

December 2018 Storm and Looking Ahead:

The most damaging storm
in BC Hydro's history



Report

August 2019

The windstorm that hit B.C.'s South Coast on December 20, 2018 resulted in more than 750,000 customers without power and thousands of damaged pieces of equipment.

Highlights

- The December 2018 storm was the most damaging storm in BC Hydro's history—and was unlike any previous weather event BC Hydro had encountered because:
 - The wind came from multiple directions—including the southeast, south and southwest.
 - The windstorm was preceded by several heavy rain events—more than 400 millimetres of rain fell in some areas leading up to the storm, which destabilized trees.
 - The wind speeds were significant—topping 100 kilometres per hour in some areas.
- The storm left more than 750,000 customers without power, making it larger than the August 2015 windstorm that affected the Lower Mainland and Fraser Valley, and larger than the 2006 windstorm that hit Vancouver Island and devastated Stanley Park in Vancouver.
 - More than 400,000 customers in the Lower Mainland and Fraser Valley were impacted.
 - Vancouver Island and the Gulf Islands were the hardest hit with nearly 350,000 customers without power, which represents more than 80 per cent of the total number of customers in those areas.
- With more than 1,900 spans of wire, 390 power poles, 700 cross-arms and 230 transformers that needed to be repaired or replaced, responding to the storm required BC Hydro's single biggest mobilization of staff, contractors and resources.
 - There were more than 900 field workers restoring power, including crews from the Interior, and contractor crews from Alberta and the East Coast.
- Within the first 24 hours, BC Hydro had restored power to over 550,000 customers.
 - All customers in the Lower Mainland and Fraser Valley were restored by December 24; however, the damage and access issues on Vancouver Island and the Gulf Islands due to trees on the roads made it particularly challenging, causing repairs to take much longer.
 - All customers impacted by the December 20 storm were restored by December 31.
- While BC Hydro is proud of how the crews responded and the quick restoration for a majority of our customers, there is always room for improvement. Since the event, BC Hydro has conducted a number of workshops across various departments, engaged with our contractor and community partners and solicited feedback from customers to define the core areas of opportunity for future storm response.
- BC Hydro is in various stages of implementing identified improvements in preparation for the 2019/2020 storm season. For example:
 - **Customer Experience:** BC Hydro is looking at ways it can provide more support to communities that experience outages over 72 hours, including having a customer service representative available for face-to-face communications. BC Hydro knows some customers had challenges learning about the status of their outage and efforts are in progress to resolve these issues to ensure we are providing timely updates to our customers.

- **Public Safety:** Some customers encountered challenges when trying to report downed lines because 911 operators in certain areas were overwhelmed with calls. Safety is BC Hydro’s number one priority and efforts are underway to improve outcomes, ensuring that when a customer reports a downed line to 911 it is received appropriately. Additional resources in our restoration centre, to analyze calls during storm events, will allow more intake of calls from emergency partners.
- **Logistics:** Efforts are underway to formalize our processes for bringing in multiple crews from outside B.C. if required in the future.
- **Business Operations/Technology:** Rolling out a mobile work order application for our crews and contractors will enhance the way the field workers enter and transfer data regarding tasks that are being completed on trouble calls. The consistent dispatching and tracking of work orders will improve efficiencies and provide more timely updates for customers.

On December 20, 2018 a severe windstorm hit B.C.’s South Coast, resulting in the most damaging storm BC Hydro has experienced. The storm left more than 750,000 customers without power from Parksville to Victoria on Vancouver Island and West Vancouver to Mission in the Lower Mainland, and damaged or destroyed thousands of pieces of electrical equipment. Responding to the storm involved the single biggest mobilization of staff, contractors and resources in BC Hydro’s history.

This report looks at why this storm caused so much damage, how BC Hydro responded, how it stacks up against previous devastating storms, what was learned and how the learnings will inform the response to future storms.

Wild winds and water

The December 20 storm was unlike any previous weather event BC Hydro and its infrastructure had encountered. One of the main reasons the storm was so damaging is that wind came from multiple directions and, when combined with the rain, destabilized, uprooted and damaged trees and vegetation throughout Vancouver Island, the Gulf Islands and parts of the Lower Mainland and Fraser Valley. This resulted in an unprecedented amount of damage to BC Hydro’s distribution infrastructure.

The windstorm was preceded by several heavy rain events, which affected ground conditions and trees. More than 400 millimetres precipitation fell in some areas over the week leading up to the December 20 storm. As a result, soils were completely saturated to a point where they were seeping water even when it was not raining. Saturation reduces the stability of the soil and some coniferous trees, like Douglas Firs and Hemlocks, have shallow roots making them more vulnerable.



Crews repairing extensive damage in Nanaimo.

Another major contributing factor was the wind on December 20 came from three different directions. During the early morning, winds came from the southeast, by the late morning they were coming from the south, and by the early to mid-afternoon they were coming from the southwest. Southwest winds, in particular, are known to cause significant damage across the Cowichan Valley, Duncan, Nanaimo and the Gulf Islands—and happen less frequently than other wind directions. The duration of strong southwest winds in Duncan was more than 12 hours, and Salt Spring and some of the other southern Gulf Islands experienced them for 8 hours.

Summary of wind speeds

Location	Wind speed
Lennard Island Lighthouse	144 km/h
Tofino	111 km/h
Saturna Island	102 km/h
Abbotsford	101 km/h
Tsawwassen	98 km/h
Esquimalt	94 km/h
Victoria Airport	89 km/h
Vancouver Airport	87 km/h
Nanaimo	85 km/h

Source: Environment Canada

In addition, the low pressure centre of the storm tracked across north–central Vancouver Island, making it the optimal storm track for strong winds over the most populated areas of the South Coast—the southern half of Vancouver Island and the Lower Mainland. The storm’s central pressure was 982 millibars, which made it much more intense than most storms that typically cross the South Coast. For reference, a Category 1 hurricane has a central pressure of about 980 millibars.

The wind speeds during the storm were significant. The sustained winds were generally in the range of 70 to 100 kilometres per hour; however, in some areas gusts topped 100 kilometres per hour.

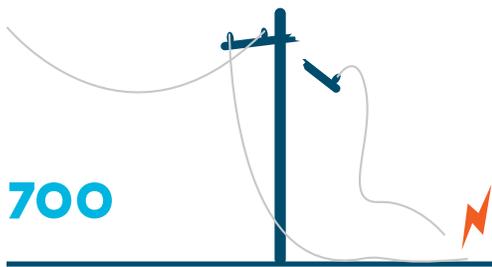
Finally, this was the first widespread strong windstorm on the South Coast since last winter. As a result, the “clearing” effect that would have occurred through several smaller windstorms had not happened yet. This left a significantly higher amount of vegetation susceptible during this storm.

The aftermath

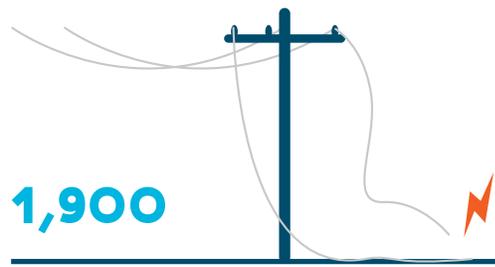
Across the South Coast, 1,900 spans of wire, 390 power poles, 700 cross–arms and 230 transformers needed to be repaired or replaced. This storm resulted in more than 5,800 trouble orders—that is 19 times greater than the number of trouble orders BC Hydro receives during an average storm. A trouble order is how work is assigned to crews so that power can be restored. This ranges from removing a tree from a line to replacing a power pole.



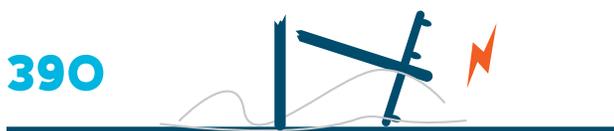
Trees made many roads inaccessible—particularly on the Gulf Islands.



Cross–arms



Spans of wire down



Power poles



Transformers

In total, more than 400,000 customers in the Lower Mainland and Fraser Valley were impacted; however, Vancouver Island and the Gulf Islands were hit the hardest with nearly 350,000 customers left without power, which represents more than 80 per cent of the total number of customers in those areas.

With winds above 100 kilometres per hour and the storm on a perfect track to do damage, the result was complete destruction in some areas. Otherwise healthy trees and branches came crashing down on BC Hydro's equipment and roads across Vancouver Island, the Gulf Islands, parts of the Lower Mainland and Fraser Valley. Once the winds died down, more than 750,000 customers were left without power.

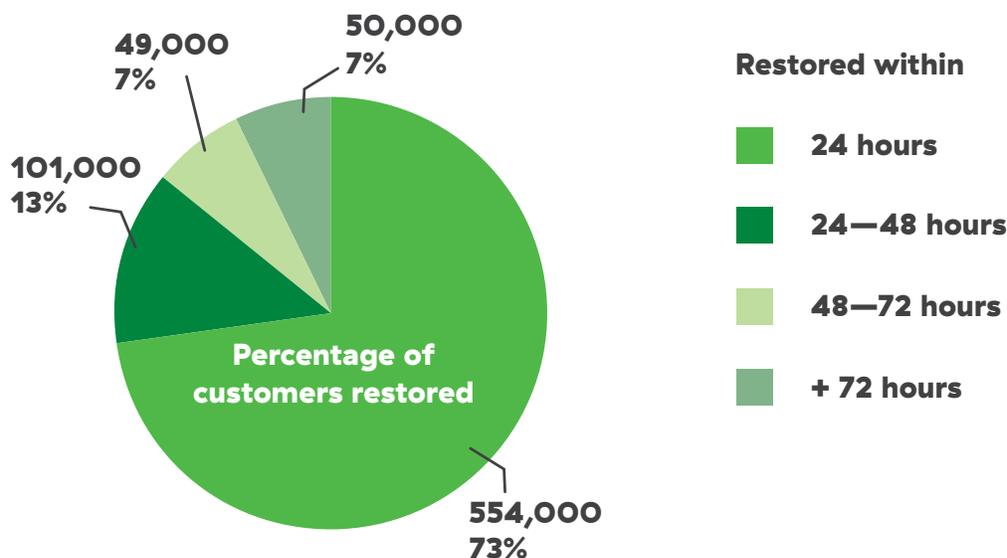
The response

The unique nature of the storm meant it required an unprecedented mobilization of resources and people. Prior to the storm, BC Hydro's team of both in-house and contractor meteorologists were closely tracking the incoming system, and BC Hydro had crews on standby to respond. Multiple storm rooms had been established in the regions that were to be impacted so crews could respond immediately and be moved around with ease to restore power in the hardest hit areas.

Every available resource was brought in to support restoration efforts. There were more than 900 field workers working around-the-clock. Crews from the Interior, Alberta and the East Coast were brought in for additional support. Within the first 24 hours, BC Hydro had restored power to over 550,000 customers.

While BC Hydro made significant progress restoring power to customers in the first few days, it was not able to move its crews around as easily as it would during a typical windstorm because the December storm hit four regions at once. Typically, BC Hydro is able to move crews quickly between the regions so that it can get extra help to the hardest hit areas. Moving this many crews and bringing the trucks, heavy machinery and materials that were needed to rebuild the system over to the many islands and regions added an additional layer of complexity. This was one of the reasons there were longer than average restoration times for many customers.

Customer restoration by outage time



All customers in the Lower Mainland and the Fraser Valley were restored by December 24; however, the damage on Vancouver Island and the Gulf Islands was particularly challenging and took longer to repair. The Ministry of Transportation and Infrastructure noted there were trees down on 100 per cent of the roads in some of the southern Gulf Islands. This made access extremely challenging in some places.

In other areas, portions of the distribution system needed to be completely rebuilt due to the destruction. On Salt Spring Island alone, more than 500 spans of wire needed to be replaced. Because so much of the damage occurred on the Gulf Islands, some crews were sent over by water taxi. The restoration efforts, however, were not just about moving people – it was also about moving materials. Thousands of pieces of electrical equipment were required to make repairs, and in the Gulf Islands some of the materials and equipment were sent over by barge. The management of materials during this storm was a significant success.

BC Hydro crews also had to complete a lot of repair work in rural or remote areas, which required extensive work off the main roads without the support of trucks. Crews were required to get to some sites by ATV or hike through forests on foot.

All customers impacted by the December 20 windstorm were restored by December 31. BC Hydro experienced no serious safety incidents, which considering the hours worked (and often overnight) and the number of workers, was exceptional.



Example of infrastructure damage on Gabriola Island.

How is work prioritized?

The safety of the public and the crews is BC Hydro's top priority. Restoring power always starts by addressing immediate dangers like potentially live wires across roads or near homes, and bringing power back to critical services like hospitals.

Crews then make repairs to high-voltage transmission lines and substations as this brings the most customers back as quickly as possible. They then work on the smaller pockets of customers and those located at the end of a line where repairs to the rest of the circuit need to be completed first.

Comparing the most damaging storms

Over the past two decades, three major storms have impacted the South Coast. In 2006, a storm that struck in early December resulted in 240,000 customers losing power. This was the same storm that caused devastation in Stanley Park and had a significant impact on Vancouver Island. At the time, it was considered the single largest storm impact in BC Hydro's history, and it did more damage to the distribution system than what would typically be experienced in an entire year.

The next major storm happened in 2015. The Lower Mainland and Vancouver Island were hit by an unusual late summer windstorm that left about 700,000 customers without power. At the time, it was BC Hydro's new single largest outage event.

The windstorm on December 20 was more damaging than the 2006 and 2015 windstorms. It resulted in more than 750,000 customers without power, which is the equivalent to more than 60 per cent of the customers impacted by storms in all of 2017.

When compared to the August 2015 windstorm, the December windstorm was worse in every category. While the total number of customers was not much greater, it is not just the number of customers without power that measures the impact of a storm. The damage in August 2015 was nowhere near as extensive as the damage from the December 20 storm. The August 2015 storm had over 2,400 trouble orders, the December 20 storm resulted in more than 5,800. While there were 10,000 metres of damaged power line in 2015, this storm was over 8 times that—more than 86,000 metres.

How the August 2015 windstorm compares to the December 2018 windstorm

2015 windstorm		2018 windstorm	
Number of customers without power	700,000	Number of customers without power	+ 750,000
Metres of damaged power line	10,000	Metres of damaged power line	86,000
Number of damaged power poles	200	Number of damaged power poles	390
Number of damaged cross-arms	500	Number of damaged cross-arms	700
Pieces of electrical equipment damaged	1,200	Pieces of electrical equipment damaged	3,200

Looking ahead: continuing to improve storm response

BC Hydro released a report in November 2018 that found storms and extreme weather events in B.C. are becoming more frequent and severe. In the past five years, the number of individual storm events BC Hydro has responded to has tripled. The December windstorm is another indicator that this trend is not slowing down, and the frequency and severity of the storms are now increasing. For example, this storm generated more than twice the number of storm-related outages than BC Hydro experienced in all of 2013.

To battle against this increasingly extreme weather, BC Hydro remains focused on preparing for storm season year-round. It is using its smart meter network and introducing new technology and processes to improve its response times, some of which includes:

- **Enhanced prediction logic:** using an algorithm and the smart meter network, BC Hydro's system can confirm an outage and mark its location on a map, where a dispatcher can then analyze and send a crew to investigate and make necessary repairs.
- **New mobile dispatch tools:** these tools will be able to transfer information from the field to the operations centre faster and more frequently—providing more timely updates for customers.
- **Improved meteorology models:** this information provides greater insight into where and when a storm might hit so BC Hydro can ensure crews are ready to respond quickly.

In addition, BC Hydro reviews its response at the end of every storm—regardless of the storm's size. It is a regular part of our operations.

While BC Hydro is proud of how the crews responded and the quick restoration for a majority of our customers, there are always ways we can improve. Since the storm event, BC Hydro has conducted a number of workshops across various departments, engaged with our contractor and community partners and solicited feedback from customers to define the core areas of opportunity for future storms. These are categorized as follows under customer experience, public safety, logistics and business operations/technology.



BC Hydro is in various stages of implementing identified improvements in preparation for the 2019/2020 storm season as follows:

Customer Experience

- **BC Hydro website and phone system** – Some customers had challenges finding updates for the status of their outage on the BC Hydro website, including within the outage maps. In addition, some issues with the automated phone system were discovered, if a customer selected any option other than to report an outage when they phoned in. Efforts are in progress to resolve these issues and to ensure we are reducing the time for our customers to see updates on the status of outages.
- **Additional resources for restoration centre** – The BC Hydro Restoration Centre plays a critical function for any trouble responses. During the December 2018 storm it was identified that additional people answering customer calls and prioritizing trouble reports would have been beneficial. As a result, additional BC Hydro employees have been trained to expand the pool of available resources to increase intake capacity during future large storm events.
- **Support to communities** – BC Hydro will provide additional support, through face-to-face communications, to communities that are affected by outages that are more than 72 hours long as a result of an extreme storm. BC Hydro is typically able to restore 95 per cent of customers within 24 hours.

Public Safety

- **Downed lines reporting** – Some customers encountered challenges when trying to report downed lines in their communities. Local 911 operators in some communities were overwhelmed and in certain areas these calls were not being treated as a priority. Safety is BC Hydro's number one priority and efforts are underway to improve outcomes, ensuring that when a customer reports a downed power line to 911 it is received appropriately. As well, additional resources in our restoration centre, to analyze calls during storm events, will allow more intake of calls from emergency partners.
- **Operational enhancements** – We're examining how to enhance the use of crews to make downed wires safe pending full restoration. This includes improvements to our use of Wire Guards – trained employees who can relieve first responders from the scene of downed wires and keep the public safe until the restoration crews arrive.
- **Municipal coordination on priority traffic infrastructure** – Efforts are underway to connect with cities and municipalities to better map out major intersections and primary traffic routes so lines feeding those areas can be prioritized during future major storms to avoid traffic congestion and related safety issues.

Logistics

- **Mutual aid agreements with other utilities and jurisdictions** – We learned much about the intake process required to bring crews in from other parts of the province and the country. Efforts are underway to formalize our processes for bringing in multiple crews from outside B.C. if required in the future.
- **Logistics support** – Challenges were overcome during the December storm in “soft” logistics – the support needed outside of materials and equipment. Booking hotels, managing ferry reservations and ensuring our crews had sufficient food and water are a focus for enhancement, to ensure we accomplish these tasks more efficiently in the future.

Business Operations/Technology

- **Mobile work order application** – The mobile work order application (a smart phone app) will enhance the way our field workers communicate with different BC Hydro systems – including materials management and customer support – regarding the work that is being completed on trouble calls. The app will let crews enter the bulk of the data right at the site, improving the quality and timeliness of the data (materials used, damage cause, etc.). This, in turn, will assist in providing more timely updates for customers.
- **Work order application for contractors** – Extending the work order application to our contractor partners will align the process we use for them with the process we use for BC Hydro crews, allowing greater visibility into crews in the field and the trouble orders they are working on. The consistent dispatching and tracking of work orders will improve efficiencies and assist in providing more timely updates for customers.
- **Damage assessment tool** – During the December storm the damage was sufficiently widespread that it was challenging to understand which trouble orders crews were working on, and it became time consuming for crews to sort through multiple trouble calls to clearly identify which ones related to the work they were conducting. A damage assessment tool will provide a means for this function to happen through software integration, allowing crews to prioritize the work and repair damaged equipment while the software system aligns the work they're doing with the appropriate trouble call for tracking, awareness and recording. Ultimately, this will improve the timeliness and accuracy of restoration estimates.

Don't be powerless in a power outage

It is difficult to predict how much damage a storm may cause to BC Hydro's system and how long a power outage might last. This is why it is important for British Columbians to be prepared with the right supplies and information on hand.

BC Hydro recommends:

- **Having a well-stocked emergency kit:** this should include basic supplies like:
 - Flashlight
 - Extra batteries
 - First-aid kit
 - Blanket or warm clothing
 - Ready-to-eat non-perishable food
 - A three day supply of bottled water for each member of the household
 - Other optional items include personal toiletries, medications, cash in small bills, copies of important documents, a portable cell-phone charger and books or games.
- **Developing a preparedness plan:** share it and be sure everyone knows what to expect and what to do.
- **Knowing where to get updates and information:** customers can visit [bchydro.com/outages](https://www.bchydro.com/outages) from their mobile device for the most up-to-date information on an outage and estimated restoration times once available.

