Power Sector Integration in the North American Northeast

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While almost all countries around the world have signed the Paris Agreement, aiming at limiting global warming below 2° Celsius by 2100, only a few are taking actual policy and regulatory decisions to cut their own greenhouse gas (GHG) emissions. This is especially true in North America, where GHG emission have risen between 1990 and 2015 by 3.51% in the United States and by 18.13% in Canada (UNFCC, 2018). Some sub-national governments in North America are however adopting voluntary targets to deeply cut their emissions, notably through the Under2 Coalition (under2mou.org). Among these sub-national governments, the provinces of Ontario and Quebec in Canada have signed the Under2 Memorandum of Understanding (MOU), aiming at reducing emissions by 80 to 95% below 1990 levels, or below 2 annual metric tons per capita, by 2050. In the US, New York and all New England states (except Maine) have also signed this Under2 MOU. These provinces and states are all in the North American Northeast, which is unique as a region in its shared commitment to fight climate change on this continent.

Achieving such ambitious GHG reduction goals will obviously require drastically cutting the use of fossil fuels. Electricity, when generated from renewable or non-emitting sources, can be a very good energy substitute for heating and transportation, the two sectors where most fossil fuels are used. However, decarbonizing without integrating neighboring power sectors can significantly increase the challenge. In this policy brief, the rationale for such regional integration is explained. First, some additional evidence of serious climate action in the North American Northeast is provided. Then the main features of the power systems of these different sub-regions are described, leading to some recommendations aiming at fostering regional power sector integration.

Climate Change Action in the North American Northeast

The North American Northeast is the host of a variety of significant GHG reduction initiatives, which illustrate the commitment of these subnational governments to implement real constraints on GHG emissions. These initiatives are two carbon markets, and various other programs to reduce GHG emissions.

The US Northeast has witnessed the first GHG cap-and-trade market in North America, known under the name of the Regional Greenhouse Gas Initiative (RGGI). New York and all New England states (Maine, Vermont, New Hampshire, Massachusetts, Rhode Island and Connecticut) are part of this regional initiative. This cap-and-trade market started in 2009 with a binding cap on CO_2 emissions from the power sector. Other sectors, such as transportation, heating or industrial emissions are not covered by this market. It allocates all emission rights through auctions, with a floor price (called the auction reserve price). There are therefore no free allocations of emission rights to power producers. While the price per tonne of CO_2 never exceeded US$7.50 (in 2015), total proceeds from the auction amount to close to US$3 billion dollars (RGGI, 2018). Between 2020 and 2030, the cap on CO_2 emissions will decrease by 30%, forcing generators to further decrease emissions from their power plants.

The other carbon market of the region is the Quebec and Ontario carbon market, also linked to the California carbon market under the Western Climate Initiative (WCI). This carbon

market started in 2013 in Quebec and in 2017 in Ontario and has a much wider coverage than the RGGI. All emissions, except those from agriculture and waste, are covered. The floor price is also much higher than the RGGI floor price: US$14.53 in 2018 compared to US$2.20 for RGGI. Large industrial emitters benefit from free allocation for the majority of their emissions, but in the transportation and building sectors, energy distributors have to purchase emission rights. They have to acquire emission rights for an amount equivalent to the emissions resulting from the combustion of the energy products they sell (mostly gasoline, diesel, natural gas). The Quebec and Ontario cap will be declining progressively through 2030, to reach a level of 37.5% and 37%, respectively, below the 1990 level of emissions by 2030. With the California cap declining by 40% between 2020 and 2030, no surplus of emission rights should be available in the market by 2030.

In addition to these carbon markets with a hard cap, Quebec and Ontario both provide subsidies for the purchase of electric vehicles (EVs): up to Can$8,000 and Can$14,000 respectively. With rebates up to $2,000 in New York and $2,500 in Massachusetts, those states also incentivize EVs, but less significantly. A zero-emission vehicle (ZEV) rule will further force the penetration of EVs in Quebec, through a system of tradable credits that will increasingly penalize automakers for not selling the required amount of ZEV, as a proportion of their total sales.

While carbon markets will reduce the amount of fossil fuels available to consumers and while EVs will become more and more frequent in the Northeast, explicit renewable electricity targets in New York and New England are also ambitious. In New York, the energy strategy "Reforming the Energy Vision" (REV) aims at 50% renewable electricity by 2030. In New England, renewable portfolio standards (RPS) aim at bringing the share of renewable electricity sold to distributors to 27% in 2020 in Connecticut and to 15% in Massachusetts (only new resources will count in this latter case). The four other smaller New England states also have ambitious RPS targets: 38.5% by 2035 in Rhode Island, 75% by 2032 in Vermont, 24.8% by 2025 in New Hampshire and 40% by 2017 in Maine (DSIRE, 2017).

Power Sectors in the North American Northeast

The carbon, EV and renewable electricity policies described above will clearly force the electricity sectors of all northeastern provinces and states to evolve. In Ontario and Quebec, as their electricity production is already largely emission-free (due mostly to nuclear and hydropower in Ontario and hydropower in Quebec), the penetration of EVs and distributed generation technologies (mostly roof-top solar photovoltaic panels) will create power demand and financial challenges.

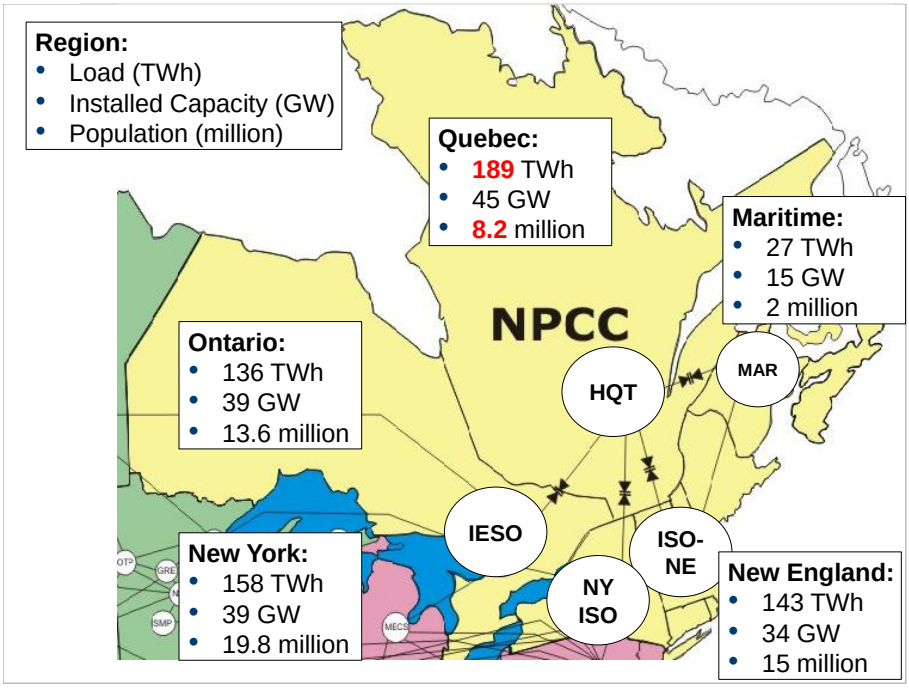
In New York and New England, 2016 shares of renewable generation were generally low: 25% in New York, 17% in New Hampshire, 9% in Massachusetts, 4% in Rhode Island and 3% in Connecticut (EIA, 2018). While figures are higher in Vermont (100%) and Maine (65%), these two states are small players within New England. Overall, 46% of the 242 TWh combined New York and New England electricity generation came from natural gas

in 2016, while 31% came from nuclear power and 2.5% from coal and oil. Only 21% was from renewable sources, with conventional hydropower accounting for 14%.

Such figures mean that significant efforts will be necessary to decarbonize the US side of the North American Northeast. The region is already tied together by an electric reliability coordinating council, the Northeast Power Coordinating Council (NPCC). Such entity is however only responsible for reliability standards and cooperation and is not involved at all in power market design, generation and transmission planning or environmental issues.

The NPCC region, as shown in Figure 1, is actually a very poorly harmonized set of power systems. Each sub-region has its own system operator (or even several ones in the same system, such as in the Canadian Maritime region), market design, regulatory institutions and, as described in the previous section, various climate and environmental policies.

Figure 1 The Northeast Power Systems: Total Load (TWh), Installed Capacity (MW) and Population in 2016



Source: NPCC 2017 LONG RANGE ADEQUACY OVERVIEW

The province of Quebec stands as very different sub-region in the NPCC. Despite its relatively small population (of 8.2 million, see Figure 1), it has the highest annual load with 189 terawatt-hours (TWh). This is explained by its abundant capacity of relatively cheap hydropower: more than 40 GW, complemented with some wind and biomass generation capacity. It also benefits from 176 TWh of storage capacity through its 27 large reservoirs, which could be used to balance intermittent wind and solar generation. Such cheap hydropower explains the high consumption: electricity intensive industries have moved to Quebec (such as aluminum smelters) and heating is already largely electrified.

Although current interconnections between NPCC sub-regions allow some trade to take place, more power, especially renewable power, could potentially be produced and circulate between these sub-regions. Indeed, several potential technical benefits could be obtained from power sector integration (Pineau, 2013):

- Improving reliability and pooling reserves
- Reduced investment in generating capacity
- Improving load factors and increasing demand diversity
- Economies of scale in new construction
- Diversity of generation mix and supply security
- Economic exchange
- Environmental dispatch and new plant sitting
- Better coordination of maintenance schedules

In the context of the forthcoming major power sector transformation, due to climate change policies, ignoring these potential benefits could not only be very costly – it could also discourage attempts to achieve the various targets by making them appear unachievable.

Recommendations

As the North American Northeast is already committed to heavy GHG emission reductions, the focus should now turn to finding the best approaches to decrease these emissions. The power sector is central to these objectives for two reasons. First, it is still an important source of GHG in New York and New England. Second, electrification of some energy uses (transportation and heating) is likely to increase the reliance on the power system.

Finding ways to decarbonize and increase the reliability the region's power systems is an essential component of any successful decarbonization path. Many benefits can be attached to power system integration in general, and the NPCC region even possibly more, due to the large hydropower resources available in Quebec. Consequently, analyzing the region's power system as a whole, rather than as five interconnected, but distinct, systems, should be a priority in the region's climate change planning.

Harmonizing carbon markets and the other various climate-related policies should of course be prioritized. But premiers and governors of the Northeastern sub-regions should also consider these three actions:

1. Mandate a regional analysis of the Northeast multidimensional integration benefits.
2. Assess the best sources of renewable electricity, and develop a regional procurement approach.
3. Design and develop joint institutions to foster the development of a more integrated power system.

Building on current institutions, such as the NPCC organization, and taking inspiration from other regional cooperation experiences around the world (see for instance Joergensen, 2016, for the Nordic case), the North American Northeast should be able to successfully complete its energy transition, by making the most of its different energy resources.

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