In 2015, Hydro-Québec commissioned the International Reference Centre for the Life Cycle of Products, Processes and Services (CIRAIG) to conduct a comparative analysis of the potential environmental impacts of electric vehicles compared with those of conventional vehicles in various contexts.

The goal was to assess the environmental benefits of using electric vehicles powered by electricity produced in Quebec instead of gasoline-powered vehicles.

[Electric vehicles—a sensible choice in Quebec; 99% renewable energy; Over their life cycles, an electric vehicle (EV) powered by hydroelectricity has lower greenhouse gas emissions than a gasoline-powered vehicle.]
Results

Most of the environmental impact of an electric vehicle occurs at the manufacturing stage, while that of a conventional vehicle occurs when it is in use. At the time of purchase, an electric vehicle has a bigger footprint than a conventional vehicle. However, after being driven for some 300,000 km, the former’s greenhouse gas emissions are much lower than those of the latter—between 55% and 80% lower.

A number of factors can affect a vehicle’s environmental impact, including its mass, its energy efficiency and operating conditions. The study fully accounted for the influence of these factors.

In sum, the results vary with operating conditions and distance driven. The more an electric vehicle is driven, the greater its advantage. Electric vehicles are therefore more environmentally friendly than conventional vehicles in the operating conditions found in Quebec.

Results—Analysis using different sources of electricity

The potential environmental impacts were assessed using the following indicators:

- climate change;
- human health;
- depletion of fossil resources;
- ecosystem quality; and
- depletion of mineral resources.

For the purpose of your question, the climate change indicator represents the greenhouse gas impact. However, please note that all the indicators should be taken into account to obtain the full picture.

The figures on the following page show the impact of an electric vehicle compared with that of a conventional vehicle (VC) across all the indicators, using electricity from various types of energy sources.

To view the entire report and its addendum, please use the following links:

- CIRAIG. Comparative life-cycle assessment: Potential environmental impacts of electric vehicles and conventional vehicles in the Quebec context [PDF – 12.9 MB], 2016, 95 p. and appendices [in French only].

- CIRAIG. Addendum to the comparative life-cycle assessment report on the potential environmental impacts of electric vehicles and conventional vehicles in the Quebec context [PDF – 2.82 MB], 2016, 15 p. [in French only].

Note: The addendum assesses the impacts of using electricity from various sources to recharge an electric vehicle.
Climate change; human health; depletion of fossil resources; ecosystem quality; depletion of mineral resources

It is worth noting that this comparison was performed using the base scenario from the life-cycle assessment report of 150,000 km driven. However, it is unlikely that any given electrical grid will be supplied by only one energy source.

1 The red portion of the bars (Constant) represents every stage in an electric vehicle’s life cycle, from resource extraction to manufacturing to end-of-life, except for its use. The use stage is represented by the blue portion (Use) and accounts for the impacts of using and recharging an electric vehicle. The abbreviation “VC” means “conventional vehicle.” The vertical scale shows unit values. For example, in the climate change chart, the scale runs from zero to six (kg CO2 eq. from 0.0E+00 to 6.0E+04).