

Center of Natural Gas Technologies

**HEAT REFLECTORS**  
**Site 1 Report (#218204)**  
**July 8, 2004**

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# **Measurement and Verification of Heating Energy Savings Resulting From the Installation of Heat Reflector Panels**

“Reflector Panels”

Site 1 Report:  
Centre Calixa-Lavallée, Montreal

## **ADDENDA**

Project No.: 218204

**September 16, 2004**

Presented to:

**Energy Efficiency Fund (EEF)**

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Confidential

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<b>FACT SHEET</b>		
<p>1. Title and Subtitle</p> <p style="text-align: center;">Measurement and Verification of Heating Energy Savings Resulting From the Installation of Heat Reflector Panels – “Reflector Panels”, Site 1 Report: Centre Calixa-Lavallée, Montréal</p>		
<p>2. Author(s)</p> <p style="text-align: center;">Caroline Duphily</p>		<p>3. Collaborator(s)</p>
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<p>10. Summary (maximum of 200 words)</p> <p>Following the preceding report, the client requested that the actual energy savings be calculated comparing the gas consumption at the Centre Calixa-Lavallée during the on site measurement. These calculations were not presented in the first report because of the open windows at the site during winter months which were judged to compromise obtaining valid results. These calculations are now added as an addenda to the first report.</p>		
<p>11. Key Words</p> <p style="text-align: center;">Reflector panels, radiators, energy savings</p>		
<p>12. Client(s)</p> <p style="text-align: center;">Energy Efficiency Fund (EEF)</p>		<p>13. Level of confidentiality</p> <p style="text-align: center;">Not releasable</p>
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<p>15. Authorization</p> <p>Project Leader _____ Caroline Duphily, Eng., MASc.                      Manager, R&amp;D _____ Stéphane Brunet, Eng., MASc.</p>		
<p>Natural Gas Technologies Centre: 1350 Nobel Street, Boucherville, QC, Canada J4B 5H3                      Tel. (450) 449-4774 – Fax (450) 449-4994 – Internet Site: <a href="http://www.ctgn.qc.ca">www.ctgn.qc.ca</a></p>		

**7.0 CONTEXT**

Following the report submitted concerning the analysis of a primary measurement site, Montreal's Calixa-Lavallée cultural centre, the client requested energy savings calculations based on consumption readings from Centre's gas meter during the measurement period, before and after installation of the heat reflectors. These calculations were not presented in the first report because of windows being open on site during winter, which compromised the calculation of savings. We have included estimates of these savings in this addendum to the first report.

**8.0 NATURAL GAS ENERGY SAVINGS ACHIEVED DURING THE MEASUREMENT PERIOD**

The energy savings resulting from the presence of the heat reflectors were calculated in two ways; by isolating the energy used by an individual radiator and by considering the total natural gas consumption of the building, which included domestic hot water (potable water).

Gas consumption data was recorded before the installation of the heat reflectors and was compared to data gathered after the installation. The period prior to the installation of heat reflectors was January 21<sup>st</sup> to February 17<sup>th</sup>, 2004. The post-installation period was March 4<sup>th</sup> to April 15<sup>th</sup>, 2004. The data was adjusted as a function of heating degree days.

In order to isolate the amount of natural gas used to heat domestic hot water and estimate the amount used to heat the building, the energy consumption history for 2003 was used:

Date	Days	Adjusted m <sup>3</sup> (P, T)	
2003-01-27			
2003-02-25	29,00	6058	
2003-03-25	28,00	5349	
2003-04-24	30,00	3789	
2003-05-26	32,00	1696	
2003-06-25	30,00	275	} Summer Months
2003-07-25	30,00	196	
2003-08-25	31,00	208	
2003-09-24	30,00	249	
2003-10-24	30,00	2314	
2003-11-24	31,00	5072	
2003-12-19	25,00	4493	
2004-01-27	39,00	8458	
<b>total</b>	<b>365,00</b>	<b>38157</b>	

The average daily consumption for domestic hot water was evaluated during the summer months m<sup>3</sup>/day (summer), where heating of the building was not a factor, and then corrected for the average water temperature of the reservoir during winter (T<sub>of water for winter</sub>). The municipal water reservoir is colder in winter, so the average energy required for the heating of domestic water is more significant than it is during summer months.

## Natural Gas Consumption: Hot Water

### Hypothesis:

-Summer months = June, July, August = solely used for domestic hot water

-Average reservoir temperature (summer) = 68°F; Cp = 2.19 Btu/°F

-Average reservoir temperature (winter) = 39°F; Cp = 2.19 Btu/°F

$$\text{m}^3/\text{day (winter)} - \text{m}^3/\text{day (summer)} * (T_{W-H} - T_{\text{winter average}})/(T_{\text{summer average}})$$

where  $T_{W-H}$  = temperature of domestic hot water – 140°F (60°C)

### Average:

$\text{m}^3/\text{day}$ (summer)	liters/day	$\text{m}^3/\text{day}$ (winter)
7.46	1670.79	10.46

The average energy estimated for heating domestic hot water was then subtracted from the total gas consumption observed during the measurement period, therefore isolating the amount of natural gas used for heating of the building itself. The following values used for the subsequent calculation of energy savings...

### Measurement period:

Gas meter volumes	F correction (gas pressure)	1,008
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### BEFORE HEAT REFLECTORS

	ft <sup>3</sup> recorded	ft <sup>3</sup> corrected	
January 21, 2004 16:41	5772000.00	5818176.00	
February 17, 2004 11:32	5988600.00	6036508.80	
Total gas for the period	218332.80 ft <sup>3</sup>	6182.43806 m <sup>3</sup>	heating + domestic
Number of days in the period	26.8 days		
Total gas – gas C-E (10.5 m <sup>3</sup> /day)		5901.03806 m <sup>3</sup>	heating
Degree days during the period	847.00 degree days	(source: Environment Canada)	

### AFTER HEAT REFLECTORS

	ft <sup>3</sup> recorded	ft <sup>3</sup> corrected	
March 4, 2004 11:21	6078900.00	6127531.20	
March 18, 2004 13:50	6152400.00	6201619.20	
April 15, 2004 13:40	6253500.00	6303528.00	
Total gas for the period	175996.80 ft <sup>3</sup>	4983.62735 m <sup>3</sup>	heating + domestic
Number of days in the period	42.1 days		
Total gas – gas C-E (10.5 m <sup>3</sup> /day)		4541.57735 m <sup>3</sup>	
Degree days during the period	740.00 degree days	(source: Environment Canada)	
Gas corrected for degree days		5198.26489 m <sup>3</sup>	heating
		5640.31489 m <sup>3</sup>	heating + domestic (only the heating part is corrected for degree days)

The energy savings achieved during the measurement period following the installation of reflector panels were then estimated for both the total building gas consumption and then for heating only.

Energy saving calculations (21/01/2004 to 17/02/2004) vs (04/03/2004 to 15/04/2004)

Energy Savings =  $100\% * (m^3 \text{ "after panels" corrected} - m^3 \text{ "before panels"}) / m^3 \text{ "before panels"}$

- 1) Heating only: 11.91% savings
- 2) Total Consumption (with domestic hot water): 8.77% savings

## 9.0 CONCLUSION

It should be recognized the energy savings were only evaluated for the duration of the study; which was carried out for a limited time period. A more complete study would include an entire heating season. Another element to consider in conjunction with the energy saving results is the fact that windows were open on site during the measurement period.

In conclusion, despite the fact that windows were opened during winter, the energy savings achieved at the Calixa-Lavallée centre during the measurement period remain agreement with the literature; which claims approximately 10% energy savings after the installation of heat reflectors.