The Electric Power System

- CANADA -
Basic facts

- Area: 9,984,670 km²
- Number of electricity consumers: 34 Million
- Number of TSOs: 17
- Number of DSOs: 26
- Peak load: TBD
- Average interruption of electricity: 75 min.
Basic facts (2014)

By the Global numbers...
- 5th - Canada’s world ranking in primary energy production (2014)
- 6th - Canada’s world ranking in primary energy consumption (2014)
- 24.3% Canada’s total exports that were energy related (2014)
- 3rd - Canada’s ranking in Hydroelectricity generation (2014)

By the Domestic numbers...
- 14.7% Canada’s electricity produced from nuclear generation (2014)
- 10.77% Canada’s electricity produced by coal (2014)
- 62.6% Canada’s electricity generated from hydropower (2014)
- 599.8 Terawatt-hours of total electricity generation (2014)
Global map of the grid and of its interconnections
Grid facts and characteristics


Source: North American Electric Reliability Council (NERC)
Structure of electrical power system
Electricity Market Structures in Canada

- **Saskatchewan**
  - Wholesale open access
  - Vertically-integrated Crown corporation

- **Québec**
  - Wholesale open access
  - Vertically-integrated Crown corporation
  - Expanding IPP development

- **Alberta**
  - Mandatory Power Pool
  - Wholesale & retail open access since 2001
  - Fully competitive wholesale market

- **Manitoba**
  - Wholesale open access
  - Vertically-integrated Crown corporation

- **Ontario**
  - Industry unbundling in 1998
  - Wholesale & retail open access since 2002
  - Hybrid regulation and competition model

- **BC**
  - Wholesale & industrial open access
  - Vertically-integrated Crown corporation serves 94% of customers

- **PEI**
  - Procurers electricity from New England market and long-term contracts with New Brunswick

- **New Brunswick**
  - Wholesale open access
  - Vertically-integrated Crown corporation

- **Newfoundland**
  - Vertically-integrated Crown corporation and investor-owned distribution utility

- **Nova Scotia**
  - Wholesale open access
  - Investor-owned utility regulated on cost-of-service
Map of the high voltage grid
## Information on TSO(s)

<table>
<thead>
<tr>
<th>Companies</th>
<th>Network length (km)</th>
<th>Served Area (km²)</th>
<th>Annual Transmitted energy (TWh)</th>
</tr>
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<tbody>
<tr>
<td>AltaLink</td>
<td>12,500</td>
<td>212,000</td>
<td>80</td>
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<tr>
<td>Atco Electric</td>
<td>10,000</td>
<td>320,000</td>
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<td>BC Hydro</td>
<td>75,000</td>
<td>870,000</td>
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<td>Brookfeild Infrastructure</td>
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<tr>
<td>Enmax</td>
<td>288</td>
<td>825</td>
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<tr>
<td>EPCOR</td>
<td>257</td>
<td>89,600</td>
<td>7</td>
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<tr>
<td>Fortis BC</td>
<td>1,500</td>
<td>17,000</td>
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<tr>
<td>Hydro One</td>
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<td>690,000</td>
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<td>Maritime Electric</td>
<td>5,275</td>
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<td>Manitoba Hydro</td>
<td>13,000</td>
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<td>New Brunswick Power</td>
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<td>Nalcor</td>
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<td>Nova Scotia Power</td>
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<tr>
<td>Sask Power</td>
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<td>651,000</td>
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</tr>
</tbody>
</table>
Cooperation of TSO and DSOs

- Provincial governments have control of generation and transmission of electrical energy
- Policies and power industry structure set regionally – differs from province to province
- Where disaggregated utilities exist TSO and DSO are open access and regulated as monopolies with franchise areas
Responsibilities of TSO & DSOs

- Congestion mitigation of transmission lines and distribution lines
- Voltage support
- Transmission-Distribution interface
- Balancing load
- Etc
Installed capacity with reference to primary resources

Note: Total Electricity Generation in 2012 = 595 TWh
Energy production with reference to primary resources

Electricity Generation in Canada by Fuel Type, 2012
Total Electricity Generated in Canada, 2012 = 594.9 TWh

- Hydro: 63.3%
- Nuclear: 15.3%
- Conventional Steam: 15.0%
- Internal Combustion: 0.2%
- Combustion Turbine: 4.7%
- Tidal: 0.00%
- Wind: 1.5%
- Solar: 0.04%

*Numbers may not sum to 100 percent due to rounding.
Source: Statistics Canada, Survey 2151, 2012
Retrieved April 22, 2013
Development of generation capacity since ....

Electricity Generation in Canada by Fuel Type, 1990 - 2012

Total Electricity Generation in Canada, 2012 = 594.9 TWh

*Prior to 2008, wind and tidal generation are included in hydro.
Source: Statistics Canada, Survey 2151, 2012
Retrieved May 5, 2013
Consumption per customer groups

Electricity Demand in Canada by Sector, 2011

Total Electricity Demand in Canada, 2011 = 518.9 TWh

- Residential: 29%
- Industrial: 40%
- Commercial & Institutional: 26%
- Agriculture: 2%
- Transportation: 1%
- Public Administration: 2%
Comsuption per customer groups

Electricity Demand in Canada by Sector, 1990 - 2013

Total Electricity Demand in Canada, 2013 = 481.52 TWh
Location of renewable energy sources
Development of wind power

Installed Wind Capacity in Canada as of April 2013

Canada’s current installed capacity: 6,568 MW
Development of photovoltaic power

- To be provided in future version
RES installed capacity and production since 2002
Price development for industry consumers

- To be provided in future update
Price development for households


Notes: Based on 1,000 kWh monthly consumption. Average electricity price is an average of 11 major Canadian cities for years 1998-2008 and an average of 12 major Canadian cities for years 2009-2013; and may not represent an exact national average.
Power balance/energy Exchange in 2014

- **Generation**: 594,9 TWh, source of 2012
- **Consumption**: 518,9 TWh, source of 2011
- **Imports**: 11,4 TWh, source of 2012
- **Exports**: 58,0 TWh, source of 2012
- **Losses (TWh)**: TBD
Specific aspects of the electricity market

- multiple market structures depending on region
- See Slide 6 for overview