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A study on the energy storage market in Canada

Summary for policymakers prepared for Natural Resources Canada

March 2021

Introduction

The objectives of this study are to:

1. Identify and describe energy storage technologies that could be deployed in Canada.
2. Characterize the current energy storage market in Canada.
3. Simulate the potential adoption and value of energy storage through mid-century within Canada under a variety of assumptions about future GHG reduction policy and technology costs and performance.

To accomplish these objectives, Navius developed a version of its North America-wide electricity dispatch model (IESD), capable of simulating the adoption of grid-scale storage.

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Outline

This deck summarizes key insights from this study related to:

1. Future investment in electricity storage technologies
2. Development of Canada's electricity system
3. Economy-wide decarbonization
4. Opportunities for future research

Please note that this high-level summary for policymakers is based on extensive modeling work and analysis conducted between 2020 and 2021. For more information about this study and its findings, please see the full report.

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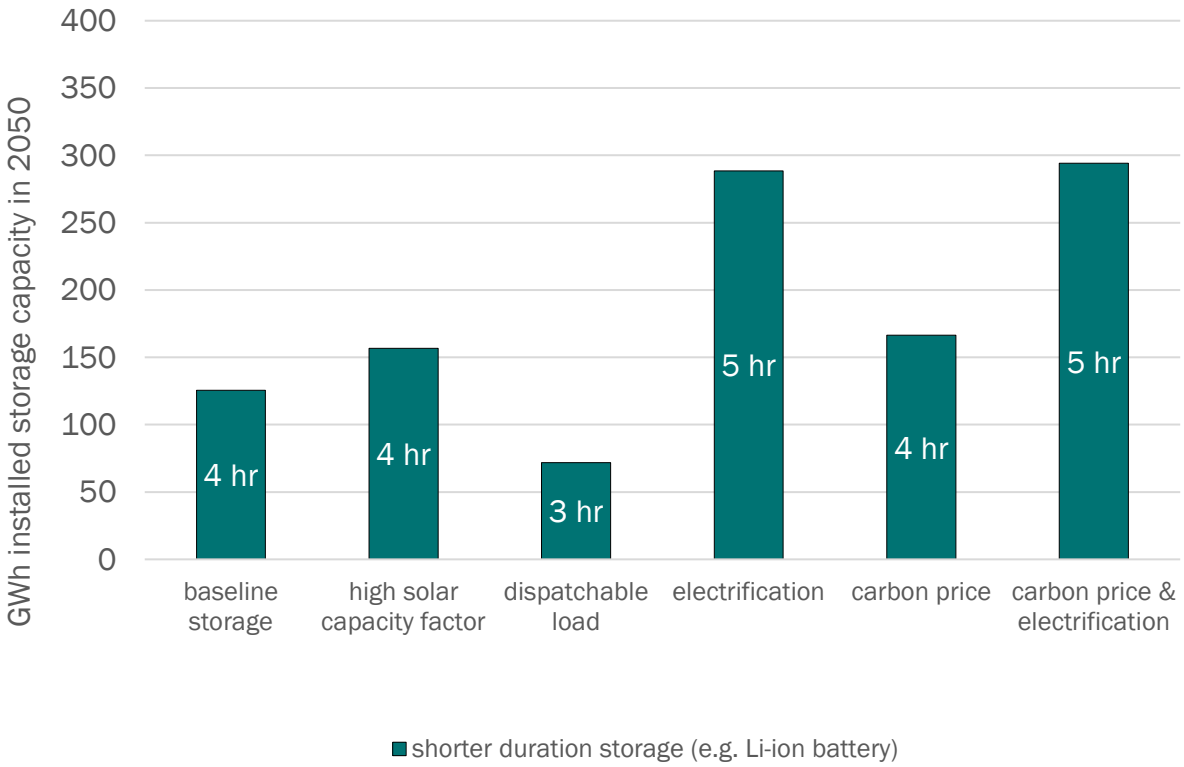
Section 1
Electricity storage technology

1. Electricity storage technology

2-8 hour storage is likely to become a significant component of Canada's electricity system

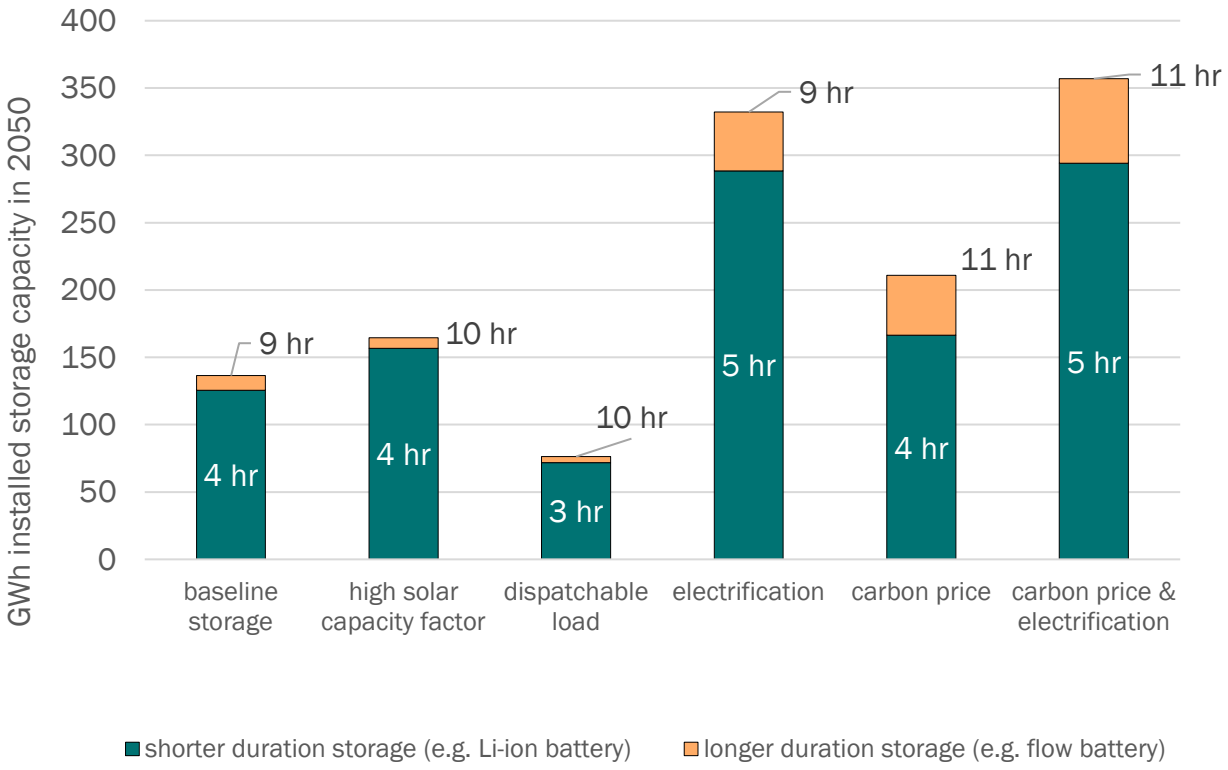


- All scenarios result in significant adoption of short (2-8 hour) storage by mid-century.
- This type of storage is consistent with the capabilities of lithium-ion battery technology that is widely deployed today.

Data labels show average duration (i.e., ratio of storage:capacity). Source: Navius analysis using IESD.

1. Electricity storage technology

The role of longer duration (8+ hour) storage in Canada is uncertain, and the market is crowded



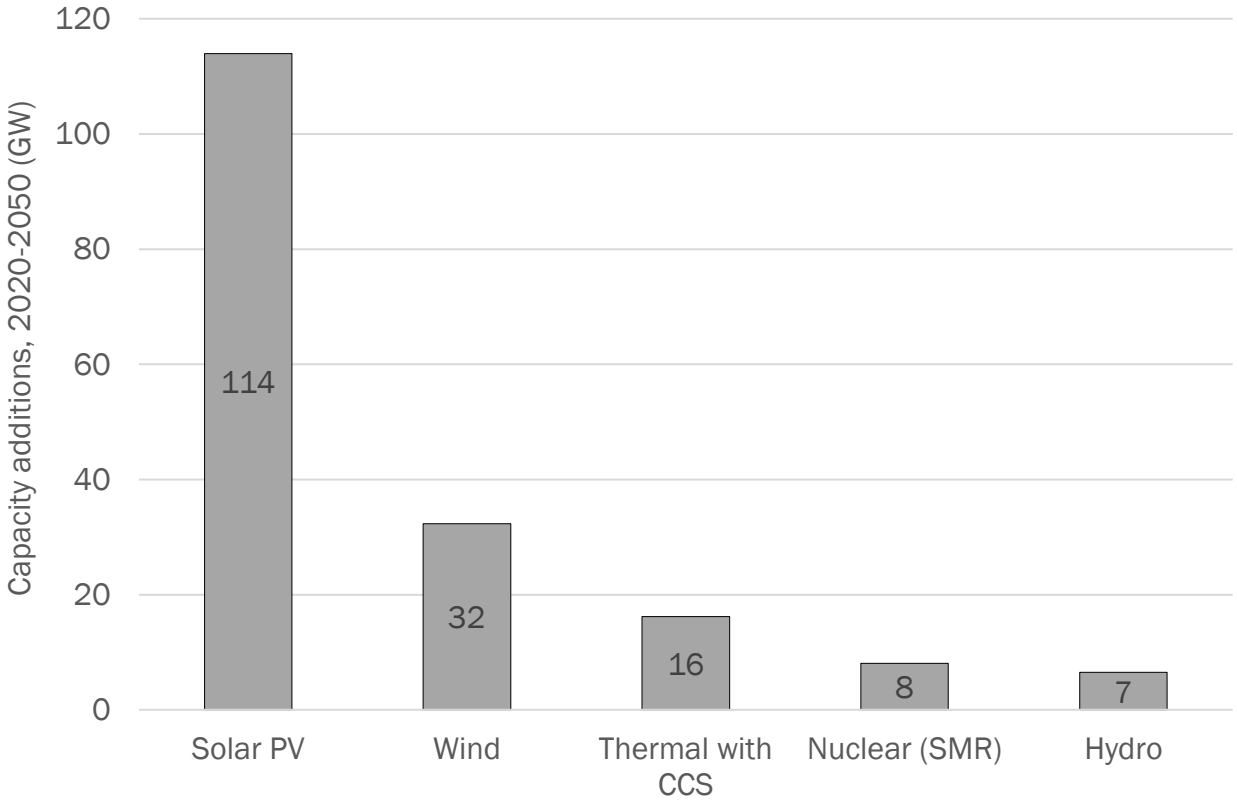
- The need for longer duration storage technologies (consistent with flow batteries or other advanced chemistries) is less assured.
- Such storage competes with low-capacity factor gas and overbuilding (and curtailing) renewable capacity.

Data labels show average duration (i.e., ratio of storage:capacity). Source: Navius analysis using IESD.

Section 2
Electricity generation technology

2. Electricity generation technology

Solar is the primary contributor to new energy supply between 2020 and 2050, followed by wind



- Solar dominates new capacity additions through mid-century under all scenarios.
- It is driven by low levelized costs anticipated for the technology, resulting in substantial overbuilding and curtailment.

Figure shows zero-emission capacity additions with ECCC's social cost of carbon (~$370/t) and high electrification. Source: Navius analysis using IESD.

2. Electricity generation technology

- A high carbon price (or sufficiently high incentives) could induce the adoption of gas-fired electricity generation with carbon capture.
  - Carbon capture technology on combined cycle gas plants was a feature of all scenarios with a rising carbon price.
  - Capacity factors were in the range of ~35%, suggesting the primary value of gas is its winter availability (i.e., when solar generation is low) and flexibility.
- Additional firm baseload capacity is cost-ineffective and not needed to ensure reliability in Canada.
  - Given the availability of low-cost storage and variable renewables, the analysis found little need for additional firm capacity such as run-of-river, nuclear (conventional or SMR), geothermal power, biomass boilers with steam turbines or high capacity factor gas.
  - This outcome is primarily due to existing hydroelectric and nuclear capacity which already provides firm baseload capacity and would continue to do so in a low-carbon future.

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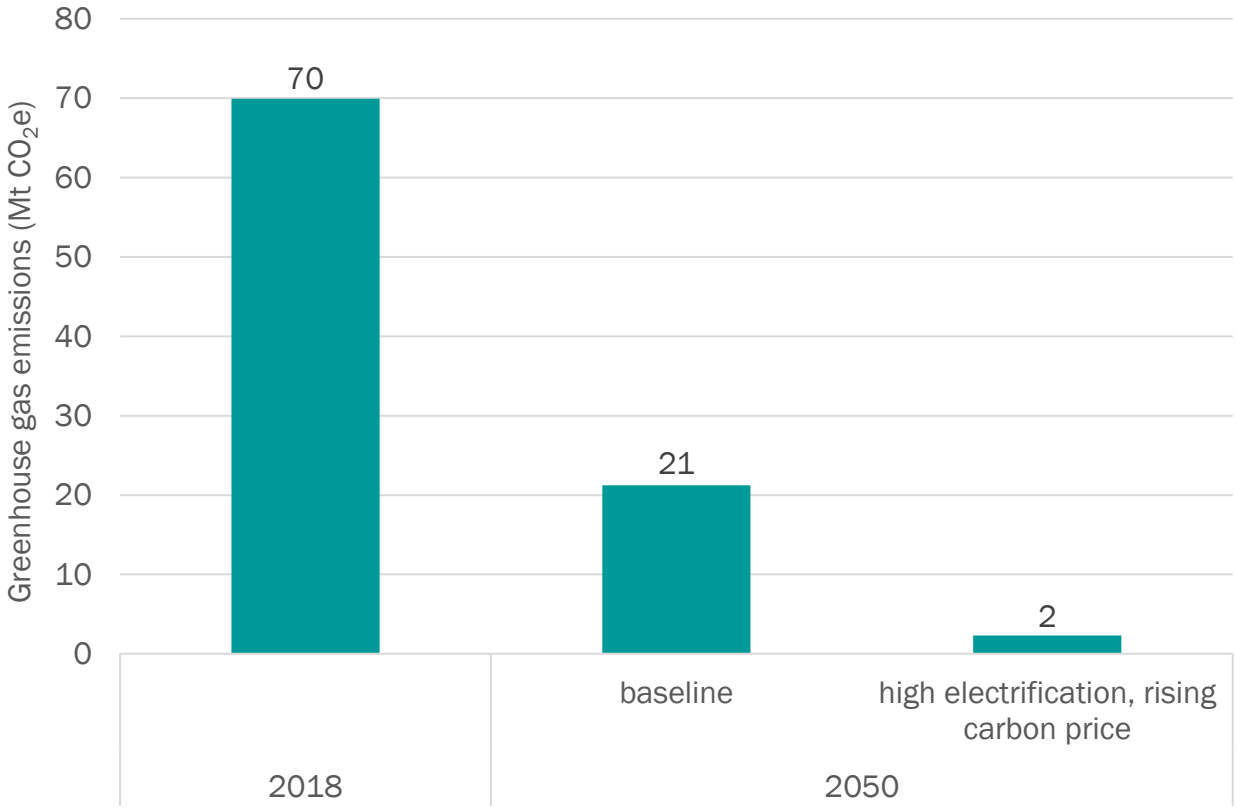
Section 3
Economy-wide decarbonization

3. Economy-wide decarbonization

The electricity system presents an opportunity for helping achieve national climate objectives



- Under a worst-case scenario for climate objectives, GHGs fall substantially.
- Under a best-case scenario, the sector can (1) enable electrification across the economy while (2) reducing its own emissions to a negligible amount by mid-century.

Excluding emissions from industry cogeneration. Source for historical data: National Inventory Report. Source for forecast data: Navius analysis using IESD.

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Section 4
What we didn't learn (yet)

4. What we didn't learn

Future modeling efforts could build on this work to explore:

- Relative value of different chemistries or storage mediums.
- Impact of significant but uncertain new sources of electricity demand (e.g. full electrification of space heating, freight transport and industry).
- Relative cost and availability of demand response and other distributed energy resources.
- Value of new transmission lines between provinces and the United States.
- Potential change in electricity prices associated with electricity distribution system costs.
- Value of wind, solar and storage using a probabilistic approach.
- Potential of increasing hydroelectric capacity at existing sites.
- Impact of low-cost, flexible and/or cogenerating small modular reactors.
- Potential to reduce emissions from industrial cogeneration.

Thank you!

Questions or comments:

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