Sentient ENERGY

CASE STUDY: Manitoba Hydro

Utilizing Line Sensors for Accurate and Efficient Substation Monitoring

Sentient Energy, Inc.

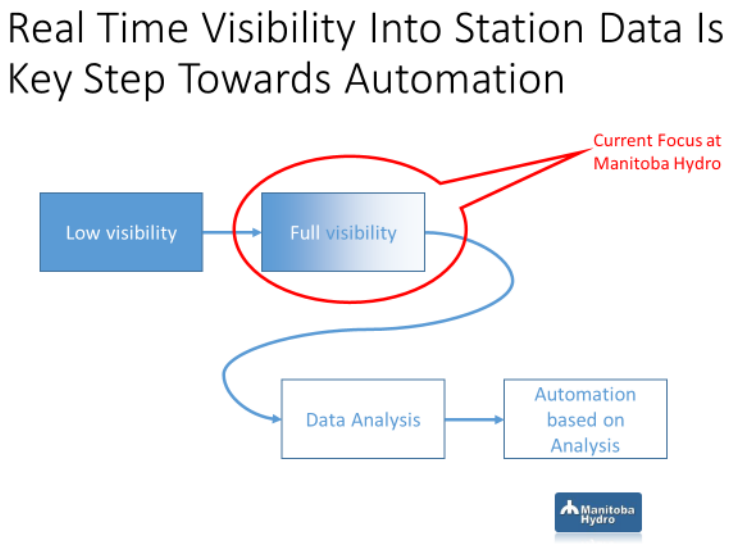
DETECT PREDICT DELIVER

The Client

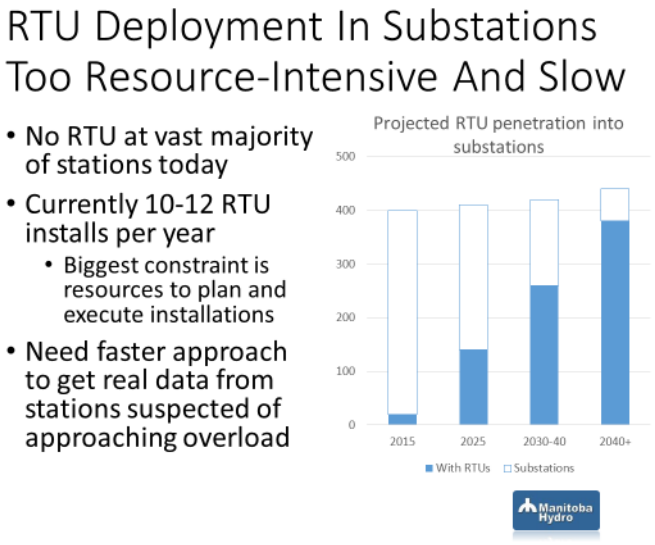
Manitoba Hydro is a Canadian Crown Corporation governed by Manitoba Hydro Electric Board. In addition to supplying more than 50 utilities in the U.S. and Canada with hydroelectric power, the company serves 560,000 electric and natural gas customers in the province of Manitoba. Manitoba Hydro maintains more than 400 distribution stations with approximately 1,800 feeders.

The Challenge

Due to increasing demand and aging infrastructure, Manitoba Hydro has been actively engaged in modernizing its electric distribution system to reduce the duration and frequency of outages. Understanding that this a time, resource, and capital intensive initiative, the company wanted to prioritize upgrade projects at locations where reliability was most at risk. This would require some way to accurately measure peak loads on substations to predict potential overloads and resulting failures.

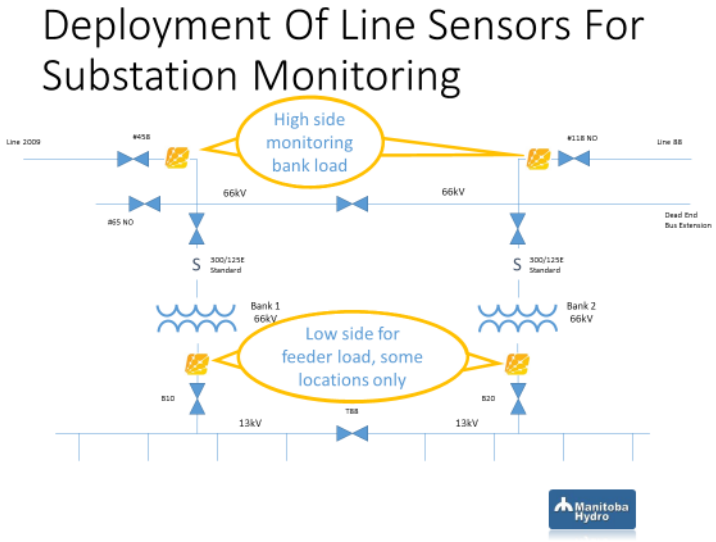


Manitoba hydro has more than 400 substations spread across the 250,000 square miles of Manitoba province with no RTUs or other forms of automated communications. This means the Utility is essentially blind to real-time demand at these locations. The only way it could attempt to confirm that stations might be overloaded, was to send out a service crew twice a year with load loggers to record a peak load reading. Not only was this manual procedure slow and resource intensive, the harsh winters in the province made a number of the stations virtually inaccessible part of the year. In addition, the load loggers only recorded one peak load number at one specific time, and could not record coincidental peaks – hardly the optimal data set on which to make the most informed capital planning decisions. Although Manitoba was installing RTUs at a rate of 10-12 substations per year, this rollout was not going to meet the Utility's distribution system modernization timetable. It needed a faster approach to get real-time data from substations suspected of approaching overload.



The Solution

In 2013, Manitoba Hydro began testing line sensors as a viable alternative for real-time substation monitoring. The essential decision drivers were time and resources. The new generation of line sensors, like the Sentient MM3, could be deployed, provisioned, and begin communicating data through cellular networks in an hour. They also required no external power source, as opposed to an RTU that had to be designed, built and installed -- requiring a much longer time window. Manitoba Hydro continues to deploy the line sensors at locations of greatest concern, providing a fast, accurate and resource-efficient technology to achieve real-time visibility into substation load.



Intended Benefits Achieved

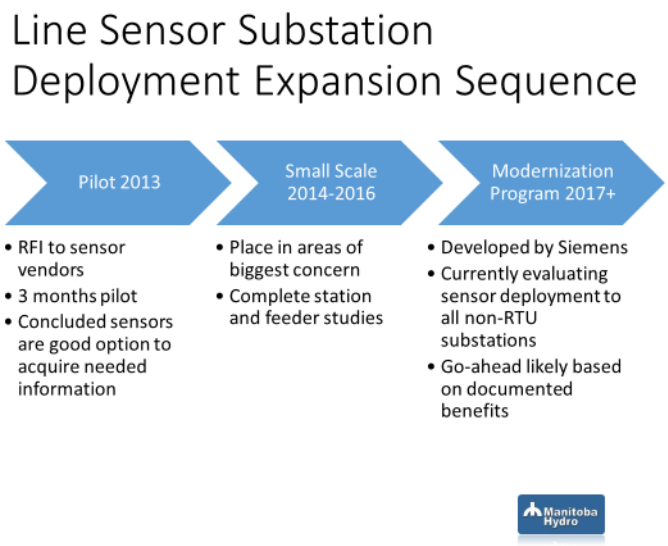
By comparing the line sensor data with the data that was previously obtained by the load loggers, Manitoba Hydro soon determined that the load logger estimates were only 50% accurate. The line sensors quickly achieved the goal of providing accurate, real-time load data that served as a reliable basis on which to make sound decisions about which locations needed attention first, which could be deferred, and for how long.

Additional, Unexpected Benefits

In addition to the benefits of being able to monitor load and peak load in real time, Manitoba Hydro began using the sensors for notification when substation banks were tripping out. By simply moving the sensors to the feeders, the could learn when feeders were tripping out, as well. Once RTU's are installed at a future date, there will be no loss in value, because the exceptional portability of the sensors mean they can be moved to the circuit heads. Having Oscillography at the circuit head was one of the biggest added benefits, as all information is captured in one spot, and is accessible in minutes after a fault occurs. Getting the same information from a relay or IED, displayed on a map of the system in the correct location, would take at least an hour. The Sensors can also be moved to the feeder lines to find out when they are tripping out.

> *"At substations where we think we have issues, the sensor deployments are always going be ahead of the RTUs. We're going to learn from them, and whenever the RTU comes in, we can move them to another useful place. There's no loss in value here because when you put them at the circuit head, you get a whole bunch of other benefits that you didn't have before."*
>
> Graham Eason
> Certified Engineering Technologist for Distribution Performance Engineering, Manitoba Hydro

Benefits received as expected	Benefits expected but not received	Benefits received beyond expectations
Accurate, real-time load data	None — Line sensors provided all expected benefits	Notification when banks are tripping out
Reliable, accurate basis for station investment decisions		Move to feeders, find out when feeders are tripping out
Quick, easy, resource friendly deployment		Find out which circuits are balanced
		Establish which circuits have frequent outages
		Direct operational problems, e.g., 2 networked circuits balanced on a station bank, C phase current going through at one, but not the other station, as disconnect not closed
		Detect momentaries, identify cause based on length and oscillography (e.g., cap bank with blown fuse)
		Determine were on feeder to put automated feeder ties (at 2/3 point per line sensor data)
		When station receives RTU, sensors can be easily moved to feeder locations: no stranded capital



Manitoba Hydro will also be looking at using the sensors to determine where automation can best be deployed on the feeder lines. The sensors will help them determine which feeder ties are viable for automation and where on the feeder line they want to put automation such as fault interrupters. Another big added benefit is the ability to detect momentary outages they never even knew about before, and identify the cause (e.g. a cap bank with a blown fuse) based on the length of the outage and the sensor Oscillography.

About Sentient Energy

Sentient Energy makes electric power delivery safe, reliable and solar ready. Sentient Energy offers the Utility Industry's only grid analytics system that covers the entire distribution network with intelligent sensors that are quick and easy to deploy, as well as analytics that detect and analyze potential faults and other grid events that can disrupt electric service or present potential hazards. We lead the market with the largest mesh network line-sensor deployments in North America, and partnerships with leading utility network providers including Silver Spring Networks, Landis + Gyr, Cisco, and AT&T.

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