

Notes to readers

WRITER : Renée Michaud

DATE : August 20, 2008

SUBJECT : Hydro-Québec Project

Comparative Life Cycle Assessment (LCA) of Electric Light Bulbs:
Incandescents and Compact Fluorescents

This document constitutes the final version of the study submitted on April 24, 2008, and it is based on the recommendations made by the critical review committee on March 26, 2008.

The values presented in this document slightly differ from those in the project summary included in Annex E¹. As stated in the CIRAIG's response to the critical review (Annex D), the correction of the erroneous values identified by the review committee does not alter any of the conclusions and it was not necessary to modify the study itself.

The following table summarizes the values that differ in the complete report and project summary (Annex E).

Parameter	Report	Summary
Percentage of the year during the warm or neutral season	45	36
Percentage of homes heated with gas/oil	23	16

NOTE: The corrected value of the percentage of the year during the cold or neutral season is 50% (rather than the 45% initially used and presented in the study). At the request of Hydro-Québec, however, the project summary presents the proportion of annual lighting during the warm or neutral season that corresponds to the crossed effect rate used by the Régie de l'énergie du Québec (i.e., 64%, which represents the proportion of annual lighting in the cold season).

¹ Especially regarding the parameters of the scenario that considered the crossed effect of the heat generated during lighting on the heating/cooling systems.

Also, since the study was submitted, the results of the research into the effect of the heat generated during lighting on the heating/cooling systems were published (Ivanco *et al.*, 2008)¹. This work concluded that the province-wide substitution of the incandescents by compact fluorescents would increase annual greenhouse gas emissions by 220 000 tonnes.

Though this result differs from the one obtained by the CIRAIG in terms of the amount of additional GHG released annually, it does not contradict the conclusions of the study. As presented in sub-section 5.2.1 of the study, the substitution of incandescent bulbs by compact fluorescents is associated with a net increase in GHG emissions when considering the crossed effect of the heat generated during lighting based on the distribution of heating systems in Québec².

More specifically, the estimated increase is 130 000 tonnes of GHG when considering essentially the same hypotheses and methodological choices than those initially used (and presented in the study) with the exception of:

The **lighting parameters**: The values that were corrected by the critical review committee are considered (rather than those presented in Table 4-2 of the report).

	Days/year	Hours/day	Hours/year
Cold season: heating	181	5.8	1 049
Warm season: cooling	92	2.5	230
Neutral season: no heating, no cooling	92	4.2	390
Total	365	--	1 669
Source: Gilles Meunier, Hydro-Québec			

- The **functional unit**: Residential lighting during one year is considered (1 669 hours based on the lighting parameters stated above rather than the 10 000 hours over 4.47 years initially considered).
- The **distribution of heating systems in Québec**: Only 10% of homes in Québec are heated with oil (as opposed to the 17% initially presumed) and 75% of homes are heated with electricity (as opposed to 68%).
- The **number of light bulbs to be replaced**: $4.73^{E}07$ and not the $7.49^{E}7$ bulbs estimated based on the hypotheses used by Ivanco *et al.* The model presumes that all of these light bulbs are used during the estimated lighting hours.

¹ Ivanco, M. et al. (2008). *To Switch, or Not to Switch: A Critical Analysis of Canada's Ban on Incandescent Light Bulbs*, Study conducted by Atomic Energy of Canada Ltd and the Civil Engineering Department of the University of Toronto, 6 p.

² This result can be explained by the fact that the additional heat generated by the incandescent bulbs is from an energy source (essentially hydroelectricity) that causes less damage than oil or gas heating (used in only 16% of Québec homes).

This difference in the results (i.e., an increase of 130 000 as compared to 220 000 tonnes of GHG) can possibly be explained by the fact that the study's authors (Ivanco *et al.*) did not use the same method or values as the CIRAIG for several parameters¹.

Finally, it is important to mention that these conclusions do not consider the use of the electrical savings once the bulbs are replaced and especially the potential of these savings to act as a substitute for more pollutant forms of energy than gas or oil heating (thermal energy, for example). As stated in the study, it is important to assess the degree to which the environmental consequences of the use of energy savings can impact the comparative analysis of the two types of bulbs.

¹ Especially as they pertain to the efficiency and intensity of the GHG released by the heating units, to the proportion of gas- or oil-heated homes, to the lighting parameters and to the intensity of the GHG generated by the Québec grid mix. These are not the results of an LCA (and therefore the GHG associated with the life cycle are not taken into account. Only those generated through energy consumption during the use phase of the bulbs are considered).