ 52,726	$ -	$ 52,726				19.3	-	19.3
Water pump 7/8	-	658,080	2,369	-	2,369	$ 39,485	$ -	$ 39,485				14.5	-	14.5
Claude Galibois School	25,000	35,040	126	794	920	$ 2,102	$ 7,940	$ 10,042	1.4	8.8	10.2	0.8	40.5	41.3
Golf clubhouse	5,800	-	-	807	807	$ -	$ 8,070	$ 8,070	-	38.7	38.7	-	41.2	41.2
Total	**146,011**	**3,346,289**	**12,047**	**14,319**	**26,365**	**$ 200,777**	**$ 143,190**	**$ 343,967**				**73.6**	**730.3**	**803.9**

Building: **Town Hall**
Area: 9,684 ft²

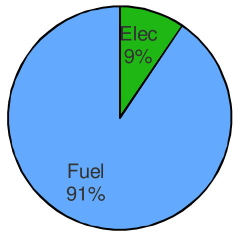
Consumption Data

Elec	104,520	kWh	$	6,271	2.3	tonnes CO2e
Fuel	431	GJ	$	4,310	22.0	tonnes CO2e
Total	807	GJ	$	10,581	24.3	tonnes CO2e

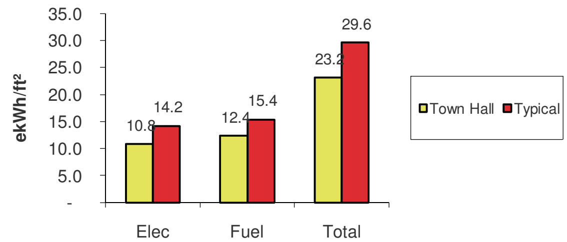
	Town Hall		*Typical*	
Elec	10.8	ekWh/ft	14.2	ekWh/ft
Fuel	12.4	ekWh/ft	15.4	ekWh/ft
Total	23.2	ekWh/ft	29.6	ekWh/ft



Annual Energy Cost



GHG Emissions



Energy per ft² - Town Hall vs Typical

Building description

The Town Hall is a wood frame building built in 1983. It is single storey plus a basement. Windows are double glazed with aluminum frames. Energy consumption is somewhat lower than typical.

Hours of use: 8:00 - 5:00 M-F, plus one evening meeting a week

Lighting
Most lighting is fluorescent T12, with a few T8s and some T5 in the basement. Light levels are generally acceptable, although a bit bright in some areas. There are incandescent lamps in the lobby.

HVAC
The main floor heating and cooling is provided by three gas rooftop units. These have recently been replaced with new high efficiency units, and are controlled by programmable t'stats. There are also wall mounted electric heaters in each office, with an internal temperature adjustment. The basement is heated by a new high efficiency furnace with DX cooling.

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.
Other
* Control elec heat circuits to shut off at night

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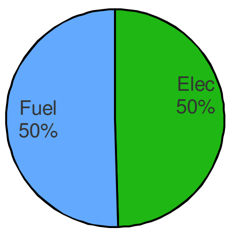
Building: **Public Works**
Area: 8,285 ft²

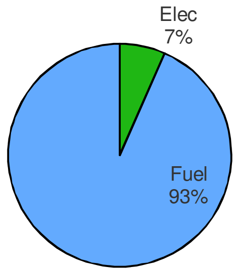
Consumption Data

Elec	125,440	kWh	$	7,526	2.8	tonnes CO2e
Fuel	766	GJ	$	7,660	39.1	tonnes CO2e
Total	1,218	GJ	$	15,186	41.8	tonnes CO2e

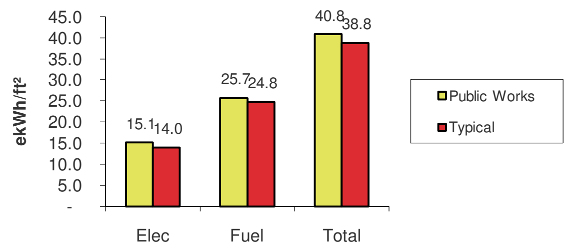
	Public Works		*Typical*	
Elec	15.1	ekWh/ft	14.0	ekWh/ft
Fuel	25.7	ekWh/ft	24.8	ekWh/ft
Total	40.8	ekWh/ft	38.8	ekWh/ft



Annual Energy Cost



GHG Emissions



Energy per ft² - Public Works vs Typical

Building description

Public Works consists of two buildings - the main shop and an equipment storage shed. The main shop is insulated concrete block while the shed is wood frame with spray insulation. There are insulated bay doors. Weatherstripping is poor or missing. Energy consumtion is slightly higher than typical.

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

Lighting
Lighting in the shop is T12 fluorescent, with some T8. The hallways and lunch room have recently been converted to T5, and are excessively bright. The equipment shed is also T5 and is overlit, but usually only half the lights are used to to the second switch location at the back. There are some incandescent lamps remaining.

HVAC
The shop area is heated by three old gas unit heaters, one of which is broken, along with electric underfloor heating. The underfloor heating is kept on for a month or so in fall to bring it up to temperatutre and then set to 17° for the winter. The unit heaters are controlled by a programmable t'stat, which has been overridden to 67°F. Other parts of the building are heated by a gas unit heater, and electric unit heater (which doesn't appear to be used), and electric baseboard, all on manual t'stats.

The equipment shed is heated by gas radiant heaters, with manual t'stats set to 12°.

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.
* Use pulse start metal halides, or fluorescent high bay lighting.

HVAC Energy Cost Savings Strategies
* Install high efficiency furnaces/unit heaters
* Install programmable thermostats or timeclocks

Building Envelope
* Install weather stripping, caulk around windows and doorways, check seals

Other
* Reduce temperature in equipment shed

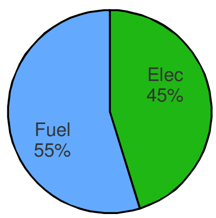
Building: **Community Centre**

Area: 89,000 ft²

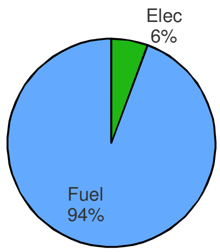
Consumption Data

Elec	1,457,280	kWh	$ 87,437	32.1	tonnes CO2e
Fuel	10,589	GJ	$ 105,890	540.0	tonnes CO2e
Total	15,835	GJ	$ 193,327	572.1	tonnes CO2e

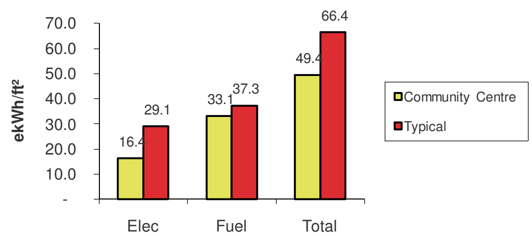
	Community Centre		*Typical*	
Elec	16.4	ekWh/ft	29.1	ekWh/ft
Fuel	33.1	ekWh/ft	37.3	ekWh/ft
Total	49.4	ekWh/ft	66.4	ekWh/ft



Annual Energy Cost



GHG Emissions



Energy per ft² - Community Centre vs Typical

Building description

The Community Centre is a large complex that includes an ice arena, curling rink, pool, library and other ancillary spaces. Originally the pool and arena were separate buuildings but have been connected. Construction is wood frame with double glazed windows in aluminum farmes. A project is underway to re-side the building, adding insulation to the walls and roof and replacing the windows with new high efficiency ones. Electricity consumption is quite low compared to similar facilities, while gas consumption is slightly lower than typical. However, a new boiler plant has been installed and gas consumption can be expected to drop.

Hours of use: 6:00 - 10:00

Lighting

Lighting is metal halide in the pool, rink, and curling rink. Elsewhere is predominantly T12 fluorescent, with some CFLs. Light levels are generally good.

HVAC

The pool originally had its own boiler plant, but was recently connected to the main boiler plant, which consists of three new condensing boilers with isolation valves. At the time of the site visit the boilers were not operating in condensing mode. There is a 10 hp main heating pump and 7.5 hp pool system heating pump, both constant volume. There are 15 hp and 10 hp pool circulation pumps, as well as smaller circulation pumps.

The main pool supply fan is small compared to some facilities, with a 10 hp fan. There is a Dryotron mechanical dehumidification unit with heat rejection into the airstream, but this is not currently used, although the fan was running. There is a small air handling unit to serve the squash courts, and a number of fan coils throughout the building. All systems are controlled by a new building automation system.

The ammonia ice plant has three 75 hp compressors. There are 30 hp and 15 hp brine pumps on VSDs, although according to staff these are only used as a soft start, not to vary flow. The condensor fans are also controlled on a VSD, again just for soft start. Ice temperature sensors control the compressors. There is heat recovery, with heat utilized for underslab heating, ice melt, flood water, and some space heating.

Potential Measures

Lighting Strategies

* Install T8 fluorescent lamps.
* Replace magnetic ballasts with electronic ballasts.
* Use pulse start metal halides, or fluorescent high bay lighting.

HVAC Energy Cost Savings Strategies

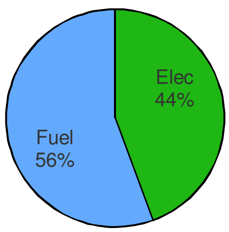
* Install variable frequency drives on variable flow air systems
* Install variable frequency drives on variable pumping systems

Other

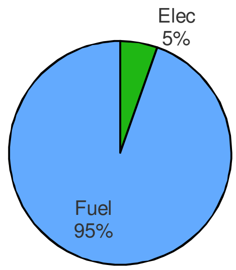
* low-e ceiling in ice rink and curling rink
* revise boiler water temperatures/flows to ensure boilers condense
* add a condenser to Dryotron unit, or revise opertation

Enerficiency CONSULTING

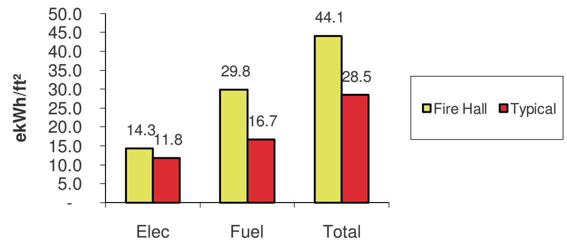
Building:	**Fire Hall**					
Area:	4,842	ft²				
Consumption Data						
Elec	69,147	kWh	$	4,149	1.5	tonnes CO2e
Fuel	520	GJ	$	5,200	26.5	tonnes CO2e
Total	769	GJ	$	9,349	28.0	tonnes CO2e
	Fire Hall				*Typical*	
Elec	14.3	ekWh/ft			11.8	ekWh/ft
Fuel	29.8	ekWh/ft			16.7	ekWh/ft
Total	44.1	ekWh/ft			28.5	ekWh/ft



Annual Energy Cost



GHG Emissions



Energy per ft² - Fire Hall vs Typical

Building description

The firehall was constructed in 1983 and is insulated concrete block with double glazed windows in aluminum frames. The bay doors are insulated. Energy consumption is quite high, particularly in gas. However, a new boiler has recently been installed and gas consumption can be expected to drop.

Hours of use: 8:00 - 4:30 M-F plus Wed evening training and emergency callouts.

Lighting
Lighting is mostly T12 fluorescent, with metal halide in the truck bay and some CFLs. Light levels in the offices are somewhat high. Exit lights are incandescent.

HVAC
Heating and DHW is provided by a condensing boiler with supplemental non-condensing boiler, which seldom if ever runs. At the time of the site visit the boiler was not operating in condensing mode. This serves hot water radiation in the office and hot water unit heaters in the truck bay, controlled by manual t'stats. There is a hot water florce flow on a manual t'stat in the hose tower. There is also one electric unit heater.

Potential Measures

Lighting Strategies
* Install T8 fluorescent lamps.
* Replace magnetic ballasts with electronic ballasts.
* Reduce number of lamps and/or fixtures if over designed.
* Replace incandescent emergency exit lamps with LED technology.
* Use pulse start metal halides, or fluorescent high bay lighting.

HVAC Energy Cost Savings Strategies
* Install programmable thermostats or timeclocks
* Revise hot water supply temperatures to ensure boilers condense
* Use humidistat to control hose tower heating

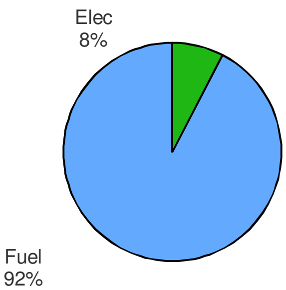
Building: **Bay 5 Fire Dept**

Area: 1,000 ft²

Consumption Data

Elec	2,882	kWh	$	173	0.1	tonnes CO2e
Fuel	210	GJ	$	2,100	10.7	tonnes CO2e
Total	220	GJ	$	2,273	10.8	tonnes CO2e

	Bay 5 Fire Dept		*Typical*	
Elec	2.9	ekWh/ft	-	ekWh/ft
Fuel	58.3	ekWh/ft	-	ekWh/ft
Total	61.2	ekWh/ft	-	ekWh/ft



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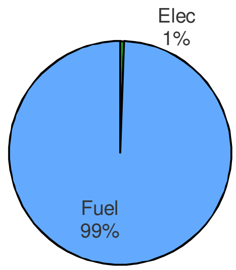
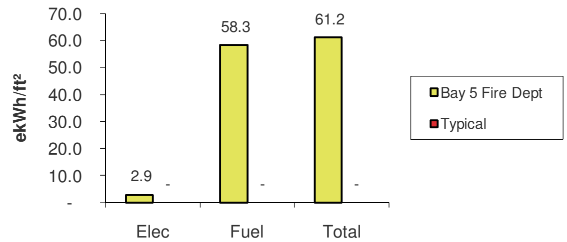


GHG Emissions



Energy per ft² - Bay 5 Fire Dept vs Typical

Building description

This is a leased storage bay used to store vehicles and equipment. It is wood frame construction. There are some large cracks allowing air leakage around the door. Electricity consumption is very low, while gas consumption is very high, perhaps due to a gas leak.

Hours of use: Unoccupied.

Lighting

Lighting is T12 fluorescent, with very little usage.

HVAC

Heating is provided by a low efficiency gas unit heater with a pilot light. The manual t'stat is set to 10°C, although the space was 16°. There was a smell of gas at the time of the site visit.

Potential Measures

Lighting Strategies

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

HVAC Energy Cost Savings Strategies

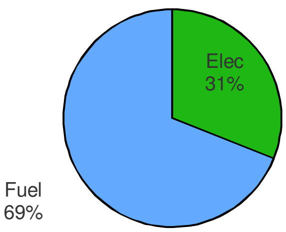
* Install high efficiency furnaces/unit heaters

Other

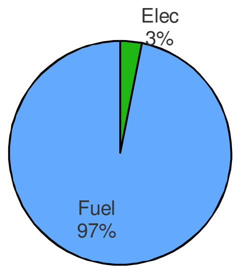
* Check for gas leak

Building:	**Recycling building**					
Area:	2,400	ft²				
Consumption Data						
Elec	15,140	kWh	$	908	0.3	tonnes CO2e
Fuel	202	GJ	$	2,020	10.3	tonnes CO2e
Total	256	GJ	$	2,928	10.6	tonnes CO2e

	Recycling building		*Typical*	
Elec	6.3	ekWh/ft	-	ekWh/ft
Fuel	23.4	ekWh/ft	-	ekWh/ft
Total	29.7	ekWh/ft	-	ekWh/ft



Annual Energy Cost



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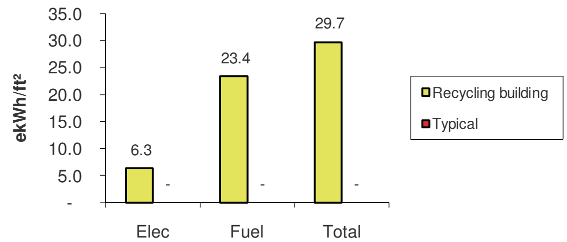


Energy per ft² - Recycling building vs Typical

Building description

This new building was constructed in 2008. It has insulated metal walls and no windows. Electrcity consumption is quite low, while gas consumption is somewhat high.

Hours of use: 8:00 - 4:30 M-F. Not occupied all day.

Lighting

Metal halide in the bay. Some T8 fluorescent with electronic ballasts. Light levels are somewhat high.

HVAC

Heating is underfloor hot water, provided by a condensing boiler, which was operating ijn condensing mode at the time of the site visit. There are two circuits, one for the bay and one for the outdoor snow melting. The indoor temperature is controlled by a dial controller on the boiler, while the snow melt is controlled by outdoor air temperature.

Potential Measures

HVAC Energy Cost Savings Strategies

* Install programmable thermostats or timeclocks

Other

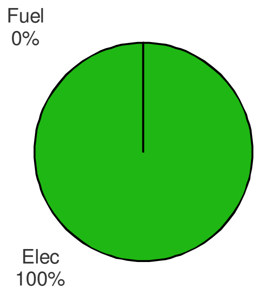
Building: **Sewage treatment**

Area: - ft²

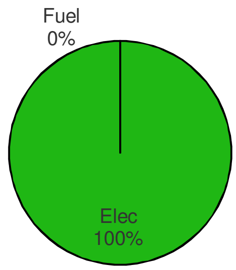
Consumption Data

Elec	878,760	kWh	$	52,726	19.3	tonnes CO2e
Fuel	-	GJ	$	-	-	tonnes CO2e
Total	3,163	GJ	$	52,726	19.3	tonnes CO2e

	Sewage treatment		*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



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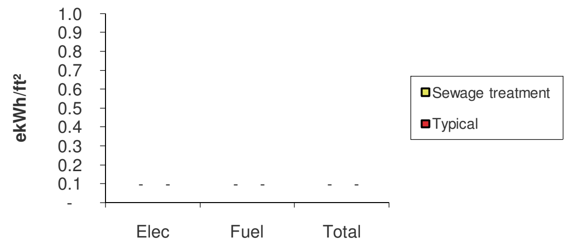


Energy per ft² - Sewage treatment vs Typical

Building description

The sewage treatment plant building is insulated concrete block, with double glazed windows and aluminum frames. There is no gas used in the fcility, and electrcity consumption is mostly process related.

Hours of use: Unoccupied.

Lighting

Lighting is T12 fluorescent. Light levels are somewhat high.

HVAC

Heating is by electric unit heaters and force flows, on manual t'stats.

There are three 60 hp aeration blowers, two of which run at any given time. Air intake can be manually adjusted, but generally isn't changed.

Potential Measures

Lighting Strategies

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

Other

* Variable speed drives for aeration blowers

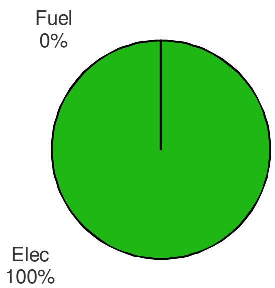
Building: Water pump 7/8

Area: - ft²

Consumption Data

Elec	658,080	kWh	$	39,485	14.5	tonnes CO2e
Fuel	-	GJ	$	-	-	tonnes CO2e
Total	2,369	GJ	$	39,485	14.5	tonnes CO2e

	Water pump 7/8		*Typical*	
Elec	#DIV/0!	ekWh/ft	-	ekWh/ft
Fuel	#DIV/0!	ekWh/ft	-	ekWh/ft
Total	#DIV/0!	ekWh/ft	-	ekWh/ft



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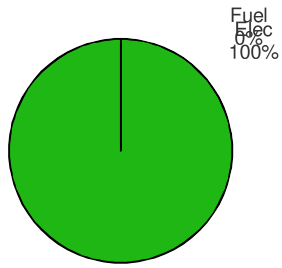

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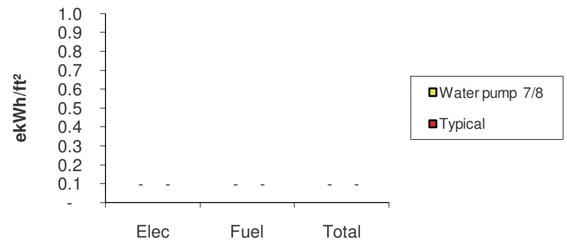


Energy per ft² - Water pump 7/8 vs Typical

Building description

These are two insulated metal buildings, one for pump 7 and one for pump 8. Both are on the same electrical meter. There is no gas used in the facility, and electrcity use is mostly process related.

Hours of use: Unoccupied

Lighting

Lighting is T12 fluorescent.

HVAC

Heating is by electric unit heater and force flow, with manual t'stat set to 18°C.

Each building has a 200 hp water pump which cycles to maintain reservoir level. A PRV provides a soft start and maintains steady flow.

Potential Measures

Lighting Strategies

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

HVAC Energy Cost Savings Strategies

* Install variable frequency drives on variable pumping systems

Other

* Reduce temperature setpoint
* Trim pump impellers to optimize flow

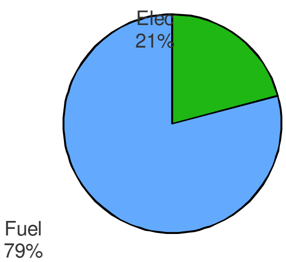
Enerficiency CONSULTING

Building: **Claude Galibois School**
Area: 25,000 ft²

Consumption Data

Elec	35,040	kWh	$	2,102	0.8	tonnes CO2e
Fuel	794	GJ	$	7,940	40.5	tonnes CO2e
Total	920	GJ	$	10,042	41.3	tonnes CO2e

	Claude Galibois School		*Typical*	
Elec	1.4	ekWh/ft	-	ekWh/ft
Fuel	8.8	ekWh/ft	-	ekWh/ft
Total	10.2	ekWh/ft	-	ekWh/ft



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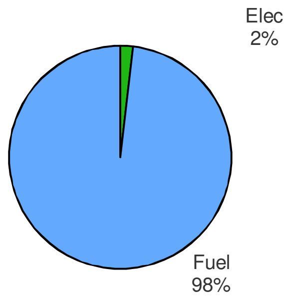

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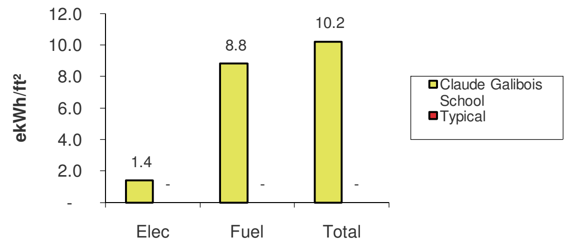


Energy per ft² - Claude Galibois School vs Typical

Building description

This school building is currently used as a dinosaur museum. It is wood frame construction with double glazed windows in aluminum frames. Windows in a large section used for storage have been boarded over. Energy consumption is quite low, but this is because some of the bills date to when the school was unoccupied.

Hours of use: 8:00 - 5:00, M-F winter, 7 days summer.

Lighting
Lighting is exclusively T12 fluorescent.

HVAC
Heating is provided by 21 gas furnaces located in two mechanical rooms. There is a common return air section with mixed air dampers. Timeclocks to control the furnaces and dampers are not used. Furnaces are controleld by manual t'stats. Staff believe ductwork in the crawlspace may not be insulated, as it is difficult to get heat from the longer runs. There is talk of replacing this system with a boiler and fan coils. Hot water is provided by gas DHW tanks.

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.
* Install programmable thermostats or timeclocks

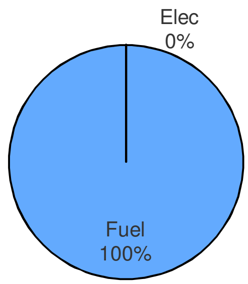
Other
* Insulate ductwork if not already
* Insulate over boarded up windows.
* Review outside air volumes

Building:	**Golf clubhouse**					
Area:	5,800	ft²				

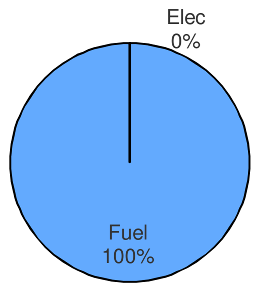
Consumption Data

Elec	-	kWh	$	-	-	tonnes CO2e
Fuel	807	GJ	$	8,070	41.2	tonnes CO2e
Total	807	GJ	$	8,070	41.2	tonnes CO2e

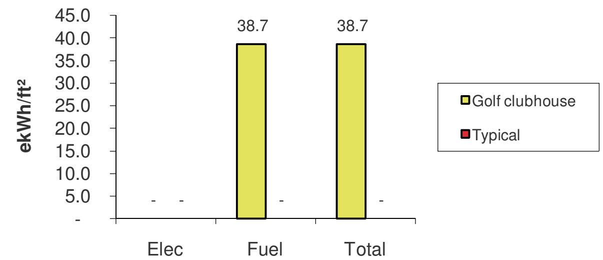
	Golf clubhouse		*Typical*	
Elec	-	ekWh/ft	-	ekWh/ft
Fuel	38.7	ekWh/ft	-	ekWh/ft
Total	38.7	ekWh/ft	-	ekWh/ft



Annual Energy Cost



GHG Emissions



Energy per ft² - Golf clubhouse vs Typical

Building description

The gold clubhouse is wood frame, with additional insulation recently added. Windows are double glazed low-e in thermally broken aluminum frames. Gas consumption is quite high. No electricity bills were available.

Hours of use: 10:00 - 10:00 summer, 3:00 - 10:00 winter, 7 days/week

Lighting

All lighting is incandescent, some of it halogen, in a mix of fixture types.

HVAC

A gas A/C unit serves the main restaurant area, with a programmable t'stat that has been overridden. A gas make-up air unit provides ventilation to the kitchen, on a manual switch. There are also two gas furnaces with manual t'stats.

Potential Measures

Lighting Strategies

* Install compact fluorescent lamps to replace incandescent.

HVAC Energy Cost Savings Strategies

* Install programmable thermostats or timeclocks