CASE STUDY

GRID SIGHT

evoenergy

Gridsight Helps Evoenergy Achieve LV Network Visibility With Only 20% Smart Meter Data Penetration

"Gridsight has provided visibility to one of the most likely constrained parts of our network due to the concentration of rooftop PV. This allowed Evoenergy to take a cutting-edge, proactive approach to voltage compliance that will ultimately result in better quality of supply for our customers."

Leylann Hinch
Strategy & Operations Group Manager, Evoenergy

Traditional network design and operational practices assuming unidirectional electricity flow are being disrupted by the growth in distributed energy resources (DER), particularly residential solar. This has resulted in an increase in quality of supply complaints experienced by Evoenergy and prompted an internal review of how to manage network compliance. Historically, this has been managed through dedicated teams that make physical measurements of points on the network to identify complaints and alter distribution transformer taps to meet compliance requirements.

COMPANY

evoenergy

LOCATION

Australian Capital Territory (ACT), Australia

CHALLENGES

Increasing adoption of distributed energy resources was causing traditional distribution network voltage management approaches to become expensive and inaccurate:

- **Limited existing low voltage network asset data**
- **Power quality surveys becoming prohibitively expensive and time inefficient**
- **Two-way power flow causing linear assumptions of traditional techniques to break down.**

SOLUTION

Gridsight's platform was used to evaluate voltage compliance (V1 & V99) across low voltage feeders with 20% or more smart meter data penetration.

Evoenergy supplied CIM extracts, network monitoring (IoT) data and smart meter batch data, which Gridsight then ingested into their software for the analysis.

The integration took 6 weeks to complete, from final data handover to providing login credentials.

While Evoenergy is compliant to voltage supply standards at a system level, there are developing hot-spots across the network. One driver for the hot spots is mandated 100% residential rooftop solar in new greenfield suburbs in the ACT.

Before engaging with Gridsight, Evoenergy was reviewing its approach to managing network voltage issues by modelling distribution substations using traditional load flow applications and techniques.

A team of internal engineers undertook a pilot project and used the outputs of a load flow analysis to develop recommended transformer taps for individual distribution transformers along a distribution feeder with approximately 3,000 customers. This feeder supplies one of the mandated 100% residential rooftop solar suburbs.

This approach involved undertaking static theoretical simulations and applying estimated margins of error to the outputs to account for asset data assumptions, seasonal changes and assumed load flow values. This method required significant manual calculation that had to be repeated for each individual distribution substation. This resulted in a lack of trust in the outputs and hesitancy to apply them in the network.

Evoenergy engaged Gridsight to perform a comparison analysis on the same distribution feeder to develop a more reliable and cost-effective process to manage network voltage issues.

RESULTS

Evoenergy received immediate value from implementing Gridsight:

- **Improved detection of distributions substations operating outside specified limits by using 250x more network data than traditional methods**
- **Reduced voltage compliance assessment time from hours to seconds**
- **Automatically identified optimal tap requirements, saving weeks of engineering**
- **Automatically identified and validated network asset data, potentially saving months of field surveys**

During the analysis, the Gridsight platform ingested over 25 million measured data points from devices on the feeder.

Gridsight identified instances of non-compliance centered around areas of the network with 100% PV penetration. Recommendations for rectification were provided in a way that was repeatable, required minimal manual intervention and is available on-demand in the future.

Use Case Priorities

Gridsight is focused on identifying network voltage excursions, calculating network hosting capacities and modelling network changes. It is a Software-as-a-Service tool to support power system engineers and operators.

The key primary use case for Evoenergy was the accurate identification of areas of the network where supply voltage was outside of required limits (AS 61000.3.100).

Evoenergy engineers also wanted to model network changes such as tap changing and phase rebalancing to understand the most effective and efficient way of managing instances of non-compliance once they were identified.

Challenges

Managing a power system is a complex task:

- Network augmentation is costly and requires robust justification
- The broad spectrum of assets has resulted in a mixed standard of network data
- Thousands of kilometres of cables and conductors are required to service +200,000 customers
- Dynamic network parameters, such as voltage, have to be carefully maintained between upper and lower limits

With all of these factors impacting the operating environment, Evoenergy were looking for a more efficient way to manage voltage compliance. Evoenergy's team were looking for improvement opportunities associated with with:

- **Limited existing low voltage network asset data:** Load flow modelling for power systems requires complete and accurate asset data. Networks have slowly developed over decades and there are varied levels of data. Data is often not completely correct, resulting in difficulties to proactively identify network voltage compliance problems using traditional modelling techniques.
- **Increasing number of power quality surveys becoming prohibitively expensive and time inefficient:** Traditional identification of power quality problems required initiation through random surveys or a customer complaint. Both methods are costly as they involve the installation of temporary monitoring equipment on the network and take up additional time for the assessment and interpretation of results
- **Two-way power flow causing the linear assumptions of traditional techniques to break down:** Voltage management has historically involved configuring the network to prevent undervoltage in times of high load. This can be managed through a set of linear assumptions such as customer numbers and line length. These assumptions have become outdated due to the growth in DER and introduction of two-way power flows that result in instances of overvoltage under a variety of network conditions.

Solution

Evoenergy used the Gridsight platform to evaluate voltage compliance (V1% & V99%) across low voltage feeders with 20% or more smart meter data penetration. Evoenergy supplied CIM extracts and smart meter batch data, which Gridsight then integrated with and ingested. The integration took six weeks to complete, from final data handover to providing login credentials.

Evoenergy engaged Gridsight to run the pilot project on a medium voltage feeder over the course of six weeks. The teams worked together to gather the required data which was then imported into the Gridsight software.

Results

As a result of deploying Gridsight, Evoenergy identified distribution substations that are operating outside of voltage limits, modelled potential rectifications, and provided additional network insights. Specific results included:

- Improved detection of distributions substations operating outside specified limits **by using 250x more network data than traditional methods.**
- Reduced voltage compliance assessment time **from hours to seconds** - a few clicks, not hours of analysis for a single distribution substation.
- Automatically identified optimal tap requirements for all analysed substations based on real-world data, **saving weeks of engineering.**
- Automatically identified and validated network asset data such as Solar PV installs and customer phases, potentially **saving months of field surveys.**
- Developed a data-driven method to identify feeder hosting capacity as well as instances where customer PV inverters were curtailed or isolated due to overvoltage.

Inverter disconnecting due to network overvoltage in Gridsight

Inverter active power curtailing in Gridsight

These results were obtained without any physical network data surveys, making the process very cost effective. Instead of the traditional approach, Gridsight uses a data-driven, machine learning approach and can produce accurate results for any areas of the network with greater than 20% smart meter penetration.

Gridsight put the power of machine learning algorithms in the hands of Evoenergy engineers. The user interface takes the complexity out of machine learning and provides the relevant results and findings in a succinct and actionable way. This provides confidence in results, allowing experts to focus on network planning and performance.

Greener grids, greater insight

About Evoenergy

Evoenergy is a utility licensed in the Australian Capital Territory to provide electricity transmission, distribution and connection services. Evoenergy provides electricity services over an area of 2,358 square kilometres to over 200,000 electricity customers. Evoenergy's network includes 190 kilometres of transmission lines, sixteen 132 kV/11 kV zone substations and switching stations, approximately 4700 distribution substations, and over 5,200 km of distribution lines.

About Gridsight

Gridsight helps electrical utilities transition to a decentralised grid by creating 90%-accurate, AI-powered load flow models. These models enable utilities to safely and efficiently support more residential solar, batteries and electric vehicles. Based on CEO Brendan Banfield's PhD research, Gridsight was founded in 2020 to accelerate the transition to renewables.

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