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Introduction

Electricity Canada appreciates this opportunity to submit comments in advance of the U.S. Senate Energy & Natural Resources Committee hearing to Examine the U.S.-Canada Energy and Minerals Partnership on May 17, 2022. This brief describes the positive and longstanding Canada-U.S. electricity relationship, and how it helps achieve clean energy, decarbonization and electricity reliability and security goals to the benefit of communities on both sides of the shared border.[1]

About Electricity Canada

Founded in 1891, Electricity Canada (formerly the Canadian Electricity Association) is the national forum and voice of the evolving electricity business in Canada. Electricity Canada members generate, transmit, distribute and market electric energy to industrial, commercial and residential customers across Canada and the U.S. every day. Our membership includes provincially-owned and investor-owned utilities, many of which are vertically integrated; independent power producers; independent system operators; wholesale power marketers; and municipally owned local distribution companies.

Several Electricity Canada members own and invest in assets in the U.S., and U.S. companies also invest in electricity assets in Canada. Many Electricity Canada members are engaged in the buying and selling of electricity, ancillary services, and other energy and environmental products in markets across North America, including in Federal Energy Regulatory Commission-approved regional transmission organization/independent system operator ("RTO/ISO") markets as registered participants. Those with a footprint in the Bulk Power System also follow North American Electric Reliability ("NERC") standards. This bilateral relationship is both mutually beneficial economically, and also key in ensuring the reliability and resilience of the integrated North American power grid. Clean, dispatchable and reliable Canadian electricity can also help U.S. states and regions achieve their environmental policy goals.

Background

Canadians and Americans share a highly integrated electricity grid, connected by more than 35 high voltage cross-border transmission lines. Every Canadian province along the U.S. border is electrically interconnected with at least one neighboring U.S. state.

Canadian electricity companies engage in bi-directional trade with the U.S. across this integrated grid, and work with their American counterparts to keep the grid reliable and secure. Trade and integration form the backbone of a highly positive and mutually beneficial cross-border electricity relationship that provides economic,

[1] The comments represent the current position of Electricity Canada as an organization, but not necessarily the views of any particular Electricity Canada member with respect to any issue.

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environmental, resilience and security benefits, and which contributes to affordable and increasingly clean energy for customers in both the U.S. and Canada. This positive partnership has served American and Canadian businesses and communities for over 100 years.

The value of the cross-border energy and electricity relationship is recognized at the highest levels of government in the U.S. and in Canada. The *Roadmap for a Renewed U.S.-Canada Partnership*, unveiled by President Biden and Prime Minister Trudeau in February 2021, outlined opportunities to cooperate on electricity-related items, including "a coordinated approach to accelerating progress towards sustainable, resilient, and clean energy infrastructure, including encouraging the development of cross-border clean electricity transmission". It also notes the imperative for secure electricity, and the value of allies working together to enhance the security and resilience of cross-border energy infrastructure.[2] The U.S.-Mexico-Canada Agreement ("USMCA") also includes a U.S.-Canada side letter on energy that "recognizes the importance of enhancing the integration of North American energy markets based on market principles, including open trade and investment among the Parties, to support North American energy competitiveness, security, and independence."[3]

Canadian electricity can help the U.S. meet resilience and clean energy goals affordably and reliably. Further, electricity cooperation, trade and integration offer increased energy security. Given the close integration of the North American electricity grid, Electricity Canada offers the following comments in the spirit of continued bilateral collaboration:

Trade and Economy

Over 70 TWh of electricity flowed across the U.S.-Canada border in 2021, representing an electricity trade relationship of over US$3 billion[4]. Approximately thirty states engage in electricity trade with Canada each year. This two-way exchange enables electric supply to meet demand in the most efficient manner, increases resilience, supports affordability for customers, and helps regions meet policy and business goals on both sides of the border. Many Canadian and U.S. electricity companies own assets in both countries, and increased cross-border transmission infrastructure could enable further two-way trade and allow future balancing potential.[5]

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[2] The United States Government. (2021, February 24). Roadmap for a Renewed U.S.-Canada Partnership. The White House. Retrieved September 14, 2021, from https://www.whitehouse.gov/briefing-room/statements-releases/2021/02/23/roadmap-for-a-renewed-u-s-canada-partnership/.

[3] *Canada-United States-Mexico Agreement (CUSMA) Side Letter from the U.S./Letter from Canada (Energy)*, Nov. 30, 2018.

[4] Canada Energy Regulator. *Electricity Trade Summary*. https://www.cer-rec.gc.ca/en/data-analysis/energy-commodities/electricity/statistics/electricity-summary/electricity-annual-trade-summary.html. May 3, 2022.

[5] Dimanchev, Hodge & Parsons. *Research Brief: Two-Way Trade in Green Electrons: Deep Decarbonization of the Northeastern U.S. and the Role of Canadian Hydropower.* MIT CEEPR Working Paper 2020-003. 2020.

Although Canadian electricity sales to the U.S. accounted for 2 percent of total U.S. retail sales in 2017, the Canada-U.S. transmission interconnections are integral enablers to northern border states' electricity markets.[6] In Vermont, for example, the largest share of electricity consumed comes from hydroelectric generators in Canada.[7]

Canada has an abundant clean electricity supply that can meet both domestic and cross-border clean energy demand, with additional clean energy development opportunities. Canada's strength in its electricity resources permits generation capacity in excess of domestic demand, thus creating an opportunity for Canada's plentiful electricity supply to meet both Canadian and American needs. With the majority of electricity trade between the two countries coming from hydropower generation in Canada, U.S. states – particularly in the Northeast – have taken steps to access and take advantage of this abundant and affordable source of energy supply.

Massachusetts, for example, has authorized long-term contracts of 15-20 years to procure hydropower electricity, and to leverage its environmental and reliability benefits. Further West, Manitoba Hydro has a strong trading relationship with Minnesota and Wisconsin with several power sale agreements in place. Some of these are seasonal diversity exchanges, with energy being sent south across the border in the summer and north in the winter; others are capacity sales,[8] in some cases serving to 'store' surplus wind generated in North Dakota as hydropower in Manitoba. This mutually beneficial, symbiotic relationship also exists in the Pacific Northwest, with excess hydropower and wind generation in Washington State finding markets across the border in British Columbia.

In New York, the Champlain Hudson Power Express project ("CHPE") also recently secured its final approval from the state's Public Service Commission, and will provide clean power from Canada to the metropolitan area of New York, helping that region meet its clean energy goals. This project also builds on a positive longstanding New York-Canada relationship. A fact-finding report from the U.S. International Trade Commission found that hydropower trade with Canada has provided New York with economic and environmental benefits, including cost savings in the day-ahead market and emissions reductions. It also finds that existing and new projects with Canada, like the CHPE, will be "important tools" in helping New York meet ambitious statewide and local commitments to expand renewable power and decrease emissions.[9]

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[6] Stanley, Andrew. *CSIS Briefs: Mapping the U.S.-Canada Energy Relationship.* Center for Strategic & International Studies. https://www.csis.org/analysis/mapping-us-canada-energy-relationship. May 7, 2018.
[7] U.S. Energy Information Administration. *Vermont State Profile and Energy Estimates.* https://www.eia.gov/state/analysis.php?sid=VT. July 18, 2019.
[8] Manitoba Hydro. *Power sale arrangements.* https://www.hydro.mb.ca/corporate/electricity_exports/power_sale_arrangements/. Accessed May 10, 2022.
[9] U.S. International Trade Commission. *Renewable Electricity: Potential Economic Effects of Increased Commitments in Massachusetts.* https://www.usitc.gov/publications/332/pub5154.pdf. January 2021.

The second installment of the Department of Energy's *Quadrennial Energy Review* stressed that "additional cross-border transmission infrastructure with Canada has been projected to lead to lower overall system costs in U.S. border regions, and it could enhance reliability, backstop variable renewable energy development, and enable lower overall emissions of U.S. power consumption."[10] A study by the Center for Climate and Energy Solutions found that on a levelized basis hydropower is competitive with other forms of electricity[11], and a 2020 New York ISO report found that free-flowing ties with Ontario resulted in an estimated production cost savings of $43 million in the Day-Ahead Market[12].

As further evidence of the benefits of Canadian electricity, the New England States Committee on Electricity ("NESCOE") released an analysis in 2013 of the economic and environmental impacts associated with hypothetical incremental levels of hydroelectric imports from Québec and Newfoundland and Labrador. Under different scenarios of increased imports during a 2014-2029 study period, the analysis found average annual economic benefits associated with reduced electricity prices in New England ranging from US$103 million to US$471 million, with cumulative reductions in customer costs during the study period ranging from US$3.325 billion to US$5.652 billion[13]. Significantly, it also estimated average annual reductions in electricity sector GHG emissions reductions in New England ranging from 1.3 million to 8.0 million tons, with cumulative reductions totaling between 58 million and 97 million tons.

Evidence of economic and environmental benefits of trade are further described in a study by the Midcontinent Independent System Operator ("MISO"), which found significant benefits of expanding the interface between Manitoba Hydro and MISO, including production cost savings and modified production cost savings, load cost savings, reserve cost savings, and U.S. wind curtailment reduction.[14]

Reduced electricity rates offer direct economic benefits to consumers, and they also offer enabling benefits in the form of fuel switching, and of lower operating costs for manufacturing, retail, and other industries.

Further, electricity options that are both clean and competitive will be increasingly attractive to the growing number of companies that are committing to clean energy targets.

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[10] U.S. Department of Energy. *Transforming the Nation's Electricity System: The Second Installment of the QER.* Page 6-4. January 2017.

[11] Aarons, K. & Vine, D. *Canadian Hydropower and the Clean Power Plan*. Center for Climate and Energy Solutions. April 2015.

[12] Patton, D., LeeVanSchaick, P., Chen, J. et al. *2020 State of the Market Report for the New York ISO Markets.* May 2021.

[13] Black & Veatch. *Hydro Imports Analysis prepared for New England States Committee on Electricity.* 1-1. November 1, 2013.

[14] Bakke, J., Zhou, Z. & Sumeet M., *Manitoba Hydro Wind Synergy Study (Final Report)*. MISO 2013.

Environmental Benefits

Canada has the advantage of a remarkably low-carbon electricity grid, and an abundance of clean, reliable, and affordable dispatchable baseload electricity, with further clean resource development opportunities. The Canadian electricity sector is among the most sustainable in the world, with more than 80% of electricity produced in Canada already non-emitting and predominantly dispatchable reliable hydropower. Hydroelectricity generation produces no air pollutants, and has extremely low levels of greenhouse gas emissions. From a full life cycle assessment basis, Canadian hydropower is amongst the lowest emitting resources available.[15] Hydropower projects are also subject to environmental assessments as part of the Canadian approval process.

Since 2005, the Canadian electricity sector has reduced GHG emissions by more than 40% and will further decrease emissions by at least that much between now and 2030. Canadian electricity companies operate within various provincial and federal climate-change regulatory frameworks and carbon pricing regimes in place across Canada. Federal regulations were also announced in 2018 to phase out traditional coal-fired electricity by 2030.

Canada's electricity system represents one of the world's lowest-carbon electricity systems, with its predominantly clean, abundant, reliable and dispatchable electricity supply. Accordingly, Canadian electricity can offer additional tools to meet U.S. clean energy and climate change goals. There is precedence for recognition of this. For example, the Clean Power Plan recognized Canadian non-emitting electricity imports as an eligible way for states to meet clean energy targets. More recent federal Clean Energy Standard legislation, such as S. 1359 (116th) and the Climate Leadership and Environmental Action for our Nation's Future Act (117th), also recognize Canadian non-emitting imports as eligible for clean energy credits within their frameworks.

Canada's abundant clean electricity supply can be used by U.S. jurisdictions to meet U.S. clean energy and climate targets, as was recently highlighted by the Center for Climate and Energy Solutions.[16] In 2017 alone, exported electricity from Quebec resulted in over 8.3 million metric tons of avoided CO_2 emissions.[17] Additionally, there is seasonal complementarity between Canada and the U.S. for peaks in electricity demand, with each country experiencing demand peaks at different times of the year. This allows for an exchange of reserve services though cross-border interconnections which reduces the need for new generation capacity that may otherwise sit idle (except during peak times on both sides of the border), thus increasing efficiency.[18]

Many states are pursuing clean energy goals. In New England, for example, states have renewable energy standards. Recently, several of these states have taken further steps, directing the establishment of long-term

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[15] Waterpower Canada. *Learn.* https://waterpowercanada.ca/learn/
[16] Vine, D. *Clean Connection: Canadian and U.S. Electricity.* June 2021.
[17] Hydro-Quebec. *International FAQs: Why is importing electricity from Hydro-Québec beneficial for customers in New England or New York?* http://www.hydroquebec.com/international/en/faq.html.
[18] National Renewable Energy Laboratory. *Integrated Canada-U.S. Power Sector Modeling with the Regional Energy Deployment System (ReEDS).* February 2013. https://www.nrel.gov/docs/fy13osti/56724.pdf

contracts for carbon-free electricity. One such state law from Massachusetts required the state to solicit long-term contracts for the procurement of 1.6GW of offshore wind power and 1.2GW of hydropower or other renewable resources.

Canadian hydropower imports could have a significant impact on the emission rates of importing states. For example, a hypothetical addition of 250 MW of imported hydropower electricity could help Massachusetts reduce its power sector emission rate by about 10 percent, moving it 32 percent of the way toward its proposed 2030 target. In Minnesota, imports from a new 250 MW project could help reduce power sector emissions by 5 percent, which would move the state 19 percent of the way toward its proposed 2030 target.[19]

Resilience and U.S. Renewable Development Opportunities

Hydropower is well positioned to provide overall grid resilience benefits, while also serving as a clean energy supply. For example, the 2017 U.S. Department of Energy Staff Report on Electricity and Reliability notes that resources such as hydropower offer essential reliability services and fuel assistance critical to electric system reliability.[20] It notes that hydropower plants can also support the dynamic behavior of grid operations by offering a full range of ancillary services.

Canada's clean, predominantly hydropower supply can support increased development of U.S. renewable generation, while providing reliability and resilience benefits. Canada's predominantly clean, dispatchable baseload generation fleet can serve as backstop energy to U.S. variable renewables, such as solar and wind, hence allowing more of these resources to come reliably online. Canadian hydroelectric power can play an especially unique role, allowing U.S. variable renewables to sell excess electricity to Canada which allows hydro reservoirs to reserve water, and can be used to generate power to be sold to the U.S. when needed in the future. The *Canada-U.S.-Mexico North American Renewable Integration Study* ("NARIS") also shows how considering interregional and international planning can support reliable and affordable renewable integration.[21]

This mutually beneficial arrangement already facilitates two-way trade and cross-border projects like the Great Northern Transmission Line, which came on-line in 2020. Analysis in the 2013 Manitoba Hydro Wind Synergy Study demonstrates that projects similar to this one, pairing new U.S. wind generation with Canadian hydro and transmission, can offer significant U.S. load cost savings.[22] This builds on previous benefits that saw imports of

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[19] Aarons, K. & Vine, D. *Canadian Hydropower and the Clean Power Plan*. Center for Climate and Energy Solutions. April 2015.

[20] U.S. Department of Energy. *Staff Report to the Secretary on Electricity Markets and Reliability*. August 2017.

[21] Brinkman, Gregory, Dominique Bain, Grant Buster, Caroline Draxl, Paritosh Das, Jonathan Ho, Eduardo Ibanez, et al. 2021. The North American Renewable Integration Study: A Canadian Perspective. Golden, CO: National Renewable Energy Laboratory. NREL/TP-6A20-79225. https://www.nrel.gov/docs/fy21osti/79225.pd

[22] Bakke, J., Zhou, Z. & Sumeet M., *Manitoba Hydro Wind Synergy Study (Final Report)*. MISO 2013.

Manitoba hydropower to U.S. utilities reduce GHG emissions in the Upper Midwest by an estimated 44-60 million tons between 2006 and 2012.[23]

Resilience and Energy Security

The North American electricity grid is undergoing tremendous evolution to meet the challenges of an evolving resource mix and extreme weather incidents. This reality is captured in *NERC's 2021 State of Reliability Report* which notes that a pandemic, extreme weather, and cyber security and supply chain issues all impacted the transforming grid in 2020. At the same time, the system was overall reliable despite unprecedented conditions.[24]

The interconnected nature of the North American grid offers numerous reliability and resilience-related advantages to both countries, and electricity trade with Canada can help U.S. states and regions meet environmental and clean energy goals in a reliable manner. Advantages include: (1) a higher level of reliable service for customers through enhanced system stability; (2) efficiencies in system operation and fuel management; (3) opportunities to use power from nearby markets to address local contingencies; (4) opportunities presented by seasonal/time zone variations associated with diversified load; and (5) expanded access to low-carbon and competitively priced resources.

Similarly, Canada-U.S. trade serves to increase the diversity of supply available in certain regions confronting unique challenges, and integration and cross-border cooperation help both countries better manage increasing extreme weather events. Cross-border connections allowed Canadian utilities Manitoba Hydro and SaskPower, who are well versed in cold weather operations, to help serve U.S. load during extreme winter weather events in 2021.

Canadian electricity companies also assist their neighbors through mutual assistance, which remains a hallmark of the industry and has continued throughout COVID-19. During 2020, for example, Hydro-Québec sent over 200 crews across the border to help restore power, and in recent years, many other Canadian entities have deployed personnel to facilitate power restoration efforts following nor'easters, California wildfires, Hurricane Florence, and other severe weather events in the U.S.

Canadian and American Bulk Power System owners and operators understand that due to the interconnected nature of the North American electricity grid, its reliable and safe operation is a shared responsibility. 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

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[23] Manitoba Hydro. *Reducing Emissions.* https://www.manitobahydropower.com/reducing-emissions/

[24] North American Electric Reliability Corporation, 2021 State of Reliability: An Assessment of 2020 Bulk Power System Performance (2021). Retrieved September 14, 2021, from https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2021.pdf.

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; and (2) the standard market practices and protocols utilized by RTOs, ISOs 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.

In addition to this coordinated regulatory adherence, Canadian and American security experts continue to work together in other forums to develop the tools, standards and best practices that protect the integrity of our shared grid. The Electricity Subsector Coordinating Council ("ESCC") is an effective forum and a good example of effective U.S.-Canada security cooperation, which enjoys the participation of senior government officials and electricity industry CEOs from both countries. The Canadian electricity sector and Canadian government also participate in major incident response exercises, including the recent GridEx exercise in 2021, to practice and strengthen response plans for cyber and physical attacks on North American electricity infrastructure. The importance of these efforts, and of a unity of effort approach to energy security, has been underlined by the current geopolitical conflict in Ukraine.

Technology and Innovation

Looking to the future, Canadian and U.S. electricity industries are working together to develop the advanced technology that will be needed to meet future demand. Ontario Power Generation and the Tennessee Valley Authority, for example, recently announced plans to collaborate on developing advanced nuclear technology, including small modular reactors, by drawing on complementary strengths of experience in recently completed projects and construction timelines.

Another example of clean energy innovation is Capital Power with respect to carbon capture and utilization. Capital Power is in advanced design stages of a nearly $2 billion Carbon Capture and Storage project at their flagship Genesee Generating Station in Alberta, which is expected to capture up to 3 million tons of CO2 annually from what will be best-in-class natural gas combined cycle technology. In addition, Capital Power is developing the Genesee Carbon Conversion Center, which will utilize emissions from the facility alongside a carbon conversion technology to transform captured carbon into carbon nanotubes. The company is exploring a number of commercial scale end uses for these nanotubes, including for use in concrete mixtures.

Future-enabling technologies, such as renewable energy storage and batteries for electric vehicles, will require not only processes, but key resources and stable supply chains. To that end, in the *Roadmap for a Renewed U.S.-Canada Partnership*, both countries affirmed the importance of strengthening the Canada-U.S. Critical Minerals Action Plan[25] and have recently announced sector support to boost and secure North American production.

[25] The United States Government. (2021, February 24). Roadmap for a Renewed U.S.-Canada Partnership. The White House. Retrieved September 14, 2021, from https://www.whitehouse.gov/briefing-room/statements-releases/2021/02/23/roadmap-for-a-renewed-u-s-canada-partnership/.

Conclusion

Canada remains a reliable and trusted electricity partner to the U.S. This positive partnership has served American and Canadian businesses and communities for over 100 years. Electricity Canada appreciates the opportunity to provide these comments to the U.S. Senate Energy & Natural Resources Committee, recognizing the key role that electricity serves in society, and the resulting benefits for decarbonization and climate change. Electricity Canada respectfully requests consideration of the comments raised herein, and looks forward to working with the U.S. Senate Energy & Natural Resources Committee to advance continued bilateral collaboration.

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