Decarbonizing the Northeast

(\text{\text{g}} \ \text{CO}_2 \ \text{eq.} \ / \text{kWh})

<table>
<thead>
<tr>
<th>CONTINUOUS-OUTPUT OPTION</th>
<th>INTERMITTENT-OUTPUT OPTION</th>
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<tr>
<td>14</td>
<td>17a</td>
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<td>6</td>
</tr>
</tbody>
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| Hydropower – run-of-river | Nuclear | Wind | Hydropower – reservoir | Solar photovoltaic |

a) Hydro-Quebec’s results.

b) Reservoir hydropower differs from run-of-river hydropower with respect to GHG emissions. After it is impounded, a reservoir releases GHG emissions, with the emission rate diminishing gradually over the following ten years. This is why GHG emission rates are higher for reservoir hydropower than for run-of-river hydropower.
Decarbonizing the Northeast

- **Ontario**: 4.6 TWh
- **Québec**: 171 TWh (99.9% hydropower)
- **New York**: 7.9 TWh
- **New England**: 18.2 TWh
- **New Brunswick**: 2.1 TWh
- **Other markets**: 1.6 TWh

**Total net exports**: 34.4 TWh

- 53%
- 23%
- 13%
- 6%
- 5%
Massachusetts Clean Energy RFP

- 9.45 TWh of Québec hydropower selected by Massachusetts
- New transmission line between Québec and New England grids
- 20-year contract for deliveries every hour of the year
And after that 20-year contract?

We’ll need:

- Clean
- Firm
- Cost-effective
- Flexible

- Balancing variable renewables
- Seasonal storage
- Ramping capabilities

- Transmission, transmission, transmission
KEY TAKEWAYS

• The need for flexibility has increased and this trend will in all likelihood continue.

• The Northeast has flexibility in many of its energy supply options but some of it will need to be unlocked. This could be accomplished through:
  - Improvements to existing market mechanisms: more flexible scheduling at interties, better price signals
  - New flexibility-specific products (ramping, attribute-specific capacity, wind balancing, storage)
  - Development of other incentives (inside or outside organized markets): mandates/RFPs, incentives for resources under contract
HYDRO-QUÉBEC: THE BATTERY OF THE NORTHEAST