Esquimalt Municipal Hall, Public Safety Building and Fire hall Energy Retrofit Opportunity

Energy Evaluation for:

Esquimalt Municipal Hall, Public Safety Building and Fire Hall

Esquimalt, BC

Attention:

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Township of Esquimalt

Prepared by:

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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 Municipal Hall, Public Safety Building and Fire Hall. 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.

Municipal Hall

This 1,900 m^2 (20,463 ft^2) predominantly three story building has most of its HVAC equipment on the roof. This facility is comprised of a library and municipal hall on the main floor, and offices on the second and third floor. The facility currently produces **6** Tonnes of annual CO_2 emissions based on the following energy consumption data.

Public Safety and Fire Hall

This 1,275 m^2 (13,732 ft^2) two story building with a basement, has a combination of functions, acting as the fire hall and the police headquarters. This facility currently produces **7.4** 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 two facilities. This accomplishment will require some modifications of scheduling of the heating and ventilation systems.

Municipal Hall

The predominant portion of this facility is heated, cooled and ventilated by six Lennox rooftop heat pump units. Each of these units has an economizer in order to monopolize on free cooling during periods of moderate climate.
The library is heated, cooled and ventilated by three Lennox split systems. These systems have backup electric heating.
The server room is cooled by a pair of Mitsubishi ductless split systems.

Public Safety Building and Fire Hall

Two rooftop heat pumps serve the top two floors of this facility. One serves the police station and the second conditions the fire hall. Both of these units have economizers to take advantage of free cooling. To augment the heat pump rooftop units there are a number of baseboard electric heaters throughout the facility.
The basement houses a pair of storage rooms, washrooms, a weight room, a meeting room and a utility room. This space is heated and ventilated by a 100% outdoor air make up air unit.
This unit brings in outdoor air that is then heated by a duct heater and distributed to the floor. An exhaust unit extracts all of this air and releases it to atmosphere.

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)
Municipal Hall	**$ 13,700.00					
**eco-Energy possible solar contribution	($2,000.00)					
**Provincial possible solar contribution	($2,000.00)					
BC Hydro Incentive ***	??					
Municipal Hall Final	**$ 9,700.00**	**$2,300.00**	**33,700**	**0**	**4.2**	**0.7**
Public Safety and Fire Hall	$45,800.00					
BC Hydro Incentive ***	??					
Public Safety and Fire Hall Final	**$45,800.00**	**$ 8,700.00**	**137,400**	**716**	**5.2**	**3**
Total	**$54,500.00**	**$11,000.00**	**171,100**	**5,490**	**4.9**	**3.7**
Projected Future Usage			**728,060**			**9.7**

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.**
3) **Contact Key Account Manager for Possible BC Hydro Incentive. ***

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

The Municipal Hall

This project has the potential to reduce the **energy footprint** of the facility by **6%**.

If all of these recommendations meet with your approval, then we recommend that **$ 13,700.00** 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 **33,700** kWh or **121.6 GJ_e**.
The net result of this is **121.6 GJ_e** of annual energy savings. These energy saving strategies earn the Township of Esquimalt **0.7 Tonnes** reduction in annual greenhouse gas **(GHG)** emissions. The project will earn the (**12%** GHG reduction) and will concurrently reduce the energy consumption by **$2,300** 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.

Public Safety and Fire Hall

This project has the potential to reduce the **energy footprint** of the facility by **41%**.

If all of these recommendations meet with your approval, then we recommend that **$ 45,800.00** 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 **137,400** kWh or **496 GJ_e**.
These energy saving strategies earn the Township of Esquimalt **3.0 Tonnes** reduction in annual greenhouse gas **(GHG)** emissions. The project will earn the (**41%** GHG reduction) and will concurrently reduce the energy consumption by $8,700 each year. Note that these savings are based on 2009 electrical energy costs.

2. Customer Information

Municipal Hal	1229 Esquimalt Road Esquimalt, B.C. V9A 3P1
Public Safety Building	500 Park Place Esquimalt, B.C. V9A 6Z9
Contact Information:	Marlene Lagoa, Sustainability Coordinator 1229Esquimalt Road Phone: (250) 414 7114 Email: marlene.lagoa@esquimalt.ca

Municipal Hall

BC Hydro account	**(Hydro Address 1235)**	**9992 8218 051**
BC Hydro rate		**1200**
Facility type		**Office Building**
Facility age		**Opened late 2004**
Total floor area and number of floors		**1,900 m^2 / predominantly three storey building**

The condition of the exterior of the building appears to be in good condition, and about 30% of the façade is double pain windows.

Public Safety and Fire Hall Building

BC Hydro account	**9992 8217 251**
BC Hydro rate	**1200**
Facility type	**Combination office and Fire Hall**
Facility age	**Opened late 1975**
Total floor area and number of floors	**1,275 m^2 / predominantly a two storey building plus basement**

The condition of the exterior of the building appears to be in good condition, and about 14% of the exterior façade is double pain windows. Most of the windows are not well 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:

- We emphasise that solar heating is most feasible on a cost payback bases. Once the capital cost has been paid, the cost of operation of solar heating is minimal. On the Municipal Hall we recommend it not for its payback but for its environmental stewardship.
- On the fire hall we recommend converting the MUA to a heating ventilation unit in order to reduce energy consumption.

3.2 Green House Gas Reductions

The Esquimalt Municipal Hall, and the Public Safety Building, 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:

Municipal Hall	0.7 Tonnes
Public Safety Building	3 Tonnes

This equals a total green house gas saving of **3.7** Tonnes of CO_2 emissions per year.

3.3 Maintenance (Municipal Hall)

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

- We recommend a drain-back DHW preheat system. This will eliminate the need for frequent propylene glycol testing.

3.4 Warranty (Municipal Hall)

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

- The Solar system panels come with a ten year warranty.
- The pump has 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: Municipal Hall 0.7 Tonnes.
  Public Safety Building 3.0 Tonnes.
  3.7 Tonnes
- Provide a total energy savings of approximately:
  Municipal Hall 121.6 Gj_e/year.
  Public Safety Building 496 Gj_e/year.
  617.6 Gj/year

- Reduce the cost of the energy consumption of the facilities:
  Municipal Hall by $ 2,300/year (based on 2009 energy costs).
  Public Safety Building by $ 8,700/year (based on 2008 energy costs).
  $ 11,000/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

Municipal Hall

Heating and ventilation for the municipal hall is performed by some six Lennox rooftop heat pumps. These units are able to provide free cooling and backup electric heat. The Library is heated and cooled by three Lennox heat pump split systems with backup electric heat. The Server room is cooled year round by a pair of Mitsubishi ductless splits. All of this equipment is fairly new and in good shape.

Public Safety and Fire Hall

The heating and ventilation of the two storey building is provided by a pair of rooftop heat pumps. One of these two units is brand new. One of these units serves the Police station and the second the Fire hall. These units do have programmable thermostats but since the facility is occupied on a 24/7 bases it is hard to set back the space temperatures.

The basement is ventilated by a make up air unit and the air is heated by a large electric coil located in the basement. At the other end of the floor an exhaust air fan discharges all of this heated air to atmosphere.

The fire engine bay is heated by a pair of electric heaters which do not appear to be on most of the time.

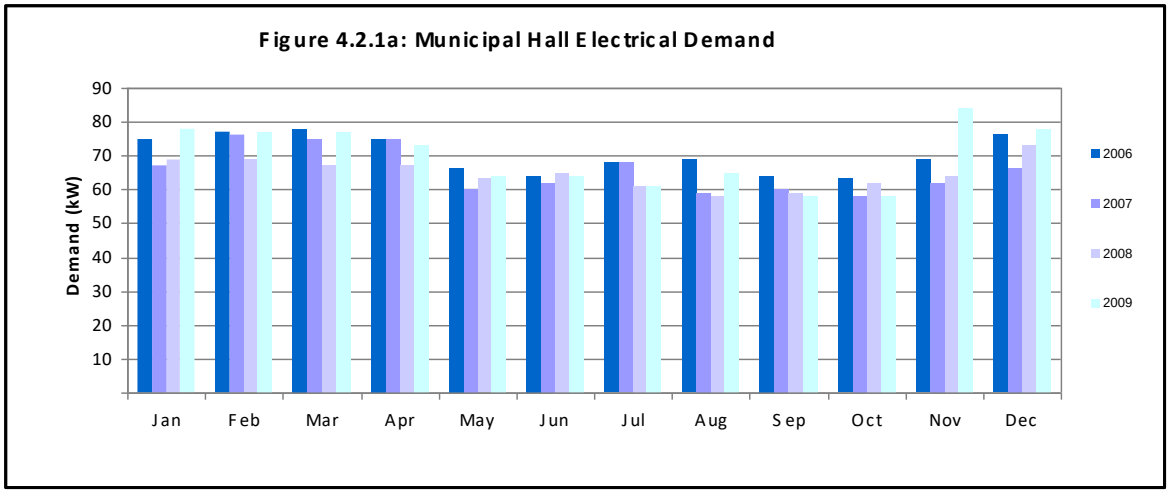
4.2 Energy Analysis

Municipal Hall

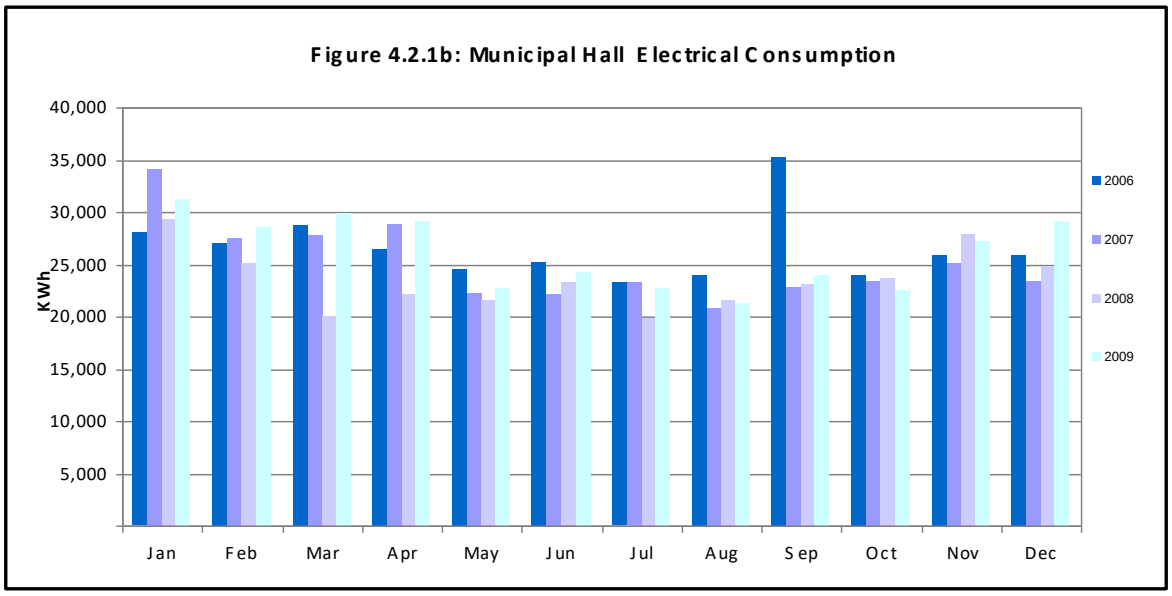
To understand the patterns of energy consumption, we have analyzed the natural gas and electrical consumption of the building.

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.



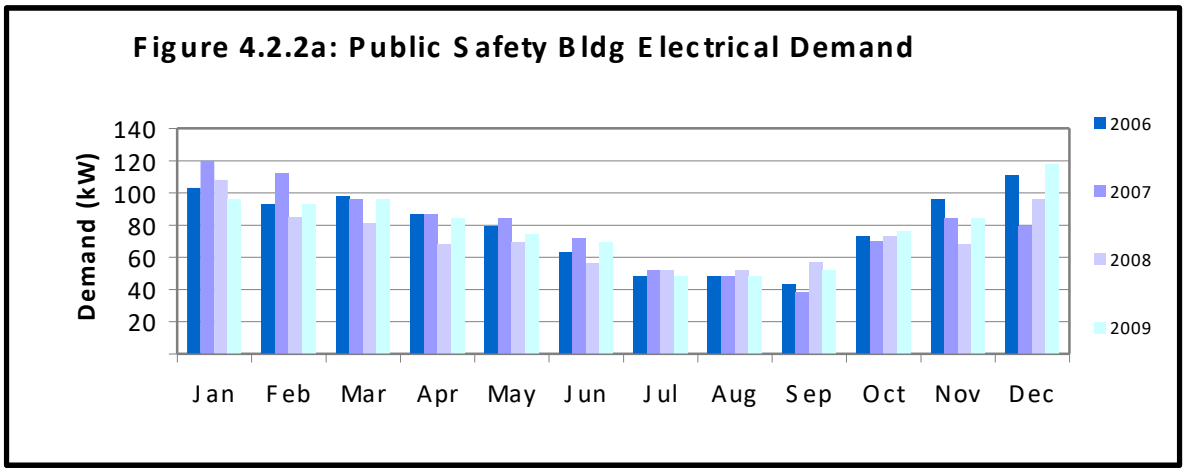
In Figure 4.2.1 a, we notice the facility's demand has had a relatively consistent load profile for the last several years with a peak load of approximately 75 kW year round. This reflects the relatively constant use of the facility and it appears that there is a slightly lower load during the summer which possibly is relative to the reduction in use of the facility.



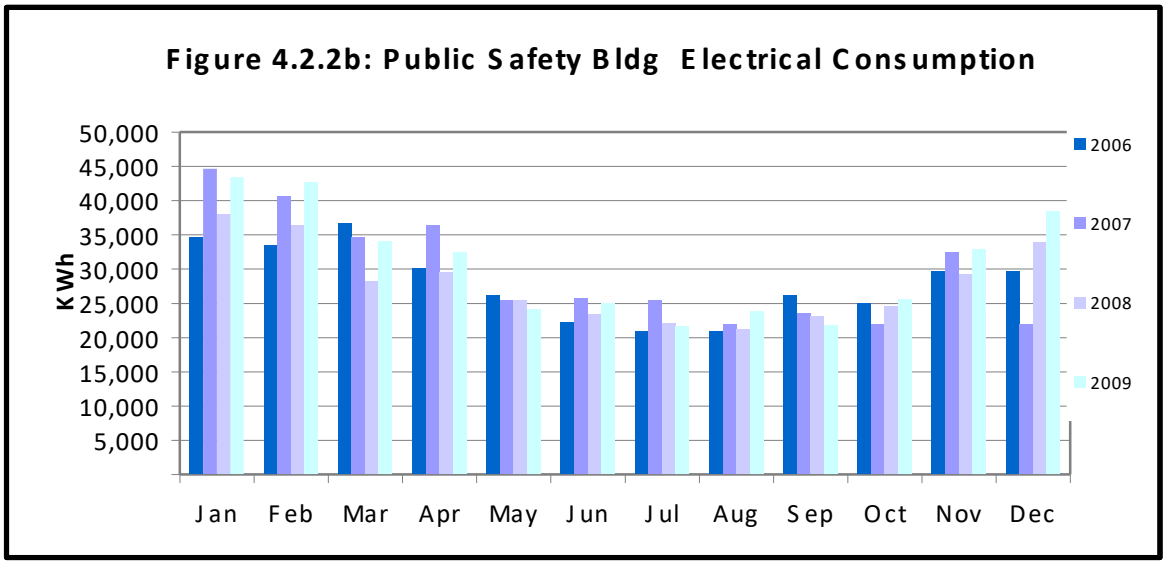
In Figure 4.2.1 b), we notice that the monthly electrical consumption is quite usual, with no large variations for a given month from year to year. When we look at the monthly consumption trend, it appears that the monthly consumption is peaked at around 35,000 kWh per month.

Public Safety Building

In Figure 4.2.2 a) below, we notice the facility's demand has a strong seasonality to the load. The winter peak is consistent at about 120 kW.



In Figure 4.2.2 b) below, 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 45,000 kWh per month.



Municipal Hall

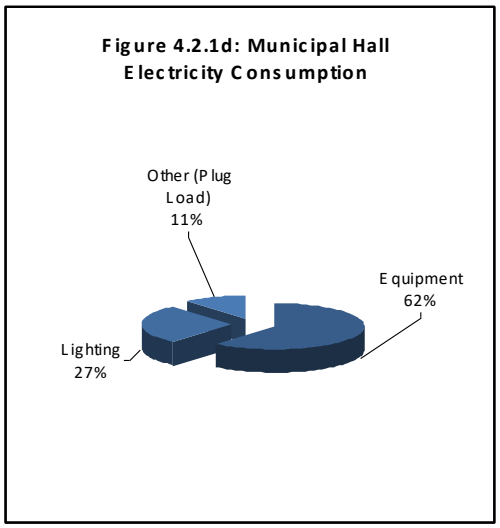
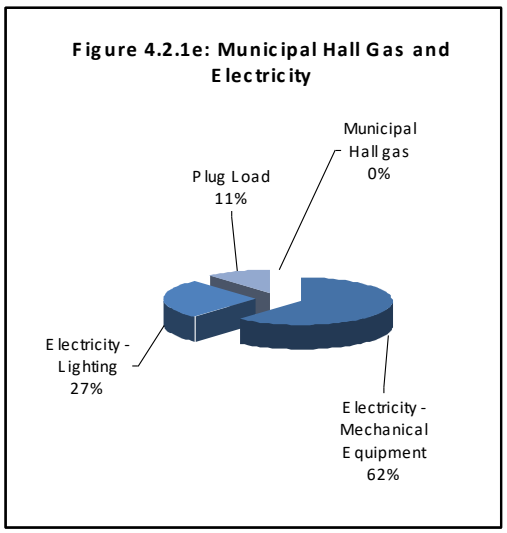


Figure 4.2.1d) and Figure 4.2.1e) for the Municipal Hall are the same because there is no gas use at this facility. All of the heating is performed by electrical resistant heaters.



Public Safety and Fire Hall

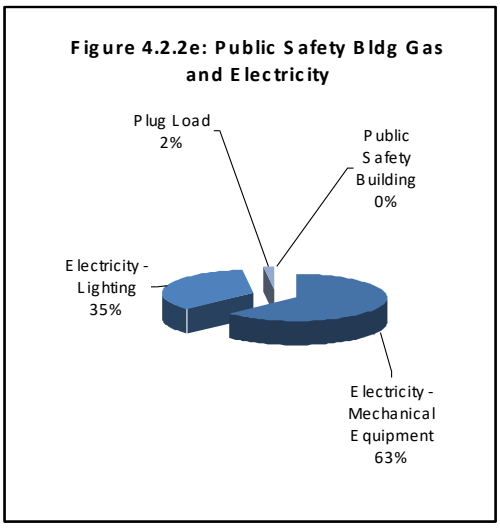
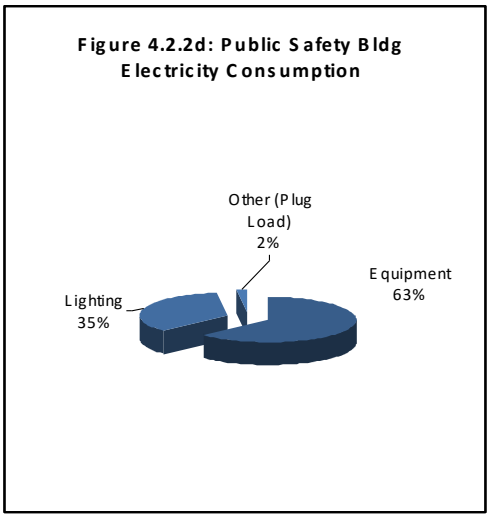


Figure 4.2.2e) and Figure 4.2.2d) are identical since there is not natural gas used by this facility.

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



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 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.

Municipal Hall

5.1.1 Addition of a Demonstration Solar System.

Although the domestic hot water consumption at the municipal hall is small, we recommend the installation of a drain back glazed solar DHW system, for demonstration purposes and as a sign of environmental stewardship.

5.1	Mechanical Measure Summary			Savings			
Item	Description	Cost	Payback	$	GJ	kWh	GHG
5.1.1	Install Demonstration Solar Panel	$ 8,000	184	$ 43		0 0 1,050 0 0	0.0 0.0 0.0 0.0 0.0
5.1	**Total Mechanical**	**$ 8,000**	**184**	**$ 43**	**-**	**1,050**	

5.1.2 Demand Ventilation of Council Chamber HVAC

Should a group want to use the space, the motion detectors will enable the unit and the CO_2 detectors will allow the unit to control the CO_2 levels in the space.

5.1.3 Unoccupied Setback

The council chambers are often not used and yet is has a schedule similar to the rest of the municipal offices. When units are enabled, they have a minimum outdoor air damper position allowing in outdoor air when the space is un-occupied. This outdoor air usually needs to be heated or cooled. This is a waste of energy. We recommend that when the space is un-occupied as determined by motion detectors that the units go into a sleep mode and are disabled but kept fairly close to the daily set-point; maybe a couple of degrees warmer in the summer and a couple of degrees colder in the winter. The outdoor air damper remains closed, so that we are not adding an un-necessary load on the HVAC equipment.

5.1	**DDC Measure Summary**			Savings			
Item	Description	Cost	Payback	$	GJ	kWh	GHG
							0.0
5.1.2	Demand Controlled Ventilation			$ 535		13,000	0.3
5.1.3	Unoccupied Setback	$ 500	9.4	$ 54		1,300	0.0
							0.0
							0.0
5.1	**Total DDC**	**$ 500**	**.8**	**$ 589**		**14,300**	**.3**

Public Safety and Fire Hall

5.1.4 Convert the MUA-1 into an Heating Ventilation unit.

Presently the 100% make up air unit, which serves the basement, runs long hours while there is very little use of the space. We recommend that the MUA be converted to an heating ventilation unit allowing return air to become the majority of the air that serves this area with its ventilation needs.

5.1	**Mechanical Measure Summary**			Savings			
Item	Description	Cost	Payback	$	GJ	kWh	GHG
						0	0.0
5.1.1	Convert MUA to Heat Vent Unit	$ 8,000	2.9	$ 2,800		64,400	1.4
						0	0.0
						0	0.0
						0	0.0
5.1	**Total Mechanical**	**$ 8,000**	**2.9**	**$ 2,800**	**-**	**64,400**	**1.4**

6. Energy Consulting and Project Management

We will further assist the Township of Esquimalt in obtaining grants for the solar component of the energy retrofit from eco-Energy and Solar BC.
It is important to note that the above estimated financial support needs to be applied for and we do not offer any guarantee that the city will qualify to receive this support from the Provincial and Federal agencies.

7. Lighting

Lighting portion of this report is done under separate cover.

8. 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 their assistance at the various job sites.

Appendix "A-1" Mechanical Projects

Municipal Hall

Mechanical Equipment Measures

5.1.1 **Install Demonstration Solar Panel**

Description	Gas (GJ) Before	Gas (GJ) After	Electricity (kWh) Before	Electricity (kWh) After	Cost	Savings GJ	Savings kWh	Savings $	Comments
Install Demonstration Solar Panel			2,633	1,580	$ 8,000		1,053	$ 43	The solar panel will be installed as a water loop drain back system , this not requiring Propylene glycol which will deteriorate with high heat. It is estimated that the sysystem will save approximatelt 25% of the DHW heating needed for this building.

Summary	*Ref*	*Payback*	*GHG*	*Cost*	*GJ*	*kWh*	*$*
Install Demonstration Solar Panel	5.1.1	184.3	0.02	$ 8,000	-	1,053	$ 43

DDC Controls Measures

5.1.2 **Demand Controlled Ventilation**

Description	Gas (GJ) Before	Gas (GJ) After	Electricity (kWh) Before	Electricity (kWh) After	Cost	Savings GJ	Savings kWh	Savings $	Comments
Council Chamber Demand ventilation			25,948	12,974			12,974	$ 535	Council Chambers are seldom occupied. Motion detection and CO2

Summary	*Ref*	*Payback*	*GHG*	*Cost*	*GJ*	*kWh*	*$*
Demand Controlled Ventilation	5.1.2	0.0	0.3		-	12,974	$ 535

5.1.3 **Unoccupied Setback**

Description	Gas (GJ) Before	Gas (GJ) After	Electricity (kWh) Before	Electricity (kWh) After	Cost	Savings GJ	Savings kWh	Savings $	Comments
Council Chamber Unoccupied setback			25,948	24,651	$ 500		1,297	$ 53	Council Chambers are not continually occupied. Recommend the installation of motion detection equipment allowing the equipment to go into a sleep mode with the outdoor damper fully closed.

Summary	*Ref*	*Payback*	*GHG*	*Cost*	*GJ*	*kWh*	*$*
Unoccupied Setback	5.1.3	9.4	0.0	$ 500	-	1,297	$ 53

Public Safety and Fire Hall

Mechanical Equipment Measures

5.1.1 **Convert MUA to Heat Vent Unit**

Description	Gas (GJ) Before	Gas (GJ) After	Electricity (kWh) Before	Electricity (kWh) After	Cost	Savings GJ	Savings kWh	Savings $	Comments
Convert MUA to Heat Vent Unit			2,178 80,256	1,949 16,051	$ 8,000		229 64,205	$ 2,804	Presently the basement air handler is a 100% outdoor air make up air unit. There is very little occupancy in the basement and converting the MUA to a heating ventilation unit c/w CO2 sensor will save 80% of the electrical heating of this unit.

Summary	*Ref*	*Payback*	*GHG*	*Cost*	*GJ*	*kWh*	*$*
Convert MUA to Heat Vent Unit	5.1.1	2.9	1.4	$ 8,000	-	64,434	$ 2,804

Appendix "A-2" Mechanical Inventories

Municipal Hall

ENERGY INVENTORY FORM - Mech Systems

BUILDING NAME: **Municipal Hall** **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
	Rooftop Unit																								
V	Lennox LGA088H	RTU-1	Roof	Building	A	2.0	1.5	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	6,535	3.2	24/7	12
V	Lennox LGA060H	RTU-2	Roof	Council Chamber	A	1.0	0.7	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	3,267	1.6	24/7	12
V	Lennox LGA048H	RTU-3	Roof	Council Chamber	A	0.8	0.6	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	2,451	1.2	24/7	12
V	Lennox LGA048H	RTU-4	Roof	Building	A	0.8	0.6	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	2,614	1.3	24/7	12
V	Lennox LGA072H	RTU-5	Roof	Building	A	1.5	1.1	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	4,901	2.4	24/7	12
V	Lennox LGA060H	RTU-6	Roof	Building	A	1.0	0.7	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	3,267	1.6	24/7	12
V	Exhaust fan	EF-1	Roof	Outside washroom	A		0.2	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	745	0.4	24/7	12
V	Exhaust fan	EF-2	Roof	Straff washroom	A		0.2	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	745	0.4	24/7	12
V	Exhaust fan	EF-3	Roof	Janitorroom	A		0.1	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	307	0.1	24/7	12
V	Exhaust fan	EF-5	Roof	Washrooms	A		0.1	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	307	0.1	24/7	12
V	Exhaust fan	EF-6	Roof	Outside meeting room rm213	A		0.1	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	600	0.3	24/7	12
V	Exhaust fan	EF-7	Roof	Outside meeting room rm221	A		0.3	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	1,415	0.7	24/7	12
V	Exhaust fan	EF-8	Roof	Washroom 219	A		0.2	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	745	0.4	24/7	12
V	Exhaust fan	EF-9	Roof	Washroom 104	A		0.3	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	1,310	0.6	24/7	12
V	Exhaust fan	EF-10	Roof	Staff room 114	A		0.2	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	745	0.4	24/7	12
V	Exhaust fan	EF-12	Roof	Elevator rm	A		0.2	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	730	0.4	24/7	12
V	Exhaust fan	EF-13	Roof	Sprinkler	A		0.1	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	569	0.3	24/7	12
V	Exhaust fan	EF-14	Roof	Book drop	A		0.1	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	307	0.1	24/7	12
V	Dust exhaust	EF-15	Roof	Meeting room	A		0.2	100%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	832	0.4	24/7	12
V	Lennox GB3CM65	FC-1	Roof	Library	A	0.8	0.6	80%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	1,960	1.0	24/7	12
V	Lennox GB3CM65	FC-2	Roof	Library	A	0.8	0.6	80%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	1,960	1.0	24/7	12
V	Lennox GB3CM95	FC-3	Roof	Library	A	1.5	1.1	80%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	3,921	1.9	24/7	12
V	Mitsubishi PK24FK	FC-4	server rm	Server room	A		0.3	80%	496	448	496	480	496	480	496	496	480	496	480	496	5,840	1,402	0.7	24/7	16
V	Mitsubishi PK24FK	FC-5	server rm	Server room	A		0.3	80%	248	224	248	240	248	240	248	248	240	248	240	248	2,920	701	0.3	24/7	8
	Plug Loads																								
M	Computers, elevator, printers and copiers	PL-1			A		10.0	100%	271.25	245	271.25	262.5	271.25	262.5	271.25	271.25	262.5	271.25	262.5	271.25	3,194	31,938	15.6	Demand	8.75
	Cooling and Heating																								
C	Lennox LGA088H	RTU-1	Roof	Building	A	9.0	6.7	80%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	23,494	11.5	Demand	12
C	Lennox LGA060H	RTU-2	Roof	Council Chamber	A	6.0	4.5	80%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	15,663	7.6	Demand	12
C	Lennox LGA048H	RTU-3	Roof	Council Chamber	A	4.0	3.0	80%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	10,442	5.1	Demand	12
C	Lennox LGA048H	RTU-4	Roof	Building	A	4.0	3.0	80%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	10,442	5.1	Demand	12
C	Lennox LGA072H	RTU-5	Roof	Building	A	8.0	6.0	80%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	20,884	10.2	Demand	12
C	Lennox LGA060H	RTU-6	Roof	Building	A	6.0	4.5	80%	372	336	372	360	372	360	372	372	360	372	360	372	4,380	15,663	7.6	Demand	12
C	HP26-060	HP-1	Roof	Library	E		5.0	80%	186	168	186	216	111.6	0	0	297.6	252	223.2	180	186	2,006	8,026	3.9	Demand	12
C	HP26-060	HP-2	Roof	Library	E		5.0	80%	186	168	186	216	111.6	0	0	297.6	252	223.2	180	186	2,006	8,026	3.9	Demand	12
C	HP26-090	HP-3	Roof	Library	E		8.0	80%	186	168	186	216	111.6	0	0	297.6	252	223.2	180	186	2,006	12,841	6.3	Demand	12
C	Slimline Server cooling	C-1	Roof	Server room	E		1.0	80%	201.5	182	201.5	234	120.9	0	0	322.4	273	241.8	195	201.5	2,174	1,739	0.8	Demand	13
C	Slimline server cooling	C-2	Roof	Server room	E		1.0	20%	124	112	124	144	74.4	0	0	198.4	168	148.8	120	124	1,338	268	0.1	Demand	8
					E		1.0	0%	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0.0	Demand	0
	Heating																								
EH	Electric heat	EH-2	Duct	room 301	H		1.0	20%	31	28	31	36	18.6	0	0	49.6	42	37.2	30	31	334	67	0.0	Demand	2
EH	Electric heat	EH-3	Duct	room 204	H		1.0	20%	31	28	31	36	18.6	0	0	49.6	42	37.2	30	31	334	67	0.0	Demand	2
EH	Electric heat	EH-4	Duct	room 216	H		1.5	20%	31	28	31	36	18.6	0	0	49.6	42	37.2	30	31	334	100	0.0	Demand	2
EH	Electric heat	EH-5	Duct	room 203	H		1.0	20%	31	28	31	36	18.6	0	0	49.6	42	37.2	30	31	334	67	0.0	Demand	2
EH	DHW tank	WH-1	Facility	DHW tank	H		3.0	100%	46.5	42	46.5	54	27.9	0	0	74.4	63	55.8	45	46.5	502	1,505	0.7	Demand	3
EH	DHW tank	WH-2	Facility	DHW tank	H		2.3	100%	46.5	42	46.5	54	27.9	0	0	74.4	63	55.8	45	46.5	502	1,129	0.6	Demand	3
	Pumps																								
P	Condensate pump		server rm	Server room	A		0.0	100%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	88	0.0	24/7	24
				Totals			78.6														155,225	204,780			
																				Without plugloads		172,843			
L	Lighting						29.4															77,242			
																				Total		282,022			
																				Actual		282,000			

Code	Totals by System Type	hp	kW	Hrs	kWh	
V	Ventilation	10	10	105,120	42,334	21
C	Cooling	37	48	35,810	127,486	62
D	Dehumidification	-	-	-	-	-
P	Pumps	-	0	8,760	88	0
H	Heating	-	-	-	-	0
M	Plug	-	10	3,194	31,938	16
EH	Electric Heat	-	10	2,341	2,934	1
	Total	47	78	155,225	204,780	100
				Without plugs	172,843	

Public Safety and Fire Hall

ENERGY INVENTORY FORM - Mech Systems

BUILDING NAME: **Public Safety Bldg** **Inventory By:** J Groenewoud

Syste Type	System Name	Equipment Number	Location	Area Served	Quantity	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
	Rooftop Unit																									
V	York XP090	HP-1	Roof	Firehall		A	1.5	1.1	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	7,842	3.6	24/7	24
V	Carrier 50QJ006	HP-2	Roof	Police		A	1.0	0.7	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	5,228	2.4	24/8	24
V	Engineered Air	MUA-1	Roof	Basement		A	0.8	0.6	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	3,921	1.8	24/9	24
V	Exhaust fan	EF-1	Roof	Washroom		A		0.2	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	1,191	0.5	24/7	24
V	Exhaust fan	EF-2	Roof	Basement		A		0.2	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	1,191	0.5	24/7	24
V	Exhaust fan	EF-3	Roof	Fire hall smake exhaust		A		0.1	80%	62	56	62	60	62	60	62	62	60	62	60	62	730	41	0.0	24/7	2
V	Exhaust fan	EF-5	Roof	Washrooms		A		0.1	80%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	491	0.2	24/7	24
	Plug Loads																									
M	Work shop tools,washer,drier,Fire doors					A	2.0	1.5	20%	279	252	279	270	279	270	279	279	270	279	270	279	3,285	979	0.4	Demand	9
M	Computers, printers and copiers, etc.	PL-1				A	3.0	2.2	80%	279	252	279	270	279	270	279	279	270	279	270	279	3,285	5,874	2.7	Demand	9
	Cooling and Heating																									
C	York XP090	HP-1	Roof	Firehall		A4	9.5	7.1	100%	446.4	403.2	279	270	111.6	378	446.4	4464	270	334.8	486	558	8,447	59,786	27.4	Demad	18
C	Carrier 50QJ006	HP-2	Roof	Police		A4	6.0	4.5	80%	297.6	268.8	186	180	74.4	252	297.6	2976	180	223.2	324	372	5,632	20,139	9.2	Demad	12
	Engineered Air MUA	MUA-1	Roof	Basement		A2	0.5	0.4	80%	520.8	470.4	595.2	576	669.6	648	744	744	648	595.2	576	520.8	7,308	2,178	1.0		24
	Heating																									
EH	Force Flow	FF-1	wall	stairwell		G		5.0	50%	62	56	62	72	37.2	0	0	99.2	84	74.4	60	62	669	1,672	0.8	Demand	4
EH	Force Flow	FF-2	wall	stairwell		G		5.0	50%	62	56	62	72	37.2	0	0	99.2	84	74.4	60	62	669	1,672	0.8	Demand	4
EH	Basement electric heat	EH-4	Duct	Basement		G		25.0	80%	372	336	372	432	223.2	0	0	595.2	504	446.4	360	372	4,013	80,256	36.8	Demand	24
EH	Baseboards	BB-1to 15	wall	through out	15	G		0.5	40%	372	336	372	432	223.2	0	0	595.2	504	446.4	360	372	4,013	803	0.4	Demand	24
EH	Electric heat	HP-1	Rooftop Unit	rooftop unit		G		13.6	15%	372	336	372	432	223.2	0	0	595.2	504	446.4	360	372	4,013	8,186	3.8	Demand	24
EH	Electric heat	HP-2	Rooftop Unit	rooftop unit		G		10.0	15%	372	336	372	432	223.2	0	0	595.2	504	446.4	360	372	4,013	6,019	2.8	Demand	24
EH	DHW tank	WH-1	Facility	DHW tank		G		30.0	22%	77.5	70	77.5	90	46.5	0	0	124	105	93	75	77.5	836	5,518	2.5	Demand	5
EH	DHW tank	WH-2	Facility	DHW tank		G		30.0	20%	77.5	70	77.5	90	46.5	0	0	124	105	93	75	77.5	836	5,016	2.3	Demand	5
	Pumps																									
P	Condensate pump		server rm	Server room		A		0.0	100%	744	672	744	720	744	720	744	744	720	744	720	744	8,760	88	0.0	24/7	24
				Totals				137.7														109,068	218,089			
																					Without Plugs		211,237			
L	Lighting							25.3															117,143			
																					Total		335,232			
																					Actual		335,160			

Code	Totals by System Type	hp	kW	Hrs	kWh	
V	Ventilation	3	3	53,290	19,905	9
C	Cooling	16	12	14,079	79,925	37
D	Dehumidification	-	-	-	-	-
P	Pumps	-	0	8,760	88	0
H	Heating	-	-	-	-	0
M	Plug	5	4	6,570	6,853	3
EH	Electric Heat	-	119	19,061	109,141	50
	Total	24	137	101,760	215,912	99
				Without	209,059	

Appendix"A-3" Utility Information

Municipal Hall

Municipal Hall

Read Date	Days	Consumption (kWh) from meter read	Daily Average (kWh/day)	Demand (kW)	Amount ($)	Power Factor (%)	PF Surcharge ($)
15-Dec-09	29	29160	1006	78	2166.99	99	0
17-Nov-09	32	27240	851	84	2013.38	99	0
16-Oct-09	30	22560	752	58	1705	98	0
16-Sep-09	33	23880	724	58	1760	98	0
14-Aug-09	31	21240	685	65	1681	97	0
16-Jul-09	31	22680	732	61	1723	98	0
15-Jun-09	32	24240	758	64	1802	98	0
14-May-09	27	22680	840	64	1735	98	0
16-Apr-09	32	29160	911	73	1968	99	0
16-Mar-09	31	29880	964	77	2002	99	0
13-Feb-09	29	28560	985	77	1949	99	0
15-Jan-09	30	31200	1040	78	2058	99	0
16-Dec-08	28	24720	883	73	1779	99	0
17-Nov-08	33	27840	844	64	1866	99	0
16-Oct-08	30	23640	788	62	1691	99	0
16-Sep-08	32	23040	720	59	1654	98	0
15-Aug-08	30	21480	716	58	1588	98	0
16-Jul-08	30	19920	664	61	1539	98	0
16-Jun-08	32	23280	728	65	1690	98	0
15-May-08	29	21600	745	63	1614	99	0
16-Apr-08	33	22080	669	67	1600	99	0
14-Mar-08	29	20040	691	67	1475	99	0
14-Feb-08	29	25080	865	69	1671	99	0
16-Jan-08	33	29280	887	69	1828	99	0
14-Dec-07	28	25080	896	66	1686	99	0
16-Nov-07	29	23160	799	62	1586	99	0
18-Oct-07	31	23400	755	58	1579	99	0
17-Sep-07	32	22800	713	60	1565	98	0
16-Aug-07	30	20880	696	59	1486	98	0
17-Jul-07	32	23280	728	68	1615	98	0
15-Jun-07	30	22080	736	62	1545	99	0
16-May-07	29	22200	766	60	1566	99	0
17-Apr-07	33	28920	876	75	1855	99	0
15-Mar-07	29	27720	956	75	1809	99	0
14-Feb-07	28	27480	981	76	1805	99	0
17-Jan-07	34	34080	1002	67	2203	99	0
14-Dec-06	28	27720	990	76	1863	99	0
16-Nov-06	30	25880	863	69	1733	99	0
18-Oct-06	30	23880	796	63	1662	99	0
18-Sep-06	45	35160	781	64	2458	98	0
3-Aug-06	30	24000	800	69	1692	98	0
5-Jul-06	30	23280	776	68	1598	98	0
5-Jun-06	32	25200	788	64	1655	99	0
4-May-06	30	24480	816	66	1636	99	0
5-Apr-06	29	26520	914	75	1747	99	0
6-Mar-06	31	28680	925	78	1840	99	0
5-Feb-06	29	27000	931	77	1773	99	0
3-Jan-06	30	27960	932	75	1801	99	0

Public Safety and Fire Hall

Public Safety Bldg

Read Date	Days	Consumption (kWh) from meter read	Daily Average (kWh/day)	Demand (kW)	Amount ($)	Power Factor (%)	PF Surcharge ($)
15-Dec-09	28	38520	1376	118	2631.8	99	0
17-Nov-09	32	32880	1028	84	2248.36	99	0
16-Oct-09	31	25680	828	76	1914.15	98	0
15-Sep-09	29	21840	753	52	1648.47	97	0
17-Aug-09	33	23880	724	48	1716.16	96	0
15-Jul-09	30	21720	724	48	1626	97	0
15-Jun-09	32	24960	780	69	1853.54	97	0
14-May-09	28	24120	861	74	1840.06	98	0
16-Apr-09	31	32400	1045	84	2140.85	99	0
16-Mar-09	28	34080	1217	96	2248.03	99	0
16-Feb-09	32	42720	1335	93	2578.79	99	0
15-Jan-09	30	43440	1448	96	2619.68	99	0
16-Dec-08	29	33960	1171	96	2243.44	99	0
17-Nov-08	32	29280	915	68	1940.01	99	0
16-Oct-08	30	24600	820	73	1775.14	98	0
16-Sep-08	32	23040	720	57	1646.01	97	0
15-Aug-08	29	21240	732	52	1552.97	97	0
17-Jul-08	31	22080	712	52	1586.64	97	0
16-Jun-08	32	23400	731	56	1656.07	97	0
15-May-08	29	25440	877	69	1791.4	98	0
16-Apr-08	33	29520	895	68	1889.74	99	0
14-Mar-08	29	28200	972	81	1834.69	99	0
14-Feb-08	29	36360	1254	85	2154.64	99	0
16-Jan-08	33	38040	1153	108	2309.29	99	0
14-Dec-07	28	32400	1157	79	2001.11	99	0
16-Nov-07	30	26160	872	84	1786.84	99	0
17-Oct-07	30	21960	732	70	1572.79	98	0
17-Sep-07	32	23520	735	38	1503.51	98	0
16-Aug-07	30	21960	732	48	1484.58	97	0
17-Jul-07	32	25440	795	52	1631.8	97	0
15-Jun-07	30	25800	860	72	1725.2	98	0
16-May-07	28	25440	909	84	1759.45	99	0
18-Apr-07	34	36480	1073	87	2283.08	99	0
15-Mar-07	29	34680	1196	96	2155.16	99	0
14-Feb-07	29	40680	1403	112	2440.71	99	0
16-Jan-07	33	44640	1353	120	2699.15	99	0
14-Dec-06	28	37560	1341	111	2387.67	99	0
16-Nov-06	29	29640	1022	96	2020.07	99	0
18-Oct-06	32	25080	784	73	1749.75	97	0
16-Sep-06	43	26160	608	43	19939.57	97	0
4-Aug-06	30	20880	696	48	1484.27	97	0
5-Jul-06	30	20880	696	48	1328.93	98	0
5-Jun-06	32	22320	698	63	1543.92	99	0
4-May-06	30	26260	875	79	1750.22	99	0
4-Apr-06	29	30120	1039	87	1929.41	99	0
6-Mar-06	31	36720	1185	98	2219.41	99	0
3-Feb-06	29	33480	1154	93	2078.49	99	0
5-Jan-06	30	34680	1156	103	2163.05	99	0