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United States Department of Energy – Quadrennial Energy Review

Comments of the Canadian Hydropower Association

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The Canadian Hydropower Association appreciates the opportunity to provide comments to the Department of Energy under the Quadrennial Energy Review and to describe how Canadian hydropower can contribute to improving the performance of the North American electricity system, including its transmission, storage and distribution components. Policy recommendations developed by the Department should facilitate electricity trade and access to all clean electricity sources in order to provide certainty for stakeholders and realize the full potential of Canadian hydropower imports.

Our Shared North American Electricity System

The American and the Canadian electricity markets are increasingly connected across national borders. The United States (U.S.) and Canada currently share more than 35 interconnections and 200,000 miles of high-voltage transmission lines. In fact, the North-American electricity grid is more connected North-South than East-West. In many cases, transmission connections enable American customers to access substantial hydropower resources located in Canadian provinces. Figure 1 (*Transmission Map)* illustrates the extent of American-Canadian electrical integration.

There are numerous advantages to this shared electricity system; higher reliability, enhanced system stability, effective fuel management, seasonal/time zone opportunities and expanded access to low carbon and competitively-priced resources.

Canada plays an important role in the overall energy security of the U.S. We are each other's largest trading partners. Electricity flows both North and South between the United States and Canada. On a net annual basis, Canada exports approximately 40 TWh of electricity to the U.S. The vast majority of that power (~80%) is from hydropower. In some border states, Canadian imports play a significant role in meeting electricity needs. For example, Manitoba typically provides the Upper Midwest with about 10,000 GWh of electricity per year. This is enough to power nearly 1 million homes, and accounts for over 30% of the region's supply of renewable generation. In Vermont, the portion is even higher, with one-third of the electricity consumed in the state supplied by Québec. New York receives about 7% of its electricity from Canada. But the consumption of Canadian electricity is not just limited to border states.

Canada provided over 2,250 GWh of electricity to California in 2010—enough electricity to power about 320,000 California homes[1].

Canada's Hydropower Resources

Canada is third largest producer of hydroelectric energy in the world. Hydropower accounts for over 60% of Canadian electricity generation, making Canada's electricity grid one of the cleanest and most renewable in the world. The country still has vast untapped hydroelectric potential (see Figure 2: *Canadian Hydropower Capacity and Potential),* more than enough to double the current installed capacity. A number of new Canadian hydroelectric generating stations and cross-border transmission projects are currently in various stages of development.

As older sources of generation are retired, Canada's vast hydropower resources can play an increasing role in meeting growing electricity demand and pollution reduction objectives in both Canada and the US, but more transmission and interconnections will be needed to realize the full benefits of Canadian hydropower.

Canada's hydropower projects are developed only after a thorough environmental review and with the participation of local and aboriginal communities.

Advantages of Hydropower Imports to the United States

Hydropower is renewable and has virtually no GHG emissions. Hydroelectric facilities have an extremely long (in excess of 100 year) useful life and are highly reliable. Hydropower is cost competitive and contributes to the long-term stability of electricity prices, thus benefiting consumers and investors. Hydropower also offers the only economically viable technology for the large-scale storage of energy on electricity grids. To put its storage capabilities in perspective, a single hydro facility can provide more than a thousand times the storage of a compressed air energy storage facility. One of the largest natural reservoirs in Manitoba Hydro's system, for example, is Lake Winnipeg, which occupies approximately 9,500 square miles. Drawing on hydro storage capacity, operators can increase or decrease production more rapidly from hydropower than from any other electricity source, whether it is renewable or non-renewable.

Historically, there have been many benefits of integrating Canadian hydropower systems with primarily thermal systems in the U.S.; load diversity between warmer and cooler climates can be can be leveraged, system reliability is improved, generation portfolios can be diversified, fuel can be used most efficiently and emissions can be reduced. With the challenges of integrating increasing quantities of variable generation such as wind and solar, hydropower can provide additional benefits.

Hydropower's rapid response times and energy storage capabilities make it a perfect partner for wind and other variable sources. When excess U.S. wind enters the market, Canadian hydropower operators can use the wind energy to serve their load, storing their water in reservoirs for future use. When less

[1] Estimate based on 2010 Energy Information Administration data

U.S. wind blows, they can release water and send clean power to the grid. In fact, this relationship is part of a long-term contract between Manitoba Hydro and Minnesota Power. The two utilities are also working together to build the proposed Great Northern Transmission Line between Manitoba and Minnesota to further enable the synergies between wind and water.

Quantifying the benefits hydropower brings to larger markets can be difficult. In 2013, the Midcontinent Independent System Operator (MISO) undertook a ground-breaking Wind Synergy Study to examine the benefits of incorporating new and existing hydroelectric facilities located in Manitoba with the current and planned wind generation in the remaining MISO footprint. For the first time, models were developed that simulate both the hourly, day-ahead and five-minute real-time energy and ancillary-services markets over a one year study period. The results clearly demonstrated hydropower's ability to quickly ramp up or down to adjust to variability in wind generation (see Figure 3: *Comparing Hydro and Wind Generation in MISO*). As a result, these synergies have the potential to provide weighted average load cost savings in the U.S. Midwest of $430 million annually.[2] This is because "more wind energy is delivered to the market (reduced wind curtailments) and is stored to be delivered at periods of higher demand (energy storage economics)."[3]

Canadian hydropower also provides US customers with virtually non-emitting electricity at a time when climate policies at the state and federal level in both our countries are increasingly striving to reduce greenhouse gas emissions. As an example, over the last five years, thanks to Hydro-Québec's net exports of electricity to the New England region, the emission of over 62 million metric tons of greenhouse gas emissions was avoided. While some have speculated that climate change will reduce the rainfall and runoff negatively affecting hydropower production, comprehensive studies undertaken by industry and governments have found that this is not expected to be the case for Canada. In 2014, Natural Resources Canada published an extensive analysis of the impacts of climate change in Canada and concluded that "*all climate projections indicate a future increase in annual runoff, so average hydroelectric generation should also increase*."[4]

Recognizing these benefits, an increasing number of U.S. utility partners and states are including Canadian hydropower in their long-term electricity supply strategies. In the Northeast, the long-term (2012-2038) contract between H.Q. Energy Services (U.S.), a subsidiary of Hydro-Québec, and Vermont's distribution utilities is a key component of Vermont's strategy. In the past 3 years, states ranging from Vermont, to Wisconsin, to Minnesota, to California adopted legislation or regulations that provide for increasing use of Canadian hydropower by local utilities.

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[2] See Miso : Manitoba Hydro Wind Synergy Study, Final Report, 2013 -10 - 21

[3] Jacob Snell, Daniel Prowse & Ken Adams (2014) The changing role of hydropower: from cheap local energy supply to strategic regional resource, International Journal of Water Resources Development, 30:1, 121-134, DOI: 10.1080/07900627.2013.860771

[4] NRCan, *Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation*, Chapter 3, Section 5.2, Pages 84-87: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Chapter3-Natural-Resources_Eng.pdf

US Policy should recognize the benefits of our shared electricity system.

Our shared electricity system delivers many benefits to both the United States and Canada. North America's hydropower resources represent a key asset for our economies at a time when the need for reliable, clean and economically competitive energy resources is strong.

In order to continue to realize these benefits it is critical that policy does not create any artificial barrier to electricity trade and facilitates access to all clean energy resources. The CHA believes that policy recommendations that will be developed during the Quadrennial Energy review should strive to maximize the value of all renewable resources on both sides of the border and facilitate the planning for new transmission accordingly. These recommendations should take into account the important role that Canada's vast hydropower resources can play in providing cost-competitive, clean and renewable electricity and energy storage, enabling the increased development of wind and solar generation in the U.S., and contributing to the stability, reliability and flexibility of North America's electricity system.

The most imminent regulation that could have implications for cross-border electricity trade is the Environmental Protection Agency's *Clean Power Plan*, which aims to limit greenhouse gas emission from existing power plants. While the draft rule appears to implicitly recognize a role for new and incremental hydropower in helping states meet their carbon reduction targets, the role that hydropower can play should be more fully recognized. New (and existing) hydropower, including Canadian hydropower, can assist U.S. states and regions in cost-effectively meeting their carbon reduction targets but states and utilities need certainty that this resource can be used for compliance in state and regional implementation plans.

About the CHA

The Canadian Hydropower Association (CHA) is the national voice for the hydroelectricity industry in Canada and works to promote the technical, economic, social, and environmental advantages of hydropower. In carrying out this role the CHA works with both Canadian and American government representatives to exchange views and provide information. We also work closely with the National Hydropower Association to promote a better understanding of the important role that hydropower plays in a clean energy future for North America.

Figure 1

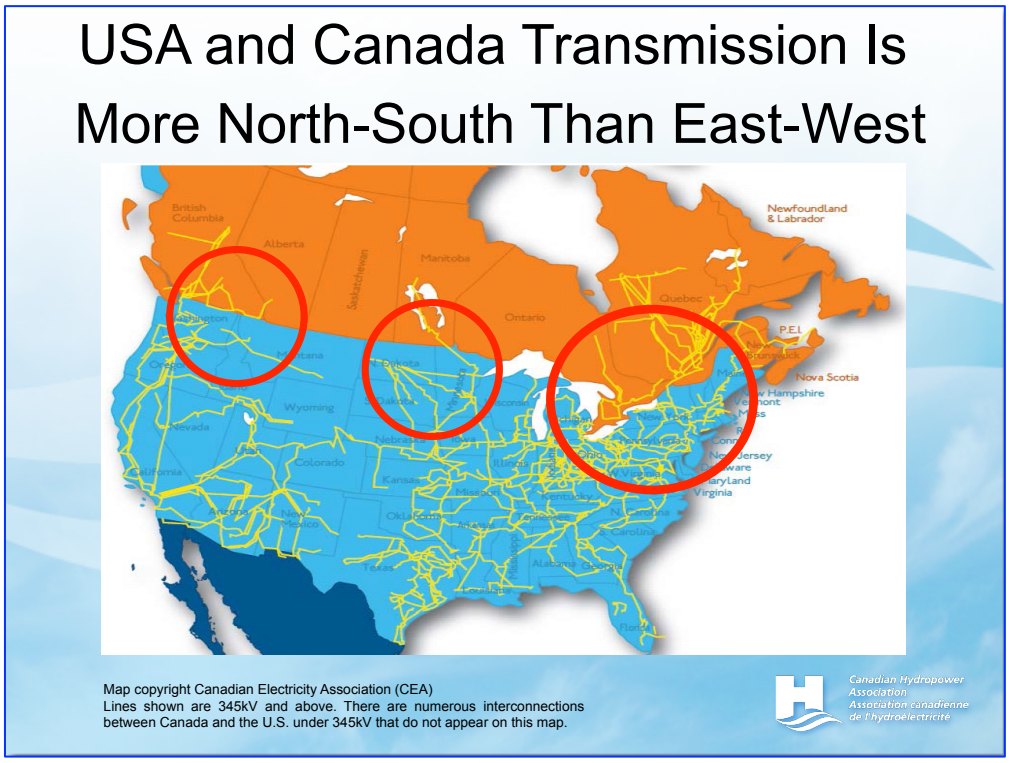

Figure 2