



*Canadian Hydropower
Association
Association canadienne
de l'hydroélectricité*

Water to Wheel :

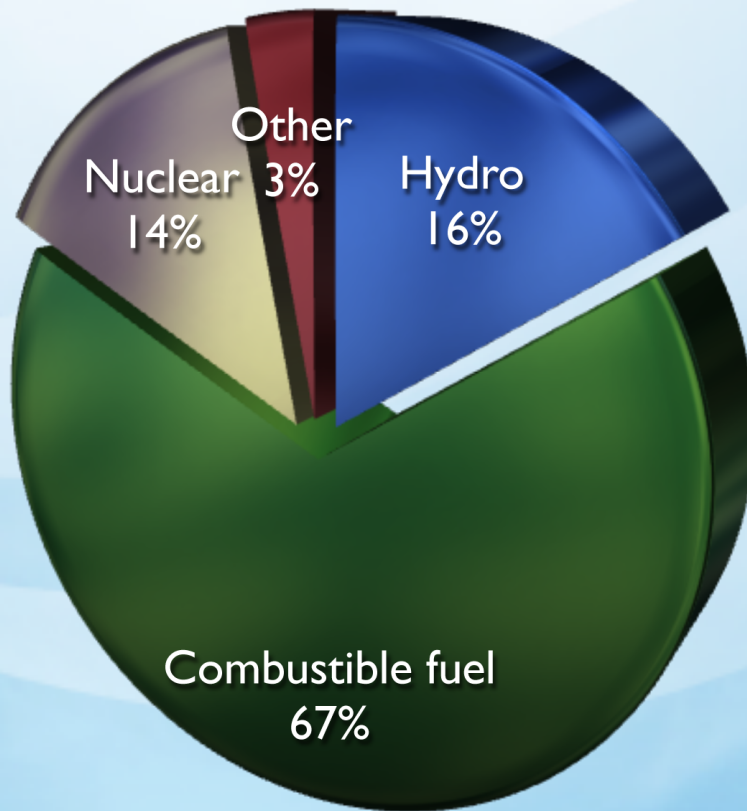
Hydropower Resources and Electric Road Vehicles

Jacob Irving, President Canadian Hydropower Association

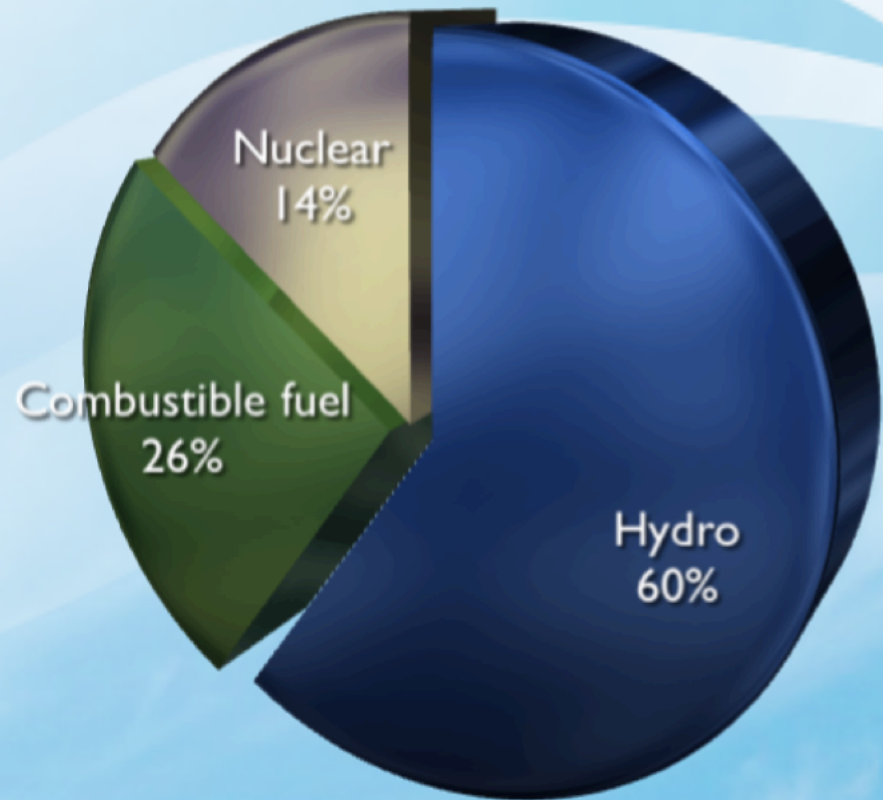
Pierre Lundahl, CHA

**EV 2012 VÉ
Montreal
October 2012**

Electricity Globally



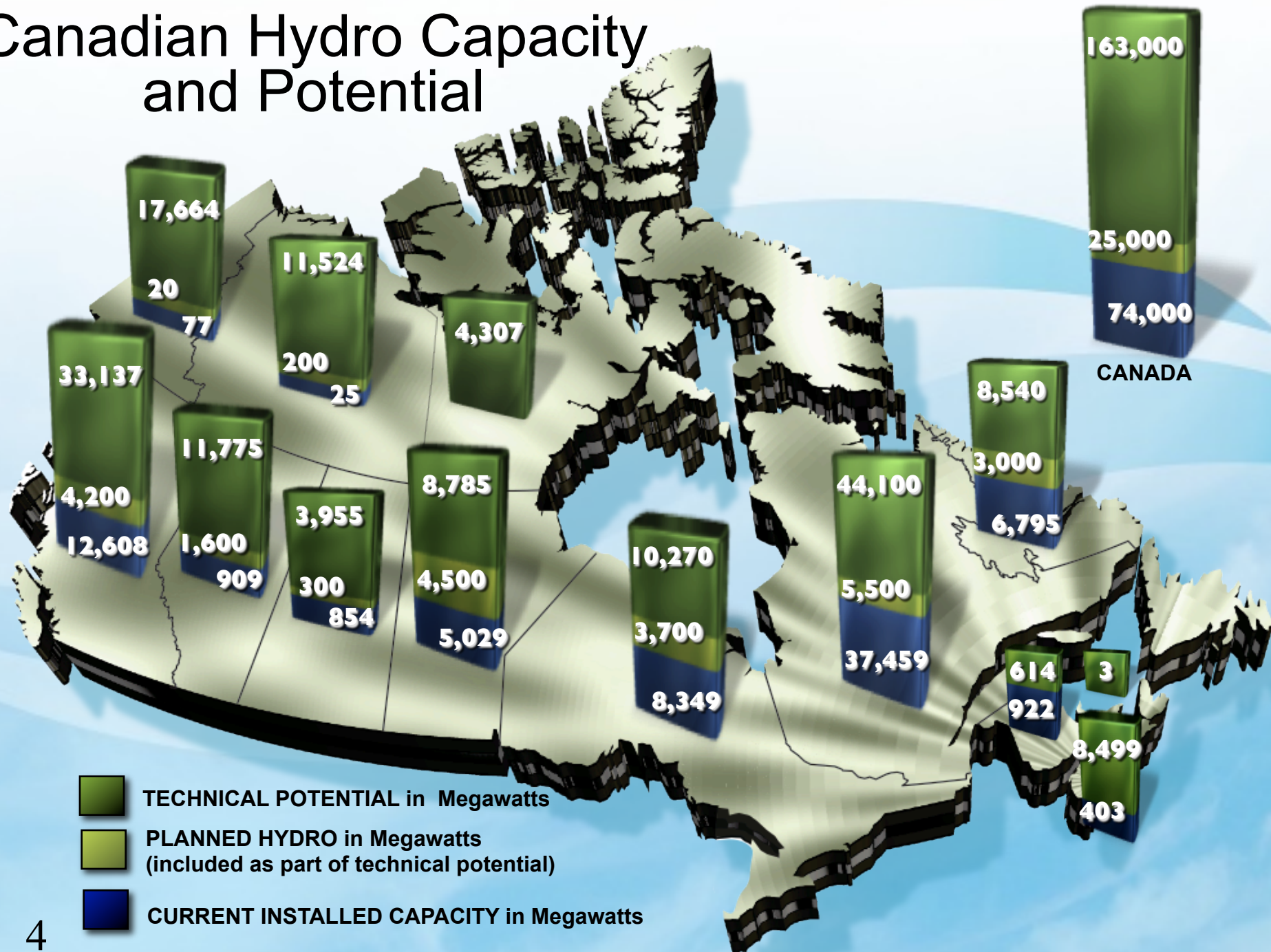
Canadian Electricity



Hydro Facts

- 60% of Canada's electricity
- Installed capacity over 74,000 MW
- 4th Largest in world
- ~360 TWh/year - 3rd largest generator
- Over \$125 billion cdn in investment over the next 20 years
- More than 1 million potential new jobs over the next 20 years

Canadian Hydro Capacity and Potential



Objectives of the CHA EV Study

- Estimate the incremental electricity demand that would result from the electrification of light duty road vehicles (LDVs) in Canada
- Compare the electricity demand of the EV fleet with hydropower resources at the provincial and Canadian levels
- Estimate reductions in GHGs emissions, primary energy use and fossil fuel use that would result from the electrification of the LDV fleet

Study Scope and Limitations

1. The study is focused on hydroelectric energy resources. Electricity distribution constraints and changes in peak load are beyond the scope of this study
2. The assessment focuses on the operation phase of the vehicles life-cycle only
3. This study illustrates the benefits of water-to-wheel energy in a theoretical scenario of 50% electrification of the current LDV fleet.
4. LDVs are assumed to be replaced by 100% electric vehicles powered by hydropower, (rechargeable hybrids have not be considered)

Estimating Incremental Electricity Demand

1. The energy use of the current fleet of LDV is estimated on the basis of statistics on gasoline use
2. The energy efficiency of electric vehicles (EV) is compared with the energy efficiency of conventional LDVs on the basis of published data. The comparison is on a pump-to-wheel / electrical outlet-to-wheel basis
3. The additional electricity demand of the EV fleet is estimated by is dividing the annual energy use of the fleet of conventional vehicles by the energy efficiency ratio

Comparison of Incremental Electricity Demand to Hydropower Resources

5. The incremental electricity demand of EVs is compared to:

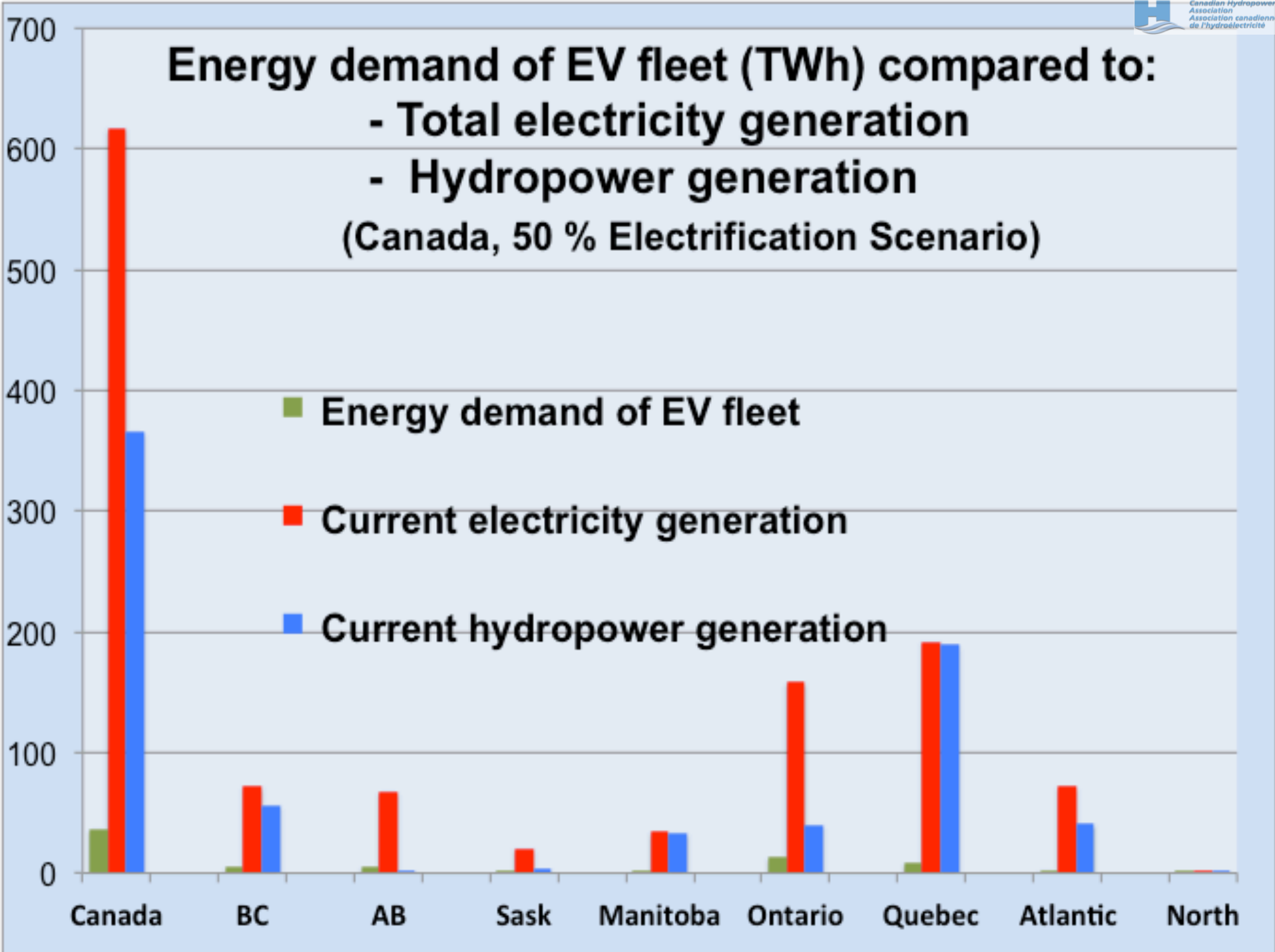
- ☐ Current hydro generation
- ☐ Hydropower projects currently under consideration
- ☐ Hydro technical potential

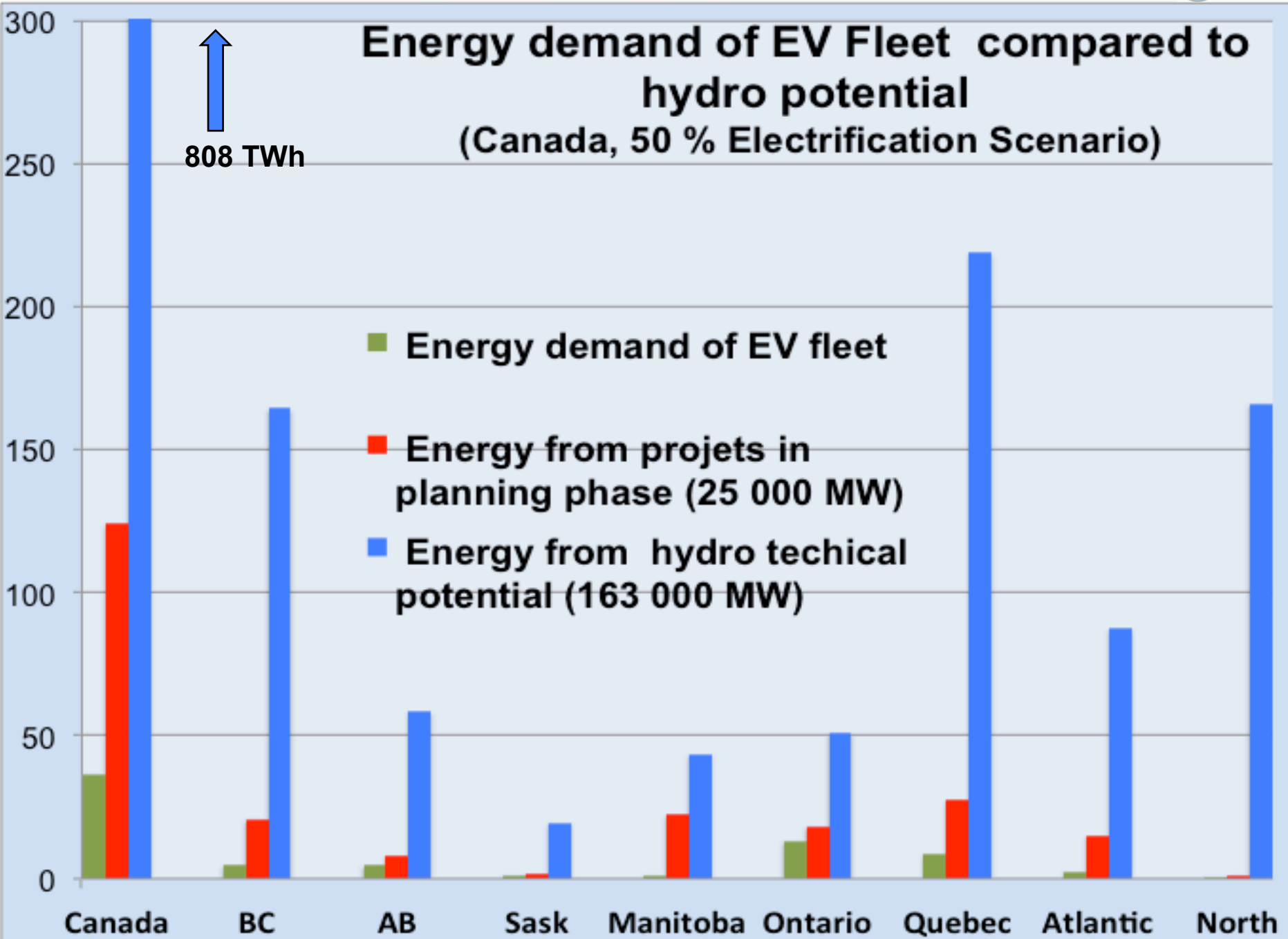
6. Avoided GHG emissions are equal to the emissions of the displaced fleet of conventional vehicles

Energy demand of EV fleet (TWh) compared to:

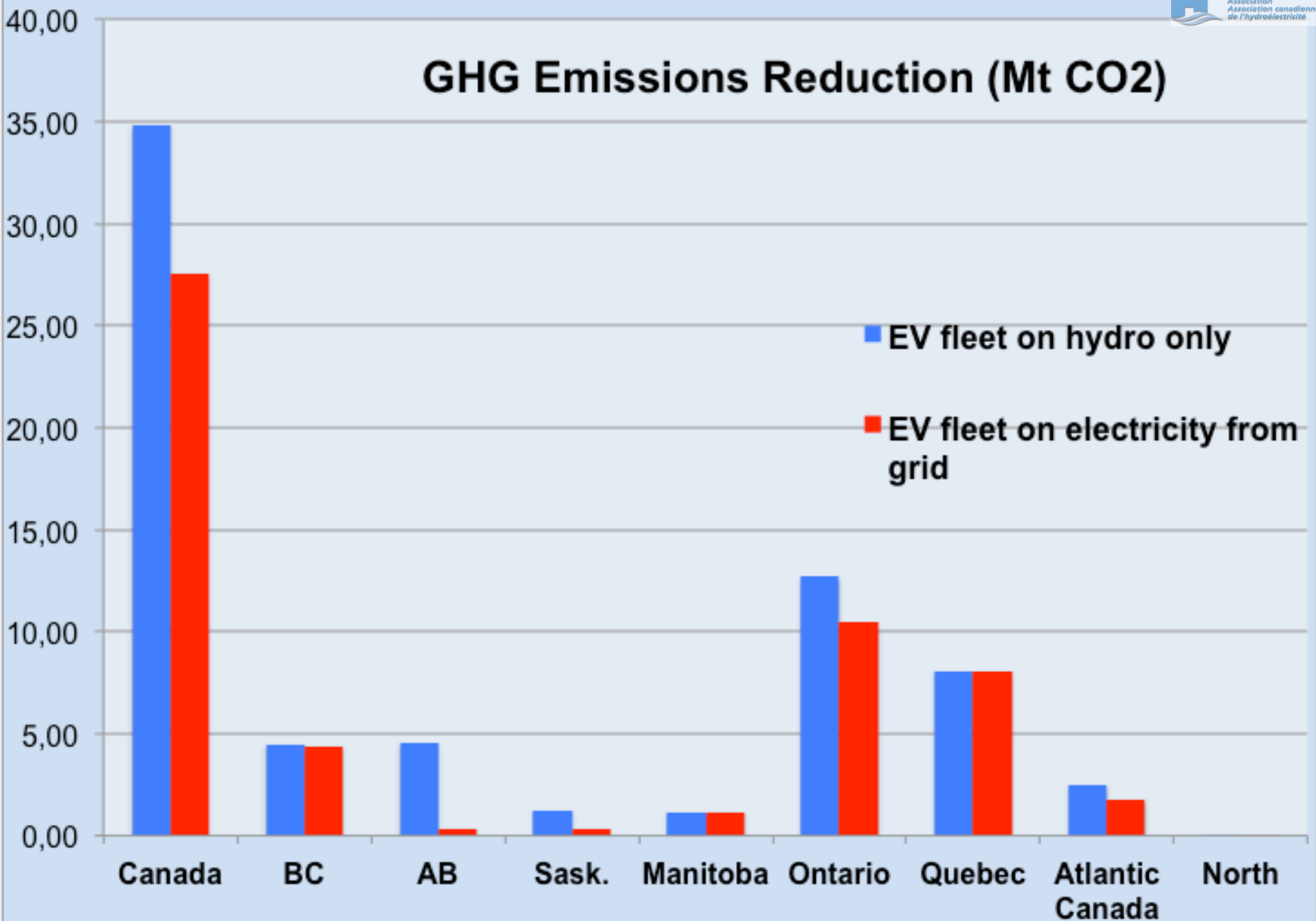
- Total electricity generation
- Hydropower generation

(Canada, 50 % Electrification Scenario)





GHG Emissions Reduction (Mt CO₂)



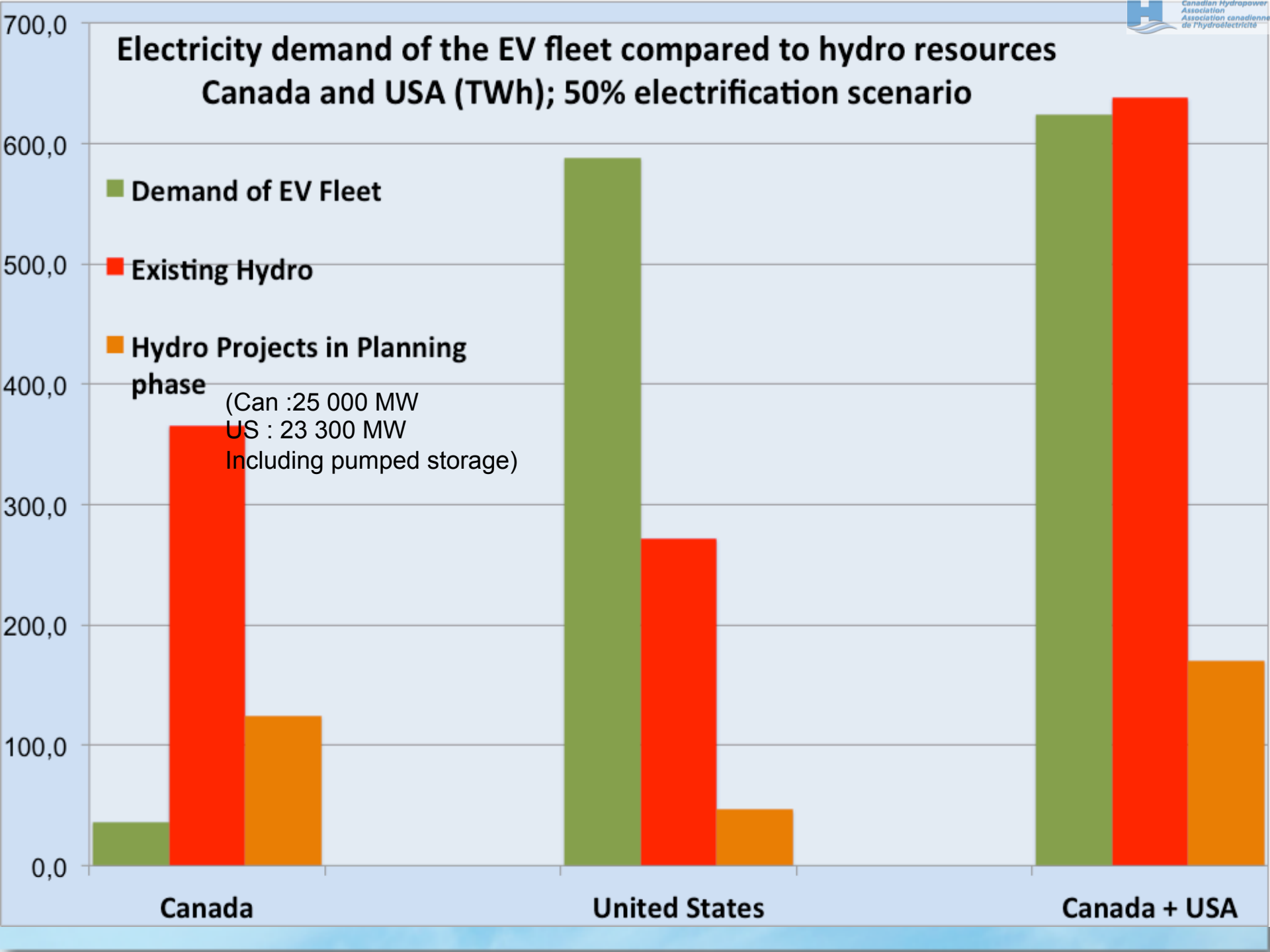
Electricity demand of the EV fleet compared to hydro resources Canada and USA (TWh); 50% electrification scenario

■ Demand of EV Fleet

■ Existing Hydro

■ Hydro Projects in Planning phase

(Can :25 000 MW
US : 23 300 MW
Including pumped storage)



Canada

United States

Canada + USA

Results: 50% Electrification of LDVs (1)

- 1. An increase of 10% of the current hydropower production would be sufficient to satisfy the additional demand in electricity**
- 2. Hydro projects under consideration (25 000 MW) would produce more than twice the electricity needed**

Results: 50% Electrification of LDVs (2)

- 3. Gasoline consumption would be reduced by approximately 30 million m³, reducing oil imports in regions that depend on foreign sources**
- 4. Canada's primary energy demand would be reduced**
- 5. GHG emissions in Canada would be reduced by 35 Mt**