

Making smart metering a success

How Ontario's PowerStream used long-range radio for one of the most advanced smart metering networks in the world



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Senior Vice President, Smart Grid
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On August 14 2003, 55 million people were subjected to what was, at the time, the second most widespread electrical blackout in history.

Affecting 45 million people across eight US states and 10 million people in the province of Ontario, Canada, the blackout lasted for some four days. During this time, power generation, water supply, transportation and communications were disrupted or suspended, with a devastating effect upon people, commerce and industry.

The suspected root of the problem was simple: a hot summer's day. The failure of an electrical distribution system in the US Midwest, combined with a surge in the use of fans and air conditioning, caused power lines to fail under the strain of higher currents. This triggered a cascading failure that - within just nine seconds - led to more than 100 power plants shutting down.

Ontario's challenge

For Ontario, the blackout highlighted a major weakness. The province was not only completely interconnected with the whole North American grid, but was also dependent on imported energy to service the day-to-day needs of residents - making it extremely vulnerable to outages.

In the immediate aftermath, the government pledged that this would never happen again.

A number of transformational initiatives were launched. Work was done across the province to raise public awareness of the need to conserve energy. Efforts were made to replace power-hungry household electrical devices with more energy-efficient models. And the government introduced a number of laws to enforce a more sensible, conservational attitude towards energy across the province.

Introducing smart metering

One such law was the Energy Conservation Responsibility Act of 2006. This mandated the installation of smart meters in all Ontario businesses and households by 2010, in order to provide greater insight into energy supply and demand and prevent future outages.

In this document, you will read the story of one of the largest electricity distributors involved in Ontario's smart metering programme - PowerStream. Focusing specifically on the data transport network, you will discover which technology the company chose for this critical infrastructure and how the lessons learned are relevant to Great Britain.

You will see how the rollout of smart meters in Ontario highlighted the need to take a long term strategic view of all available communication technologies - especially if the longer term objectives of delivering 'smart grid' functionality were to be achieved. And you will learn how the work has helped to give Ontario one of the most successful and advanced smart metering infrastructures in the world.

Smart metering: the pilot programme

To get smart metering up and running, the Ontario government launched a pilot programme in 2006. From 80 electricity distributors across the province, 13 were selected to participate in a smart meter/grid pilot that would result in three-quarters of Ontario's four million electricity consumers adopting smart meters. The rest of the province would follow suit within just four years.

"PowerStream is the second-largest municipally-owned electricity distributor in Ontario. We were chosen to be among 13 early adopters," explains Edward Chatten, Senior Vice President, Smart Grid and Strategic Support, PowerStream. "We also worked closely with the government to put together a tender for a selection of approved communication technology suppliers for the programme."

Importantly, the aim of the tender process was not to authorise one single data transport technology. Rather, it was to provide minimum specifications to all prospective vendors, giving them room to qualify for approved use in a number of ways.

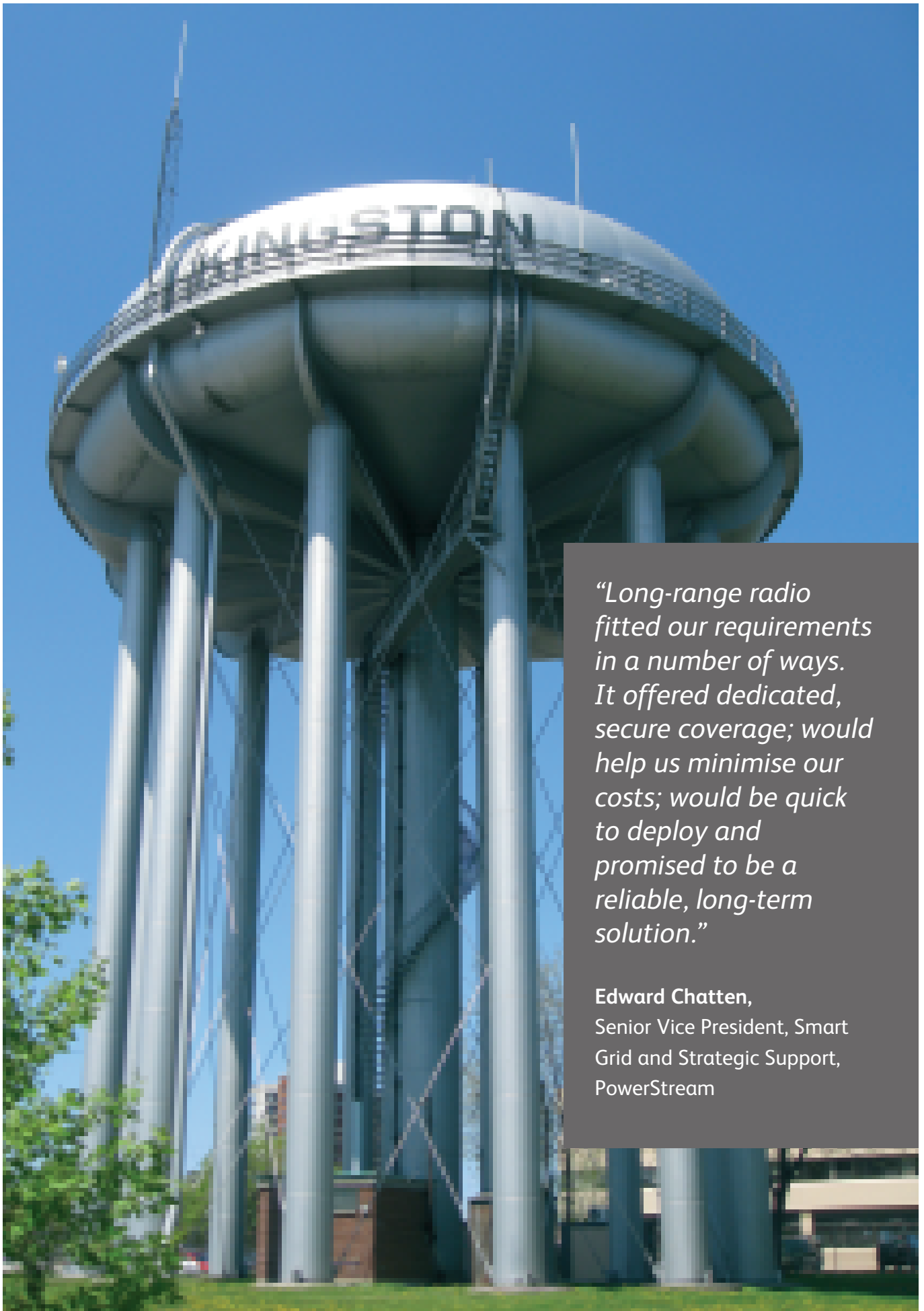
As a result of this approach, five suppliers were approved by the government for use during the pilot. These suppliers proposed a range of data transport technologies - including mesh, long-range radio and power line carrier.

PowerStream's technology choice

Edward and the team at PowerStream chose the FlexNet long-range radio solution from Sensus. FlexNet was chosen by one third of the distributors in the province of Ontario, servicing 1.3 million customers.

"Long-range radio fitted our requirements in a number of ways. It offered dedicated, secure coverage; would help us minimise our costs; would be quick to deploy and promised to be a reliable, long-term solution.

"And unlike a technology such as power line carrier, the speed and quality of long range radio would enable us to collect really detailed, granular information about energy usage and needs. This would be vital to prevent Ontario from suffering such a major blackout ever again, and offers a long-term scalable solution capable of meeting demands of a future smart grid."



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PowerStream's findings: a network that is regulated, dedicated and secure

Two of the primary benefits of long-range radio to PowerStream are its reliability and high security.

All data concerning meter usage is encrypted before it is transmitted over the data transport network. The radio network itself operates within licensed spectrum. However, other data transport technologies operate in unlicensed spectrum - which has already caused a few problems.

"There have been numerous public incidences of meter traffic in unlicensed spectrum causing baby monitors to malfunction, or interfering with cell phone traffic," explains Edward. "One group of angry residents in south-west Ontario actually took one utility to the federal communications regulator, wanting them removed from the unlicensed spectrum because of these kinds of problems. These are issues that no customer deserves to have, and which can be very troublesome for a utility to deal with."

Issues such as these have raised governmental awareness of the need for the data transport network to be regulated, and as such isolated from interference and better protected against security threats. "Ontario's Privacy Commissioner has taken a lot of interest recently in data security and smart grid security - specifically in the threat of personal data being stolen by hackers and misused. By operating a long-range radio network that is regulated as standard,

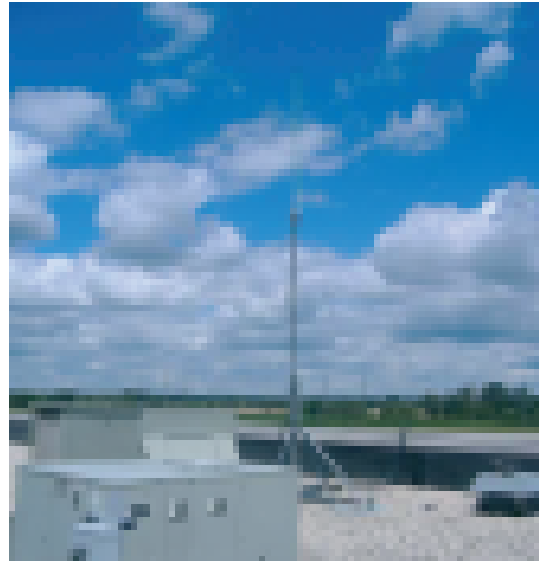
PowerStream is better equipped to protect its customers in this respect."

Importantly, PowerStream's network is also physically secure. "We use our own fibre to backhaul, and our own transformer stations for the antennas. This gives the network terrific physical security," concludes Edward.

The right quality of regulated data

For every distributor in Ontario, the ability to gather high quality information about customer energy usage is vital. It's this that enables them to effectively balance supply with demand, which in turn will help to prevent a power surge like that which triggered the 2003 blackout.

For PowerStream, long-range radio is providing the right level of detail for this purpose. "Historically, the information we gathered on our customers was not particularly detailed; we couldn't really 'see' below 2,500 people," says Edward. "Through smart metering, and thanks to long-range radio, we can see every house - if it has power, how much is being used and when." Importantly, Edward believes this level of detail would be more difficult to gather if PowerStream were using another data transport technology - such as power line carrier, for example. "Power line carrier was an approved technology for use in the Ontario smart metering pilot.



But not one of the other 13 early adopters chose it.

“While I can’t speak for everyone, I know that PowerStream didn’t choose power line carrier because its software cannot be reconfigured without significant extra cost. You also need to install additional hardware to either bypass or enable data to be transmitted through the transformer and this is very expensive. As standard, long range radio would allow us to make incremental changes cheaply and remotely - changes that would be essential for maintaining and improving our service levels. There was no contest.”

Mesh net was also deemed unsuitable for PowerStream’s requirements - the main reason being its lack of stability. “Long range radio is point-to-point; a radio tower transmits data back and forth to each and every household. But mesh net uses ‘collectors’ which are typically installed at an individual’s home. Each one collects data from as many as 400 meters,” explains Edward. “If that collector loses power, you lose data from 400 customers. But if a meter on a long range radio infrastructure loses power, you only lose the data from that one meter. Long range radio simply promises to be far more stable than mesh net.”

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Minimising costs

Managing costs was a critical part of the pilot project. The regulator agreed to reimburse distributors against a minimum solution specification only.

Edward highlights three key requirements from the specification: “As a minimum, we needed a technology that supported data communications; that offered polling success rates of between 98.5% (for 24 hours) and 99.5% (for 30 days); and which could support data from multiple utilities.”

This meant that distributors had a delicate balance to strike. The technology needed to offer long term value; after all, it would be up and running for many years. But buy too much functionality at the outset, and there was a real risk the regulator would see it as unnecessary - and therefore refuse to cover the cost of it.

This made long-range radio all the more appealing to Edward. During PowerStream’s research, long-range radio promised to be cost-effective in a number of ways. “For example, it could penetrate concrete very easily; more easily than mesh net, for example, which operates at a lower wattage as it’s on unlicensed spectrum. This meant we didn’t have to incur the cost of moving meters to more ‘accessible’ locations for the network, or create costly interfaces with different data transport technologies.”

What’s more, the technology can carry a variety of data. “Customer usage and billing data can all be transmitted over the same connection - and for multiple utilities at once. Mesh net can support water, for instance, but a lot of costly duplicate hardware is needed. And the very nature of power line carrier means it can only support electricity data. Because we manage water billing for some customers, being able to support data from multiple utilities as standard through FlexNet proved very cost-effective for us.”

And the results? During the pilot programme, PowerStream achieved the lowest installed cost per smart meter in Ontario. “Our cost per point was more than 3.5 times lower than the highest cost in the province,” confirms Edward. “This is partly because we negotiated hard on our installation contracts, and because we held out during deployment for hardware that would see us into the long term; it’s also because we have a higher population density than other areas of the province. But the fact that long range radio is a simpler infrastructure - and therefore cheaper - is very significant. It gave us confidence that we could reduce our risk of cost recovery from the regulator.”



Ensuring the best coverage

For smart metering to work effectively across any territory, network coverage needs to be sound. The success of the project relies upon detailed data being transmitted successfully and regularly between consumers and distributors across potentially vast areas of differing terrain.

As the second-largest electricity distributor in Ontario, PowerStream delivers power across some 1,000 square km. This territory is both flat and hilly in places, and densely populated - making long-range radio an ideal technology. "The transmission success rate of long range radio proved to be exceptional - 100% from the moment you install and initialise the meters," confirms Edward. "And the coverage is excellent. We worked with a design specification of 20km for each radio antenna. But what we found is that each will actually cover up to 75km."

According to Edward, this meant that some antennas were initially being overloaded with data. "But because the infrastructure is minimal, it was very easy and quick to re-point them and rectify this."

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Ensuring fast deployment

In 2006, the Ontario government set an aggressive deadline of a million meters being installed within the province by the end of 2007. This meant that time was of the essence for all distributors.

Thankfully, Edward and his team were able to fulfil their part of this deadline with ease.

Via a series of towers, the antennas were relatively cheap and quick to install. And because each radio antenna has such an excellent geographic reach, coverage was established across the whole of PowerStream's region rapidly. What's more, the signal's ability to penetrate the building fabric meant that rolling out the smart meters themselves could become a 'plug and play' activity. "Each member of the installation team was able to deploy up to 75 new meters a day," confirms Edward.

In actual fact, PowerStream installed the smart meters before deploying the communications network.

"In hindsight, this decision was not such a good one!" says Edward. "We were taking a real risk given our deadline, and I certainly wouldn't advise anyone else to work this way." Fortunately, the long-range radio technology was very straightforward to roll out. "There's very little to it. We used our own transformer stations to house the antennas. It was very simple."

"It's helped to give us exactly what Ontario needed - the intelligence to balance load effectively, and prevent the outages that once ground our province to a halt."

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Closing thoughts

Looking back, PowerStream is very happy with how the smart metering project has gone. "In the early days of the pilot, we could only hope that our choices would be the right ones. But we've not been disappointed," Edward confirms.

Long-range radio has, Edward believes, been an excellent choice for the data transport network. "It's a single technology that works across our densely-populated territory; it's easy to deploy and cost-effective to run. It's also got the longevity we wanted - it should be up and running for decades.

"And it's helped to give Ontario exactly what it needed - the intelligence to balance load effectively, and prevent the outages that once ground our province to a halt."

Aware that it's early days for smart metering around the rest of the world, Edward is very keen for his experience to help others in the same situation. "We took a few gambles ourselves, which ultimately paid off", he smiles. "But I really want to help others learn from our experience. For territories similar to ours, that are keen to develop a smart grid in the longer term, I would have no hesitation in recommending long-range radio. It's exceeded our expectations."

About Arqiva

Arqiva operates at the heart of the broadcast, satellite and mobile communications markets - and at the forefront of network solutions and services in the digital world. We provide much of the infrastructure behind television, radio, satellite and wireless communications in the UK and have a significant presence in Ireland, mainland Europe and the USA.

Our customers include major broadcasters such as the BBC, ITV, BSkyB and the independent radio groups, the UK's five mobile network operators and the emergency services.

The founder shareholder of Freeview; the rollout of DAB digital radio; ownership of the UK's only national digital radio multiplex; the design, rollout and operation of the world's first outsourced mobile telephone network, and, of course, the digital switchover - each of these projects has




come to fruition thanks to the commercial and technical expertise of the Arqiva team.

It's this breadth of technical and commercial strengths that makes our business ideally equipped to deliver the technology for Great Britain's smart metering project.

About PowerStream

PowerStream is the second largest municipally-owned electricity distribution company in Ontario, Canada. The company provides power to more than 325,000 residential and business customers located immediately north of Toronto and in Central Ontario.



Jointly owned by the municipalities of Barrie, Markham and Vaughan, PowerStream is committed to providing customers with a safe, reliable and efficient service. This is achieved by focusing on operational efficiencies and procedures to minimise overhead costs and maximise the use of company assets.

About Sensus

Sensus has led the discovery, development, and implementation of technologies for the energy and water industries for more than a century. Its leading innovative and evolving technology solutions enable intelligent use and conservation of critical energy and water resources. Utility customers around the world benefit from its open, flexible products and solutions to help them optimise their resources – today and tomorrow.

With operations and service facilities on five continents and over 225 utility customers for FlexNet™, its Smart Meter and



Grid solution, Sensus is a global leader in utility infrastructure systems and resource conservation, with its focus squarely on the future.

A privately held company, Sensus employs almost 4,000 people worldwide. Almost 1,000 of those are in Europe, with offices or manufacturing facilities in Germany, France, UK, Italy, Spain, Poland, Ukraine, Czech Republic and Slovakia. Sensus headquarters are in Raleigh, North Carolina, USA.

For more information, visit www.sensus.com/flexnet



Find out more

To find out more about Arqiva's dedicated long-range radio solution, and why it constitutes the most secure, available and cost-effective communications network for Great Britain's smart metering project, contact +44 (0)845 650 4020 or email wireless.access@arqiva.com



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