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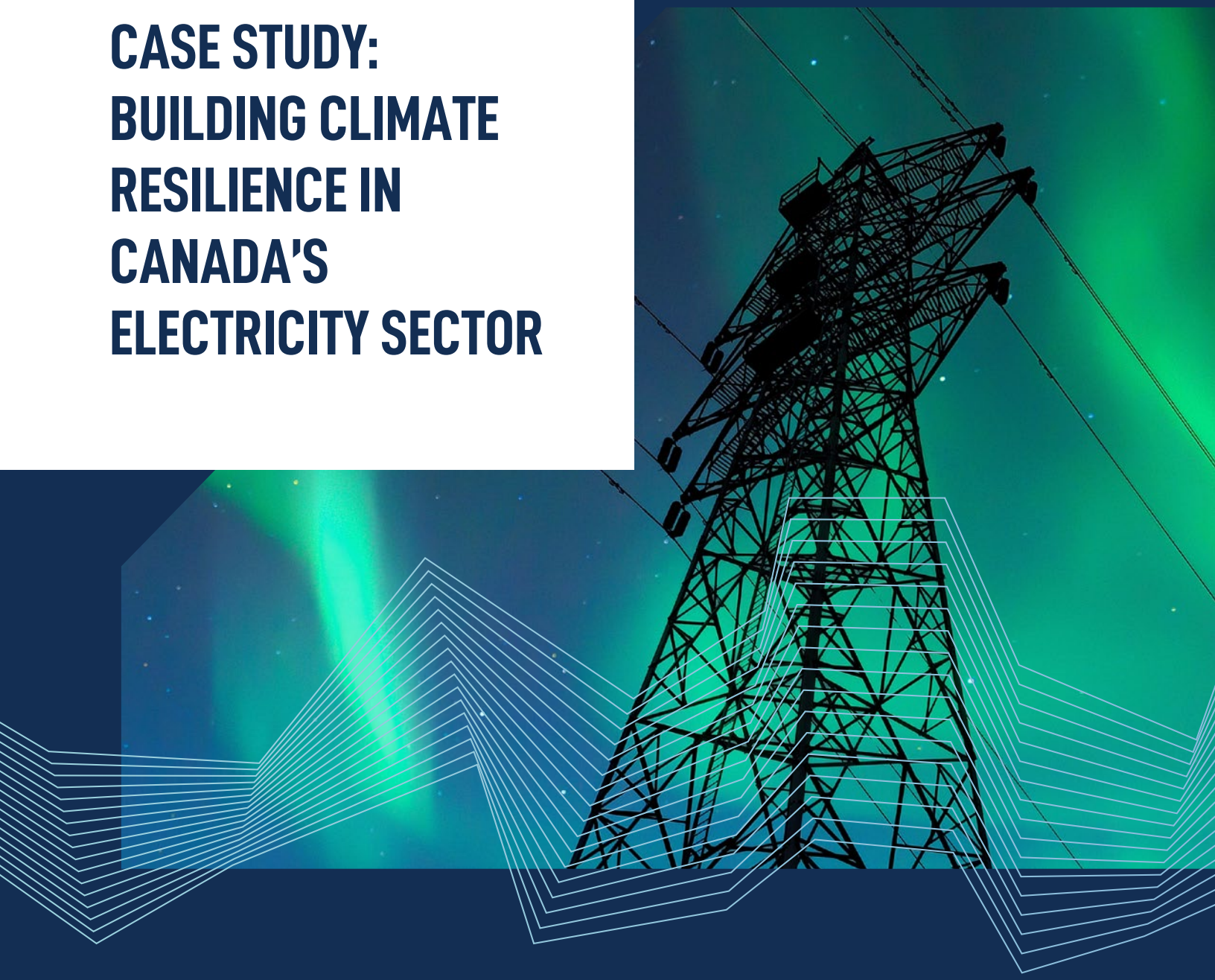
CASE STUDY: BUILDING CLIMATE RESILIENCE IN CANADA'S ELECTRICITY SECTOR



Electricity Canada's Guide to Adaptation Planning for Electricity Companies

Electricity Canada

Canada

Highlights

- **Electricity Canada**, with support from Natural Resources Canada (NRCan), developed a guide to help Canadian electricity utilities to prepare for and adapt to the impacts of climate change.
- Released in 2020, *Climate Change and Extreme Weather: A Guide to Adaptation Planning for Electricity Companies in Canada* has been used by over 85% of Electricity Canada member companies.
- The sector continues to develop ways to prepare and respond to climate change realities. This includes mapping risks, upgrading infrastructure, and adopting new technologies to increase the reliability of the Canadian electricity supply.

About this case study

Canada's electricity sector faces growing risks from climate change. Events such as droughts, extreme weather, wildfires and floods are becoming more frequent and disruptive.

A practical adaptation guide, called *Climate Change and Extreme Weather: A Guide to Adaptation Planning for Electricity Companies in Canada*, was created to help companies better understand and manage climate risks. Electricity Canada (formerly the Canadian Electricity Association), with support from NRCan, developed the guide in response to the risks and the need for a sector-wide approach to adaptation.

This case study:

- Summarizes the climate impacts on the energy sector
- Outlines the key features of the guide and its resources
- Highlights lessons learned while developing the guide
- Explains where further action is needed

Canada's electricity industry is building the foundation for a more secure, reliable, and sustainable energy future by advancing this adaptation work and strengthening resilience across the sector.

A power utility crew works to restore power after a damaging ice storm in Beaver Bank, Nova Scotia, on February 2, 2022.

Climate change and Canada's electricity sector

Climate hazards have always affected Canada's electricity sector.

Hydropower is susceptible to changes in precipitation and river flow patterns. Prolonged droughts or excessive rainfall can disrupt generation capacity.

Nuclear power plants need stable water supplies for cooling. This makes them vulnerable to water scarcity and extreme heat.

Wind and solar power are influenced by changing wind patterns and increased cloud cover. Wildfires also have an impact when particulate matter in the air reduces solar irradiance.

Transmission and distribution lines are vulnerable to extreme weather, including ice storms, wildfires, floods and high winds[1].

Damage to these systems can cause widespread power outages that can cause significant economic impacts. For example, under a high greenhouse gas emissions scenario, future weather-related damages to electrical infrastructure are projected to cost up to $4 billion annually[2].

However, utilities can reduce these future costs by up to 77%[3] by making the electrical infrastructure more resilient now. This projection provides a clear business case for the sector to take proactive measures against increasing climate-related risks.

Did you know?

The electricity sector plays a critical role in Canada's economy. The sector accounted for about **2% (over $36 billion)** of Canada's GDP in 2024[4] and employed nearly **200,000 people**[5].

Canada has one of the cleanest electricity grids in the world because **82.5% of its generation is from non-emitting sources**[6].

Canada's **electricity demand** is expected to grow by 1.6 to 2.1 times by 2050 compared to today. Our **electricity generation capacity** needs to be 2.2 to 3.4 times greater to meet that demand[7].

What is adaptation?

Climate change adaptation refers to actions that either reduce the negative impacts of climate change or take advantage of potential new opportunities, thereby increasing resilience to a changing climate. Adaptation incorporates **future climate projections** to better prepare for what is ahead instead of relying only on historical data to guide operations and planning.

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1 Climate Impacts on Canada's Electricity System, Canadian Energy Research Institute (2021). For more information on climate change risks to Canada's electricity sector and the energy sector more broadly, refer to NRCan's National Issues Report.

2, 3 Damage Control: Reducing Climate Impacts, Canadian Climate Institute (2022)

4 Table 36-10-0434-06 Gross domestic product (GDP) at basic prices, by industry, annual average, industry detail (x 1,000,000), Statistics Canada (2024)

5 Table 36-10-0489-01 Labour statistics consistent with the System of National Accounts (SNA), by job category and industry, Statistics Canada (2024)

6 Electricity in Canada, Natural Resources Canada

7 The Big Switch: Powering Canada's Net Zero Future, Canadian Climate Institute (2022)

Canada's electricity sector is investing in climate change adaptation to build sector resilience and reduce future costs. Examples of adaptation include:

- **Raising and flood-proofing substations** to protect equipment during heavy rain and flooding
- **Upgrading powerlines** with fire-resistant materials to reduce damage during wildfires
- **Strengthening the electricity grid** to manage increased demand from air conditioner use
- **Improving vegetation management** around powerlines to reduce the risk of outages during extreme weather events. For more examples of adaptation, refer to Appendix 5: List of adaptation measures in Electricity Canada's *Guide to Adaptation Planning for Electricity Companies in Canada*

About the project

From 2017 to 2020, **Electricity Canada** led a national initiative to develop guidance for utility companies to mitigate the risks from climate impacts on electricity infrastructure and operations. Utilities across the sector recognized that the lack of concrete guidance and tools was a barrier to action.

They supported this initiative through their own investments including by being actively involved in developing and using the guide. The initiative's goal was to help utility companies better prepare for climate change impacts. Being prepared will avoid future service disruptions and the associated costs and will increase the resilience and reliability of the electricity system.

NRCan's Climate Change Adaptation Program provided funding and access to adaptation experts from across Canada. Electricity Canada members provided in-kind support, which demonstrated a shared commitment to advancing resilience through collaboration and private-public partnerships. The members of Electricity Canada that provided in-kind support include Toronto Hydro, Saint John Energy, Manitoba Hydro, BC Hydro, Hydro One, and Ontario Power Generation.

Electricity Canada developed the guide through more than two years of workshops and interviews with electricity companies across Canada. They held five **training workshops** across the country to help members interpret and apply the guide to their regional contexts. Electricity Canada also presented a series of **interactive webinars** at which members could share experiences about preparing their adaptation plans and receive additional support and advice on using the guide.

About the guide

The guide provides an eight-step risk management framework. This framework helps electricity generation, transmission, and distribution utilities develop effective adaptation plans.

The framework has four phases:

- **Phase I. Setting the Stage** (Step 1). Utilities define the goals of their climate risk assessment, maintain focus on desired outcomes, and align planning with existing corporate objectives such as reliability. Success depends on engaging the senior leadership early in the process.

The Climate Change and Extreme Weather guide offers a framework with eight steps to help utility companies develop adaptation plans (image adapted from the Electricity Canada guide).

- **Phase II. Risk assessment** (steps 2, 3 and 4). Utilities assess the vulnerability of key assets to climate risks by using historical data and future projections. They use vulnerability matrices and scenario analyses to prioritize risks by likelihood and consequence.
- **Phase III. Risk response and adaptation planning** (steps 5 and 6). Utilities identify and prioritize adaptation strategies by using criteria such as cost, timing, and non-financial benefits. They apply tools such as cost curves, sensitivity analyses, and best practice benchmarks to support decision-making.
- **Phase IV. Prepare for implementation** (steps 7 and 8). Utilities develop a road map that links key assets, risks, and planned adaptation measures with schedules, budgets, accountabilities, and performance metrics. They track progress and revise strategies as climate risks evolve.

The guide includes a wide range of tools and resources to help utility companies work through the framework:

- **Checklists** for each of the eight steps in the guide
- **A comparison table** that illustrates the alignment between the guide and the ISO (International Organization for Standardization) 14001/14090 standards
- **A glossary of key terms** used in the guide
- **Potential climate impacts** for electricity distribution, generation and transmission subsectors (Step 3)
- **Adaptation measures** organized by type of climate impact (Step 5)

- **Potential benefits** of various adaptation measures to support cost-benefit analyses (Step 6)
- **A verification protocol** that helps utilities track and report on the implementation of adaptation measures, ensuring accountability and continuous improvement (Step 8)

Project results and impact

Uptake

The publication of the guide in 2020 was a major milestone for Canada's electricity sector, particularly in closing the sector-wide guidance gap previously identified by utility members. Before the project, only 40% of Electricity Canada member companies had identified key climate risks. After the project and the national rollout of the guide, over **90% of Electricity Canada member companies started adaptation planning**, with 85% stating that they used the guide to develop those plans.

Application

The guide's flexible framework enabled member utilities to begin or enhance their adaptation planning, regardless of their size or operational model. About **60% of the utilities conducted detailed risk assessments**, and about **20% began evaluating adaptation options**. The verification protocol played an important role in helping utilities apply the guide correctly within their own planning processes.

Benefits

Larger utilities that already have adaptation strategies used the guide to identify common elements and compare practices, providing a shared structure for alignment. Smaller utilities, which are often constrained by limited capacity or limited access to localized climate data, benefited from the guide's practical, accessible format. By reducing technical barriers, the guide empowered more companies to take meaningful action.

Lessons learned

Several lessons were learned by reflecting on the project, the guide, and its impact since publication.

- **No one-size-fits-all.** What works in one location or for one company is unlikely to work everywhere. Identifying risks to critical infrastructure and how to mitigate those risks needs to be done on a case-by-case basis to be effective.
- **Adaptation is a whole-of-organization process.** Climate adaptation does not belong to just one department or team. Successful adaptation requires engaging across functions early and often to identify gaps and opportunities.

- **Adaptation is about more than just hardware.** Some risks can be managed effectively with "hard" solutions such as replacing weaker materials with stronger materials. However, all adaptations are, at their core, about adapting organizational behaviours to cope and thrive in new situations. Sometimes, using the same equipment in a different way is more effective than upgrading equipment or the infrastructure.
- **Adaptation is continuous.** Companies are never finished adapting. Successful organizations develop the capacity to continuously respond to, and thrive in, changing circumstances.

Ongoing and future work

Electricity Canada continues to build on the guide's foundation by releasing new tools to strengthen sector resilience. For example, the 2024 Wildfire Risk Management Framework offers insights into risk modeling and supports developing wildfire mitigation plans.

For overall resilience, Electricity Canada's Security and Infrastructure Protection program facilitates the sector's physical and cyber security and emergency management.

Conclusion

Thanks to Electricity Canada, NRCan, and participating utility companies, the electricity sector is protecting Canadians from the worst impacts of climate change. By using the guide, utility companies are preparing for climate risks and building climate-resilient infrastructure.

These practices reduce the financial and human costs of climate change and improve reliability. The guide demonstrates how clear, actionable tools can develop long-term resilience in a changing climate.

For information on the Adaptation Guide, contact info@electricity.ca.

For information on NRCan's Climate Change Adaptation Program, contact ccap-pacc@nrcan-rncan.gc.ca.

Aussi disponible en français sous le titre :
Étude cas : Renforcer la résilience climatique du secteur de l'électricité au Canada

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Cat. No. M4-293/1-2026E-PDF (Online)
ISBN 978-0-660-99699-8

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