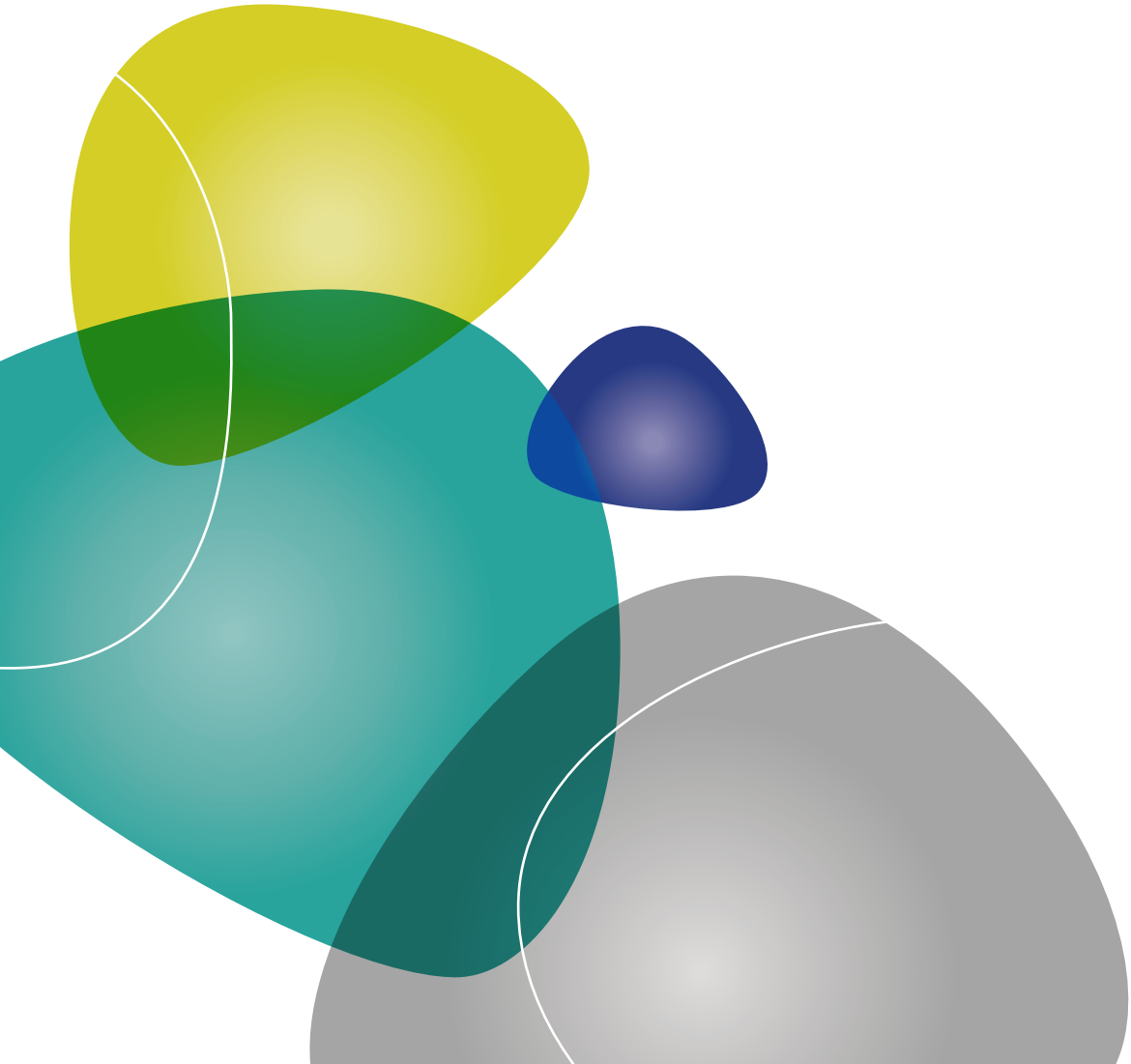
Energy Networks Australia

Network Innovation

2021 Report

This report details case studies that were submitted to Energy Networks Australia for the 2020 Industry Innovation Award.

Energy Networks Australia is the national industry body representing Australia's electricity transmission and distribution and gas distribution networks. Our members provide more than 16 million electricity and gas connections to almost every home and business across Australia.



INTRODUCTION

Andrew Dillon
CEO, Energy Networks Australia

The energy sector is currently undergoing the most momentous periods of change since the introduction of electricity into the home.

From the integration of renewables, storage solutions, hydrogen adoption and market and system design, networks are creating a smarter system, giving customers more control over their energy use and encouraging better management of energy demand. Finding innovative solutions to problems is a big part of creating a smarter grid for the future.

These awards are a way to recognise ground-breaking initiatives, technology, services or solutions from networks that have benefits to energy customers and help us to share learnings across the sector.

Energy Networks Australia received 11 entries of an extremely high standard to the 2020 Industry Innovation Award. Nominating companies included Endeavour Energy, Energy Queensland, Horizon Power, Jemena, SA Power Networks, TransGrid, United Energy and Western Power.

The independent judging panel, comprising members from the Australian Energy Market Commission, Australian Energy Market Operator, Australian Renewable Energy Agency, Clean Energy Council, St Vincent de Paul Society and Energy Networks Australia, was unanimous in its decision.

There were four shortlisted finalists:

- Energy Queensland - Smart solar export in real-time via Dynamic Operating Envelopes
- SA Power Networks - Advanced VPP Grid Integration Trial
- TransGrid - Unmanned aircraft (drone) power line stringing program and
- Western Power - Autonomous Grid modelling and solution.

Operating energy networks safely is a critical issue for everyone within the network sector. The judges short-listed one project that takes an innovative approach to deliver safer outcomes and there were also several other outstanding project entries that delivered innovative solutions to improve safety outcomes. It was particularly pleasing to see innovation projects that had been initiated by frontline staff and supported internally to deliver tangible safety outcomes. This indicates a strong safety culture within these organisations, which allows ideas to percolate up from the grassroots level and be adopted across the organisation.

The winner of the 2020 Industry Innovation Award was SA Power Networks - Advanced VPP Grid Integration Trial. This initiative looks forward to post 2025 and two way markets and involves other participants. It is in keeping with how the energy market is evolving. In particular, SAPN's collaboration and engagement efforts were well articulated. This project incorporates flexible connection agreements, a national API and collaboration reform and was a worthy winner given the tangible outcomes that it provides.

The first nominations to the innovation award at its inception in 2018, were focused on technology. This year the judging panel noted the nominations were more sophisticated - using technology for consumer benefit. This report highlights all 11 nominations which details some of the innovative work happening across energy networks throughout Australia.

I thank the judging panel for their time and consideration in evaluating the nominations and thank the entrants for their thoughtful and considered entries to the award.

CONTENTS

JUDGING PANEL

Jill Cainey

Dr Jill Cainey is Energy Networks Australia's General Manager Networks. She works with ENA members to transform Australia's electricity system to accommodate new and innovative approaches to delivering sustainable energy.

Jill represented the interests of electricity storage in the UK and Europe and was appointed MBE for services to Energy Technology in 2017 for work in electricity policy and regulation.

Jill also has more than 25 years of experience internationally in climate change and is very interested in the interaction of extreme weather and electricity systems and developing resilient network infrastructure for the future.

Gavin Dufty

Gavin is Senior Executive of Policy and Research Manager at the St Vincent de Paul Society.

Gavin has been as a consumer representative in the energy sector for over 25 years. During this time, he has undertaken research about electricity disconnections; documented changes in energy pricing and its impacts on households; and been involved in the development of state and federal energy consumer protection and concession frameworks.

Gavin is currently a representative on several industry and government committees including gas and electricity distribution companies' customer consultative committees; AGL's national customer council; the AER's customer consultative group and is a board member of Energy Consumers Australia.

Lillian Patterson

Lillian is the Clean Energy Council's Director Energy Transformation, where she leads the development and implementation of the CEC's electricity market and network policy and advocacy work. She joined the CEC from Origin Energy, where she managed regulation and policy development on electricity and gas market issues. She has also worked in the areas of power markets at the International Energy Agency and energy security in the Federal Government.

Lillian holds a Masters in Sustainability and Energy Management from Bocconi University in Italy and a Bachelor of Business (1st Class Honours in Economics) and Bachelor of International Studies from the University of Technology, Sydney.

David Feeney

Before becoming the Executive General Manager of Transmission and Distribution Networks at the Australian Energy Market Commission, David Feeney was appointed as Executive General Manager of Retail and Wholesale Markets where he was responsible for reviews and rule changes relating to the competitive parts of Australia's electricity and gas sectors.

He has more than 20 years' experience across government and telecommunications sectors with previous roles including commercial development with Telstra and managing industry engagement and commercial access arrangements for NBN Co.

He has a Bachelor of Commerce from the University of Newcastle and a Masters of Public Affairs from the University of Sydney.

Violette Mouchaileh

Violette's current role of Executive General Manager of Emerging Markets and Services, AEMO is responsible for strategies relating to the Distributed Energy Resources program and data initiatives. Since joining AEMO in 2009, Violette has held various roles across gas and electricity in market design development, market change implementation and operational roles.

Violette has more than 17 years' experience in the Australian energy industry holding various positions in Commonwealth Government departments and regulatory bodies. Her experience includes economic regulation, energy policy development, development of regulatory frameworks, market development and design, and market change implementation.

Craig Chambers

Craig has over 25 years of experience in the energy sector, his diverse background spans pioneering distributed and renewable energy innovation to founding a vertically integrated start-up, in addition to leading corporate strategy, innovation, stakeholder engagement, regulation and pricing for Australia's largest utility group.

As a thought leader, Craig has supported the electricity sector to adapt to new technologies, adjust to changes in customer behaviour, and deployed innovative business models to achieve sustainable transformation. He is an industry advisor and supports ARENA with its Distributed Energy portfolio and transactions.

ENDEAVOUR ENERGY - EARLY FAULT DETECTION TECHNOLOGY

Principal company
Endeavour Energy

Name of project
Early Fault Detection (EFD) Technology

Project partners

IND.T
INTELLIGENT NETWORK DIAGNOSTIC TECHNOLOGY

Project timeline
March 2020 – July 2020 (ongoing)

Location
Selected circuits serving the communities of Mount Victoria, Hawkesbury Heights, Epping and Ebenezer NSW

Funding
Internally funded – future networks technology trial investment

Themes
Safe, Reliable and Secure Network

The Energy Charter

Description
Endeavour Energy sought to demonstrate the potential for EFD technology to improve service, reliability and safety for customers living in rural, bushfire prone areas. This trial of 28 EFD monitors on four feeders covered 130km of poor performing 3-phase feeders, which had a history of poor reliability and included High Voltage and Low Voltage overhead assets. Building on initial positive trials on single wire earth return (SWER) networks elsewhere, this was Australia's largest 3-phase EFD system.

Rationale
The trial aimed to show the potential of EFD to identify early-stage faults on the network.

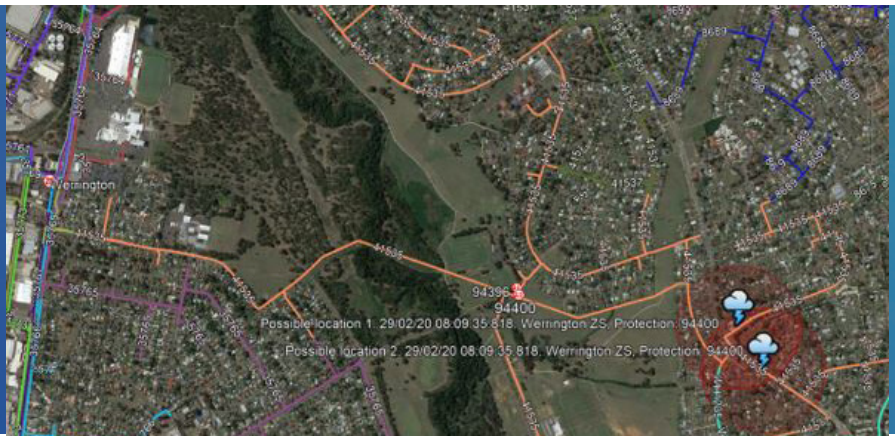
Approach
The project team looked for the lowest cost, technically or technologically acceptable way to install the EFD equipment and receive the data and information collected by the system. Network coverage was sufficient to ensure quick results and shared learnings.

Benefits, results, and outcomes
Initial results from the trial show the EFD system provides early warning of developing faults with high sensitivity, precisely locating them to ten-metre accuracy for repair to avoid outages and potential safety events. These initial results have shown that EFD can greatly enhance network health visibility on high and low voltage assets. Identifying, and where necessary, rectifying these defects, will provide outcomes of improved supply reliability and reduced bushfire risk for customers on our network.

Beyond the direct benefits of defect rectification, this technology provides deep insight into how and when faults occur on the network. It therefore has the potential to inform network investment decisions around vegetation management regimes, effectiveness of reliability improvement methods and defect-prone asset types. The early findings from the trial have enhanced understanding about the detection potential and the use cases for EFD technology. The trials will help inform the business case for future deployment of EFD technology and will contribute to asset management plans for overhead networks.

Innovation indicators
The trial is a first for Endeavour Energy and for the Australian energy industry. The EFD system looks at network assets, not through the usual 50Hz lens, but like an X-ray machine to find issues both visible and hidden assets. The trial has demonstrated the EFD system already offers short-term opportunities to cut the occurrence of costly and disruptive emergency system outages, provide real-time data on vegetation code compliance and reduce the risk of network related bushfires. The system also offers the longer-term opportunity to refine operational processes and investment decisions which can lead to improved supply reliability and affordability outcomes for Endeavour Energy customers. As the trial progresses, this knowledge will be shared more broadly through relevant Australian industry bodies including ENA and Energy Charter working groups and internationally with other EFD system users. The learnings from the trial could provide useful insights to all distributors and may encourage increased use of fault anticipation technologies on other networks. Ultimately this will lead to a safer, more reliable and secure network across Australia.

ENDEAVOUR ENERGY - FAULT LOCATOR



Principal company
Endeavour Energy

Name of project
Fault Locator Program

Project partners
Operational Technology partner and Mathworks

Project timeline
March 2020 – July 2020 (ongoing)

Location
Selected distribution networks throughout Sydney's Greater West, Blue Mountains, Southern Highlands, the Illawarra and South Coast.

Funding
Internally funded

Themes
Network Operation, Monitoring, Reliability and Power Quality (PQ)

Description
This program is designed to improve customer service via improved fault response times. It provides near real-time location estimates for faults on select distribution (11/22kV) networks. Data gathered from zone substation PQ monitors, as well as SCADA and network models, is used to provide estimated fault locations to system controllers within minutes of a fault having occurred. The program runs continually and gives an audio notification when estimated fault locations are available. It has seen improved fault response times and is presently being developed for production.

Rationale
This project sought to add value to existing systems and assets with the goal of improving reliability performance with little additional investment. Development of the program into production will improve the system's performance and accessibility to staff tasked with finding and repairing network faults.

Approach
The Fault Locator program was developed internally by staff dedicated to network modelling. They developed a standalone application (written in MATLAB and Simulink) that displays results for the operational team.

Benefits, results, and outcomes
Endeavour Energy's system controllers have been able to utilise Fault Locator to shorten response times and the duration of outages on the distribution network. The product is being produced with the aim to improve system reliability and accessibility by developing a web portal for use by field staff.

Fault Locator is an example of value adding, providing significant benefits by bringing together existing assets and systems. The program was not presented to the end users as a 'silver bullet' for finding faults but rather another tool to be used for shortening outage durations. Thorough consultation about the system's intentions and limitations resulted in widespread usage.

Innovation indicators
Fault Locator combines existing methods and technologies to provide an innovative tool for improving network reliability and reducing the societal and economic impact that electricity outages bring.

The approach could be applied across network businesses with a power quality monitoring program or other methods that provide fast feedback following network faults.

Many of the present systems used by Fault Locator are static in their nature, relying on "system normal" network topologies with little insight into dynamic load behaviour. The project gives additional insight into the benefits that future technology rollouts, like ADMS and dynamic network modelling, as well as additional research into load behaviour, could have on reliability. It is likely that development in these areas could be used to improve fault location capability. The concepts used on this project could also be extrapolated and further developed to provide automated fault anticipation.

ENERGY QUEENSLAND - POLARITY TESTING

Principal company
Energy Queensland (EQL)

Name of project
Polarity testing

Project partners

Project timeline
September 2019 to
February 2020

Location
Various locations across Queensland

Funding
Internal network business funding

Themes
Safe, reliable and secure

Videos
Participant feedback -
Polarity Review process
John Fry's up in lights video

Description
Thousands of polarity tests are carried out by energy networks every year - 60,000p.a. at EQL. Getting tests wrong potentially means equipment damage or serious injury to crews or the community. EQL completely revamped the testing process including the test steps, re-wrote the manual, introduced innovative safe ways of testing and training for all levels of field experience. This transferable and scalable new process has reduced polarity testing process incidents to zero since its 2019 implementation.

Rationale
A well-understood, well-documented clear and easy-to-use polarity testing regime is key to helping crews get a fundamental process right. EQL delivered an innovative redesign of the polarity testing process and introduced a new polarity testing app.

Approach
A learning group was established, comprising field staff who had previous polarity testing incident experience and safety leaders, subject matter experts and industrial partners. This encouraged open conversation identifying key issues and contributing factors. Initially, EQL considered the process needed to be shorter and simpler, but closer inspection revealed just a few steps needed to be added to control hazards. The development, testing, training and implementation of the polarity app, took about four months.

Benefits, results, and outcomes
Since the implementation of the new process, app and an associated comprehensive reporting dashboard, there have been no polarity incidents. In 2018/19, there were 14 - costing more than $100K each. To 30 June 2020, 42,500 tests were completed with no incidents. Key achievements include reassurance for network staff and visibility of the volume and type of polarities conducted to manage the risk. The new testing regime provides legislative / legal evidence, saving images of switchboards and structures in the app. Another key benefit is improved employee engagement by delivering on innovative ideas. An innovative workforce is rewarded with professional satisfaction and recognition.

Innovation indicators
Innovation leadership - The polarity testing app is easily transferrable and applicable right across the energy network system. It removes guesswork and exponentially improves personal safety in the testing process. EQL's training and development team have developed a virtual training platform, successfully using polarity testing as proof of concept.

Innovation impact has been taking the project leader offline for the review and development of the new process. This transition to technology was successfully achieved with little to no resistance.

Knowledge sharing - For the new process and innovative app to be widely used, it needed to be accepted. To create trust in the result, the review team engaged with a broad range of staff of all levels in the business, continuing through trials and deployment. Feedback received from field staff and our industrial partners was it was the best training they have received. It was designed for field crews with field input and delivered and supported by peers.

ENERGY QUEENSLAND - SMART SOLAR EXPORT IN REAL-TIME VIA DYNAMIC OPERATING ENVELOPES

2020 Finalist
Industry Innovation Award

Principal company
Energy Queensland

Name of project
Smart solar export in real-time via dynamic operating envelopes

Project partners

Project timeline
Cleveland installation and demonstration May 2019 – Dec 2019.

Subsequent work is ongoing

Location
Cleveland, QLD

Funding
Ergon Energy Network and Energex

Themes

- Customer Oriented Electricity
- Carbon Abatement
- Intelligent Networks & Markets

Key EQL DOE trial team members (L – R) Renewable Energy & Demand Management Consultant Greg Martin, Senior Future Technology Development Engineer Terese Milford and Manager Intelligent Grid Enablement Tim Lewsey.

Description
The Cleveland Solar Dynamic Operating Envelope (DOE) Trial successfully demonstrated the innovative application of available cost-effective technologies to implement a DOE that efficiently manages surplus energy exported to the network from a commercial scale 50kVA solar photovoltaic (PV) system.

Rationale
Many PV systems (30kVA – <100kVA) are required to connect to the grid with nil export, to mitigate voltage or capacity problems during infrequent critical periods with high solar export and minimum load. A current lack of network visibility and an inability to intelligently manage export means a worst-case scenario is considered. This innovative work proved the application of a cost-effective technology can successfully manage PV export within a DOE – based on real-time network conditions.

Approach
Off-the-shelf PV systems capable of DOE do not exist, so EQL sought a solar installer and engineering firm to work collaboratively to build the onsite DOE controller. A prototype platform was established to retrieve real-time data from network monitors polled each minute, allowing a DOE to be calculated based on current network conditions. This is continually published to a webpage monitored by an IoT Gateway installed onsite. This one-way broadcast approach was simple and swift to implement and minimised cyber security risks. It also processed site data to determine if PV generation levels should be decreased based on the existing site load and DOE, in which case the PV inverter was sent a reduced generation limit.

Benefits, results, and outcomes
The interconnected energy system spanning from large scale generators to prosumers (customers who both produce and consume energy) is growing more complex. Facilitating the connection of masses of commercial-scale PV systems to export to the grid requires a paradigm shift to the existing approach of static or fixed limits. This project demonstrated DOEs successfully applied to a 50kVA PV system in Cleveland by utilising cheap available technology in an innovative way.

Innovation indicators
This project is innovative as it:

- supports the wide-spread uptake of DER at far greater levels than currently exist.
- has the potential to stimulate innovation in the sector with installers and manufacturers inventing new ways to fulfil the functional requirements for dynamic solar export
- is focussed on supporting the increased integration of DER within distribution networks - making a more sustainable future and providing greater customer equity.

HORIZON POWER - ONSLOW DISTRIBUTED ENERGY RESOURCES PROJECT

Principal company
Horizon Power (HP)

Name of project
Onslow Distributed Energy Resources (DER) Project

Project partners

PXiSE Energy Solutions

switchDin

Project timeline
Nov 2018 to Nov 2020

Location
Onslow, Western Australia

Funding
WA Government to deliver power infrastructure upgrades in Onslow, underpinned by the Ashburton North (Wheatstone Project) State Development Agreement with Chevron Australia.

Themes
Transitioning to 'a future where up to 45 per cent of all electricity is generated by customers, opposite from its original system design.

The Energy Charter

Description
The Onslow DER Project provides customers with the opportunity to generate up to 50 per cent of all electricity through decentralised renewable energy sources. The large, regional microgrid is fully automated in managing the dynamic, real time distribution and two-way flow of electricity via an intelligent control platform to optimise network stability.

Rationale
Renewable energy generation is a cleaner and increasingly cheaper source of energy, but its continued proliferation faces technical barriers. In many WA regional towns, hosting capacity has been reached, which restricts customers' ability to benefit from rooftop solar.

Approach
The goal was customer take up of 2MW of rooftop solar and 1MWh of battery storage with visibility and control by the deployment of a DER management system (DERMS). The approach focussed on customer involvement and technical innovation.

Benefits, results, and outcomes
The Onslow DER Project achieved its objectives.

- Customers purchased 2.4MW of discounted solar while accepting the need for 'generation management' to protect the network from power quality and reliability issues from reverse power flows and intermittency of solar generation.
- Network and customer DER provide more than 50 per cent of Onslow's annual energy volume.
- Concessions were provided to those most in need, with solar installed on every home in the Onslow Bindi Aboriginal community.

Overall, the improved outcome for networks is visibility and control of high DER in tandem with traditional infrastructure while continuing to provide customers with choice and benefit.

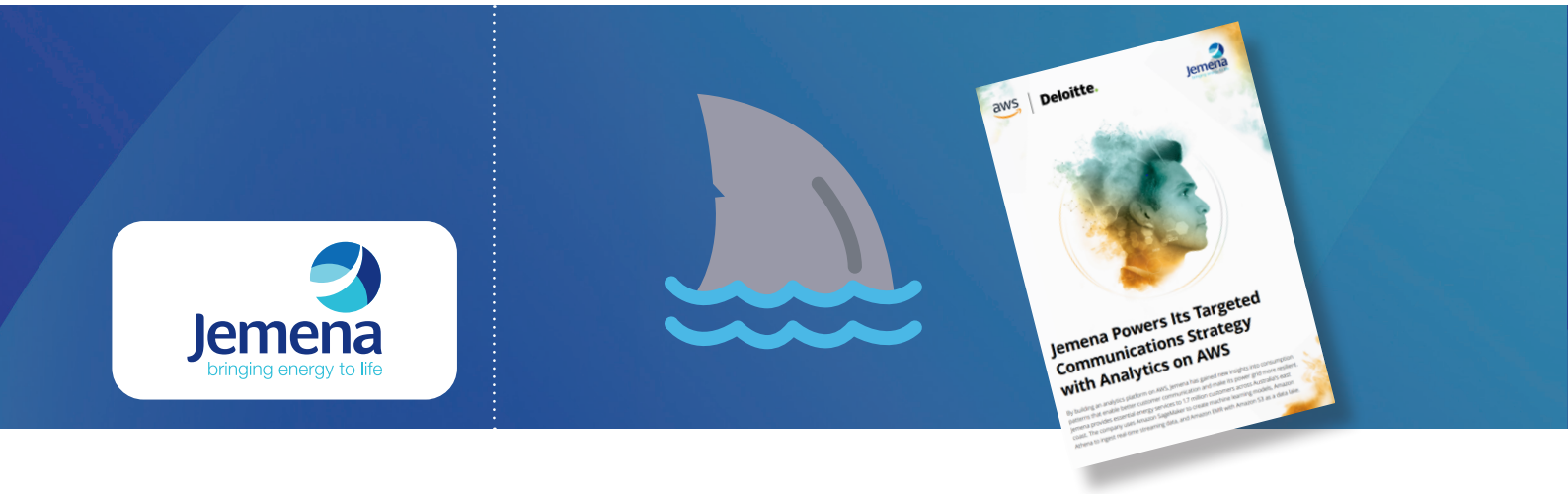
Innovation leadership – Increased capability to gain visibility and control of network and customer 'behind the meter' DER at scale.

Innovation impact – Our approach is to identify the enabling technology and business models required to partner with customers to share in the costs and benefits of DER as an integral part of current and future energy systems.

Knowledge sharing – Horizon has participated in knowledge sharing locally, nationally and internationally.

Efficiency and productivity – Horizon expects to reduce investment in conventional energy infrastructure over time. This will ultimately place downward pressure on energy prices for customers as we orchestrate electrons across right-sized, balanced and equitable energy systems.

JEMENA ELECTRICITY NETWORKS - JEMENA AMAZON WEB SERVICES 'JAWS'



Principal company
Jemena Electricity Networks

Name of project
Jemena Amazon Web Services 'JAWS'

Project partners

Deloitte.

aws

Project timeline
July 2019 – June 2020

Location
Inner north and west of Melbourne, Victoria

Funding
Co-contributed by Jemena, AWS & Deloitte

Themes
Customer Orientated Electricity

Video
Customer centric organisation

The Energy Charter

Description

In the digital era, the way we connect and interact with people is driven by data. Jemena's customer insights platform, named "JAWS", was the first step towards an energy network providing a data-driven customer experience. JAWS utilises a data lake, rich with billions of data points from multiple sources, including customers' consumption data via AMI meters. It overlays innovative machine learning (ML) algorithms to intelligently analyse and predict behaviour. Within days of launching, Jemena delivered outcomes including demand response identification, COVID-19 customer response and aggregated consumption tracking.

Rationale

During 2018 and 2019 Jemena undertook customer research and understood that customers wanted more personalised interactions. To provide this, they needed to develop a customer segmentation model, based on actual consumption behaviour, utilising customers' smart meters and ML to group customers. Given the volume of data to process, the existing tools required significant capital investment and a longer delivery timeframe.

Approach

Jemena developed a cloud analytics platform which combined a data lake to store historical and granular data related to electricity consumption, curated data sets (such as weather, electricity consumption and demographics), and re-usable ML applications that produce consumable insights and visualisations for business users.

Jemena engaged with their Community Reference Group (CRG) and industry to develop communications to support customers whose electricity consumption has changed significantly as a result of COVID-19 movement restrictions. JAWS is the engine used to identify these customers and ensure that they are made aware of the support available to them.

Benefits, results, and outcomes

Upon demonstrating business value, a decision was made to operationalise the platform across multiple environments. It was extended to Jemena's gas distribution market – to prove that network faults could be predicted to optimise response team staffing. Asset performance could also be analysed in detail to drive asset investment and replacement decision from granular performance data.

Innovation impact

JAWS has had a significant impact to Jemena's ability to innovate and use data to solve complex problems. The turnaround time to harvest insights has been reduced from weeks to minutes. This increases the agility and efficiency of the organisation.

Knowledge sharing

There is considerable application potential across the energy sector. Learnings have been shared at a webinar, a presentation at Griffith University and through **publishing a case study**. Jemena, led the industry by **publishing consumption data** on a weekly basis. The speed of this turnaround was enabled by JAWS. There was an article published by Energy Networks Australia on **mapping the impact of COVID-19 on electricity demand**.

Jemena Gas Networks - Digitising Gas Reads '#ReadMyMeter'

Jemena
bringing energy to life

Gas Meter Mate

Principal company
Jemena Gas Networks (JGN)

Name of project
Digitising Gas Reads '#ReadMyMeter'

Project timeline
February – October 2020

Location
High rise and medium density buildings within the JGN footprint in NSW that have site conditions and/or meter access issues that inhibit meter readers obtaining manual reads.

Funding
JGN

Themes
Digital Customer Experience
Mobile App
Design Thinking and Customer Co-Creation
Enhancing CSAT

The Energy Charter

Description
Customers who receive estimated energy bills indicated that being able to submit self-readings via digital channels would help reduce bill shock and enhance their customer experience. JGNs product development team co-created a digital solution - the first distributor app of its kind.

Rationale
JGN has 1.45 million customers across NSW - most have manually read meters with about four per cent (60,000) of customers receiving two or more consecutive estimated bills per year, as their meters are considered 'difficult to access'. This is a major pain point, as customers feel they are not being fairly or accurately billed for their gas consumption. Estimated reads often lead to bill shock and poor customer experience with Jemena and the retailer.

Approach
The team began by validating the hypothesis that "To make sure bills are a fair reflection of actual consumption, customers with difficult to access meters will submit their meter reads to Jemena via digital channels". Customers were engaged throughout the project from conception to customer testing. JGN engaged and consulted four energy retailers and the Ethnic Communities Council of NSW.

Benefits, results, and outcomes
In response to COVID-19, to ensure the health and safety of our customers and meter readers, JGN temporarily stopped reading internal meters. To avoid affected customers receiving estimated bills, an interim self-read solution was introduced in May 2020. In addition, following consultation with AER, AEMO & retailers, 'customer reads' (with a photo) were treated as 'actual reads', until the end of 2020.

Learnings included:
- Between May-Jul 2020, 19 per cent of the 41K customers targeted used the new self-read initiative to submit a meter reading.
- Since the launch, the website **https://readmygasmeter.jemena.com.au** has attracted 6.5K users, 74 per cent of whom used the form to submit a self-read.
- Forms were available in multiple languages. Other than English, Mandarin forms were used by two per cent of customers, followed by Korean and Arabic.
- 60 per cent of customers who submitted a read had received three or more consumption estimates in 2019.
- 80 per cent of reads submitted by customers passed the validation criteria to be classified as an actual read and flowed through to retail bills.

Innovation indicators
Building on strong customer relationships and a collaborative approach, this was JGN's first opportunity to create a product with customers. It has set a valuable cultural precedent and anchor for future projects.

JGN regularly engaged and showcased solutions with energy retailers and distributors (gas and electricity), who are supportive of the digital self-read solution roadmap.

SA POWER NETWORKS - ADVANCED VPP GRID INTEGRATION TRIAL

Principal company
SA Power Networks

Name of project
Advanced Virtual Power Plant (VPP) Grid Integration Trial

Project partners

Project timeline
January 2019 to September 2020, with primary activity (field trial) from July 2019 to July 2020

Location
South Australia

Funding
This project received funding from ARENA as part of ARENA's Advancing Renewables Program

Themes
Foundation: Essential information for an integrated grid.

Implementation: Networks optimised with distributed energy resources.

Description
The project demonstrated the provision of dynamic, locational export limits (operating envelopes) via an open interface (API), to a VPP operator actively trading in the national electricity market (NEM). Since October 2019 this innovation has enabled Tesla's 1,000-customer (5MW) SA VPP to dispatch at higher power levels and generate greater value while trading in wholesale and FCAS markets.

Rationale
VPPs will play a key role in the future energy system, supplying critical wholesale energy. However, the aggregated operation of thousands of customer resources to import or export energy simultaneously can easily exceed distribution network technical limits at certain times. VPPs need dynamic, locational information about available network capacity to operate to their fullest potential.

Approach
This project co-designed and developed technology to enable the SA VPP to operate within dynamic 'operating envelopes', continually updated by SAPN. Instead of the normal 5kW per-customer dispatch limit, this increased to 10kW per customer, when the network has capacity. CSIRO was engaged to quantify how much increased participation in FCAS and energy markets, the system could create for the VPP. The project used national industry technical reference groups to ensure the approach was aligned with broader industry needs and to develop an API specification with the potential for adoption as a future Australian standard. The project includes a significant knowledge sharing component and will be published in 2021.

Benefits, results, and outcomes
The project demonstrated the active adaptation of dispatch limits by a VPP operator to maximise access to the energy market without breaching distribution network constraints. During the trial this innovation has enabled the SA-VPP to dispatch at higher power levels with confidence and generate greater value while trading actively in the NEM.

Innovation leadership – This project lays the foundations to transition to flexible export limits for all DER customers. This work is recognised as industry-leading by stakeholders including technology companies: Tesla and Redback, industry bodies: Total Environment Centre and the Clean Energy Council and agencies such as AER, AEMC, AEMO and ARENA. It has put the concept of 'operating envelopes' at the centre of the national debate around the capabilities needed in a high-DER grid.

Innovation impact – The technology design, build and integration phases were complete in six months and have transformed the way SAPN delivers innovation projects.

Knowledge sharing – The approach sets a blueprint for the successful integration of VPPs with Australia's distribution networks as the NEM continues to decentralise and VPPs become larger and more prevalent.

TRANSGRID - UNMANNED AIRCRAFT (DRONE) POWER LINE STRINGING PROGRAM

2020 Finalist
Industry Innovation Award

Principal company
TransGrid

Name of project
Unmanned aircraft (drone) power line stringing program.

Project partners

Project timeline
April 2019 - July 2020

Location
NSW electricity grid

Funding
Project funded by TransGrid.

Themes
Safety for our people and the community
Customer oriented electricity
Power system security
Intelligent networks and innovating

Video
Award video

Description
TransGrid partnered with Infravision to develop an unmanned aircraft (drone) power line stringing program. A connected hardware system using drones and networked smart winches to provide a safer, more cost effective and more customer-focused method for power line stringing in the transmission industry was created.

Rationale
A fatality in March 2019 where a helicopter was used for stringing conductors and pilot wires led an investigation into alternate safer methods. The risk profile of helicopters for this type of work was too high. TransGrid banned the use of close proximity construction and maintenance of transmission infrastructure in NSW and chose to investigate and fund the development of alternative methods. The view being to ultimately pass solutions back to industry service providers and foster competitive alternatives. TransGrid's drone program makes working on the NSW transmission network safer.

Approach
After initial proof of concept, TransGrid invited principal contractors and stakeholders to attend an onsite demonstration of the Infravision prototype system, with the aim of identifying further opportunities to trial the system, at a few locations on existing projects and obtain industry feedback and support.

Benefits, results, and outcomes
TransGrid and Infravision have developed regulatory compliant techniques to conduct aerial power line stringing and maintenance using custom heavy lift drones and specialist ground hardware. The system is easily deployed and designed for all types of terrain. Outcomes are improved safety, reduced outages, environmental impact and costs (up to 40 per cent). TransGrid has a two-year lease of two drone systems to continue further development of these technologies. Drone operators can be trained by an existing Australian Registered Training Organisation in a fraction of the time and cost, using a specialised drone hardware/software combination that supports automated flight profiles. Opportunities exist to upskill the transmission workforce with drone hardware and software training to improve efficiencies in transmission construction and maintenance activities.

Innovation indicators

TransGrid led the innovation of a new, unmanned method for stringing transmission lines with the vision for safer, lower cost, environmentally friendly construction methods. This innovation leadership created a significant advance by producing an alternative approach to traditional line stringing methods for adoption throughout the industry. This project has reduced risk, increased productivity, reduced environmental impacts and contact with cultural heritage sites.

UNITED ENERGY - BAYSIDE BATTERY PROJECT

Principal company
United Energy (UE)

Name of project
Bayside Battery Project

Project timeline
June 2019 to December 2021

Location
Unit #1 – Telford Street, Highett, Victoria
Unit #2 – Gordon Street, Black Rock, Victoria

Funding
UE's Demand Management Incentive Allowance (DMIA) and UE Capital expenditure budget

Themes
This project seeks to unlock the value of distributed energy resources (DER) to provide system support in the 'right place at the right time'.

Description
UE has installed two pole-mounted 30kW/75kWh batteries connected to the low voltage (LV) network to manage existing constraints on the distribution substation and LV circuits. This is the first pole-mounted grid-connected battery installation in Australia. The project aims to develop a flexible network capable of meeting the future needs of customers. It demonstrates that grid batteries installed on the LV network can address immediate capacity shortfalls to defer and avoid network augmentations.

Rationale
Introducing batteries to store excess electricity and discharge during peak periods has been tested at household level, however application at network level has been limited. The pilot substations had increased demand over recent years, reaching their operational capacity. The objective was to design a solution to harness high local solar penetration, that could install where distribution transformer are located. This solution has increasing future potential to scale and be used in a variety of network applications.

Approach
The approach comprised three prongs:

- work with battery suppliers to determine the most appropriate size of battery and specifications to suit LV network peak demand applications,
- engage with community stakeholders to capture views, identify concerns and create positive relationships, and
- liaise with retailers to gauge interest in leasing battery capacity outside of network peak times for retail market participation.

Benefits, results, and outcomes
This project successfully developed an innovative, robust and safe pole-mounted battery installed on a LV distribution pole. This solution improves customer outcomes for increased DER hosting capacity on the distribution network. The battery storage of excess solar, averts network issues caused by reverse power flows. A locally manufactured solution suits our overhead network conditions and meets our needs. The pilot has generated interest from networks and retailers, indicating high potential for scale to fill a gap in the market.

Innovation leadership – This project demonstrates how distributor-owned batteries on the LV network can increase the supply and maximise the value of renewable energy in the form of visible, dispatchable storage capacity in the NEM.

Innovation impact – in a future dominated by DERs and customer interaction, this solution is a first step in increasing hosting capacity but also giving networks greater visibility and control of the LV network.

Knowledge sharing – UE is keen to share its knowledge about this solution with the hope it can be widely applied across distribution networks, across Australia and potentially the world.

Efficiency and productivity – LV pole mounted batteries have the potential to become an affordable, reliable and sustainable solution in managing constraints on the network.

WESTERN POWER - AUTONOMOUS GRID MODELLING AND SOLUTION

2020 Finalist
Industry Innovation Award

Principal company
Western Power (WP)

Name of project
Innovative modelling tools and renewable energy solutions transforming Western Power's network to an autonomous grid

Project timeline
March 2016 trial to implementation 1 July 2020

Location
Western Australia

Funding
Western Power

Themes
Customer oriented; electricity; carbon abatement; incentives and network regulation; power system security; intelligent networks and markets.

Customer case studies
Why WA is the perfect place for SAPS
Keeping cool in the summertime

Description
Western Power (WP) developed 'the Grid Transformation Engine (GTEng)', that considers a range of energy scenarios to change the network. In 2020 WP delivered 52 standalone power systems (SAPS) with 100 units planned for 2021. This improves power reliability, network efficiency and delivers a lower carbon energy future.

Rationale
WP's South West Interconnected System is one of the world's largest islanded grids, spanning 255,000 kms servicing 2.3 million customers. Providing reliable power to regional areas is challenging, as many factors impact network infrastructure and power reliability. Currently 50 per cent of WP's overhead distribution network services less than three per cent of its customers. Modelling shows by installing microgrids and SAPS over 30 years, WP can avoid millions of dollars in traditional network building, deliver customer benefits and facilitate sustainable energy.

Approach
To test SAPS technology on the network, WP developed a business case based on comprehensive research, modelling and consultation with stakeholders. GTEng was used to understand the scale, timing and economics for SAPS. A 2016-19 trial investigated the success of six SAPS and provided valuable learnings to the research team. Large-scale SAPS use in WA required regulatory changes. WP worked with regulators and the government to achieve legislative change in April 2020, enabling WP to own, operate and provide SAPS.

Benefits, results, and outcomes
Over the trial, over 200 hours of outages were avoided. Customers rated their satisfaction and use of renewable energy at 9.9 / 10. In 2020 WP commissioned 52 SAPS realising an estimated $4m net benefit, compared with traditional network costs over 50 years. WP de-energised 230km of overhead assets and is engaging with the community to de-energise 100 units in 2021, with 100 per cent opt-in rates. To deploy 6,000 units over coming decades will enable 23,000km of overhead assets to be decommissioned. This delivers significant cost savings, upskilling employees, reduced bushfire risk, improved regional conservation and cultural tourism in WA.

Innovation Leadership – The GTEng tool provides repeatable models to deliver innovative customer solutions including driving legislative change, advancing design and delivery of technology.

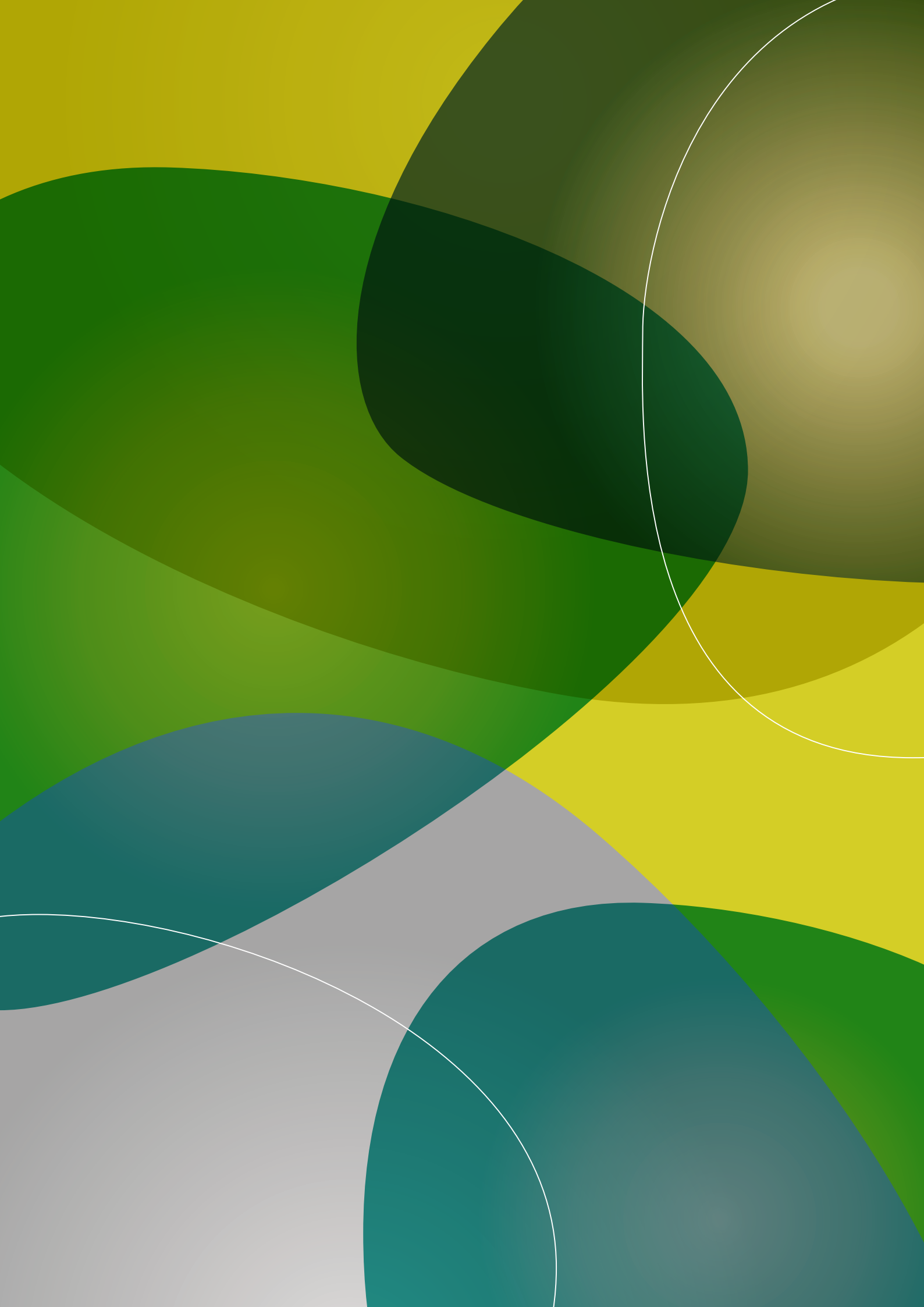
Innovation impact – The SAPS program has been a catalyst for a wider business transformation program, in a range of areas including workforce and depot infrastructure.

Knowledge sharing – WP have consulted with organisations such as CSIRO, ENA, ARENA, ERA and AEMO. WP is represented on the Australian Standards committees dealing with inverter energy systems and industry groups seeking to develop strategies to accelerate the uptake of electric vehicles.

Efficiency and productivity – Current indications are that the SAPS program will deliver efficiency and performance benefits measured in $100s of millions and possibly billions.


Safety is
DEFENCE


Stand-alone
Power System



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