



CANADIAN ELECTRICITY REGULATION

PRESENTATION TO BRAZIL MARKET MODERNIZATION INITIATIVE

CANADIAN ELECTRICITY CONTEXT



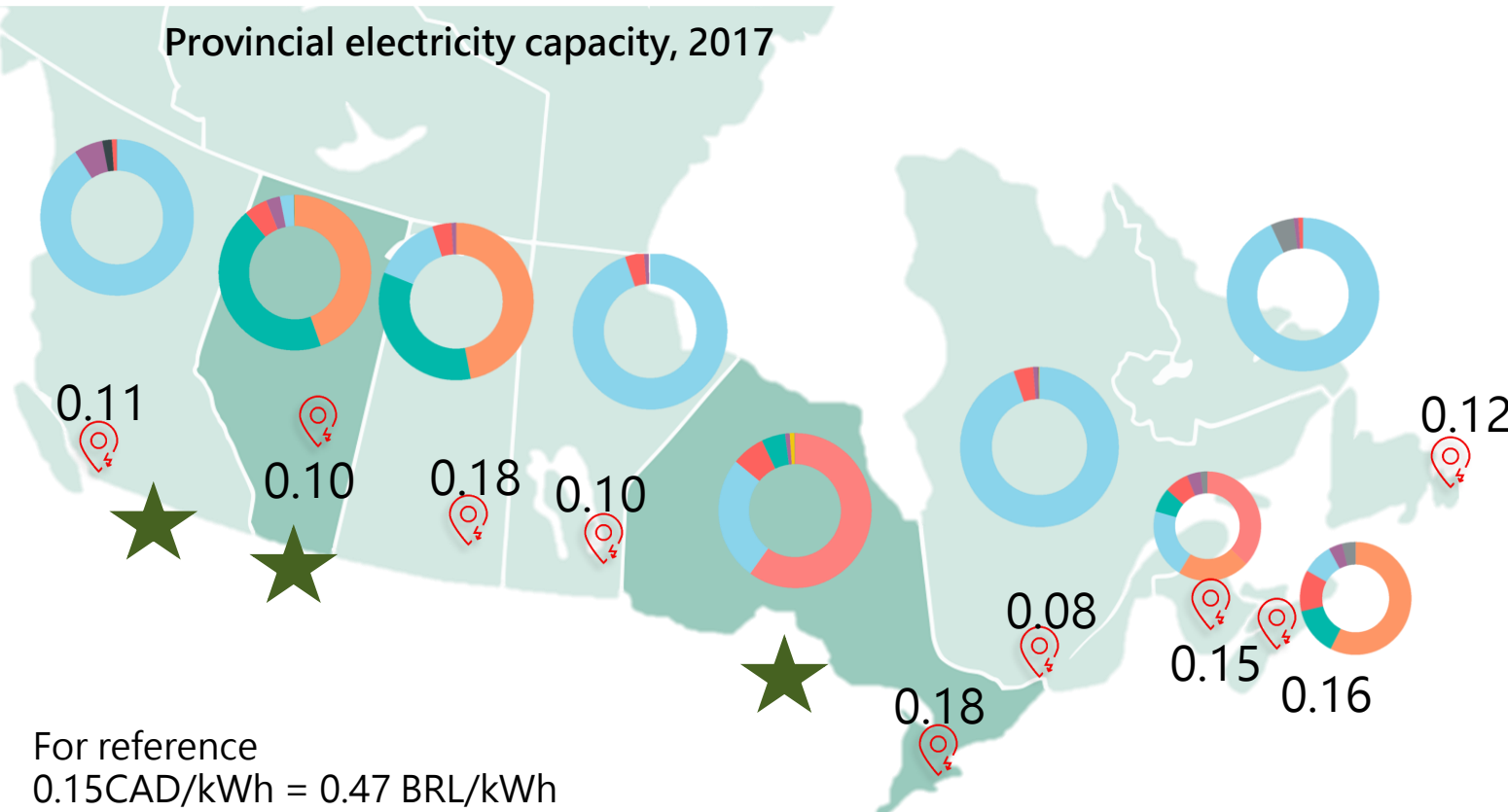
Canadian constitutional separation of electricity jurisdiction

- Economic development and regulation resides with provincial and territorial governments
- Environmental and cross-boundary regulation resides with federal government

Canadian policy environment

- The Pan-Canadian Framework on Clean Growth and Climate Change (PCF) was developed to meet Canada's commitments under the Paris Agreement
- The PCF introduced a price on carbon pollution (\$10/tonne in 2018 scaling to \$50/tonne in 2022) with proceeds to be returned to jurisdictions
- Performance based coal-fired and gas-fired electricity generation regulations were introduced
- Enhance inter-provincial transmission capacity
- Modernize electricity systems with accelerated adoption of smart-grid technologies
- Reduce reliance on diesel in the north and in indigenous communities

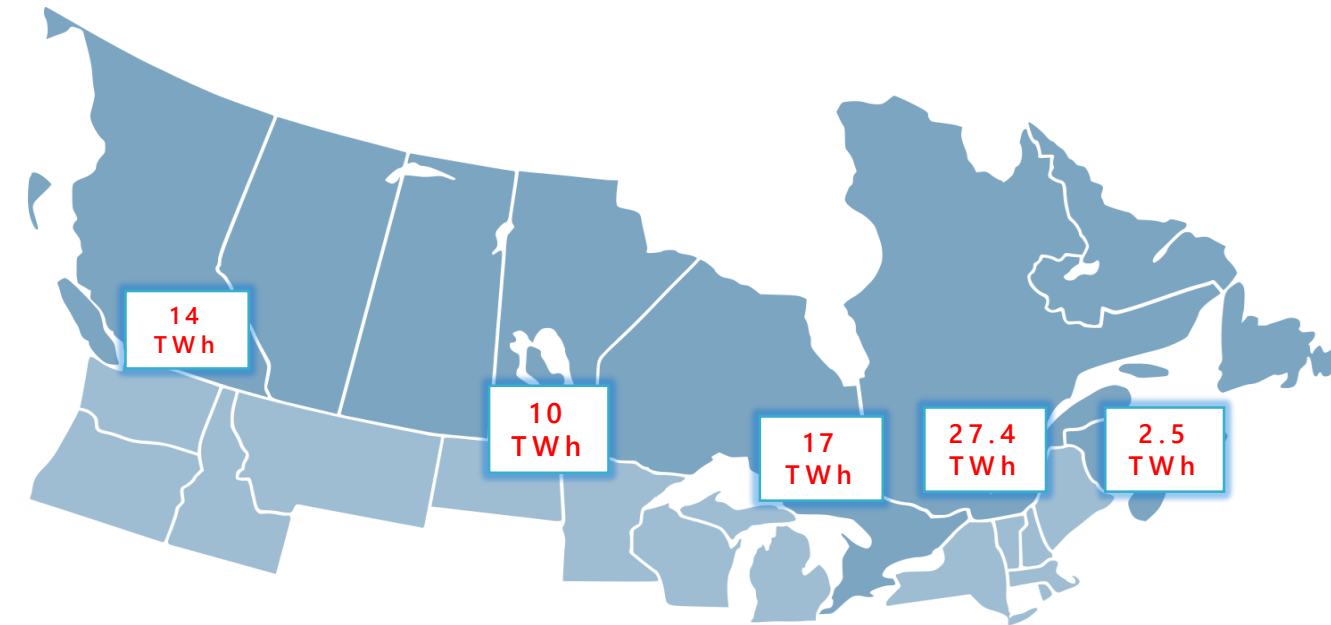
Provincial electricity capacity, 2017



For reference
0.15CAD/kWh = 0.47 BRL/kWh



INTERNATIONAL INFLUENCE



Canadian utilities use North American Electric Reliability Corporation (NERC) standards

- NERC is recognized by Canadian regulators as a standards authority for the Bulk Power System
- NERC annually assesses and reports on reliability, adequacy and risks seasons for summer and winter seasons and a 10-year period

Canadian utilities participate in U.S. Federal Energy Regulatory Commission (FERC) regulated markets

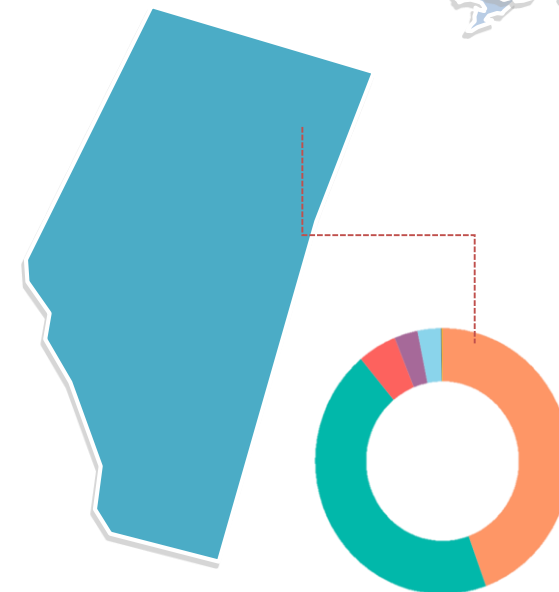
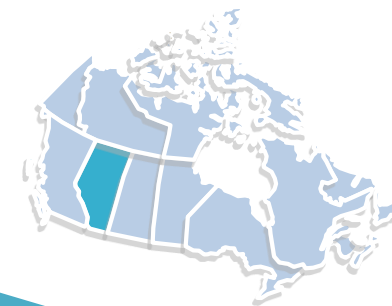
- FERC-regulated markets require reciprocity of non-regulated utilities in order to sell into markets
- FERC-regulated bulk power markets are highly competitive and transparent
- In general, FERC-regulated markets have a high time resolution energy market (5 minute increments), day-ahead and real-time transactions and ancillary services markets
- FERC-regulated markets and Canadian markets have Open-Access Transmission Tariff requirements.




CASE 1: ALBERTA ELECTRICITY

Alberta's electricity policy environment

- Alberta operates a competitive wholesale electricity market
 - Energy only model plus ancillary services market
 - Capacity model was considered but recently discarded
- Alberta committed to phase out coal-fired electricity generation by 2030
 - This will cause the retirement of ~38% of Alberta's capacity and ~50% of energy
- Alberta has committed to produce 30% renewable energy by 2030
 - Renewable Electricity Program (REP 1) delivered 600MW of wind with weighted average price of \$37/MWh (lowest in Canada to date) (\$37 CAD = ~116 BRL)
 - *REP 2 required Indigenous equity ownership and delivered 363 MW of wind with weighted average price of \$38.69/MWh
 - REP rounds are overseen by an independent, third-party Fairness Advisor

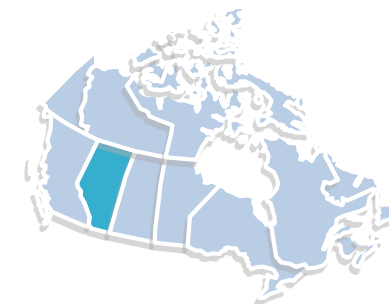


 Edmonton

 \$0.1086 / kWh



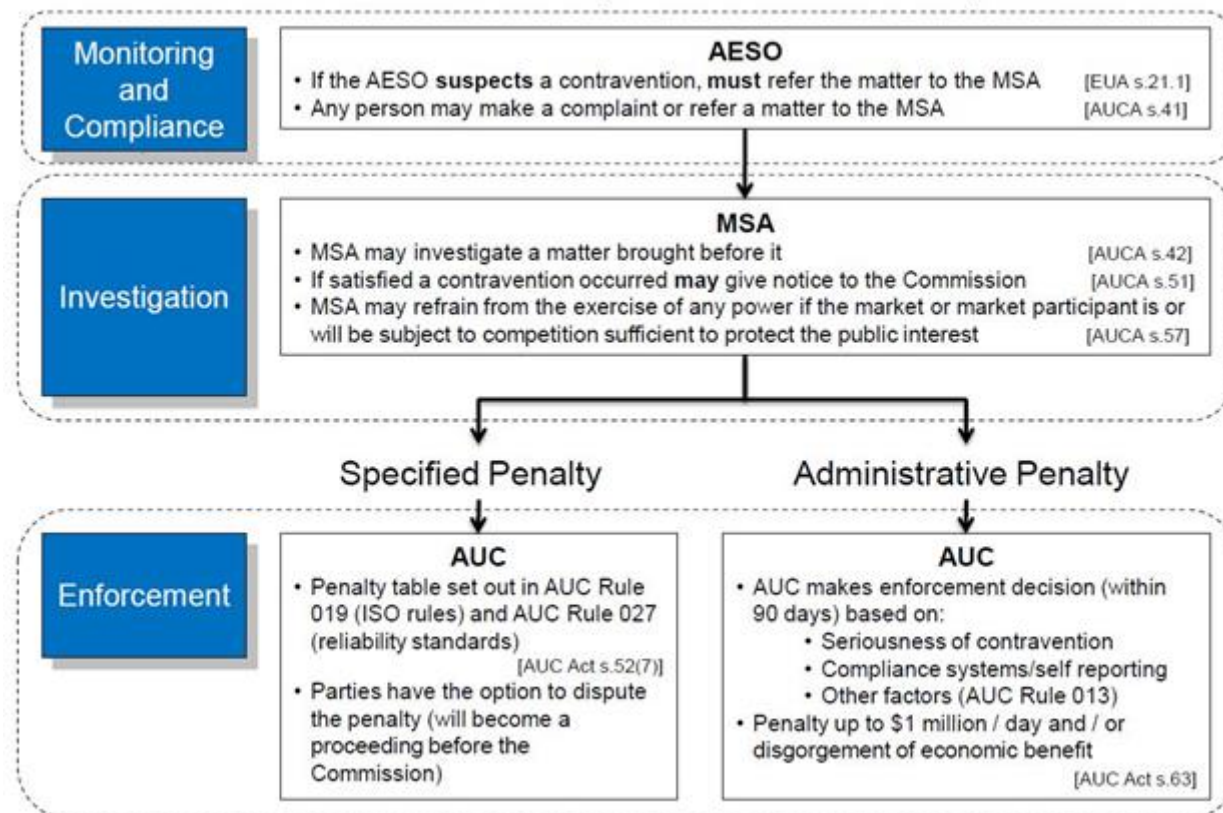
CASE 1: ALBERTA ELECTRICITY



Alberta's regulatory environment

- The Alberta Electric System Operator (AESO) manages and operates the provincial power grid, by:
 - Managing and operating the power grid
 - Manage and operate energy markets
 - System planning and connecting customers to the grid
- The Alberta Utilities Commission (AUC) is responsible for provincial electricity regulation
 - Reviews and approves transmission and distribution construction, operation and decommission decisions, according to system needs identified by the AESO
 - Approves applications for siting of new power generation

- The Market Surveillance Administrator (MSA) monitors the electricity market to ensure it operates in a fair, efficient and openly competitive manner.

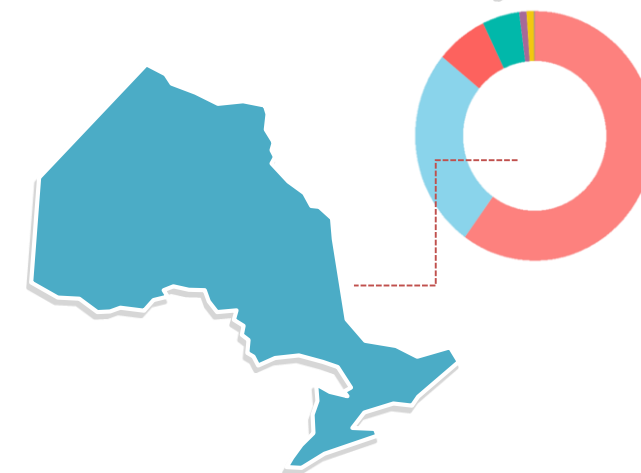




CASE 2: ONTARIO ELECTRICITY

Ontario's electricity policy environment

- Ontario operates a hybrid wholesale electricity market
 - Regulated portion which includes nuclear and hydro generation
 - De-regulated portion which operates a competitive market
 - Retail consumers have time of use tariffs
- Ontario retired coal-fired electricity generation in 2014
 - Retired 7,587 MW of coal, which provided 25% of Ontario's energy in 2003
- Ontario is in the process of refurbishing nuclear units
- Ontario tried to accelerate the deployment of renewables via the Green Energy Act, 2009.



 Toronto

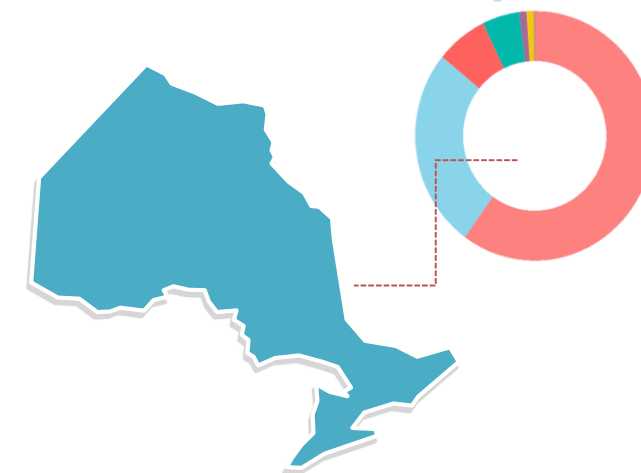
 \$0.1888 / kWh



CASE 2: ONTARIO ELECTRICITY

Ontario's regulatory environment

- The Independent Electric System Operator (IESO) ensures the reliability of the power system, by:
 - Managing and operating the power grid
 - Manage and operate the wholesale electricity market
 - System planning and promoting energy efficiency
 - As Ontario's designated Smart Metering Entity (SME), operates the meter data management repository
- The Ontario Energy Board (OEB) is responsible for provincial electricity regulation
 - Reviews and approves transmission and distribution construction, operation and decommission decisions, according to system needs identified by the AESO
 - Approves applications for siting of new power generation
- The Market Surveillance Panel (MSP), with support from IESO's Market Assessment and Compliance Division monitors the electricity market that might have an adverse impact on market efficiency of effective competition.



Toronto



\$0.1888 / kWh



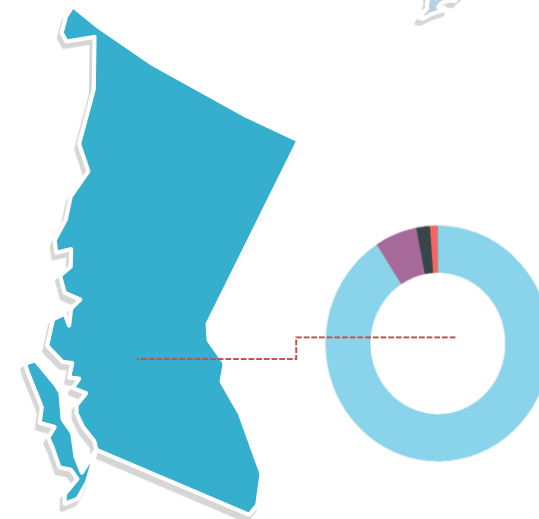
CASE 3: BRITISH COLUMBIA ELECTRICITY

British Columbia's electricity policy environment

- British Columbia Hydro and Power Authority (BC Hydro), a crown corporation, is the largest electric utility in the province
 - It is responsible for generation, transmission and distribution
 - It is also the provincial Balancing Authority and soon to be BC's Reliability Coordinator
 - BC also has some Independent Power Producers
- CleanBC is a provincial strategic electrification plan

CleanBC programs, rebates and incentives will:

- Make buildings more energy efficient, incent heat pumps and mandate percentage use of renewable gas
- Increase industrial electrification, such as using electricity from hydro to power natural gas production and liquefaction
- Incent uptake of electric vehicles

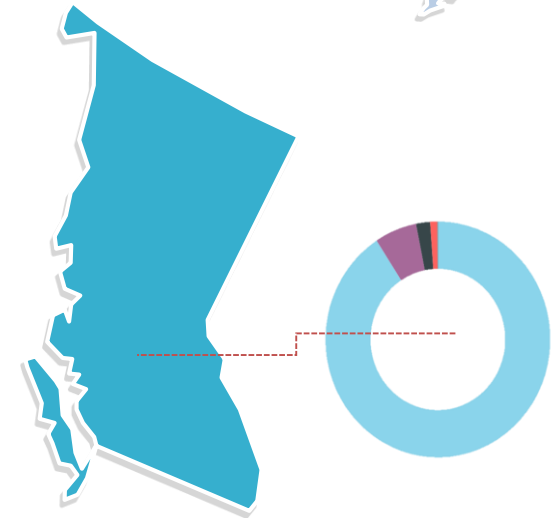
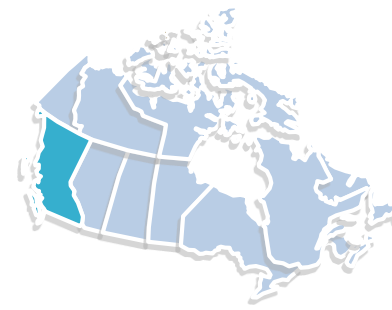




CASE 3: BRITISH COLUMBIA ELECTRICITY

British Columbia's regulatory environment

- The British Columbia Utilities Commission (BCUC) is the provincial regulatory agency. It ensures customer's receive safe, reliable services at fair rates, by:
 - Reviewing and approving revenue requirements
 - Reviewing and approving project applications to ensure public interest
- PowerEx is a energy marketer wholly owned by BC Hydro
 - All energy trading undertaken in US markets are subject to US federal regulatory oversight
- The BCUC was directed to conduct a public inquiry into the decision to construct Site C, an 1100 MW hydro electric generating station
 - The BCUC received direction via an Order in Council (OIC) from the BC government, including a Terms of reference outlining the scope of the inquiry (August 2017)
 - Results of the inquiry were published in November 2017
 - BCUC recommended the project continue





CONSIDERATIONS FOR **ELECTRICITY** REFORM

- Policy alignment is required
 - Alignment and sequence matter
- Transparency & price signals
 - Investment horizons are longer-term
- Respect regulatory process and administrative law