CANADA’S ELECTRICITY INDUSTRY
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The Canadian Electricity Association (CEA)

- Founded in 1891, the Canadian Electricity Association is the national forum and voice of the evolving electricity business in Canada.

- Mission Statement: A safe, secure, reliable, sustainable and competitively-priced supply of electricity is essential to Canada’s prosperity.
CEA’s Corporate Utility Members

ALTAlink
ATCO Electric
ATCO Power
BC Hydro
Brookfield

Ontario Power Generation
TransCanada
Hydro Ottawa
ENMAX
EPCOR

FORTIS BC
FORTIS Alberta
horizon utilities
hydro one
Manitoba Hydro

 Saskatoon Light & Power
 Reliable. Responsive.

Capital Power
Northwest Territories Power Corporation
Empowering Communities

Newfoundland Power
A Fortis Company

Nova Scotia Power
An Emera Company

Medicine Hat The Gas City
Electric Utility

Columbia Power
Positive Energy

Maritime Electric
A Fortis Company

Toronto Hydro

Saint John Energy

Énergie NB Power
CEA Mission Statement

A safe, secure, reliable, sustainable and competitively priced supply of electricity is essential to Canada’s prosperity. CEA is the voice of the Canadian electricity industry, promoting electricity as the critical enabler of the economy and Canadians’ expectations for an enhanced quality of life.
CEA Strategic Goals

Infrastructure – Ability to build needed electricity infrastructure, to meet growing demand and replace aging assets.

Energy Efficiency – Ability to provide options to customers to assist them in using electricity more efficiently, manage costs and minimize environmental impacts.

Technology – Ability to maximize and deploy leading-edge technologies.

Regulation – Need for more coordinated, effective and efficient regulatory regimes within and between governments, and more timely decisions.

Environment – Need for holistic approach and greater regulatory coherence on environmental issues.

Security – Need to ensure the long-term security, reliability and stability of the electricity system.
Canada’s Multi-Jurisdictional Environment

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<th>Provincial/Territorial Governments</th>
<th>Federal Government</th>
</tr>
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<tr>
<td>• Intra-provincial trade and commerce</td>
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<tr>
<td>• Intra-provincial environmental impacts</td>
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<tr>
<td>• Generation and transmission of electrical energy</td>
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<tr>
<td>• Conservation and demand response policies</td>
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<td></td>
<td>▪ Resource management on frontier lands</td>
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<td></td>
<td>▪ Nuclear safety</td>
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<td></td>
<td>▪ Inter-provincial and international trade</td>
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<td></td>
<td>▪ Trans-boundary environmental impacts</td>
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<td>▪ Environmental impacts where federal lands, investment or powers apply</td>
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<td></td>
<td>▪ Codes, standards and labeling relating to conservation and demand</td>
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<tr>
<td></td>
<td>▪ Other policies of national interest</td>
</tr>
</tbody>
</table>
Electricity Market Structures in Canada

- **Saskatchewan**: Wholesale open access • Vertically-integrated Crown corporation
- **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
- **Québec**: Wholesale open access • Vertically-integrated Crown corporation • Expanding IPP development
- **Newfoundland**: Vertically-integrated Crown corporation and investor-owned distribution utility
- **BC**: Wholesale & industrial open access • Vertically-integrated Crown corporation serves 94% of customers
- **PEI**: Procures electricity from New England market and long-term contracts with New Brunswick
- **New Brunswick**: Wholesale open access • Vertically-integrated Crown corporation
- **Nova Scotia**: Wholesale open access • Investor-owned utility regulated on cost-of-service
North American Electric Reliability Corporation (NERC) Regions
Electricity Demand in Canada by Sector, 2014

Total Electricity Demand in Canada, 2014 = 491.22 TWh

- Residential: 33%
- Commercial & Institutional: 18%
- Industrial: 43%
- Agriculture: 2%
- Transportation: 1%
- Public Administration: 3%

*Numbers may not sum to 100 percent due to rounding

Updated August, 2016
Electricity Demand in Canada by Sector, 1990 - 2014

Total Electricity Demand in Canada, 2014 = 491.22 TWh

Since 2003 electricity demand has decreased 7% and, since an historic high in 2008, 12%

Updated April, 2016
Electricity Consumption in Canada by Sector, 2003 - 2013

Total Electricity Consumption in Canada, 2013 = 485.19 TWh

Since 2003 electricity consumption has decreased 3.2% and, since an historic high in 2008, 7.5%

Source: IEA Statistics, Canada: Electricity and Heat 2003-2013
Updated January 6, 2016
Electricity Generation in Canada by Fuel Type, 2014

Total Electricity Generated in Canada, 2014 = 627.68 TWh

- Hydro: 60.6%
- Nuclear: 16.2%
- Conventional Steam: 14.6%
- Combustion Turbine: 6.5%
- Wind: 1.8%
- Solar: 0.05%
- Tidal: 0.00%
- Internal Combustion: 0.3%

*Numbers may not sum to 100 percent due to rounding.

Source: Statistics Canada, Electric power generation, by class of electricity producer, annual (CANSIM Table 127-0007), 2014
Retrieved April, 2016
Electricity Generation in Canada by Fuel Type, 1990 - 2014

Total Electricity Generation in Canada, 2014 = 627.68 TWh

*Prior to 2008, wind and tidal generation are included in hydro.

Source: Statistics Canada, Electric power generation, by class of electricity producer, annual (CANSIM Table 127-0007), 2014
Retrieved April. 2016
Electricity Generation in Canada by Province and Fuel Type, 2014

Total Electricity Generation in Canada, 2014 = 627.68 TWh

*Point Lepreau nuclear generating station resumed power production on November 23, 2012, nuclear has been re-established as a major source (about 30%) of electricity in New Brunswick.

Source: Statistics Canada, Electric power generation, by class of electricity producer, annual (CANSIM Table 127-0007), 2014 Retrieved August, 2016
Canada-U.S. Electricity Trade Volume, 1990 – 2015

Canada-U.S. Natural Gas Trade Volume. 1990 – 2015

Source: Statistics Canada, Natural Gas Exports and Imports, 2015
Retrieved August, 2016
California Energy Crisis of 2000 and 2001 was the situation when California had a shortage of electricity.

Canada-U.S. Natural Gas Trade Revenue, 1990 – 2015

Source: Statistics Canada, Natural Gas Exports and Imports, 2015
Retrieved April, 2016
Canada-U.S. Natural Gas Export/Import Prices, 2002 – 2015

Source: Statistics Canada, Natural Gas Exports and Imports, 2015
Retrieved April, 2016
Canada-U.S. Electricity Export/Import Prices/MWh, 1997 – 2015

Source: National Energy Board, *Electricity Exports and Imports, 2015*
Retrieved August, 2016
Canada-U.S. Natural Gas and Electricity Export/Import Price Comparison, 2002 – 2015

Source: National Energy Board, 2015
Retrieved August, 2016
U.S.-Canada Electricity Trade Volume (1990–2014)

2014 Exports= 59.2 TWh  2014 Imports= 12.8 TWh  2014 Net= 46.4 TWh

Major Canada-U.S. Transmission Interconnections

Source: National Energy Board
Electricity Exports and Imports Between Canada and the U.S. (2014)

Data displayed are in gigawatt hours
Numbers may not sum due to rounding
The Integrated North American Grid

Map copyright CEA.
Lines shown are 345kV and above. There are numerous interconnections between Canada and the U.S. under 345KV that do not appear on this map.
Manitoba-Minnesota Transmission Project

- Manitoba Hydro (MH): 500 kV line to U.S. border.
- Minnesota Power (MP): 500 kV line from border to Duluth.
- “Hydro by wire” from Manitoba enables “wind by wire” from North Dakota.
- Overall project enhances regional reliability and provides energy market benefits.
- 2020 expected in-service date.
Utility Investment in Canada’s Transmission and Distribution Cable and Lines, 2006 – 2012

Source: CANSIM Table 029-0050 Capital and repair expenditures, by industry and type of asset, Canada, provinces and territories. Retrieved April, 2016
Electric Power Generation, Transmission and Distribution Sector Contribution to Canada’s GDP, 2010-2015 (2007 constant dollars)

Source: Statistics Canada, Gross domestic product at basic prices, utilities, trade, transportation, and communications. April, 2016
Capital Investment in Canada’s Electric Power Sector, 2007–2013 (billions of constant 2007 dollars)

Total capital investment in 2013 = $20.8 billion
Electric Sector Environmental Protection Expenditures by type, 2012

Total electric sector environmental protection expenditures, 2012 = $1301.6 million

- Reclamation and decommissioning: 27%
- Waste management and sewerage services: 42%
- Pollution prevention, abatement and control: 7%
- Wildlife and habitat protection: 6%
- Environmental assessments and audits: 15%
- Environmental monitoring: 3%
- Fees, fines and licenses: 0%
- Other: 0%

Environmental Protection Expenditures by the Electric Power Sector, 1996 – 2012

Total electric sector environmental protection expenditures, 2012 = $1301.6 million

Source: Statistics Canada, *Environmental Protection Expenditures in the Business Sector, 2010*
Retrieved June 9, 2013
Greenhouse Gas (GHG) Emissions in Canada by Sector, 2014

Total GHG Emissions in Canada, 2014 = 732 Mt CO₂ Equivalent

- **Transportation (170 Mt CO₂ equivalent)** 23.6%
- **Electricity (85 Mt CO₂ equivalent)** 12.3%
- **Oil and Gas (179 Mt CO₂ equivalent)** 24.8%
- **Emissions Intensive & Trade Exposed Industries (76 Mt CO₂ equivalent)** 11.2%
- **Buildings (86 Mt CO₂ equivalent)** 11.5%
- **Agriculture (75 Mt CO₂ equivalent)** 9.9%
- **Waste & Others (54 Mt CO₂ equivalent)** 6.7%

Note: Emissions do not include the following sectors: land use change and forestry, solvent and other product use and biomass

Greenhouse Gas (GHG) Emissions in Canada for Energy Sector, 2014

Total GHG Emissions in Canada, 2014=732 Mt CO₂ Equivalent

Total Energy Sector GHG Emissions in Canada, 2014=594 Mt CO₂ Equivalent

- Transportation 28.5%
- Fossil Fuel Industries* 10.5%
- Buildings 10.8%
- Agriculture 0.6%
- Emissions Intensive and Trade Exposed Industries 13.6%
- Waste, Light Manufacturing, Construction & Forest Resources 7.6%
- Electricity & Heat Generation 12.1%

Note: Total energy sector emissions include all those under the National Inventory Category, ‘Energy’

*includes Oil & Gas and Coal Production
CO₂ Emissions in Canada for Public Electricity and Heat Production Sector, 2014

Total Public Electricity & Heat Sector CO₂ Emissions in Canada, 2014 = 85.5 Megatonnes

- Coal, 61.6 Mt CO₂E
- Natural Gas, 19.0 Mt CO₂E
- Other fuels, 4.8 Mt CO₂E
- Other emissions, 0.8 Mt CO₂E

Source: UNFCCC, National Inventory Submission for Canada, for 1990-2014, Report dated April, 2016
Utility-Generated Electricity by Source and GHG Emissions, 1990–2013

Factors Contributing to GHG Emissions Reductions in the Electricity Sector, 1990-2014, Mt CO$_2$E

Advances in the Generation and Fuel Mix have led to a 9 Mt reduction in emissions despite a 22.8 MWh increase in demand.

Notes:
Demand – the level of electricity generation activity in the utility sector and consists of generation from combustion and non-combustion sources.
Generation mix – the relative share of combustion and non-combustion sources in generation activity.
Fuel mix (combustion generation) – the relative share of each fuel used to generate electricity.
Energy efficiency – the efficiency of the equipment used in combustion related generation of electricity.
Emission factors – The emission factor effect reflects changes to fuel energy content over time.

Source: UNFCCC, National Inventory Report for Canada, for 1990-2014, Retrieved April, 2016
Factors Contributing to GHG Emissions Reductions in the Electricity Sector, 2005-2014, Mt CO$_2$E

| Source: UNFCCC, National Inventory Report for Canada, for 1990-2014, Retrieved April, 2016 |

| Notes: |
| Demand – the level of electricity generation activity in the sector and consists of generation from combustion and non-combustion sources. |
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| Fuel mix (combustion generation) –the relative share of each fuel used to generate electricity. |
| Energy efficiency –the efficiency of the equipment used in combustion related generation of electricity. |
| Emission factors – The emission factor effect reflects changes to fuel energy content over time. |
Nitrogen Oxide (NO\textsubscript{x}) Emissions in Canada by Sources, 2014

Total NO\textsubscript{x} Emissions in Canada, 2014 = 1,922.5 Kilotonnes

- Mobile Sources: 54.6%
- Upstream Petroleum: 23.2%
- Other Industrial: 8.9%
- Open & Natural Sources: 0.6%
- Electric Power: 8.6%
- Residential/Commercial Fuel & Wood: 3.0%
- Incineration & Miscellaneous: 0.1%

Source: Environment Canada, National Pollutant Release Inventory, 2014 Air pollutant emissions summary for Canada
Retrieved April, 2016
**Sulphur Oxide (SO\(_x\)) Emissions in Canada by Sources, 2014**

Total SO\(_x\) Emissions in Canada, 2014 = 1,142.5 Kilotonnes

- **Electric Power**: 24.2%
- **Petroleum Industry (Up- & Downstream)**: 24.5%
- **Other Industrial**: 15.1%
- **Open & Natural Sources**: 1.0%
- **Mobile Sources**: 0.3%
- **Residential/Commercial Fuel & Wood**: 3.0%
- **Incineration & Miscellaneous**: 0.2%
- **Non-Ferrous Smelting and Refining Industry**: 33.6%

Electric Sector Sulphur Oxide (SO$_x$) Emissions in Canada, 1990 - 2014

Total Electric Sector SO$_x$ Emissions in Canada, 2014 = 269 Kilotonnes

Source: Environment Canada, National Pollutant Release Inventory (NPRI) Retrieved April, 2016
Mercury Emissions in Canada by Sources, 2014

Total Mercury Emissions in Canada, 2014 = 3,888.4 Kilograms

- Electric Power: 21.5%
- Incineration & Miscellaneous: 12.1%
- Open Sources: 17.4%
- Iron and Steel Industries: 16.5%
- Non-Ferrous Smelting and Refining Industry: 8.1%
- Cement and Concrete Industry: 8.4%
- Mobile Sources: 2.4%
- Petroleum Industry (Up- & Downstream): 2.4%
- Other Industrial Sources: 6.5%
- Residential & Commercial Fuel & Wood: 4.6%

Source: Environment Canada, National Pollutant Release Inventory, 2014 Air pollutant emissions summary for Canada
Retrieved April, 2016
Electric Sector Mercury Emissions in Canada, 1990 - 2014

Total Electric Sector Mercury Emissions in Canada, 2014 = 762 Kilograms

Source: Environment Canada, National Pollutant Release Inventory (NPRI)
Retrieved on April, 2016
Particulate Matter (PM$_{2.5}$) Emissions in Canada by Sources, 2014

Total PM$_{2.5}$ Emissions in Canada, 2014 = 1,799.5 Kilotonnes

- Open & Natural Sources (Inc. Agriculture & Waste) 83.2%
- Electric Power 0.2%
- Residential & Commercial Fuel & Wood 9.2%
- Incineration & Miscellaneous 0.6%
- Mining and Rock Quarrying 0.6%
- Mobile Sources 2.8%
- Petroleum Industry (Up- & Downstream) 0.6%
- Other Industrial 2.9%

Source: Environment Canada, National Pollutant Release Inventory, 2014 Air pollutant emissions summary for Canada
Retrieved April, 2016
Electric Sector Particulate Matter (PM$_{2.5}$) Emissions in Canada, 1990 - 2014

Total Electric Sector PM$_{2.5}$ Emissions in Canada, 2014 = 3,977 Kilotonnes

Source: Environment Canada, National Pollutant Release Inventory (NPRI) 
Retrieved on April, 2016
2014 CO₂ Electricity Emissions and Intensity in Canada

85.5 MT CO₂ e Emissions
160 Tonnes/GWh CO₂ e System Intensity

Source: National Inventory Report, 1990-2014
Greenhouse Gas (GHG) Emissions in Canada and the US by Sector, 2014

Total GHG Emissions in Canada, 2014 = 732 Mt CO$_2$ Equivalent

- Transportation 23.4%
- Oil & Gas 26.3%
- Electricity & Heat Generation 10.7%
- Agriculture 10.0%
- Industrial Processes 10.4%
- Residential 6.3%
- Commercial & Institutional 5.6%
- Waste 7.4%

Total GHG Emissions in US, 2014 = 6,108 Mt CO$_2$ Equivalent

- Transportation 26.4%
- Electric Power Industry 30.3%
- Industry 21.3%
- Agriculture 9.1%
- Commercial 6.6%
- U.S. Territories 0.7%
- Residential 5.7%

Electricity Generating Capacity in the US and Canada by Fuel Type,¹ 2014

Canada

- Hydro, 59.02%
- Conventional Steam (Coal), 15.67%
- Nuclear, 10.58%
- Combustion Turbine, 8%
- Wind, 4.64%
- Tidal and Solar, 0.30%

Total Generating Capacity = 132.7 GW

United States

- Natural Gas, 40%
- Coal, 28%
- Petroleum, 4%
- Others, 5%
- Wind, 6%
- Hydro, 8%
- Nuclear, 9%

Total Generating Capacity = 1,066.3 GW

¹Numbers may not sum to 100 percent due to rounding. Source: US Energy Information Administration, Electric Power Monthly, November 2014 and Statistics Canada, CANSIM Table 127-0009, 2014
Electricity Generation in the US and Canada by Fuel Type,¹ 2014

**Canada**
- Hydro: 61%
- Conventional Steam (Coal): 15%
- Nuclear: 16%
- Internal Combustion: 0%
- Combustion Turbine: 6%
- Wind: 2%
- Solar: 0%

**United States**
- Coal: 41.5%
- Natural Gas: 29.1%
- Nuclear: 20.6%
- Petroleum: 0.7%
- Other renewables: 0.3%
- Other gas: 0.3%
- Other: 0.3%
- Hydro: 7.0%

Note: Total Electricity Generation in 2014 = 627.68 TWh

¹Numbers may not sum to 100 percent due to rounding.

Building the Next Generation of Infrastructure: Capital Investment Requirements

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<tr>
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<th>Billions of 2010 CDN dollars</th>
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<tr>
<td></td>
<td>Generation</td>
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<tr>
<td>2010 – 2030</td>
<td>195.7</td>
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</tbody>
</table>

Total Canadian Electric Sector Investment Required by 2030 = 293.8 Billion in 2010 CDN dollars, or **347.5 Billion in current CDN dollars**.

Source: The Conference Board of Canada, Shedding Light on the Economic Impact of Investing in Electricity Infrastructure, February 2012
# Active MPMO Electricity Sector Projects

<table>
<thead>
<tr>
<th>MPMO Project Name</th>
<th>Description</th>
<th>Proponent</th>
<th>Project Type</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>Labrador - Island Transmission Link</td>
<td>1,100 km line</td>
<td>Nalcor Energy</td>
<td>Transmission</td>
<td>NL</td>
</tr>
<tr>
<td>Maritime Link Transmission</td>
<td>500-MW, +/- 200 to 250-kV HVDC &amp; HVAC</td>
<td>ENL Maritime Link Inc.</td>
<td>Transmission</td>
<td>NL/NS</td>
</tr>
<tr>
<td>Keeyask Hydroelectric Generation</td>
<td>695 MW</td>
<td>Keeyask Hydropower Limited Partnership</td>
<td>Hydro</td>
<td>MB</td>
</tr>
<tr>
<td>Lower Churchill Hydroelectric Generation</td>
<td>3,074 MW</td>
<td>Nalcor Energy</td>
<td>Hydro</td>
<td>NL</td>
</tr>
<tr>
<td>Site C Clean Energy Hydroelectric Generation</td>
<td>1,100 MW</td>
<td>BC Hydro</td>
<td>Hydro</td>
<td>BC</td>
</tr>
<tr>
<td>Darlington New Nuclear Power Plant</td>
<td>Up to 4,800 MW</td>
<td>OPG</td>
<td>Nuclear</td>
<td>ON</td>
</tr>
<tr>
<td>NaiKun Offshore Wind Energy</td>
<td>320 MW (off-shore)</td>
<td>NaiKun Wind Development</td>
<td>Wind</td>
<td>BC</td>
</tr>
<tr>
<td>Tazi Twe Hydroelectric Generation</td>
<td>50 MW</td>
<td>Saskatchewan Power Corp.</td>
<td>Hydro</td>
<td>SK</td>
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Source: Major Projects Management Office, Project Tracker, updated April, 2016
### Active MPMO Electricity Sector Projects – indirect relevance

<table>
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<tr>
<th>MPMO Project Name</th>
<th>Description</th>
<th>Proponent</th>
<th>Project Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bow City Coal Mine and Power</td>
<td>2x 500 MW</td>
<td>Bow City Power Ltd.</td>
<td>Coal</td>
<td>AB</td>
</tr>
<tr>
<td>Deep Geological Depository</td>
<td>Waste Management</td>
<td>Ontario Power Generation</td>
<td>Nuclear</td>
<td>ON</td>
</tr>
</tbody>
</table>

Note: indirect relevance refers to projects that are indirectly related to electricity generation and include infrastructure related activities, such as mining (of coal for power generation), waste management (of radioactive waste) and dam (re)construction.

Source: Major Projects Management Office, Project Tracker, Updated April, 2016
Non-MPMO Electricity Sector Projects – new proposals

<table>
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<tr>
<th>MPMO Project Name</th>
<th>Description</th>
<th>Proponent</th>
<th>Project Type</th>
<th>Location</th>
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<tbody>
<tr>
<td>Bipole III Transmission Line</td>
<td>1,475 km</td>
<td>Manitoba Hydro</td>
<td>Transmission</td>
<td>MB</td>
</tr>
<tr>
<td>Chamouchouane - Bout-de-l’Île Transmission Line</td>
<td>735 kV</td>
<td>Quebec Hydro</td>
<td>Transmission</td>
<td>QC</td>
</tr>
<tr>
<td>Green Electron Natural Gas Power Generation Project</td>
<td>300 MW</td>
<td>Greenfield South Power Corporation</td>
<td>Generation</td>
<td>ON</td>
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<tr>
<td>Hawkeye Green Energy Hydroelectric Generation</td>
<td>175 MW</td>
<td>Hawkeye Energy Corporation</td>
<td>Hydro</td>
<td>BC</td>
</tr>
<tr>
<td>Mica 5 and 6</td>
<td>1000 MW</td>
<td>BC Hydro</td>
<td>Hydro</td>
<td>BC</td>
</tr>
<tr>
<td>Rocky Creek Wind Power</td>
<td>500 MW</td>
<td>Rupert Peace Power Corporation</td>
<td>Wind</td>
<td>BC</td>
</tr>
<tr>
<td>Trillium Offshore Wind Farm</td>
<td>414 MW</td>
<td>Trillium Power Wind Corporation</td>
<td>Wind</td>
<td>ON</td>
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</tbody>
</table>

Note: indirect relevance refers to projects that are indirectly related to electricity generation and include infrastructure related activities, such as mining (of coal for power generation), waste management (of radioactive waste) and dam (re)construction.

## Canada’s Regulatory Regime for Large Energy Projects

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<th>Permitting</th>
<th>Follow-up</th>
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<td><strong>Canadian Environmental Assessment Act - CEA Agency</strong></td>
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<td><strong>National Energy Board Act - NEB</strong></td>
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<td><strong>Nuclear Safety and Control Act - CNSC</strong></td>
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<td>Impact reviews (YESAA, MVRMA Land Claim / CEAA)</td>
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<td>Innuvialuit Final Agreement - INAC*</td>
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<td>Management Boards</td>
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<tr>
<td></td>
<td>Territorial Lands / Water Act</td>
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<td></td>
<td><strong>Species at Risk Act - EC/DFO</strong></td>
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<td></td>
<td><strong>Metal Mining Effluent Regulations - EC/DFO</strong></td>
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<td><strong>Explosives Act - NRCan</strong></td>
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<td></td>
<td><strong>Fisheries Act - DFO</strong></td>
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<td></td>
<td><strong>NWPA - TC</strong></td>
<td></td>
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<tr>
<td></td>
<td><strong>Others: MBCA / IBWTA / CPRA / Offshore Accords / CEPA</strong></td>
<td></td>
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</tr>
</tbody>
</table>

*Permits required under other Acts trigger CEAA OGD participants
Illustrative – some components would not apply to same project
NWPA – Navigable Waters Protection Act / YESAA – Yukon Environmental and Socio-Economic Assessment Act
MVRMA – Mackenzie Valley Resource Management Act / MBCA – Migratory Birds Convention Act
IBWTA – International Boundary Waters Treaty Act / CPRA – Canadian Petroleum Resource Act
Offshore Accords – Canada - NS and NFLD Offshore Accords / CEPA – Canadian Environmental Protection Act
Average Residential Electricity Price in Canada, 1998 – 2015 (cents/kWh)


Ontario Hydro: Electricity Rates by Province, Retrieved June 20, 2015

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 2009-2015; and may not represent an exact national average.
Selected World Residential Electricity Prices, 2014

US cents/kWh


*Hydro Quebec, Comparison of Electricity Prices in North American Cities 2014*
Selected World Industrial Electricity Prices, 2014

<table>
<thead>
<tr>
<th>Country</th>
<th>US cents/kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>35</td>
</tr>
<tr>
<td>Ireland</td>
<td>25</td>
</tr>
<tr>
<td>Portugal</td>
<td>20</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>16</td>
</tr>
<tr>
<td>Switzerland</td>
<td>15</td>
</tr>
<tr>
<td>Belgium</td>
<td>14</td>
</tr>
<tr>
<td>France</td>
<td>13</td>
</tr>
<tr>
<td>Mexico</td>
<td>12</td>
</tr>
<tr>
<td>Turkey</td>
<td>11</td>
</tr>
<tr>
<td>Finland</td>
<td>11</td>
</tr>
<tr>
<td>Denmark</td>
<td>10</td>
</tr>
<tr>
<td>Poland</td>
<td>10</td>
</tr>
<tr>
<td>Canada</td>
<td>9</td>
</tr>
<tr>
<td>United States</td>
<td>7</td>
</tr>
</tbody>
</table>


Hydro Quebec, *Comparison of Electricity Prices in North American Cities 2014*
Note: The price increase for the residential electricity sector has increased 39% between 1999 and 2013, the lowest amongst property taxes, water and internet services for principle accommodation.

Canada’s Future Residential Electricity Needs

Reference: Graphics from BC Hydro: Lighting the Way. Estimates based on a business as usual scenario. Stats Canada Population Projections: Table 052-0005
## Low Emission and Sustainable Technologies Used for Electricity Generation in Canada

<table>
<thead>
<tr>
<th>Resource</th>
<th>Advantages</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Power</td>
<td>No fuel cost, no emissions or waste, renewable source of energy, commercially viable source of power</td>
<td>Less cost competitive than conventional energy source, variable energy resource, transmission issues, environmental concerns with regards to noise and interaction with birds, land use issues</td>
</tr>
<tr>
<td>Small Hydro</td>
<td>Low capital costs, many potential sites in Canada, well established technology, able to meet small incremental capacity needs, reduction in GHG emissions</td>
<td>Regulatory approval can be costly and time consuming, access to grid, local opposition to new development</td>
</tr>
<tr>
<td>Biomass</td>
<td>Uses landfill gas, wood pellets, and waste products to create electricity, reduces greenhouse gas, high availability of sites</td>
<td>High capital equipment and fuel costs; produces some emissions; access to transmission, competition for biomass materials use</td>
</tr>
<tr>
<td>Geothermal Energy</td>
<td>Reliable source of power, low fuel and operating costs, clean and renewable source of energy</td>
<td>High capital costs, connecting to the grid can be difficult, few potential sites in Canada</td>
</tr>
<tr>
<td>Solar PV</td>
<td>Reliable, renewable energy source with zero emissions and silent operation, fuel is free, suitable for areas where fossil fuels are expensive or where there is no connection to the grid</td>
<td>Restrictive and lack of grid connection for remote areas, not cost competitive, sun does not always shine and potential varies across regions</td>
</tr>
<tr>
<td>Ocean Energy</td>
<td>Costs are expected to decline as technology develops, intermittent, but predictable source of green energy</td>
<td>Potentially intrusive to marine life, investment is needed to promote research and development</td>
</tr>
<tr>
<td>Clean Coal</td>
<td>Highly efficient, potential for reduced greenhouse gas emissions</td>
<td>High capital costs, lengthy start-up period</td>
</tr>
</tbody>
</table>
Canadian Electricity Statistics

By the Global numbers…

5  Canada’s world ranking in primary energy production (2014)
6  Canada’s world ranking in primary energy consumption (2014)
24.3  Per cent of Canada’s total exports that were energy related (2014)
2  Canada’s ranking in Hydroelectricity generation (2015)

By the Domestic numbers…

10.4% of Canada’s electricity produced from nuclear generation (2014)
9.63  Per cent of Canada’s electricity produced by coal (2014)
60.3  Per cent of Canada’s electricity generated from hydropower (2014)
627.68  Terawatt-hours of total electricity generation (2014)
Installed Wind Capacity in Canada as of December 2015

Source: Canadian Wind Energy Association, retrieved August, 2016
Coal Fleet Profile (MW)

Coal Capacity Reduction - Retirement as per the Coal Regulation*

(Source: NPRI data)

* Retirement age 45-50 years as per the 2012 Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations. Includes Ontario coal shutdown by 2014.
**NO\(_x\) and SO\(_2\) Reductions from CO\(_2\) Regulation**

Reduction in SO\(_2\) emission from 2002 levels:
- 54% reduction by 2020
- 84% reduction by 2030

Reduction in NO\(_x\) emissions from 2002 levels:
- 50% reduction by 2020
- 80% reduction by 2030

Source and assumptions: NPRI data was used for existing unit emissions, forecast based on 2009-2011 operation, coal unit retirement from 45-50 years as outlined in the 2012 *Reduction of Carbon Dioxide Emissions from Coal-Fired Generation of Electricity Regulations*
Electricity leading all Canadian industrial sectors in reduction of CO₂

Forecasted Change in Emissions by Sector: 2005-2020

Electricity leads all sectors in current (35 Mt CO₂E) and anticipated (50 Mt CO₂E) reductions in CO₂

Regulations to address GHG emissions from coal-fired electricity (Sept. 2012)

- Establish an emissions performance standard of 420 tonnes of CO₂ per gigawatt hour of electricity produced for new coal-fired electricity generation units (those commissioned after July 1, 2015), and units that have reached the end of their life.

- The proposed Regulations are to be promulgated under the Canadian Environmental Protection Act (CEPA) and are set to come into effect on July 1, 2015.

- Existing and new units may apply for a deferral in meeting the performance standard until January 1, 2025, if the technology for Carbon Capture and Storage (CCS) is incorporated.

- The regulation will be effective only if compliance is achievable.

- Compliance will contribute to clarity and stability for industry that will enable investment in electricity infrastructure to flow.

- Cumulative reduction in GHG emissions of approximately 214 megatonnes and cumulative health benefits of $4.2 billion expected in the first 21 years.

- Some jurisdictions will be more heavily impacted than others.
Vision 2050: the sector’s vision for Canada’s electricity system between now and 2050

- The four key recommendations of Vision 2050 include:
  - accelerating customer innovation and management of energy;
  - implementing financial instruments for carbon reduction, including a North American carbon price that is implemented across the economy;
  - enabling electric vehicles; and,
  - expanding collaboration with the U.S. to optimize electricity assets while expanding opportunities for electricity storage and the export of low-carbon electricity.

Source: Canadian Electricity Association, 2014 Sustainable Electricity Annual Report, Engaged for a Sustainable Future
The CEA’s Sustainable Electricity Program: Guiding member efforts on sustainability

<table>
<thead>
<tr>
<th>ENVIRONMENTAL PERFORMANCE</th>
<th>Environment: Minimize the adverse environmental impacts of our facilities, operations and businesses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stewardship and Biodiversity: Manage the environmental resources and ecosystems that we affect to prevent or minimize loss and support recovery</td>
</tr>
<tr>
<td></td>
<td>Climate Change: Manage greenhouse gas emissions to mitigate the impact of operations on climate change, while adapting to its effects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOCIAL PERFORMANCE</th>
<th>Health and Safety: Provide a safe and healthy workplace for our employees and contractors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Workplace: Support a fair, respectful and diverse workplace for our employees and contractors</td>
</tr>
<tr>
<td></td>
<td>Communications and Engagement: Communicate with and engage our stakeholders in a transparent and timely manner</td>
</tr>
<tr>
<td></td>
<td>Aboriginal Relations: Communicate with and engage Aboriginal Peoples in a manner that respects their culture and traditions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECONOMIC PERFORMANCE</th>
<th>Economic Value: Provide economic benefits to shareholders, communities and regions in which we operate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy Efficiency: Produce, deliver and use electricity in an efficient manner while promoting conservation and demand-side management</td>
</tr>
<tr>
<td></td>
<td>Security of Supply: Provide electricity customers in a safe, reliable and cost-effective manner to meet current and future needs</td>
</tr>
</tbody>
</table>

Source: Canadian Electricity Association, 2014 Sustainable Electricity Annual Report, Engaged for a Sustainable Future
The CEA Councils

- Generation Council
  - Develops and influences policy associated with investment in electricity generation infrastructure, as well as manages environmental and health impacts related to generation
- Transmission Council
  - Formulates positions on transmission, including cross border reliability, electric and magnetic fields and utility properties
- Distribution Council
  - Focuses on technological and regulatory developments associated with smart grid development and deployment, advanced meter performance, power quality issues, and national trends in provincial distribution utility regulation
- Customer Council
  - Seeks to increase the value of electricity service to Canadians
- Power Marketers Council
  - Promotes competitive and efficient electricity markets in Canada and the United States
Energy Efficiency

- Commitment to sustainability through efficient production, delivery and use of energy, while promoting energy conservation and demand side management
- CEA’s involvement in initiatives
  - Old refrigerator removal
  - Exchange programs to lower air conditioner levels during peak summer demand
  - Support for implementation of new technologies – smart meters for time-of-use pricing
- Promotion of conservation programs by CEA member utilities for their larger commercial, industrial and direct customers
- Demand Side Management
  - can be a least cost option,
  - postpones the development of new power plants,
  - improves energy efficiency
- Partnership among CEA, NRCan and utilities in promotion of ENERGY STAR qualified light fixtures
Smart Grid

- A suite of information-based applications through increased automation of the electricity grid and the underlying automation and communication infrastructure itself
- Smart grid is posed to deliver grid resilience, environmental performance, and/or operational efficiencies
- Design and implementation of the smart grid integrated system aims to achieve desired customer priorities, interoperability with legacy infrastructure, and be appropriate for use with respect to geographical location and other needs
- Key characteristics or capabilities:
  - Demand response, facilitation of distributed generation, facilitation of electric vehicles, optimization of asset use, and problem detection and mitigation
  - Capabilities supported by development of hard infrastructure, soft infrastructure through stakeholder engagement
  - Expected results in new service offerings, reduced delivery charges, and faster response time
- Security, privacy, implementation cost, and stakeholder engagement requires *collaboration* among vendors, policy-makers, regulators and utilities
Human Resources – Commitment by CEA member utilities

• Providing safe environment for general public as well as ensuring health and safety of employees and contractors in the workplace,
• Support a fair, respectful and diverse workplace for our employees and contractors, and investing in human resources
• Partnering with communities and stakeholders, communicating and engaging in a transparent and timely manner
• Engaging Aboriginal Communities while respecting their culture and traditions
### Economic Value

<table>
<thead>
<tr>
<th>Economic Indicators for 2015</th>
<th>All Canadian Sectors Contribution</th>
<th>Canadian Electricity Sector Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP (billions chained 2007 dollars)</td>
<td>1,652.1</td>
<td>27.9</td>
</tr>
<tr>
<td>Merchandise Exports (dollars x 1,000,000)</td>
<td>525,304</td>
<td>3,137</td>
</tr>
<tr>
<td>Merchandise Imports (dollars x 1,000,000)</td>
<td>547,765</td>
<td>306.6</td>
</tr>
</tbody>
</table>
# Electricity in Canada at a Glance

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Generation in 2014 (Twh)</td>
<td>627.8</td>
</tr>
<tr>
<td>Total Demand in 2014 (Twh)</td>
<td>491.2</td>
</tr>
<tr>
<td>Average Price in 2014 (¢/kWh) Residential</td>
<td>12.15</td>
</tr>
<tr>
<td>Average Price in 2014 (¢/kWh) Industrial</td>
<td>7.31</td>
</tr>
<tr>
<td>Canada – US trade volume in 2014 (Twh): exports/imports</td>
<td>58/12.8</td>
</tr>
<tr>
<td>Canada – US trade revenue in 2014 (billions $): exports/imports</td>
<td>2.9/0.6</td>
</tr>
<tr>
<td>Capital Expenditure on New/Refurbished Infrastructure in 2010 (billion $)</td>
<td>8.8</td>
</tr>
<tr>
<td>Environmental Expenditure in 2012 (million $)</td>
<td>1301.6</td>
</tr>
<tr>
<td>GHG emissions from Public Electricity and Heat Production Sector (CO₂, CH₄ and N₂O eq. Mt) in 2013</td>
<td>85</td>
</tr>
</tbody>
</table>
For more information, contact:

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Ottawa, ON   K1P 5H9

613 230 9263

info@electricity.ca