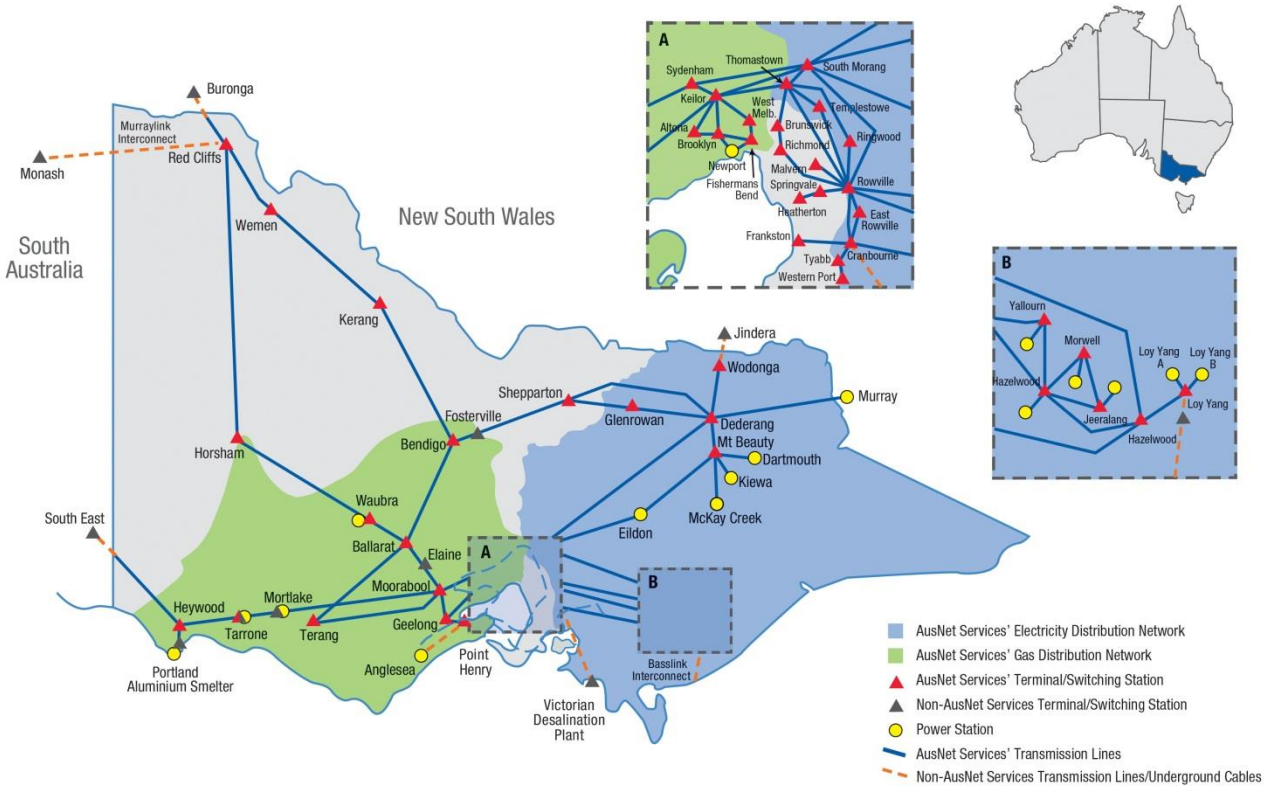
Introduction to AusNet Services

Global Regulatory Perspectives Programme
Electricity Regulatory Commissions of India

13 March 2019

What We Do

100% own, operate and control critical energy delivery infrastructure in Victoria



Electricity Transmission

- 6,600 km of transmission lines
- 13,000 towers

Electricity distribution

- 52,000 km of electricity distribution network
- 720,000 customers

Gas distribution

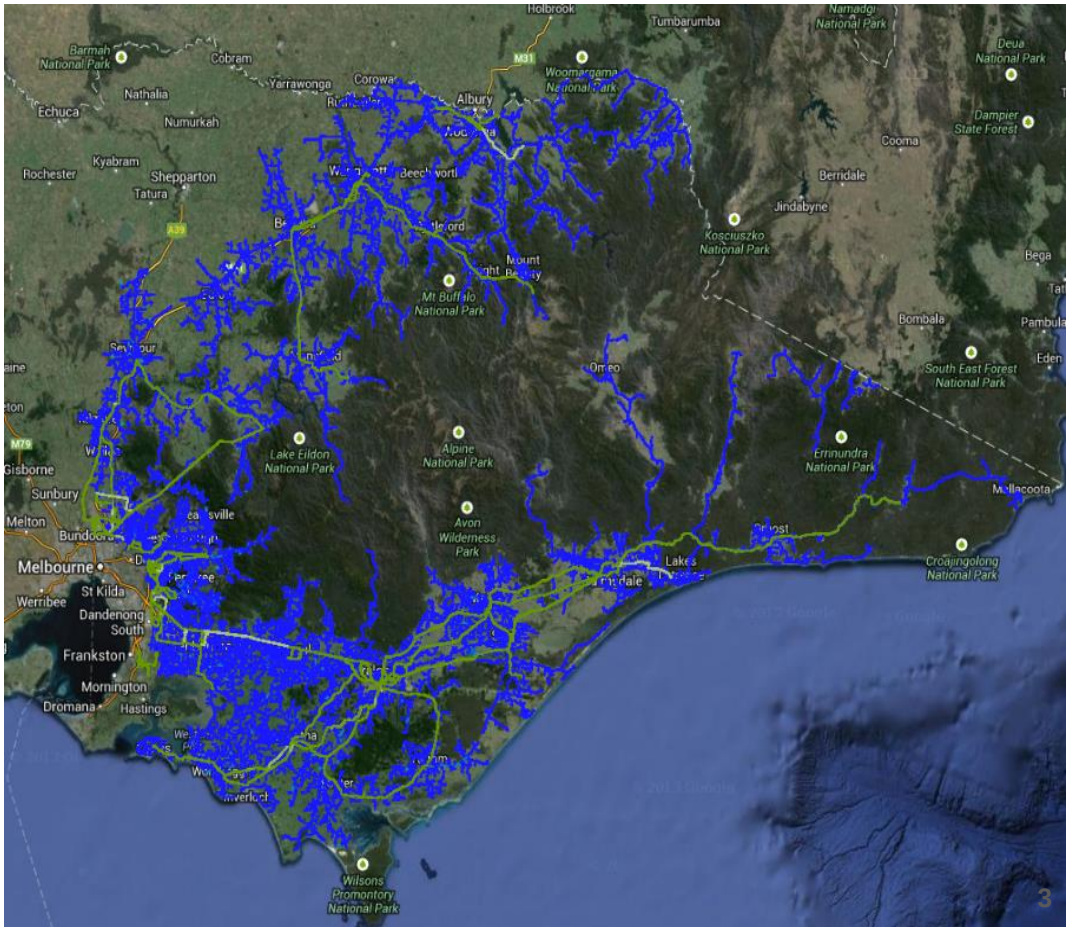
- 11,400 km of gas distribution network
- 690,000 customers

* All figures are approximate as at 31 March 2017

Our electricity distribution network

AusNet Services' electricity distribution network is highly diverse, from suburbs to mountains, farmland to forests

- **80,000 km^2 service area**
- **52,000 km lines & cables**
- **400,000 poles**
- **720,000 customers**
- **18% solar customers (residential)**



Smart Grid Technologies and Implementation

Global Regulatory Perspectives Programme
Electricity Regulatory Commissions of India

Justin Harding

13 March 2019

1. Integrating Distributed Energy Resources

Mooroolbark Mini Grid Innovation Project

Network trends and smart grid drivers

- **Electricity sector undergoing exciting and unprecedented change**

Shift towards Distributed Energy Resources (DER)

Shift to low carbon and renewable energy sources

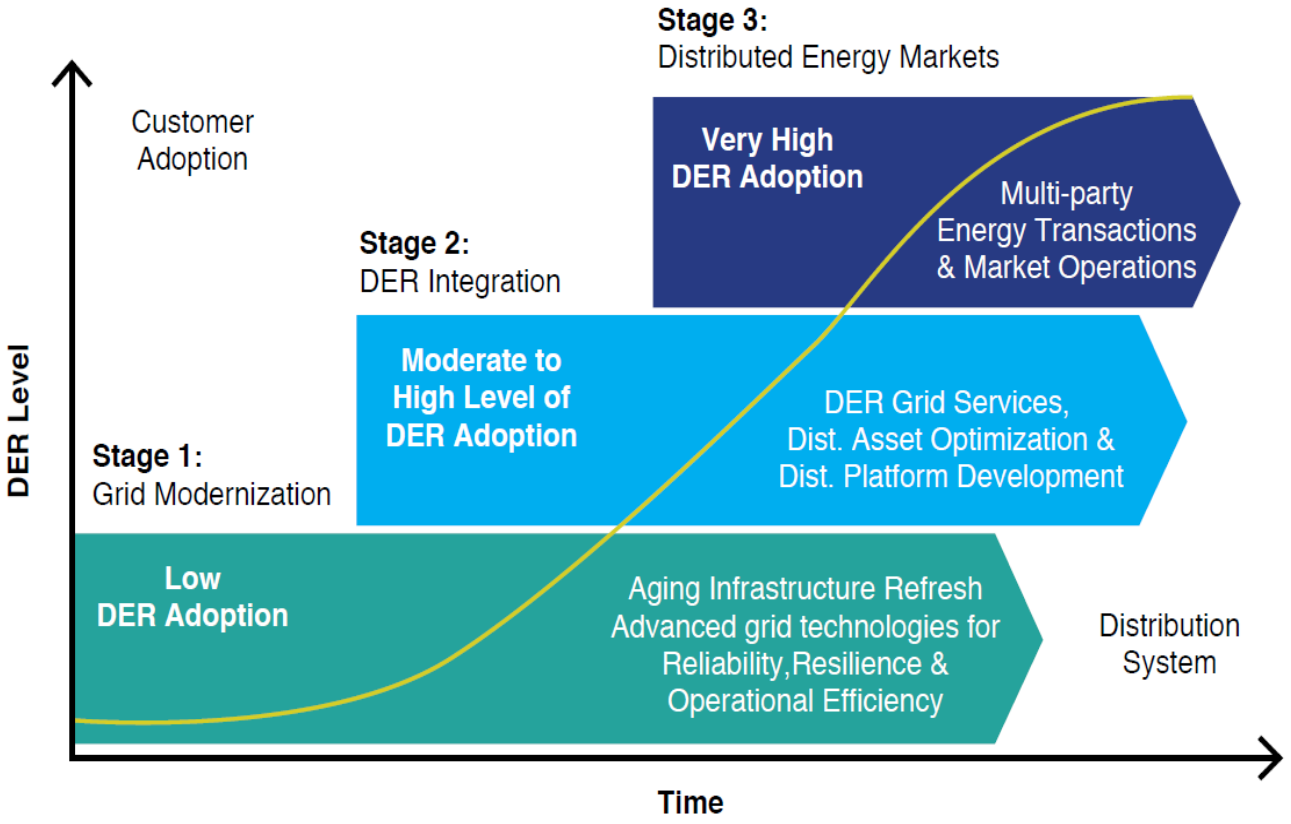
Customers moving from literacy to empowerment

Digital platforms & big data analytics

- **Our Network Innovation program seeks to test and leverage this future environment with smart grid technologies**

Electricity networks need to transform

- More customers using DER to control of their energy needs
- Networks expected to evolve through progressive stages of sophistication



Reference: *De Martini, NREL, as represented by ENA/CSIRO*

Case study: Mooroolbark Mini Grid Project

Decentralised microgrid

- **2016:** Australia's first 100% renewable microgrid in an established community

- **Objectives**
  - › Creating a snapshot of the future energy network
  - › Understanding the impacts and benefits of a high-DER network
  - › Prepare for a future "Distribution System Operator' model

- **Modes of operation:**
  1. Grid connected
  2. Home island (backup supply)
  3. Minigrid island

The Mooroolbark Mini Grid Project

Creating a snapshot of the future energy network

AusNet services

HOUSEHOLD DER (14 Participants)

- Battery system, 5kW/10kWh
- Solar PV system, 3kW+
- GreenSync PRU control unit

GreenSync

CENTRAL DER

- LV Switching cabinet & relay
- **Stabiliser unit**, 18kVA inverter, 10kWh battery storage

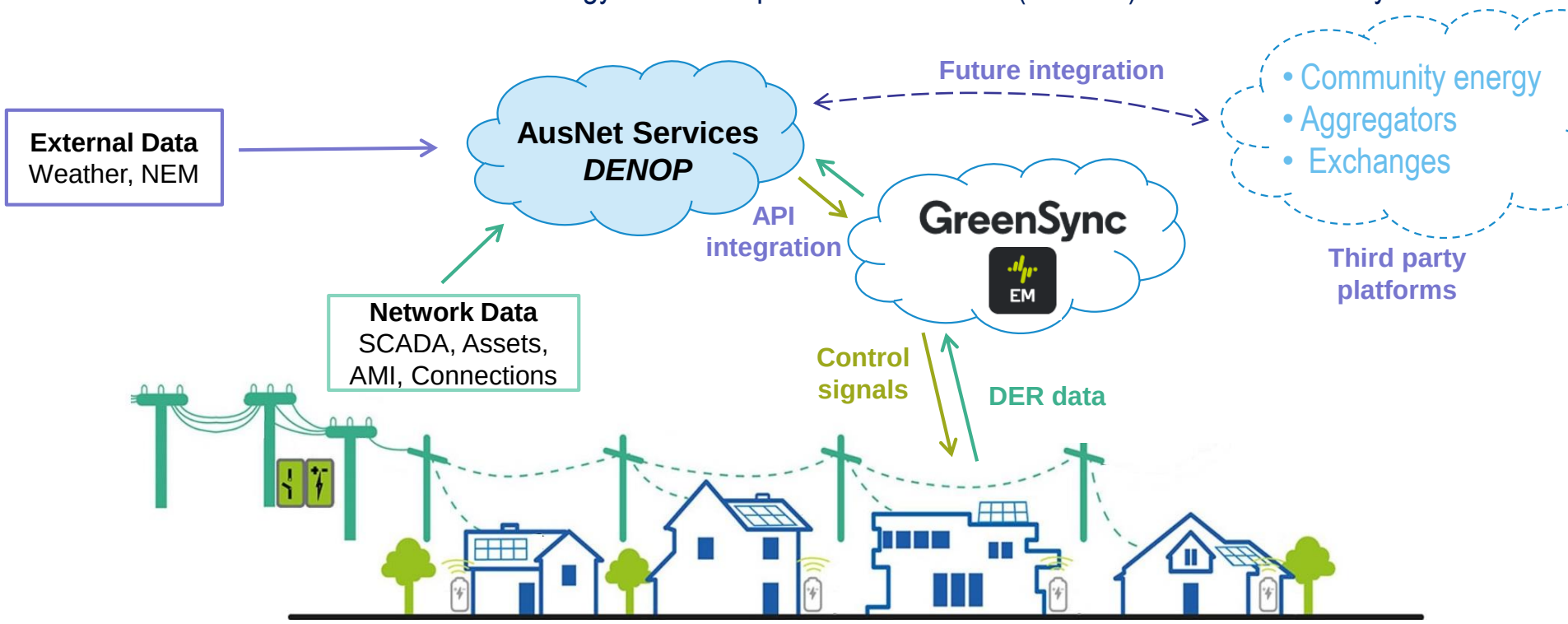
POWER TECHNOLOGY
ENGINEERED SOLUTIONS

Control system architecture

Designed for realistic testing of future DSO model at manageable scale

Three levels of control:

1. ***Local household system control:***
   Inverter native functions + local control unit (GreenSync PRU, PowerTec PaDECS) – Fast response
2. ***'Microgrid' control system:***
   Aggregated fleet control software (GreenSync EM) – 1 min control cycle
3. ***Network optimisation:***
   AusNet Services Distributed Energy Network Optimisation Platform (DENOP) – 1+ min control cycle



Use cases and value streams

The Mooroolbark Mini Grid is a test bed for DER uses cases that can return customer and network value, when orchestrated

A series of operational tests were conducted to understand the real-world challenges, implications and benefits of DER orchestration under a potential DSO construct

Peak demand management

Coordinate distributed energy to provide network peak demand reduction

Supply reliability and resilience

Provide islanded supply to customers during network outages

Solar uptake management

Facilitate higher penetration of distributed generation

Power quality improvement

Regulate supply voltage and power factor

Customer bill savings

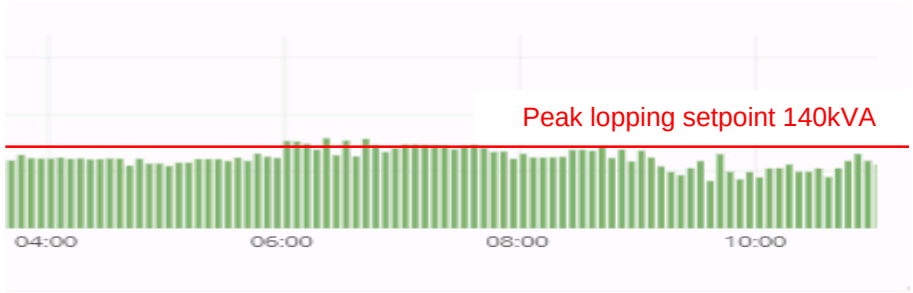
Reduce energy costs by reducing net consumption and tariff arbitrage

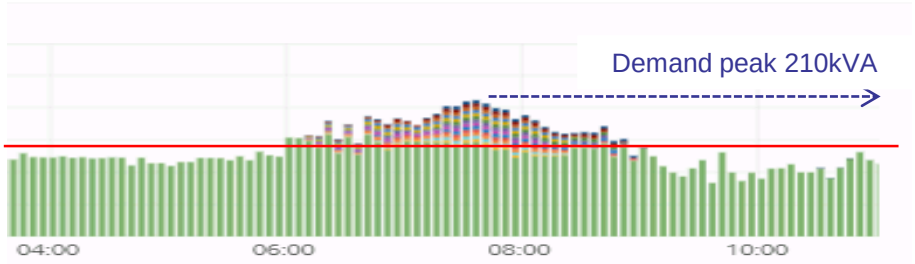
New options for customers to share & trade energy

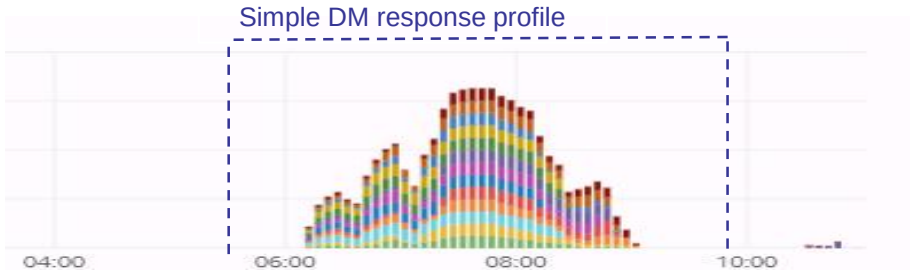
Enable community energy models and access for customers to market

Use case example: Demand Management

Peak Lopping: *Allows maximum demand on a network element to be capped to a defined value, with automated response from DER customers*







- **Scenario:** Peak lopping of upstream network element (22kV feeder ACR)
- DENOP reads in SCADA data and dispatches the required level of support every 10mins

- DER is successfully orchestrated to bring down peak from 210kVA to 140kVA

- Each colour represents the contribution of each customer
- Relative customer contributions optimised (in this case according to battery SoC)
- Vastly improved response compared to traditional “simple” demand management

2. Large Scale Energy Storage

Grid Energy Storage System, Thomastown

Case study: Grid Energy Storage System (GESS) Trial

Centralised microgrid

- **2013:** The first ‘large scale’ network support battery system in Australia

- **Objectives**
  - Understand and evaluate the network value of grid-scale battery storage
  - Gain experience and build organisational capacity
  - Prepare for lower storage system prices in future

- **Network value streams**
  - Peak demand management
  - Voltage & power factor support
  - Operation in islanded mini-grid mode, with smooth transition to and from grid

Courtesy ABB

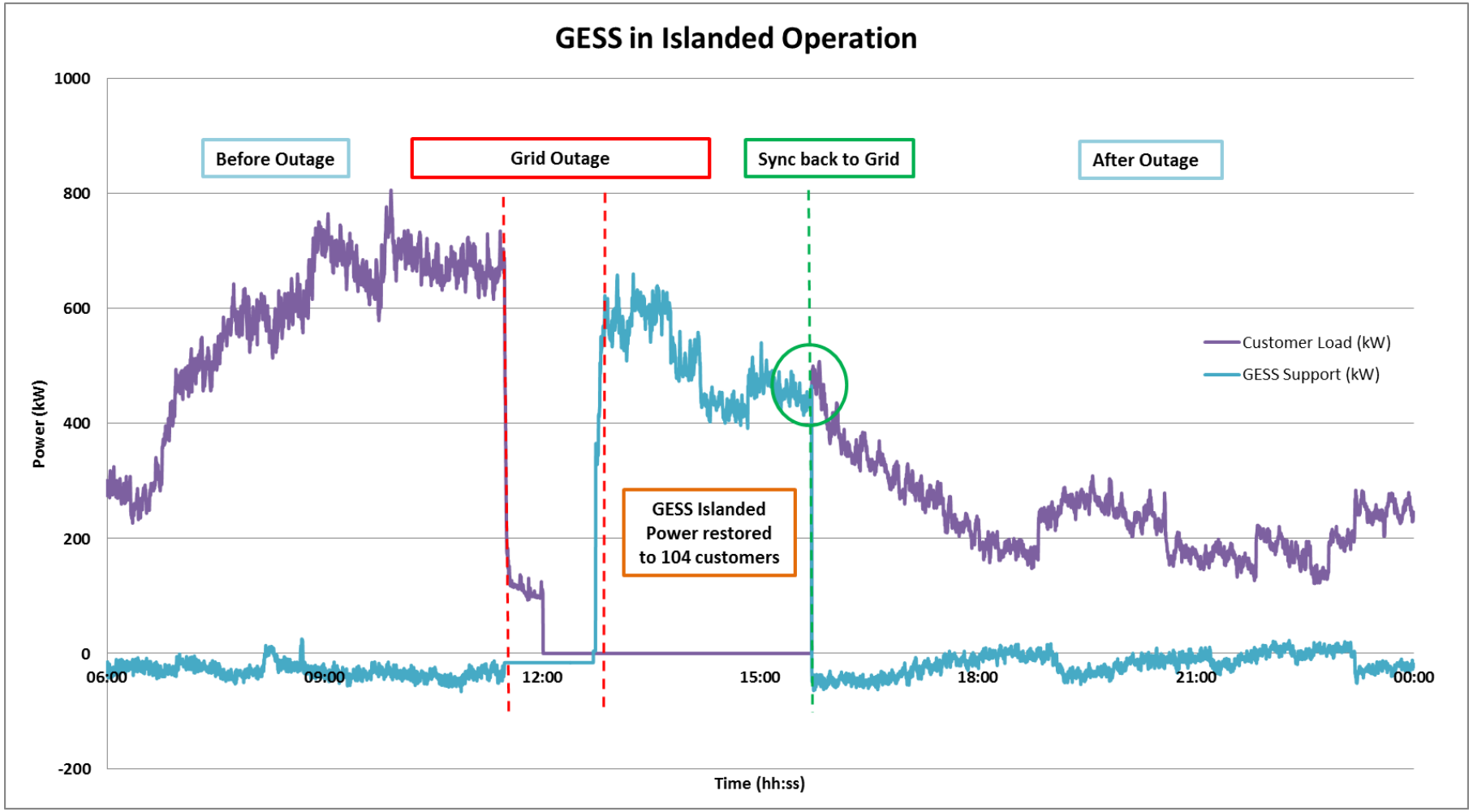
GESS facility and hardware

- 1MW / 1MWh lithium-ion battery + 1MW diesel get set
- EPC contract awarded to ABB after tender process
- Located in an industrial zone in Thomastown, Melbourne, 22kV feeder

Courtesy ABB

Islanded operation testing

Reducing customer outage time

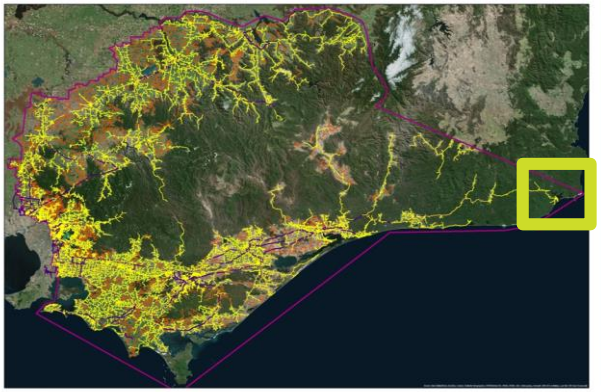


GESS established at remote township

Mallacoota islanded supply system

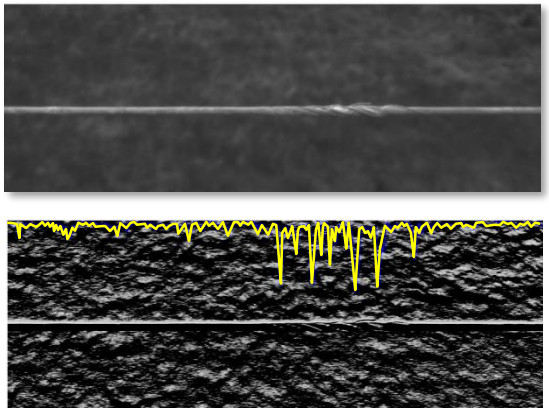
Mallacoota Project stats:

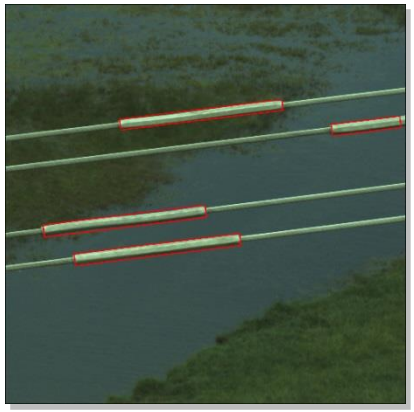
- Population: 1030, swelling >3000 during holiday periods
- Supplied via 250km radial network through national park
- 9 sustained outages p.a.
- Restoration time of 3.5hours
- Occasional multi-day outage
- Aiming for sub 1-min islanding

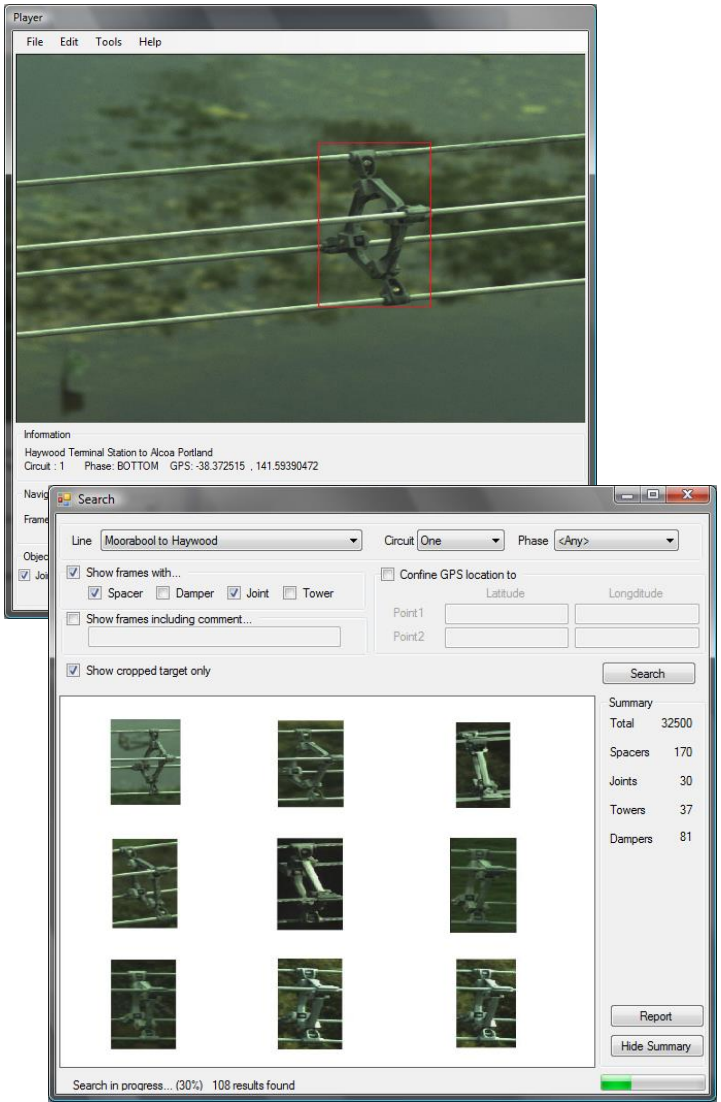


3. Data analytics

Transmission asset inspection using aerial survey techniques and digital image capture/processing





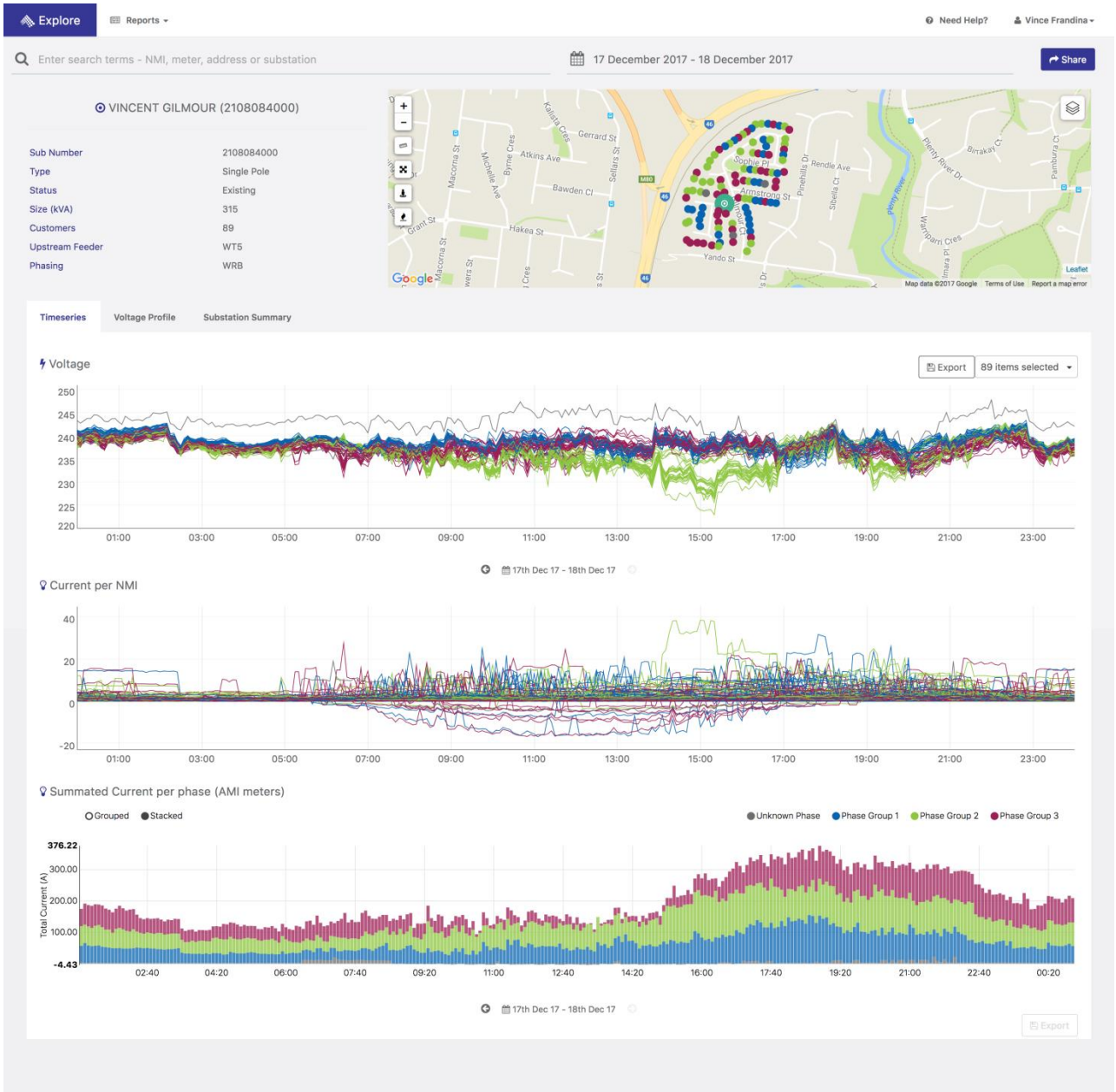


- GPS/GIS/Laser Enabled Digital Image Capture
- Advanced Digital Image Processing Techniques
- Automatic Detection of Defects, Abnormalities
- Rapid Inspection of Specific Asset Categories

  (spacers, dampers, joints etc.)

Smart meter data visualisation

Explore tool - *Substation View*



- Smart meter data:
  - 30min interval data (accumulated data for billing purposes)
  - 5min Power Quality data (instantaneous readings for network status)
- Communications are currently a hybrid of:
  - Wimax (base station)
  - Silverspring (mesh)
  - 3G in rare occasions
- Many different visualisation & analytics tools developed

Smart meter data visualisation

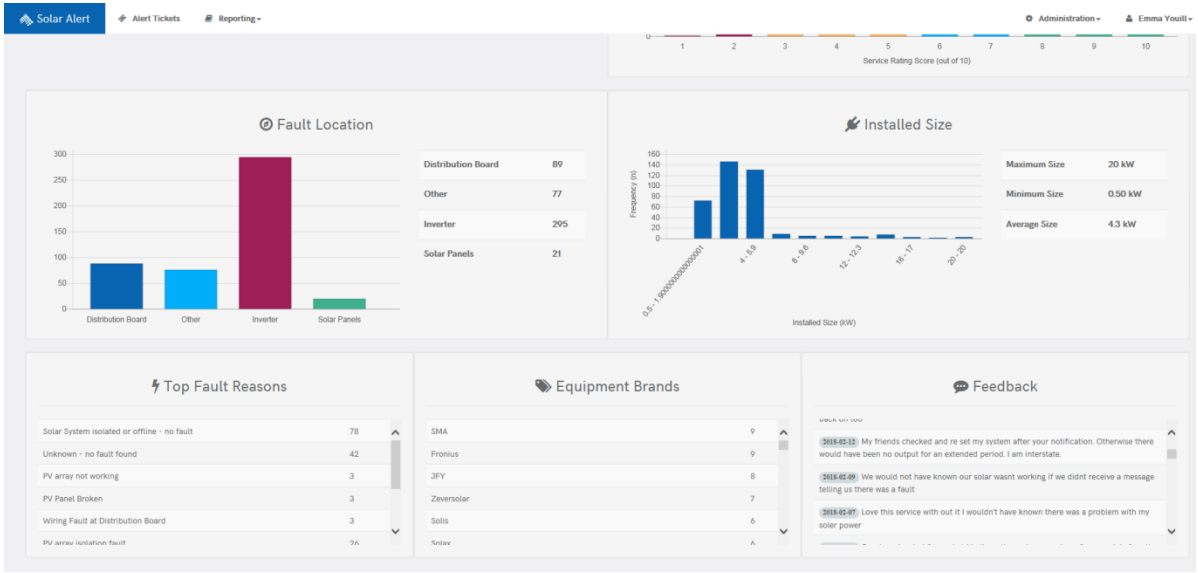
Explore tool - Network Voltage by Feeder Distance

Smart meter data analytics

Solar Alert – Automatic customer notifications

AusNet Services has developed analytics – using Smart Meter Data – that detects when a customer solar systems may have stopped working.

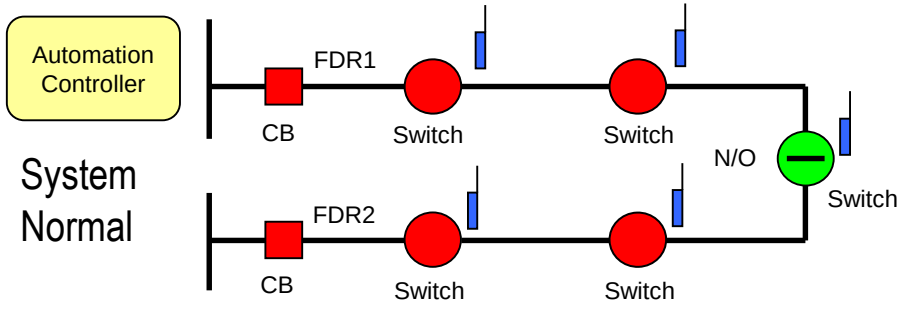
- Using voltage data collected from AMI Meters we detect when a solar system has not exported for over 7 days.
- Customers are notified by an SMS message of the issue, and the Solar Alert Analytics continue to monitor the customer's meter until an export is detected again.
- Since implementation >4,000 alerts have been provided to customers.
- Customer response to this service has been very positive with most customer rating 10/10.

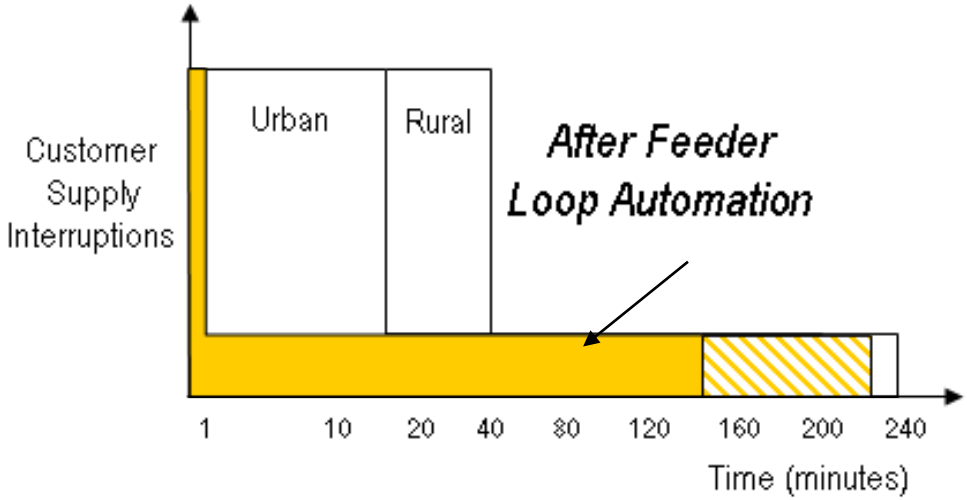


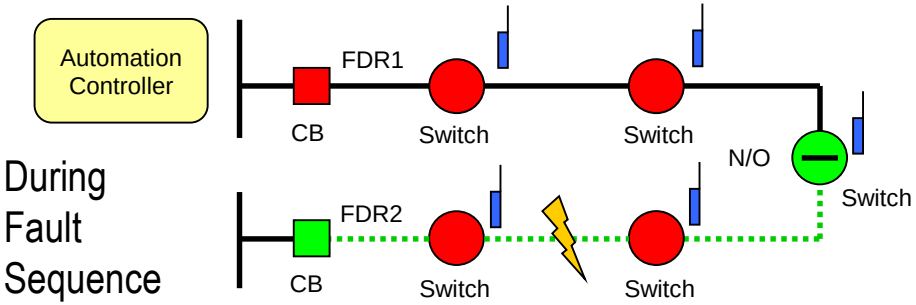
4. Network Automation

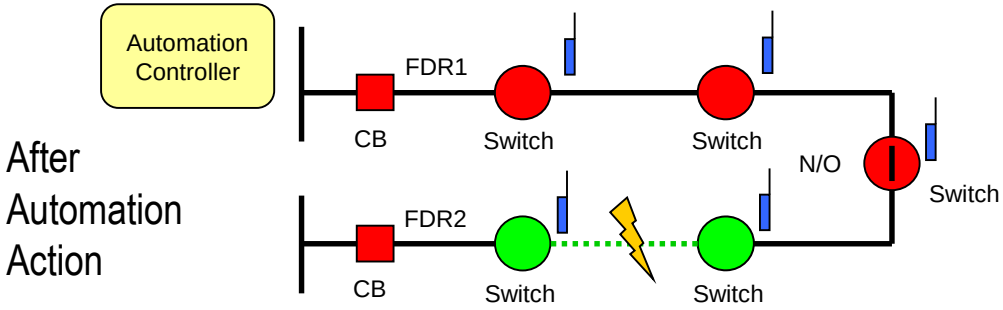
Distribution Feeder Automation

Distribution feeder automation based on data analytics









Thank you