

Silverpond.



CitiPower & Powercor Embark on Smarter Electrical Grids Through Cloud-Powered Advanced Analytics with Silverpond

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Nearly 1.2 million smart meters spanning western Victoria to inner city Melbourne collect power quality data on behalf of power providers, CitiPower and Powercor. To help make sense of this data flood, CitiPower and Powercor enlisted data science experts at Silverpond. What they got was an intelligent, scalable fault detection platform that advises safety engineers of priority sites for inspection.

Spearheading Smart Grids Through Data Science

As the Internet of Things proliferates, CitiPower and Powercor are pioneering Australian smart grids. Upon rolling out 1.2 million smart meters, the power providers spurred on their digital revolution with a pilot data analytics project. The initial mission was simply to explore potential data science use cases.

CitiPower and Powercor engaged Silverpond for their unique combination of data science, software engineering and design capabilities. Silverpond's experience in introducing cutting edge technology to similarly traditional organisations such as Australia Post offered additional confidence.

From Data Silos to Data Lake

It was precisely this experience that would be useful early on. Silverpond enlisted AWS partner Vibrato, and worked closely with Powercor to design and build a data lake and data pipeline in the cloud. This included AWS (Amazon Web Services) S3 for storage, Spark for distributed computing, Docker for clustering and Luigi for the data pipeline.

Not only was data now accessible company-wide, but the setup also enabled dynamic testing. Clusters of 20 – 30 machines could be turned on and off as needed. This was essential for testing complex Stan probabilistic models and Monte Carlo simulations of possible relationships between currents, voltage and resistance in the network.

Two Industry Problems – Loss of Neutral & Phase Detection

With the necessary infrastructure in place, Silverpond delved into reams of data feeds. Working closely with CitiPower and Powercor's AMI (Advanced Metering Infrastructure) team, they came to solutions for two typical electrical network challenges.

The first was automating neutral integrity fault detection. The second challenge was phase identification. Running on three phases (A, B, C), electricity is typically generated to meet assumed maximum load on any one of these phases. As consumer demand varies, imbalanced loads are inevitable. This in turn strains network components and reduces their lifespan. The ability to identify phases of households on a network would allow for load balancing and more efficient power distribution to meet actual demand.

Math Modelling to Scale

For each problem, Silverpond developed and tested multiple mathematical models, progressing from the simple to complex. All the while, the need to scale chosen algorithms to handle data from 1.2 million smart meters was kept front-of-mind.

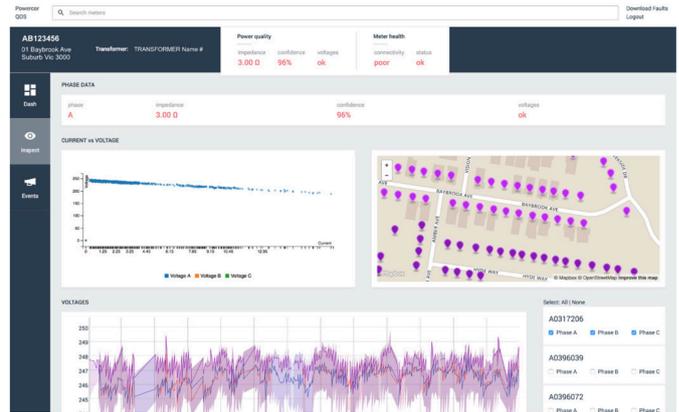
For automating fault detection, these included regression algorithms and Bayesian statistics that exploited spikes in current accompanied by dips in voltage. A final choice was made that struck a balance between rigorous modelling and computation speed, while expressing outcomes in probabilities rather than binary.

The final algorithms were very quick to compute, processing data from millions of meters each day on 5 machines compared to potentially 200+ machines for another model. This helped contain platform costs, while enabling flexible analysis. For phase identification, various matrix algorithms including graph cuts, singular value decomposition and principal component analyses were applied. These mapped correlations between meters' voltage,

current and power factor feeds to identify three clusters – one for each phase.

All-in-One Platform: Data Science + Cloud Computing + Web Application

With robust algorithms and cloud infrastructure in place, Silverpond’s designers completed the platform by integrating a user-friendly web application. The interface highlights potential problems on network maps as pins, noting phase, resistance and statistical confidence. An additional drill-through window gives engineers and technical staff insight into current and voltage activity, before heading out on site visits.

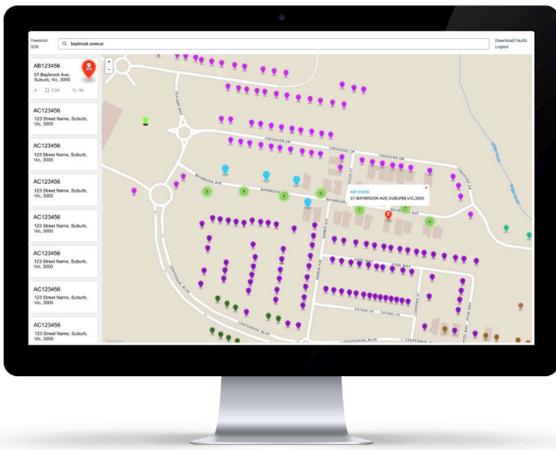


Fault Detection Web Application: Drill through detail on current and voltage activity informs engineers and technical staff in preparing for on-site visits.

Leading the Digital Revolution

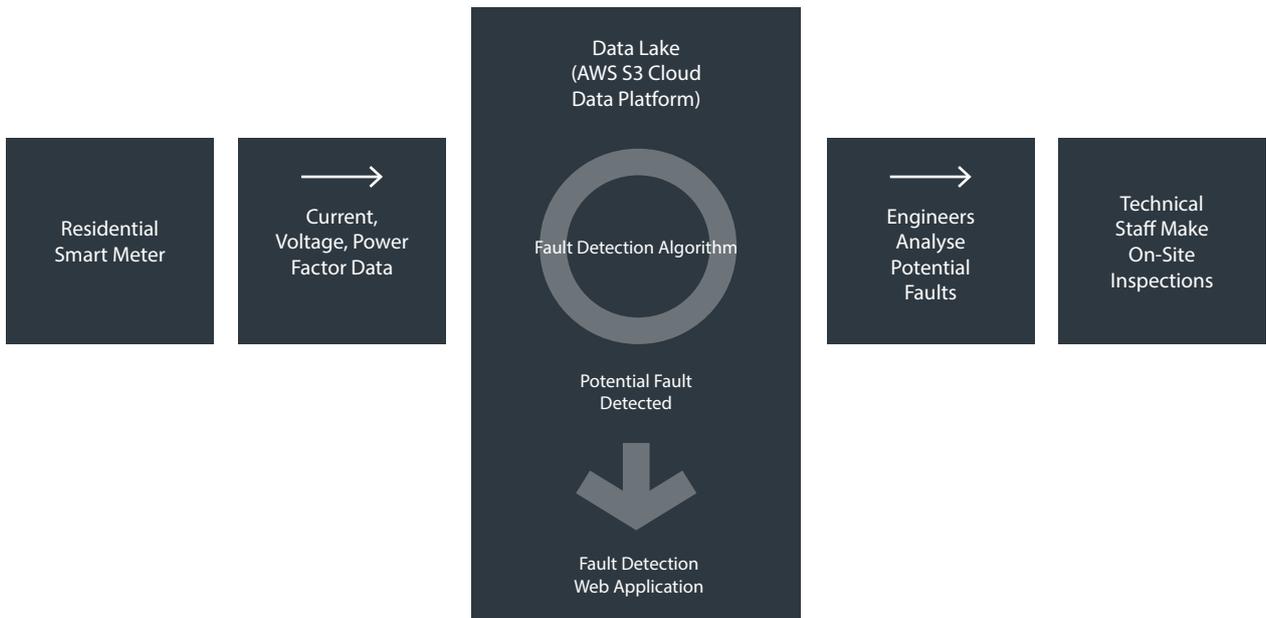
Before long, the automated problem detection platform was promoted from prototype to production. As it rolls out, the platform makes it easier for CitiPower and Powercor engineers to proactively respond to issues in the field before they become safety problems.

Through phase identification, the power distributors have opened the gates to demand based network planning. Indeed, the project has given CitiPower and Powercor a competitive edge as utilities capable of running their own advanced models at scale.



Fault Detection Web Application: Visualising potential faults on network maps with prioritization

Fault Detection Platform Solution: The prototype platform collects smart meter feeds in the cloud-based data lake, churns feed data through linear regression algorithms and maps potential faults for engineers and technical staff to view on a web interface.



Armed with these capabilities, CitiPower and Powercor are leading the power industry in the digital revolution to smart grids.

“Silverpond helped transform this simple idea using data science into intelligent, scalable and actionable fault detection on our first analytics platform.”

– Luke Skinner
Head of Network Technology, CitiPower & Powercor

About CitiPower & Powercor

CitiPower and Powercor are Victoria's largest electricity suppliers, delivering electricity to almost 1.1 million residential and commercial customers across Victoria.

About Silverpond

Silverpond is a team of data scientists, machine learning specialists and software engineers who design solutions to hard problems. We love big data and turning blue-sky ideas into reality. Over 11 years we have developed big data and software solutions for clients in industries ranging from utilities, retail and technology, to healthcare, education and research.

