North American Electricity Futures

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Agenda

1. Canada-U.S. electricity relationship
   • Background
   • Benefits

2. Shared challenges & opportunities in North American context
   • Infrastructure
   • Emissions reduction
   • Reliability & security
1. Canada-U.S. Electricity Relationship – Background

Transmission Interconnections in Canada

Legend
- 115-150 kV
- 230-245 kV
- 345 kV
- 450-500 kV
- 735-765 kV

Note: Location of the arrows on the map do not reflect the precise location of the corresponding interconnection.
The Integrated North American Transmission Grid

Map copyright Canadian Electricity Association. Lines shown are 345 kV and above. There are numerous interconnections between Canada and the U.S. under 345 kV that do not appear on this map.
Data displayed are in gigawatt-hours. Source: National Energy Board, Electricity Exports and Imports, 2014
• Integration and trade are enabled by common rules of the road:
  o Open access
  o Reliability standards
  o Market rules
Electricity Generation in the U.S. and Canada by Fuel Type (2013)

**UNITED STATES**
Total Electricity Generation in 2013 = 4058 TWh

- Coal 39%
- Natural Gas 27.4%
- Nuclear 19.4%
- Hydroelectric 6.6%
- Other Renewables 6.2%
- Petroleum 0.7%
- Other 0.3%
- Other gas 0.3%

**CANADA**
Total Electricity Generation in 2013 = 611 TWh

- Hydro 63%
- Fossil 19%
  (coal, natural gas, petroleum)
- Nuclear 16%
- Wind 1%
- Other 0%

Numbers may not sum to 100 percent due to rounding.
Canada-U.S. Electricity Relationship – Benefits

• **Reliability**
  - Operational efficiencies; supply diversity; ability to manage oversupply, loss of supply and extreme contingencies.

• **Affordability**
  - Consistent observation from U.S. market monitors – importing electricity from Canada reduces wholesale power costs for U.S. consumers.

• **Emissions reduction**
  - Electricity imports from Canada help displace U.S. GHG emissions.

• **Support for development & optimization of renewables**
  - Cross-border marriage of wind and water (e.g. Manitoba exports are critical to wind growth and integration in U.S. Midwest).
2. Shared Challenges, Opportunities in N. American Context

(i) Infrastructure investment

• Conference Board of Canada – C$350 billion required by 2030.
  o Average annual investment = C$15 billion (highest in history).
• Similar figures in U.S. EEI estimates US$90 billion annually.
Drivers

• Reinforcing, modernizing aging system
• Meeting current and future demand growth
• Integrating new sources of non-emitting and variable generation

Challenges

• Regulatory
• Public acceptance and evolving relationship with customer
• Stakeholder consultation
• Who pays?
Solutions & opportunities

• Modernized and efficient regulatory review.
• Policy and regulatory environment that looks to the long-term.
• Strengthened, diversified regional connections and markets:
  o New U.S.-Canada interconnections (multiple projects in the queue).
• New partnership models (e.g. equity projects with First Nations).
• Maintaining openness to cross-border investment (e.g. Berkshire Hathaway acquisition of AltaLink; proposed Emera purchase of TECO Energy).
(ii) Emissions reduction

• Electricity emissions in Canada trending nowhere but downwards:
  o More hydro, renewables coming online.
  o Most stringent GHG rules for coal (926 lbs/MWh); CCS deployment.

• More integration will maximize N. America’s clean energy potential.

• Each pending and proposed Canada-U.S. transmission project would unlock new supplies of non-emitting energy.

• Clean Power Plan recognizes emissions benefits of Cdn imports.
  o Expansion and/or creation of regional carbon markets under CPP may present opportunities for additional linkages with Canadian markets.

• Positive developments in state policy:
  o Revised California RPS allows for out-of-state generation, including Canada.
  o New England increasingly interested in importing more Canadian hydropower.

• Transportation electrification also ripe for N. American cooperation.
(iii) Reliability & Security

• Risks, threats to the grid are increasingly complex & sophisticated. Bilateral cooperation therefore becoming even greater imperative.

• North American Electric Reliability Corporation (NERC) is unique success story. NERC standards set forth common, mandatory requirements for grid planning and operations (including cyber).
  o There is interest at NERC forums in prospects of including Mexico.

• NERC regime and standards are well-suited to addressing many reliability and security challenges – but not all.

• Electric utility sector welcomes legislation to facilitate greater government-industry sharing of threat information.

• Enhanced gov’t-industry partnerships (e.g. Electricity Subsector Coordinating Council) are showing effectiveness, nimbleness in improving sector’s security posture. Will be critical moving ahead.
QUESTIONS?

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