

Ontario Hydro  
Emission Reductions Credits from  
Lighting Retrofit Programs

Strategy Summary

The Ontario Hydro 1994 report on Sustainable Energy Development (SED) identified Ontario Hydro as being the largest user of electrical power in the province. The corporate “In-House efficiency group was formed in the summer of 1994 to coordinate internal energy reductions. Reducing internal consumption made good business, economic and environmental sense. It reduced costs, made more energy available for sale, reduced emissions and increased profitability.

One of the larger areas for efficiency improvements was in lighting. By upgrading existing lighting to Metal Halide, High Pressure Sodium, and using High Efficiency Ballasts in conjunction with the installation of occupancy sensors, 41,127 MWh of electrical energy has been saved.

Since the start of the In-House initiative to December 31, 1996, 62 lighting related projects have been completed. The emission reductions associated with these projects are:

- 97.6 Mg of NO<sub>2</sub>
- 159.85 Mg of SO<sub>2</sub>
- 33.28 Gg of CO<sub>2</sub>

Regulatory Issues

The In-House energy efficiency program was/is strictly voluntary. Were it not for the In-House initiative the efficiency improvements would not have been realized. As no regulations to reduce energy consumption currently exist, all the associated emission reductions created are surplus.

General<sup>1</sup>

Establishing Credits

To receive credit for energy savings, the initiator of the project (referred to as the Business Unit) is responsible for collecting and maintaining sufficient documentation to support the claim. All supporting documentation is assembled and forwarded to the Business Unit’s Energy Services advisor. The advisor verifies the savings and inputs the savings into the

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<sup>1</sup> General information is available in the “In-House Energy Efficiency, 1994, 1995, 1996 Result Tracking Guidelines”

Results Tracking System (RTS). All projects must have a minimal duration of ten years to be eligible under the program.

The responsibility for accuracy and completeness of projects in the RTS rests jointly with the Business Unit, the energy advisor and the corporate In-House department.

#### Quality Assurance Reviews

Once a project has been entered into the RTS, a “Quality Assurance Review” is initiated to minimize potential errors in the database. The objectives of the review are to:

- ensure the claim is supported by adequate documentation.
- review at least one project from each facility that has claimed a project for any current year.
- ensure that the RTS guidelines are understood by the Business Units and field staff.

#### Verification

Since the inception of the In-House program, the firm of Ernst and Young has performed yearly audits of the projects in the RTS. All major projects that create savings in excess of 5 GWh are audited along with random audit of smaller projects.

For each audit, Ernst and Young contacts the Business Unit representative to verify the load impact and the permanence of the project. In the event that the results cannot be verified at this level, the energy advisor may be brought in to provide additional information, to clarify information or supply the supplementary documentation.

If an audited project is found to be over reported, all non-audited project savings for that business unit will be rolled back the same percentage as the over reported project.

#### Lighting Upgrades

Lighting upgrade projects have been undertaken in all of Ontario Hydro facilities. Appendix 1 is a listing of the 62 projects by RTS identification number, including the Business Unit, facility, location, energy savings in MWh., and the in service date. The projects range from 2.67 to 4,108 MWh savings per year.

#### Calculation Methodology

All lighting upgrade calculations are based on the net difference in power consumption. Either by changing to lower voltage fixtures or by reducing lighting requirements. Table 1 shows the energy reduction associated with the conversion of Lakeview’s stack lighting from 1000 watt incandescent to 400 watt Metal Halide.

Table 1

Sample Calculation of Energy Reduction

Based on 48 fixtures lit 12 hours/day	Original 1,000 watt Incandescent Fixtures	Replacement 400 watt Metal Halide Fixtures
Daily Consumption in KWh (fixtures*watts*hours/1000)	576	230.4
Yearly Consumption in KWh (KW*365/1000)	210,240	84,096
Net Yearly Savings KWh		126,144

Project 4099680, involves Pickering B, Turbine Hall Lighting. The project claims 3,142 MWh in savings annually. The scope of work involved replacing 980 fluorescent fixtures with 114, 1,000 watt metal halide fixtures. Although the new fixtures use 585 watts more energy the increase in luminance of Metal Halide allows for a reduction in fixtures of 866.

The energy savings are based on a July 1992 report by Pickering ENCON Services. The load of the original 980 lighting fixtures was 480.2 kW (490 watts per fixture). The baseline fixtures were high output fluorescent lamps with 2 tubes per fixture @ 215W each plus a 60W ballast. The replacement Metal Halide fixtures load is 122.55 kW (1,075 watts per fixture). The net yearly efficiency claim being 3,140 MWh.

Emission Reductions

The MWh saved does not necessarily mean that an emission reduction has occurred. A correlation is made between the MWh saved by season to Fossil generation. Whenever a Fossil unit is required on line for generation, it is termed “Coal on Margin”. Table 2 shows the percentage “Coal on Margin “ for 1994, 1995, and 1996

Table 2

Percent Coal on Margin

	Ozone Season		Non Ozone Season	
	Peak	Off Peak	Peak	Off Peak
1994	81%	49%	94%	77%
1995	100%	71%	94%	86%
1996	100%	86%	95%	83%

For the purposes of In-House Energy Efficiency all MWh savings have been annualized<sup>2</sup>. As emission credits must be earned before being claimed, appendix 2 shows the calculation of the lighting related projects based on actual reductions. Table 3 shows the electrical savings and the associated emission reductions attributed to the 62 lighting related projects.

Table 3

## Emission Reduction Credits

Ozone Season (April 1 <sup>st</sup> to September 30 <sup>th</sup> )						
	MWh on Peak	MWh off Peak	Total MWh	Mg NO2	Mg SO2	Gg CO2
1994	725	219	944	2.5	5.6	.830
1995	3864	1372	5,236	12.8	21.8	4.6
1996	8554	3678	12,232	32.5	51.0	10.9
Non Ozone Season (October 1 <sup>st</sup> to March 31 <sup>st</sup> )						
1994	447	183	630	1.7	3.75	0.55
1995	4423	2024	6,447	15.7	26.9	5.6
1996	8483	3706	12,189	32.4	50.8	10.8
Total Emission Reductions						
1994				4.20	9.35	1.38
1995				28.50	48.70	10.20
1996				64.90	101.80	21.70

note: table 1 1994 emission rates:

- NO2 @ 2.73 kg/MWh.
- SO2 @ 5.96 kg/MWh.
- CO2 @ 880 kg/MWh.

1995 emission rates:

- NO2 @ 2.44 kg/MWh.
- SO2 @ 4.17 kg/MWh.
- CO2 @ 870 kg/MWh.

1996 emission rates:

- NO2 @ 2.66 kg/MWh.
- SO2 @ 4.17 kg/MWh.
- CO2 @ 890 kg/MWh.

The total emission reductions due to lighting projects during the ozone season are:

<sup>2</sup> annualized refers to a projects savings over a year regardless of the actual in service date, i.e. if a project is in service in December of any year, the savings are calculated based on 365 days.

- NO2 47.8 Mg
- SO2 78.4 Mg
- CO2 16.33 Gg

The total emission reductions due to lighting projects during the non ozone season are:

- NO2 49.8 Mg
- SO2 81.45 Mg
- CO2 16.95 Gg

Criteria for Evaluation

Criterion	Pros	Cons
Real	<ul style="list-style-type: none"> <li>• Energy savings are well documented, verified and audited.</li> <li>• Calculations are based on efficiency gained by using lower wattage replacements of incandescence or time in use has been lowered by using sensors/timers.</li> </ul>	
Quantifiable	<ul style="list-style-type: none"> <li>• Yearly savings are not effected by capacity factors.</li> <li>• Balance of savings are based on sound engineering calculations.</li> </ul>	
Surplus	<ul style="list-style-type: none"> <li>• The In-House program was/is voluntary.</li> <li>• No regulations exist for reducing internal energy consumption</li> </ul>	
Verifiable	<ul style="list-style-type: none"> <li>• New equipment is in place and operational.</li> </ul>	
Duration	<ul style="list-style-type: none"> <li>• A major component of all In-House projects is that there be a 10 year minimal duration.</li> </ul>	

Supporting Documentation

Each of the lighting projects is supported by the In-House, Results Tracking System. Calculation summaries and project details are kept by the Energy Services representative and the originating facility.

Future Emission Reduction Credits

As the lighting upgrades referred to in this protocol are permanent, this protocol will be used to claim Emission Reduction Credits in the years following December 31, 1996. The future credits claimed will include any new lighting retrofit projects input into the results tracking system.