Intelligence MEMOS

From: Brett Dolter and Nicholas Rivers

To: Canadian electricity system planners and government leaders

Date: December 7, 2017

Re: **CONNECTING CANADA WITH NEW HIGH-VOLTAGE DIRECT CURRENT TRANSMISSION LINES**

Canada has one of the cleanest electricity sectors in the world. In 2014, Canada generated 78.4 percent of its electricity using low-carbon technologies such as hydropower plants (60.3 percent), nuclear power plants (16.2 percent), and wind turbines (1.8 percent).

In the light of the Paris Agreement on climate change, our clean electricity sector is a competitive advantage. With clean electricity, we can work to electrify everything from transportation to steelmaking and eliminate greenhouse gas emissions from our energy system.

Canada's clean electricity advantage is not spread equally across the country. Power plants fuelled by coal and natural gas are still important sources of generation in Alberta, Saskatchewan, Ontario, Nova Scotia, and New Brunswick.

Fortunately, Canadians are known for being good neighbours. In Canada, we can think regionally and connect all of the provinces to our clean electricity advantage.

Our recent paper looked at the cost of eliminating greenhouse gas emissions from the Canadian electricity system. We find that strategic investments in high-voltage direct current (HVDC) transmission lines would allow us to get to zero emissions for a lower cost.

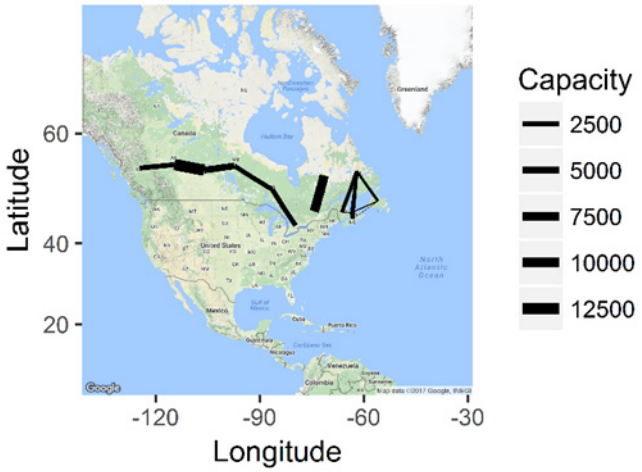
This is because the provinces that rely on coal and natural gas fuelled power plants are located beside provinces with hydroelectric power capacity. Connecting to this hydroelectric capacity has two advantages.

First, neighbouring hydroelectric facilities provide a source of clean electrons. Provinces such as Quebec have spare capacity that can be used to supply neighbours in Ontario and New Brunswick.

Second, many of Canada's hydroelectric facilities have reservoirs that act as a giant battery. These giant batteries can help balance the variability of renewable energy sources like wind turbines and solar photovoltaic facilities. When the wind is blowing in southern Saskatchewan it can provide electricity to homes and businesses within the province. When it is not windy, an enhanced connection to Manitoba's hydroelectric system could provide backup power.

With the cost of wind turbines at an all-time low, this wind + hydro mix offers a cost-effective way to move away from coal and natural gas fired electricity.

Building new transmission lines is not cheap. Manitoba's Bipole III transmission project will cost $5 billion for an additional 2000 MW of transmission capacity.



Investments in new transmission offer a payback by lowering the cost of getting to a zero-emissions electricity sector in Canada. Even in scenarios where new HVDC transmission lines are three times as expensive as Manitoba's Bipole III connector, our model recommends a 450 MW connection from Manitoba to Saskatchewan, a 1,300 MW connection from Saskatchewan to Alberta, and a 2,100 MW connection from Alberta to British Columbia.

We propose that new HVDC transmission connections are a worthy nation-building project for Canada. They promise to connect Canadians to our clean electricity advantage, allow for the integration of new wind facilities, and lower the cost of getting to a zero emissions future. Now, what's needed, is the willingness to co-operate and coordinate electricity trade across provincial borders.

A free download of our paper is available at this link until January 10, 2018:
https://authors.elsevier.com/a/1W5TX14YGgTtq4
https://www.sciencedirect.com/science/article/pii/S0301421517307140

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