

Decarbonizing Global Electricity Generation: Canada's Role

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Issue

The electricity generation sector comprises a large share of global greenhouse gas (GHG) emissions; therefore, strategic and creative decarbonization policy solutions are required in this crucial sector worldwide in order to effectively combat climate change.

Background

Electricity Trade as a Tool for Emissions Reduction

Electricity trade has potential to reduce GHG emissions within a region. To illustrate, given two jurisdictions with differing generation mixes (i.e., one emits more through generation) and commitments to reducing GHG emissions, trade can reduce GHG emissions if the jurisdiction with the dirtier generation mix purchases electricity from the other jurisdiction instead of constructing new generation sources at home. Regional emissions can be further reduced by targeting clean generation investments to the jurisdiction with the cleaner generation mix and likely comparative advantage.

Electricity Trade in the World Today

There is a high volume of electricity trade worldwide in both developed and emerging economies. The volume of this trade is facilitated and organized by numerous power pools worldwide. These are formal regional entities with the purpose of coordinating electricity generation, transmission and trade among jurisdictions in a region. These power pools and their constituent jurisdictions

generally seek to increase trade for many purposes including increasing resilience to electricity supply shocks and reducing electricity pricing. However, generation emissions reduction is not often an explicit goal — it is typically only a by-product of increasing trade. An example of this is the trade between Ontario and the Pennsylvania-New Jersey-Maryland (PJM) interconnection in the Eastern United States. Ontario, with an almost entirely clean generation mix, sells a large volume of electricity to distribution companies in the PJM interconnection, a jurisdiction with a considerably dirtier generation mix. This is primarily due to the lower costs of Ontario power and not to the cleaner nature of its sources.

Global Drivers for Increased Clean Electricity Trade

Sustainable Development Goals

There is considerable overlap between the benefits associated with the expansion of electricity trade and the targets outlined in the UN 2030 Agenda for Sustainable Development, especially those related to Goals 7 and 8. Goal 7 strives for increased energy access, improved international cooperation on clean technology and improving energy efficiency, all of which are closely related to increasing electricity trade. Increasing electricity trade is conducive to the targets of Goal 8 in technology innovation and diversification.

Climate Change: Climate Adaptation

The planet continues to experience rising temperatures, rising sea levels and more extreme weather patterns

due to growing concentrations of GHGs. Sustainable development can reduce vulnerability to climate change by enhancing adaptive capacity and increasing resilience within communities (UN Framework Convention on Climate Change [UNFCCC] 2018). With increased trade of electricity, vulnerabilities to associated adverse effects will be reduced through the more distributed power grid.

Decarbonization as a Driver for Increased Electricity Trade

Growing consensus within the global community on combatting climate change is best represented by agreements such as the 2015 Paris Agreement. The participation of global actors in these agreements increasingly urges the global community to decarbonize and increase electrification in order to meet environmental standards. Mitigation pathways to these ends require increased decarbonization of electricity and increased electrification of energy use.

Barriers to Decarbonization Using Electricity Trade

Since electricity trade as an explicit policy tool for reducing GHG emissions is an underutilized option, existing barriers to its use for this purpose are difficult to identify specifically. The primary barriers to the concept are simply barriers to increasing electricity trade at all.

The Self-sufficiency Mandate

Historically, jurisdictions organized their electricity systems so that they have the capacity to operate without support from other jurisdictions. This was an important factor in generation investment decisions in the past when transmission systems were weaker and more unreliable, but today, with the extensive enmeshment of economies and the very low risk of neighbour dependence, especially within developed economies, this concept has become outdated, inefficient and detrimentally persistent.

Rising Barriers to Trade

The current global trend, temporary or otherwise, is a growing attitude of nationalism and increasing barriers to trade, especially within the United States. The nationalist attitude of nationally generated electricity with no attention to its efficiency or cleanness is a clear barrier to decarbonization using electricity trade.

Slow Climate Action Goal Progress

Although nearly all countries have submitted intended nationally-determined contributions (INDCs) as a requirement in the Paris Agreement, there is little progress towards fulfilling these INDCs collectively. For example, coal-dependent generation policies are still being implemented by countries that have made significant commitments to reducing emissions. Using electricity trade as a tool to reduce emissions is only possible when jurisdictions want to reduce emissions.

Popularity of the Micro-grid Concept

In some markets, such as in Sub-Saharan Africa, large centralized generation systems may be less efficient than local generation due primarily to the high transmission cost to customer revenue ratio and the dramatically falling price of photovoltaic solar generation technology. Although there are substantial efficiency gains by micro-grids in some regions, in the cases where centralized generation involving electricity trade is more efficient and emissions-reducing, the popularity of the micro-grid concept may push back against the more effective centralized generation system.

Insufficient Investments

Investments in transmission infrastructure, somewhat obviously, is crucial to the expansion of electricity trade. In emerging markets especially, there is a perceived high risk to transmission projects and so attracting investment can be difficult.

The Role of Canada in Global Decarbonization Using Electricity Trade

Domestically, Canada is home to a world-leading generation mix with 82 percent of electricity generated through clean sources (National Resources Canada 2019a). This clean electricity advantage is central to fulfilling Canada's climate pledges and to the Pan-Canadian Framework on Climate Change, which holds green technology, innovation and jobs as one of its key pillars. In order to achieve the transition to clean energy, the generation sector is projected to triple in generating capacity by 2050 and require unparalleled cooperation between the public, private, indigenous and civil society sectors (Canadian Electricity Association 2017).

Abroad, Canada has been active in energy governance as a member country of both the International Energy Agency (IEA) and the International Renewable Energy Agency

(IRENA), as well as the Mission Innovation initiative announced at the 2015 United Nations Climate Change Conference in Paris dedicated to accelerating global clean energy innovation (National Resources Canada 2019b). Specific to electricity, Canada and the United States co-manage the North American Electric Reliability Corporation (NERC), a standard-setting body dedicated to continental grid resilience that also partners with the European Union around grid collaboration and innovation (NERC 2019). As part of its 2018 Group of Seven Presidency, Canada made climate change and clean energy a core issue of discussion, emphasizing the transition to clean energy sources as an international challenge.

How Decarbonization Using Electricity Trade is in Canada's Interest

Electricity trade and clean technology benefit Canadian interests in multiple ways. Internationally, action on expanding renewable sources and electricity transmission are key parts of climate action, as supported by the UNFCCC, IEA and IRENA. Economically, Canada is the fifth-largest net energy exporter, with energy making up 11 percent of nominal GDP (National Resources Canada 2018). Leading this energy transition is an imperative for ensuring future economic prosperity and maintaining competitiveness in a fast-changing energy landscape. The development of Canadian clean energy technology also enables economic and trade diversification, promoting the export of clean technologies to countries intent on greening their generation mixes. Natural Resources Canada has noted energy efficiency and distributed power generation as two natural opportunity areas for the government to lead in promoting and fostering greater global energy innovation (Natural Resources Canada and McKinsey & Co. 2012).

Recommendations

1. **Canada should promote the use of electricity trade as an explicit tool for reducing GHG emissions within regional power pools worldwide.** Through its membership in the UNFCCC, IEA and IRENA, Canada should promote the importance of electricity trade as a useful tool for regional reductions in GHG emissions. At future Conferences of the Parties, the Canadian delegation should advocate for investments in transmission infrastructure and power pool-coordinated clean generation technologies. Canada should use its diplomatic ties with regional power pools (such as the Southern African Power Pool or the PJM interconnection) to include reducing emissions through trade as an explicit goal within their mandates.
2. **Canada should engage in sustainable finance internationally and support standards for climate-related financial disclosure.** Sustainable finance covers capital flows, risk management, and financial processes that include environmental and social factors as key considerations for capital allocation. The Canadian Expert Panel on Sustainable Finance has called for effective and consistent financial regulation and greater financial cross-sector collaboration (Executive Summary 2018). GAC should facilitate knowledge sharing between Canadian finance authorities and foreign central banking or international institutions, such as the Network for Greening the Financial System or the IEA. The European Union is developing taxonomies and frameworks for sustainable economic activity, market benchmarks and labelling of financial products, and Canada should play an active part in this discussion through forums such as the Comprehensive Economic and Trade Agreement (International Institute for Sustainable Development 2019). GAC should facilitate linking trade opportunities, development financing and central banking around creating risk disclosure standards that better inform Canadian companies and align domestic and international finance with the UN Sustainable Development Goals.
3. **Canada should promote investment in micro-grids where they have efficiency gains over distributed power grids.** Micro-grids operate independently from distributed power grids. The implementation of micro-grid technology at a larger scale where appropriate provides increased electricity access while avoiding increased GHG emissions. As a demonstration, Quebec companies have been implementing renewable micro-grid electricity projects in Nunavut to supply electricity to Indigenous communities (Export Development Canada 2017). GAC should invest in micro-grid projects that support technology developers and promote research and development centres. Furthermore, GAC should act as a facilitator in linking potential entrepreneurs who have the capacity to launch or expand micro-grid projects.

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