A study published by Ouranos (Lafrance and Desjarlais, 2006) showed that a climate change-induced temperature rise would result, in Quebec, in a significant drop in the energy demand for heating and in an increase, albeit smaller, in the need for air conditioning. Given the relevance of these kinds of findings for public policy, it is critical importance that the 2006 study be updated to incorporate the latest climate projections and socioeconomic and technological data.

**OBJECTIVES**

- Produce realistic scenarios of the physical and economic impacts of climate change on the energy demand in Quebec for the 2030 and 2050 horizons.
- Develop a useful and replicable methodology for the various Canadian organizations interested in this topic.
- Analyze, in an exploratory manner, various adaptation strategies for the different sectors of consumption (residential, commercial, industrial and transportation) and outline prospects facing each form of energy.

**METHODOLOGY**

- Selection of a demographic scenario and development of an economic scenario based on demographic and labor productivity trends;
- Determination of the energy intensity for the retained uses and energy sources;
- Creation of a first baseline demand scenario for the 2030 horizon and, based on that, extrapolation of scenarios for the 2050 horizon by sector and before climate impacts;
- Selection of climate change scenarios (in terms of degree days of heating and cooling);
- Calculation of the climate change impact as well as of the use variation, form of energy and sector of consumption;
- Calculation of peak consumption by energy source.

**REFERENCE**

RESULTS

The study calculated the possible impacts of climate change for the four sectors of consumption: residential, commercial, industrial, and transportation. Overall, the results show that the warming of temperatures will have mainly two direct and opposite effects on the energy demand: a decreased demand for heating in the winter and an increased demand for air conditioning in the summer. Because of this combined effect, the impact will be less pronounced on the demand for electricity than on the demand for fuels, with the greater demand for electricity for air conditioning partially compensating the lower consumption of heating fuels. The results also suggest that by 2030 the climate change-induced decrease in the energy demand will be twice as large for fuel than for electricity. This impact on the demand for fuel will translate, among others, into a reduction in greenhouse gas emissions.

For electricity, the impact is very large in the residential sector, and in particular with regard to heating. Note that heating represents the bulk of energy consumption in the residential sector in Quebec, and that its predominant form of energy is electricity. By 2050, this decreased demand due to climate change will have cancelled out the expected increase in the demand for heating electricity on an absolute basis (Figure 1). As for the demand for air conditioning, the climate change impact in relative terms is also higher in the residential than in the commercial sector. This is largely due to combined increased in penetration rates and usage in the residential sector, whereas the commercial sector is already, nearly fully equipped with air conditioning. Globally, for the residential sector, the drop in the electricity demand could reach 9.1% by 2050 (2.4% for commercial), as shown in Table 1.

As for fuels, the biggest impact is estimated to occur in the commercial sector, with consumption decreases in the order of 16 and 26 PJ for the 2030 and 2050 horizons, respectively. This result is based on the assumption that natural gas will remain the most commonly used form of energy for heating in this sector, in contrast to the residential sector, where fuels will become rather marginal compared to electricity. In the industrial sector, the climate change impact is lower since the proportion of energy needed for heating—on which climate change has the most pronounced impact—is small compared to the energy needed for industrial processes. Finally, the impact of climate change on the transportation sector is expected to be marginal.

Overall, with regard to energy demand, the impact of climate change will translate into a net decrease in consumption in the coming decades. The adaptation measures will primarily call on energy producers and distributors to adjust to significant reductions in heating requirements and to a sustained increase in cooling requirements. In terms of air conditioning, all stakeholders in the building sector will be called on to develop more efficient technologies, with regard to the building envelope as well as the air conditioning units, in order to minimize the additional costs incurred by climate change to Quebec society.

<table>
<thead>
<tr>
<th></th>
<th>Heating</th>
<th>Air conditioning</th>
<th>Total electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2030</td>
<td>2050</td>
<td>2030</td>
</tr>
<tr>
<td>Commercial</td>
<td>-3,6</td>
<td>-5,3</td>
<td>1,7</td>
</tr>
<tr>
<td>Residential</td>
<td>-8,9</td>
<td>-13,2</td>
<td>2,9</td>
</tr>
</tbody>
</table>

Figure 1. Change in the demand for electricity (%) compared to the anticipated demand without climate change.

BENEFITS FOR ADAPTATION

This study is particularly useful for energy policymakers concerned with energy production and distribution, including demand management, the upscaling of equipment, and energy efficiency programs allowing to reduce heat gain in buildings in order to mitigate the increase in air conditioning requirements.