

EXTREME WEATHER


CLIMATE CHANGE
AND
YOUR POWER

December 2019

NEW BRUNSWICK
POWER CORPORATION



Énergie NB Power



Weather events in New Brunswick are more severe creating greater obstacles for power restoration.

While the frequency of weather events has not increased significantly, the severity and duration of events has grown exponentially and is impacting customer experience.

Since 2013, there has been a 400 per cent increase in annual customer outage hours compared to the 10 previous years.

Adverse weather, lightning, and trees are the main cause for weather related outages. In 2018 alone, trees accounted for 84 per cent of outage hours during weather events.



NEW BRUNSWICK GEOGRAPHY¹

The natural beauty and picturesque landscapes are what make New Brunswick a tourist destination and outdoor enthusiasts' playground. New Brunswick covers 73,440 square kilometres. Over 83 per cent of the province is forest, while other parts of the province include the Appalachian range in the north to flat rocky terrain in the southeast.

NB Power has 21,000 km of distribution lines and 6,800 km of transmission lines that powers communities across these terrains. The electrical grid powers over 400,000 direct and indirect customers.

When it comes to major weather events that cause damage to our power grid, it also creates some significant challenges.

21,000 km
Distribution lines

6,800 km
Transmission lines

400,000
Direct and indirect customers

¹ https://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/ForestsCrownLands/GNBForestryBrochure_EN.pdf



CLIMATE CHANGE²

Not unlike our neighbours in Canada and the United States, New Brunswick is feeling the effects of climate change. It is expected to have further impacts on this province in the future.

Scientists at New Brunswick's Department of Environment and Local Government, suggest that we can anticipate the following changes in the future

- a rise in coastal water levels and increased storm surges
- warmer weather in winter and summer, and an increase in total precipitation, falling in fewer, but more intense events
- more frequent winter thaws, and an increased risk of ice-jam flooding
- larger fluctuations in river runoff
- more significant coastal erosion and flooding
- more extreme and variable weather patterns
- larger fluctuations in groundwater availability

In September 2018, NB Power established a Corporate Climate Mitigation and Adaptation Committee to prepare for and manage the effects of climate change. So far, the risk that climate poses to critical and vulnerable assets have been assessed. Operations activities are now underway to identify potential adaptation measures (risk control) as part of the adaptation planning process. The new plan is scheduled to be completed in 2020.

50-60 cm

Expected sea level rise by 2100

1-6 °C

Global temperature rise by 2100

25-50 per cent

Snow pack decrease since 1920

² https://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/climate_change/content/climate_change_affectingnb.html



THE REALITY

Hurricanes, ice storms, and two of the worst floods in the past 50 years are some of the extreme weather events that New Brunswick has faced in the past five years. The trend of major weather events moving through New Brunswick, as with the rest of the world, is expected to continue.

Severe weather events in New Brunswick are creating greater obstacles for power restoration.

While the frequency of weather events has not increased significantly, the severity and duration of events are impacting service for New Brunswickers. The NB Power team is working hard to improve our response times and reduce how long our customers are without power.

What's causing power outages?

- mother nature (e.g. trees, floods, ice, wind, rain, snow)
- equipment upgrades (e.g. imminent failures detected by maintenance, deterioration from age)
- external interference (e.g. wildlife, motor vehicle accident, vandalism)
- planned outages (i.e. maintenance)
- other

Storms by the numbers

2013

Ice (South)

54,000

Peak customer outages

88,000

Total customer outages

Day 11

Last customer reconnected

2014

Wind (Arthur)

140,000

Peak customer outages

195,000

Total customer outages

Day 14

Last customer reconnected

2017

Ice (North)

133,000

Peak customer outages

200,000

Total customer outages

Day 12

Last customer reconnected

2018

Wind

105,000

Peak customer outages

214,759

Total customer outages

Day 6

Last customer reconnected



UNRAVELING THE IMPACT

As reported by the Department of Natural Resources, extreme weather events will become more frequent, with hurricanes and storms being the greatest contributors in our province. We have included five of the worst weather events that have occurred in New Brunswick in the past five years.

Christmas Storm 2013

A series of winter storms and bitter cold hit New Brunswick over an 11-day period at the end of December 2013 and early January 2014. The freezing rain, heavy snowfall and extended cold weather knocked out power to approximately 88,000 customers. At the peak of the event, 54,000 people were without power at the same time.

Post-Tropical Storm Arthur 2014

On July 5, 2014, Hurricane Arthur arrived in New Brunswick as a post tropical storm with wind gusts as high as 100 km/h. At landfall, the winds were near hurricane strength with rainfall amounts of 120 to 145 mm. Nearly 195,000 customers experienced outages province-wide, with the last customer restored on Friday, July 18, 2014.

The storm caused road closures, infrastructure damage, washouts, localized flooding, and downed trees across the province. The greatest impact was to Fredericton and Woodstock, with approximately 140,000 NB Power customers left without power.

10-30 mm

Ice

100 km/h

Wind gusts

145 mm

Rainfall



Ice Storm 2017

The power outages associated with the 2017 ice storm impacted nearly 200,000 New Brunswickers. This unprecedented freezing rain storm was catastrophic. Between January 24 and 26, 2017, a snow and freezing rain storm moved across the entire province, delivering the heaviest impact in the east and northeast areas of the province.

The Environment Canada weather station in Bas-Caraquet recorded 30 mm of rain, 8 cm of snow in combination with freezing fog. There was between 50 and 100 mm of ice buildup on trees and infrastructure in the Acadian Peninsula, which is far greater than past storms and far beyond the threshold for our system design.

Storm-related customer outages peaked at approximately 133,000 on Wednesday, January 25, 2017. Heavy ice buildup on lines, poles and cross-arms caused more than 600 poles to fail, primarily in the Acadian Peninsula. In Miramichi, most outages were caused by heavy snow and ice on trees and utility infrastructure. In Kent County, most outages were caused by ice-laden trees making contact with lines. The restoration effort lasted more than two weeks. The last storm-related customer outage was restored at approximately 6:30 pm on Sunday, February 5, 2017.

50-100 mm
Ice buildup

600
Structure failures



Flood 2018

In 2018, mild conditions, rapid melting snow and rainfall amounts created one of our worst flood events in years. Flooding occurs in downtown Fredericton when water flow exceeds 230,000 cubic feet per second, and in 2018 the flow exceeded 300,000. Flood levels exceeded two of our worst recorded events (1973 and 2008).

While Fredericton did not exceed our worst recorded levels, it did exceed the flood stage by almost a metre. All other areas, including Maugerville, Jemseg, Grand Lake, Sheffield-Lakeville, Oak Point, Quispamsis-Saint John, peaked between one and two metres above flood stage.

Our NB Power Emergency Operations Centre was activated on April 27, 2018 in support of Technical Inspection Services - the provincial electrical authority.

The Department of Transportation fully closed 81 roads and bridges to traffic due to flooding. As a result, NB Power responded to safety hazards via boats.

November Wind Storm 2018

The most widespread storm event NB Power has experienced began on November 2, 2018. New Brunswick experienced two low pressure weather systems that brought strong winds and heavy rain to all areas of the province. Violent winds during the second low pressure system saw wind gusts reaching 119 km/h in Bouctouche. With heavy rain being reported around the province, a maximum of 97 mm of rain was recorded at the Saint John River in Oak Point. Downed trees were the main cause of outages. A third weather system occurred November 5 and 6, 2018, while restoration efforts were still in progress.

At the peak, NB Power experienced 1,200 outages, which affected more than 105,000 customers. Due to winds and fallen trees, 63 poles and 13 transformers were damaged. Most of the outages were directly related to fallen trees and tree contact. The restoration was completed the morning of November 10, 2018.

230,000 ft³/s

Water flow

119 km/h

Wind gusts

81

Road and bridge closures

97 mm

Rainfall



THERE FOR NEW BRUNSWICKERS HOW WE'RE IMPROVING OUR RESPONSE¹

We know how difficult it can be without power. That's why we've committed to improving our processes, look for new technologies to help us and become more coordinated so we can be there for New Brunswickers when they need us the most.

We're moving towards an All-Hazards Emergency Management approach. This plan will ensure businesses like ours have the right tools for planning, training and leadership to address a broad range of emergencies.

This approach in any emergency response is more effective, efficient and safer for customers, employees, contractors and the public.

Tree Program

Over 15 million of the 18 million hectares of land in New Brunswick is covered in forest. With increasing weather events targeting our province, our bountiful tree coverage can quickly become problematic for the power system. With the weather events we've experienced over the past five years, we've seen an increase in tree damage resulting in power outages. These aren't just dead trees along roads, or those growing up through power lines. We've seen an

increase in off-right-of-way trees, standing on private property, well away from maintained power lines, that are uprooting or breaking, and causing power outages.

To storm harden our system, in 2018, NB Power started a hazard tree removal program. This program targets trees that typically fall during severe weather events causing increased outages.

An increase in vegetation management spending has

- widened approximately 4000 km of distribution line since 2014
- improved reliability for customers
- reduced the time for crews to find and address vegetation contacts

15 million
Hectares of forest covered land

4000 km
Right-of-ways widened

¹ https://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/ForestsCrownLands/GNBForestryBrochure_EN.pdf



Operational Improvements

We're focused on improving our processes, to better support New Brunswickers when weather strikes.

We've implemented a new Emergency Response Plan. This plan helps to ensure consistent preparedness, response, communications and recovery practices across the entire utility.

Our Emergency Planning Management team is now centralized for proactive decision-making and strategic planning ahead of, and during, an event.

For each event, we set up local centres in each affected region to monitor outages, realign crews and reduce restoration wait times for customers.

We've improved coordination between key internal teams, and outside partners like the New Brunswick Emergency Measures Organization to ensure a united response to support New Brunswickers.

As a utility, we have adopted best practices based on

- our operational experience learned in past events
- discussions with partner utilities and mutual assistance partners
- customer feedback
- training with Emergency Measures Organization in both Canada and the United States

Predictive Analysis

NB Power has partnered with IBM to develop a system for Outage Prediction and Resource Optimization (OPRO). The system uses historical storm data from IBM's The Weather Company and historical outage event information from NB Power. We are testing this system which uses a mathematical model to analyze and predict the potential effects of approaching weather on our power grid.

The Outage Prediction and Resource Optimization tool will allow us to better plan our response and proactively stage our powerline and tree trimming crews in key regions ahead of impending weather.

Risk Mitigation

Emergency planning includes not only being prepared, but also regular maintenance. Our annual maintenance program helps to identify and respond to issues. 20 per cent of our utility poles are inspected annually, as part of a five-year cycle. A maintenance plan is established for aging poles, and our field crews perform the work to maintain the safe operation of our electrical grid.

Every spring a system review of power quality is performed to establish short and long-term goals for our power supply equipment (e.g. conductor and feeders). From the reviews, NB Power establishes a detailed plan for the following year.

20 per cent

Utility poles inspected annually



ESTIMATED RESTORATION TIMES

When the power goes out, we get to work to restore power as quickly and safely as possible. We know how important it is for New Brunswickers to know when power will be restored in an emergency event, which is why we do our best to provide accurate information as soon as possible. Not knowing when power will be restored can be very frustrating, especially during adverse weather conditions.

In major storms, crews must wait until the weather clears before assessing the damage, and this means it takes time to provide accurate estimates of when power might be restored. During these major storms, the cause of the power outage may take time to locate, may be difficult to access, or there may be a combination of issues resulting in longer restoration times.

For events predicted to last less than 48 hours, individual estimated times of restoration are published as they become available - typically within six hours.

For events predicated to last more than 48 hours, community estimated times of restoration are published within 24 hours. In some cases, this can be a challenge, especially when crews are working in remote areas, where there could be multiple issues that are not clearly visible.

Sometimes, we need to disconnect some customers to safely restore customers outages, which could result in new outages and longer estimated times of restoration.

With small outages in localized areas, it is easier to provide estimates and locate damage. When we experience major events that impact multiple regions or create significant damage, the challenges require a greater effort from our teams. We need to perform damage assessment while safely managing the grid. To establish a restoration and construction plan, we may need to use specialized equipment and aerial damage assessment



PRIORITIZATION AND CRITICAL INFRASTRUCTURE

The safety of employees and the public are always our top priority. Once safety hazards and NB Emergency Measures Organization priorities are addressed, we focus on restoring the greatest number of customers as quickly and safely as we can.

1. We respond as directed by the Province's Critical Infrastructure Program, which includes outages that impact public safety, emergency situations, and critical care customers.
2. We restore power to NB Power critical transmission infrastructure like substations and transmission lines.
3. We make repairs to return power to the largest number of customers in the shortest amount of time. Consideration is also given to areas that provide services to the public and not just the number of customers out.
4. We restore power to smaller outages and individual customers.



WHEN THE POWER GOES OUT

Is Severe Weather Approaching?

Build a 72-hour kit that includes

- water and non-perishable food
- manual can opener
- flashlights and fresh batteries
- first aid kit
- battery powered radio
- extra keys to your car and house

What can you do to be safe during an outage?

- don't open your fridge or freezer
 - Generally, food will keep for 24 to 48 hours if the doors stay closed
 - If you suspect food has spoiled, throw it out
- report downed power lines immediately – and stay at least 10 metres away
 - Keep pets and children clear too.
- do not go near electrical equipment around areas of standing water, like a flooded basement
- never use barbecues, propane or kerosene heaters or portable generators indoors.
- never leave candles unattended
- don't use a gas stove as a source of heat.
- secure windows and doors as well as outdoor furniture and equipment
- park vehicles in protected areas, if possible.
- if you use electric heating, turn your thermostats down to avoid load issues when power is restored.

For a full checklist and important information refer to

<https://www.nbpower.com/en/outages/preparing-for-outages>

PLANNING FOR THE FUTURE

NB Power has a long-term investment plan to build a smarter, stronger, more resilient and efficient power grid. Advancing our grid with these investments will reduce the need for future spending on power plants, while making sure we have clean, reliable energy at stable prices for generations to come. With a smart grid, we will be able to manage our infrastructure using digital controls and applications. We will have more visibility into potential issues so we can address them before they lead to power outages. Moreover, when outages do occur, NB Power will receive notification automatically so we can get to work restoring power faster—including after storms.

We know our customers expect a high standard of reliability from their utility. At the same time, New Brunswick is experiencing more severe weather events than ever before. In order to minimize the impact of these unpredictable events, we continue to invest in our infrastructure to strengthen system reliability.

In 2018/19, we took additional measures to reinforce the wires side of our business through an extensive transmission line rebuild program and distribution vegetation management activities. We also applied lessons learned from previous storms to improve our emergency response times for our customers impacted by storms. We were able to shorten our storm restoration efforts and get affected customers re-connected sooner by using state-of-the-art technology to provide a more accurate picture of where and when outages could occur because of storms. This allowed us to better position our internal and contracted resources during storm events.

We are also seeking approval to deploy smart meters across New Brunswick as they are essential to a smart grid. Not only our climate is changing but the way energy is produced, delivered and used is changing, and we are changing too - starting with the grid. We must be ready to balance electricity supply and demand while maintaining the stability of the grid.

By building smart technologies such as smart meters into the grid we can support greater customer participation in renewables while also improving reliability and efficiency. A smarter grid will provide better visibility into the health of the power grid, enabling us to address some issues before they lead to outages. We will also have more insight into how and when energy is being consumed and use that information to operate more efficiently and provide better service, new energy-saving products and potentially more flexible rate plans.

Our focus on reliability remains unwavering so our customers can continue to have the energy they need when they need it to power their homes and businesses.





This report is also available
in French and on our website
www.nbpower.com

Ce rapport est également publié
en français sur notre site Web
www.energie.com

