Esquimalt Public Works Yard, Teen Centre, and Nursery Energy Retrofit Opportunity

Energy Evaluation for:

Esquimalt Public Works Yard, Teen Centre and Nursery.

Esquimalt, BC

Attention:

Marlene Lagoa
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Township of Esquimalt

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Township of Esquimalt

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1. Executive Summary

1.1 Background of the Project

Coral Engineering Limited was asked to provide an Energy Opportunity report on the Esquimalt Public Works Yard, Teen Centre, and Nursery. This report is to provide a series of strategies and measures which when implemented will reduce each facility's energy consumption and green house gas emissions.

Public Works Yard

This 1,150 m^2 (12,386 ft^2) single story structure has a mix of systems because of its varied use. This facility is comprised of a large maintenance garage, woodwork shop, metal shop, storage sheds, washrooms, a group of change rooms and offices. The facility currently produces **23** Tonnes of annual CO_2 emissions based on the following energy consumption data.

Teen Centre

This 130 m^2 (1,400 ft^2) single storey small house, has a washroom, kitchen, living room and a games room. This facility is a centre for teens to drop in and communicate. This facility currently produces **0.3** Tonnes of CO_2 annually.

Nursery

This 223 m^2 (2400 ft^2) two storey building, has a washroom, a small kitchen/ lunch room, offices, a small work shop and a pair of furnace rooms. This facility currently produces **5.1** Tonnes of CO_2 annually.

1.2 Précis of Project

We have identified a number of opportunities to cut the overall energy consumption for your three facilities. This accomplishment will require some modifications to the heating and ventilation systems.

Public Works Yard

The predominant office and change room portion of this facility is heated, by a Trane air handler with an electric heating coil.
The vehicle bay is exhausted by a number of fans. These are vehicle direct muffler exhaust fans and service pit exhaust fans.
The space is heated by a number of radiant heaters and by a natural draft boiler which heats the vehicle bay floor slab.
The facility also houses a wood work shop and a metal shop. The metal shop is heated by radiant heat and the fumes are exhausted by a point source exhaust fan The wood work shop has a dust extraction system and is also heated by radiant heaters.

The ancillary buildings do not have any ventilation or heating.
The server room is cooled by a ductless split system.

Teen Centre

A small electric furnace located in the crawl space of this home heats the small Teen centre. A mercury bulb thermostat controls this electric furnace and there is no night setback function.

Nursery

There are two structures which are heated on the property.
There is a plastic covered green house which is used for about 200-300 hrs a year for bedding plants which is heated by a pair of gas fired unit heaters. The run hours of this equipment is too short to make any capital cost recommendations.

The other building is heated by a pair of standard efficiency furnaces. Again the facility is controlled by mercury bulb thermostats.

1.3 Summary Report Table

The costs and benefits associated with this project are summarized below:

Project Summary						
	Capital	Savings	Electricity	Gas	Payback	GHG
	Cost $	$	(kWh)	(Gj)	years	(tonnes)
Public Works Yard	$ 49,300.00	$ 6,000	56,300	100	8.2	6.8
Teen Centre	$ 4,200.00	$ 600	8,100	0	7.0	0.2
Parks Nursery	$19,100.00	$ 2,100	3,300	25	9.1	1.3
Total	**$72,600.00**	**$ 8,700**	**67,700**	**125**	**4.5**	**8.3**
Projected Future Usage						

Note:

1) **The capital costs listed for this project include engineering, implementation and project management, but does not include for hazardous waste removal or seismic upgrades of equipment.**
2) **The capital costs further assume that all of the equipment such as valves and controls are fully operational.**

1.4 Limited Liability

This Proposal is prepared by Coral Engineering Limited for the Township of Esquimalt and for grant applications.

This report was prepared by Coral Engineering Limited for the Township of Esquimalt. The material in it reflects our professional judgment in light of the information available to us at the time of preparation. The savings calculations are estimates of savings potential and are not guaranteed. The impact of building changes, building use changes, and staff control changes, new equipment additions, change in the operation procedures, additional computers and weather need to be considered when evaluating savings.

Without the express written permission, any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. Coral Engineering will accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Please direct any questions to me directly at 778- 829- 9711. We await your further instructions on this matter and assure you of our co-operation at all times.

1.5 Allocation of Funds

Public Works Yard

This project has the potential to reduce the **energy footprint** of the facility by **28.7%**.

If all of these recommendations meet with your approval, then we recommend that **$ 69,300.00** be budgeted for the implementation of capital projects. The Township of Esquimalt may want to have a contingency fund for items and controls that are found to be defective during the energy retrofit.

We estimate that these projects will decrease the electrical load by **(56,300)** kWh or **195.5 GJ_e**, while saving **100 GJ** of natural gas.
The net result of this is **295.5 GJ** of annual energy savings. These energy saving strategies earn the Township of Esquimalt a **6.8 Tonnes** reduction in annual greenhouse gas **(GHG)** emissions. The project will earn a (**27.3%** GHG reduction) and will concurrently reduce the energy consumption by **$6,000** each year. Note that these savings are based on 2009 electrical energy costs.
The capital costs indicated in this report are firm for a period of two months after which time it may need to be adjusted based on the Labour and Metals index and the possible adjustment in the relationship of the Canadian dollar.

Teen Centre

This project has the potential to reduce the **energy footprint** of the facility by **43.5%**.

If all of these recommendations meet with your approval, then we recommend that **$ 4,200.00** be budgeted for the implementation of capital projects.
We estimate that these projects will decrease the electrical load by **8,100)** kWh or **28.1 GJ_e**.
These energy saving strategies earn the Township of Esquimalt a **0.2 Tonnes** reduction in annual greenhouse gas **(GHG)** emissions. The project will earn a (**43.5%** GHG reduction) and will concurrently reduce the energy consumption by $600 each year. Note that these savings are based on 2009 electrical energy costs.

Nursery

This project has the potential to reduce the **energy footprint** of the facility by **21.1%**.

If all of these recommendations meet with your approval, then we recommend that **$ 19,100.00** be budgeted for the implementation of capital projects.
We estimate that these projects will decrease the electrical load by **3,300)** kWh or **11.45 GJ_e** While saving 25 Gj/year of natural gas.
These energy saving strategies earn the Township of Esquimalt a **1.3 Tonnes** reduction in annual greenhouse gas **(GHG)** emissions. The project will earn a (**27.5%** GHG reduction) and will concurrently reduce the energy consumption by $2,100 each year. Note that these savings are based on 2009 electrical energy costs.

2. Customer Information

Public Works Yard	601 Canteen Road Esquimalt, B.C.
Teen Centre	535 Fraser Street Esquimalt, B.C. V9A 6H6
Nursery	1100 Craigflower Road Esquimalt, B.C. V9A 2Y1
Contact Information:	Marlene Lagoa, Sustainability Coordinator 1229Esquimalt Road Phone: (250) 414 7114 Email: marlene.lagoa@esquimalt.ca

Public Works Yard

BC Hydro account	**(Hydro Address 1235)**	**9992 8430 581**
BC Hydro rate		**1200**
Terasen account		**647630**
Facility type		**Works Yard**
Facility age		**Opened late 1975**
Total floor area and number of floors		1,150 m^2 **/ single storey building**

The condition of the exterior of the building appears to be in good condition. About 15% of the façade is double pane windows. Most of the windows are poorly shaded.

Teen Centre

BC Hydro account	**10000 927**
BC Hydro rate	**1100**
Facility type	**House**
Facility age	**Opened late 1940**
Total floor area and number of floors	**130 m^2 / two single storey house**

The condition of the exterior of the building appears to be in good condition. About 14% of the exterior façade is single pane windows. Most of the windows are reasonably well shaded.

Parks Nursery

BC Hydro account	**9992 7110 901**
BC Hydro rate	**1200**
Terasen account	**665191**
Facility type	**House**
Facility age	**Opened late 1979**
Total floor area and number of floors	**223 m^2 / two storey house**

The condition of the exterior of the building appears to be in good condition. About 14% of the exterior façade is single pane windows. Most of the windows are poorly shaded.

3. Administrative Issues

3.1 Sustainability

One of the key functions of this report is to provide measures that can be implemented with the re-use of as much of the existing equipment as possible. This will minimize the capital cost of the retrofit as well as make the facility more sustainable in its energy consumption both embodied as well as direct usage. As part of this process we have included the following features:

- In all three facilities, although the main mechanical equipment is old technology the rest of the infrastructure can be re-used.

3.2 Green House Gas Reductions

The Esquimalt Works Yard, Teen Centre and the Nursery, can reduce its impact on the environment and reduce greenhouse gas emissions by implementing measures outlined in this opportunity report.
The implementation of the measures in this proposal will reduce the green house gas produced by your facility by the following:

Works Yard	6.3 Tonnes
Teen Centre	0.2 Tonnes
Nursery	1.4 Tonnes

This equals a total green house gas savings of **7.9** Tonnes of CO_2 emissions per year.

3.3 Maintenance

The designs of the new systems are very simple and require minor control modifications.

- Some more maintenance is required for this more sophisticated condensing technology.

3.4 Warranty

The various pieces of equipment have different manufacturer's warranties.

- The condensing furnaces have a one year parts and labour warranty and a ten year prorated heat exchanger warranty.
- The condensing boilers have a one year warranty.

3.5 Project Benefits

All three facilities can reduce its impact on the environment and reduce green house gas emissions by implementing the recommended measures in this proposal.
Some of the benefits of this implementation are listed below:

- GHG reductions:

Public Works Yard	6.8 Tonnes.
Teen Centre	0.2 Tonnes.
Nursery	1.3 Tonnes
Total	**8.3 Tonnes**

- Provide a total energy savings of approximately:

Public Works Yard	295.5 Gj/year.
Teen Centre	28.1 Gj_e/year.
Nursery	11.5 Gj/year
Total	**335.1 Gj/year**

- Reduce the cost of the energy consumption of the facilities:

Public Works Yard by $6,000/year (based on 2009 energy costs).
Teen Centre by $ 600/year (based on 2009 energy costs).
Nursery by $ 2,100/year (based on 2008 energy costs).
Total $ 8,700/year

Implementing the measures suggested will show leadership and environmental stewardship which can be used to teach our younger generation the measures that can be taken towards carbon neutrality.

4. Background Description of Facility, Hardware and Systems

4.1 Mechanical Systems

Public Works Yard

A Trane air handler performs heating and ventilation for the office portion of the works yard with an electric heater.

Radiant heaters heat the metal and woodwork shops.

The vehicle repair bay is heated by a combination of a radiant floor and radiant heaters.

An electric unit heater heats the change room.

Teen Centre

An electric furnace provides the heating and ventilation of the one storey house. A mercury bulb type thermostat controls this unit. There is no unoccupied program, so if the thermostat is not set back manually the space remains at a constant temperature.

Parks Nursery

A pair of natural gas, natural draft, low efficiency furnaces provides the heating and ventilation of the two-storey building. A mercury bulb type thermostat controls these units. There is no unoccupied program, so if the thermostat is not set back manually the space remains at a constant temperature.

The green house has a supply fan. Two standard efficiency units heat this supply air. Since these two units heaters only run for about 200 hrs a year any recommendations to change them will have insufficient hour for any reasonable payback.

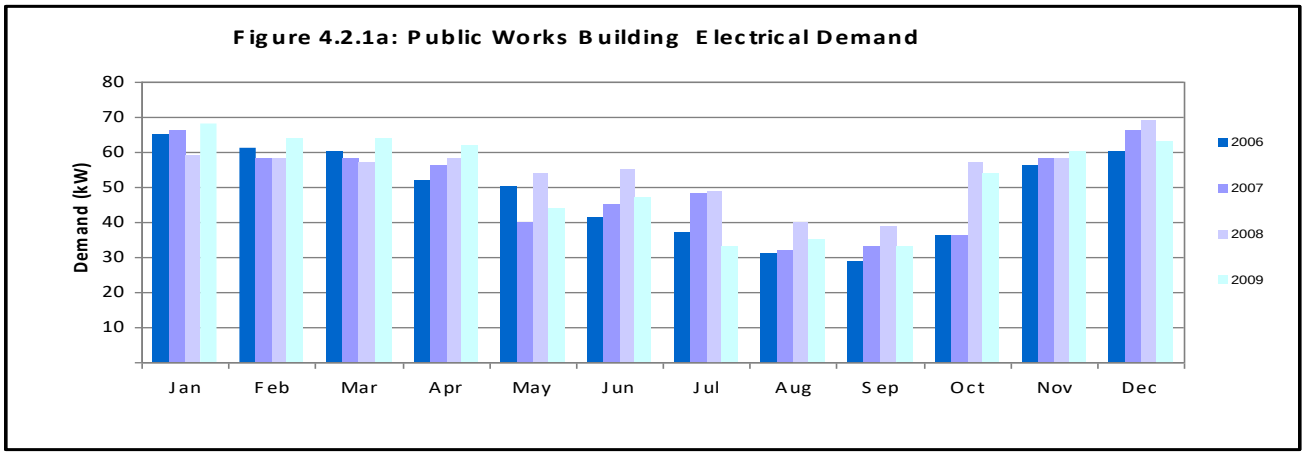
4.2 Energy Analysis

To understand the patterns of energy consumption, we have analyzed the natural gas and electrical consumption of the building.

The following energy analysis for the facility is based on the BC Hydro utilities' records for this facility.

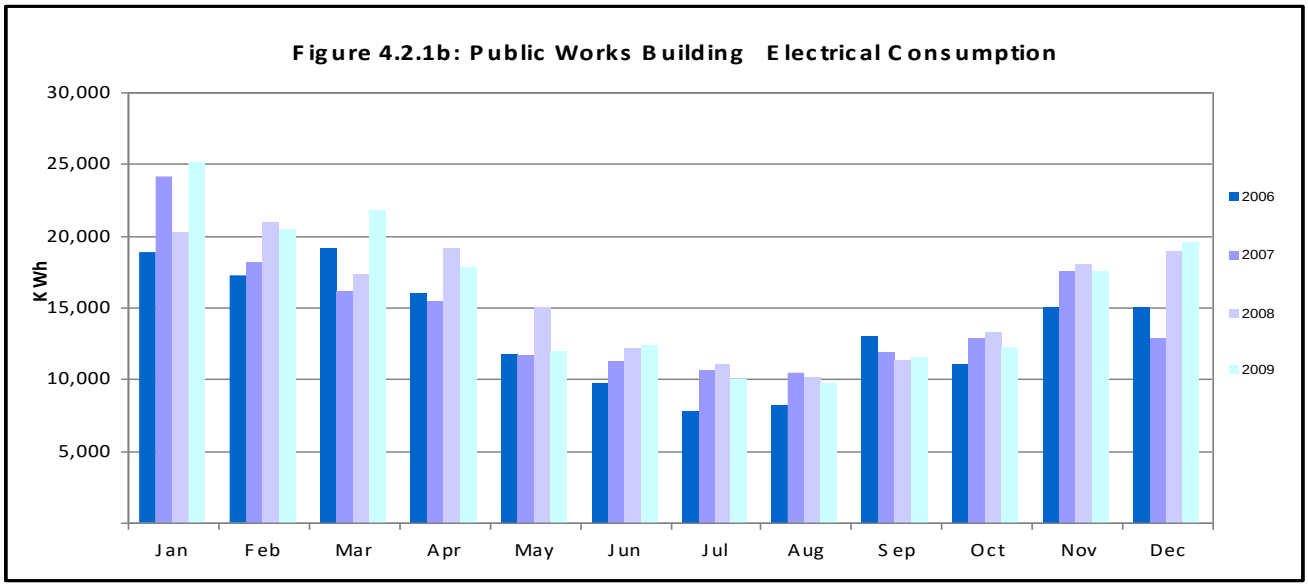
These graphs highlight trends in energy demand and consumption that help us identify areas for potential conservation.

Public Works Yard



In Figure 4.2.1 a), we notice the facility's demand has had a relatively consistent load profile for the last several years with a peak load of approximately 70 kW each year. This reflects the relatively constant use of the facility.

It appears that there is a lower load during the summer, which possibly is relative to the reduction in use of lights during the better weather.



In Figure 4.2.1 b) above, we notice that the monthly electrical consumption is also seasonal. When we look at the monthly consumption trend, it appears that the monthly consumption is peaked at around 25,000 kWh in January.

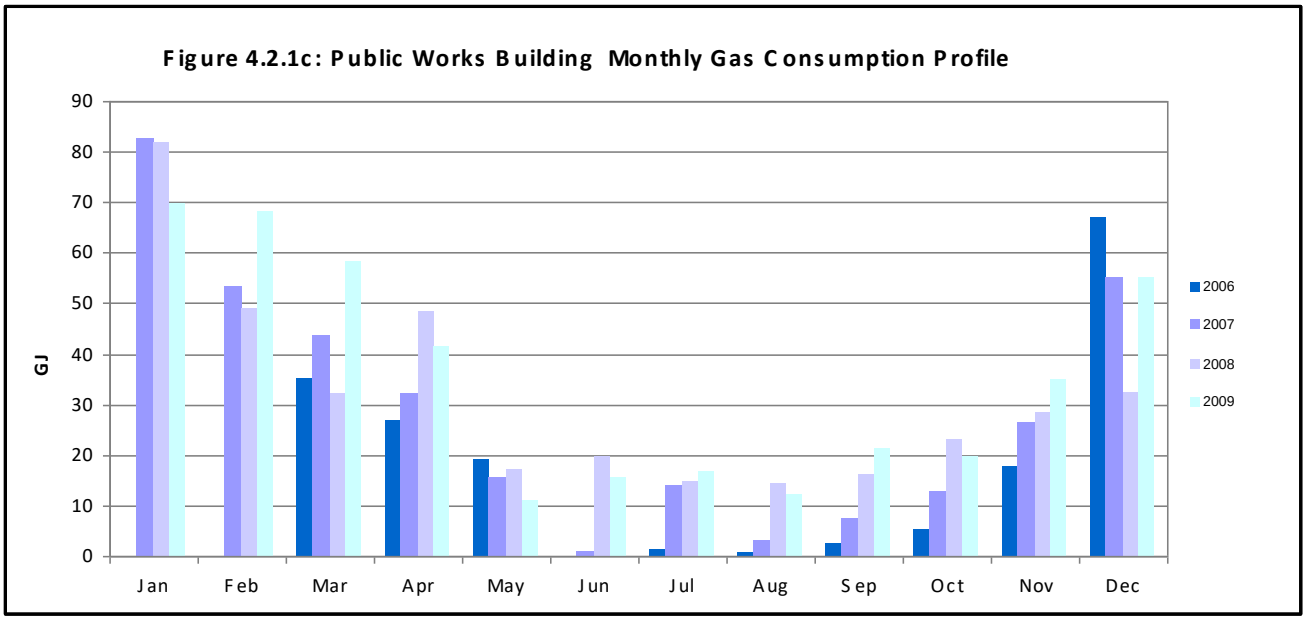


Figure 4.2.1c), shows a strong seasonality with little natural gas being consumed in the summer.

Public Works Yard

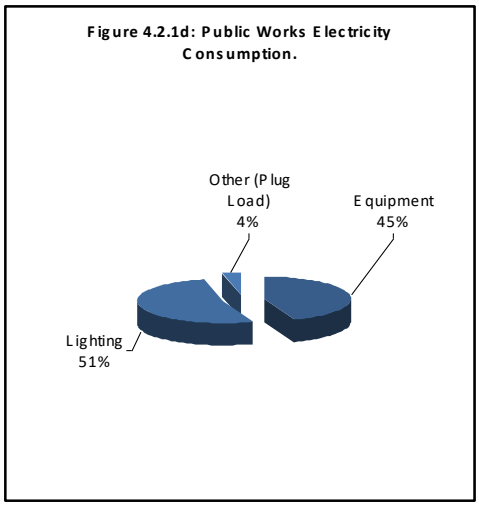
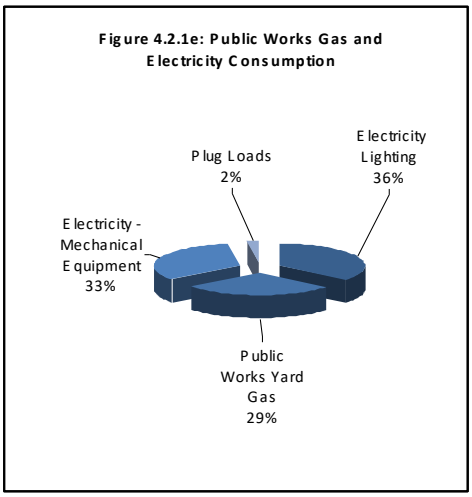
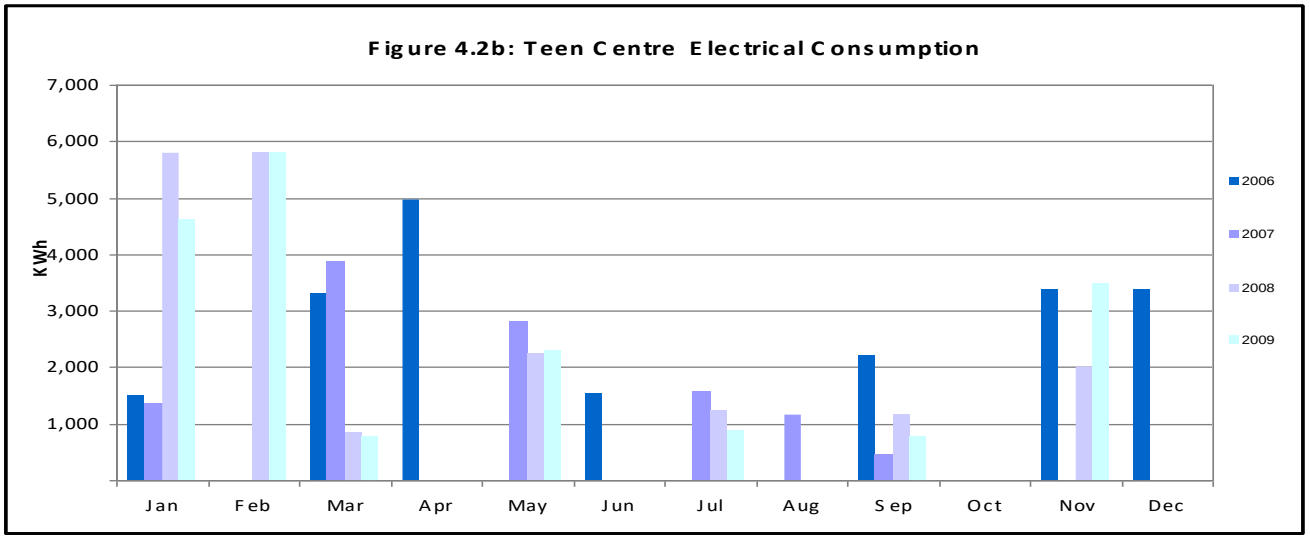


Figure 4.2.1d), shows that the majority of the electrical consumption of this facility is lighting.

Figure 4.2.1e), for the Works Yard shows that the largest load is the electrical consumption of the lighting. There is surprising low heat consumed by this facility.



Teen Centre



In Figure 4.2 b) above, we notice that the monthly electrical consumption is seasonal but very sporadic. This graph appears this way because the meter is not read each month but once every two months.

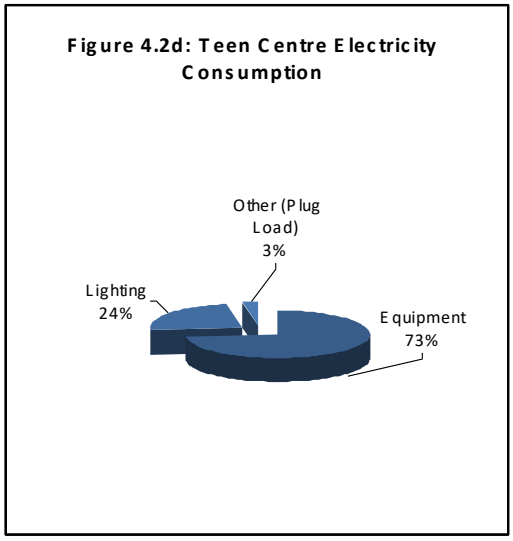
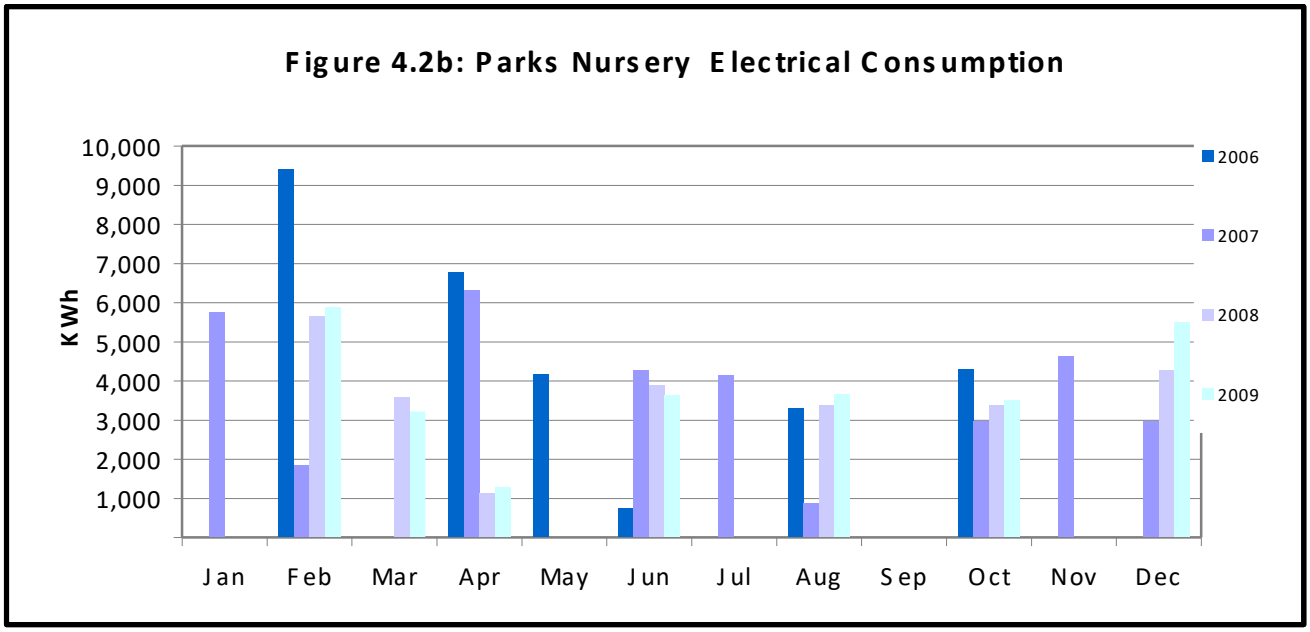


Figure 4.2d), shows the energy consumption at the Teen Centre. There is no gas at this facility.

The HVAC component is a large portion of the total electrical use of the facility because all the heating is performed by electric heat.

Parks Nursery



In Figure 4.2 b) above, one can see that here also is a seasonal influence to the consumption curve at the Parks Nursery, and again the graph appears sporadic due to the electric reading being taken every second month.

There is no demand charge at this facility.

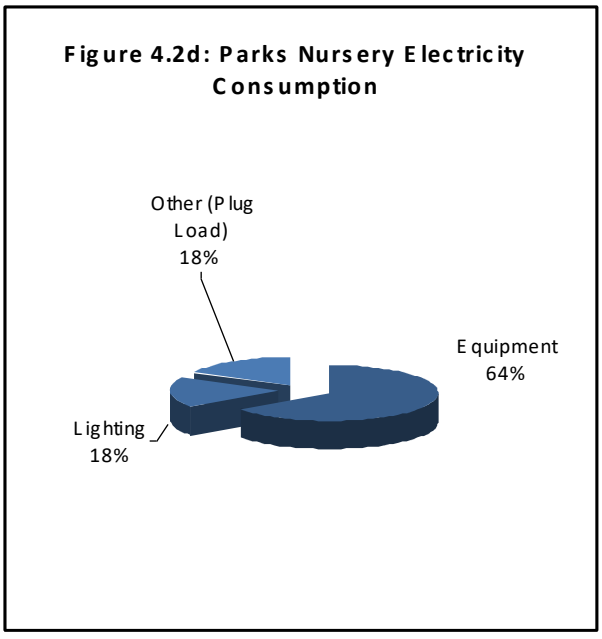


Figure 4.2d), shows the HVAC being the largest consumer of electrical energy.

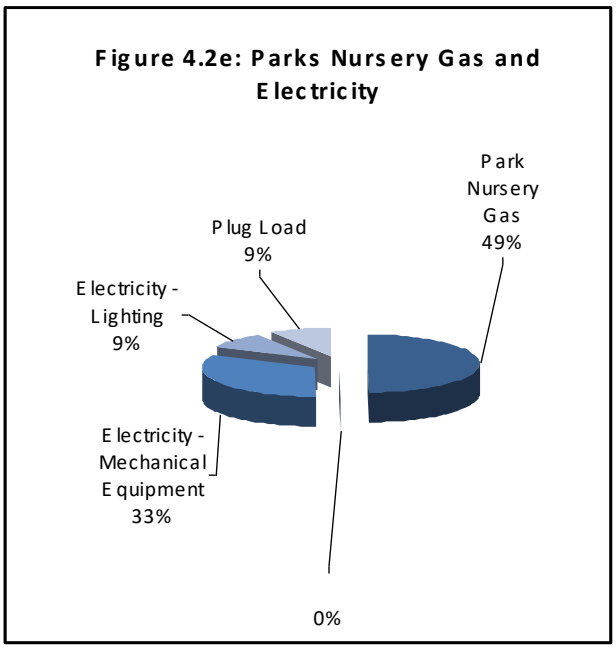


Figure 4.2), shows the HVAC natural gas consumption as the largest load at this facility.

5. Energy Conservation Opportunities

The primary purpose of this study was to identify energy conservation opportunities at the two Township of Esquimalt facilities. We have identified and analyzed many potential opportunities to save energy and cost by modifying and upgrading mechanical systems at this facility. We will explain these ideas in detail in this section. For electricity, current BC Hydro electricity rates of $8.92 / kW for demand and $0.0437 / kWh for consumption have been used for the Works yard only.

For greenhouse gas estimates, we have used emissions factors of 0.022 kg CO_2e / kWh of electricity in BC.

5.1 Mechanical Upgrades

The following measures describe a minor upgrade to the control system and the addition of some new technology.

Public Works Yard

5.1.1 Replace the Natural Draft Radiant Floor Boiler with a Condensing Boiler.

The water distributed to the vehicle repair shop floor by the natural draft boiler pump can be set at relatively low temperature. The return water back to the boiler will also be colder than a natural draft boiler prefers. We recommend the replacement of this boiler with a condensing boiler. Condensing boilers have thermal efficiencies as high as 95% when the return water is close to 120F.

5.1.2 Install Programmable Thermostats on the Air Handler and the Large Unit Heater.

Mercury bulb thermostats control both the air handler and the large unit heater. We recommend that these be replaced with programmable thermostats so that we can implement night setback.

Esquimalt Public Works Yard, Teen Centre, and Nursery.

5.1	Mechanical Measure Summary			Savings			
Item	Description	Cost	Payback	$	GJ	kWh	GHG
						0	0.0
						0	0.0
5.1.1	Relpace the under slab boiler with	$ 16,000	8.6	$ 1,870	93.3	0	4.8
5.1.2	Programmable thermostat on Air	$ 1,800	18.3	$ 98		2,250	0.0
						0	0.0
5.1	**Total Mechanical**	**$ 17,800**	**9.0**	**$ 1,970**	**93**	**2,250**	**4.8**

Teen Centre

5.1.3 Install an Air to Air Heat Pump as the Facilities Main Heating Source.

An air to air heat pump on average has a COP (coefficient of performance) of 3.0. This is three hundred percent more efficient than electric heat.

5.1	Mechanical Measure Summary			Savings			
Item	Description	Cost	Payback	$	GJ	kWh	GHG
						0	0.0
						0	0.0
5.1.3	Install Air to Air Heat Pump	$ 4,000	7.0	$ 569		7,590	0.2
						0	0.0
						0	0.0
5.1	**Total Mechanical**	**$ 4,000**	**7.0**	**$ 569**	**-**	**7,590**	**.2**

Parks Nursery

5.1.4 Replace existing Furnaces with Condensing Furnaces.

The existing furnaces have a steady state efficiency of approximately 60%. When replaced with Condensing furnaces the efficiency will be close to 94% and will not operate during un-occupied hours except to bring the facility back to night time set point.

5.1	Mechanical Measure Summary			Savings			
Item	Description	Cost	Payback	$	GJ	kWh	GHG
						0	0.0
						0	0.0
5.1.4	Install Condensing Furnaces	$ 14,000	8.0	$ 1,740	24.6	787	1.3
						0	0.0
						0	0.0
5.1	**Total Mechanical**	**$ 14,000**	**8.0**	**$ 1,740**	**25**	**787**	**1.3**

6. Appendix "A"

Acknowledgements

Coral Engineering Limited would like to acknowledge the valuable assistance of the following personnel in providing the necessary information for this report. Thanks to Mike Reed for his assistance at the various job sites.

Appendix "A-1" Mechanical Projects

Public Works Yard

Mechanical Equipment Measures

5.1.1 **Relpace the under slab boiler with a Condensing Boiler**

Description	Gas (GJ) Before	Gas (GJ) After	Electricity (kWh) Before	Electricity (kWh) After	Cost	Savings GJ	Savings kWh	Savings $	Comments
Condensing Boiler	267	173			$ 16,000	93		$ 1,867	The existing natural draft boiler has a thermal efficiency of about 60%. The new condensing boilers with this low temperature return water will have a thermal effciency closer to 95%.

Summary	*Ref*	*Payback*	*GHG*	*Cost*	*GJ*	*kWh*	*$*
Relpace the under slab boiler with a Condensing Bo	5.1.1	8.6	4.8	$ 16,000	93	-	$ 1,867

5.1.2 **Programmable thermostat on Air handler**

Description	Gas (GJ) Before	Gas (GJ) After	Electricity (kWh) Before	Electricity (kWh) After	Cost	Savings GJ	Savings kWh	Savings $	Comments
Programmable Stat on AHU			16,051	14,928	$ 900		1,124	$ 49	There are murcury bulb thermostats controlling these two units.
Programmable stat on UH-1			16,051	14,928	$ 900		1,124	$ 49	

Summary	*Ref*	*Payback*	*GHG*	*Cost*	*GJ*	*kWh*	*$*
Programmable thermostat on Air handler	5.1.2	18.3	0.05	$ 1,800	-	2,247	$ 98

Teen Centre

Mechanical Equipment Measures

5.1.3 **Install Air to Air Heat Pump**

Description	Gas (GJ) Before	Gas (GJ) After	Electricity (kWh) Before	Electricity (kWh) After	Cost	Savings GJ	Savings kWh	Savings $	Comments
Install Air to Air Heat Pump			11,382	3,794	$ 4,000		7,588	$ 569	An air to air heat pumps have an average COP of 3.0+.The electrical consumption of the electric heater can be cut by 66% implementing this strategy.

Summary	*Ref*	*Payback*	*GHG*	*Cost*	*GJ*	*kWh*	*$*
Install Air to Air Heat Pump	5.1.3	7.0	0.2	$ 4,000	-	7,588	$ 569

Parks Nursery

Mechanical Equipment Measures

5.1.4 **Install Condensing Furnaces**

Description	Gas (GJ) Before	Gas (GJ) After	Electricity (kWh) Before	Electricity (kWh) After	Cost	Savings GJ	Savings kWh	Savings $	Comments
Install Condensing Furnaces	82	57	3,921	3,134	$ 14,000	25	787	$ 1,744	Replace the old existing furnaces with condensing furnaces c/w programmable thermostats.

Summary	*Ref*	*Payback*	*GHG*	*Cost*	*GJ*	*kWh*	*$*
Install Condensing Furnaces	5.1.4	8.0	1.3	$ 14,000	25	787	$ 1,744

Appendix "A-2" Mechanical Inventories

Public Works Yard

ENERGY INVENTORY FORM - Mech Systems

BUILDING NAME: **Public Works Building** **Inventory By:** J Groenewoud

Syste Type	System Name	Equipment Number	Location	Area Served	Mont Profil	hp	Load kW	Load Factor	Check Month Op. Hours Apply												Annual Hrs	Annual kWh	% of Total	Schedule	hours / day
									Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	Rooftop Unit																								
V	Trane air handler	AHU-1	Roof	Lounge	A	0.5	0.4	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	2,614	2.9	24/7	24
V	Propeller fan	DSI-1	Ceiling	Shop	A	0.0	0.0	80%	31	28	31	30	31	30	31	31	30	31	30	31	365	7	0.0	24/8	1
V	Propeller fan	DSI-2	Ceiling	Shop	A	0.0	0.0	80%	31	28	31	30	31	30	31	31	30	31	30	31	365	7	0.0	24/9	1
V	Exhaust fan	EF-1	Roof	Main washroom	A	3.5	2.6	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	18,298	20.3	24/7	24
V	Exhaust fan	EF-2	Roof	Lunch room	A	0.1	0.1	80%	62	56	62	60	62	60	62	62	60	62	60	62	730	36	0.0	24/7	2
V	Exhaust fan	EF-3	Roof	Janitorroom	A	0.0	0.0	80%	248	224	248	240	248	240	248	248	240	248	240	248	2,920	58	0.1	24/7	8
V	Exhaust fan	EF-4	Roof	Lockers	A	0.1	0.0	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	261	0.3	24/7	24
V	Exhaust fan	EF-5	Roof	First aide room	A	0.1	0.0	80%	31	28	31	30	31	30	31	31	30	31	30	31	365	11	0.0	24/7	1
V	Exhaust fan	EF-6	Roof	Paint shop	A	1.0	0.7	80%	186	168	186	180	186	180	186	186	180	186	180	186	2,190	1,307	1.4	24/7	6
V	Exhaust fan	EF-7	Roof	Stores	A	0.3	0.2	80%	248	224	248	240	248	240	248	248	240	248	240	248	2,920	436	0.5	24/7	8
V	Exhaust fan	EF-8	Roof	Heated equip storgae	A	0.1	0.0	80%	248	224	248	240	248	240	248	248	240	248	240	248	2,920	87	0.1	24/7	8
V	Exhaust fan	EF-9	Roof	Tool estorageSupply room	A	0.1	0.0	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	261	0.3	24/7	24
V	Exhaust fan	EF-10	Roof	Battery room	A	0.3	0.2	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	1,307	1.4	24/7	24
V	Exhaust fan	EF-11		Supply room	A	0.1	0.0	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	261	0.3	24/7	24
V	Exhaust fan	EF-12		Washrooms	A	0.1	0.0	80%	62	56	62	60	62	60	62	62	60	62	60	62	730	22	0.0	24/7	2
V	Exhaust fan	EF-13		Maintenace shop general exhaust	A	1.0	0.7	80%	248	224	248	240	248	240	248	248	240	248	240	248	2,920	1,743	1.9	24/7	8
V	Exhaust fan	EF-14		Welding shop	A	0.6	0.4	80%	62	56	62	60	62	60	62	62	60	62	60	62	730	261	0.3	24/7	2
V	Exhaust fan	EF-15		Service pit	A	0.5	0.4	80%	62	56	62	60	62	60	62	62	60	62	60	62	730	218	0.2	24/7	2
V	Dust exhaust	DE-1		Dust exhaust	A	2.0	1.5	80%	62	56	62	60	62	60	62	62	60	62	60	62	730	871	1.0	24/7	2
V	Welding exhaust	DE-2		Welding exhaust	A	0.8	0.6	80%	62	56	62	60	62	60	62	62	60	62	60	62	730	327	0.4	24/7	2
V	Welding direct exhaust arm	DE-3		Point of origin exhaust	A	0.8	0.6	80%	62	56	62	60	62	60	62	62	60	62	60	62	730	327	0.4	24/7	2
V	Vehicle exhaust	VE-1		Vehicle exhaust	A	0.3	0.2	80%	62	56	62	60	62	60	62	62	60	62	60	62	730	131	0.1	24/7	2
V	Vehicle exhaust	VE-2		Vehicle exhaust	A	0.3	0.2	80%	62	56	62	60	62	60	62	62	60	62	60	62	730	131	0.1	24/7	2
V	Unit heater	UH-1	Shop		A	0.3	0.2	80%	93	84	93	90	93	90	93	93	90	93	90	93	1,095	163	0.2	24/7	3
V	Unit heater	UH-2	Shop		A	0.3	0.2	80%	93	84	93	90	93	90	93	93	90	93	90	93	1,095	163	0.2	24/7	3
	Plug Loads																								
M	Computers, tools etc.	PL-1			A		10.0	30%	186	168	186	180	186	180	186	186	180	186	180	186	2,190	6,570	7.3	Demand	6
	Cooling																								
C	Server cooling	C-1	Server	Facility	A		1.0	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	7,008	7.8	Demad	24
	Heating																								
EH	Unit heater	UH-1	Shop	shop	H		20.0	20%	372	336	372	432	223.2	0	0	595.2	504	446.4	360	372	4,013	16,051	17.8	Demand	24
EH	Unit heater	UH-2	Shop	shop	H		3.0	20%	372	336	372	432	223.2	0	0	595.2	504	446.4	360	372	4,013	2,408	2.7	Demand	24
EH	Electric duct heater	DH-1	Hall	Heat non arena spaces	H		20.0	20%	372	336	372	432	223.2	0	0	595.2	504	446.4	360	372	4,013	16,051	17.8	Demand	24
EH	Baseboard	BB-1 to 12	Offices	various offices	H		12.0	20%	372	336	372	432	223.2	0	0	595.2	504	446.4	360	372	4,013	9,631	10.7	Demand	24
EH	DHW tank	WH-1	Facility	DHW tank	H		2.3	20%	372	336	372	432	223.2	0	0	595.2	504	446.4	360	372	4,013	1,806	2.0	Demand	24
EH	DHW tank	WH-2	Facility	DHW tank	H		1.5	20%	372	336	372	432	223.2	0	0	595.2	504	446.4	360	372	4,013	1,204	1.3	Demand	24
	Pumps																								
P	Circulating pump	P-1	Shop floor	Shop floor	A	0.2	0.1	20%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	218	0.2	24/7	24
				Totals			79.3														120,072	90,256			
																						Equipment no plug loads			83,686
L	Lighting						33.0															Lighting			97,471
																						Plug			6,570
																						Total			187,727
																						Actual	2008		187,840

Teen Centre

ENERGY INVENTORY FORM - Mech Systems

BUILDING NAME: **Teen Centre** **Inventory By:** J Groenewoud

System Name	Equipment Number	Location	Area Served	Mont Profil	hp	Load kW	Load Factor	Check Month Op. Hours Apply Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Hrs	Annual kWh	% of Total	Schedule	hours / day
Ventilation Units																								
Fan Coil Unit	FC-1	Crawl Space	House	A	0.3	0.2	80%	248	224	248	240	248	240	248	248	240	248	240	248	2,920	436	3.1	24/7	8
Kitchen stive fan	FC-2	Kitchen hood	Range	A	0.0	0.0	80%	31	28	31	30	31	30	31	31	30	31	30	31	365	2	0.0	24/7	1
washroom exh fan	EF-1	washroom ceiling	Wasgroom	A		0.1	80%	31	28	31	30	31	30	31	31	30	31	30	31	365	29	0.2	24/7	1
Plug Loads																								
TV,stove,fridge,sterio	PL-1			A		1.0	30%	155	140	155	150	155	150	155	155	150	155	150	155	1,825	548	3.9	Demand	5
Heating																								
Electric heat	EH-1	Fan Coil	house	H		3.0	95%	744	604.8	446.4	288	223.2	144	0	0	144	297.6	432	669.6	3,994	11,382	80.2	Demand	24
DHW tank	WH-1	Facility	DHW tank	H		3.0	15%	744	604.8	446.4	288	223.2	144	0	0	144	297.6	432	669.6	3,994	1,797	12.7	Demand	24
Pumps																								
Condensate pump																								
			Totals			7.3														13,462	14,193			
						3.4														Equipment withou plug loads				13,646
																				Lighting				4,436
																				Plug				548
																				Total				18,629
																				Actual	2009			18,613

Parks Nursery

ENERGY INVENTORY FORM - Mech Systems

BUILDING NAME: **Parks Nursary** **Inventory By:** J Groenewoud

Syste Type	System Name	Equipment Number	Location	Area Served	Mont Profil	hp	Load kW	Load Factor	Check Month Op. Hours Apply Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Hrs	Annual kWh	% of Total	Schedule	hours / day
	HVAC																								
V	Furnace	FU-1	Main floor	Main Floor	A	0.3	0.2	100%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	1,960	12.0	24/7	24
V	Furnace	FU-2	Second floor	Second Floor	A	0.3	0.2	100%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	1,960	12.0	24/8	24
V	washrrom exhaust fan	EF-1	Ceiling	Shop	A		0.1	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	701	4.3	24/7	24
V	Ventilation fan	SA-1	greenhouse	greenhouse	A		0.3	15%	31	28	31	30	31	30	31	31	30	31	30	31	365	14	0.1	24/7	1
V	space exhaust fan	EF-2	wall	Main washroom	A		0.2	10%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	175	1.1	24/7	24
V	unit heater	UH-1	Greenhouse	Greenhouse	A		0.2	15%	31	28	31	30	31	30	31	31	30	31	30	31	365	11	0.1	24/7	1
V	unit heater	UH-2	Greenhouse	Greenhouse	A		0.2	15%	31	28	31	30	31	30	31	31	30	31	30	31	365	11	0.1	24/7	1
	Plug Loads																								
M	Computers, stove,Fridge, printers and cop	PL-1			A		3.3	80%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	11,563	70.5	Demand	12
	Heating																								
C	Furnace	HP-1	Roof	Library	E		0.0	35%	0	0	0	0	49.6	96	148.8	148.8	96	49.6	0	0	589	0	0.0	Demad	8
C	Furnace	HP-2	Roof	Library	E		0.0	35%	0	0	0	0	49.6	96	148.8	148.8	96	49.6	0	0	589	0	0.0	Demad	8
C	Unit heater	HP-3	Roof	Library	E		0.0	10%	0	0	0	0	49.6	96	148.8	148.8	96	49.6	0	0	589	0	0.0	Demad	8
C	Unit heater	C-1	Roof	Server room	E		0.0	10%	0	0	0	0	49.6	96	148.8	148.8	96	49.6	0	0	589	0	0.0	Demad	8
				Totals			4.7														42,870	16,396			
							3.4														Equipment without Plugs				4,833
																					Plugs				11,563
																					Lighting				4,436
																					Total				20,832
																					Actual				21,157

Appendix"A-3" Utility Information

Public Works Building							
Read Date	Days	Consumption (kWh) from meter read	Daily Average (kWh/day)	Demand (kW)	Amount ($)	Power Factor (%)	PF Surcharge ($)
15-Dec-09	28	19600	700	63	1603.95	99	0
17-Nov-09	30	17520	584	60	1505.13	99	0
16-Oct-09	30	12240	408	54	1144.71	98	0
16-Sep-09	33	11600	352	33	1006.14	98	0
14-Aug-09	30	9760	325	35	846.95	97	0
15-Jul-09	30	10000	333	33	867.64	98	0
15-Jun-09	32	12320	385	47	1121.04	98	0
14-May-09	28	12000	429	44	1079.48	99	0
16-Apr-09	31	17840	575	62	1467.33	99	0
16-Mar-09	31	21760	702	64	1624.63	99	0
13-Feb-09	29	20480	706	64	1573.51	99	0
15-Jan-09	30	25120	837	68	1774.65	99	0
16-Dec-08	29	18960	654	69	1534.33	99	0
17-Nov-08	32	18080	565	58	1453.48	99	0
16-Oct-08	30	13280	443	57	1193.43	99	0
16-Sep-08	32	11360	355	39	959.38	98	0
15-Aug-08	30	10160	339	40	864.29	98	0
16-Jul-08	30	11040	368	49	974.88	98	0
16-Jun-08	32	12160	380	55	1092.95	98	0
15-May-08	29	15040	519	54	1315.47	99	0
16-Apr-08	33	19200	582	58	1452.1	99	0
14-Mar-08	29	17360	599	57	1335.39	99	0
14-Feb-08	29	20960	723	58	1473.51	99	0
16-Jan-08	33	20240	613	59	1452.31	99	0
14-Dec-07	28	17520	626	66	1389.46	99	0
16-Nov-07	29	15040	519	58	1264.3	99	0
18-Oct-07	31	12880	415	36	1017.13	99	0
17-Sep-07	32	11840	370	33	931.89	98	0
16-Aug-07	30	10480	349	32	825.14	98	0
17-Jul-07	32	10640	333	48	890.1	98	0
15-Jun-07	30	11280	376	45	927.84	99	0
16-May-07	29	11680	403	40	938.92	99	0
17-Apr-07	33	15440	468	56	1271.98	99	0
15-Mar-07	29	16160	557	58	1306.41	99	0
14-Feb-07	28	18160	649	58	1378.9	99	0
17-Jan-07	34	24160	711	66	1773.67	99	0
14-Dec-06	28	18960	677	60	1459.08	99	0
16-Nov-06	29	14960	516	56	1288.21	99	0
18-Oct-06	30	11040	368	36	897.42	99	0
18-Sep-06	46	12960	282	29	1050.48	98	0
3-Aug-06	29	8160	281	31	661.42	98	0
5-Jul-06	30	7760	259	37	614.01	98	0
5-Jun-06	32	9680	303	41	779.42	99	0
4-May-06	29	11760	406	50	875.87	99	0
5-Apr-06	30	16000	533	52	1264.37	99	0
6-Mar-06	31	19200	619	60	1415.55	99	0
5-Feb-06	20	17280	864	61	1347.63	99	0
3-Jan-06	31	18880	609	65	1423.47	99	0

Esquimalt Public Works Yard, Teen Centre, and Nursery.

Parks Nursery

Read Date	Days	Consumption (kWh) from meter read	Daily Average (kWh/day)	Demand (kW)	Amount ($)	Power Factor (%)	PF Surcharge ($)
16-Dec-09	58	5504	95	95	485.08		
16-Nov-10	0	0	0	0	0		0
16-Oct-09	62	3497	56	0	312.76	-	0
16-Sep-09	0	0	#DIV/0!	0	0	-	0
14-Aug-09	63	3656	58	0	326.65	-	0
16-Jul-09	0	0	#DIV/0!	0	0	-	0
15-Jun-09	60	3627	60	0	323.61	-	0
14-May-09	0	0	#DIV/0!	0	0	-	0
16-Apr-09	17	1271	75	0	112.66	-	0
31-Mar-09	43	3213	75	0	261.72	-	0
16-Feb-09	62	5893	95	0	496.79	-	0
15-Jan-09	0	0	#DIV/0!	0	0	-	0
16-Dec-08	60	4265	71	0	362.17	-	0
17-Nov-08	0	0	#DIV/0!	0	0	-	0
17-Oct-08	60	3376	56	0	288.84	-	0
16-Sep-08	0	0	#DIV/0!	0	9	-	0
15-Aug-08	62	3386	55	0	290.03	-	0
16-Jul-08	0	0	#DIV/0!	0	0	-	0
16-Jun-08	61	3884	64	0	330.91	-	0
15-May-08	0	0	#DIV/0!	0	0	-	0
17-Apr-08	17	1143	67	0	97.21	-	0
14-Mar-08	45	3578	80	0	284.83	-	0
14-Feb-08	60	5644	94	0	447.51	-	0
16-Jan-08	0	0	#DIV/0!	0	0	-	0
14-Dec-07	60	4622	77	0	371.6	-	0
16-Nov-07	0	0	#DIV/0!	0	0	-	0
18-Oct-07	48	2966	62	0	240.01	99	0
17-Sep-07	0	0	#DIV/0!	0	0	-	0
31-Aug-07	14	864	62	0	69.92	-	0
17-Aug-07	60	4157	69	0	335.2	-	0
15-Jun-07	61	4278	70	0	344.83	-	0
16-May-07	0	0	#DIV/0!	0	0	-	0
18-Apr-07	62	6312	102	0	504.18	-	0
15-Mar-07	0	0	#DIV/0!	0	0	-	0
15-Feb-07	15	1840	123	0	146.46	-	0
31-Jan-07	47	5765	123	0	457.21	-	0
15-Dec-06	58	6596	114	0	478.31	-	0
16-Nov-06	0	0	#DIV/0!	0	0	-	0
18-Oct-06	62	4302	69	0	356.58	-	0
18-Sep-06	0	0	#DIV/0!	0	0	-	0
17-Aug-06	48	3295	69	0	273.2	-	0
5-Jul-06	0	0	#DIV/0!	0	0	-	0
30-Jun-06	11	755	69	0	60.31	-	0
19-Jun-06	60	4167	69	0	332.81	-	0
20-Apr-06	63	6786	108	0	536.31	-	0
6-Mar-06	0	0	#DIV/0!	0	0	-	0
16-Feb-06	59	9394	159	0	737.84	-	0
3-Jan-06	0	0	#DIV/0!	0	0	-	0

Esquimalt Public Works Yard, Teen Centre, and Nursery.

Teen Centre

Read Date	Days	Consumption (kWh) from meter read	Daily Average (kWh/day)	Demand (kW)	Amount ($)	Power Factor (%)	PF Surcharge ($)
17-Nov-09	63	3488	55	0	276.72		
16-Oct-09	0	0	#DIV/0!	0	0	-	0
15-Sep-09	62	772	12	0	56.14	-	0
14-Aug-09	0	0	#DIV/0!	0	0	-	0
15-Jul-09	62	871	14	0	62.29	-	0
15-Jun-09	0	0	#DIV/0!	0	0	-	0
14-May-09	44	2291	52	0	180.59	-	0
16-Apr-09	0	0	#DIV/0!	0	0	-	0
31-Mar-09	15	781	52	0	54.96	-	0
16-Mar-09	60	5793	97	0	429.16	-	0
15-Jan-09	59	4617	78	0	340.29	-	0
16-Dec-08	0	0	#DIV/0!	0	0	-	0
17-Nov-08	62	2017	33	0	143.92	-	0
17-Oct-08	0	0	#DIV/0!	0	0	-	0
16-Sep-08	62	1150	19	0	87.52	-	0
15-Aug-08	0	0	#DIV/0!	0	0	-	0
16-Jul-08	62	1241	20	0	93.78	-	0
16-Jun-08	0	0	#DIV/0!	0	0	-	0
15-May-08	45	2246	50	0	160.58	-	0
17-Apr-08	0	0	#DIV/0!	0	0	-	0
31-Mar-08	17	848	50	0	56.92	-	0
14-Mar-08	58	5796	100	0	381.66	-	0
16-Jan-08	61	5788	95	0	381.53	-	0
14-Dec-07	0	0	#DIV/0!	0	0	-	0
16-Nov-07	60	3942	66	0	264.69	-	0
18-Oct-07	0	0	#DIV/0!	0	0	-	0
17-Sep-07	17	442	26	0	30.99	-	0
31-Aug-07	45	1168	26	0	81.93	-	0
17-Jul-07	62	1549	25	0	108.95	-	0
15-Jun-07	0	0	#DIV/0!	0	0	-	0
16-May-07	62	2808	45	0	191.02	-	0
18-Apr-07	0	0	#DIV/0!	0	0	-	0
15-Mar-07	43	3882	90	0	258.6	-	0
15-Feb-07	0	0	#DIV/0!	0	0	-	0
31-Jan-07	15	1353	90	0	84.89	-	0
16-Jan-06	61	7620	125	0	519.37	-	0
16-Nov-06	61	3370	55	0	234.2	-	0
18-Oct-06	0	0	#DIV/0!	0	0	-	0
16-Sep-06	78	2209	28	0	158.54	-	0
17-Aug-06	0	0	#DIV/0!	0	0	-	0
5-Jul-06	0	0	#DIV/0!	0	0	-	0
30-Jun-06	59	1530	26	0	106.58	-	0
19-Jun-06	0	0	#DIV/0!	0	0	-	0
2-May-06	61	4968	81	0	329.39	-	0
2-Mar-06	58	3311	57	0	221.75	-	0
16-Feb-06	0	0	#DIV/0!	0	0	-	0
3-Jan-06	63	1484	24	0	104.11	-	0

Esquimalt Public Works Yard, Teen Centre, and Nursery.

Premise: 601 CANTEEN ROAD ESQUIMALT BC V9A 3P1
Service: 1 - Gas
Start Date: 3/6/2006
End Date: 10/9/2009
Public Works Yard

Date	Consumption in GJ	Metered Charge	Unmetered Charge	Temperature
6-Mar	35.1	558.56	38.23	4.39
6-Apr	26.8	426.48	38.23	6.81
6-May	18.9	300.77	38.23	9.43
6-Jun	0.1	1.6	38.23	13.3
6-Jul	1.1	17.34	37.89	16.79
6-Aug	0.5	7.89	37.89	17.72
6-Sep	2.5	39.43	59.36	15.87
6-Oct	5.3	83.6	37.89	12.1
6-Nov	17.7	279.18	37.89	8.38
6-Dec	67.1	1058.42	37.89	3.75
Total 2006	**175.1**	**2773.27**	**401.73**	**10.854**

Date	Consumption in GJ	Metered Charge	Unmetered Charge	Temperature
7-Jan	82.4	1337.54	37.89	3.44
7-Feb	53.2	885.27	37.89	5.11
7-Mar	43.7	727.19	37.89	6.17
7-Apr	32	532.49	37.89	8
7-May	15.5	257.93	37.89	10.41
7-Jun	0.9	14.98	37.89	13.67
7-Jul	14	232.96	37.89	16.97
7-Aug	3	49.92	37.89	16.83
7-Sep	7.4	123.37	38.02	15.62
7-Oct	12.9	215.43	38.02	10.57
7-Nov	26.6	444.2	38.02	8.3
7-Dec	55.2	921.8	38.02	3.29
Total 2007	**346.8**	**5743.08**	**455.2**	**9.865**

Date	Consumption in GJ	Metered Charge	Unmetered Charge	Temperature
8-Mar	162.9	2815.01	113.06	4.31
8-Apr	48.3	846.26	37.69	5.85
8-May	17.1	299.6	37.69	8.48
8-Jun	19.5	341.66	37.69	13.41
8-Jul	14.5	258.07	37.69	16.57
8-Aug	14.3	258.02	37.69	16.77
8-Sep	16.3	294.07	37.69	15.91
8-Oct	23	414.97	37.69	11.47
8-Nov	28.2	508.79	37.69	9.12
8-Dec	32.4	584.57	37.69	5
Total 2008	**376.5**	**6621.02**	**452.27**	**10.689**

Date	Consumption in GJ	Metered Charge	Unmetered Charge	Temperature
9-Jan	69.8	1288.4	37.69	2
9-Feb	68.2	1296.95	37.69	2.97
9-Mar	58.3	1108.68	37.69	4.06
9-Apr	41.4	787.3	37.69	6.84
9-May	10.8	205.37	37.69	9.86
9-Jun	15.6	296.67	37.69	15.28
9-Jul	16.8	321.67	37.69	16
9-Aug	12.3	237.12	37.69	18
9-Sep	21.1	406.76	37.69	16.53
9-Oct	19.7	379.76	37.69	12.03
9-Nov	34.8	670.85	37.69	8
9-Dec	55	1060.27	37.69	3.79
Total 2009	**423.8**	**8059.8**	**452.28**	**115.36**

Premise: 1100 CRAIGFLOWER RO/ ESQUIMALT BC V9A 2Y1
Service: 1 - Gas
Start Date: 3/6/2006
End Date: 10/9/2009
Parks Nursery

Date	Consumption in GJ	Metered Charge	Unmetered Charge	Temperature
6-Mar	53.7	854.54	38.23	4.37
6-Apr	48.5	771.79	38.23	6.76
6-May	23.7	377.15	38.23	9.58
6-Jun	9.9	157.53	38.23	13.14
6-Jul	5.1	80.44	37.89	16.58
6-Aug	2.6	41.01	37.89	17.79
6-Sep	4.8	75.71	60.63	15.81
6-Oct	7.7	121.45	37.89	12.07
6-Nov	19.3	304.43	37.89	8.33
6-Dec	32.7	515.8	31.58	3.08
Total 2006	**208**	**3299.85**	**396.69**	**10.751**

Date	Consumption in GJ	Metered Charge	Unmetered Charge	Temperature
7-Jan	43.4	705.03	37.89	3.42
7-Feb	25.6	426	37.89	5.24
7-Mar	29.4	489.23	37.89	6.14
7-Apr	23.8	396.04	37.89	7.97
7-Jun	13.7	227.98	75.77	12.21
7-Jul	3.3	54.92	37.89	17.27
7-Aug	1.5	24.97	37.89	16.87
7-Sep	3.2	53.35	38.02	15.47
7-Oct	2.2	36.74	38.02	10.47
7-Nov	5.7	95.19	38.02	7.97
7-Dec	11	183.7	38.02	3.43
Total 2007	**162.8**	**2693.15**	**455.19**	**9.678181818**

Date	Consumption in GJ	Metered Charge	Unmetered Charge	Temperature
8-Mar	37.3	648.01	113.06	4.32
8-Apr	9.7	169.95	37.69	5.87
8-May	5.8	101.62	37.69	8.83
8-Jun	2.7	47.3	37.69	13.28
8-Jul	2.6	46.34	37.69	16.63
8-Aug	2.5	45.1	37.69	17.06
8-Sep	2.3	41.49	37.69	15.53
8-Oct	3.7	66.77	37.69	11.33
8-Nov	6.2	111.88	37.69	8.97
8-Dec	17	306.72	37.69	4.93
Total 2008	**89.8**	**1585.18**	**452.27**	**10.675**

Date	Consumption in GJ	Metered Charge	Unmetered Charge	Temperature
9-Jan	20.6	380.65	37.69	2
9-Feb	16.6	315.67	37.69	3.06
9-Mar	13.1	249.12	37.69	4.14
9-Apr	21.5	408.86	37.69	7
9-May	9	171.16	37.69	9.82
9-Jun	5.4	102.7	37.69	15.47
9-Jul	3	57.48	37.69	16.1
9-Aug	3.1	61.45	10.62	17.94
9-Sep	2.4	47.58	10.62	16.55
9-Oct	3.2	63.43	10.62	12.03
9-Nov	9.8	194.26	10.62	8
9-Dec	38.2	757.24	10.62	3.93
Total 2009	**145.9**	**2809.6**	**316.93**	**116.04**