Increasing Network Resilience with Specialized Weather Forecasts

Photo credit : Frank Weber

Electricity assets are vulnerable to extreme weather events—a vulnerability that could grow in the future due to increases in both the frequency and intensity of extreme events. A good way to cope with this vulnerability is to be proactive and take appropriate action before extreme events trigger significant, negative consequences. To achieve this goal, BC Hydro established a system that uses weather and hydrology data to inform the company's decision-making processes. A dedicated team monitors and analyzes relevant data, and alerts company officials when extreme events are likely to occur. The system benefits BC Hydro over both the short and long terms, and improves their capacity to adapt to climate change.

"There is a lot of business-focused knowledge that we provide that informs the decisions made by others in the company."

Stephanie Smith,
BC Hydro's manager of hydrology [1]

CONTEXT

Extreme climate events threaten energy systems around the world. In British Columbia, Canada, windstorms are a major concern for distribution and transmission lines. In December 2014, a windstorm left 100,000 customers in the province without power. Outages such as this one can have significant impacts on society, shutting down businesses and critical infrastructure such as telecommunication networks and hospitals. Since the key to reducing the impacts of an outage is to act quickly and effectively, advance knowledge of extreme weather events is quite valuable.

'What would a windstorm be like in the future, considering the impact of climate change?' is a question that many scientists would like to be able to answer with a high degree of confidence. However, extreme events are by nature rare and challenging to analyze. Natural Resources Canada conducted a review of available data related to projected extreme events in the country.[2] The review shows increasing trends in both the frequency and intensity of extreme hot days and in precipitation amounts for most of Canada—variables in which the scientific community has good confidence. For other weather conditions, such as wind and freezing rain—variables that can have significant impacts on energy-system components such as transmission lines—the information is not as robust. Utilities are therefore left with many uncertainties concerning the frequency and intensity of extreme events in the future.

The IPCC defines climate resilience as the capacity of a system to cope with hazardous events and to respond in ways to maintain its principal function and structure.[3]

Even with these uncertainties, however, building increased capacity to cope with, and respond to, extreme events—a concept known as climate resilience—helps reduce the overall vulnerability of an energy system. Investments in climate resilience are often profitable right away. According to Stephanie Smith, BC Hydro's manager of hydrology, the company's hydrology forecasting service saves "millions (of dollars) or hundreds of millions!".[1] The service features a weather and hydrology forecasting team able to predict extreme events and help inform business decisions.

FROM CLIMATE RESILIENCE TO CLIMATE CHANGE ADAPTATION

BC Hydro developed in-house weather and hydrology forecasting capacity because it requires more specialized information than what the Government of Canada provides through Environment Canada. "Environment

Canada's main goal in weather forecasting is to protect public safety," explains Smith. "Much of BC Hydro's critical infrastructure and reservoirs are in very remote areas of British Columbia, and are subject to a variety of weather risks."[1] The company's weather and hydrology forecasting team produces information about specific places, such as remote reservoirs and transmission lines.

When an extreme event is expected, the team acts like a watchdog: "Basically when there is a big storm coming," says Smith, "the team can predict how it might impact the business." The team relies on a network of contacts to alert company divisions about the timing, location, severity and the relative certainty of extreme events. Briefing meetings will be organised to communicate as much information as possible on the event that is coming. "We try to give as much as warning and as much knowledge as we can about how certain or uncertain the event is," says Stephanie.[1] This information enables company managers to make appropriate decisions, such as relocating crews or adjusting water levels in reservoirs. In April 2010, for example, the team predicted strong winds in the Strait of Georgia that could lead to the cancellation of ferry service to and from Vancouver Island (see figure CS10.1).[4] Thanks to the warning, BC Hydro dispatched crews before the storm hit to deal with potential outages.

Figure CS10.1 A ferry from Blubber Bay to Powell River in the Strait of Georgia on April 10th 2010

The forecasting team's work goes well beyond extreme storms; it also provides data to support ice modeling and to coordinate the utility's emergency response to summer forest fires. The team tracks current climate and hydrology conditions in all watersheds managed by BC Hydro and gets involved in "basically anything related to weather," according to Smith.[1]

The team of 13 meteorologists, hydrologists, engineers, scientists, technologists and analysts produces a hydrologic forecast every weekday to help company engineers optimize water resources for electricity generation, environmental and recreational flows and other uses. The team consults data from the Canadian Meteorological Centre and the U.S. National Weather Service, and co-manages—with the provincial and federal governments—more than 200 monitoring stations (see figure CS10.2). Thanks to ongoing collaboration with the Weather Forecast Research Team at the University of British Columbia, "UBC is able to provide us with ensembles of point weather-parameter forecasts

at exactly the locations that we are interested in" says Smith. The hydrologic forecast is made using the UBC Watershed Model through an integrated platform developed in-house.

Figure CS10.2 Colpitti Creek monitoring station, British Columbia

Of the team's annual budget of $4.5 million, 44 percent goes to hydrometric-monitoring stations, while snow-monitoring stations and climate monitoring account for 13 and 9 percent, respectively.[5]

BC Hydro's current broad strategy for adaptation to climate change grew out of the questions asked by stakeholders in 1994, when the company started to develop water-use plans for the watersheds where it operates reservoirs. The company recognized that more research was needed to develop and interpret future climate scenarios, and to be able to answer questions from external stakeholders.[6] To help analyze the potential impacts of climate change on its assets, BC Hydro began to partner with the Pacific Climate Impacts Consortium (PCIC) in 2007 on a series of studies, published by PCIC in 2010 [7] and later summarized in a BC Hydro brochure.[8] In 2010, BC Hydro established an adaptation to climate change strategy that prioritizes vulnerabilities according to the severity of risks and potential business impacts. The company reviews the strategy continually and updates it as needed.

LESSONS LEARNED

After multiple years of efforts concerning adaptation to climate change on a broader scale, this work has slowed a bit at BC Hydro in recent years. The company faces many challenges, including a major restructuring. Stephanie Smith also identifies other issues: "the biggest challenge about integrating adaptation to climate change at BC Hydro is that there are no standard methodologies available yet, and with no staff resources dedicated to climate change; it is a collaboration across the company and with inter-utility working groups to figure out how to do this." Stephanie Smith and Brenda Goehring, Senior Manager of Policy & Reporting at BC Hydro, currently lead the work: "We are bringing people together from across the organization, to talk about how we are going to technically assess the risks from climate change and how does that translate in terms of adaptation or mitigation."[1]

Smith has worked at BC Hydro since 1994 and has headed the Hydrology department for six years. She and her team serve as a centre of knowledge and capacity for the company and reflect BC Hydro's commitment to climate resilience. Smith sees herself more as a "climate coach" than as an "adaptation champion;" she helps every division in the company access the climate information needed to adapt to climate change. "We want to educate the experts [about climate change] for them to incorporate

[adaptation to climate change] in the planning activities they are already doing," she says. [1]

Stephanie Smith encounters a certain amount of resistance from others; adaptation to climate change is a task that people must do on top of their regular duties. She says that while she encounters few "climate change sceptics" at BC Hydro, she regularly encounters people who are not sure if they must act on climate change. She explains the potential ways that climate change might impact their work, but recognizes that staff must gauge the relative risks posed by climate change for themselves. Smith says that senior management supports her efforts. "The board of directors and the executive are very focussed on identifying and reducing our climate risk and also in terms of funding the research we need from PCIC and others."[1] Part of what drives this focus on risk is the BC government's climate policy, along with pressure from the BC Utilities Commission and other regulators to ensure that BC Hydro considers climate change impacts in its long-term resource planning and environmental assessments of new projects.

Smith emphasizes that learning how to adapt to climate change is a long and in-depth process. "It's a steep learning curve to figure out how to use this information," she says. "It seems quite straightforward from the outside to run a climate scenario in a hydrological model and to get hydrological scenarios, but then you get stuck. It's much more complex than people realize." Each expert in the company has his or her own model and knowledge; it's often hard to figure out how to incorporate climate information. "We're trying to build this knowledge in-house in a way that it builds on itself rather than hire an outside consultant."[1]

Ultimately, BC Hydro recognizes that adapting to climate change requires timely action informed by accurate data and analysis. Smith's team recently finished a comprehensive study of climate change impacts on water resources that demonstrates that changes in the timing and amount of inflows to reservoirs will be neither sudden nor dramatic. BC Hydro recognizes that it must manage these incremental changes. "It takes some of the pressure off in terms of how quickly we need to incorporate that," says Smith. "We feel we have some time to study this."[1] In the meantime, BC Hydro has developed the skills and tools needed to assess, predict and communicate the potential impacts of extreme weather events.

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AT A GLANCE

KEYTAKEAWAYS

1. **Investments in climate resilience yield benefits over both the short and long terms, and can help achieve larger adaptation goals.**

2. **Development of an in-house weather and hydrology team is a viable option given appropriate time and resources.**

3. **Knowing when to act helps move the adaptation strategy forward.**

ORGANIZATION(S)
BC Hydro (Canada)

POWER SUB-SECTOR(S)
- Hydroelectricity generation, transmission and distribution

ADAPTATION TYPE(S)
- Informational – Climate Services
- Informational – Supply and demand forecasts
- Informational – Monitoring equipment and technology

CLIMATE CHANGE IMPACT(S)
- Extreme events
- Forest fires
- Changing availability of water resources

ADAPTATION COSTS
- The cost of generating and interpreting forecast data is low.
- The cost of maintaining a team of 13 people is medium.
- The cost of maintaining 200 monitoring stations is high.

ADAPTATION BENEFIT(S)
- More effective management and faster response to extreme events
- Minimize or prevent damage during extreme events

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FULL REPORT
https://ouranos.ca/en/programs/energy-adaptation-case-studies/

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