

# Are we ready for transportation electrification?

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## About Hydro-Québec

- Largest electric utility in Canada
- One of the world's largest producer of hydropower
- 3.9 million customers across the province of Québec
- Peak load 38,000 MW – winter peaking (98% hydraulic)
- By 2015 – 4000 MW of wind power will be online



## Driving towards PEV Launch



# GHGs in the province of Québec

- In 2007 transportation was responsible for 42% (36Mt) of all GHG emissions in Québec
- Power Generation accounts only for 2,7% of all GHG emissions in Québec
- The Québec government has the goal of reducing GHG emissions by 20% under the levels of 1990 by 2020.

| Source                  | Technology + upstream process | Vehicle Efficiency | Upstream Energy System Efficiency | Life cycle Efficiency | Life cycle CO <sub>2</sub> reductions |
|-------------------------|-------------------------------|--------------------|-----------------------------------|-----------------------|---------------------------------------|
| Gasoline                | ICE                           | 17%                | 83%                               | 14%                   | Base                                  |
| Gasoline 50%, Hydro 50% | Plug-in hybrid electric       | 32%                | 83%                               | 50%                   | 72%                                   |
|                         |                               | 80%                | 93%                               |                       |                                       |
| Hydro                   | Battery powered electric      | 80%                | 93%                               | 74%                   | 98%                                   |

| Option                                   | Load factor | kJ / pass .km | CO <sub>2</sub> g. /pass .km |
|--|-------------|---------------|------------------------------|
| Sports utility vehicle<br>(17 l /100 km) | 1           | 5950          | Gasoline = 405               |
| Compact car<br>(9 l /100 km)             | 1           | 3150          | Gasoline = 214               |
|  | 3           | 1100          |                              |

Source: Gagnon, Luc – PHEV 2009 Conference Montréal, Sept. 2009

# Hydro-Québec's strategic plan

## Electric transportation action plan:

- Provide financial support for the development of electric infrastructure for public transit
- Develop and market advanced technologies
  - TM4's Motive series electric motors
  - New battery materials, including lithium-iron-phosphate
- Test-drive plug-in vehicles and experiment with their integration
- Plan support infrastructure for vehicle charging

Visit our transportation electrification website to learn more:

<http://www.hydroquebec.com/transportation-electrification/index.html>



## *Provide financial support for the development of electric infrastructure for public transit*

- Currently 50% of public transit users in the Montréal Region use an electrically powered system.
- Hydro-Québec wishes to encourage the adoption of electric public transit in Québec
- It is currently participating in feasibility studies conducted by various public transit authorities to establish the needed infrastructure and level of investment needed to be assumed by Hydro-Québec
- The studies include:
  - Trolleybus feasibility study in Laval
  - Tramway feasibility study in Montréal
  - Electrification of commuter rail in the Montréal Region
- Hydro-Québec is not in "push" mode, but accompanies the public transit authorities in their electrification projects



## *Test-drive plug-in vehicles and experiment with their integration*

- Hydro-Québec wants to remain at the forefront of companies working on the addition of electric vehicles to the power grid
- Hydro-Québec will conduct projects to demonstrate the reliability and advantages of plug-in vehicles
- Agreements signed with Ford (for the Escape PHEV) and Mitsubishi for the (i-Miev)
- These projects will allow:
  - Evaluate the grid impacts
  - Test the vehicles in real drive conditions
  - Evaluate the need for public charging infrastructure

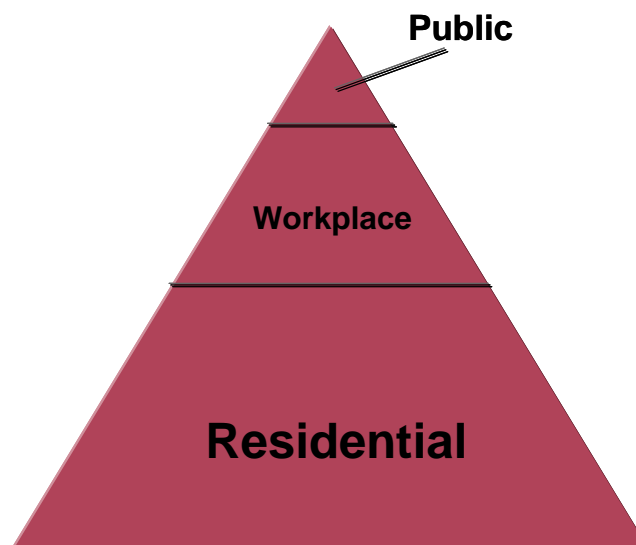


## *Plan support infrastructure for vehicle charging*

- Hydro-Québec is helping to develop the technical parameters required to implement vehicle charging infrastructure
- Through its vehicle demonstrations HQ will test different charging solutions and locations
- Hydro-Québec will evaluate the different charging models and business models available



Prototype model shown. Final production model may vary.  
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## *How Much Load is a 64km Range EREV?*

### PLASMA TV



Annual Energy  
**623**  
kWh

### SET TOP BOX



Annual Energy  
**263**  
kWh

Annual Energy Consumption  
**= 865 kWh**

### CHEVY VOLT

Extended Range Electric Vehicle

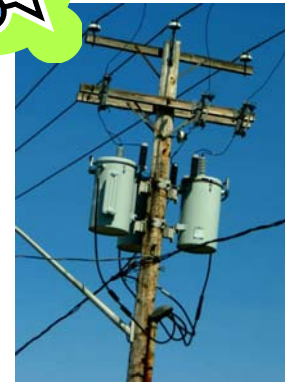


Annual Energy Consumption  
**= 2,500 kWh**

**~ 3 PLASMA TVs  
and SET TOP BOXES**

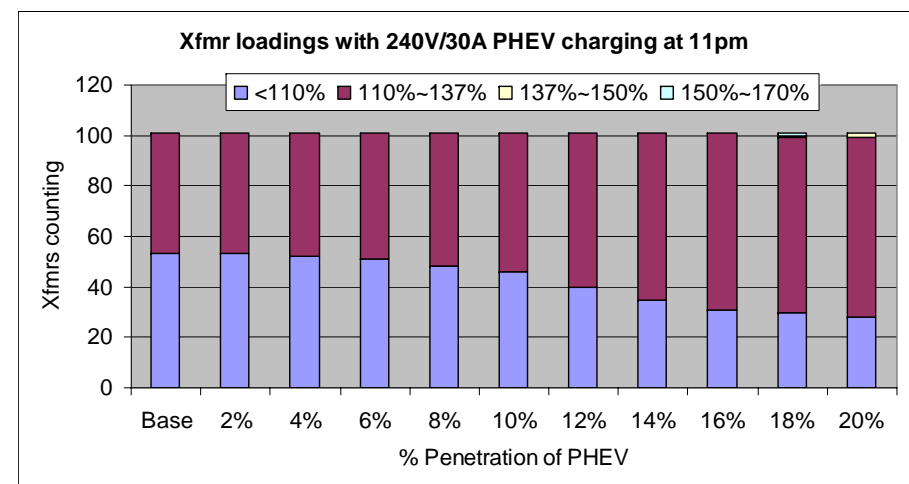
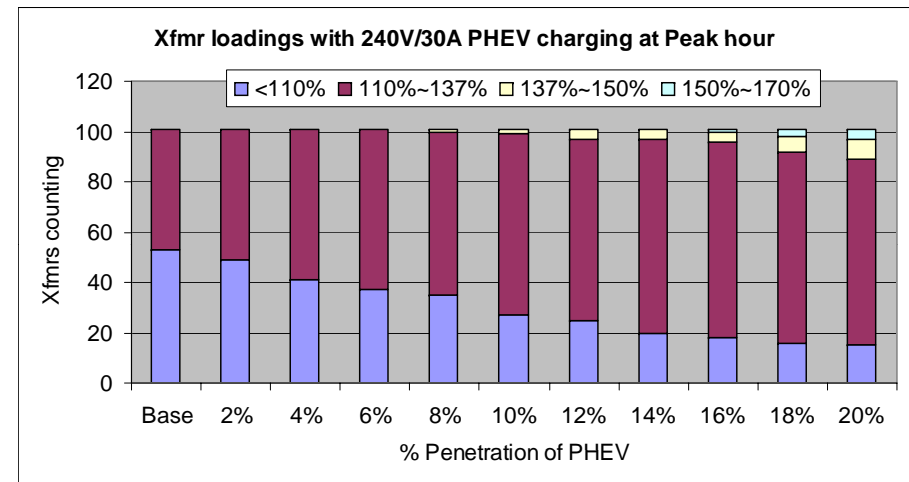
## *How will this load affect the distribution system?*

- Published studies have been focusing mostly on the generation, environmental and transmission sectors
- The distribution system due to its age and complexity is the most at risk. Possible problems include:
  - Feeder overloads due to load growth
  - Premature ageing distribution assets
  - Premature failure rates for distribution assets
  - Power Quality
  - Metering
  - Imbalance
  - Demand response



# Asset Overloads - Component Deterministic Analysis

- Service transformers and underground cables are most susceptible asset to PHEV clusters/penetration
- Service transformer overload impact is minimal even at 20% penetration on specific feeder
- Charging on peak during peak hours less than 10% of transformers are critical
- On typical feeders of Hydro-Québec's grid, PEVs will not pose a threat



## *Electric Vehicle Technology Roadmap*

- Collaborative effort put forth by Electric Mobility Canada, NRCan, Transport Canada, Electric utilities, Industry and End Users

### GOAL:

- Encourage the rapid adoption of EVs for passenger and commercial transport markets in Canada through appropriate regulations, incentives, infrastructure and education/awareness. We recognize that most EV's will be built by OEMs headquartered outside Canada.
- Develop the EV industry in Canada in areas where Canada has a competitive advantage: parts suppliers, bus builders, niche vehicle builders.
- Power these vehicles with new green electricity

## *Electric Vehicle Technology Roadmap*

***By 2018, in addition to Hybrid Electric Vehicles, there will be at least 500,000 other highway capable – plug in electric drive vehicles on the road in Canada. These vehicles will have increased Canadian content over current 2008 internal combustion engine vehicles.***

Thank you!

