



Climate Change Adaptation Plan

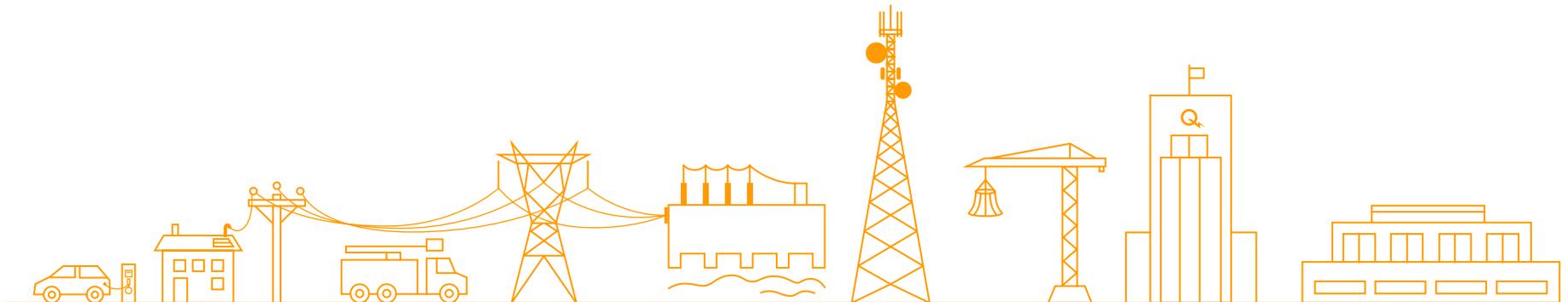
2022-2024 | Summary



Despite international efforts to reduce greenhouse gas (GHG) emissions, climate change has already started and is set to escalate in the coming years. Hydro-Québec takes an active role in reducing GHG emissions, in part because its energy production system has one of the lowest carbon emission rates in the world. Nevertheless, it must adapt to climate change to ensure that it fulfills its main mission of providing reliable and sustainable power and quality services tailored to the needs of its customers.

To this end, Hydro-Québec has undertaken an extensive analysis of the potential impacts of climate change on its assets and activities and has established measures to ensure their resilience. This initial *Climate Change Adaptation Plan* provides Hydro-Québec with both a governance framework and concrete measures to more effectively manage the climate change risks it faces.

Hydro-Québec's efforts to adapt to climate change are not new. For more than 20 years now, Hydro-Québec has been improving its understanding of the impacts of climate change through its collaboration with the regional climatology consortium Ouranos. The new adaptation plan will enable Hydro-Québec to take even stronger measures to ensure that climate change is taken into account in all its activities, from the generating station to its customers' homes.

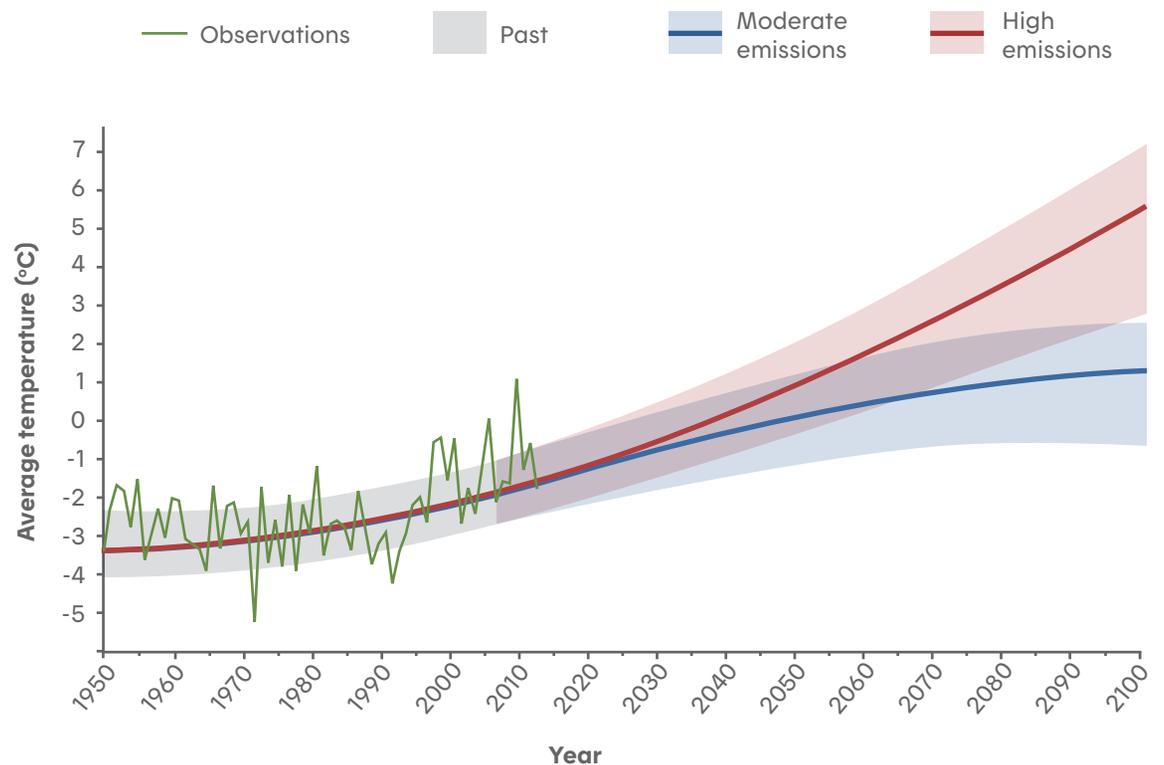


Climate change poses challenges for Hydro-Québec across Québec

Climate projections are based on GHG emission scenarios developed by the Intergovernmental Panel on Climate Change (IPCC).

The graph opposite shows the changes in annual mean temperatures in Québec between 1950 and 2100. While temperatures were fairly stable between 1950 and 1980, they started increasing at the end of the 20th century. Since the impacts of climate change experienced today are a consequence of GHG emissions produced several decades ago, adaptation measures will still be needed no matter what efforts are made to lower carbon emissions in the future.

Annual average temperature in Québec from 1950 to 2100 based on a set of global climate models*



Source: Ouranos (2021a).

* The bands represent values between the 10th and 90th percentiles of simulations used for past (1951-2005) and future (2006-2100) periods, while the curves represent the medians.

Higher average temperatures will result in greater seasonal temperature increases—which will be more pronounced in the northern part of the province—as well as extreme weather events, such as more intense and frequent heat waves across Québec.

Climate models also predict that climate change will not only increase the total annual amount of precipitation but will also affect the type of precipitation. Generally speaking, snowfall will decrease in the southern regions of Québec, while the opposite will be true in the North. In addition, extreme precipitation events will tend to increase in frequency and intensity across the province.



Hydro-Québec's many activities extend across the province. As a result, it could face a wide variety of impacts, as shown in the following figure.

Examples of current or future issues faced by Hydro-Québec

CENTRAL QUÉBEC

Increase in wildfires and precipitation

- Changes in water management practices due to changes in peak flow regimes
- Damage to infrastructure
- Reduced transmission capacity



URBAN AND RURAL QUÉBEC

Rising temperatures and extreme precipitation

- Heat stroke among workers
- Increase in floods
- Increased summertime energy demand



ARCTIC QUÉBEC

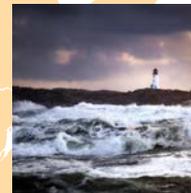
Rising temperatures and permafrost degradation

- Damage to roads and infrastructure
- Northward migration of the treeline
- Impact on off-grid systems (e.g., subsidence caused by thawing permafrost could force the shutdown of a thermal plant that supplies power to the grid)

COASTAL QUÉBEC

Increase in storms, storm surges and erosion

- Highly vulnerable infrastructure (roads, power lines and buildings)
- Change in wind power potential due to change in average prevailing wind direction



Hydro-Québec's adaptation approach is based on a rigorous cross-sectoral analysis

Hydro-Québec consulted experts from all of its business sectors to guide and implement its strategy for adapting to climate change.

To be able to take action at the right time and in the right place, Hydro-Québec embarked on a major effort to identify its main physical risks related to climate change so it could determine its action areas. The company developed a strategy adapted to its needs based on a number of standards and best practices. The process involved five steps, as shown in the figure below.

Hydro-Québec's adaptation plan development process



Hydro-Québec has identified 26 action areas to tackle over the next few years

Those participating in the process established 26 action areas for Hydro-Québec based on the detailed risk assessment conducted in the previous step and their expert judgment (see Table below). They divided the action areas into the following four categories:

Hydro-Québec's action areas for adapting to climate change*

DESIGN

1. Adjust design standards and activities
2. Maintain appropriate discharge capacity
3. Increase the resilience of control structures
4. Increase the resilience of retaining structures
5. Plan the maintenance and replacement of wooden poles to optimize their useful service life in extreme weather conditions
6. Limit the heat island effect caused by Hydro-Québec facilities
7. Adapt the management and design of heating, ventilation and air-conditioning systems to extreme heat conditions
8. Adapt rainwater drainage systems to high-intensity precipitation events

9. Collaborate with external telecommunications partners to increase the resilience of shared services and infrastructure
10. Increase the resilience of external penstocks and surge tanks

OPERATIONS

11. Adapt snow removal procedures and roof design practices to heavy snow accumulation
12. Adapt vegetation control to the increased growth of certain species
13. Maintain good communication with all residential and business customers in a context of growing demand

* Action areas are grouped by category rather than by order of priority.

14. Plan regular activities in light of increased pressure on human resources due to climate change
15. Adapt construction practices to the new climate situation
16. Improve facility access during extreme weather events as much as possible
17. Plan line maintenance work based on new heat stress conditions

POWER OUTAGES AND IMPACTS ON ASSETS

18. Limit the impact of extreme weather events on the reliability of the overhead system
19. Increase the resilience of off-grid systems
20. Prevent flooding upstream and downstream of generating stations
21. Increase the resilience of critical buildings
22. Protect the safety of assets and activities in areas exposed to forest fire risk

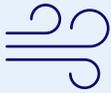
WORKER HEALTH AND SAFETY

23. Protect personnel from heat stroke and related conditions
24. Protect personnel from illnesses associated with working outdoors
25. Adjust health and safety activities to prevent slips and falls on ice
26. Emphasize the importance of safe behaviors on roads and waterways in the context of climate change

Now that Hydro-Québec has established its priorities, it is ready to act

To reduce the risks associated with the action areas it has established, Hydro-Québec has listed the **concrete actions** to be taken, which are guided by targets and indicators to measure progress. These actions can be stepped up as the situation and knowledge evolve.

| Examples of climate change impacts | Examples of action areas | Examples of actions |
|---|---|---|
|  <p>Extreme heat</p> | <ul style="list-style-type: none"> • Protect personnel from heat stroke and related conditions • Limit the heat island effect caused by Hydro-Québec facilities | <ul style="list-style-type: none"> • Promote and deliver training on working in high heat conditions • Introduce a policy to renovate parking lots to make them more eco-friendly |
|  <p>Forest fires</p> | <ul style="list-style-type: none"> • Protect the safety of assets and activities in areas exposed to forest fire risk | <ul style="list-style-type: none"> • Strengthen prevention efforts by implementing adaptation solutions as a priority for critical infrastructure and renewing the SOPFEU agreement |

| Examples of climate change impacts | Examples of action areas | Examples of actions |
|---|--|--|
|  <p>Wind</p>  <p>Lightning</p>  <p>Freezing rain</p> | <ul style="list-style-type: none"> • Limit the impact of extreme weather events on the reliability of the overhead system • Plan the maintenance and replacement of wooden poles to optimize their useful service life in light of extreme weather conditions • Adapt vegetation control to the increased growth of certain species | <ul style="list-style-type: none"> • Focus efforts on strengthening certain lines using anti-cascading towers in priority areas such as Baie-James, Montréal, the city of Québec and Côte-Nord • Install composite poles in targeted areas • Increase budgets and resources to carry out the integrated vegetation control program |
|  <p>Extreme precipitation</p> | <ul style="list-style-type: none"> • Adapt rainwater drainage systems to high-intensity precipitation events • Increase the resilience of control structures | <ul style="list-style-type: none"> • Conduct climate change resilience assessments of targeted facilities (generally during refurbishment work) • In collaboration with Université du Québec à Montréal and Ouranos, launch a research project examining the impact of climate change on extreme weather hazards that put Québec's hydroelectric and mining infrastructure at risk |

These actions represent the first of **four spheres of action** in Hydro-Québec's *Climate Change Adaptation Plan*:

- 1** Implementing actions related to the 26 action areas
- 2** Educating, training and collaborating with stakeholders
- 3** Implementing a research and expertise development program
- 4** Formalizing Hydro-Québec's long-term commitment to climate action in its policies and guidelines



Climate risks must now be considered in all of Hydro-Québec's decisions. That is Hydro-Québec's commitment to Quebecers.

www.hydroquebec.com

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