Canadian Electricity Association | Association canadienne de l'électricité

September 18, 2014

U.S. Department of Energy – Quadrennial Energy Review

Comments of the Canadian Electricity Association

I. Introduction

On behalf of its members, the Canadian Electricity Association ("CEA") is pleased to offer these comments on the U.S. Department of Energy's ("DOE") Quadrennial Energy Review ("QER").

DOE has stated that "the QER will provide a multiyear roadmap that outlines Federal energy policy objectives, legislative proposals to Congress, Executive actions, an agenda for [research, development and demonstration] programs and funding, and financing and incentive programs."[1] The QER is intended to advance the core U.S. energy goals of economic competitiveness, energy security and environmental responsibility, and to provide a four-year planning horizon to enable such energy infrastructure characteristics as minimal-environmental footprint, affordability, flexibility and robustness by 2030.[2] Transmission, storage and distribution infrastructure ("TS&D") is set to be the focus of the first QER Report, scheduled for release in 2015.

The QER is a commendable initiative and CEA appreciates the opportunity to participate in the associated stakeholder process. As noted in the Presidential Memorandum establishing the QER, major transformations are occurring in how energy is supplied, marketed and used.[3] Challenges to maintaining, operating and renewing infrastructure are numerous. Many are unprecedented.

However, this period of transformation validates the old adage that with great challenge comes great opportunity. Ongoing and impending decisions on how to address the myriad challenges confronting North America's integrated energy infrastructure represent unique opportunities. Among these is the occasion to pause and take stock of whether policy, legislative and regulatory regimes currently in place are optimally-suited to overcoming the historic challenges at hand. The QER appears to be a timely and ambitious means to achieve such an end.

In addition, CEA views the QER as a valuable opportunity to examine and pursue policy recommendations which can further enhance the numerous benefits associated with the robust level of integration between the U.S. and Canadian electric power systems. Strengthened and expanded bilateral integration can play a significant role in helping advance the core energy goals and desired characteristics for energy infrastructure which are championed in the QER.

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[1] http://energy.gov/epsa/quadrennial-energy-review-qer.

[2] http://energy.gov/sites/prod/files/2014/06/f17/qer_public_deck_june_twothree.pdf, slides 15-16.

[3] http://www.whitehouse.gov/the-press-office/2014/01/09/presidential-memorandum-establishing-quadrennial-energy-review.

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II. Description of CEA

CEA is the authoritative voice of the Canadian electricity industry, promoting electricity as a key social, economic and environmental enabler that is essential to North American prosperity. CEA members generate, transmit, distribute and market electric energy to industrial, commercial and residential customers across Canada and into the U.S. every day. Our membership includes provincially-owned and investor-owned utilities, many of which are vertically-integrated; independent power producers (several of which also own assets in the U.S.); municipally-owned local distribution companies; independent system operators; and wholesale power marketers.

III. Summary of Comments

The remainder of these comments is divided into the following sections:

- Section IV provides an overview of the interconnected and integrated nature of the U.S.-Canada relationship on electricity, and highlights the mutual benefits thereof (e.g. enhanced reliability and affordability of supply, expanded access to low-carbon resources, and maximized emissions reductions).

- Section V summarizes the need for massive infrastructure renewal across the electricity system in North America and examines the great potential for new U.S.-Canada interconnections in this context.

- Section VI offers specific policy recommendations in support of the core energy goals and desired characteristics for energy infrastructure which the QER seeks to promote.

  Namely, CEA recommends that the QER:

  1. As a fundamental principle of policy, recognize the interdependency of the U.S. and Canadian segments of the larger North American grid;

  2. Avoid erecting barriers that may inhibit inter-jurisdictional electricity trade;

  3. Update and enhance the efficiency of the U.S. permitting process for cross-border electricity infrastructure and trade;

  4. Affirm and support the existing framework in place for the development of mandatory electric reliability standards for the North American grid;

5. Recommend actions to enhance public-private sector, as well as government-to-government, coordination and sharing of timely and actionable threat information; and,

6. Expand existing U.S.-Canada programs to support research, development and/or demonstration of innovative grid modernization technologies.

Much of the content in these comments responds to specific questions raised by DOE for public input during the early phases of stakeholder outreach on the QER. For example, what are important connections and relationships with TS&D infrastructure in Canada and Mexico? And what is the potential for TS&D infrastructure changes to enable alternative, lower-carbon, and more energy-efficient energy production and use?[4]

IV. The U.S.-Canada Electricity Relationship

Electricity plays an integral role in the vibrant bilateral energy relationship, which itself is a pillar of the broader flow of two-way trade that is without compare anywhere in the world. There are more than 35 electric transmission interconnections between the Canadian and U.S. power systems, which together form a highly integrated North American grid (see Appendix 1).

These linkages between the U.S. and Canadian grids have enabled steady growth in a continent-wide electricity marketplace. Bilateral trade occurs routinely – and has occurred for decades – at a range of points across and beyond the border, with supply fulfilling demand in the most efficient, cost-effective manner possible (see Appendix 2). Such trade enables market participants to take advantage of supply diversity across the wider grid, reflected in the very different generation mixes in place in either country (see Appendix 3). System and market integration also underpin economic development on both sides of the border.

In a very real sense, the North American electricity market is borderless. Supply meets demand north-to-south or south-to-north as conditions require, to the advantage of consumers everywhere. In fact, it seems fair to argue that if planners were to start from scratch tomorrow in designing the international electric grid, the power system would be oblivious to political borders and would instead follow the dictates of economic and environmental efficiency. Under these imperatives, system flexibility is maximized, with operators able to take advantage of a wide

[4] *Supra*, slides 29 and 33.

spectrum of resources over a large control area, thereby reducing aggregate variability in both generation and demand, and mitigating price volatility.[5]

The physical linkages between the U.S. and Canada offer numerous advantages to both countries – a higher level of reliable service for customers through enhanced system stability; efficiencies in system operation and fuel management; opportunities to use power from nearby markets to address local contingencies; opportunities presented by seasonal/time zone variations associated with diversified load; and expanded access to low-carbon and competitively-priced resources.

DOE's engagement with stakeholders to date has made clear that the recommendations ultimately set forth in the QER Report will rest on a robust analytical framework. Seeking to support the data-driven approach underpinning the QER, CEA wishes to elaborate upon four specific areas in which U.S.-Canada electric grid integration advances core U.S. energy goals and presents a host of benefits to U.S. consumers.

1. Canada-U.S. Electric Integration Helps Reduce U.S. Greenhouse Gas Emissions.

<u>Canada – A World Leader in Non- and Low-Emitting Generation</u>

With abundant hydropower resources, a sizeable nuclear fleet and expanding renewable production, Canada boasts one of the cleanest supply mixes in the world, with approximately 80% non-emitting generation.

Canada's portfolio is set to shift even further towards a lower-carbon profile, as a result of new federal regulations prohibiting the construction of new coal-fired plants without carbon capture and storage ("CCS") technology and requiring existing plants to shut down following a maximum of 50 years of operation (again, unless CCS technology is applied). It should be noted that the performance standard for the intensity of carbon dioxide ("CO_2") emissions established in these regulations – 420 tonnes per gigawatt-hour[6] – represents the most stringent regulation of greenhouse gases ("GHGs") from coal units anywhere in the world.

With Canada's coal-fired regulations finalized in 2012 and scheduled to take effect in 2015, new regulations limiting CO_2 emissions from natural gas-fired generation are also pending and will likewise be based upon this rigorous standard of performance.

[5] Hal Harvey and Sonia Aggarwal. "America's Power Plan: Rethinking Policy to Deliver a Clean Energy Future." (September 2013), p. 15. http://americaspowerplan.com/site/wp-content/uploads/2013/10/APP-OVERVIEW.pdf.
[6] This figure is equivalent to 926 lbs/megawatt-hour.

In addition to action at the federal level in Canada, there are numerous activities underway with respect to CO_2 reduction in many provinces across the country. For example:

- British Columbia ("BC"), Alberta and Québec have all applied a price on carbon: BC, through the establishment of a C$30 per tonne of CO_2 equivalent ("tCO_2e") carbon tax; Alberta, through regulation of major GHG-emitting facilities (for which payment of a C$15/$tCO_2e$ fee is one compliance option); and Québec, through implementation of a provincial carbon trading market, which is linked with California's cap-and-trade program. (The most recent auction of carbon allowances in Québec resulted in a clearing price of C$11.39).[7]

- In Saskatchewan, the provincially-owned utility SaskPower is on the cusp of placing in-service the world's first commercial-scale, fully-integrated CCS system at Unit 3 of its Boundary Dam Power Station.[8] This CCS project represents a total investment of C$1.35 billion from SaskPower, and the federal and provincial governments.

- In Manitoba, the government's environmental protection strategy contemplates new electric generation and transmission projects which will bring online more than 2,300 MW of hydroelectric capacity. This will complement other ongoing GHG-reduction efforts in the province, including consideration of a cap-and-trade program.[9]

- Whereas 7,500 MW of coal represented approximately 25% of provincial capacity in 2003, Ontario burned its last supply of coal in April 2014, making it the first jurisdiction in North America to eliminate the fuel as a power generation source. This generation has been replaced by a mix of non- and low-emitting resources such as natural gas, hydropower, nuclear, wind and solar.[10]

- Central to the GHG-reduction and climate change plan for New Brunswick is the development of non-emitting energy – in particular, renewable and nuclear.[11] The province has committed to a Renewable Portfolio Standard ("RPS") of 40% by 2020, while the recent refurbishment of the reactor at Point Lepreau Generating Station means New Brunswick is set to have a 75% non-emitting generation mix by the same year.

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[7] http://www.mddelcc.gouv.qc.ca/changements/carbone/ventes-encheres/resultats-vente20140829-en.pdf.
[8] http://www.saskpowerccs.com/ccs-projects/boundary-dam-carbon-capture-project/.
[9] http://greenmanitoba.ca/climate-change-action-manitoba/.
[10] http://news.ontario.ca/mei/en/2014/04/creating-cleaner-air-in-ontario-1.html.
[11] http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Climate-Climatiques/ClimateChangeActionPlan2014-2020.pdf.

- Finally, the provinces of Nova Scotia and Newfoundland and Labrador are embarking on an ambitious project to lower their respective GHG emissions profile by linking their provincial transmission systems and leveraging investments in thousands of MWs of new hydroelectric capacity. The Maritime Link, an underwater cable between the island of Newfoundland and Nova Scotia, will facilitate diversification in Nova Scotia's mix as it transitions away from coal in order to comply with federal GHG regulations and to achieve the 40% by 2020 requirements for renewable energy in the province.[12] Meanwhile, the 3000 MW of new hydro capacity associated with development of the Lower Churchill Project in Labrador is estimated to have region-wide CO_2 reduction potential of 16 million metric tons per year.[13]

The combined effect of the federal and provincial action listed above will be to further reinforce the status of Canada's electrical generation mix as one of the cleanest in the world.

<u>A Robust Cross-Border Trading Regime</u>

Historically, electricity exports to the U.S. have represented 5-10% of total electric generation in Canada. The majority of these exports involve the sale of surplus output from provinces with major hydropower resources, such as BC, Manitoba and Québec. Export volumes from Ontario have also risen more recently, making the province the second largest exporter for several years. In 2013, nuclear and hydropower comprised over 80% of Ontario's supply.[14]

Over the years, this dynamic cross-border electricity trading regime has yielded tangible benefits in terms of assisting U.S. customers in transitioning to a lower-carbon economy. For example, from 2006-2012, exports of hydropower from Manitoba to utilities in the U.S. helped to reduce GHG emissions in the U.S. Midwest by over 47 million metric tons. Likewise, in recent years, increased sales of hydropower from Québec to neighbouring markets have resulted in the avoidance of 53 million metric tons of GHG emissions – roughly tantamount to removing 13 million vehicles from the road.[15]

And in many U.S. states and regions, the importation of low-carbon Canadian electricity remains an appealing option to diminish reliance on older or less efficient fossil-fuel based energy systems even further. In Massachusetts, for example, the state's clean energy and climate plan

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[12] http://www.novascotia.ca/nse/climate-change/.
[13] http://www.nr.gov.nl.ca/nr/energy/electricity/index.html#lch.
[14] http://www.ieso.ca/Pages/Media/default.aspx.
[15] http://www.mitc.com/services/documents/HydroQuebec_000.pdf.

calls for expanding clean energy imports from Canada, with expected economy-wide GHG reductions totalling 5.1 million metric tons (or 5.4% of overall state emissions) by 2020.[16]

Similarly, there has been a recent trend of formal recognition of imported hydropower from Canada under state-level RPS standards and other renewable energy policies:

- June 2010 – Vermont revised its statutory definition of "renewable energy" to include hydroelectric generation of any capacity, including imported hydropower from Québec.[17]

- March 2011 – The Minnesota Public Utilities Commission authorized a state utility to apply environmental attributes associated with a new purchase agreement for hydropower from Manitoba towards fulfillment of the utility's state renewable energy requirements.[18]

- July 2011 – Wisconsin modified its RPS to grant recognition to specific large hydroelectric facilities in Manitoba.[19]

- June 2013 – Connecticut amended its RPS to include imported hydropower from Canada as a qualifying renewable energy resource under specified circumstances.[20]

Moreover, Massachusetts' current administration has been leading a joint effort with its New England neighbours to explore ways to increase imports from large hydropower resources into the region.[21] In step with this initiative, the New England States Committee on Electricity ("NESCOE") released an analysis in November 2013 of the economic and environmental impacts associated with hypothetical incremental levels of hydroelectric imports from Québec and Newfoundland and Labrador.[22] Under different scenarios of increased imports during a 2014-2029 study period, the analysis concluded that average annual electric sector GHG emission reductions in New England would range from 1.3 million to 8.0 million metric tons, with cumulative reductions ranging from approximately 58 million to 97 million metric tons.

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[16] http://www.mass.gov/eea/docs/eea/energy/2020-clean-energy-plan.pdf, p. 45.
[17] http://www.leg.state.vt.us/docs/2010/Acts/ACT159.pdf.
[18] https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={51ACB5C0-3C14-48EA-A8D0-BCA0D7EDFA89}&documentTitle=20113-60294-01.
[19] http://docs.legis.wisconsin.gov/2011/related/acts/34.pdf.
[20] http://www.cga.ct.gov/2013/FC/pdf/2013SB-01138-R000879-FC.pdf.
[21] http://www.mass.gov/eea/pr-2013/ne-hydro.html.
[22] http://www.nescoe.com/uploads/Hydro_Imports_Analysis_Report_01_Nov__2013_Final.pdf, 1-1.

The above examples are merely a sampling of the many ways in which non- and low-emitting electricity resources in Canada have provided and will continue to provide opportunities for meaningful reductions in GHG emissions from the U.S. electric power sector.

2. Canada-U.S. Electric Integration Enhances Reliability of Supply for U.S. Consumers.

As noted above, the interconnected nature of the North American grid offers numerous reliability-related advantages to both countries.

The physical and market linkages between the U.S. and Canada are made possible by adherence to a common set of operational and commercial rules, especially the following: (1) electric reliability standards developed by the North American Electric Reliability Corporation ("NERC"), which are mandatory and enforceable in all provinces with a footprint in the larger North American bulk power system ("BPS"); and (2) the standard market practices and protocols utilized by Independent System Operators ("ISOs"), Regional Transmission Organizations and other U.S. market participants. Compliance with these terms ensures greater liquidity in markets and a greater diversity of supply options for customers throughout North America.

While a relatively small share of U.S. power consumption is composed of imports from Canada, these sales are nevertheless critical to the U.S. supply mix in many areas in close proximity to the border. For example, in 2010 exports from Canada represented the following percentages of total retail sales in these jurisdictions: Vermont, 38%; Maine, 18%; Minnesota and North Dakota (combined), 12%; New England (all states), 10%; New York, 6%; and Michigan, 6%.[23]

Other illustrations of the reliability benefits associated with cross-border electricity trade include the complementarity in the operational characteristics of segments of the grid on either side of the border. Many regions in Canada have winter-peaking systems, thus enabling them to contribute available surplus to adjoining U.S. regions which experience peak demand season during the summer.

Similarly, Canada-U.S. trade can serve to increase the diversity of supply options available in certain regions confronting unique challenges. For example, importation of electricity from Canada in New England has helped to mitigate this region's growing reliance on constrained natural gas supply and delivery systems. Having flexible import resources to call upon from Canada is vital to the reliable operation of New England's electric system, as the region remains

[23] National Energy Board, Electricity Exports and Imports (2010) and U.S. Energy Information Administration, U.S. States, State Profiles and Energy Estimates, Exports and Imports (2010). See Appendix 3 for presentation of this data in table form.

dependent on natural gas for approximately 50% of its power generation needs. Moreover, the U.S. Energy Information Administration ("EIA") reported in August 2014 that New England may continue to rely on an increasing amount of imported hydropower from Canada in order to manage the impending retirement of a significant amount of fossil and nuclear capacity.[24]

Likewise, the importation of electricity from neighbouring Canadian jurisdictions was critical to the reliability of power supplies for several U.S. states and regions during the severe "polar vortex" events experienced in the winter of 2013-2014.[25]

In a variety of ways, cross-border integration is therefore critical to the reliability of the North American transmission network and to the energy security of several U.S. regions.

3. Canada-U.S. Electric Integration Enhances Affordability of Supply for U.S. Consumers.

For years, electricity imports from Canada have served as a cost-effective resource able to compete with a diverse set of supply options in both bilateral and wholesale power markets across the U.S.

This fact has been acknowledged in numerous ways by U.S. customers purchasing Canadian power and those entrusted with safeguarding their interests. Within the expansive community of U.S. voices attesting to the cost-effectiveness of transactions with Canadian market participants, CEA wishes to commend the following examples for DOE's consideration:

- In its most recent assessment of competitive performance of the ISO New England electricity markets, the External Market Monitor concluded that the importation of electricity from Québec and New Brunswick "reduces wholesale power costs for electricity consumers in New England."[26]

- The aforementioned NESCOE study of incremental hydroelectric imports from Québec and Newfoundland and Labrador found average annual economic benefits associated with reduced electricity prices in New England ranging from US$103 million to US$471

[24] http://www.eia.gov/todayinenergy/detail.cfm?id=17671.
[25] U.S. Federal Energy Regulatory Commission. Technical Conference on Winter 2013-2014 Operations and Market Performance in RTOs and ISOs. (April 1, 2014). Docket No. AD14-8-000. Transcript available: http://elibrary.ferc.gov/idmws/file_list.asp?accession_num=20140408-4002.
[26] http://iso-ne.com/static-assets/documents/markets/mktmonmit/rpts/ind_mkt_advsr/isone_2013_emm_report_final_6_25_2014.pdf, p. 117.

million, with cumulative reductions in customer costs during the study period ranging from US$3.325 billion to US$5.652 billion.[27]

- The Market Monitoring Unit ("MMU") for the New York ISO has consistently observed a correlation between availability of electricity imports from adjacent Canadian jurisdictions and reduced market prices. For example, after a 20% increase in the market price from 2009-2010, the MMU identified a diminshed level of imports from Québec as a key factor contributing to increased energy prices.[28]

- A 2012 independent analysis of the economic impacts of the proposed Champlain Hudson Power Express transmission line in New York – a 330-mile underwater and underground line that will deliver hydropower from Québec into New York City – projected annual savings to consumers of more than US$650 million in the form of reduced electricity costs.[29]

- In late 2013, the Midcontinent Independent System Operator ("MISO") released a study examining whether the costs associated with enhanced transmission capacity between Manitoba and MISO would enable greater penetration of wind resources across the organized market. The study concluded that significant benefits would be derived from adding new capacity, including weighted average load cost savings of US$430 million annually through 2027.[30]

In addition to the above, it is worth emphasizing that the majority of Canada-U.S. trade is transacted through the spot market. In 2013, over 75% of trade was conducted through these markets, with long-term contracts only representing about 23% of trading activity.[31]

It is clear, then, that the marketing of electricity across the border has a proven track record of helping to maintain the affordability of power supplies in many U.S. regions.

4. Canada-U.S. Electric Integration Helps Enable Development of Clean Energy in the U.S.

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[27] *Supra*, NESCOE.
[28] http://www.potomaceconomics.com/uploads/nyiso_reports/NYISO_2010_Final.pdf, p. iii.
[29] http://www.chpexpress.com/docs/Analysis-of-the-Macroeconomic-Impacts-of-the-Proposed-CHPE-Project.pdf, p. 4.
[30] https://www.misoenergy.org/_layouts/MISO/ECM/Download.aspx?ID=160821, p. 49.
[31] National Energy Board, Electricity Exports and Imports (2013). http://www.neb-one.gc.ca/CommodityStatistics/ViewReport.aspx.

In this regard, a compelling example is the marriage of wind and water which occurs in many cross-border contexts across North America. Often the storage capability of hydropower capacity in Canadian provinces can be used to firm-up the development of wind and other intermittent renewables in adjacent U.S. states.

The recent establishment of a long-term power purchase agreement between Manitoba Hydro and Minnesota Power for this exact purpose is an excellent illustration of this common synergy between the Canadian and U.S. grids. This agreement includes a "wind storage" provision, entitling Minnesota Power to deliver generation from its North Dakota wind farms into Manitoba, where the energy can be absorbed into the province's hydroelectric system.[32] In multiple public forums, Minnesota Power has repeatedly underscored how this agreement is vital to its plans to maximize the operational efficiency of its existing wind resources and to further expand its wind development in the Midwest.[33]

Elsewhere, this wind-water synergy is yielding or is set to yield similar sets of benefits in ways which are specific to the needs and interests of the local jurisdictions involved. In New York, for example, a long-standing plank of the current state administration's energy platform has been the addition of new transmission capacity to enable the purchase of competitively-priced, renewable hydro from Canada to complement the sale of surplus energy from upstate wind resources.[34]

In sum, the benefits of a shared, integrated electricity system to both Canada and the United States are manifest – whether in regards to reliability, affordability, environmental impacts or economic development. CEA views these benefits as being very much in alignment with the chief goals underlying the QER. As such, the QER should seek to build upon and expand these benefits in the policy recommendations it offers for future U.S. Federal Government action.

V. The Need for Massive Electricity Infrastructure Renewal across North America

It's often said that the North American electricity grid is "the world's largest machine." An immense network of power lines, generation facilities, and related communications systems, it is arguably the most significant achievement in modern engineering. It underpins the economy, national security and public health of the 350 million people it serves on an around-the-clock basis, making it a critical enabler of the quality of life enjoyed in Canada and the United States.

[32] http://www.mnpower.com/Content/Documents/Company/PressReleases/2011/20110524_NewsRelease.pdf.

[33] For example, see Minnesota Power's May 2012 comments to the U.S. Senate Energy and Natural Resources Committee on the *Clean Energy Standard Act of 2012*: http://www.gpo.gov/fdsys/pkg/CHRG-112shrg74903/pdf/CHRG-112shrg74903.pdf.

[34] http://webiva-downton.s3.amazonaws.com/487/89/e/798/andrew_cuomo_power_ny.pdf, p. 8.

Like anything man-made, the grid requires its fair share of maintenance and servicing. In recent years, however, utilities in North America have not always been granted the ability to invest in electric infrastructure in a manner which has kept up with population and demand growth, the proliferation of cyber and physical security threats, advances in technology, or the evolving expectations of consumers – who rely more and more on the electricity system to power their means of livelihood and leisure.

Time to Invest

In Canada, studies have found that upwards of C$350 billion is needed to refurbish, renew and replace electricity infrastructure through 2030.[35] This translates into an average annual investment requirement of C$15 billion – the highest in the country's history.

CEA acknowledges that this challenge is by no means unique to Canada. In the United States, the sector is also confronting a daunting task to fund record levels of capital expenditures. According to the Edison Electric Institute ("EEI"), U.S. investor-owned utilities spent an unprecedented US$90.3 billion in 2013 alone.[36]

Governments in the U.S. and Canada need to think long term, as electricity infrastructure projects are capital-intensive, with long lead times and technology-development cycles. The electricity industry renews and replaces its infrastructure at a much slower capital stock turnover rate than most other industries. Government policy must therefore facilitate the necessary long-term planning in support of desired outcomes in the shape and composition of the electricity system. The QER's targeted horizon of 2030 is an electric heartbeat away. What is built today will be with us until then and well beyond.

New U.S.-Canada Interconnections – A Valuable Component in the Portfolio of Necessary Electric Infrastructure Investments

As it has done in the past, ongoing and future expansion of the physical linkages between the Canadian and U.S. segments of the grid will yield significant benefits to consumers. Where appropriate, new international power lines ("IPLs") can be key transmission solutions for reducing congestion, improving system reliability and unlocking new sources of non- and low-emitting energy.

[35] "Shedding Light on the Economic Impact of Investing in Electricity Infrastructure." The Conference Board of Canada. (February 2012). http://www.conferenceboard.ca/e-library/abstract.aspx?did=4673.

[36] Comments of the Edison Electric Institute on April 2014 Department of Energy Quadrennial Energy Review Public Meeting – "Infrastructure Resilience and Vulnerabilities – Cyber, Physical, Climate, Interdependencies." (June 10, 2014), p. 5.

The table below provides a summary of the multitude of IPL projects currently under various stages of development.

Table 1 – Current U.S.-Canada International Power Line Projects

Name	**Sponsor**	**State-Province**	**Length (miles)**	**Voltage & Capacity**	**Purpose**	**In-service Date**	**U.S. Presidential Permit Status**
Champlain Hudson Power Express	Transmission Developers Inc.	New York-Québec (QC)	333	1,000 MW, HVDC (underwater, underground, merchant)	Deliver hydro and wind energy from QC to New York City area	Fall 2017 (expected)	Application filed March 2010; issuance expected late 2014
Great Northern Transmission Line	Minnesota Power (MP)	Minnesota-Manitoba (MB)	220	500 kV, 750 MW, AC	Part of MP-MB Hydro PPA; supports building wind in North Dakota	June 2020 (expected)	Application filed April 2014
Lake Erie Connector	ITC	Pennsylvania-Ontario (ON)	60	1,000 MW, HVDC (underwater, merchant)	Deliver non- and low-emitting energy from ON, enhance service reliability	TBD	Application not yet filed
New England Clean Power Link	TDI-New England	Vermont (VT)-QC	154	1,000 MW, HVDC (underwater, underground, merchant)	Deliver renewable energy from QC into VT and New England	2019 (expected)	Application filed May 2014
Northern Pass	Northern Pass Transmission LLC	New Hampshire (NH)-Québec (QC)	187	1,200 MW, HVDC line with 345 kV AC spur	Deliver QC hydro into NH and New England	2017 (expected)	Application filed October 2010; re-filed with new route July 2013
Soule River Hydroelectric Project	Soule Hydro, LLC	Alaska (AK)-British Columbia (BC)	10	138 kV, HVAC (submarine)	Support 77 MW hydro project in AK (sales to BC or Pacific NW)	TBD	Application filed March 2013

Sources: http://energy.gov/oe/services/electricity-policy-coordination-and-implementation/international-electricity-regulatio-2; http://www.itclakeerieconnector.com/.

All of the IPL proposals listed above will support the development of non- and low-emitting energy resources, including resources located in the United States. Completion of these projects will constitute a key effort in the ongoing transition towards a lower-carbon future, and will help ensure that North America's clean energy potential is maximized, rather than left stranded.

An increased number of cross-border interconnections will also pay dividends in terms of system reliability. IPLs assist in strengthening both adequacy and security of supply, by offering customers on either side of the border more outlets to maintain sufficient resources for delivery and to withstand sudden disturbances or unanticipated losses in system equipment.

The enduring appeal of IPLs as advantageous options to pursue these benefits – as well as other benefits, specific to the economic needs and public policy interests of the local jurisdictions involved – is borne out by the number of projects currently under consideration. And, in a broader context, the pursuit of these benefits is just one of the many factors underscoring a much larger need for significant investments in new electricity infrastructure.

VI. CEA QER Policy Recommendations

In step with the above discussion, CEA respectfully offers the recommendations below, as DOE assesses what actions will be essential for addressing the many challenges and opportunities in the evolving energy landscape – particularly as they relate to TS&D systems. Together, these proposed solutions can help expand the benefits yielded through cross-border electric integration and thereby advance the core objectives animating the QER.

A. North American Electric Integration

1. As a fundamental principle of policy, the QER should recognize the interdependency of the U.S. and Canadian segments of the larger North American grid.

As noted in Section IV, the North American grid is in many respects one large, interconnected machine. For purposes of U.S. policy, it is therefore imperative to bear in mind that the grid's principal actors are interdependent across borders – not just utility service area, state, or ISO/RTO borders, but across the international border as well.

As in any domain, this electric interdependency is something of a double-edged sword. For example, a basic finding of the U.S.-Canada Power System Outage Task Force report on the August 2003 blackout – triggered initially by vegetation contact in Ohio, with widespread outages subsequently cascading across the northeast, including the Canadian province of Ontario – was that a certain degree of vulnerability is inherent in the interdependent nature of the grid.[37]

[37] U.S.-Canada Power System Outage Task Force. "Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations." (April 2004), p. 165.

However, as detailed above, there are significant advantages enabled by North American electric grid integration as well. These include enhanced reliability, more efficient system operations, greater affordability of supply, and expanded access to low-carbon resources.

Accordingly, the QER ought to rest on the basic premise that the United States' electric infrastructure is interdependent with Canada's. And, as will be discussed further below, this means that shared solutions are essential to addressing our shared challenges.

2. Any recommendations set forth in the QER should avoid erecting barriers that may inhibit inter-jurisdictional electricity trade.

Section IV of these comments outline how electricity is an established and growing part of the larger Canada-U.S. trade relationship. The market is borderless. Policy impediments to the seamless and unrestricted exchange of electrons across international and state borders are few. However, those that do exist can pose significant burdens to market participants. While such hurdles are limited in number, governments must remain vigilant to avoid erecting any additional barriers which may inhibit inter-jurisdictional power flows.

Such barriers include restrictive renewable electricity production or purchase obligations. These mandates are sometimes configured to exclude non-emitting resources, such as large hydroelectric facilities or nuclear plants, or otherwise eligible energy sources from non-adjacent control areas from their definition of qualifying generation. This, in turn, can adversely impact electricity trade, as it may weaken the option of purchasing clean electricity from another jurisdiction. Such restrictive arrangements are neither conducive to cutting emissions, nor to reducing electricity rates and thereby stimulating economic growth.

One area of emerging U.S. federal regulation that may likewise have implications for U.S.-Canada electricity trade is the U.S. Environmental Protection Agency's ("EPA") impending rules limiting GHGs from existing generating units. Cross-border electricity trade can play an effective, meaningful role under this effort, as many U.S. states and regions can maximize their GHG emission reduction potential by leveraging their integration with power systems in neighbouring Canadian provinces. CEA continues to advocate for states to be granted this flexibility under the EPA's regulatory approach.[38]

A vibrant, bilateral electricity trading relationship has served as an enduring feature of the North American economy. Enhancing this relationship will help realize the potential for renewed

[38] http://www.electricity.ca/media/IndustryIssues/USAffairs/CEAPaperEPAGHG111(d)GuidelinesJan2014.pdf.

economic vitality and a more secure, independent energy future. CEA therefore encourages the QER to champion the ability to sustain exchanges of electricity across our shared border.

B. Infrastructure Renewal

3. The QER should update and enhance the efficiency of the U.S. permitting process for cross-border electricity infrastructure and trade.

DOE is responsible for permitting the U.S. segments of IPLs. It is CEA's understanding that, on balance, the experience with DOE's Presidential Permit process has usually been satisfactory and has not encountered the kind of challenges faced by other sectors in the energy industry. Nonetheless, CEA respectfully suggests that there are benefits to be gained from modernizing the process – particularly when one bears in mind the commitments that DOE has made around how this process should function and under what timelines.

For example, public information provided by DOE states that DOE requires approximately 6-18 months to issue a Presidential Permit.[39] However, the recent record in Presidential Permit proceedings reveals a trend of delays and inconsistencies in the timelines for processing applications – whether the application is for construction and operation, physical or operational change, or transfer of ownership. While CEA is not aware of any specific circumstances in which inconsistencies have jeopardized the viability of a project, such inconsistencies inject uncertainty and risk into the project from a planning perspective; result in undue escalation of administrative costs for proponents; and unnecessarily delay the consumer benefits associated with these projects.

CEA would offer similar observations with respect to DOE authorizations for electricity exports. There are several ways in which the process would be improved through modernized requirements (and would likewise allow DOE to consistently meet its commitments for reviewing applications in 3-6 months). In particular, DOE export authorizations have yet to be updated to reflect and to avoid duplication of current market or regulatory measures (including mandatory NERC reliability standards, wholesale market rules and state integrated resource planning requirements, which – together or even separately – can address the intent of existing DOE authorization requirements).

[39] http://energy.gov/oe/services/electricity-policy-coordination-and-implementation/international-electricity-regulatio-6.

Indeed, CEA would respectfully raise the question of whether there is anything governed under current DOE export authorizations that is not addressed through a separate market or regulatory mechanism, or a combination thereof.

As part of efforts to modernize its permitting process for cross-border electricity infrastructure and trade, DOE should also consider aligning its permitting requirements with those of the National Energy Board of Canada ("NEB"). CEA believes that greater synergies can be achieved in the permitting approaches utilized on either side of the border. Such synergies will assist in eliminating mismatches and inconsistencies, maximizing efficiencies, and reducing uncertainty for permit applicants.[40]

Finally, CEA acknowledges that DOE previously included the procedures governing issuance of IPL permits and export authorizations in its regulatory reform plans, developed in response to President Obama's 2011 Executive Order seeking improved federal regulatory review.[41] CEA urges DOE to propose revisions to these procedures as part of the QER Report on TS&D systems, if not sooner.

In eliminating duplication and undue administrative burden from its IPL and export authorization processes, DOE can help ensure that development of a 21st century power grid is governed by a 21st century regulatory regime.

C. Electric Reliability & Grid Security

4. The QER should affirm and support the existing framework in place at NERC for the development of mandatory electric reliability standards for the North American grid.

NERC's mission is to establish mandatory standards for reliable operation of the North American BPS. The U.S. Federal Energy Regulatory Commission ("FERC") has designated NERC as the U.S. Electric Reliability Organization ("ERO"). NERC is likewise recognized as an international standard-setting body under analogous legislative and regulatory frameworks in

[40] For further details, please the formal proposal for DOE-NEB alignment of permitting requirements which CEA submitted to the Canada-United States Regulatory Cooperation Council in August 2013: http://www.electricity.ca/media/IndustryIssues/USAffairs/CEAFilingRCCSummer2013StakeholderRequestforCommentOct2013.pdf.

[41] http://www.whitehouse.gov/sites/default/files/other/2011-regulatory-action-plans/departmentofenergyregulatoryreformplanaugust2011.pdf.

Canada. (In fact, the province of Ontario became the first jurisdiction in North America to make reliability standards mandatory in 2002).[42]

CEA and its members remain committed to the international NERC model, wherein stakeholders are able to participate effectively in the development of NERC standards, with applicable governmental authorities in the U.S. and Canada providing appropriate regulatory backstop.

Since the transition to the mandatory standards regime, NERC has proved itself to be well-suited to addressing the numerous risks facing reliable operation of the grid. As noted in NERC's 2014 "State of Reliability" report, the North American BPS continues to experience sustained levels of high performance.[43] NERC's standards govern numerous aspects of system operations, covering – among other things – planning, protection and control, vegetation management, emergency preparedness and resource balancing. The critical infrastructure protection standards developed by NERC represent the only mandatory and enforceable cyber security standards for any critical infrastructure sector in North America.

As risks to the grid evolve, so too have NERC's standards. The fifth iteration of NERC's cyber security standards has recently been approved, while in the last year alone, NERC has crafted standards to address geomagnetic disturbances and physical security threats.

Outside of the standards domain, NERC also continues to assume an increasingly crucial role in enhancing the broader security posture of the international grid. Its Electricity Sector Information Sharing and Analysis Center ("ES-ISAC") is instrumental in sharing timely and actionable information to users, owners and operators across North America on security threats and risks. Similarly, its Grid Security Exercises (known as "GridEx") offer excellent value in testing the sector's readiness to respond to and recover from sophisticated security threats.

To be sure, there remain areas for improvement and refinement within the electric reliability arena.[44] CEA and a host of other stakeholders remain actively engaged in efforts to strengthen the NERC model. Nevertheless, it must be acknowledged that the model continues to serve electric customers across North America very well and is uniquely suited to doing so moving

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[42] North American Electric Reliability Corporation. "2012 Annual Report." (March 2013), p. 16. http://www.nerc.com/news/Headlines%20DL/NERC%202012%20Annual%20Report%20(MAR13).pdf.

[43] http://www.nerc.com/news/Headlines%20DL/SOR%2021MAY14.pdf.

[44] U.S. Federal Energy Regulatory Commission. Reliability Technical Conference. (June 10, 2014). Docket No. AD14-9-000. Transcript available: http://elibrary.ferc.gov/idmws/file_list.asp?accession_num=20140610-4117. Discussions at this June 2014 FERC Technical Conference on BPS policies and priorities offer a sense of where NERC, governmental authorities and stakeholders see progress being made and where ongoing improvements are being pursed.

forward. CEA requests that the QER reflect this and signal support for the indispensable role which the NERC model plays in helping to ensure the reliability of the international BPS.

5. The QER should recommend actions to enhance public-private sector, as well as government-to-government, coordination and sharing of timely and actionable threat information.

The electric utility industry in North America has cultivated much expertise in protecting the reliability and security of its assets. Often this is achieved in partnership with appropriate government and law enforcement agencies. As threats to the grid evolve and become increasingly sophisticated – especially those threats emanating from cyberspace – strengthening such partnerships becomes an even greater imperative.

One area where this partnership can be further strengthened is in the sharing of timely and actionable threat information. While NERC standards and other measures adopted by the industry provide a robust baseline level of protection, in certain circumstances reliability and security are contingent upon asset owners and operators receiving critical threat information from government sources. Promoting greater bi-directional information sharing between government and industry in a timely, confidential manner will enhance these partnerships and further improve the security posture of the grid.

Moreover, in the U.S.-Canada context, in situations where there is justifiable concern that events in one country can impact security in the other, mitigating actions need to be coordinated to ensure that the appropriate governmental agencies and entities are involved. Timely information sharing between the U.S. and Canadian governments is equally critical to ensure that the necessary information is received by the entity in the best position to address a security threat.

In terms of information sharing in the electricity sector, expectations are high that adoption of a new set of technologies and services developed and deployed by DOE will yield significant benefits. In August 2014, NERC – through its ES-ISAC – assumed responsibility as program administrator of the Cybersecurity Risk Information Sharing Program (“CRISP”).[45] CRISP is a voluntary program to facilitate the exchange of detailed cyber security information between utilities and government sources. It provides near-real-time capability for owners and operators to share cyber threat data, analyze this data, and receive mitigation measures.

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[45] For full details on CRISP and NERC’s recently established role as program administrator, see NERC’s August 22, 2014 filing to FERC requesting acceptance of its 2015 Business Plan and Budget: http://www.nerc.com/FilingsOrders/us/NERC%20Filings%20to%20FERC%20DL/NERC2015BusPlanBudgetFiling8-22-2014.pdf (Exhibit F in Attachment 2).

Under DOE's direction and in coordination with the Electricity Subsector Coordinating Council – a CEO-level body which has become the chief industry liaison with senior U.S. government officials on addressing physical and cyber security threats – the early piloting of CRISP in the sector is now transitioning to much wider deployment. While deployment of CRISP may be limited to a subset of electric utilities, the ES-ISAC will broadly disseminate information derived from this program, thereby providing more widespread benefits to the sector and enhancing its overall cyber security posture.

CEA understands that DOE is currently examining the prospects of broadening the scope of CRISP to include government-to-government information sharing. CEA encourages DOE to pursue these prospects vigorously, as well as any other information sharing platforms, especially with respect to its partners in the Government of Canada. In turn, electric utilities will benefit from additional platforms that will improve their ability to address evolving security threats.

D. U.S.-Canada Cooperation on Grid Innovation & Modernization

6. The QER should expand existing U.S.-Canada programs to support research, development and/or demonstration ("RD&D") of innovative grid modernization technologies.

The United States and Canada enjoy a long history of joint efforts to study and promote next generation and breakthrough technologies for the electric grid. CEA strongly believes that there are numerous opportunities to expand these programs going forward and that DOE can play a central role in this activity, under the auspices of such initiatives as the U.S.-Canada Clean Energy Dialogue and the areas of strategic cooperation on energy and environment agreed to by DOE and Natural Resources Canada ("NRCan") in 2013.[46]

The following areas are a mere sampling of the possibilities for greater bilateral RD&D cooperation:[47]

- Electric Vehicles ("EVs"): Canada and the United States have cited development and adoption of EVs as an excellent opportunity to boost energy security through reduced dependence on oil, to cut emissions in the transportation sector, and to position the automotive industry for leadership and growth. Both governments also have their respective targets for EV deployment on their highway networks.

[46] For additional details on these areas of strategic cooperation, please see the following NRCan press release: http://www.nrcan.gc.ca/media-room/news-release/2013/11546.
[47] Many of these areas align well with activities outlined in DOE's Quadrennial Technology Review report, issued in 2011: http://energy.gov/sites/prod/files/ReportOnTheFirstQTR.pdf.

Joint collaboration on R&D investments, technology, harmonized codes and standards, and outreach programs can help accelerate the seamless deployment of EVs across North America and achieve economies of scale. Governments can also play a supporting role and send an important market signal in the form of "crowding-in" investments – for example, by phasing in EVs within public sector fleets.

- Energy Storage: Tremendous potential remains for broader penetration of grid-scale energy storage technologies. Early efforts undertaken by CEA members are showing excellent signs of progress. For example, British Columbia Hydro and Power Authority ("BC Hydro") is operating Canada's first battery energy storage facility, which is helping to ensure continuity of service following outages and to reduce system load during periods of high demand in a remote area of the province.[48] The Independent Electricity System Operator in Ontario ("IESO") is likewise receiving frequency regulation service from commercial flywheel and battery storage technologies, and recently issued a request for 35 MW of storage to provide additional such ancillary services.[49]

  Both the U.S. and Canada are already active in projects aimed at evaluating and demonstrating storage projects, and opportunities for cooperation should be explored.

- Geomagnetic Disturbances ("GMDs"):[50] Gaps remain in understanding the impacts of GMDs on electric infrastructure, despite the recent excellent work of NERC's GMD Task Force and the expertise cultivated over the years by CEA members (who are among the most susceptible to GMD effects of owners and operators in North America). Areas requiring additional research include validation of earth models and measurement of transformer behaviour under geomagnetically-induced currents.

- Smart Energy Networks ("SENs"): SENs integrate energy sources, and systems for delivery and storage. This enables management of the three energy vectors in a total energy network through various technical solutions and information and communications technology to optimize efficient use of energy sources by end-users. CEA would welcome joint U.S.-Canada activity in exploring this promising energy solution.

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[48] For additional details on the project, please see BC Hydro's website: https://www.bchydro.com/energy-in-bc/projects/field-battery.html.

[49] For additional details on the IESO's integration of energy storage technologies, please see the company's website: http://www.ieso.ca/Pages/Ontario's-Power-System/Smart-Grid/Energy-Storage.aspx.

[50] As defined by the U.S. Oak Ridge National Laboratory, "[a] geomagnetic disturbance occurs when the magnetic field embedded in the solar wind is opposite that of the earth. This disturbance, which results in distortions to the earth's magnetic field, can be of varying intensity and has in the past impacted the operation of pipelines, communications systems, and electric power systems." http://web.ornl.gov/~webworks/cpr/v823/rpt/51089.pdf.

- Smart Grid: This is another area in which the U.S. and Canada have previously collaborated, and which would benefit from an expansion of that effort. As deployment of Smart Grid technologies in both countries continues to increase and evolve, there remains significant value in joint collaboration in the development and harmonization of robust standards governing the interoperability of these technologies. Such an approach will minimize the risks in disparities across the border.

- Unmanned Aerial Vehicles ("UAVs"): There is growing recognition in Canada and the U.S. of the enormous potential for UAV applications for civilian use. High on the list is the possibility of cost-effective solutions for the inspection of electric transmission lines, especially in remote areas. At this nascent stage in its development, both governments have the ability to play an important role in guiding the use of UAV technology for applications in the North American electric power sector.

- Utility Innovation Funding Models: While there is a long history both in the U.S. and Canada of federal support for funding utility innovation, CEA believes that there is room for expansion and improvement. As noted in a report recently commissioned by CEA, challenging policy goals and rapidly-shifting energy supply economics magnify the potential benefits from innovation. Innovation can make such goals more readily achievable and affordable, and can exploit increasingly affordable options in new ways.[51]

  However, too often utilities are hindered in their ability to make the optimal level of investment needed to spur innovation. In step with calls from other stakeholders (such as EEI), CEA urges DOE to address this issue as part of the QER.[52] In the U.S.-Canada context, CEA encourages the QER to examine opportunities for exchange of best practices in designing and promoting utility innovation funding models.

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[51] Concentric Energy Advisors. "Stimulating Innovation on Behalf of Canada's Electricity and Natural Gas Consumers." (August 21, 2014). http://www.ceadvisors.com/publications/reportsandpublications/Stimulating%20Innovation%20on%20Behalf%20of%20Canada's%20Electricity%20and%20Natural%20Gas%20Consumers.pdf.

[52] *Supra,* EEI, p. 4: "The industry should be allowed to develop innovative alternative utility rate design models (both federal and state) to ensure that the Grid is accurately valued and utilities fairly compensated...Rate design methods should encourage: forward looking capital attraction for infrastructure investments, reliability and resilience, and innovation."

VII. Conclusion

For the reasons outlined above, CEA strongly encourages DOE to ensure the QER grants due recognition of the significant benefits which electric integration with Canada brings to the economy and consumers. This integration can serve as a valuable platform to turn challenges into opportunities, and to advance the energy goals and desired energy infrastructure characteristics which constitute the QER's core focus.

CEA sincerely appreciates DOE's consideration of these comments and the recommendations set forth therein, and looks forward to remaining engaged in this and later stages of the QER.

VIII. CEA Contact Information

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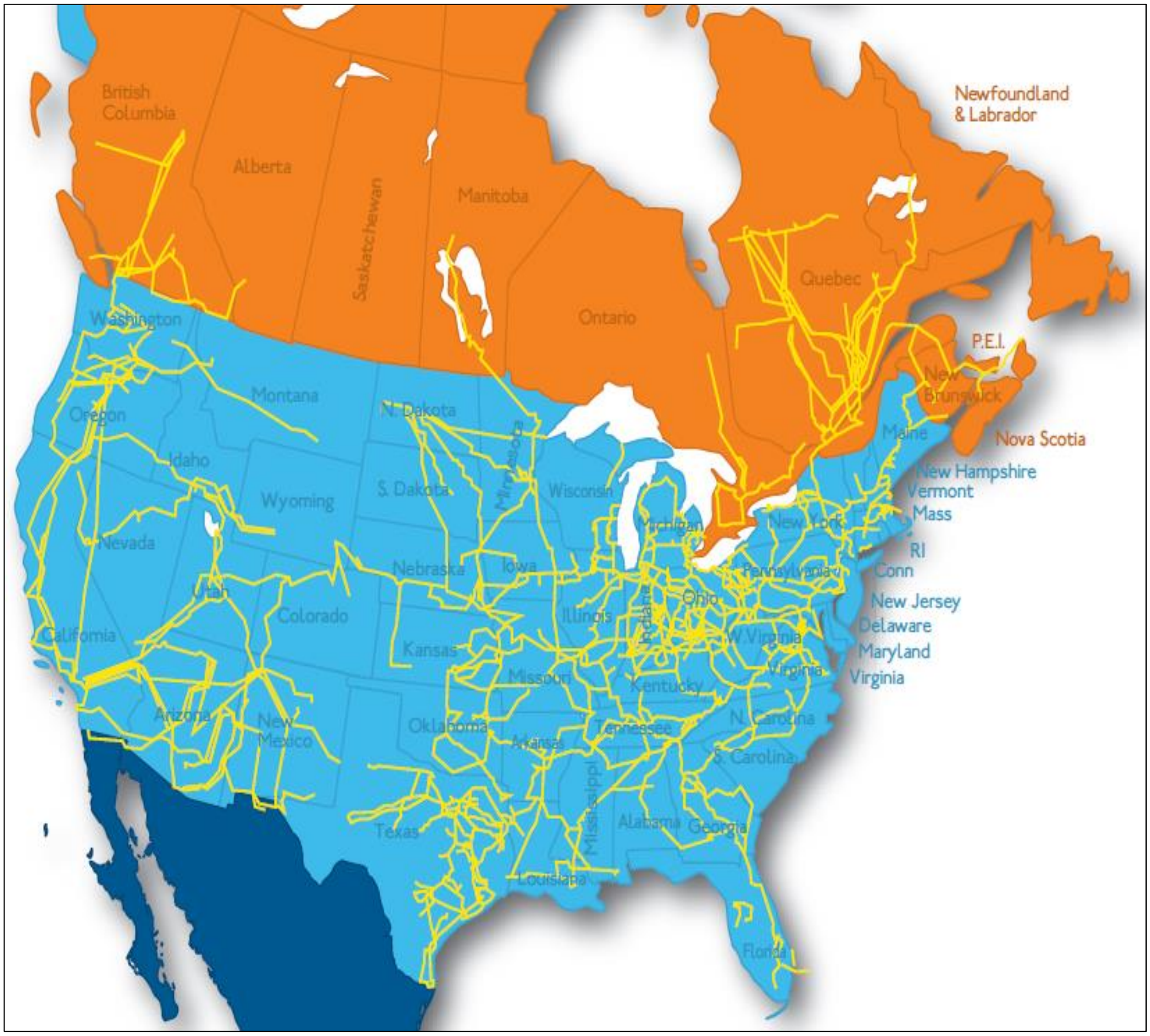
APPENDIX 1

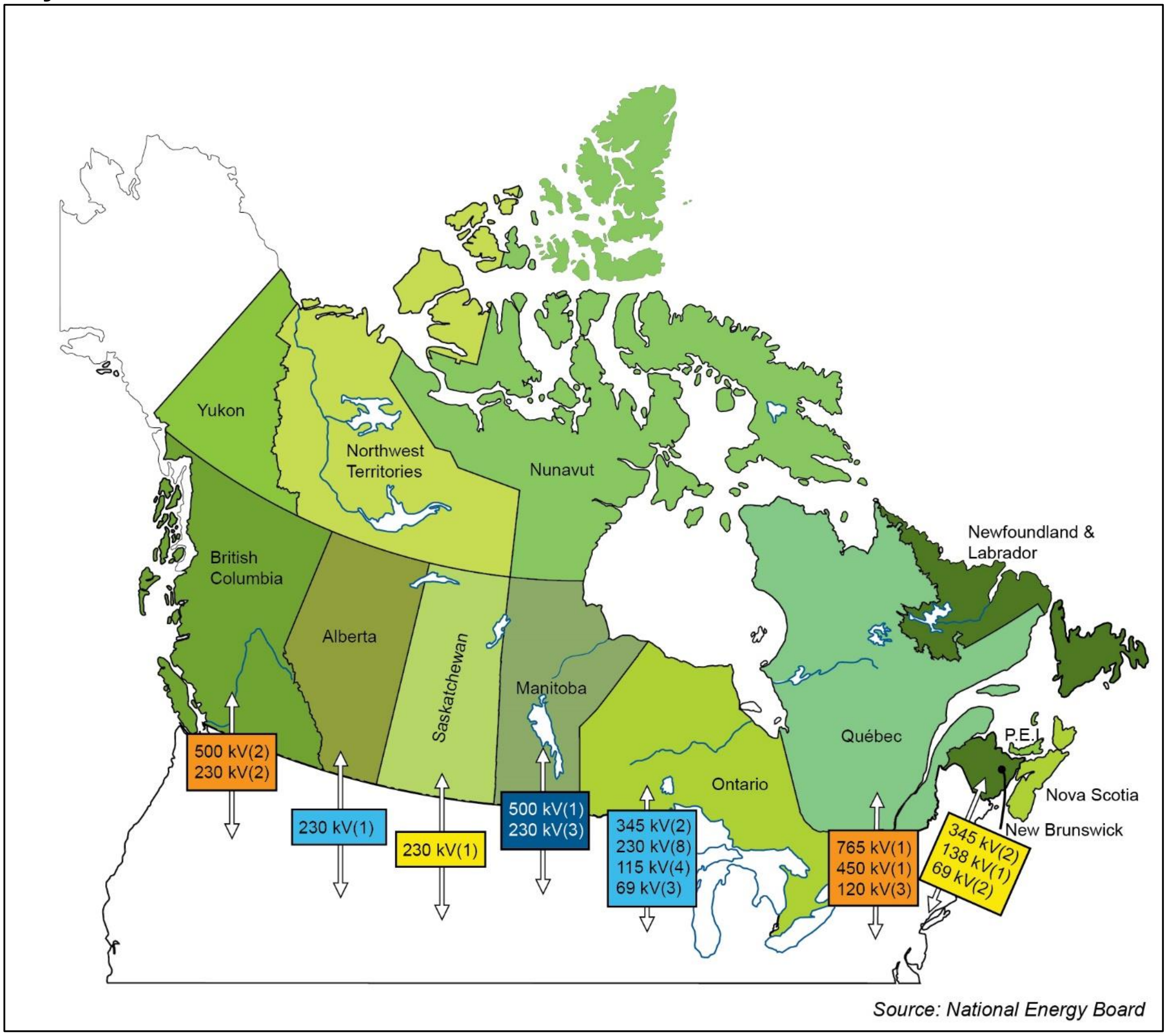
The Integrated North American Transmission Grid



Map copyright Canadian Electricity Association. Lines shown are 345 kilovolts ("kV") and above. There are numerous interconnections between Canada and the U.S. under 345 kV that do not appear on this map.

Canadian Electricity Association | Association canadienne de l'électricité

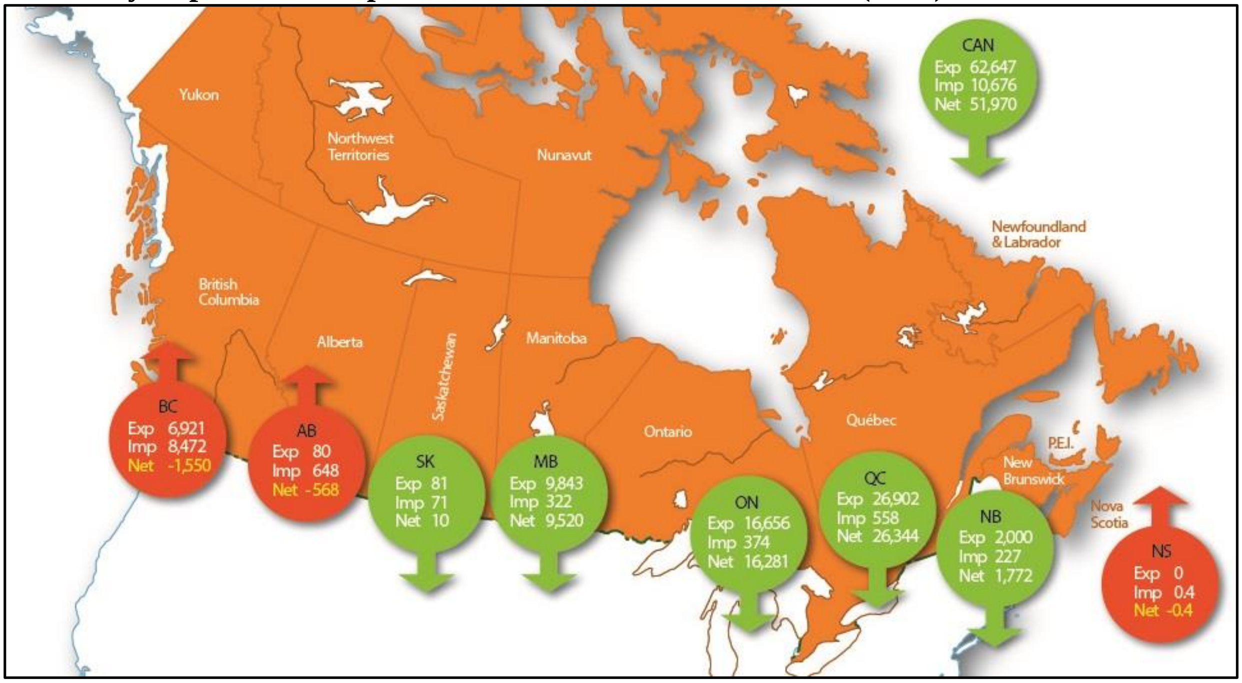
Major Transmission Interconnections Between Canada and the United States



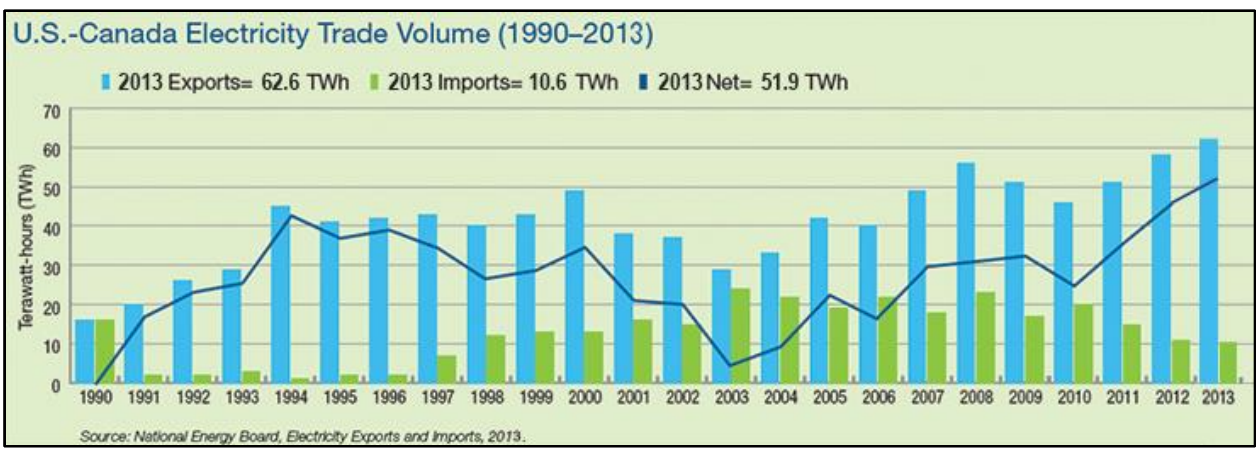
Map copyright Canadian Electricity Association.

APPENDIX 2

Electricity Exports and Imports Between Canada and the U.S. (2013)



Map copyright Canadian Electricity Association. Data displayed are in gigawatt-hours. Numbers may not sum due to rounding. Source: National Energy Board, Electricity Exports and Imports, 2013.



Graph copyright Canadian Electricity Association.

APPENDIX 3

Canadian Electricity Exports as a Percentage of Total Retail Sales in U.S. States/Regions (2010)

1	Vermont	38%
2	Maine	18%
3	Minnesota & North Dakota	12%
4	New England	10%
5	New York	6%
6	Michigan	6%
7	Montana	2%
8	Washington	2%

While Canadian power exports may constitute only a small percentage of electricity consumption in the United States nation-wide, they are critical to the energy security of numerous states and regions. The adjoining table shows the share of total retail electricity sales in various U.S. jurisdictions represented by exports of Canadian electricity into those areas in 2010.

Sources: National Energy Board, Electricity Exports and Imports, 2010; Energy Information Administration, U.S. States, State Profiles and Energy Estimates, Exports and Imports, 2010.

Electricity Generation in the U.S. and Canada by Fuel Type (2013)

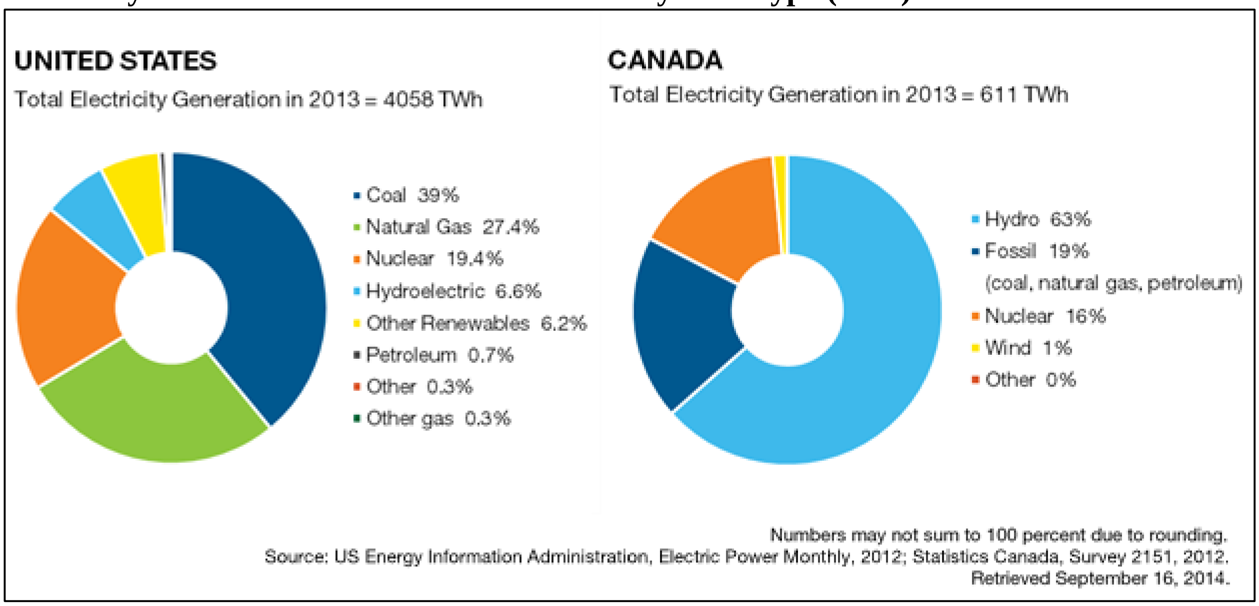


Chart copyright Canadian Electricity Association.

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