TRADUCTION

D-2011-028 – Révision du PTÉ d'efficacité énergétique en réseau intégré – Étude du potentiel d'économie d'énergie dans le secteur résidentiel, commercial, institutionnel et agricole (extraits : « Sommaire exécutif », pages iii et iv et « Conclusion », pages 89-93).

Executive summary

The purpose of this study is to review the technical and economic potential for energy conservation in Québec that was completed in 2005 for the residential, commercial and institutional (CI), and agricultural sectors. The results obtained offer an estimate of the savings associated with the implementation of energy conservation technologies and measures currently available on the market, but using a cost of measures in a mature market and an avoided cost for the Distributor.

The updated technical/economic potential for energy conservation reveals an increase with respect to the 2005 assessment. The total potential for the three sectors covered by the study, over a five-year horizon, is now assessed at 20.4 TWh, versus 15.2 TWh in the 2005 assessment.[1] Several factors may explain the rise in technical/economic potential. On the one hand, avoided costs are significantly higher as from 2023. On the other, several new measures have been added, while the performance and costs of measures evaluated previously have evolved.

As before, the potential is mainly to be derived from heating-related measures, with the list being topped by measures concerning the improvement of existing residential building envelopes. Measures concerning interior temperature control and thermostats also represent a significant component of potential. However, the potential of these measures is lower compared to 2005 due to the much more widespread distribution of electronic thermostats and, to a lesser extent, programmable thermostats.

In light of the results obtained, certain approaches to achieving the potential identified appear promising.

It would be desirable to update the energy conservation regulations governing new construction in order to take advantage of the natural savings that would ensue. For existing buildings, a promising avenue is to raise awareness among owners to the potential of building envelope improvements when major renovations are being made.

Measures concerning the use of efficient heating appliances, such as geothermal heating, high-efficiency heat pumps, and cold climate heat pumps, now offer significant potential but are still restricted to small market segments.

The potential to be derived from lighting will be significantly transformed with the introduction of regulations concerning the efficiency of incandescent light bulbs and T12 fluorescent bulbs.

[1] Further to the increase in the Distributor's avoided costs in 2006, a partial update of the 2005 assessment was performed and filed with the Régie in file R-3644-2007, HQD-14, document 4, p. 12, Table 4.1. The revised potential was then 18.0 TWh for the three sectors concerned.

The potential associated with their replacement is significantly reduced. However, continuing progress on LED efficiency enabled some related measures to qualify as having potential. The potential will strongly depend on short-run trends in the costs and efficiency of these bulbs.

Finally, hot water-related potential is growing considerably, primarily in the residential sector. The introduction of new measures such as heat pump water heaters explains the rise in potential for this use. As with LEDs, the potential associated with this measure is strongly contingent on trends in the cost of these appliances in a mature market.

9.0 Conclusions

An update of the energy conservation potential for the residential, commercial and institutional, and agricultural sectors was produced. This update allows for a consideration of Hydro-Québec's new avoided costs, the addition of new measures, and the modification of the assumptions associated with several other measures. In addition, the update was an opportunity to refine the assessment method.

In the residential sector, most potential is associated with heating, since this use remains dominant in terms of consumption. However, the potential related to electronic thermostats has been greatly reduced due to the widespread adoption of this measure. The potential now lies primarily in building envelope improvements, which will serve to reduce the heating load represented by the existing buildings. This potential is significant but remains much more difficult to exploit than that of electronic thermostats due to the complexity of implementing the measures and their much higher costs. Hydro-Québec's experience suggests that energy conservation objectives related to building envelope measures are much more difficult to attain because the costs of implementation and follow up are often much higher than expected [18]. The main opportunity to exploit this potential in the current market will therefore involve taking advantage of major home renovations to improve the building envelope.

Other measures showing significant potential are less stable than building envelope measures. Temperature reductions (day and day/night) exhibit major potential, but this is strongly tied to consumer behaviour and there is likely to be some erosion over time.

Envelope-related conservation measures are designed to reduce heating loads. Other heating-related measures seek to optimize HVAC systems, particularly the various types of heat pumps. The potential of geothermal energy, high-efficiency heat pumps, and cold climate heat pumps is higher than in 2005. However, this potential remains limited to a very specific market segment: homes already equipped with central distribution systems. These measures are not generally reflected in the potential of the large segment of baseboard-heated homes.

Global energy efficiency improvements for new construction, based on achieving minimum performance of ERS 80, 82, and 85, offer promising long-term potential since these measures are always represented with their excess cost. In addition, this potential persists over the life of the home. The advantage of the performance-based approach is to offer building designers several options for reaching a given energy efficiency target. The assessment shows that the achievement

of performance above the estimated target to be included in the new regulation, i.e., ERS 78, ranks as having potential.

The potential associated with water heating has risen considerably with respect to the 2005 assessment. The main measure responsible for this increase is the heat pump water heater. The potential of this appliance is, however, dependent on a significant cost reduction, as determined in the US DOE regulatory study. In the short term, this potential is not exploitable at the cost used in the analysis. Moreover, the significant potential associated with greywater heat recovery is based on the current costs of this technology.

The overall potential associated with lighting, home appliances, and home electronics has decreased slightly with respect to the 2005 assessment. The impact of lighting regulations and the increasingly widespread adoption of Energy Star products explains why. For the first time, the use of LED bulbs for interior lighting appears on the list of measures showing potential, but only due to the use of a projected medium-term efficiency figure of 135 lm/W. In the short term, the potential remains primarily associated with increased use of compact fluorescents. For home appliances and home electronics, the reduced use of second freezers and refrigerators remains a significant measure while the increased adoption of Energy Star products, specifically televisions, offers promising potential.

As in the residential sector, the majority of the measures showing potential in the CI sector are heating-related. The biggest proportion is associated with optimization of system operations, such as control of system operating time. The majority of these measures are implemented through energy management systems (EMS). The cost-effectiveness of these measures is often excellent for the customer, particularly in recent buildings where a basic EMS structure already exists.

Heating

In the area of heating, the energy conservation measures with the lowest unit cost are those involving ventilation and fresh air control. The optimization of fresh air intake into a building, using a CO2 sensor, for example, offers particularly promising potential where the occupation level is variable. A further control measure is recommissioning, which also deals with building operation and does not require major investment in equipment.

From the standpoint of equipment, the main energy conservation measure is that of geothermal energy. While the potential associated with this measure is very high, it does not yet include all the technical constraints in terms of the land needed to install the ducts. This constraint could considerably reduce the achievable potential associated with this measure. Another equipment-type measure with strong potential involves the installation of heat exchangers to recover heat from building exhaust air. Existing regulations [14] make heat recovery mandatory only where the quantity of heat emitted is greater than 300 kW. This threshold means that only the largest facilities will be equipped with heat exchangers. To optimize the cost-effectiveness of this equipment, it should be installed when designing the heating system. In addition, if heat recovery is not planned at the design stage, it is at times nearly impossible to implement it later. Therefore, it is often more difficult to exploit this potential in existing buildings.

Global energy improvement measures for new construction also show strong potential. As in the residential sector, these measures are based on a performance-centered approach that lets designers choose the manner in which the energy performance will be achieved. This approach is widely used in the commercial building sector, as for example in LEED buildings. For new construction, since the measures are always assessed with their excess cost, their implementation is always more advantageous and will allow the potential to be maximized.

Lighting

Lighting-related potential in the CI sector has changed considerably since 2005. Regulations governing linear fluorescents and incandescent bulbs are having a major impact. These measures are, however, now being replaced by even more efficient lighting systems, such as higher-powered T8 bulb/ballast sets for overhead lighting and LED bulbs in various other applications. In the first case, the potential is exploitable immediately. In the case of LEDs, a cost reduction for a mature market and an increase in the efficiency of the bulbs have to be considered. It follows that the potential of LEDs will only materialize when these conditions are met.

Motive force

The potential for this use is rising rapidly due to the addition of a measure concerning high-efficiency dry-type transformers. A significant proportion of these appliances offers promising potential since their efficiency is below the Canadian regulatory requirement. However, the very long lifespan of the appliances makes it more difficult to exploit this potential in the existing market, given the lower benefit from the customer's point of view. Moreover, measures concerning the recommissioning of buildings not heated with electricity only and concerning new construction of non-electric-only buildings are also associated with this use. In both cases, the energy savings actually relate to several uses, including lighting, air conditioning, and hot water.

Finally, the main highlight of the updated technical/economic potential for the agricultural sector is an update of avoided costs, market data, and measure adoption rates. The list of measures assessed and their energy assumptions are similar to those of the 2005 assessment. The potential also remains a similar, but there is an increase due mainly to the modification of the avoided cost profile, which allowed the natural ventilation measure to qualify as having potential in a larger number of cases. Also noteworthy is that the agricultural sector is, in many respects, increasingly resembling the industrial sector where energy conservation is concerned. Agricultural operations are more often governed by industrial-style decision-making criteria than residential or commercial criteria:

- Energy savings are assessed first and foremost in terms of their impact on the process. A measure with a potentially harmful impact on the operation, or for which the impact has not yet been demonstrated, is unlikely to be adopted.
- Energy costs often make up a small proportion of total farm operating costs, except in certain segments. Therefore, energy conservation measures have to be competitive with

other types of operational improvements when the time comes to make investment decisions.
- Changes to and/or expansion of the operation impose certain constraints on the size and type of the equipment that must be adopted.

Farmers' reluctance to adopt energy efficiency measures may be very high if they perceive a potential risk to their operations. Given this, any failure to implement a measure in a particular case may easily render it almost impossible to use the measure elsewhere in a given segment. For this reason, where an attempt is made to implement an innovative measure, it must be carefully done and meticulously monitored so as not to create a negative precedent for the measure.

In addition, electric energy savings are often low in comparison to savings from other energy sources such as fuel used in farm equipment, fuel used to heat outside air inflow and buildings, and in some cases fuel used for hot water. An energy efficiency approach targeting electricity only is much less likely to be received favourably than a global approach in which electricity is only one item for which energy savings are offered.

Finally, it is important to keep in mind that the buildings to which the measures are applied house animals, and this fact places specific constraints on how the measures are implemented. For example, changes made to lighting have to be done with an eye to the impact of the light spectrum on certain livestock operations, such as poultry. In many cases, an energy efficiency measure could translate into lower energy intensity for the operation (e.g., in terms of kWh/animal) but not a reduction of total farm demand because the rate of production may often increase following the implementation of certain measures.