Emission Reduction Credit Creation Report
For The Rideau Regional Centre's Energy Management Program
1997 & 1998

1.0 Creation Strategy Summary

In 1996 the Rideau Regional Centre undertook a major energy management program, with the assistance and project payback guarantee of Rose Technology Group, a specialist energy service company. The program involved improvements to the lighting, HVAC, building envelope, laundry and central heating plants. These improvements reduced emissions to the atmosphere in four ways:

- Ontario Hydro burns less fossil fuel as a result of Rideau Centre reducing electrical requirements for lights and motors.
- Rideau Centre burns less gas in its boilers as a result of actions to reduce heat loss, control ventilation and improve efficiency.
- Rideau Centre reduces boiler emissions by replacing large boilers with multiple high efficiency boilers designed for low NO_x emission.
- Rideau Centre eliminates the burning of oil during gas supply interruptions by switching from interruptible to firm gas supply contract.

Construction was fully conducted through 1996 and 1997. Actual savings are now at the rate of 13% for electricity and 37% for gas. The retrofits reduced emissions during 1997 and 1998 in the following quantities:

NO_x Ozone Season	3.49	Tonnes
NO_x Non-Ozone Season	6.12	Tonnes
SO_2	6.56	Tonnes
CO_2	5,859	Tonnes

These emission reductions have been computed from utility meter records, adjusted for weather differences, building and operational changes. The energy savings quantities were computed by methods in common use in the energy performance contracting industry where on other projects the owner pays cash for demonstrated savings as a means of paying for retrofit investments. John Cowan, P.Eng. of Environmental Interface Limited has verified these savings reports and converted the savings into ERC tonnes, using procedures developing through the Pilot Emission Reduction Trading program in Ontario.

The primary features of this emission reductions reported herein are summarized below, in the form requested by PERT.

Criteria Eligibility	
Real	Conventional well proven fuel and electricity saving retrofits. Replacement boilers have lower emission rates. Oil was eliminated as a standby fuel.
Quantifiable	Energy use is measured continuously through the generating period. Energy savings calculation methodology is widely used and subject of several industry standards. Energy savings data is scrutinized and accepted in a commercial transaction for other purposes. Emission impact of on site boiler fuel savings is estimated from US EPA AP-42 boiler emission data.
Surplus	There are no voluntary or regulatory requirements for emission or energy management in existing buildings. Energy efficiency improvements required for new products are deducted from ERC computation.
Verifiable	Utility metered gas and electricity use is easily audited. (Fraction of electrical savings in Ontario Hydro's peak period was estimated.) Weather data is published Actual Hydro dispatch and emission data is published. Site boiler emission data from US EPA published reference source. (New boiler emission rates set above manufacturer's report for low NO_x design.) Gas service interruption period is derived from average over three years. Changes in occupancy recorded to demonstrate conformance with energy savings guarantee. Environmental Interface Limited has verified calculations.
Duration	Most reductions are "hard wired" so will remain in place indefinitely. Changes in operating methods are learned by staff and monitored by specialist firm motivated to ensure fundamental energy savings remain for 11 years.
Other Pollutants	Construction wastes handled in accordance with Ontario Regulations.

This project aimed to update equipment and lower plant operating costs. It was also part of a facility renewal program to make the space more attractive to the new programs that would keep it fully occupied. The retrofits of this project are predominantly 'additional' to the "business as usual" scenario of simply renovating the occupant space.

2.0 Source Identification

The Rideau Regional Centre is an 808,000 sq.ft. residential care facility for the developmentally handicapped. It is located on Highway 43 immediately east of Smiths Falls, Ontario, close to Ottawa.

The contact for this project is Dennis Staples, Director, Finance & Administration. His address is P.O. Box 2000, Smiths Falls, Ontario K7A 4T7 Telephone (613) 284-0123 Ext 2596. Fax: (613) 283-3463.

2.1 Ownership

The facility is owned and operated by the Ontario Government. The Ontario Ministry of Community and Social Services pays the annual energy cost. The Ministry also paid for the energy retrofits giving rise to these ERCs. Therefore the provincial government, as represented by the Ministry of Community and Social Services has clear title to all ERC's from the facility.

3.0 ERC Quantification

Emission reductions arise from the reduction in energy consumption, replacement of boilers with new lower NO_x boilers, and the elimination of the burning of oil. All data is derived from actual utility meter data for the 1997/8 generation period.

The facility used to be heated by three high pressure central steam boilers each rated at 25,000 lbs/hr. Though the boilers were 45 years old they were in good condition. 80% of the space was directly heated by steam radiators. The facility was aging and facing a dwindling demand for its core program. To make the facility attractive to other potential tenants, keeping jobs in the community, Rideau Regional Centre needed to be modernized. The energy management program was integrated with the facility renewal program. However most parts of the project did not directly involve the occupant space. Instead they aimed at updating and lowering plant operating costs. Emission reduction was a by-product of this plant cost reduction focus. However an agreement to sell ERCs derived from the project was achieved before construction was completed so that the ERC value could be used to enhance the emission management of the project. The retrofits in this project are predominantly 'additional' to the "business as usual" scenario of simply renovating the occupant space.

The activities which led to the reductions are summarized in Appendix 1. These activities were conceived during a 1995/6 engineering study before commitment to the retrofits. The study considered every piece of equipment, its capacity and its probable operating pattern during the baseline period. The study proposed a wide range of changes to capacity and operating periods. The engineering study is on file at Rideau Centre.

Rose Technology Group engineered the retrofits to ensure that they produced savings, since the firm is liable for any savings shortfall. Environmental Interface Limited verifies that the described retrofit activities could reasonably be expected to produce savings of the approximate magnitude noted. The savings reported have been reviewed by the Ministry of Community and Social Services to ensure that the terms of the guarantee have been met.

The energy management activities include hardware changes as well as operational changes managed by automation and manual methods. The changes are expected to remain in place indefinitely. The guarantee of Rose Technology motivates this firm to take an active interest over the 11 year term of its contract to maintain savings. By the end of the contract term, new operating methods will have become the norm for the facility so savings are expected to be permanent.

3.1 Baseline Determination

There are no voluntary or regulatory requirements limiting total energy use of Rideau Centre. Therefore pre-retrofit actual energy consumption is used as the baseline for determining reductions in energy use.

In 1994 the facility spent $1,000,000 for 5 GWh of electricity, 4 million m^3 of natural gas, and 600,000 litres of No 2 fuel oil during periods of gas supply interruption.

Rose Technology reviewed utility billing data from 1991 to select 1994 as the period best representing operations before retrofit decisions were committed. Monthly utility bill consumption information was recorded and analyzed to assess consumption patterns and their correlation with ambient temperature. Ambient temperature data was obtained from Environment Canada's Ottawa weather station.

For the gas and electric utility meters, data was separated into weather dependent and weather independent components by regression analysis. For the weather dependent portion of the gas consumption, gas use per heating degree day was derived, using a 16^{o}C reference temperature for degree days corresponding to the gas consumption patterns. The weather dependent portion of the electricity use per cooling degree day was also derived, using a 14^{o}C reference temperatures for cooling degree days. These factors are used for projecting the baseline usage pattern to future years.

Appendix 2 contains the 1994 utility data, regression coefficients, and graphical portrayals of the consumption relative to winter weather for fuel consumption and summer weather for electricity consumption.

The baseline was adjusted by specific engineering calculations to account for the following changes in the use of the facility since 1994:

- added laundry processing and operation of ventilation fans to meet proper standards of ventilation,
- part of the facility is now occupied by Ontario Provincial Police requiring extra ventilation air heating and extra lighting, fan and miscellaneous loads, and
- revised use of an elevator due to relocation of administrative space

Appendix 3 summarizes the derivation of these factors and shows the adjustment to Appendix 2 regression factors.

3.2 Emission Reduction

Emission reductions are computed by:
a) calculating energy savings from the gas and electric utility bills. Section 3.2.1 describes these calculations.
b) converting energy savings in Section 3.2.1 to their emission reduction values using the emission rate characteristics of the boilers involved. Section 3.2.2 describes this conversion.

3.2.1 Energy Savings

Actual energy use during the generating periods (1997 and 1998) was determined from utility bills. The adjusted baseline coefficients in Appendix 3 were applied to generating period weather and meter reading dates to determine the consumption that would have existed if the energy consumption pattern had been the same as that of the baseline period. The energy savings are the difference between actual consumption and baseline, corrected to conditions of the generating period. Appendix 4 contains spreadsheets showing the computed savings for gas and electricity in each of 1997 and 1998, along with all weather and baseline data.

The fraction of the electricity savings that occur during Ontario Hydro's peak period were not directly measured. It is estimated that 60% of these savings occur during the peak period.

Total adjusted savings are as shown below:

	1997	1998
Natural Gas (m^3)	725,125	1,481,108
Electricity (kWh)	312,642	657,286

3.2.1.1 Non-Surplus Energy Savings

Some of the adjusted energy savings are not "surplus," as defined by PERT for emission trading. These are the savings that were required under the federal and provincial Energy Efficiency Acts and their Regulations. These Regulations make it impossible to buy replacements for the inefficient types of the lamps and ballasts which were installed at the Rideau Centre. Savings associated with the simple replacement of products in the facility with the minimum efficiency products now on the market are not 'surplus.'

The lighting retrofit, involved delamping, reballasting and T8 lamps that went far beyond the requirements of the Regulations. However 112,000 kWh/year of lighting savings are estimated to be "non-surplus," or related to the removal of the remaining old inefficient products. These non-surplus savings are removed from the savings record when converting electrical savings to emission reductions (see Appendix 5 and Section 3.2.2.1. below). Since 1997 was a construction year when savings are only half of the final level, only half of the non-surplus deduction is applied in 1997.

3.2.2. Conversion to Emission Reductions

Emission reductions are derived from the non-surplus energy savings in Section 3.2.1. These derivations are shown for electricity and gas as described in Sections 3.2.2.1 and 3.2.2.2.

The installation of multiple small new low NO_x boilers further reduced emissions and made the use of standby oil impractical. Sections 3.2.2.3 and 3.2.2.4 show the computation of these two additional types of emission impacts.

3.2.2.1. Electricity Efficiency Emission Reduction

Electricity is supplied by Ontario Hydro's generators. Ontario Hydro publishes data on its 1997 and 1998 emission rates for purposes of determining the ERCs resulting from load reductions. These data account for the fraction of time that fossil fuel fired boilers are the marginal energy source, and the emission rates of these fossil fired boilers.

The electric energy reductions from Sections 3.2.1 and 3.2.1.1 were assigned to the periods and seasons corresponding to Ontario Hydro's reporting of marginal emission rates. The emission reductions and the Ontario Hydro factors are shown in Appendix 5.

3.2.2.2. Natural Gas Efficiency Emission Reduction

No emission test data is available for the old boilers. Therefore United States Environmental Protection Agency AP-42 emission rates are used to determine the emissions that would have been released if the old boilers had remained in place during the fuel efficiency improvement program's reductions reported in Section 3.2.1. NO_2 and CO_2 emission rates of 0.14 and 120 lbs/million Btu, respectively, were assumed as shown in the Appendix 6 computation of emission reductions.

3.2.2.3. Low NO_x Boiler Emission Reduction

The large central steam boilers were replaced by new small hot water boilers. The hot water replacement boilers have a low NO_x design. Lochinvar, their manufacturer, has supplied ERL bench test data to the Ministry of the Environment for some of the models supplied to the Rideau Centre showing that they emit only 10 ppm of NO_x. The manufacturer's representative also reported that field tests typically show NO_x emissions of 10-40 ppm for the models of boilers installed at Rideau. An emission rate of 50 ppm is assumed, to be conservative. The difference between old and new boiler emission rates is applied to the actual total gas consumption of these boilers.

A small portion of the new boilers are steam rather than hot water, with no particular low NO_x design. No metering was in place during the generating period to separate gas burned in the low NO_x boilers from gas burned in these new steam boilers. Therefore, based on boiler capacity and seasonal load patterns, it was estimated that the Lochinvar boilers consume 87% of the gas in winter and 75% of the gas in the ozone season.

Since phase-in of the new boilers took place over a one year period, the NO_x reduction from new boilers was ignored in 1997. 1998 NO_x reduction from the new boilers is shown in Appendix 7.

3.2.2.4. Oil Elimination Emission Reduction

The SO_2 emission reduction resulting from the elimination of on-site oil consumption was derived from the estimated emission rates of the old boilers when firing oil. These estimates were taken from US EPA AP-42 tables. The amount of oil that would have been fired, if the project had not been implemented, depends on the number of days of gas supply interruption that might have happened if the facility had remained on an interruptible gas supply arrangement. There is no way of determining what this interruption period would have been in any generation period. However for the 1994 – 1996 period, before the impact of retrofits, an average of 8.2% of the fuel consumed was actually oil (see Appendix 8). Therefore it is assumed that 8.2% of the baseline fuel use, adjusted to generating period weather would have been burned as oil.

Fuel suppliers in the area report typical sulphur content of their Number 2 fuel oil to be 0.3%. This sulphur oxidizes to predominantly form SO_2 at an emission rate of 0.3 lbs/million Btu. The net avoided SO_2 emission is shown in Appendix 8.

3.3 Data Integrity

These ERC computations are based on the accurate consumption measurements used by utilities in the sale of their energy commodities. The gas, electric and oil meters are required to meet Federal Government "Specifications for Approval of Type" standards, and "Reverification periods" for recalibration frequency. The weather data used for weather adjustment is from Environment Canada, a primary data source.

Data has been scrutinized by Rideau Regional Centre and Environmental Interface Limited as measures of quality control.

The energy savings calculations follow procedures consistent with energy performance contracting methods[1]. These methods involve financial transactions between arms length parties based on savings calculations. In these transactions, both parties are interested in scrutinizing the savings computations. Environmental Interface Limited has reviewed the calculations for this project and finds them consistent with good practise.

The baseline coefficients for energy saving calculations were derived by regression analysis. The r^2 coefficients of these regressions were high: 98% for gas and 84% for electricity (Appendix 2). For the gas meter, where the greatest weather adjustment is needed, it can be shown with 95% confidence that the uncertainty in reported gas savings is 19%[2] (9% at a 68% confidence).

Section 3.2.1.1's reduction of credits due to non-surplus lighting changes is conservative because it assumes all remaining old style lamps needed replacement at the time of the retrofit. In fact they may have had one to three years remaining life. Therefore the early replacement of good lamps made savings that might be called surplus in 1997 and 1998. Since the exact remaining lamp life is

1. "International Performance Measurement and Verification Protocol" October 1997, Published by the United States Department of Energy. Also John Cowan, President of Environmental Interface Limited, is actively involved in an ASHRAE committee drafting a guideline on measuring energy savings.
2. Based on a paper prepared by Reddy T.A. & Claridge D.E. 1997 "Uncertainty of 'Measured' Energy Savings From Statistical Baseline Models" Submitted for publication in the HVAC&R Journal of ASHRAE

not known, and PERT definitions of surplus are not clear on this point, the conservative assumption was made to treat all old style lamp replacements as non-surplus.

The computation of electricity based emission reductions is conservative because it ignores the reduction in energy losses of the electrical distribution system between the generation plant meters and Rideau Centre's meter. Such conservative factor may be of the order of 5% of the emission reductions computed from site measured electricity savings.

Emission factors provided by Ontario Hydro are of high quality. The Fossil On Margin factors are determined directly from actual plant dispatch logs. For the large majority of boilers NO_x and SO_2 emission rates are recorded by continuous emission monitors. For the rest of the fossil boilers stack testing data is used to determine actual emissions. CO_2 emission data is determined by fuel and ash mass balance.

69% of the ozone season NO_x ERCs reported herein involves assumptions of boiler emission rates. The AP-42 data used for the old boilers is rated as good quality by EPA, and is the only reliable way of reporting building boiler performance. Since special low NO_x design was involved in the new Lochinvar boilers, the manufacturer's reported NO_x range was used as a guide. However a value was conservatively chosen that is 25% above the high end of the manufacturer's range, namely 50 ppm. The AP-42 data for what EPA calls commercial low NO_x boilers is much lower, at 14 ppm. Therefore the 17% of the ozone season NO_x ERCs estimated for the new boilers is conservative.

Some of the heating load was shifted to the new low NO_x boilers in 1997. Since new boiler gas use during 1997 could not easily be separated from gas use of the old boilers, it was ignored. As a result NO_x reductions associated with the new boilers are further conservative.

Though the elimination of oil burning probably reduced the emission of NO_x (according to AP-42 factors), these quantities are ignored to be conservative.

All unknowns are assessed in a conservative way, making the ERCs shown herein conservative, or not overstated.

3.4 Sample Calculation

The typical basic energy savings calculation is as follows, using July 1997 electrical consumption as an example.

Baseline

Baseline Model: (from Appendix 3)

kWh = 13,189.58 kWh/day * Number of days +
216.7198 * Number of Cooling Degree Days (base 14°C)

Adjust Baseline to actual conditions of July 1997 using the Baseline Model: (see Appendix 4):

Length of meter reading period in days = 31
Recorded Cooling Degree Days = 209.3

kWh of Adjusted Baseline (from the Baseline Model):

= 13,189.58 * 31 + 216.7198 * 209.3
= **454,236** kWh (called 'Normalized Base Year' in Appendix 4)

Measured

Utility Bill for July 1997 = **432,325** kWh (called 'Current Utility Usage' in Appendix 4)

Energy Savings

= Baseline – Measured
= 454,236 – 432,325
= **21,911** kWh (called 'Savings' in Appendix 4)

Such energy savings calculations were made for both meters for the 24 months of 1997 and 1998 as shown in Appendix 4. All subsequent emission calculations are detailed in Appendices 5 – 8, in order to derive tonnes of emission reduction.

3.5 ERCs Created

The total 1997/8 emission reduction from the three sources described above is summarized below in metric tonnes. The Ozone Season is April 1 – September 30. Summary by year and by component of the ERCs is shown in Appendix 9.

NO_x Ozone Season	3.49	Tonnes
NO_x Non-Ozone Season	6.12	Tonnes
SO_2	6.56	Tonnes
CO_2	5,859	Tonnes

4.0 Demonstration of Surplus

As discussed in Section 3.1 above, there are no commitments requiring emission reductions at Rideau Centre.

Energy Efficiency Act implications for the purchase of building products have been considered above (3.2.1.1) so that all reported ERCs are surplus.

5.0 Demonstration of Real

The extensive retrofits (Section 3.0 and Appendix 1) could reasonably have been expected to produce the observed savings. All other operational changes since the base year have been considered in determining the energy savings (Section 3.1 and Appendix 3). The energy savings are proven from the record of utility bills. The conversion of these energy savings to their corresponding emission reductions has been made using factors which are conservative (Sections 3.2 and 3.3).

Most of the energy retrofits are permanent in nature so the reduction in emissions is expected to be permanent, subject only to variations in the emission rates of Ontario Hydro. However some of the saving are derived from changes to operating procedures. The energy services contract in place for 11 years ensures that an energy specialist is keenly interested in ensuring that operational changes do not erode savings.

5.1 Other Operational Effects

The retrofits reduced the number of lamps in the facility by using efficient fixtures. As a result lighting maintenance cost will be reduced.

Boiler plant staff we retrained to operate new boilers and the higher technology automation equipment. This training improved staff morale. No staff layoffs were necessary as a result of the project.

5.2 Impacts on Other Pollutants and Other Potential Environmental Impacts

Environmental contaminants encountered during construction (asbestos, PCB's and mercury) were disposed of as required by current good practise and Ontario regulations.

The reduction of energy consumed at Rideau Centre means that losses from the gas and electrical distribution systems will also be reduced. The associated emission reductions are not quantified herein.

The modernized laundry equipment installed under this project reduced water consumption from Rideau Centre's wells and reduced the loading on its own sewage treatment system.

Appendices

1 Energy Management Activities
2 Baseline Data Analysis and Graphs
3 Baseline Adjustment Computations and Adjusted Baseline Coefficients
4 Energy Savings Calculations 1997 and 1998
5 Emission Reduction From Electricity Efficiency Improvements
6 Emission Reduction From Gas Efficiency Improvements
7 Emission Reduction From Lochinvar (Low NOx) Boilers
8 Emission Reduction From Elimination of Standby Oil
9 Emission Reduction Credit Summary

Appendix 1

Rideau Regional Centre
Energy Management Activities

Lighting
Increase efficiency of light fixtures by:
- Replacing 7100 lamps with T8 style energy efficient lamps.
- Replacing 3,750 ballasts with electronic ballasts.
- Retrofitting fixtures to require fewer lamps

Convert steam heating to hot water by:
Replacing 1100 radiation valves and much condensate piping
De-commissioning central plant boilers by establishing nine small local boiler plants containing:
- 33 Lochinvar low NO_x hot water boilers,
- 2 Miura high pressure steam boilers for laundry,
- 1 Weil McLain low pressure steam boiler for a building remaining on steam heating

Air Handlers
Modify 9 air handlers to:
- match outdoor air intake to standards for current occupancy of the space
- upgrade heat recovery systems
- match operating periods to occupancy and ventilation needs

Central Control
Add 650 point direct digital control system to operate/supervise boilers and air handlers

Weatherization
- Thousands of feet of weatherstripping
- Window sealing

Indoor Pool
Control energy use and reduce moisture damage to building fabric by:
- adding a pool cover
- adding heat recovery dehumidification system

Upgrade Laundry Equipment
- New automated wash equipment
- New gas driers

Appendix 2

Baseline Data, Analysis and Graphs

Gas and Electricity Meters

Building: 1 Main Building
Meter: 2 Main Natural Gas Meter, Account # 8 65 26790 999 1

Reading Date	Days	Calc. Days	Acctng Month	Consumption [m3]
1994.01.24	A 33	33	1	810,500.77
1994.02.21	A 28	28	2	624,316.38
1994.03.24	31	31	3	534,088.00
1994.04.24	31	31	4	433,650.00
1994.05.24	30	30	5	270,788.00
1994.06.26	33	33	6	202,392.00
1994.07.24	28	28	7	136,644.00
1994.08.24	31	31	8	144,295.00
1994.09.25	32	32	9	171,959.00
1994.10.24	29	29	10	289,345.00
1994.11.23	30	30	11	387,850.00
1994.12.26	33	33	12	581,093.00
	369	369		4,586,921.16

C - Comments have been made for this month
A - Alternate meter consumption has been added for this month
S - Submeter consumption has been subtracted for this month

BASE YEAR

From / To	Base Year Model	Consumption Summer	Consumption Winter	Units
1994.01.24	Normalization Type:	DAY	DAY&DD	
1994.12.26	Balance Temperature:	16.0	16.0	°C
	Peak Base Load:	0.00	6,123.22	[m3]/day
	Peak Weather Factor:	0.0000	555.1773	[m3]/DD
	Goodness of Fit: r^2	0.0000	0.9800	

Memo:

Approximate amount of fuel oil added to bring data point in agreement with trend line. Balance temperature of 16°C gives best regression.

BEPI ANALYSIS REPORT - DETAILED

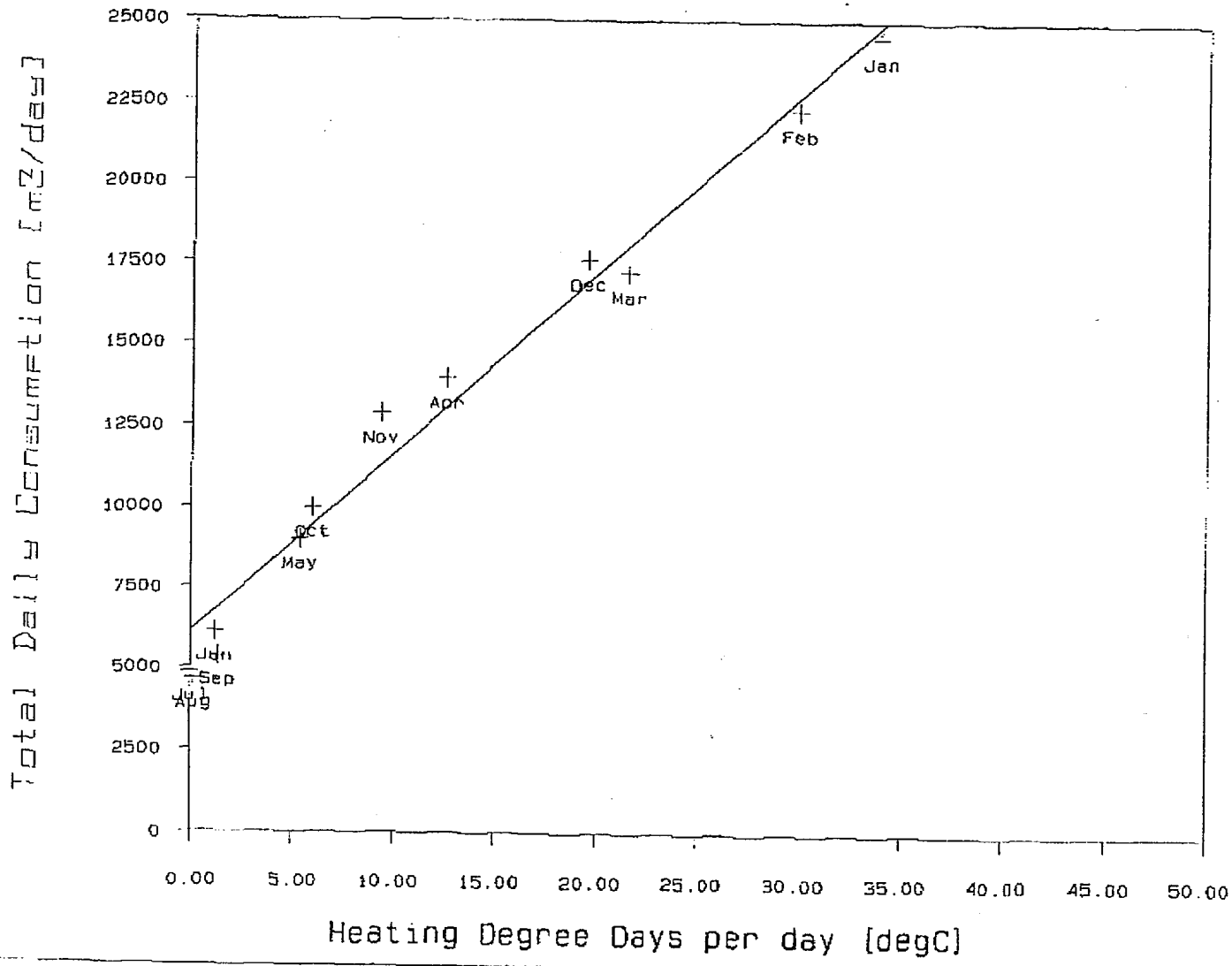
Project: 292 Rideau Regional Centre
Building: 1 Main Building
Meter: 2 Main Natural Gas Meter 0 65 26790 999 1
Weather Station: OTTAWA Ottawa Airport
Area: 808,000 ft2
Heating Balance Temperature: 16°C
Cooling Balance Temperature: 16°C
Intermediate month set to : Day weighting of Summer and Winter
Actual utility costs include applicable taxes

Reading Date	Days	Month	CONSUMPTION (m3)	CONSUMPTION Cost	Daily Consumpt. (m3)/day	HDD [°C]	CDD [°C]	Temp [°C]	Unit Costs $/(m3)
1994-Jan-24	33	W	810,500	$137,160	24,560.6	1,114.1	0.0	-17.8	$0.169
1994-Feb-21	28	W	624,316	$113,982	22,297.0	835.5	0.0	-13.8	$0.183
1994-Mar-24	31	W	534,088	$79,271	17,228.6	665.7	0.0	-5.5	$0.148
1994-Apr-24	31	W	433,650	$57,958	13,988.7	388.3	0.0	3.5	$0.132
1994-May-24	30	W	270,788	$35,730	9,026.3	161.3	9.0	10.9	$0.132
1994-Jun-26	33	I	202,392	$26,773	6,133.1	39.3	107.3	18.1	$0.132
1994-Jul-24	28	S	136,644	$18,354	4,880.1	0.1	145.8	21.2	$0.134
1994-Aug-24	31	S	144,295	$19,405	4,654.7	4.7	95.7	18.9	$0.134
1994-Sep-25	32	I	171,959	$23,074	5,373.7	43.0	32.2	15.7	$0.134
1994-Oct-24	29	W	289,345	$38,642	9,977.4	173.7	5.1	10.2	$0.134
1994-Nov-23	30	W	387,850	$51,706	12,928.3	279.2	0.0	6.7	$0.133
1994-Dec-26	33	W	581,093	$82,022	17,608.9	643.2	0.0	-3.5	$0.141
Totals:	369		4,586,921	$683,177					

* - Indicates comments for the bill
** - Indicates missing bill in printed year

Consumption vs Degree Day Graph

Project: 292 Rideau Regional Centre
Building: 1 Main Building
Meter: Main Natural Gas Meter
Date: 1994.01.24 TO 1994.12.26



1998-Nov-23

Rosa Technology Group Limited

Project: 292 Rideau Regional Centre
Building: Main Building

Building: 1 Main Building
Meter: 1 Main Electrical Meter, Account # 6731 75 1079103

Reading Date	Days	Calc. Days	Acctng Month	Consumption [kWh]	Billing Demand [kW]
1994.02.01	31	31	1	450,000.00	1,013.00
1994.03.01	28	28	2	379,897.00	914.00
1994.04.01	31	31	3	392,798.00	920.00
1994.05.01	30	30	4	395,451.00	919.00
1994.06.01	31	31	5	394,772.00	897.00
1994.07.01	30	30	6	397,773.00	910.00
1994.08.01	31	31	7	425,733.00	901.00
1994.09.01	31	31	8	408,418.00	922.00
1994.10.01	30	30	9	392,626.00	933.00
1994.11.01	31	31	10	413,018.00	971.00
1994.12.01	30	30	11	419,295.00	969.00
1995.01.01	31	31	12	421,105.00	983.00
	365	365		4,890,886.00	937.66

C - Comments have been made for this month
A - Alternate meter consumption has been added for this month
S - Submeter consumption has been subtracted for this month

BASE YEAR

From / To	Base Year Model	Consumption Summer	Consumption Winter	Consumption Units	Demand Summer	Demand Winter	Demand Units
1994.02.01	Normalization Type:	DAY&DD	DAY		NONE	NONE	
1995.01.01	Balance Temperature:	14.0	14.0	°C	14.0	14.0	°C
	Peak Base Load:	12,702.15	0.00	[m3]/day	0.00	0.00	/month
	Peak Weather Factor:	124.9791	0.0000	[m3]/DD	0.0000	0.0000	/DD
	Goodness of Fit:	0.8380	0.0000		0.0000	0.0000	

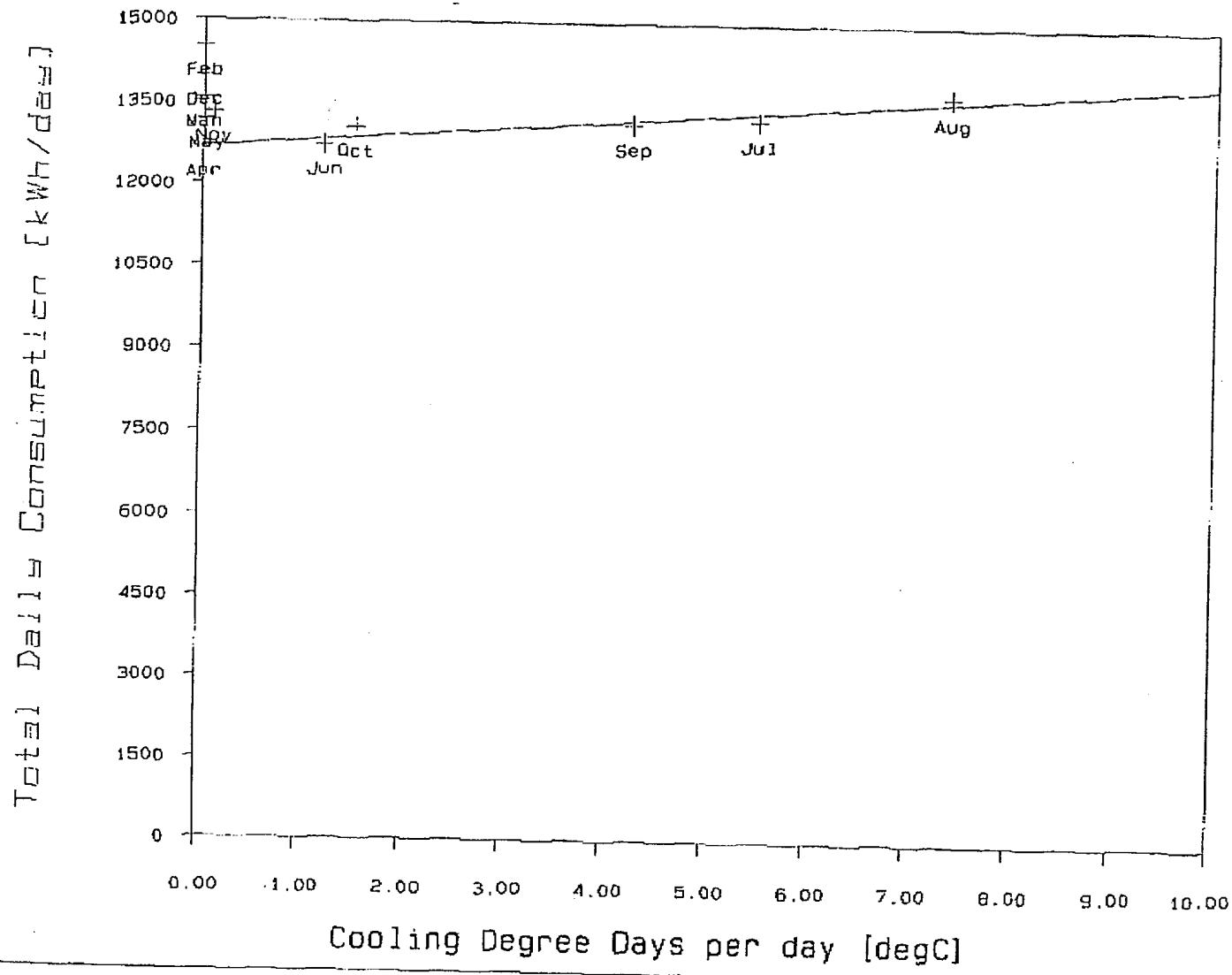
Memo:

No weather sensitivity in winter consumption (poor correlation) although other years show a distinct correlation.

Demand shows no distinct correlation to either total degree days, or peak degree days.

Consumption vs Degree Day Graph

Project: 292 Rideau Regional Centre
Building: 1 Main Building
Meter: Main Electrical Meter 20220-26886
Date: 1994.02.01 TO 1995.01.01 Cooling Balance Temperature 14.0 [degC]



1998-Nov-23

Rose Technology Group Limited

Appendix 3

Baseline Adjustment Computations

And

Adjusted Baseline Coefficients

Project: 292 Rideau Regional Centre

Building: 1 Main Building
Meter: 2 Main Natural Gas Meter

BASE YEAR

From / To	Base Year Model	Consumption Summer	Consumption Winter	Units
1994.01.24	Normalization Type:	DAY	DAY&DD	
1994.12.26	Balance Temperature:	16.0	16.0	°C
	Peak Base Load:	0.00	6,123.22	[m3]/day
	Peak Weather Factor:	0.0000	555.1773	[m3]/DD
	Goodness of Fit:	0.0000	0.9800	

Memo: Approximate amount of fuel oil added to bring data point in agreement with trend line. Balance temperature of

BASE YEAR ADJUSTMENTS

Effective	Description	Consumption Summer	Consumption Winter	Units
1997.01.26	Laundry & OPP Adjustment			
Terminates	Change in Peak Base Load:	83.60	83.60	[m3]/day
. .	Change in Peak Weather Factor:	0.0000	4.7071	[m3]/DD
	Memo:			

ADJUSTED BASE YEAR AS OF 1998.05.12

Base Year Model	Consumption Summer	Consumption Winter	Units
Normalization Type:	DAY	DAY&DD	
Balance Temperature:	16.0	16.0	°C
Peak Base Load:	83.60	6,206.82	[m3]/day
Peak Weather Factor:	0.0000	559.8844	[m3]/DD

Gas m^3

	Base Year	Adjust 1	Adjust 2
Descrip	1994	Laundry	OPP
Type		Base	HDD sens
Start Date		Jan 1997	Jan 1997
Jan	810,501	2,508	4,011
Feb	624,316	2,508	4,011
Mar	534,088	2,508	4,011
Apr	433,650	2,508	2,006
May	270,788	2,508	
Jun	202,392	2,508	
Jul	136,644	2,508	
Aug	144,295	2,508	
Sep	171,959	2,508	
Oct	289,345	2,508	
Nov	387,850	2,508	2,006
Dec	581,093	2,508	4,011
	4,586,921	30,095	26,057

÷ 4261 HDD = 4.7071 m^3/HDD

notes ÷360 days = 83.6 m^3/day

Adjust 1 - processed laundry adjustment to 3,100,000 lbs/ yr as per Concept Report
Adjust 2 - OPP air handling system adjustment (weather sensitive)

BASE YEAR ADJUSTMENTS REPORT

Project: 292 Rideau Regional Centre
Buildings: All
Meters: All

Building: 1 Main Building
Meter: 1 Main Electrical Meter

BASE YEAR

From / To	Base Year Model	Consumption Summer	Consumption Winter	Units	Demand Summer	Demand Winter	Units
1994.02.01	Normalization Type:	DAY&DD	DAY		NONE	NONE	
1995.01.01	Balance Temperature:	14.0	14.0	°C	14.0	14.0	°C
	Peak Base Load:	12,702.15	0.00	[kWh]/day	0.00	0.00	[kW]/month
	Peak Weather Factor:	124.9791	0.0000	[kWh]/DD	0.0000	0.0000	[kW]/DD
	Goodness of Fit:	0.8380	0.0000		0.0000	0.0000	

Memo: No weather sensitivity in winter consumption (poor correlation) although other years show a distinct correlati

Demand shows no distinct correlation to either total degree days, or peak degree days.

BASE YEAR ADJUSTMENTS

Effective	Description	Consumption Summer	Consumption Winter	Units	Demand Summer	Demand Winter	Units
1996.11.01	Elevetors Adjustment						
Terminates	Change in Peak Base Load:	27.33	27.33	[kWh]/day	0.00	0.00	[kW]/month
. .	Change in Peak Weather Factor:	0.0000	0.0000	[kWh]/DD	0.0000	0.0000	[kW]/DD
PERMANENT	Memo:						

Effective	Description	Consumption Summer	Consumption Winter	Units	Demand Summer	Demand Winter	Units
1997.02.01	Laundry & OPP base Adjmt.						
Terminates	Change in Peak Base Load:	326.70	326.70	[kWh]/day	19.00	19.00	[kW]/month
. .	Change in Peak Weather Factor:	0.0000	0.0000	[kWh]/DD	0.0000	0.0000	[kW]/DD
	Memo:						

Effective	Description	Consumption			Demand		
1997.06.01	Laundry supp. fan&OPP CLG	Summer	Winter	Units	Summer	Winter	Units
Terminates	Change in Peak Base Load:	133.40	0.00	[kWh]/day	18.00	0.00	[kW]/month
. .	Change in Peak Weather Factor:	91.7407	0.0000	[kWh]/DD	0.3784	0.0000	[kW]/DD
	Memo:						

Effective	Description	Consumption			Demand		
1997.12.01	Laundry supply fan Nov/97	Summer	Winter	Units	Summer	Winter	Units
Terminates	Change in Peak Base Load:	133.40	0.00	[kWh]/day	18.00	0.00	[kW]/month
1997.12.01	Change in Peak Weather Factor:	0.0000	0.0000	[kWh]/DD	0.0000	0.0000	[kW]/DD
	Memo:						

ADJUSTED BASE YEAR AS OF 1998.05.12

Base Year Model	Consumption			Demand		
	Summer	Winter	Units	Summer	Winter	Units
Normalization Type:	DAY&DD	DAY		NONE	NONE	
Balance Temperature:	14.0	14.0	°C	14.0	14.0	°C
Peak Base Load:	13,189.58	354.03	[kWh]/day	37.00	19.00	[kW]/month
Peak Weather Factor:	216.7198	0.0000	[kWh]/DD	0.3784	0.0000	[kW]/DD

	Base Year	Adjust 1	Adjust 2	Adjust 3	Adjust 4	Adjust 5
Descrip	1994	Laundry	OPP	Elevators	Laundry SF	OPP CLG
Type		Base	Base	Base	Base	CDD sens
Start Date		Jan 1997	Jan 1997	Oct 1996	May 1997	May 1997
Jan	450,000	1,274	8,527	820		
Feb	379,897	1,274	8,527	820		
Mar	392,798	1,274	8,527	820		
Apr	395,451	1,274	8,527	820		
May	394,772	1,274	8,527	820	4,001	5,577
Jun	397,773	1,274	8,527	820	4,001	11,154
Jul	425,733	1,274	8,527	820	4,001	11,154
Aug	408,418	1,274	8,527	820	4,001	11,154
Sep	392,626	1,274	8,527	820	4,001	11,144
Oct	413,018	1,274	8,527	820	4,001	5577
Nov	419,295	1,274	8,527	820	4,001	
Dec	421,105	1,274	8,527	820		
	4,890,886	16,288	102,325	9,840	28,007	55,760

÷607.8 CDD = 91.7407 kWh/CDD

÷363 = 326.7 kWh/day ÷360 = 27.33 ÷ 210 days = 133.4 kWh/day

notes

Adjust - 1 processed laundry adjustment of 3,100,000 lbs/yr as per Concept Report
Adjust - 2 OPP *renovation adjustment, lighting, plug, AHU*
Adjust - 3 Clinical elevator adjustment due to Admin relocation
Adjust - 4 Laundry supply fan operation for 7 months to meet standards
Adjust - 5 OPP cooling load adjustment

Electrical kW

kW	Base Year	Adjust 1	Adjust 2	Adjust 3		
Descrip	1994	Laundry S	OPP	OPP CLG		
Type		Base	Base	Base		
Start Date		May 1997	Jan 1997	May 1997		
Jan	1013		19			
Feb	914		19			
Mar	920		19			
Apr	919		19		CDD	
May	897	18	19	35	137.4	
Jun	910	18	19	40	164.3	
Jul	901	18	19	50	229.2	
Aug	922	18	19	50	131.7	
Sep	933	18	19	35	95.2	
Oct	971	18	19	30	1078	
Nov	969	18	19			
Dec	983		19			

230 ÷ 607.8 CDD = 0.3784 CDD

notes

Adjust 1 - Laundry supply fan operation for 7 months to meet standards
Adjust - 2 OPP renovation adjustment
Adjust - 3 OPP cooling

Appendix 4

Energy Savings Calculations

Gas 1997 and 1998

Electricity 1997 and 1998

Project: 292 Rideau Regional Centre
Buildings: 1 Main Building
Meters: 2 Main Natural Gas Meter
Energy Types: GASM3
Period: 1997.01.01 to 1997.12.31

Base Year : 1994.01.24 - 1994.12.26

Account number : 8 65 26790 999 1

Consumption	Units	1997 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	12 Mo Tc
Original Base Year	m3	810,501	624,316	534,088	433,650	270,788	202,392	136,644	144,295	171,359	289,345	387,850	581,093	4,586,
Normalized Base Year	m3	715,759	590,065	566,925	387,882	317,817	180,284	153,876	151,624	186,977	321,688	403,903	542,011	4,519,
Current Utility Usage	m3	620,411	497,639	491,743	386,882	316,295	141,659	132,806	121,514	131,413	255,143	305,282	390,904	3,793,
Savings	m3	95,348	92,426	75,182	-999	1,522	38,625	21,070	30,110	55,564	66,545	98,621	151,107	725,
% Energy Saved	%	13.32	15.66	13.26	-0.26	0.48	21.42	13.69	19.86	29.72	20.69	24.42	27.88	16
Cumulative Savings	m3	95,348	187,774	262,957	261,958	263,481	302,106	323,176	353,287	408,851	475,397	574,018	725,125	725,
Cons. Costs														
Normalized Base Year	$	108,974	89,837	86,314	59,055	48,387	27,448	23,427	23,084	28,467	48,977	61,494	82,521	687,
Current Utility Costs	$	94,457	75,765	74,867	59,207	48,155	21,567	20,219	18,500	20,007	38,845	46,479	59,515	577,
Savings	$	14,516	14,071	11,446	-152	231	5,880	3,207	4,584	8,459	10,131	15,015	23,006	110,
Cumulative Savings	$	14,516	28,588	40,035	39,883	40,115	45,995	49,203	53,787	62,247	72,379	87,394	110,400	110,
Days in Base Year		33	28	31	31	30	33	28	31	32	29	30	33	
Days in Current Period		35	28	30	29	32	29	31	32	31	31	28	30	
Current - HDD		890.4	743.5	680.0	371.3	212.9	16.6	2.8	1.3	48.1	230.9	411.0	635.5	
- CDD		0.0	0.0	0.0	0.0	0.0	81.2	152.8	117.5	43.6	3.4	0.0	0.0	
- Heatdays		35	28	30	29	32	7	2	3	11	28	28	30	
- Cooldays		0	0	0	0	0	22	28	28	20	3	0	0	
Winter:														
Normalization Type:		DAY&DD	DAY&DD	DAY&DD	DAY&DD	DAY&DD				DAY&DD	DAY&DD	DAY&DD	DAY&DD	
Balance Temperature:		16	16	16	16	16				16	16	16	16	
Peak Base Load:		6206.82	6206.82	6206.82	6206.82	6206.82				6206.82	6206.82	6206.82	6206.82	
Peak Weather Factor:		559.884	559.884	559.884	559.884	559.884				559.884	559.884	559.884	559.884	
Summer:														
Normalization Type:							DAY	DAY	DAY	DAY				
Balance Temperature:							16	16	16	16				
Peak Base Load:							83.60	83.60	83.60	83.60				
Peak Weather Factor:							0.0000	0.0000	0.0000	0.0000				

Project: 292 Rideau Regional Centre
Buildings: 1 Main Building
Meters: 2 Main Natural Gas Meter
Energy Types: GASM3
Period: 1998.01.01 to 1998.12.31

Base Year : 1994.01.24 - 1994.12.26

Account number : 8 65 26790 999 1

Consumption	Units	1998 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	12 Mo Tc
Original Base Year	m3	810,501	624,316	534,088	433,650	270,788	202,192	136,644	144,295	171,959	289,345	387,850	581,093	4,586,
Normalized Base Year	m3	661,178	505,138	494,197	324,272	232,179	213,072	173,731	137,410	181,705	273,714	383,235	435,633	4,015,
Current Utility Usage	m3	443,117	351,909	352,327	245,208	122,603	88,578	53,248	46,369	85,218	186,177	261,336	298,270	3,534,
Savings	m3	218,061	153,229	141,870	79,064	109,576	124,494	120,483	91,041	96,487	87,537	121,899	137,363	1,481,
% Energy Saved	%	32.98	30.33	28.71	24.38	47.19	58.43	69.35	66.26	53.10	31.98	31.81	31.53	36
Cumulative Savings	m3	218,061	371,291	513,161	592,225	701,802	826,297	946,780	1,037,821	1,134,308	1,221,845	1,343,745	1,481,108	1,481,
Cons. Costs														
Normalized Base Year	$	102,174	78,060	76,370	50,110	35,879	32,926	26,847	21,234	28,079	42,298	61,577	84,189	639,
Current Utility Costs	$	68,476	54,381	54,446	37,892	18,946	13,688	8,226	7,165	13,169	28,770	41,991	57,643	404,
Savings	$	33,697	23,679	21,923	12,218	16,933	19,238	18,618	14,069	14,910	13,527	19,586	26,546	234,
Cumulative Savings	$	33,697	57,377	79,300	91,518	108,452	127,690	146,309	160,378	175,288	188,816	208,403	234,949	234,
Days in Base Year		33	28	31	31	30	33	28	31	32	29	30	33	
Days in Current Period		34	27	30	30	28	33	35	29	30	30	29	30	
Current - HDD		804.0	602.9	550.1	246.6	57.1	36.5	0.0	0.3	31.5	156.3	363.0	445.6	
- CDD		0.0	0.0	0.0	0.0	46.4	88.5	184.3	130.5	45.2	8.1	0.0	0.0	
- Heatdays		34	27	30	30	13	13	0	1	13	26	29	30	
- Cooldays		0	0	0	0	15	20	35	28	16	4	0	0	
Winter:														
Normalization Type:		DAY&DD	DAY&DD	DAY&DD	DAY&DD	DAY&DD	DAY&DD			DAY&DD	DAY&DD	DAY&DD	DAY&DD	
Balance Temperature:		16	16	16	16	16	16			16	16	16	16	
Peak Base Load:		6206.82	6206.82	6206.82	6206.82	6206.82	6206.82			6206.82	6206.82	6206.82	6206.82	
Peak Weather Factor:		559.884	559.884	559.884	559.884	559.884	559.884			559.884	559.884	559.884	559.884	
Summer:														
Normalization Type:						DAY	DAY	DAY	DAY	DAY				
Balance Temperature:						16	16	16	16	16				
Peak Base Load:						83.60	83.60	83.60	83.60	83.60				
Peak Weather Factor:						0.0000	0.0000	0.0000	0.0000	0.0000				

Project: 292 Rideau Regional Centre
Buildings: 1 Main Building
Meters: 1 Main Electrical Meter
Energy Types: ELEDEM
Period: 1997.01.01 to 1997.12.31

Base Year : 1994.02.01 - 1995.01.01

Account number 6731 75 1079103

Consumption	Units	1997 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	12 Mon Tot
Original Base Year	kWh	450,000	379,897	392,798	395,451	394,772	397,773	425,733	408,418	392,626	413,018	419,295	421,105	4,890,8
Normalized Base Year	kWh	460,974	389,809	403,772	406,071	405,746	436,214	454,236	455,679	391,294	423,992	429,915	432,079	5,089,7
Current Utility Usage	kWh	436,865	386,119	409,943	384,124	380,417	390,088	432,325	419,038	374,143	369,356	371,231	423,498	4,777,1
Savings	kWh	24,109	3,690	-6,170	21,947	25,329	46,126	21,911	36,641	17,151	54,636	58,684	8,581	312,6
% Energy Saved	%	5.23	0.95	-1.53	5.40	6.24	10.57	4.82	8.04	4.38	12.89	13.65	1.99	6.
Cumulative Savings	kWh	24,109	27,800	21,630	43,578	68,908	115,034	136,945	173,587	190,738	245,375	304,060	312,642	312,6
Costs														
Normalized Base Year	$	28,447	24,060	24,917	25,059	25,049	26,920	28,031	28,120	24,163	26,187	26,551	27,064	314,5
Current Utility Costs	$	26,959	23,832	25,298	23,705	23,485	24,073	26,679	25,859	23,104	22,813	22,927	26,526	295,2
Savings	$	1,487	227	-380	1,354	1,563	2,846	1,352	2,261	1,059	3,374	3,624	537	19,3
Cumulative Savings	$	1,487	1,715	1,334	2,689	4,253	7,099	8,451	10,713	11,772	15,146	18,771	19,308	19,3
Days in Base Year		31	28	31	30	31	30	31	31	30	31	30	31	
Days in Current Period		31	28	31	30	31	30	31	32	29	31	30	31	
Current - HDD		799.0	627.4	578.3	258.4	126.5	0.0	0.0	0.0	48.5	223.3	432.6	630.9	
- CDD		0.0	0.0	0.0	1.1	10.0	187.0	209.3	155.1	47.0	10.2	0.0	0.0	
- Heatdays		31	28	31	29	26	0	0	0	14	27	30	31	
- Cooldays		0	0	0	1	5	30	31	32	15	4	0	0	
Winter:														
Normalization Type:		DAY	DAY	DAY	DAY	DAY				DAY	DAY	DAY	DAY	
Balance Temperature:		14	14	14	14	14				14	14	14	14	
Peak Base Load:		354.03	354.03	354.03	354.03	354.03				354.03	354.03	354.03	354.03	
Peak Weather Factor:		0.0000	0.0000	0.0000	0.0000	0.0000				0.0000	0.0000	0.0000	0.0000	
Summer:														
Normalization Type:							DAY&DD	DAY&DD	DAY&DD	DAY&DD				
Balance Temperature:							14	14	14	14				
Peak Base Load:							13189.6	13189.6	13189.6	13189.6				
Peak Weather Factor:							216.720	216.720	216.720	216.720				

SAVINGS REPORT - METER DETAILS

Project: 292 Rideau Regional Centre
Buildings: 1 Main Building
Meters: 1 Main Electrical Meter
Energy Types: ELEDEM
Period: 1998.01.01 to 1998.12.31

Base Year : 1994.02.01 - 1995.01.01

Account number : 20220-26886

Consumption	Units	1998 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	12 Mo To
Original Base Year	kWh	450,000	379,897	392,798	395,451	394,772	397,773	425,733	408,418	392,626	413,018	419,295	421,105	4,890.
Normalized Base Year	kWh	460,974	389,809	403,772	406,071	433,149	432,161	498,399	408,751	396,411	396,638	458,576	432,079	5,116.
Current Utility Usage	kWh	285,934	370,384	404,849	371,894	350,400	360,000	369,600	366,000	353,324	391,220	401,503	434,400	4,459.
Savings	kWh	175,040	19,425	-1,076	34,177	82,749	72,161	128,799	42,751	43,087	5,414	57,073	-2,320	657.
% Energy Saved	%	37.97	4.98	-0.27	8.42	19.10	16.70	25.84	10.46	10.87	1.37	12.45	-0.54	12.
Cumulative Savings	kWh	175,040	194,466	193,390	227,568	310,318	382,479	511,279	554,030	597,117	602,532	659,606	657,286	657.
Cons. Costs														
Normalized Base Year	$	28,874	24,416	25,291	25,435	27,131	27,069	31,218	25,603	24,830	24,844	28,724	27,064	320
Current Utility Costs	$	17,910	23,199	25,358	23,294	21,948	22,549	23,150	22,925	22,131	24,505	25,149	27,209	279
Savings	$	10,964	1,216	-67	2,140	5,183	4,520	8,067	2,677	2,698	339	3,574	-145	41
Cumulative Savings	$	10,964	12,180	12,113	14,254	19,437	23,957	32,025	34,703	37,402	37,741	41,316	41,170	41
Days in Base Year		31	28	31	30	31	30	31	31	30	31	30	31	
Days in Current Period		31	28	31	30	31	30	34	28	29	29	32	31	
Current - HDD		677.6	506.8	453.4	166.5	3.0	13.8	0.0	0.0	15.8	138.3	350.3	492.7	
- CDD		0.0	0.0	1.6	0.6	112.0	168.3	230.5	182.0	64.2	6.1	0.0	0.0	
- Heatdays		31	28	30	29	3	6	0	0	6	25	32	31	
- Cooldays		0	0	1	1	28	24	34	28	23	3	0	0	
Winter:														
Normalization Type:		DAY	DAY	DAY	DAY						DAY	DAY	DAY	
Balance Temperature:		14	14	14	14						14	14	14	
Peak Base Load:		354.03	354.03	354.03	354.03						354.03	354.03	354.03	
Peak Weather Factor:		0.0000	0.0000	0.0000	0.0000						0.0000	0.0000	0.0000	
Summer:														
Normalization Type:						DAY&DD	DAY&DD	DAY&DD	DAY&DD	DAY&DD				
Balance Temperature:						14	14	14	14	14				
Peak Base Load:						13189.6	13189.6	13189.6	13189.6	13189.6				
Peak Weather Factor:						216.720	216.720	216.720	216.720	216.720				

Rideau Regional Centre

Emission Reduction From Electricity Efficiency Improvements

1997		On Peak			Off Peak			Total
Electricity Reductions		Non-Ozone Season	Ozone Season	**Total On Peak**	Non-Ozone Season	Ozone Season	**Total Off Peak**	
Total Savings (Appendix 4)	kWh	86,118	101,467	187,585	57,412	67,645	125,057	312,642
Non-Surplus lighting savings (Section 3.2.1.1.)	kWh	(21000)	(21000)	(42000)	(7000)	(7000)	(14000)	(56000)
Net Surplus Savings	kWh	65,118	80,467	145,585	50,412	60,645	111,057	256,642
Ontario Hydro "Fossil Fuel On Margin"		98%	97%		97%	89%		
Electricity from fossil	kWh	63,816	78,053	141,869	48,900	53,974	102,874	244,742
Emission Reductions at Ontario Hydro Stations								
NO2 at 2.55g/kWh	Tonnes	**0.16**	**0.20**		**0.12**	**0.14**		0.62
SO2 at 4.77 g/kWh	Tonnes							**1.17**
CO2 at 850 g/kWh	Tonnes							**208**
1998								
Electricity Reductions								
Total Savings (Appendix 4)	kWh	152,134	242,238	394,372	101,422	161,492	262,914	657,286
Non-Surplus lighting savings (Section 3.2.1.1.)	kWh	(42000)	(42000)	(84000)	(14000)	(14000)	(28000)	(112000)
Net Surplus Savings	kWh	110,134	200,238	310,372	87,422	147,492	234,914	545,286
Ontario Hydro "Fossil Fuel On Margin"		100%	99%		100%	97.5%		
Electricity from fossil	kWh	110,134	198,236	308,369	87,422	143,805	231,227	539,596
Emission Reductions at Ontario Hydro Stations								
NO2 at 2.37g/kWh	Tonnes	**0.26**	**0.47**		**0.21**	**0.34**		1.28
SO2 at 3.96 g/kWh	Tonnes							**2.14**
CO2 at 850 g/kWh	Tonnes							**459**

Rideau Regional Centre								
Emission Reduction From Gas Efficiency Improvements								
			Non Ozone Season		**Ozone Season**		**Total**	
			1997	1998	1997	1998	1997	1998
Equivalent Gas Saved (Appendix 4)		m^3	579,233	859,963	145,892	621,145	725,125	1,481,108
		mill Btu	20,446	30,355	5,150	21,925	25,596	52,281
NO2 Emission Reductions from Gas Savings								
AP-42 Emission rate, old boiler on gas		lbs/mill Btu	0.140					
Total Emission Reduction		tonnes	1.30	1.93	0.33	1.39		
CO2 Emission Reductions from Gas Savings								
AP-42 Emission rate, old boiler on gas		lbs/mill Btu	120					
Total Emission Reduction		tonnes	1,113	1,652	280	1,193	1,393	2,845

Rideau Regional Centre					
Emission Reduction From Lochinvar (Low NOx) Boilers					
(1998 Gas Use)					
			NO2		**CO2**
			Non-Ozone Season	Ozone Season	1998
Old Boiler Emission Rates (AP-42)		lbs/mill Btu	0.140		120
Lochinvar Boiler Emission Rates (50 ppm NOx, manufacturer reports 10-40 ppm NOx)		lbs/mill Btu	0.059		92
Reduction in Emission Rate		lbs/mill Btu	0.081		28
Measured gas use 1998 (Appendix 4)		m^3	1,893,136	641,224	2,534,360
		mill Btu	66,824	22,634	89,459
Fraction of gas burned in Lochinvar boilers			87%	75%	
Lochinvar boiler gas use		mill Btu	58,137	16,976	75,113
Reduction in Emissions		tonnes	**2.14**	**0.62**	**954**

Rideau Regional Centre					
Emission Reduction From Elimination of Standby Oil					
Average Oil Used During Gas Supply Interruptions					
	#2 Oil Use				
	Litres	Gas Equiv m3	Actual Metered Gas	Total Equivalent Gas	Oil as a percentage of Total Equivalent 1994 Gas
1994	580,600	604,393	3,982,587	4,586,980	13.2%
1995	38,097	39,658			0.9%
1996	466,489	485,606			10.6%
Average	361,729	376,552			**8.2%**
			1997	1998	
Adjusted Baseline Gas Use (App 4)		m3	4,518,000	4,015,000	
		mill Btu	159,647	141,873	
Avoided Oil	8.2%	mill Btu	13,106	11,647	
Assumed Fuel Sulphur			0.29%		
SO2 Emission Rate		lb/mill Btu	0.29		
Avoided SO2		Tonnes	**1.72**	**1.53**	

Rideau Regional Centre

Emission Reduction Credit Summary

Derived from Utility Meter Data and Savings Reports
In Metric Tonnes (1,000 kg or 2205 lbs)

Emission Reduction Action	NO2				SO2		CO2	
	Ozone Season		Non-Ozone Season					
	1997	1998	1997	1998	1997	1998	1997	1998
Electricity Efficiency Improvements (Appendix 5)	0.34	0.81	0.29	0.47	1.17	2.14	208	459
Gas Efficiency Improvements (Appendix 6)	0.33	1.39	1.30	1.93	0.00	0.00	1,393	2,845
New Low NOx Boilers (Appendix 7)	NA	0.62	NA	2.14	NA	0.00	NA	954
Elimination of Oil Firing (Appendix 8)	NA	NA	NA	NA	1.72	1.53	NA	NA
Total Annual	0.66	2.83	1.59	4.53	2.89	3.67	1,601	4,258
Totals	**3.49**		**6.12**		**6.56**		**5,859**	

Totals do not add due to rounding