

# ARENA's Virtual Power Plant Knowledge Sharing Workshop Summary

MARCH 2019



Australian Government  
Australian Renewable  
Energy Agency

**ARENA**

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## WHY COME TOGETHER?

Sharing knowledge effectively helps to accelerate the development and uptake of renewable energy. Guided by this, ARENA brought together over 60 stakeholders from state and territory governments, market bodies and industry organisations to share knowledge on Energy Storage Systems (ESS) and Virtual Power Plants (VPP).

The workshop was held in Canberra across two days on 11 and 12 February 2019. Day one provided insights into state and territory initiatives, energy market reform initiatives, and VPP functional requirements. Day two explored the customer experience of VPPs, as well as data collection and platforms for national industry development.

This summary presents the key takeaways and discussion points from the two-day workshop. While ARENA works to ensure that knowledge is shared effectively from its projects, due to the sensitive nature of some information presented, *Chatham House Rules* was applied to this workshop. We have endeavoured to seek approval, and indicate a reference point, to as much knowledge as possible. At the back of this summary note, you will find a number of presentations from the day.

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## WHAT WERE THE KEY TAKEAWAYS?

- All states and territories are planning or considering subsidy programs for small-scale energy storage systems (ESS).
  - ARENA sees this as an opportunity to strengthen the 'DER Hypothesis' - that distributed energy resources (DER) can provide effective services with a net benefit to market and customers. We note that to do this, it requires comparable data which needs to be embedded into the design of projects.
  - VPPs, as an industry, is still immature and continues to be characterised by inconsistent language, fragmented policies, divergent business models.
- Effective interoperability is key to ensuring that the full benefit of orchestrated DER is realised. Discussion questions on this included:
  - How can we future-proof current and planned investments?
  - How can we ensure commonality across communications and APIs?
  - How can we ensure metering accuracy?
- Greater focus on the customer journey is needed. As the financial return on investment does not always stack up due to the current costs of ESS, the industry should look to understand the varied drivers behind the decision to purchase and/or enter into a VPP.
  - Once we understand the drivers, how do we maximise the experience?
- More attention is needed on the skilled workforce necessary to implement the proposed schemes.
  - Attendees at the workshop outlined that it can take 12+ months to train a qualified electrician to be competent in ESS installs. Beyond certifying, retention in the industry can also be an issue.

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## STATE AND TERRITORY INITIATIVES - KEY TAKEAWAYS

- All states and territories present spoke to the need to design initiatives that encourage the transitioning to a market-based system that can thrive without subsidies.
  - Questions were raised on managing customer churn vs lock-in, and the pros and cons of each.
- Not all households are currently suitable for inclusion in VPPs (e.g. no installed solar PV systems, incompatible technology/software), so how can the VPP value be shared with these households?
- Mandating technology-neutral (increase competition) smart requirements in newly installed rooftop solar PV and battery storage systems could ensure that they are eligible for future VPP programs.

- There have and continue to be product supply issues with ESS that have an impact on the speed in which initiatives can be implemented - monitoring this supply will be key for broader uptake and VPP development.
  - In addition to product supply, skills supply is also an area that will need close monitoring to ensure both program success and greater industry development.
- A great amount of data is currently being, or is planned to be, collected - how can collaboration occur to help the broader industry develop?
- For the industry to grow, regulations need to evolve with emerging VPP programs across both customer interaction, data collection and network / market regulation.
- Safety and risk management is an integral part of policy design, with references being made to mandatory inspections and product requirements.
  - Implementing an inspection scheme not only benefits customers with regular, authorised safety checks but also generates job opportunities.
- All states and territories present communicated public perception challenges of VPP programs, with trust typically being quite low and many prospective customers thinking the offers are “too good to be true”.
  - Ensuring that media messages target specific customer segments with simple messages to foster trust and encourage involvement, while not overselling benefit.
- How does consumption differ between the customer segments, and how will/does this affect customer benefits and the targeting of government subsidies?
- How can rebates and price structures be best designed to incentivise households to contribute to grid reliability and security (rather than just PV self-consumption?)

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## ENERGY MARKET REFORM INITIATIVES - KEY TAKEAWAYS

- A priority of the AEMO VPP trial is to observe how VPPs interact with the market, in terms of basic control and orchestration.
  - It is important for the industry to be mindful of API setup and how to best establish ‘practical commonality’ across industry.
- Demand Response is a key issue being considered currently (DR can form part of VPP operations), current WDR rule changes are complex and requires extensive technical knowledge to complete.
- Tariff reform and demand management incentive schemes are key considerations for the Australian Energy Regulator.
  - There is a need to align network incentives with customer benefits.

### Panel discussion points

- Complex tariffs need to be reassessed and simplified.
- ‘Value stacks’ need to be assessed, demonstrated and communicated clearly to all.
- Small changes to regulatory frameworks can make a big difference (e.g. DR providers in FCAS - noticeable difference in price and competitive outcomes).
- Aggregators do, are and will continue to, play a key role in the NEM.
- Smart metering will enable faster connections, tariff reform, greater visibility of network constraints and DER state estimation/forecasting.
- The industry needs to focus on what customers want - they are key to ensuring the successful uptake and orchestration of ESS.

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## VPP FUNCTIONAL REQUIREMENTS - KEY TAKEAWAYS (PRESENTATIONS ARE ATTACHED AT THE BACK OF THIS SUMMARY)

- If it's going to be smart, it needs to have material value, functionality and communication mechanisms (can we talk to it, can it listen?). Connectivity needs trust, translation and commonality in software languages.
- The 'light switch experience' for consumers is one of the industry's greatest achievements. How do we recreate it for DER and VPP applications?
- Fast metering (<1 second) is needed and should be standardised.
- Storage options shouldn't be limited to behind the meter, what about community scale?
- Networks are changing from just delivering energy - but behind the meter ESS can be a problem as much as a solution.
  - For example, time of battery discharge could exceed network limits.

### Panel discussion points

- Interoperability is a key consideration for all: from batteries and inverters, to controls and communication, to aggregation, networks, DSO, participation and markets - it all must operate in conjunction with each other.
- Technical constraints of distribution networks are an emerging issue for VPPs.
- How firm does DER through VPP need to be to participate in existing and emerging electricity markets?
- Harmonisation between jurisdictional schemes and market requirements will help to reduce costs and improve competition as the industry develops.
- Customers should be at the centre of VPP business models. This can be reflected by simplifying price signals, optimisation, value stacking, and balancing customer needs with overall system security.
- Are there lessons we can learn from other industries regarding data collection, use and management?

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## THE CUSTOMER EXPERIENCE OF VPPS - KEY TAKEAWAYS

- Early-adopters are already participating in the market, while mainstream customers still need convincing of the benefits to purchase ESS and enter a VPP.
- Concern was raised about the misconceptions that customers are being sold include the idea of a \$0 bill and that they can automatically get back-up power from the ESS. These are damaging to the development of the industry.
- There is often a 'golden opportunity' to communicate to the customer the best value proposition for their needs (e.g. when purchasing solar, or when reconsidering retailers). Once the opportunity closes, it's challenging to go back to the customer with information that could contradict the knowledge they gained when making the original decision.
  - Timing of communication with the customer is critical - it's important that the customer doesn't feel overwhelmed with information and has time to properly consider what, how and when they need various services and systems.
- It is important that communication with customers caters to all levels of understanding and limits industry jargon while maintaining technical accuracy.
- Non-VPP (unorchestrated) batteries have the potential to enhance existing risks, especially in peak demand emergencies, and customers should understand these risks as well.
- There is a need for the right technology (a hard constraint) and a desire (a soft constraint) to join a VPP - there can't be one without the other.

### Panel discussion points

- There is a need for one entity to 'put their arms around parties' and provide certainty throughout the customer journey.
  - Approximately 40% of rooftop solar systems in Australia are orphaned, where do customers go for help?
- The industry should cater to all levels of desired customer engagement.
  - Some segments wish to "set and forget", while others prefer direct and active involvement (e.g. exposure to the spot price).
- There is currently a disconnect between what the customer sees, what is used, and what is billed.
  - Billing and metering could be productised.
- The ROI for ESS is still ~10 years at best, which is roughly equivalent to the life of the system. As such, financial incentives are not the only drivers for customers to install batteries in the current market.
  - Current drivers of battery uptake include a sense of contribution to the network, a desire for clean technology and an interest in environmental issues, cost savings, and self-sufficiency.
- Reward schemes and retail models differ between jurisdictions and experience indicates that simpler schemes are better for the customers.
  - Greater transparency is needed on the value of ESS and how this is impaired vs. improved through orchestration in VPP.
- How can we better engage (and protect) renters? How do we consider social equity issues?

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### DATA COLLECTION APPROACHES AND PLATFORMS FOR NATIONAL INDUSTRY DEVELOPMENT - KEY TAKEAWAYS

- Use of customers apps can be useful for not only displaying energy usage patterns but also sharing research and energy insights to enhance customers' understanding.
- More practical mechanisms for customer interaction can aid in filling the current knowledge gaps.
- Collection of solar PV and battery data specifications can aid the industry's visibility of what's in the market.
- Significant amounts of data can be collected from customers, systems, and the network.

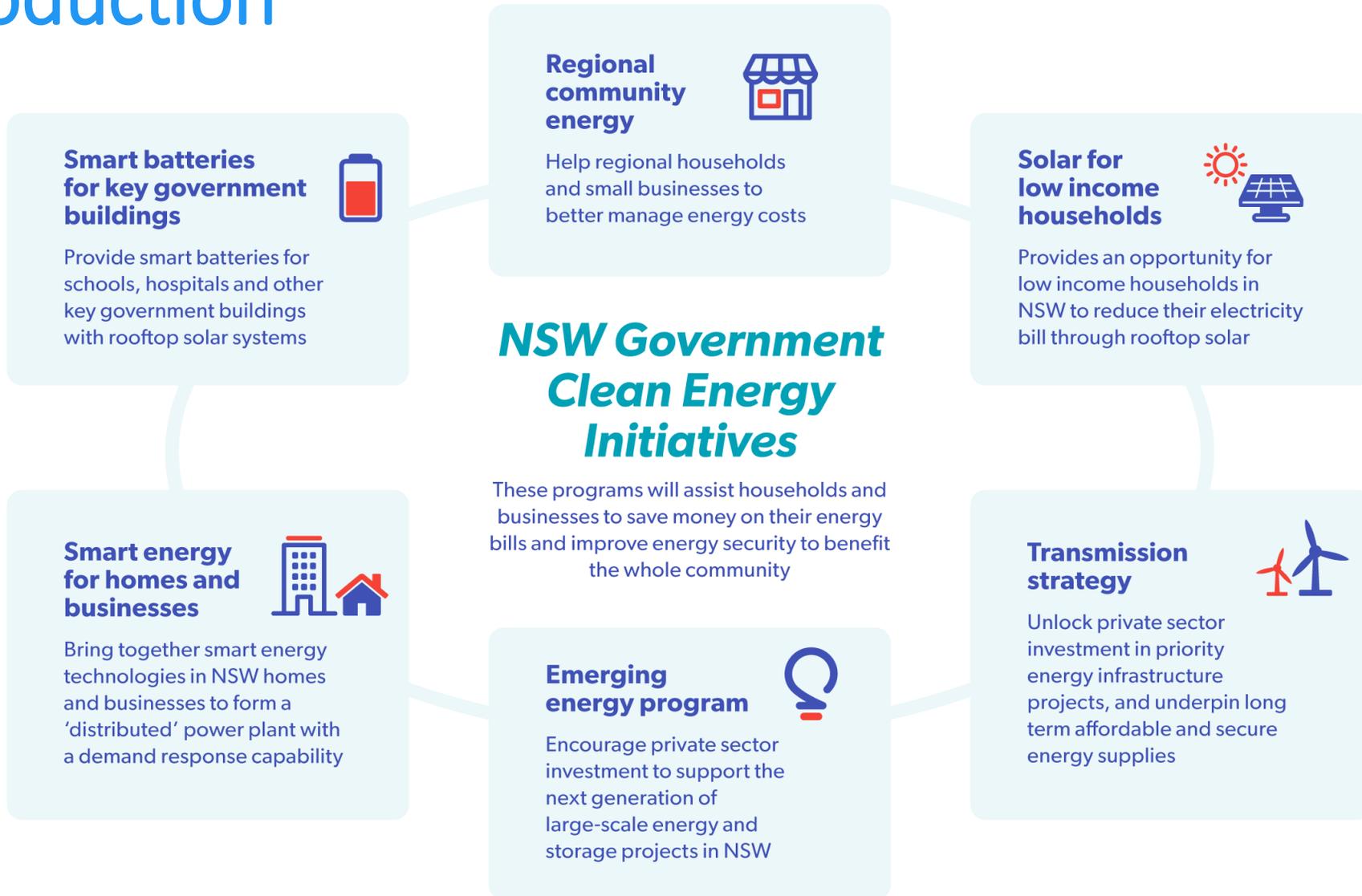
### Panel discussion points

- Valuable data needs to be secure, accessible / shareable, understandable and useful.
  - It is important to know what data you want - and what the planned purpose is - *before* you collect it. Data management is resource intensive and should be outcome driven.
- Consistent data formats is necessary for effective data sharing - there are currently no uniform formats being used across jurisdictions.
- There is an opportunity for a national body or technical focus groups to coordinate the datasets or create a standardised data model for ESS and VPPs.
- There is a need for more data scientists if the industry wants valuable data - there are currently not enough skills in the industry to manage and dissect large datasets to distil and maximise the value.



# *Smart Energy for NSW Homes and Businesses Industry Briefing*

# Introduction



# Program objectives (summarised)

Improve energy reliability by establishing a peak reserve capability

Reduce energy costs over the long term by displacing peaking power plants and network constraints

Reduce greenhouse gas emissions

Support the development and uptake of smart energy technologies

Enable households and businesses to have more active participation in the energy market

Increase the visibility and predictability of smart energy devices

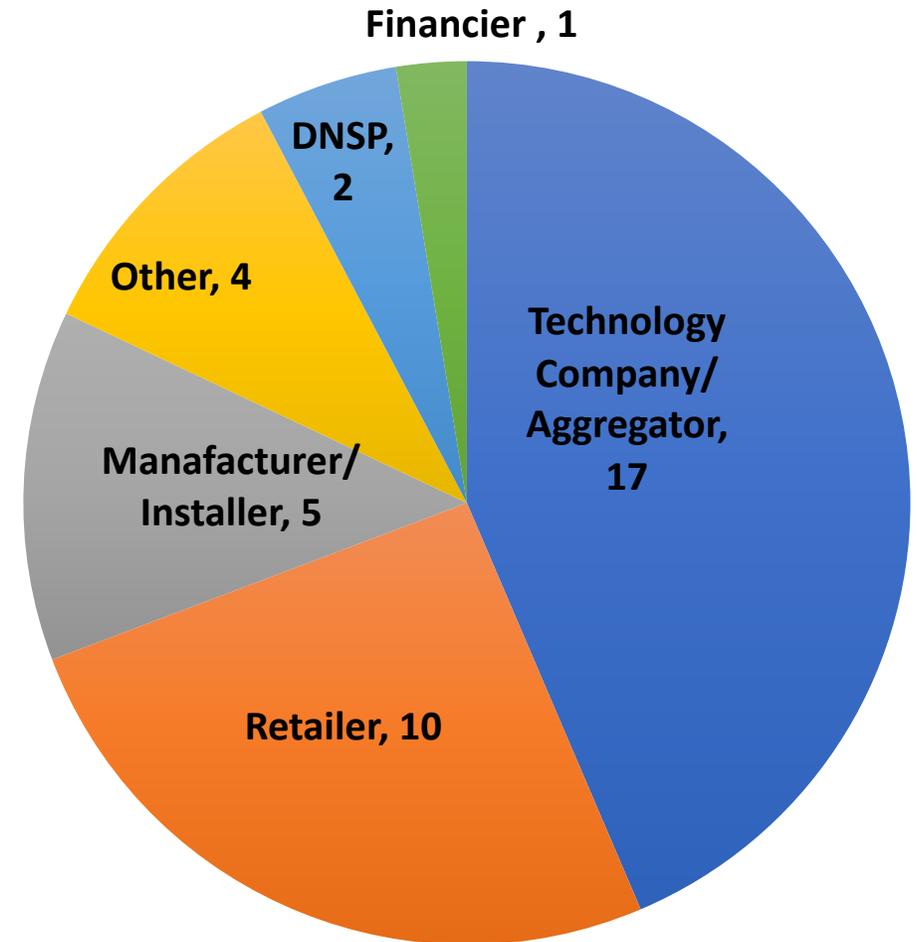
# EOI stage – what was proposed

- An EOI was run between 15 November and 17 December
- Proposed high level design included:
  - **Partnering with industry** to establish a **200MW VPP** or network of VPPs, consisting of **multiple DER technologies**
  - **Upfront payment** of up to \$1,000 procuring an **option to control** participants' **DERs** on up to **5 days per year** during tight reserve situations, for 3 a year term.
  - **Program Partners** responsible for:
    - ✓ engaging participants;
    - ✓ administering participation payments;
    - ✓ connecting participant devices to VPP platform;
    - ✓ orchestrating DERs for benefit of partners and participants;
    - ✓ providing fleet and orchestration data to DPE and AEMO.

# EOI Overview

- 39 submissions received
- Very positive response to program aims and objectives
- Large range of solutions proposed, including multiple different business models and novel technology solutions
- Valuable insights obtained on industry capabilities and capacity, along with market complexities and risks
- Program now in detailed design stage, scheduled for release in Q2 of 2019

## Submissions by Type



# Key Challenges

- Evolving sector – changing market rules, regulation, technologies, business models, players, costs etc
- Engaging participants and maintaining engagement – sustained market / persistent benefits
- Maturity of the VPP technologies and market
- Unlocking network benefits – accessing full value stack
- Avoid distorting sector development

## Key Challenges - cont

- Distribution of value / benefit between partners and participants
- Commercials of retrofitting existing devices
- Enabling consumer choice and portability
- Lack of industry standards for communications protocols



# NextGen Energy Storage Program

**Daniel Harding**

Director, Energy Markets and Renewables

ACT Government

11 February 2019

[daniel.harding@act.gov.au](mailto:daniel.harding@act.gov.au)

# Program Objectives

- High penetration of distributed storage
- Support electricity network
- ‘Smart’ systems
- Local industry development
- National leadership

# Key wins

- 1000+ systems sold (4.5MW of output)
- Smart requirements
- Battery database
- Industry/community collaborations
- Supporting local industry

# Key challenges

- Battery prices
- Lack of public awareness
- Split incentives
- Resourcing and contract management

# Lessons Learned

- Brand/technology neutral approach
- Safety and risk management
- Grant re-allocation
- Ongoing engagement is crucial
- Mid-cycle program review has just commenced

# Interested in learning about...

- Low income, rental and commercial
- Inspection and failure rates
- Experience with VPPs
- Alternative funding/financing options
- Program administration processes
- Data reporting requirements
- Local factors influencing uptake

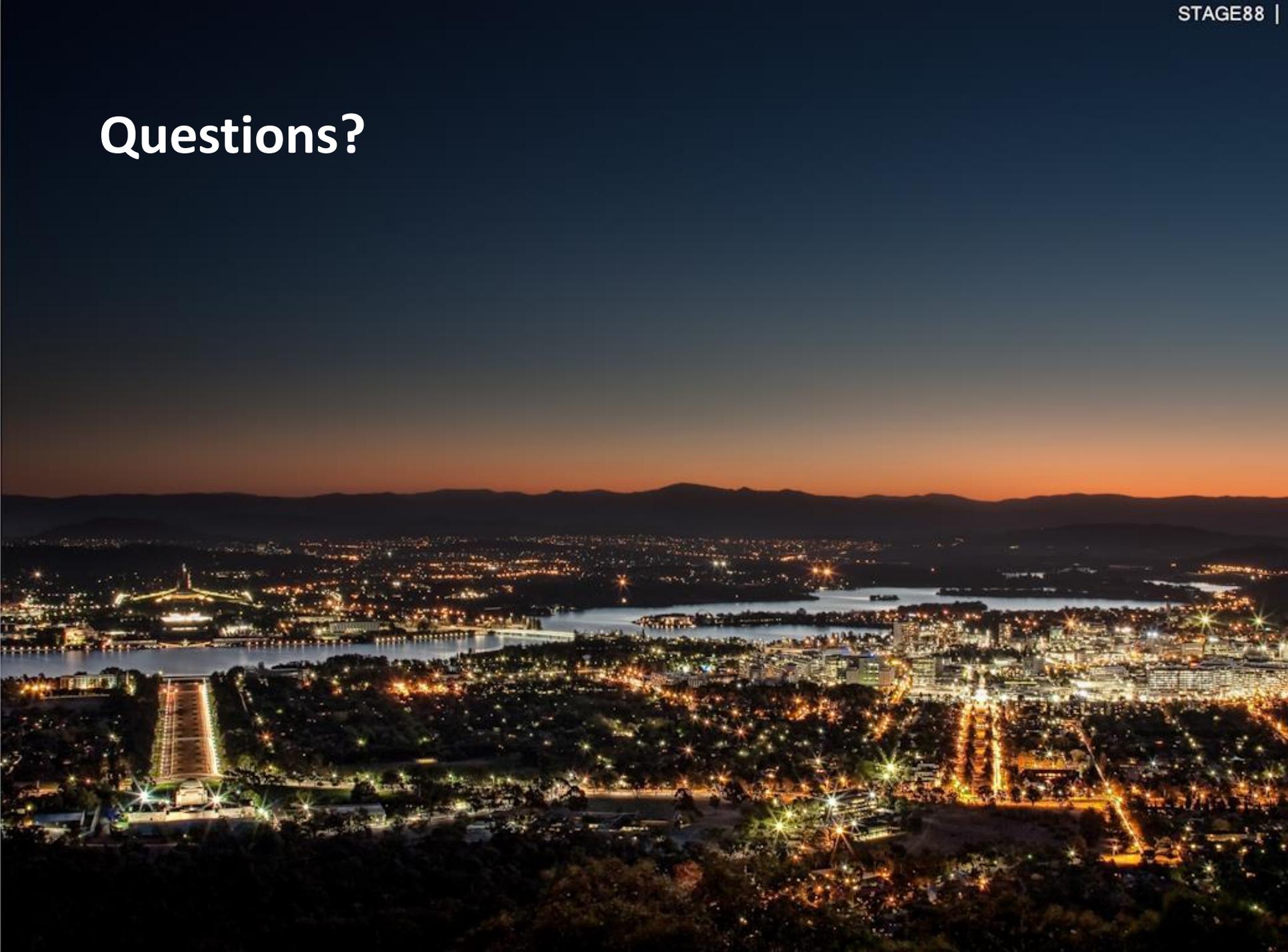
# What can we offer you?

- Database licensing opportunities
- Program design documentation
- 3 years implementation experience

# What's next?

- Design options that will drive higher uptake
- Financing models
- Extension to EV-based storage
- Regulatory sandboxes and IBRF to drive network-based storage

# Questions?





# Victorian Solar Homes Program

ARENA VPP Workshop

Luke Pickles, Technical Lead (Distributed Energy Resources)

11-February, 2019



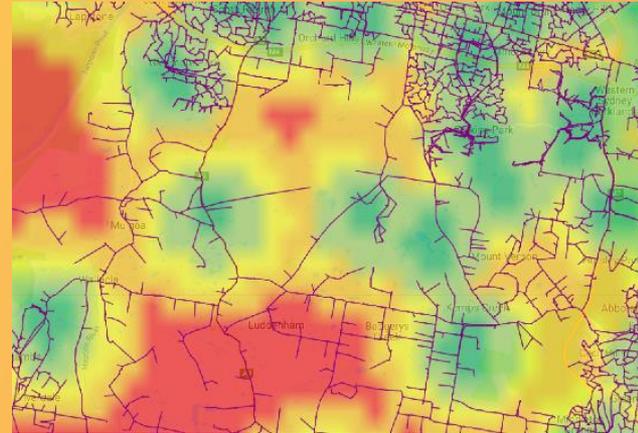
- \$1.24bn over 10 years
- Systems:
  - › 24,000 + 650,000 solar PV systems
  - › 60,000 solar hot water heaters
  - › 10,000 energy storage systems



- **Net benefit:**
  - › Environment
  - › Consumer  
(up front cost, bill savings)
  - › Jobs creation
  - › Industry development

- **Facilitate transition to future grid**
  - › “Managed” high penetration/  
Automatic functionality
  - › Visibility/ data collection
- Interoperability
- Encourage new trading platforms/  
digital markets
- Policy and regulatory reform

- 10,000 systems/ forthcoming implementation
- Target grid supply constrained locations
- Program design in development



- High safety & quality benchmark
- Future-proofing standards/ functionality
- Product supply constraints
- DER hosting capacity data
- Infrastructure constraints

- Alignment with standards and current Aust. initiatives
- Energy storage minimum specifications
- Communication protocols
- Energy market participation

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- P: 1300 363 744
- W: [solar.vic.gov.au](http://solar.vic.gov.au)





# Virtual Power Plant Demonstrations ARENA workshop

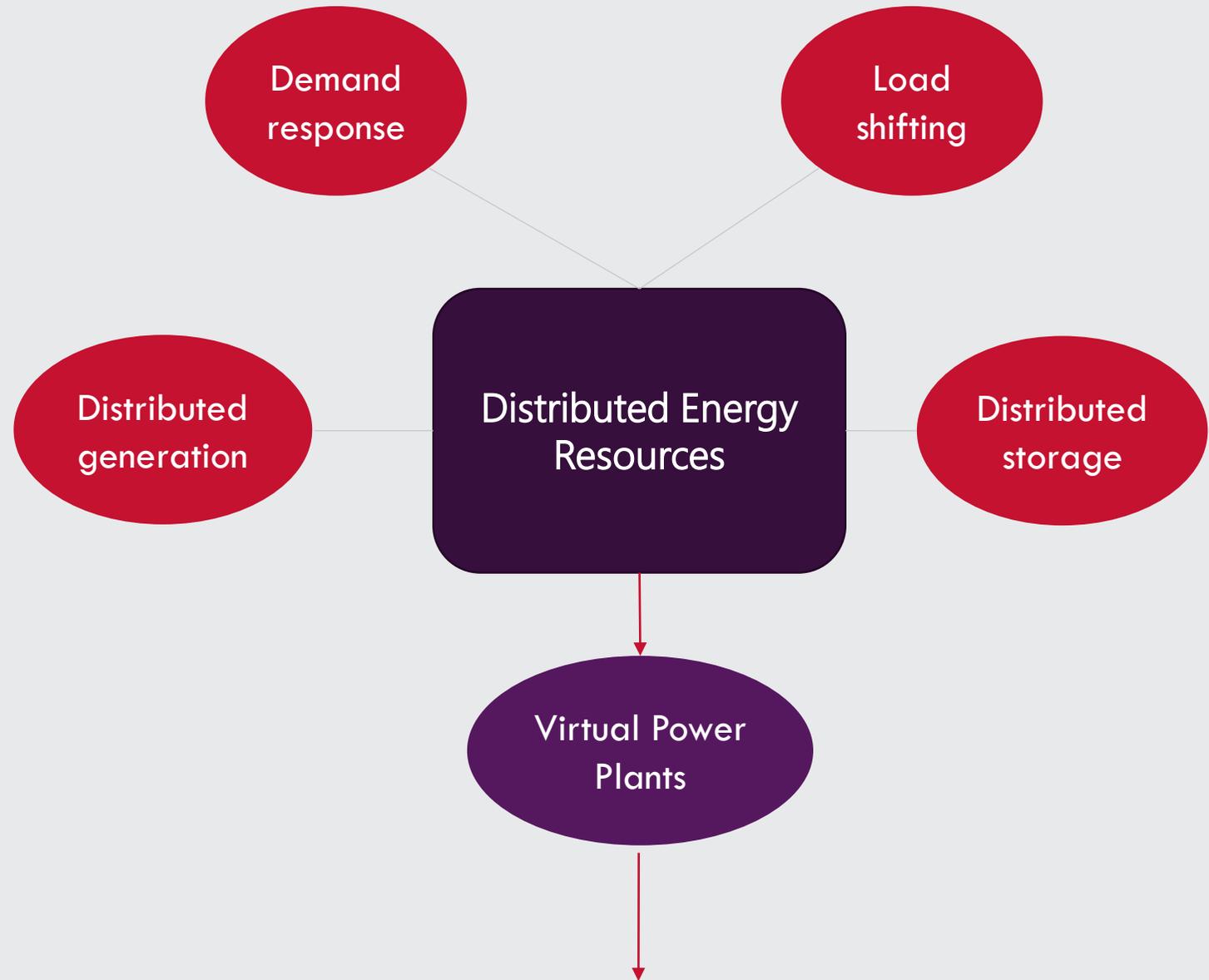
11 February 2019

Matt Armitage – Principal, DER Program

# Distributed Energy Resources

## Definition:

Distribution level resources which produce electricity or actively manage consumer demand



- **Consultation feedback = VPPs should be technology agnostic aggregation of resources.**
- AEMO may need to define further for market participation – e.g. FCAS verification

# Why: VPP context

- VPP uptake driven by existing subsidy programs aiming to deliver **up to 700 MW of VPPs by 2022**
  - And now potentially 1 million batteries (~5 GW capability) by 2025
- VPPs want to **explore commercial feasibility of the 'value stack'** – energy, FCAS & network support
- Projects are planning for **small scale deployment initially** (~1MW) 2018-19, then scaling up in 2019-20

## BUT...

- Existing outdated **framework stifles 'value stack' innovation** (e.g. energy, FCAS & network support)
- **VPP operations are currently 'invisible'** to AEMO and high VPP growth may present system security risks if appropriate visibility is not implemented
- VPP cloud-to-cloud communication and control **technology is at cutting edge globally**
  - Teething issues expected – must be resolved to be considered 'proven, reliable & secure'
  - AEMO keen to observe VPP service reliability under variable voltage conditions

- **VPP Demonstrations to facilitate operational visibility while VPPs are developing**
- **Enables practical learning on how to change market frameworks and operational systems to facilitate VPPs delivering maximum value to all energy consumers**

# VPP Demonstrations objectives

Primary objective = allow VPPs to stack value streams, obtain operational visibility, use learnings to inform changes to regulatory and operational frameworks

1. Allow participants to **demonstrate basic control and orchestration** capability for VPPs to stack energy, FCAS and network support services
2. Develop systems to deliver **operational visibility of VPPs** to new AEMO API
  - i. To understand impact on power system security and interactions with the market.
3. Assess **current regulatory arrangements** affecting participation of VPPs
  - i. Inform new or amended arrangements where appropriate
  - ii. Assess AEMO's **draft DER Contingency FCAS Specification**

# AEMO DER Program

## Integrating DER to maximise consumer value



### Workstream objectives

<p>Use pilots to inform change – partner with key stakeholders to inform operational and market design requirements</p>	<p>Visibility of DER for operational, forecasting, planning, and market (incl settlement) functions. Consumer and third party access to data and services to enable better service offerings/choice for consumers</p>	<p>Integrate DER into energy, ancillary and reserve markets. Market arrangements recognise new models, including third-party/aggregator concepts. Evolve market arrangements to a distributed market model. Network regulation &amp; pricing facilitate DER and better customer service offerings.</p>	<p>Where appropriate, a nationally consistent approach to DER connections and develop DER technical standards.</p>	<p>To better understand operational challenges and DER capabilities to inform operational processes and tools. Better operational tools to operate in high DER world</p>	<p>Industry-wide collaboration (domestic and international) to deliver outcomes for consumers</p>
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### Enablers

- Broader market evolution
- Digitalisation (including cyber security)

# Distributed Energy Integration Program (DEIP)

**DEIP purpose:** Collaborate to maximise the value of customers' Distributed Energy Resources to the Australian energy system for the benefit of all energy users.



# Stakeholder feedback

## 1. VPPs are a hot topic

- 29 submissions, overwhelmingly supportive of the initiative

## 2. VPP definition should be technology agnostic

- VPPs can deliver services using various resources

## 3. Networks are key stakeholders but there are differing views over data access

- Balance data access for system operation vs monetisation of data

## 4. There is no shortage of investment \$\$\$ into VPPs

- Govt. subsidies has mobilised commercial investments at scale
- Seeking to identify most successful consumer model for VPPs

## 5. Interoperability will be a key issue to get right so that:

- Customers can switch between VPPs/retailers/aggregators easily
- Aggregators can integrate many different technologies into their portfolios
- Aggregators can integrate easily with market or network API interfaces

## 6. Multiple aggregators/DERMS providers emerging, but only a handful will sustain

- Australia is attracting start-ups and global players
- Early days – expect consolidation

# Next steps

- **Q1 2019**
  - Digest feedback to develop
    - Terms & Conditions for participation
    - Enrolment process
  - Launch stakeholder groups:
    - API focus group
    - Stakeholder reference group
  - Build systems to facilitate VPP Demonstrations:
    - Registrations
    - Forecasting information
    - FCAS M&V portal
- **Q2 2019**
  - Begin enrolment process and start the demonstrations
  - Aim to go-live by end of June 2019

# VIRTUAL POWER PLANTS

CURRENT REVIEWS AND RULE CHANGE PROCESSES ON DER

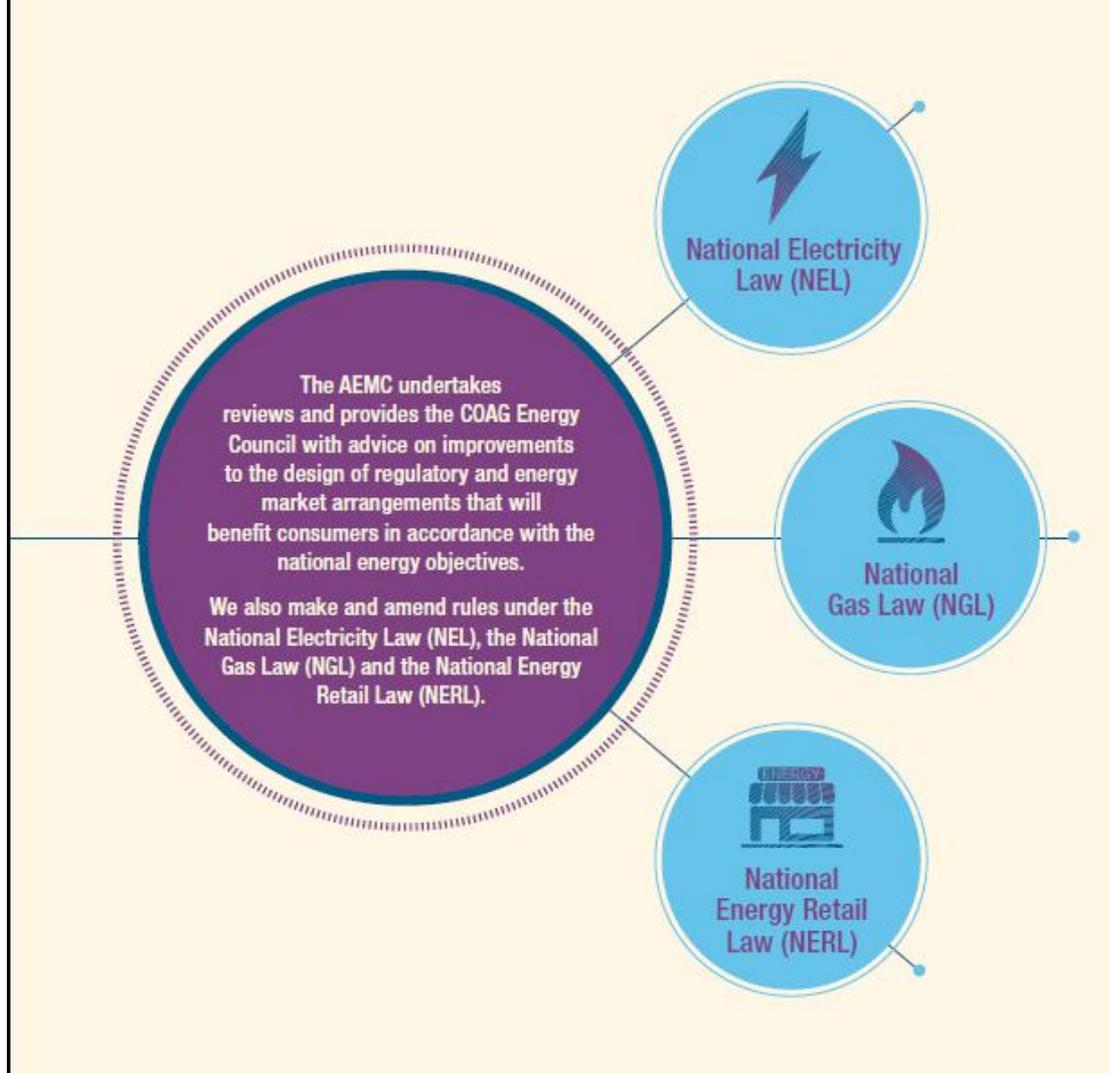
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VICTORIA MOLLARD  
11 FEBRUARY 2019

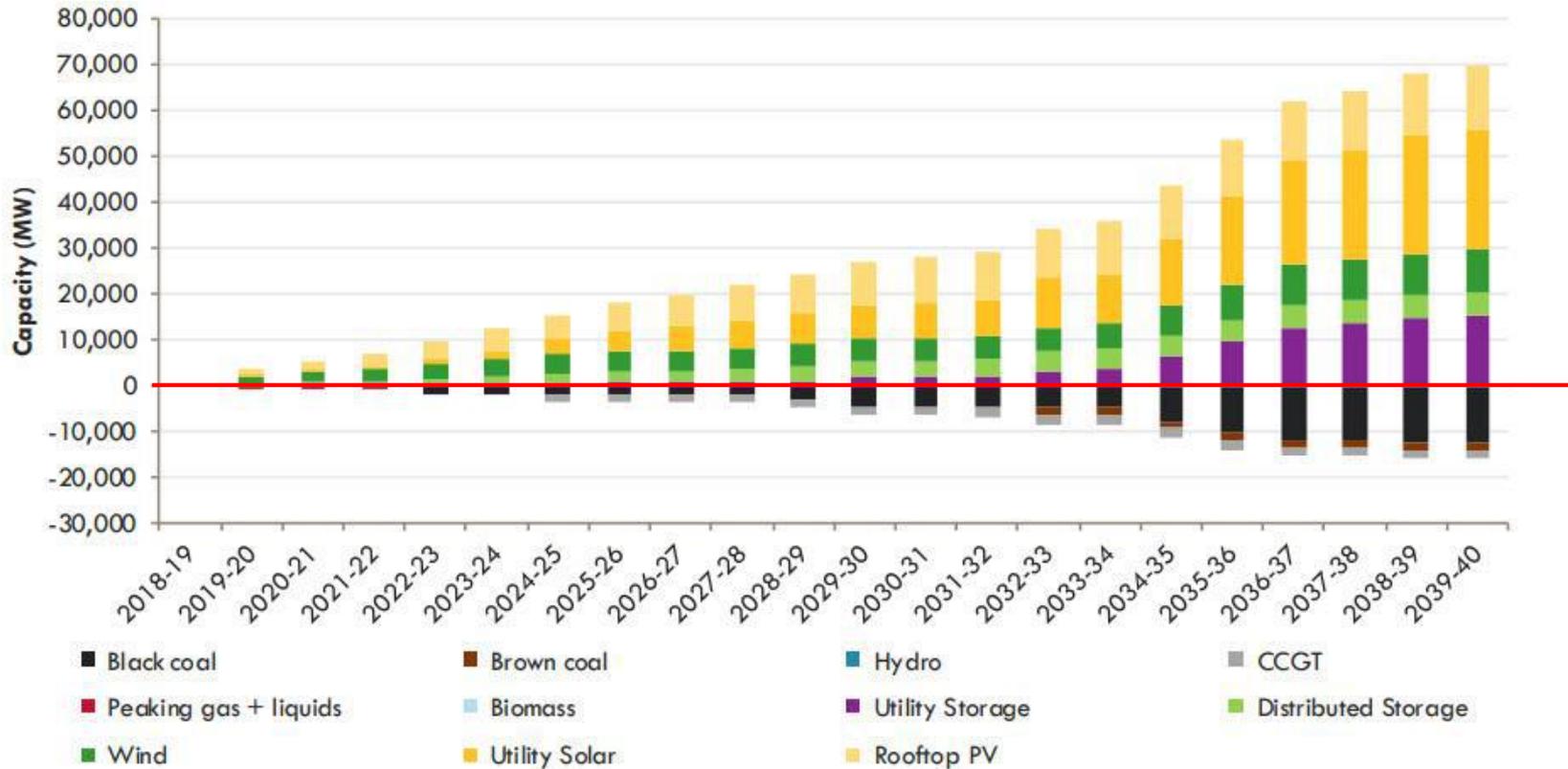
AEMC

## Who we are

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# Generation mix – out to 2040



## DER – current projects

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**Underway  
AEMC/AEMO/AER  
virtual power plant trial:**

trial to inform changes to the regulatory frameworks and operational processes so VPPs can play a bigger role in the energy market.

**Draft determination – 18 Jul  
Demand response  
mechanism rule changes**

Seeks to introduce a mechanism, register or separate market to facilitate demand response.

**Consultation paper – Apr  
Short-term forward market  
rule change request**

Seeks to introduce an AEMO-operated platform to enable market participants to contract for electricity in the week leading up to dispatch, to help enable more demand response.

**Final report – mid 2019  
Electricity network economic  
regulatory framework review**

Examines whether the economic regulatory framework is robust & flexible, with a particular focus on network incentives, market development and regulatory sandboxes.

**Workshop – April/May  
Regulatory issues with DER**

A workshop to identify and examine medium to longer-term regulatory issues arising from higher-levels of DER penetration.

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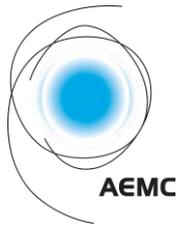
## Demand response

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We have three solutions under consideration:

- 1. Wholesale demand response mechanism:** a mechanism that would allow third parties to offer demand response into the wholesale electricity market in a transparent, scheduled manner.
  - This was proposed by both the SA Government and PIAC/TEC/TAI.
- 2. Wholesale demand response register:** a proposal that would introduce an obligation for retailers to negotiate in good faith with third parties looking to provide wholesale demand response through a register.
  - This was proposed by the AEC.
- 3. Separate wholesale demand response market:** a proposal for the introduction of a transitory, separate market for wholesale demand response.
  - This was proposed by the SA Government.





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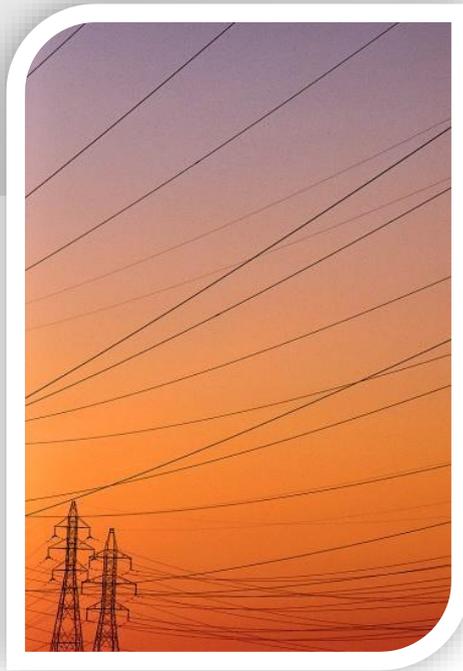
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# VPP Policy Knowledge Sharing



Anthony Seipolt



# If only they used their powers for good...

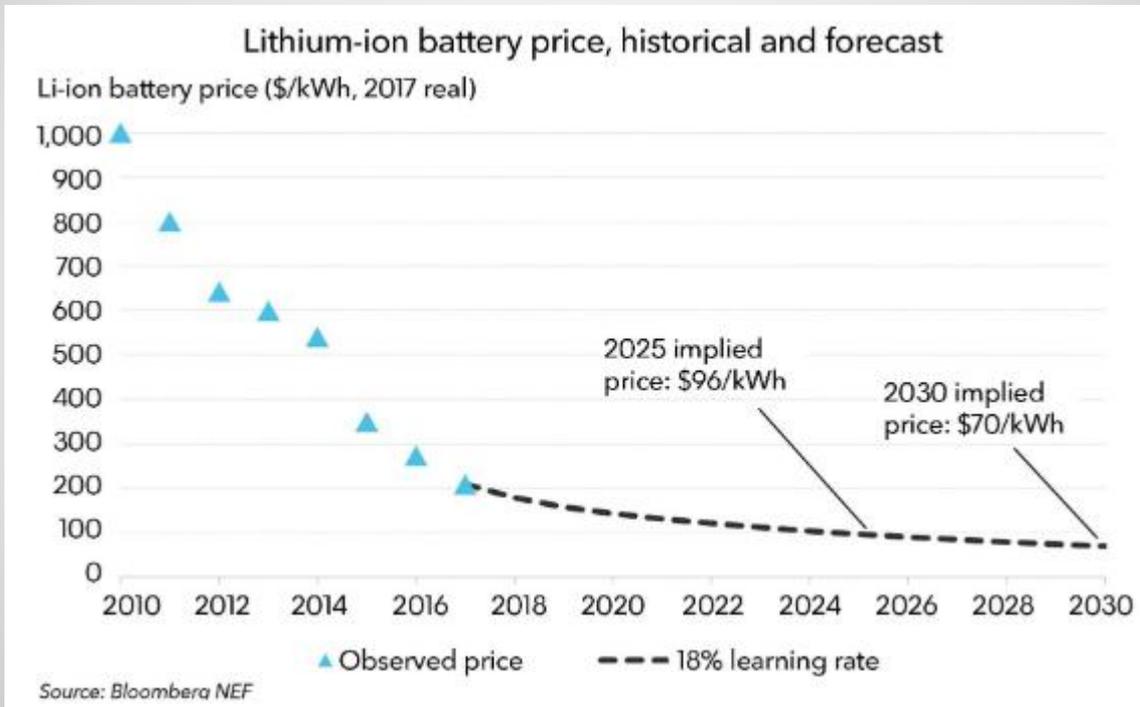
Market theory – innovate then regulate

Regulation as the market enabler (Microsoft)

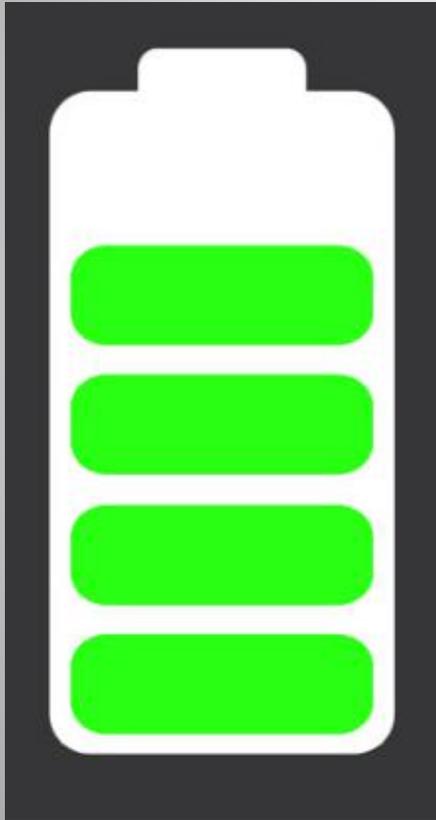
Openness and transparency



# The tide of technology



# Consumers first



## Consumer value:

- Non-economic
- Use solar at night
- Backup
- Provide services to
  - Wholesale/retailer
  - Network
  - Other

# Virtual Power Plants – why?

## Orchestration benefits

- Scale (market entry and impact)
- Efficiency
- Value
- Simplified/derogated control



# VPP Regulatory Challenges

- Tariff reform
- Standards
- Retail and wholesale barriers
- Network incentives

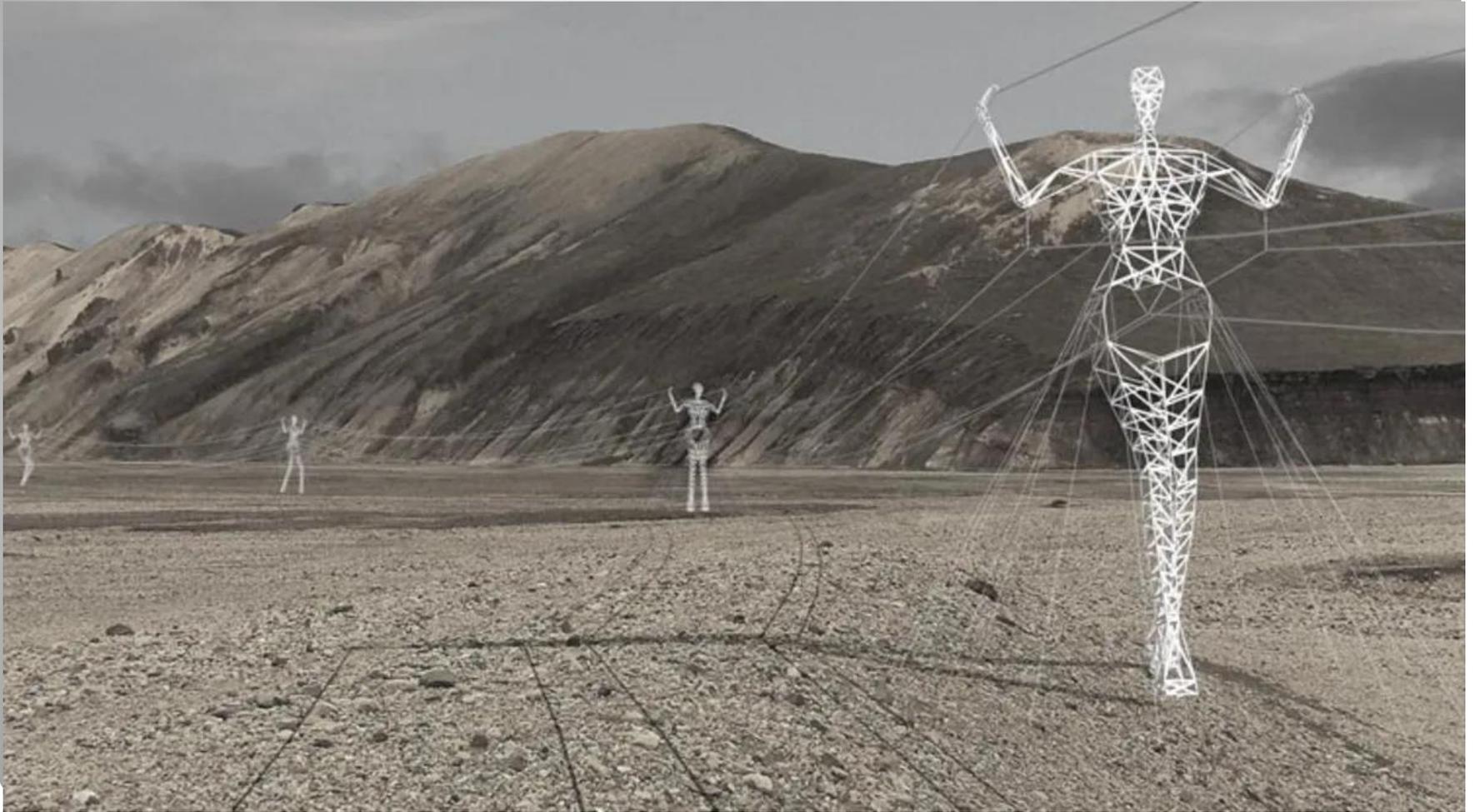
# What is the AER doing?

- Tariff reform
- VCR review
- Regulatory Investment Tests
- Demand Management (scheme and incentives)
- Annual Planning Reports
- Aligning capex, opex and reliability incentives
- Ring-fencing
- Support for ARENA DEIP, rule changes, etc

# Long term interests of consumers

- Smarter grid can release more value for consumers
- Caution required:
  - Competitive outcomes where possible
  - Technology risk
  - Small steps
  - Proving consumer benefit

- Thank you





Australian  
National  
University

# VPP Capabilities and New Models of Storage Deployment and Customer Representation



Battery Storage and  
Grid Integration  
Program

Lachlan Blackhall

Entrepreneurial Fellow and Head, Battery Storage and Grid Integration Program  
The Australian National University

# Battery Storage and Grid Integration Program

- International R&D program established in 2018.
- Experience and expertise in energy storage, power systems, analytics, optimisation, economics, regulation, and social research.
- Current projects with DNSPs, industry partners, community organisations, AEMO, ECA, and ENA with funding support from ACT Government REIF and ARENA.





# Virtual Power Plant (VPP) Capabilities

- Forecasts of over 1 million residential batteries over the coming years.
- Capabilities required in conjunction with government incentives will underpin capabilities of majority of batteries deployed in Australia.
- Unique opportunity to deploy sophisticated demand side storage, metering and control capabilities for the benefit of customers and the grid.



# Technical VPP Capabilities

- Fast metering.
- Local control of battery system / inverter.
- Network services (real and reactive power).
- Frequency support (local control and fast metering).
- Standards based interfaces and communications.



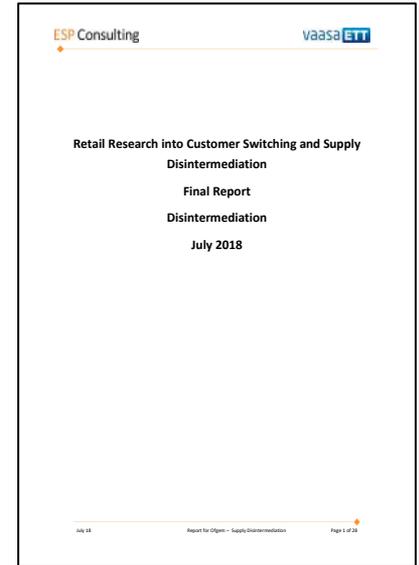
# Grid and Community Scale Storage

- Traditional model of residential storage deployment is behind the meter (BTM), alongside residential solar generation.
- Alongside BTM models, there are emerging opportunities for community scale storage (100kW – MW).
  - Reduced capital cost.
  - Reduced complexity of installation and maintenance.
  - Significant opportunities to participate in markets for energy, ancillary and network services.
- Consumers could own / benefit from a virtual 'slice' of community scale storage.



# Models of Customer Representation

- Important to ensure that customers are fairly and equitably represented.
- Storage and VPPs create new opportunities for customer representation and participation.



# Data Availability and Analysis

- Government incentives create unique opportunities to collect data for public-domain research and analysis.
  - Can inform technical design and implementation.
  - Can inform market and tariff design.
  - Can inform new customer representation models.



# Thankyou

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**Battery Storage and Grid Integration Program**

The Australian National University

Canberra, Australia



Battery Storage and  
Grid Integration  
Program



# DER Communications Overview

ARENA VPP Workshop | February 2019

Context

# We need to coordinate

Today's Paper Markets Data

Menu Home News Business Markets

FINANCIAL REVIEW

SUBSCRIBE LOGIN

Today's Paper Markets Data

FINANCIAL REVIEW

Menu Home News Business Markets Street Talk Real Estate Opinion Technology Personal Finance Leadership Lifestyle All

News Politics

## New regulatory framework for 'virtual power plants' to ensure safety of grid



By Mark Ludlow

Energy market operators and regulators are moving to create a new framework to deal with the massive influx of rooftop batteries and solar to ensure the "virtual power plants" of the future do not destabilise the national electricity grid.

While rooftop solar, battery storage and other behind-the-meter energy sources are seen as the way of the future as older coal-fired power stations



## AEMO on alert for

By Ben Potter

Updated Jan 20, 2019 — 9:48 PM, first published at 3:05 PM

Save Share

The power grid operator's week's record-breaking stepped up and some cr

Convenient weather ch Market Operator won't temperatures are forecast February.

NATIONAL VICTORIA ENERGY

## Victoria's frail energy grid exposed on day of record heat and demand

By Adam Carey

25 January 2019 — 7:30pm



SUBSCRIBE LOGIN

Victoria's energy grid is not fit for purpose in a climate increasingly prone to extreme heat, according to the state's energy minister, after more than 200,000 people had their power cut on a day when Melbourne's temperature hit 42 degrees.

The Victorian state's power generation failure from aging coal and gas generators on Friday, which left powerless in the searing afternoon heat.

australian

OPINION LIFESTYLE ENTERTAINMENT

t to WA's

West Australian

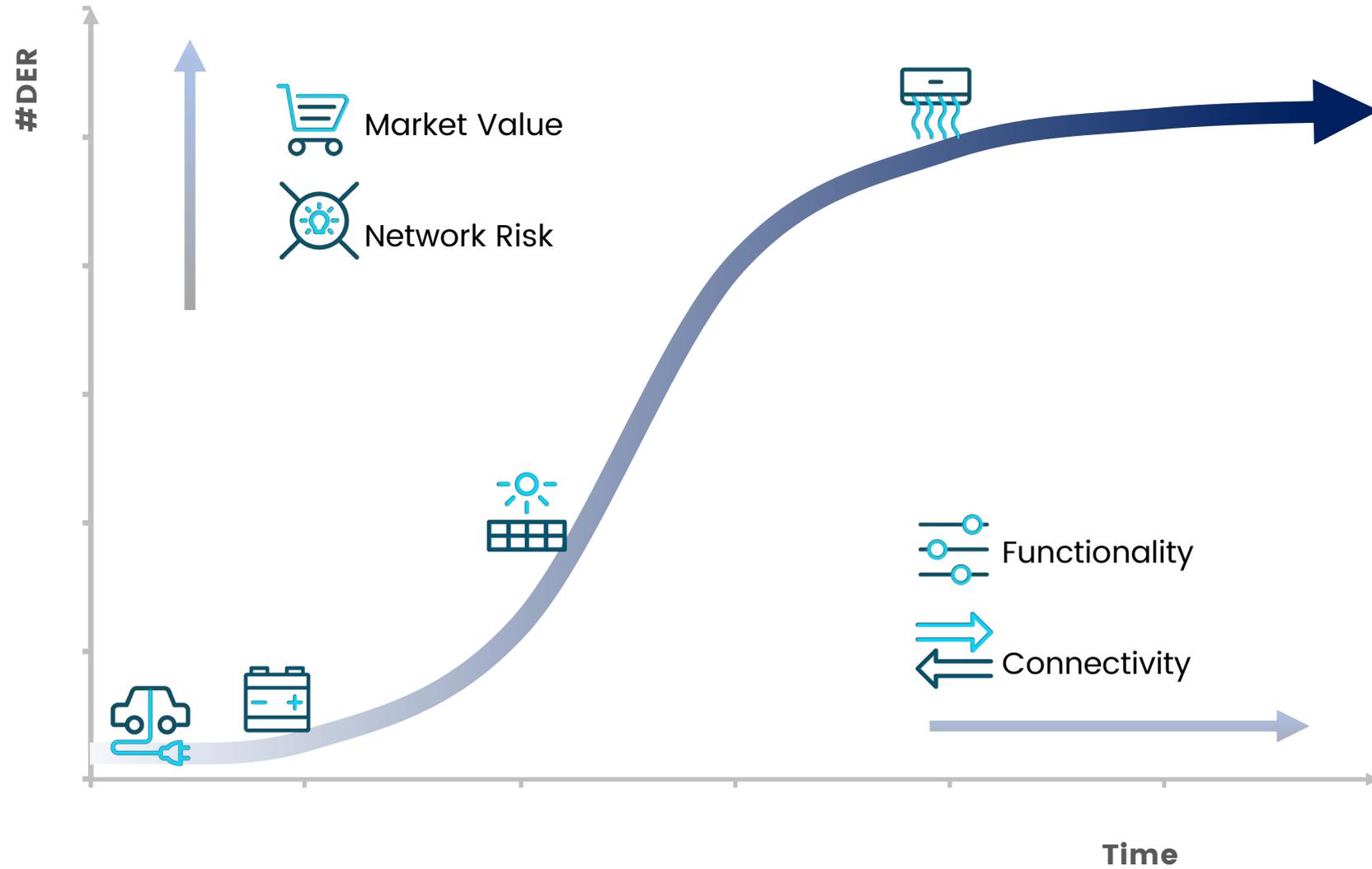
BUSINESS POLITICS OPINION LIFESTYLE ENTERTAINMENT

## g limits of power grid

Daniel Mercer | The West Australian  
Sunday, 27 May 2018 4:10PM



# Smart DER Evolution



# Smart DER



## Energy Service

Concept – Can it deliver material value/risk?

- > Capacity to provide energy products
- > Ability to change real power output (volt-watt)
- > Ability to Inject/absorb reactive power (volt-var)
- > Availability, volume, physical ramp impact value

Status – Already value, already risk

- > A/C, Solar is now material..... but not dispatchable
- > Storage is great..... but no volume yet
- > EVs are great...but they move
- > Consumer tech are interesting... but need aggregation



## Functionality

Concept – How clever is it?

- > Ability to provide dynamic response to signals
- > Awareness and response to grid state (volt. and freq.)
- > Range of implementable DER states (on/off vs set/follow)
- > Response time, reliability, accuracy impact value

Status – Hardware standards emerging

- > Emerging standards for A/C, solar/battery inverters
- > AS4777 etc
- > Shift from electricity standards to electronics standards
- > Don't underestimate consumer drive ahead of standard



## Connectivity

Concept – Can it talk? Can it listen?... who to?

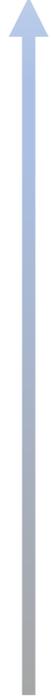
- > Ability to communicate with remote platforms
- > Ability to communicate real-time status to allow forecasting
- > Capacity to implement dispatch requests
- > Communications latency, reliability and security impact value

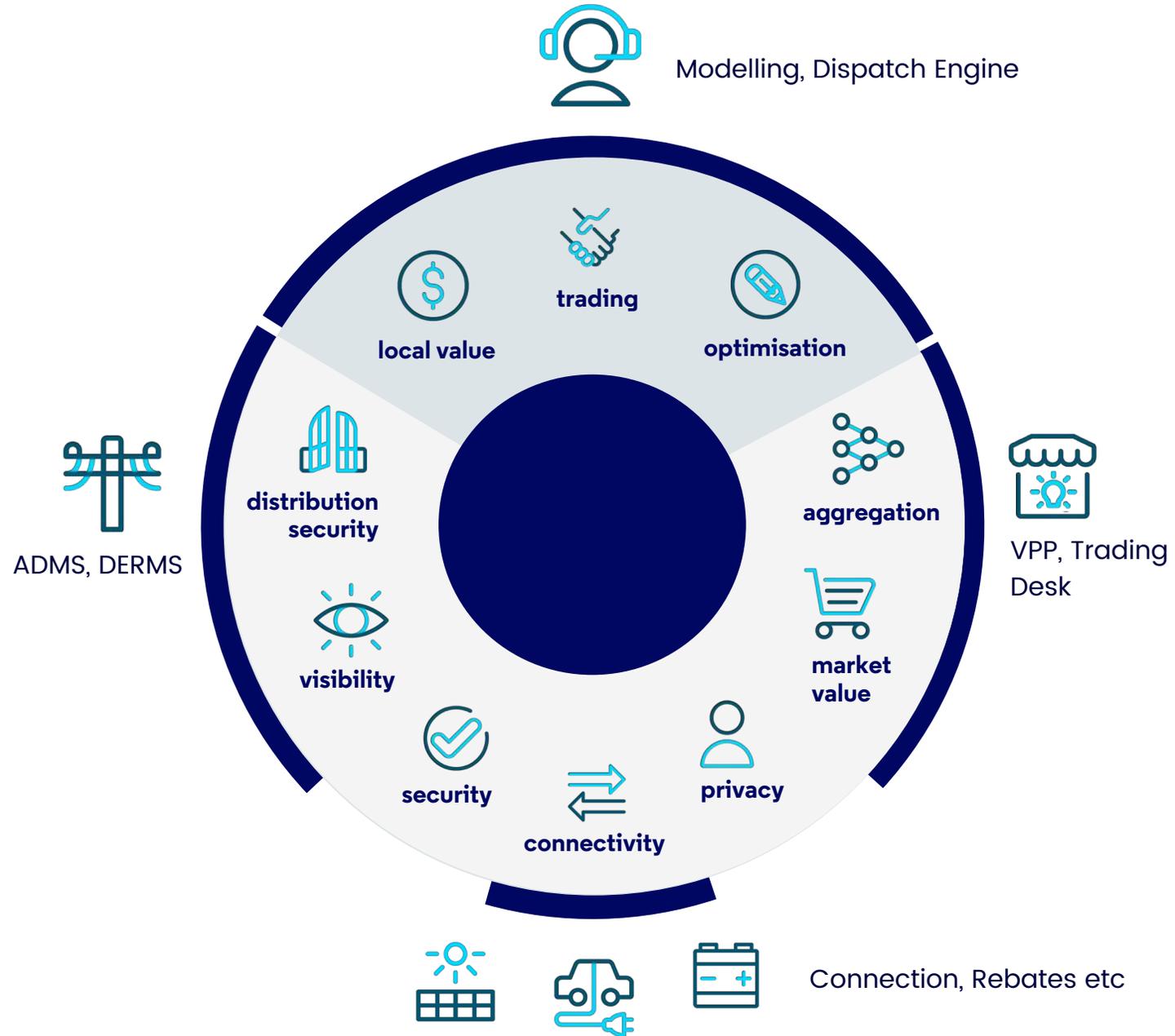
Status – We need translation..and trust

- > Evolution from static, monitoring only to remote control
- > Internet protocols replacing mesh/dedicated line coms
- > Direct utility vs aggregation platform debate
- > Data privacy and consent need consideration

Basics

# Digital Connectivity

- 
-  **Two-way**
    - > Customer value and opt in/out control
    - > Network and system services, direct control
    - > ESCo services
  -  **Monitoring Only**
    - > Customer insight
    - > Network and system real time operation
    - > Availability and settlement
  -  **Static Registration**
    - > Connection registration
    - > Network and system planning
    - > 'Call and Drop'



# What We Need



## **Consumer Participation – Value/no lock-in**

Ensure consumer investment in DER is able to unlock value and effectively participate in VPP and grid services opportunities.



## **Prepare for the Future – Flexible**

Build knowledge and establish capability and processes to manage the continued forecast growth in solar PV, energy storage and the emergence of electric vehicles.



## **State/National/International – Consistent**

Strong alignment with State DER programs and policies. Ability to integrate with NEM-wide initiatives and be consistent with international jurisdictional and OEM industry trends.



## **Network Connection – Simple/Scalable**

Visibility and trust of DER operation for distribution, transmission and system operators enabling planning, real-time monitoring and coordination of DER services for system reliability and security



## **DSO/DMO Platform Functionality**

Understand digital platform interoperability to explore the functional, operational and governance capabilities required to enable simple, transparent and flexible DER marketplaces across NEM.



## **Link to Services/Training**

Support for skills and jobs and facilitate commercial opportunities for RE companies to accelerate sales nationally and globally.

Getting started

# What we have

Pilots, Policy and Programs

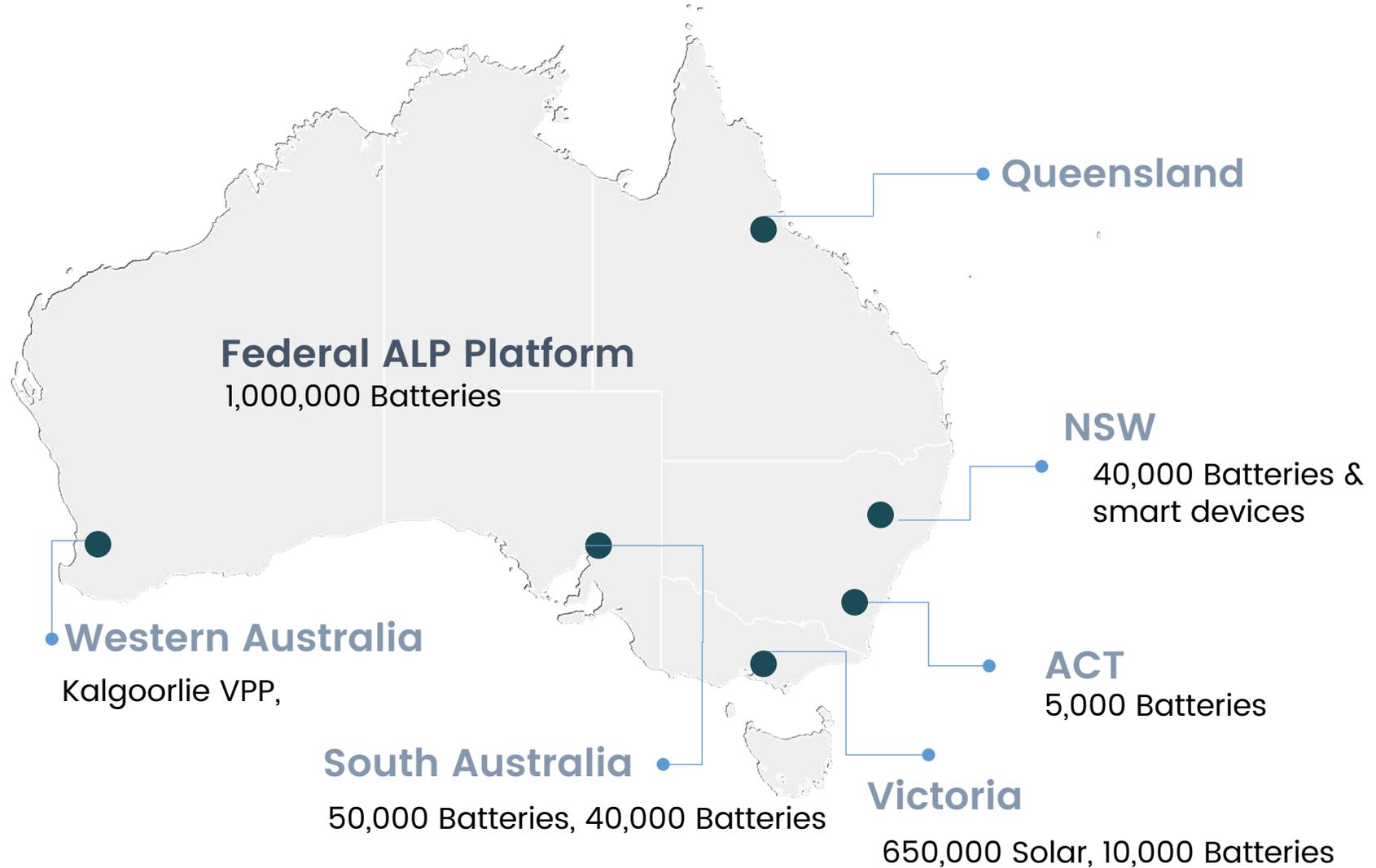
Agency Facilitation



ISO Leadership



Industry collaboration



# deX Partners & Stakeholders

## Electricity Networks



## Electricity Retailers



## Technology Vendors



# deX Partners & Stakeholders

## Installers, Aggregators & EPCs



## Peak bodies



## Consulting



## Government, Policy & Regulation



## Research



# deX Next Steps

Setting a new standard for grid-protecting, market-enabling middleware  
Release 2 (Q1 2020)



**deX markets**  
For ISOs & Market Operators

- > Support National DER Register
- > Support VPP Trials / Protocol
- > Release of deX Markets demo June 19



**deX vision**  
For Distribution Networks

- > deX Vision V1 Released Oct 18
- > ADMS Integration - API
- > Pilots in 2019 to focus on solar connection
- > Work on mediation



**platform API**

For 3<sup>rd</sup> party Platforms

- > Pilots utilising GreenSync VPP
- > Beta API available
- > Support VPP Trials / Protocol



**deX connect**  
For Technology Vendors

- > API in production
- > Collaboration/Priority integrations to support partners
- > Release of Dev Centre, Test sandbox by June 19

**For more information please contact  
US.**

---



**Level 3, 469 La Trobe St  
Melbourne VIC 3000, Australia**

<https://greesync.com>  
<https://dex.energy>

**Bridget Ryan**  
Policy

---

E: [bridget.ryan@greesync.com](mailto:bridget.ryan@greesync.com)  
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**Bruce Thompson**  
Head of Strategy & Partnerships

---

E: [bruce.thompson@greesync.com](mailto:bruce.thompson@greesync.com)  
P: +61 400 628 600

# deX connect

Connecting to solar,  
storage and load control devices

TESLA



ENPHASE



solar analytics

BLUE PILLAR

SUNGROW

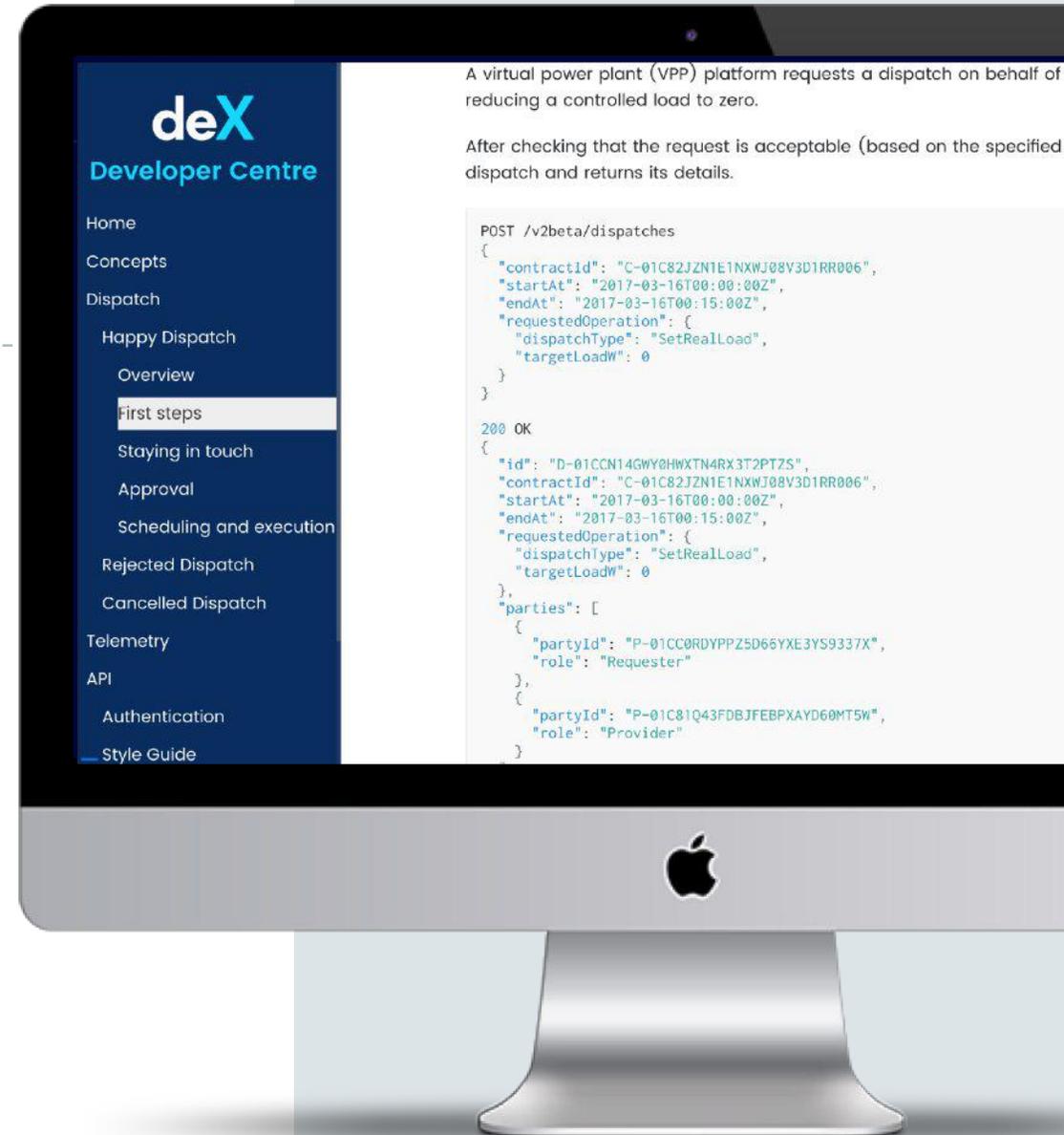
switchin

GOODWE  
your solar engine

CHARGEFOX

>50%

Australian solar /  
storage inverter market



# Getting started

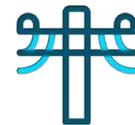
# Connection

- > Coordinate NEM participation
- > Enable ancillary markets
- > Ensure reliability, security



- > Open access protocol
- > Provide grid visibility
- > Enable market participation

deX



- > Quality control
- > Installer standards
- > Device ID validation



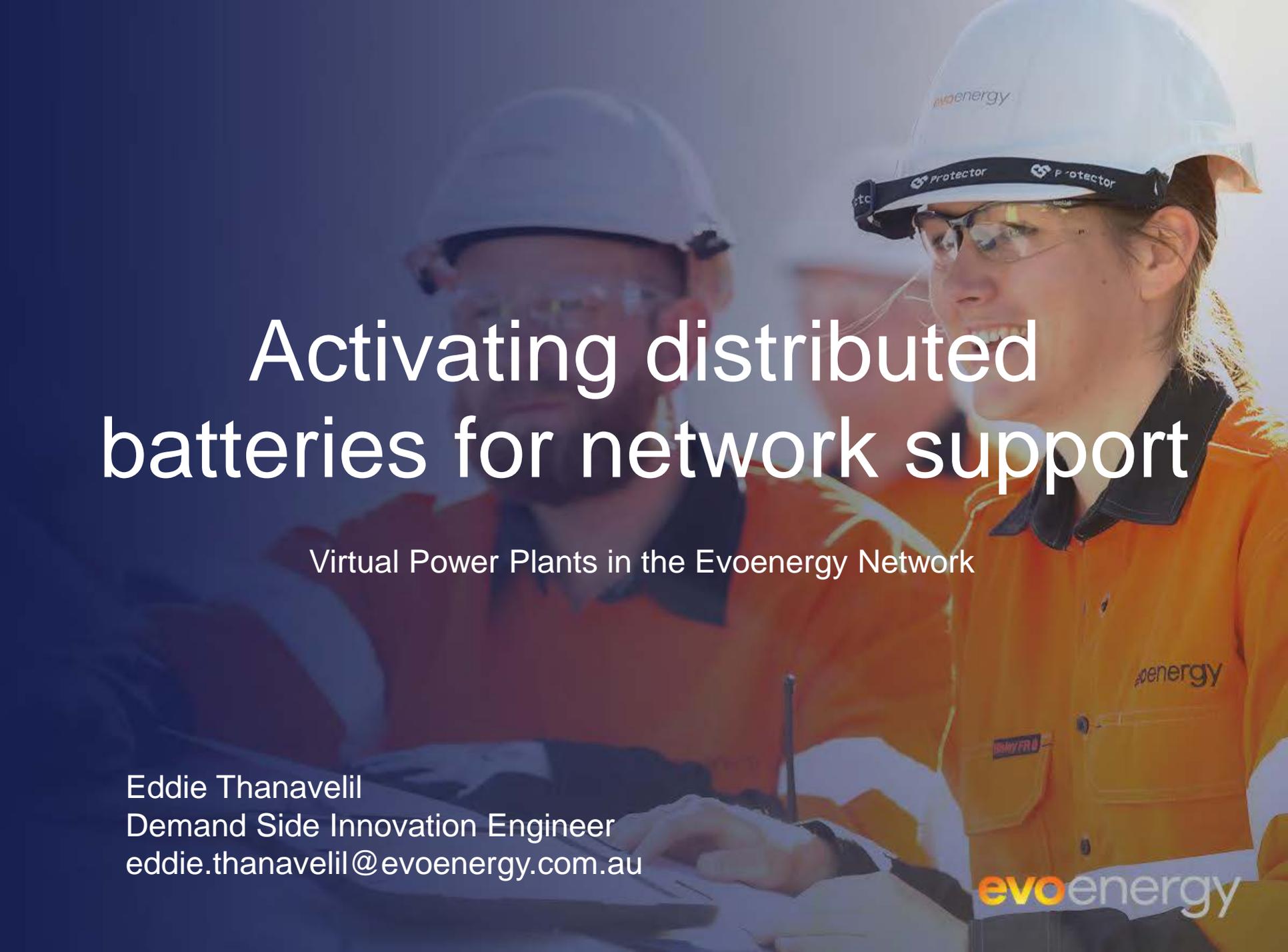
- > Customer value
- > No lock in
- > Data consent, privacy



- > Connection framework to facilitate
- > Visibility
- > market participation



- > ESCo customer services
- > Aggregate for wholesale
- > Contract for ancillary



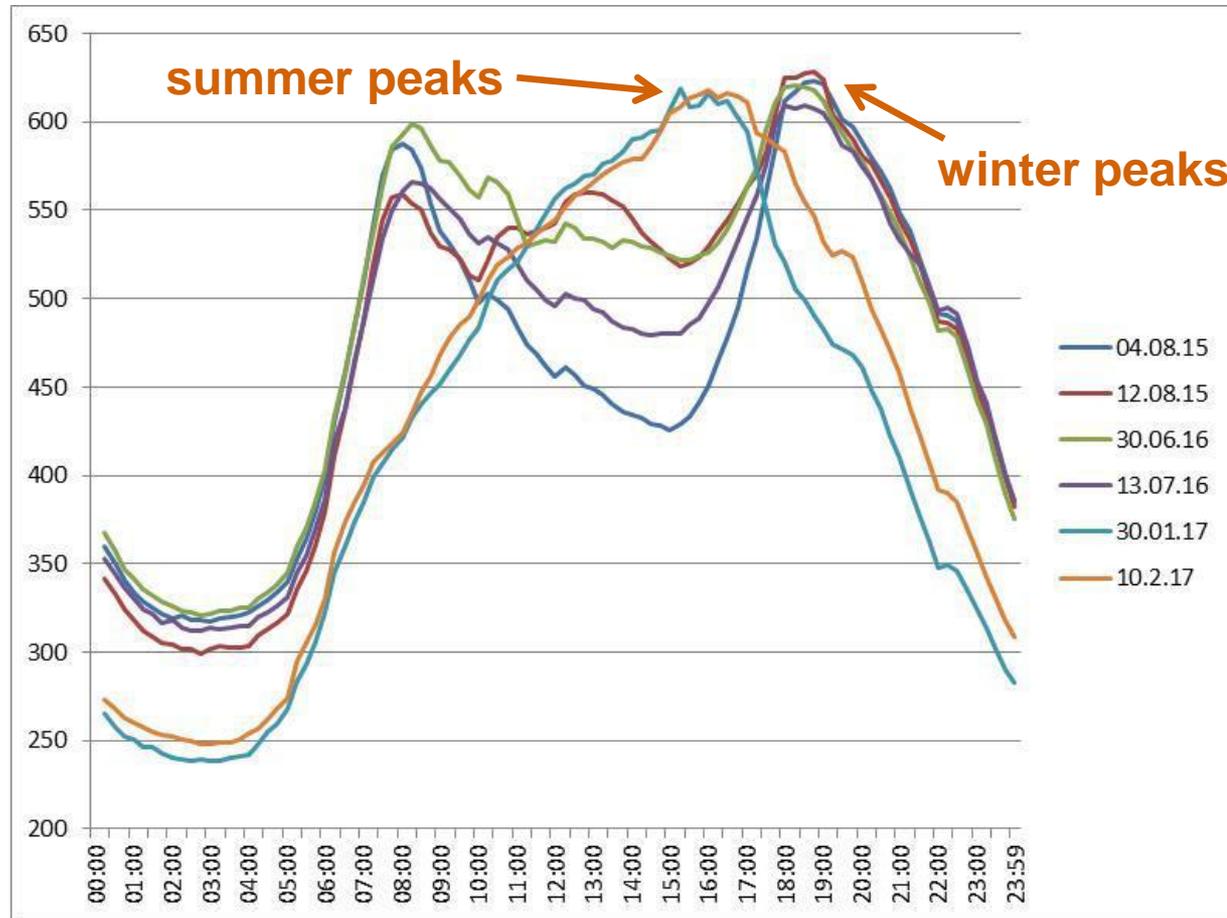
# Activating distributed batteries for network support

Virtual Power Plants in the Evoenergy Network

Eddie Thanavelil  
Demand Side Innovation Engineer  
[eddie.thanavelil@evoenergy.com.au](mailto:eddie.thanavelil@evoenergy.com.au)

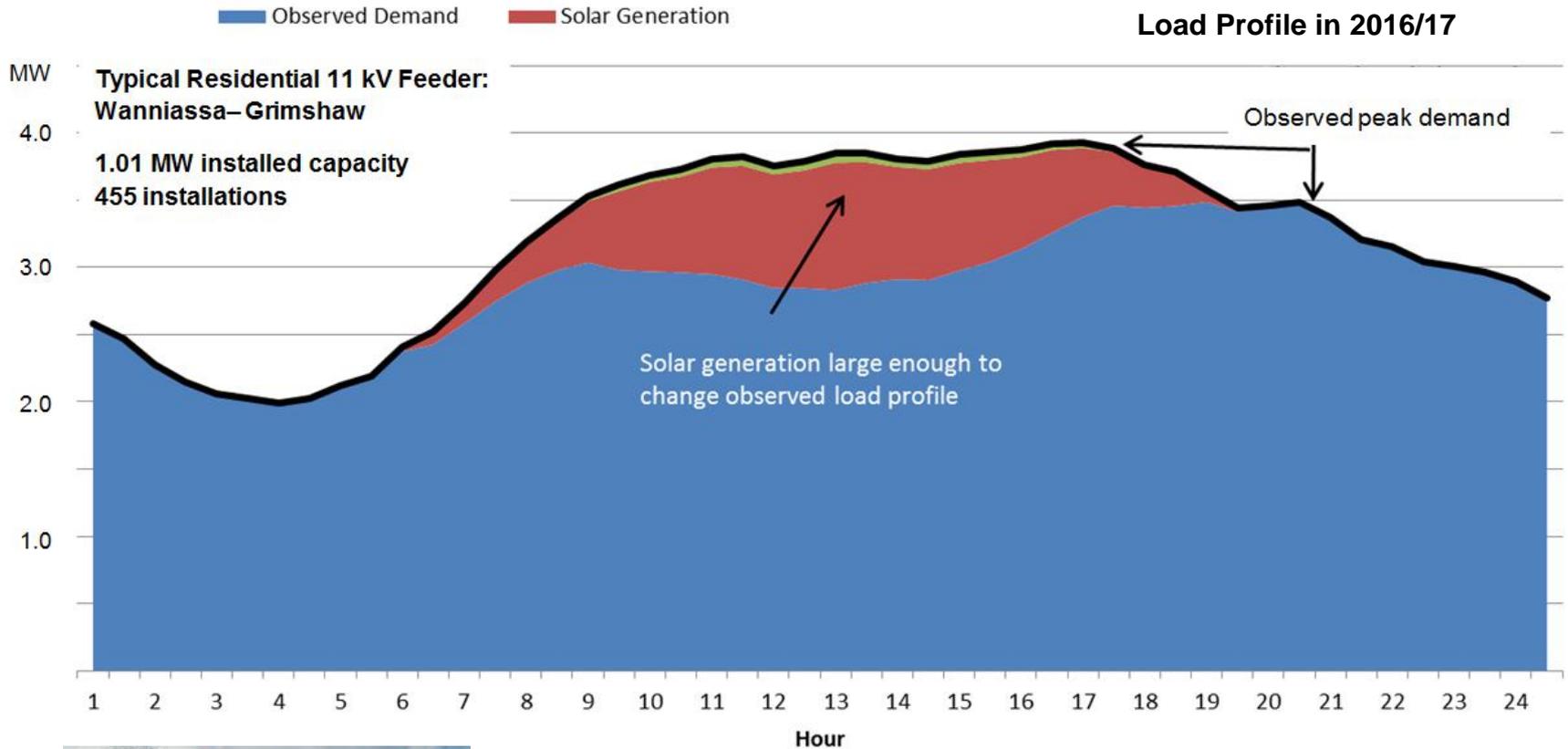
**evoenergy**

# Peak electricity demand days: 2015/16 and 2016/17 in the ACT



Canberra has a predominantly winter peaking electricity network

# Impact of Rooftop Solar PV



# LV Mapping of ACT



# Virtual Power Plant

Taking in data from the VPP, the Advanced Distribution Management System (ADMS) has been developed to provide a real time representation of solar generation, current battery storage levels, and node level low voltage (LV) network data on the Evoenergy distribution network.

This can be aggregated to the Feeder, Zone Substation and Territory level.



12 Zone substations and around 230 feeders in the ACT

# VPP stats

Total nodes: 657 individual customer PV and battery systems and growing weekly.

Systems range from LG, Panasonic, PylonTech, Tesla batteries and whole variety of Solar PV systems.

ACT government NextGen<sup>1</sup> program driving uptake in battery systems.



1. [www.environment.act.gov.au/energy/cleaner-energy/next-generation-renewables](http://www.environment.act.gov.au/energy/cleaner-energy/next-generation-renewables)

# VPP Activity in the ACT

Trial 1 – All ACT	Trial 2 – Voltage Control	Trial 3 - All ACT
Mar 2017 to Nov 2018	Dec 2018 – Jan 2019	18 Jan 2019 (Heat event day)
320 nodes	8 nodes	601 nodes
1.4 MW for one hour	3 sets of trials with lead and lag PF	2.2 MW for one hour

# Voltage control

- **Issue:**

- The induced voltage rise is usually due to the reverse power flow from photovoltaic (PV) generation increasing in the network through to the distribution feeders; affecting the power quality and stability of the network.

- **Traditional solutions:**

- On-load tap changing transformers (OLTC) which act as voltage regulators
- Increase conductor sizes (both length, and cross-sectional) which will reduce the resistance in the cables.

# Innovation with DER

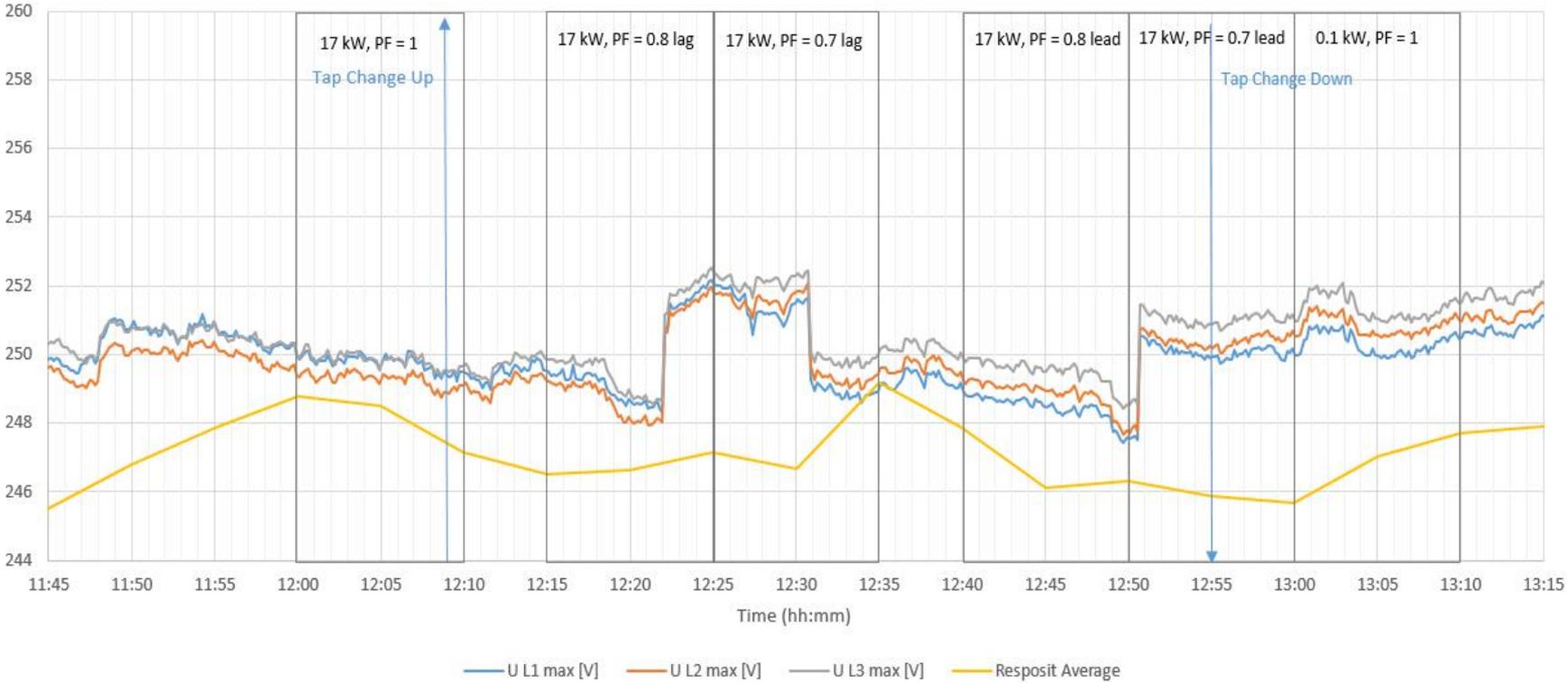
- Use distributed energy resources (PV+ batteries) to control voltage – voltage-amp reactive (VAr).
- Three trials have produced encouraging results
  - LV network can be manipulated through export of power at different power factors.
- Further trials to improve functionality and assess associated cost-saving for the customer.

# VAr Trial configuration

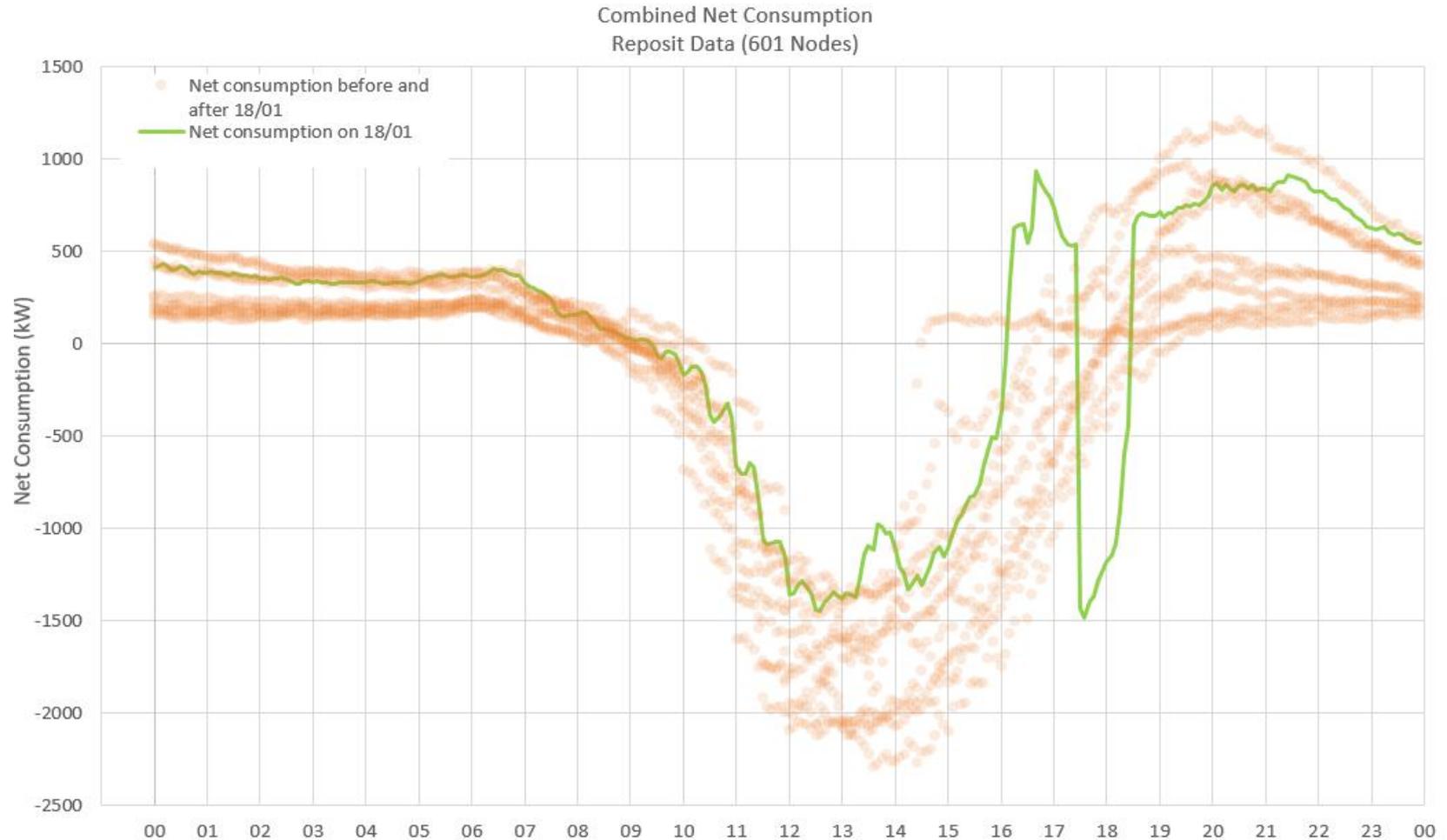
- Sites selected with:
  - highest battery penetration
  - proximity to the substation.
- Dispatches to be scheduled 24 hours in advance.
- Trial was used to learn how to create dispatches accurately and to gauge costing.
- Data loggers installed on feeders to validate the trials.

# VAr results

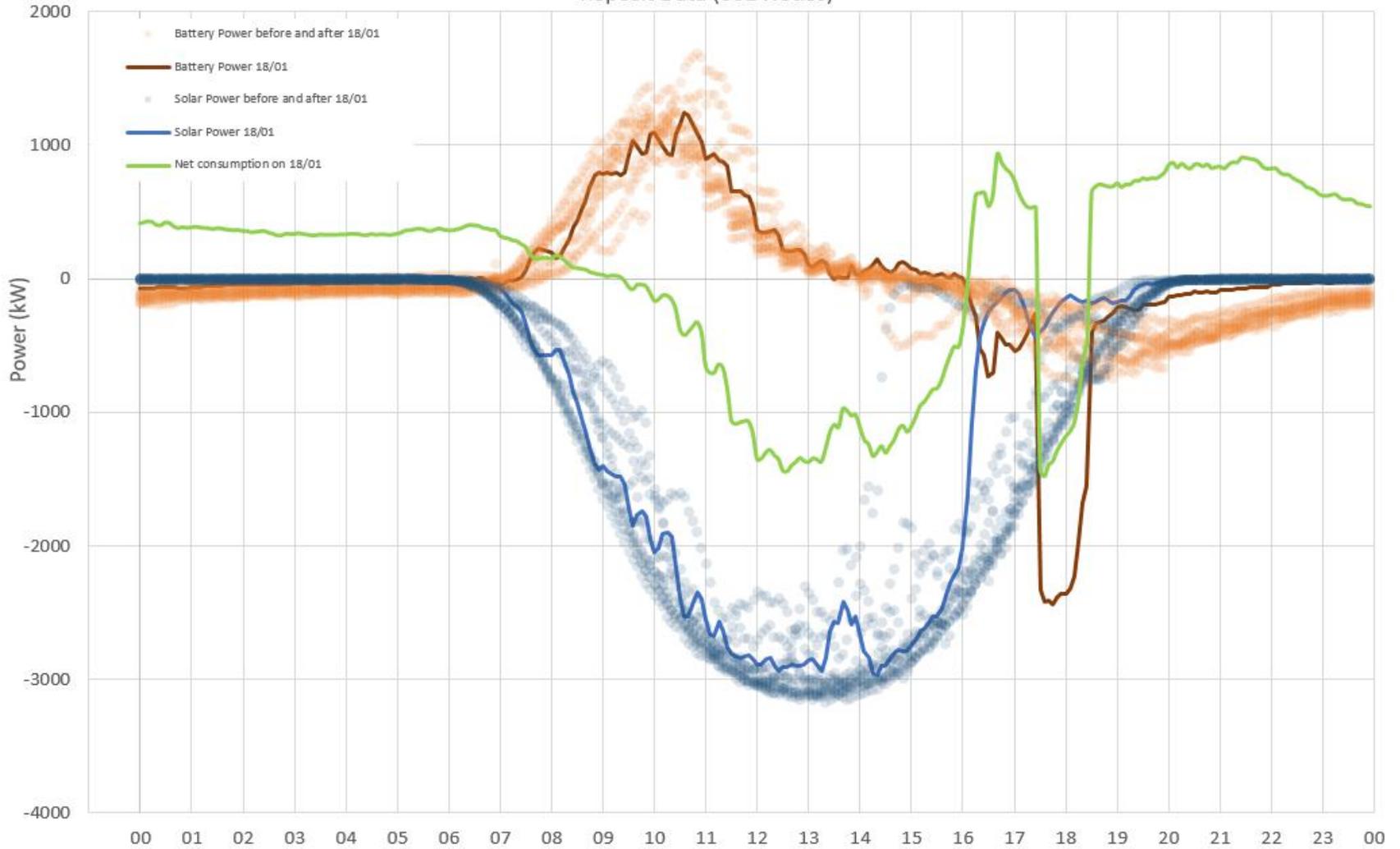
Voltage at the substation and meter



# 18<sup>th</sup> Jan 2019 - NEM heat event



Combined VPP Activity  
Reposit Data (601 Nodes)



# Key insights

- Lack of uniformity in DER design and components limiting response (solar throttled and inverter capacity limitations)
- Availability of fleet can be impacted by other competing dispatches.
- Inclement weather still a factor in battery storage.
- Validation of response difficult without critical mass.
- Functionality is available but the price point is key – appropriate incentive to customer still unknown

# Opportunities for VPP

- Smart meter rollout essential to capture data and cost benefit analysis – Government incentives can assist.
- Utilising batteries to control reverse power flow and charge intelligently using tariff structures or incentive payments.
- Deferring costly network investment using DM solutions aggregated through VPP rollout.



SA Power Networks

# Future vision for VPPs and the distribution network

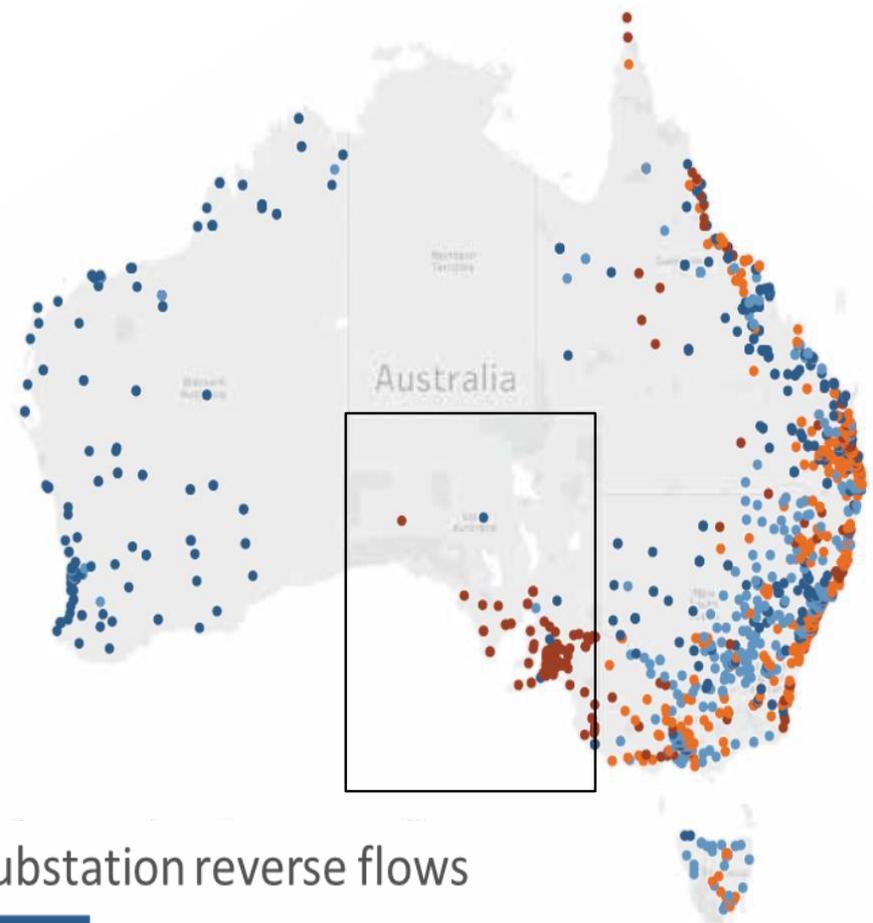
*ARENA VPP knowledge sharing workshop*

11 February 2019

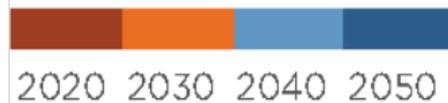


# Our energy system is in transition

- Over the coming decades, 50 – 100% of the energy we consume will be generated by customers' systems within the distribution network
- And SA is leading the charge ...



Timing of zone substation reverse flows



# Tesla household batteries in SA get green light as Sanjeev Gupta reveals electric car factory plan

By Daniel Keane, staff  
Posted Thu at 8:14am



PHOTO: Sanjeev Gupta and Elon Musk will remain major players in the SA energy market. (ABC News/AAP)

South Australia will push ahead with a plan to install battery systems built by Elon Musk's Tesla in 50,000 homes, with the new State Government committing to continue the pro-

RELATED STORY: SA Liberals tight-lipped on M storage plan

RELATED STORY: Elon Musk, SA Premier in de panels, batteries to 50,000 homes

Tesla's giant lithium-ion battery technology

## SA NEWS

# World's largest lithium battery switched on near Jamestown

Bernard Humphreys, The Advertiser  
December 1, 2017 4:17pm

3

# Australian rooftop solar boom rolls on – 351MW in first quarter

19

By Giles Parkinson on 5 April 2018

One Step Off The Grid



RENEWABLE ENERGY FRI 27 APR 18

# South Australia's Last Coal-Fired Power Station Demolished



# Renewable energy target of 50pc reached early in South Australia

2017, 9:39am

Energy production in South hit the state's target almost eight of schedule.

Government's target is for 50 per cent of the energy to be supplied from renewable sources by 2025, and in the past year it has been 48 per cent of its energy has come from renewable-based sources.

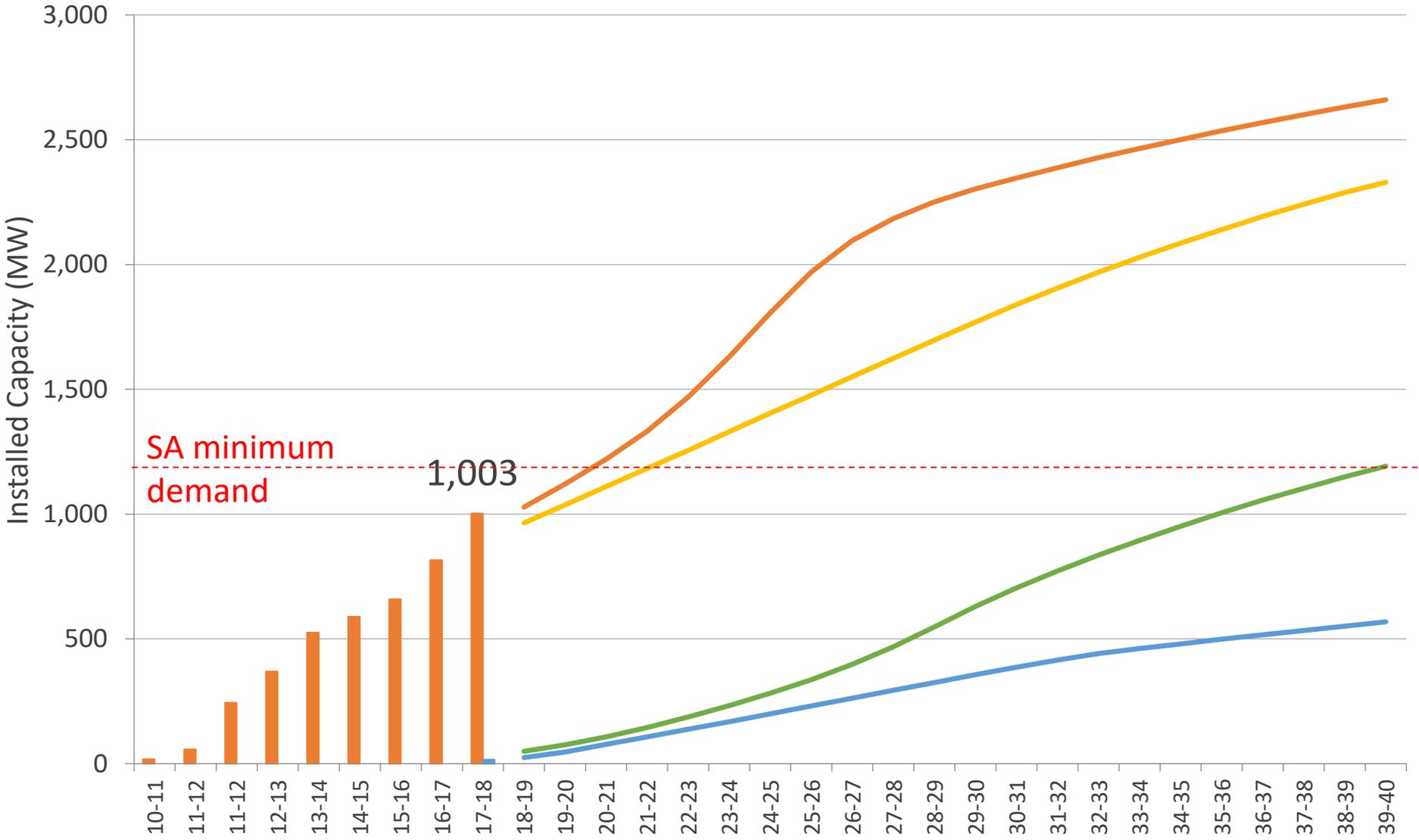


South Australian Energy Minister Tom Koutsantonis described the increase as a "good thing" while also attacking the Opposition, claiming



PHOTO: Energy from wind and solar made up 53 per cent of

# South Australia PV & battery capacity



Forecast source:  
AEMO ISP 2018

Actual PV

Neutral Batteries

Actual ESS

Strong PV

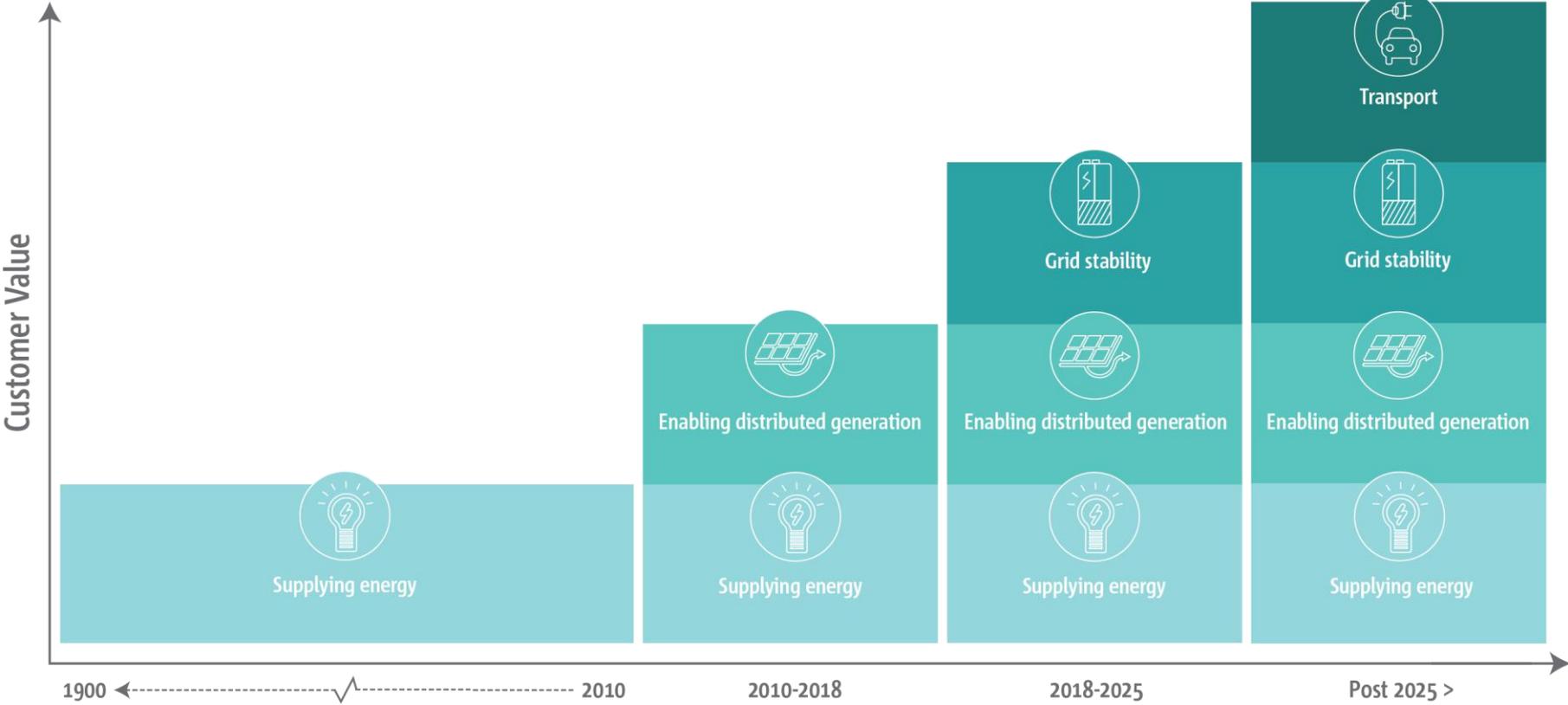
Strong Batteries

Neutral PV

# Virtual Power Plants – the next frontier

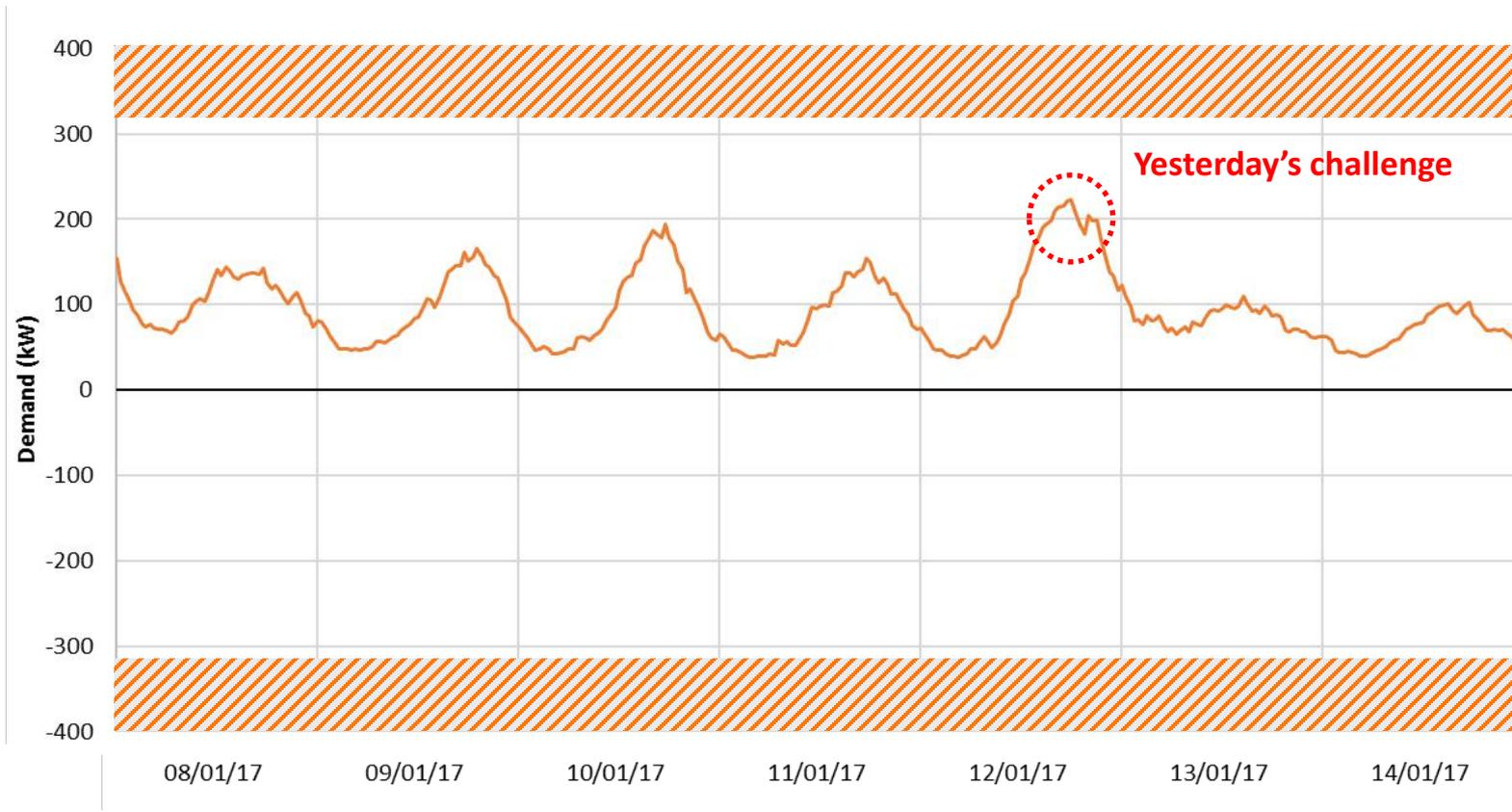


# The changing role of the distribution network



# Distribution level impacts

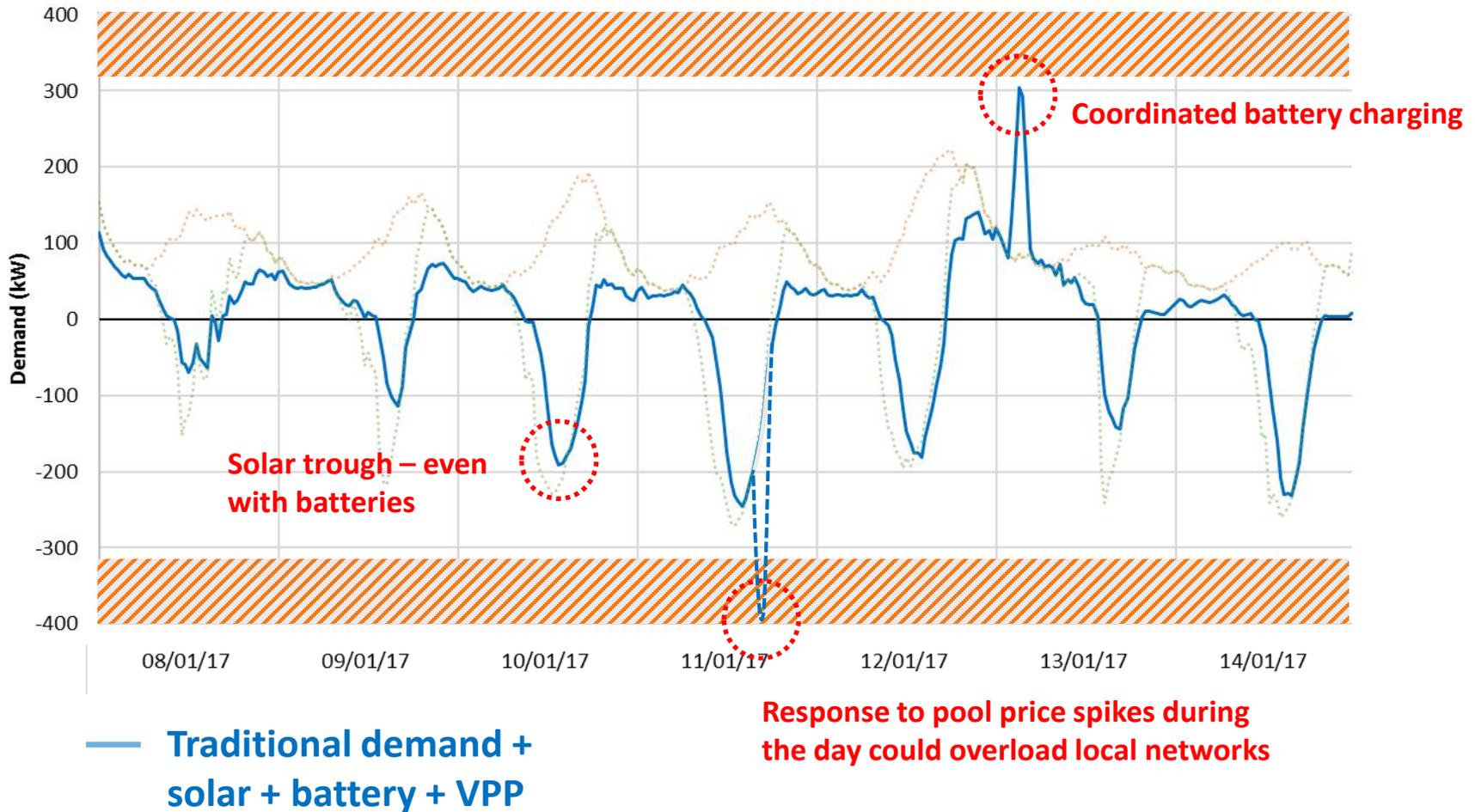
## Network demand – Salisbury battery trial



— Traditional demand

# Distribution level impacts

## Network demand – Salisbury battery trial



## So... VPPs offer tremendous opportunities

- Reduce household energy bills for DER customers
- Add low-cost energy to wholesale market
- Increase competition
- Balancing services for system stability
- Network support services

## ...but bring new technical challenges for networks

- Networks must maintain security and quality of supply for **all** customers
- Almost no visibility of low-voltage network today
- If inverters trip on overvoltage, VPP performance will be affected
- If assets are overloaded, tens or hundreds of customers could lose supply

### WORLD'S LARGEST 'VIRTUAL POWER PLANT' TO LOWER ENERGY BILLS BY 30%

The State Government has unveiled a plan to roll out a network of at least 50,000 home solar and battery systems across South Australia, working together to form the world's largest Virtual Power Plant.

Beginning with a trial of 1100 Housing Trust properties, a 5kW solar panel system and 13.5kWh Tesla Powerwall 2 battery will be installed at no charge to the household and financed through the sale of electricity.

Following the trial, which has now commenced, systems are set to be installed at a further 24,000 Housing Trust properties, and then a similar deal offered to all South Australian households, with a plan for at least 50,000 households to participate over the next four years.

A registration of interest will be open for members of the public who wish to participate in the program.

The Government has released a market notice for a retailer to deliver the program, with a preference of bringing more competition into the market.

Analysis by Frontier Economics shows the 250MW plant is expected to lower energy bills for participating households by 30 per cent.

Additionally, all South Australians will also benefit from the increased generation in the South Australian energy mix, with lower energy prices and increased energy stability.

The State Government is assisting the rollout with a \$2million grant and \$30million loan from the Renewable Technology Fund.



# Customer engagement



**2,892**  
participants



**43**  
Engagement  
activities



**36**  
Reference Group  
meetings



**13**  
Locations across  
South Australia



**10**  
Newsletters



**4,071**  
talkingpower.com.au  
visits

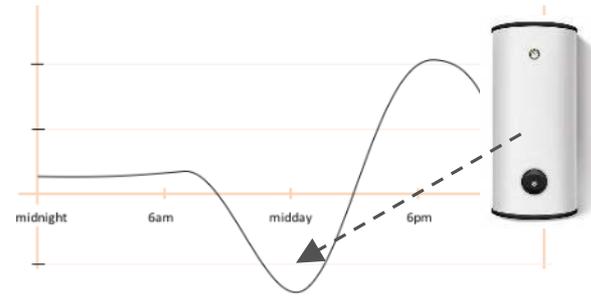
Customers want us to:

- enable continued uptake of DER
- ensure the network can handle bidirectional energy flows
- invest moderately to enable this
- see how technology develops and avoid expensive network upgrades that might be under-utilised

# Strategies to increase capacity



**Smart inverter settings**  
*AS4777.2 Volt/VAR  
response modes*



**Shifting controlled load  
into the solar trough**



**Tariffs and price signals**  
*Incentives for customers*



**Improved voltage control and  
network nominal voltage**

# What can we do when we reach capacity?

## 1. Reduce or cap per-customer export limits

*E.g. once local hosting capacity reached, limit new systems to zero export*

## 2. Invest in increasing network capacity to support DER

*Upgrade the network or procure demand-side services to support DER growth*

## 3. Dynamic DER management

*Manage DER output only at times when necessary to remain within network capacity*

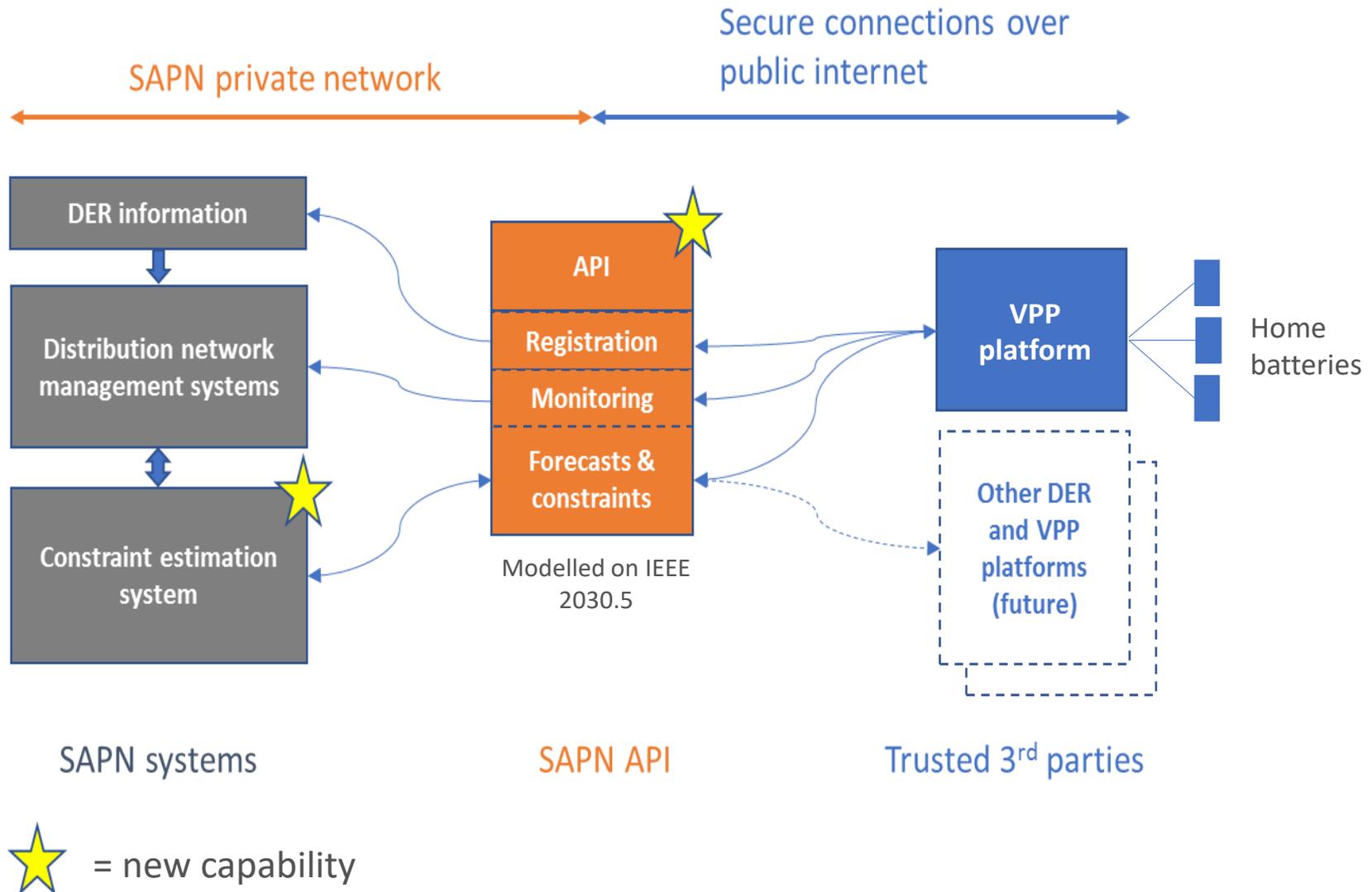
*“Static limits on export are a blunt approach to addressing the impact of distributed energy resources on the network...”*

*“prohibiting new DER systems from exporting where local hosting capacity has been reached or imposing broad restrictions is unlikely to be efficient or to meet customer expectations...”*

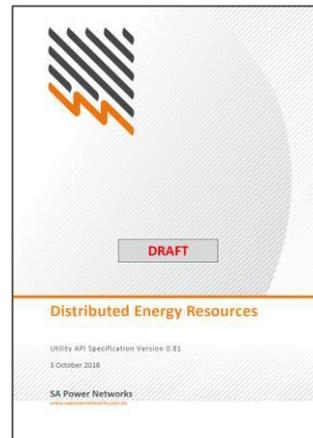
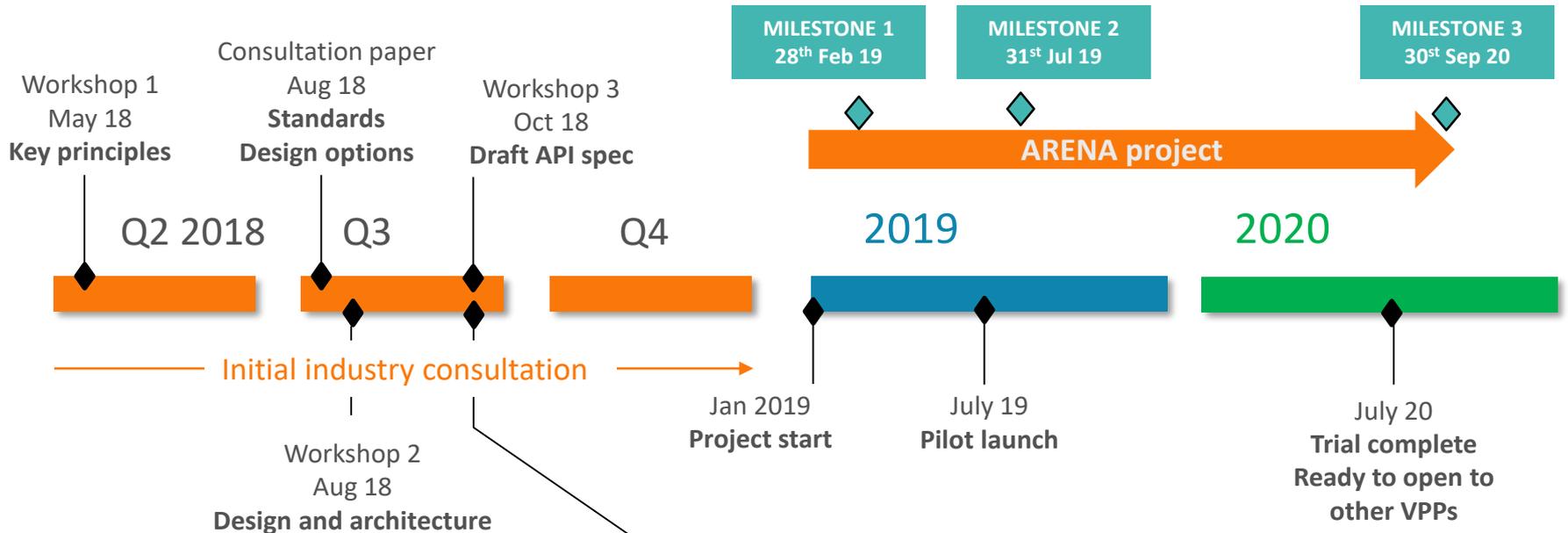
*“The Commission considers a more sophisticated and dynamic approach such as managing output to meet security, reliability and safety needs of the network would be better suited to managing the increasing penetration of DER.”*

AEMC Economic Regulatory Framework Review report “Promoting Efficient Investment in the Grid of the Future”, July 2018

# Reference architecture



# SA Power Networks' DER API journey



- VPPs will play a key role in a future energy system dominated by distributed and intermittent generation
- Home batteries will deliver greater benefits when enrolled in VPPs
- Today's networks have considerable capacity to deliver energy to and from VPPs most of the time
- However, large VPPs could easily exceed the limits of the local network if dispatched without regard to network constraints at certain times
  - this is in no-one's interest
- To maximise access to available network capacity and enable VPPs to reach their full potential will require:
  - Open access to dynamic, locational network constraint information
  - Common communications standards
  - Visibility and forecasts
  - Well-defined fallback / off-line behaviour
  - Integrated control of solar and battery output will be beneficial



[sapowernetworks.com.au](http://sapowernetworks.com.au)



# Safeguarding consumer outcomes

*The Behind-the-Meter Code of Conduct  
and emerging energy services*

Dean Lombard  
Senior Energy Analyst

**renew.**

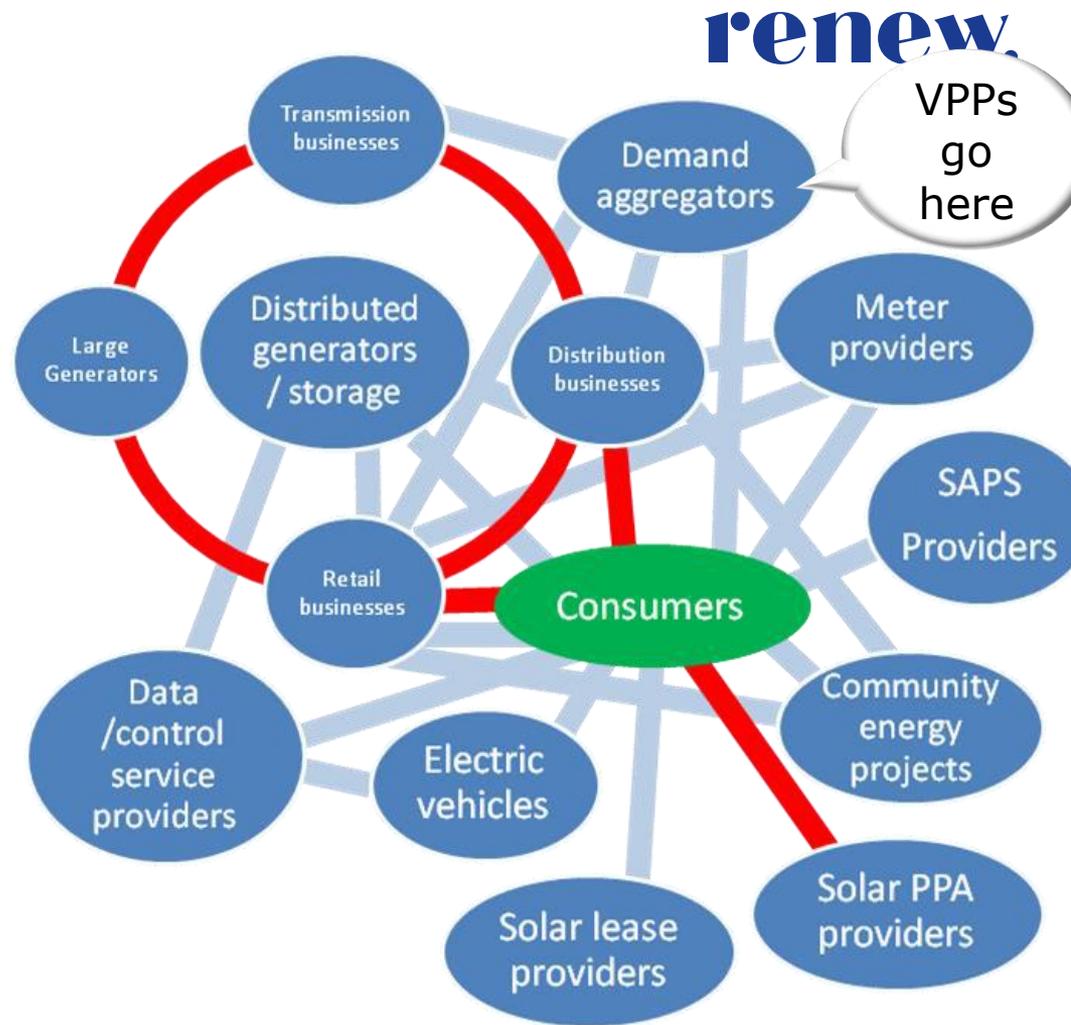
# The problem

Energy consumer protections are predicated on sales of energy in the NEM.

Transactions outside this are not captured by the National Energy Consumer Framework (NECF).

**Current NECF relationship**

**Non-NECF relationship**



# The solution?

2016 COAG  
Energy Council  
consultation on  
consumer  
protections for  
behind-the-  
meter products  
and services.

Caveat  
empton?

More  
regulation?!?

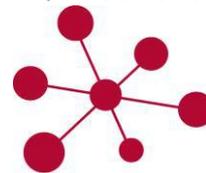
Redefine the  
scope of  
NECF?!?

W.



2017

**A  
voluntary  
industry  
code of  
conduct!**



public interest  
ADVOCACY CENTRE



# The BTM Code

Building on the CEC Code, but broader in scope and technology-neutral.

Expected to go live by the beginning of 2020.

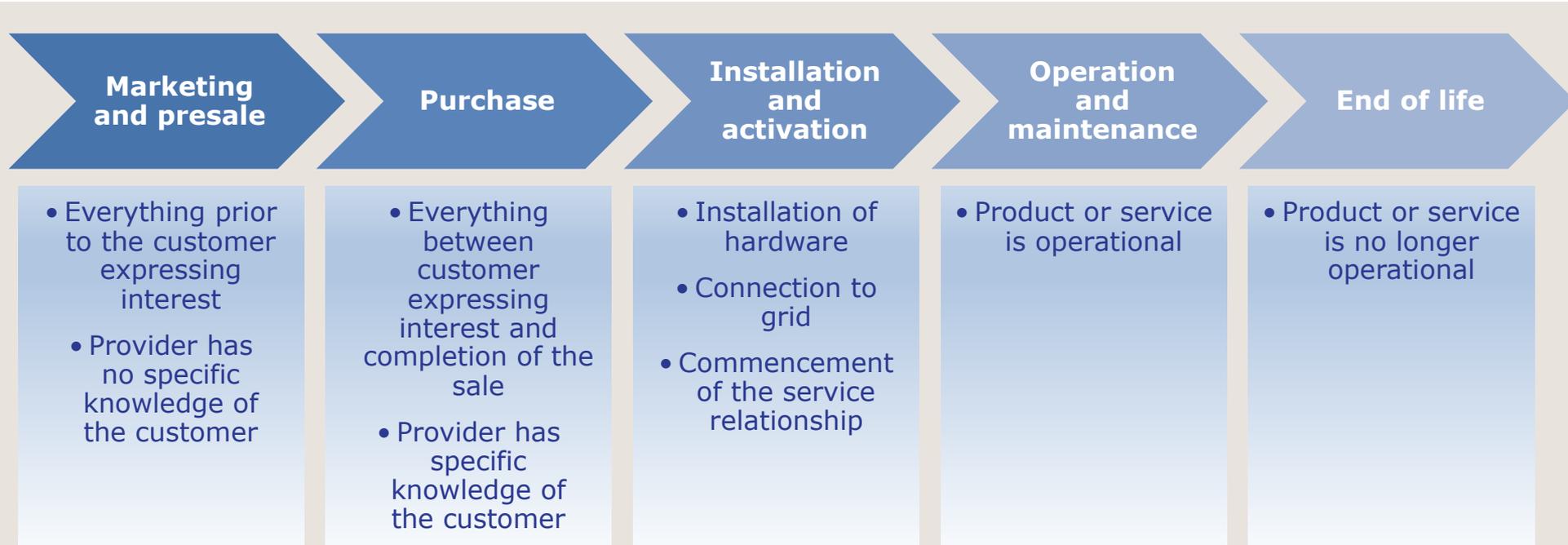


**renew.**

- ✓ *Initial draft*
- ✓ *General consultation*
- ✓ *Technical consultation*
- Final draft*
- ACCC review*
- Final version*
- ACCC authorisation*

# The customer journey

renew.



*At each stage in the customer journey there are principles that will underpin good customer outcomes.*

Marketing  
practices

Dispute  
resolution

Explicit  
informed  
consent

Fit-for-purpose

Finance

Warranties

Privacy and  
data collection

Compliance and  
enforcement

*The BTM Code aims to fulfil two roles:*

- *Clarify the application of Australian Consumer Law*
- *Provide additional protections where necessary*

*PRINCIPLE: representations of the value of a product or service must use reasonable assumptions and consider site-specific factors*

## Solar panels

Annual generation estimate considering:

- location
- shading
- orientation
- known DNSP restrictions

Bill savings and RoI based on:

- generation estimate
- actual or typical electricity tariff
- actual consumption patterns
- declining performance over time

## Virtual Power Plant

Where paid per event, compare with BAU considering:

- approx. number of events
- clear info about payment
- impact on battery life & performance

Where paid via discount hardware, bill savings and RoI based on:

- typical electricity tariff
- actual consumption patterns
- impact on battery utilisation and health

# Some issues for VPP customers

renew.

## The value proposition

- How does the customer figure out if it's a good deal?

## Privacy and security

- Data usage and rights

## Finance (where applicable)

- Impact of payment difficulties or defaults → use of licensed credit providers

## Obligation to participate

- Ability to override remote control?
- How often and with what consequences?

## Obligation to facilitate

- Customer provision of internet access?
- What if energy usage increases and battery is not sufficiently charged?

## Adverse impacts

- Impact of VPP operation on battery
  - battery cycles → health → lifetime
  - warranty conditions

## Change in circumstances

- What happens if house is sold?
- Exit fees?

# Benefits

## Ensure customer is considered

- Sometimes customer perspective is overlooked in planning and delivering innovative tech programs

## Minimise adverse outcomes

- Social license can be compromised if there are poor customer outcomes

## Stand out in the market

- Accreditation differentiates businesses from those who are unaccredited

## Consumer confidence

- Good customer protections build consumer confidence

# Risks

## Compliance and enforcement

- Poor compliance and enforcement undermines the value of a code of conduct

## Coverage

- Low coverage compromises consumer and industry outcomes:
  - Too many unaccredited businesses behaving poorly entrenches poor consumer outcomes
  - Low membership limits economies of scale that make membership affordable to small players

renew.

## *VIRTUOUS CIRCLE*

*The more businesses that are accredited:*

- the more accreditation is a market advantage*
  - the cheaper accreditation fees will be*
- the more the code is a consumer benefit*

# Thank you

More information:

[cleanenergycouncil.org.au/advocacy-initiatives/behind-the-meter-code](http://cleanenergycouncil.org.au/advocacy-initiatives/behind-the-meter-code)

*Dean Lombard*

[dean@renew.org.au](mailto:dean@renew.org.au)

*Renew's participation in the BTM Code project was funded by Energy Consumers Australia ([www.energyconsumersaustralia.com.au](http://www.energyconsumersaustralia.com.au)) as part of its grants process for consumer advocacy and research projects for the benefit of consumers of electricity and natural gas. The views expressed in this presentation do not necessarily reflect the views of Energy Consumers Australia.*

**renew.**

# CONSORT

## Bruny Island Battery Trial

# Learnings from householder responses

ARENA VPP Workshop 11-12 Feb, 2019

Dr Hedda Ransan-Cooper, on behalf of CONSORT social science team  
Research Fellow, ANU

[Hedda.ransan-cooper@anu.edu.au](mailto:Hedda.ransan-cooper@anu.edu.au)



# What is the Bruny Trial?

**How can we enable “residential power plants” to provide services to the power system in a safe way for networks?**

**= *Network Aware Coordination***

- ARENA funded
- ~7.9m total value. \$2.9m ARENA funding)
- Collaboration: ANU, USyd, UTAS, Reposit Power, TasNetworks
- April 2016 – March 2019
- 3 year research/2 year trial
- Manage cable load and Diesel use with the NAC (Network Aware Coordination)
- ~150 kW battery capacity
- ~34 customers

# Social science contribution

*What are the householder responses?*

## **Methods**

- 3 in-depth interviews with each household– 1 prior to install, 1 just after install and 1 (about) a year after install
- House observations
- context observations, observations of processes, energy diaries
- focus groups pre and post.

34 Participants: mix of lifestage, and socio-economic backgrounds



# What is driving customer decisions?

- Environmental and social values
- Cost
- Values of self-sufficiency (ie. battery gets used as much as possible within household)
- Battery as backup

## “Typical” participant

- Well educated (but not early adopters)
- Keen to help the community/the environment
- Easily overwhelmed by installation – often went with the person they felt they could trust; who seemed ‘expert’
- Confused about the details of how network support works, and the financial nitty gritty of the tech, tariffs, etc
- Willing to change behaviour, interested in own energy use

# Key pleasure/pain points on the way...

## Pleasure

- Excited about the clean tech
- Enjoyment of monitoring own energy consumption
- Confidence from the learning curve

## Pain

- Sense of being overwhelmed by tech choice
- Frustration with slow install and tech support
- Confused to anxious about the details of the tech, trial, tariffs, etc

# Installation overwhelm

*That guy came here and blinded me with statistics, and pages and pages of stuff. And what I found that each installer - and I said to people it's like choosing an insurance policy. Everyone's got their own version of what solar system is best for you.*

*And remembering I knew nothing about solar systems before this at all, bar the fact that I was always thought the return would take about 20 years or so. BT122*

# Concerns, opportunities and information needs

- Information needs are significant – TasNetworks, Reposit, social researchers all called on much more than anticipated
- Tailored support needed – prefer face to face information sessions; need for it to be ongoing (one-off won't work)

# BT112

*Nobody seems to be really on top of knowing. I don't think from beginning to end there's been enough actual information of how it all works and how it all happens. And that's I think there should have been a lot more information. It shouldn't just have come from the installer. It should have come from the program itself. They needed to write the idiots guide, basically. BT 112*

*Well in a sense we don't use it, it does it by itself, it's not like learning to use a new stove or a new appliance. It just does it and I guess at the moment it's because we can't use the app to read what's happening, it's a little bit of well we've still got our electricity. We don't really know what's happening with it. And that's a little bit annoying I guess in a sense because you want to know what's happening with something that's been installed. And so that is quite frustrating when not just this interview, but a lot of people say, 'Oh how's it going?' and you go, 'No real idea'.*



## A cautionary quote

Yeah, so how do you feel about your batteries being used by TasNetworks when it needs extra electricity?

I want to use it all, I don't want to give them any. Why should I give them any? Everybody's response would be like that, they'd want to use every bit of their own power, instead of selling it back at peanuts to Tas Energy [sic], why do we want to sell it back at peanuts, when they're paid the full price, that's not a sensible idea.

BT 116

## Lessons learnt (among others)

- Prosumer participation in network should not be taken for granted
- Background of distrust
- Baseline: valuing self-sufficiency and control over battery
- Battery also valued as back-up - enable that capability
- Level of 'engagement' highly variable - need for range of choices in network support

The Australian Government, through the Australian Renewable Energy Agency (ARENA), is providing \$2.9m towards the \$8m CONSORT project under its Research and Development Programme

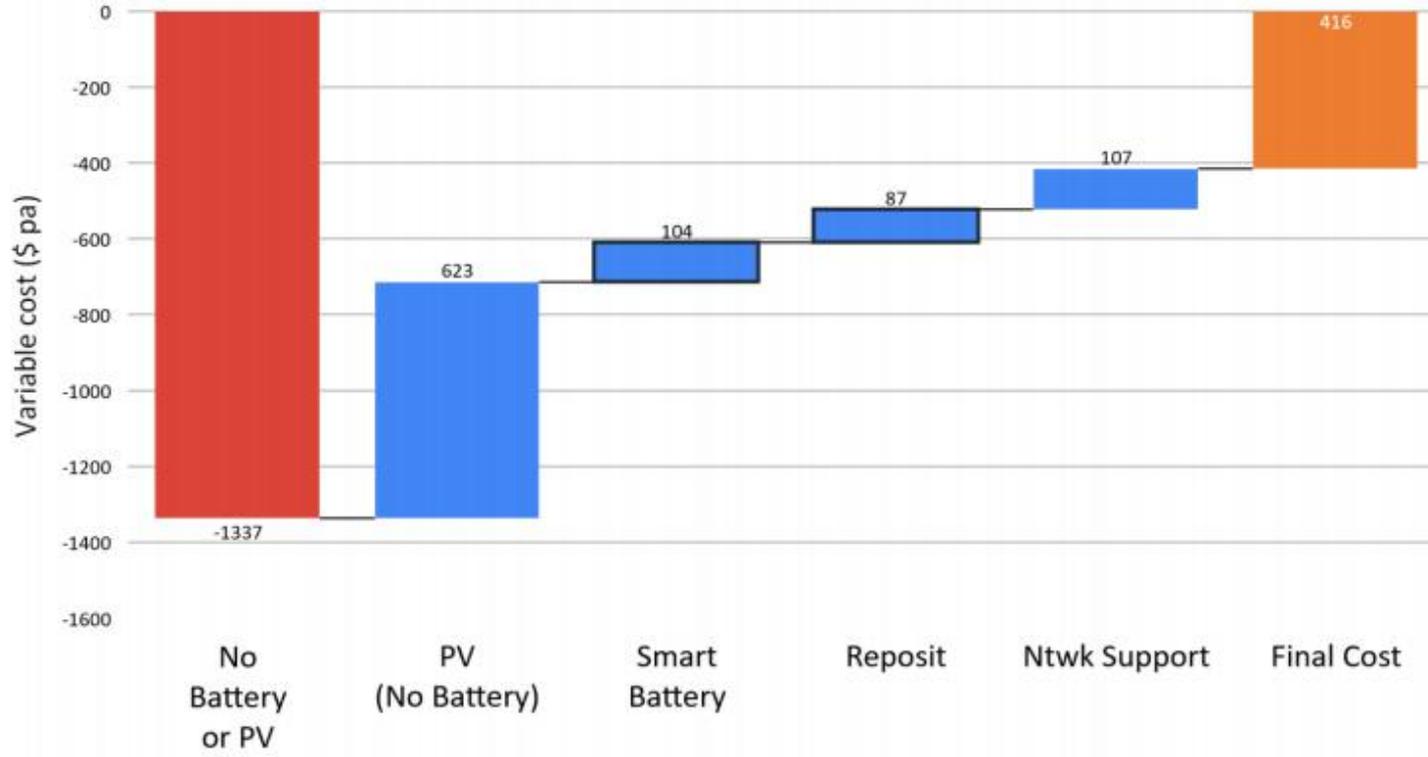


Thank you to the social research team on CONSORT: Professor Heather Lovell; Dr Phillipa Watson; Dr Hedda Ransan-Cooper; Dr Andrew Harwood; and Veryan Hann.

CONSORT's overall research lead: Professor Sylvie Thieboux, ANU



Average system component benefits



Overall benefit - \$921

## Range of Benefits

*Benefits house to house varied. Benefits in each house are primarily influenced by: the capacities of the system and the energy consumption of the household.*

	<b>\$ Benefit/saving</b>	<b>% Benefit/saving</b>
<b>Lowest benefit</b>	301	43
<b>Median benefits</b>	912	111
	1003	53
<b>Average benefit</b>	921	69
<b>Highest benefit</b>	1457	107

An aerial photograph of a suburban neighborhood. The houses have various roof colors, including red, brown, and blue. Many houses have swimming pools in their backyards. There are trees and greenery throughout the area. A road runs through the middle of the neighborhood.

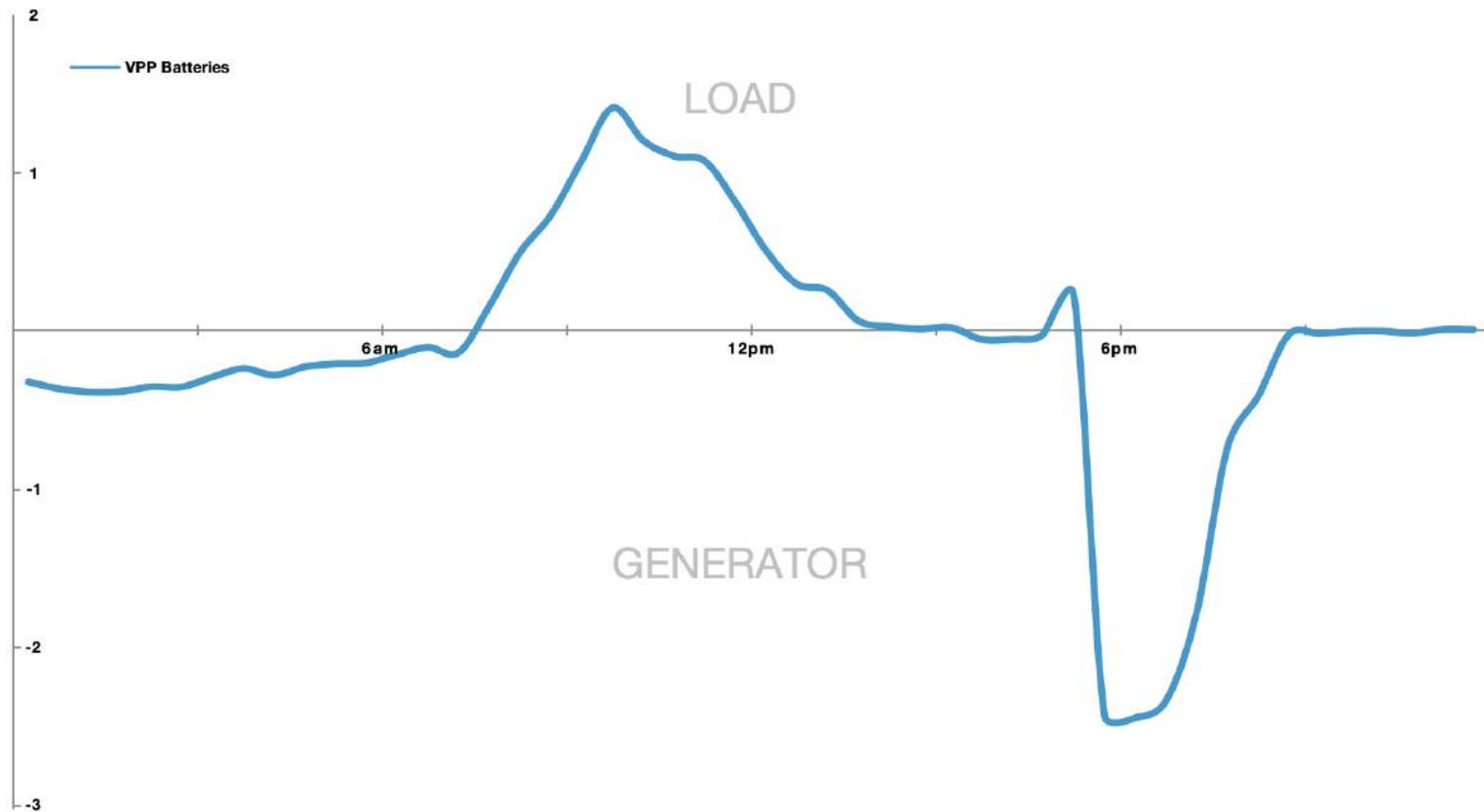
# Getting Customers Involved In VPPs

Mitch O'Neill  
Strategy Lead - Reposit Power  
February 2019

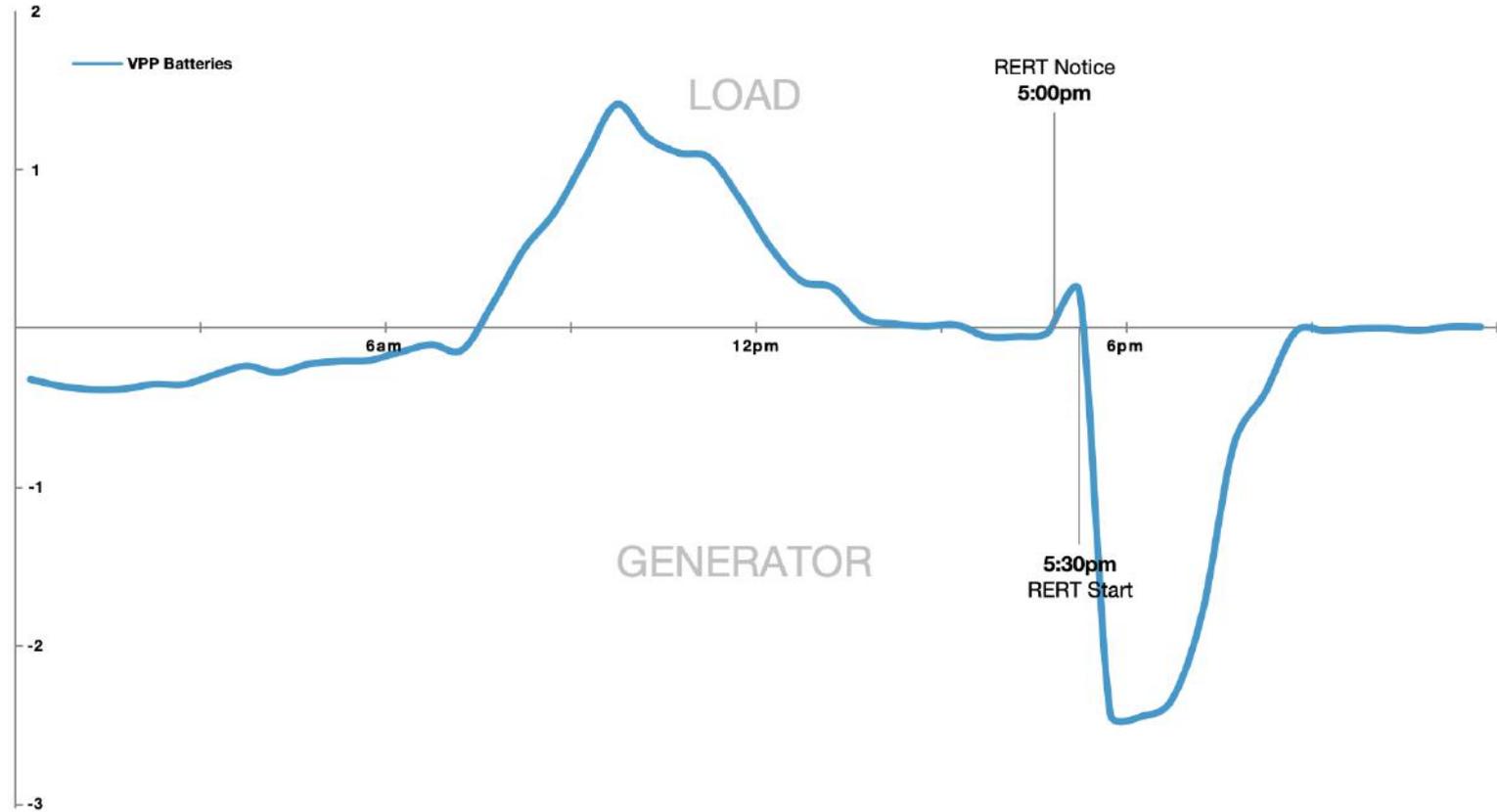
A black and white photograph of a utility pole with numerous power lines and a metal cabinet on the right side. The pole is the central focus, with many wires and cables attached to it. The metal cabinet on the right has a door with a handle and some internal components visible. The background is a clear sky.

What are the risks when residential batteries are not participating in grid management programs?

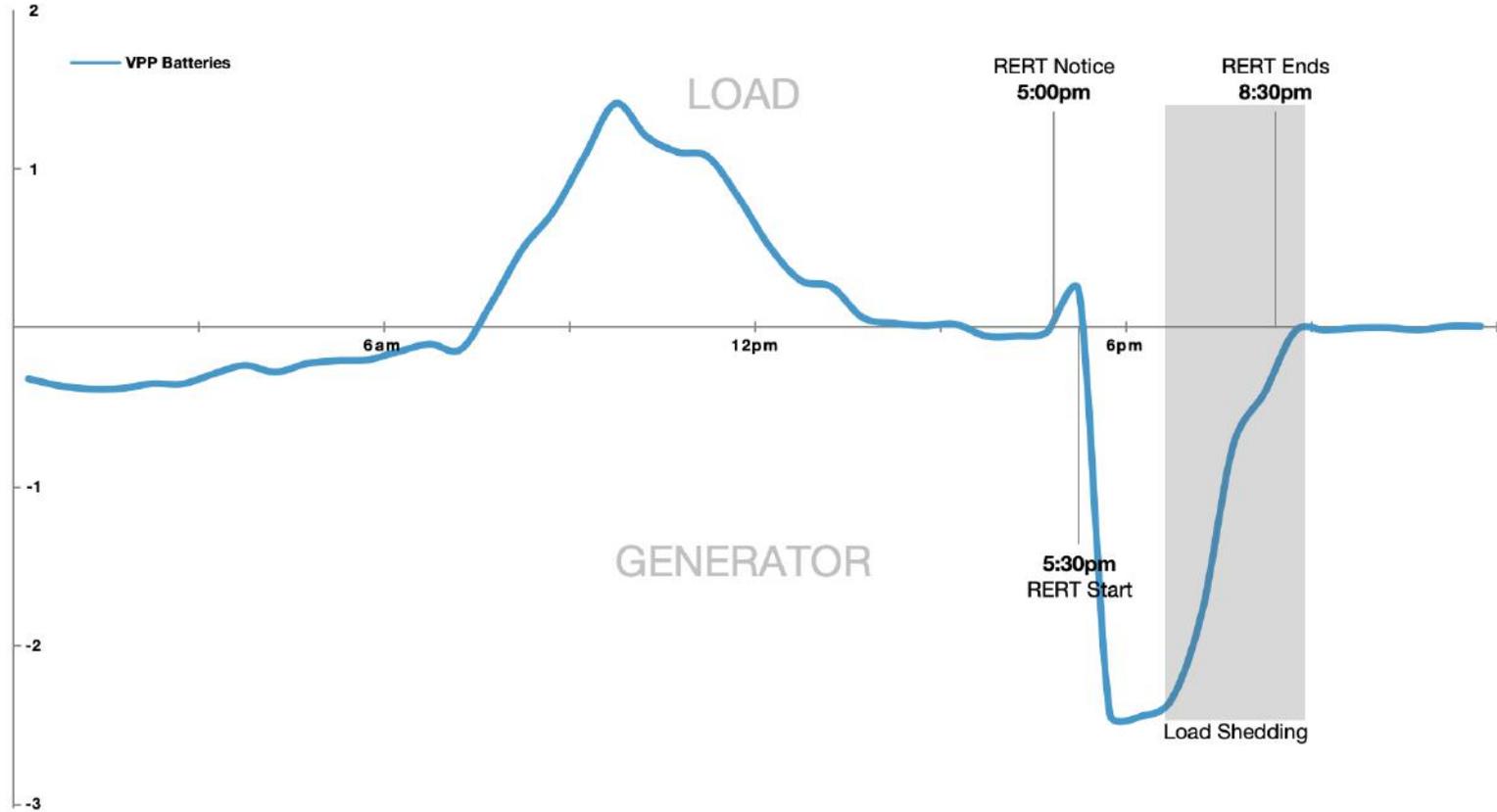
# Victoria Jan 24<sup>th</sup>



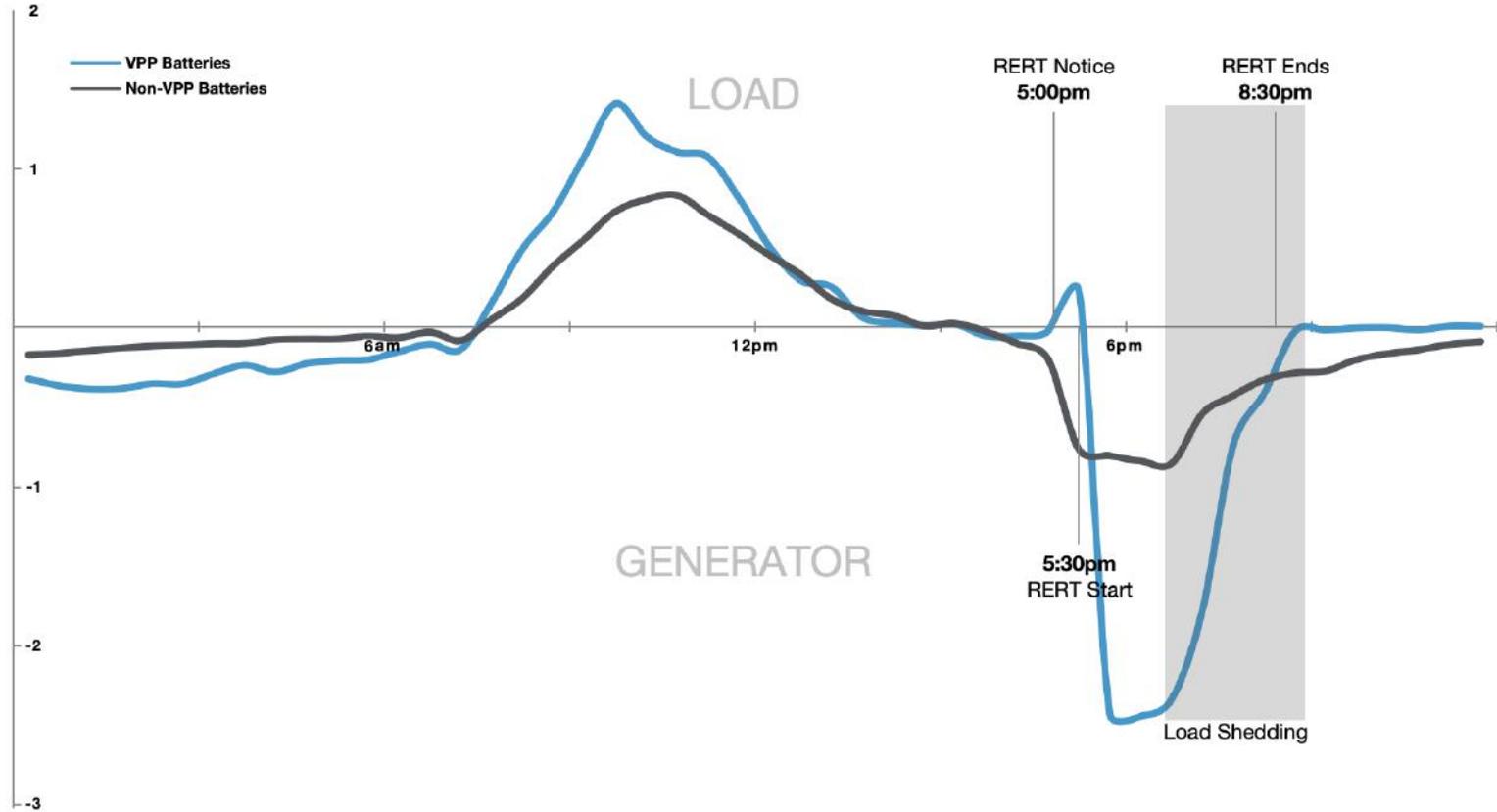
# Victoria Jan 24<sup>th</sup>



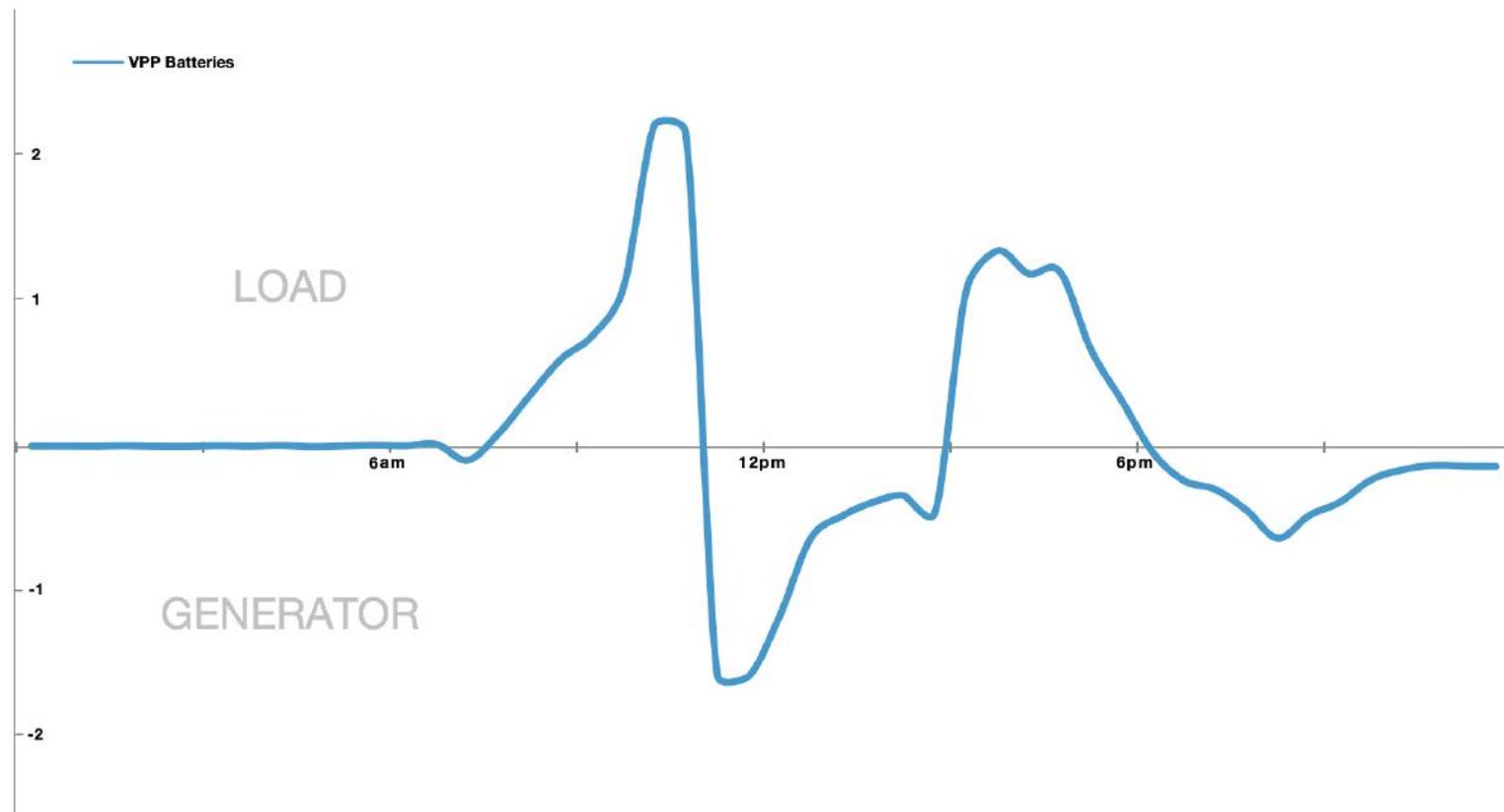
# Victoria Jan 24<sup>th</sup>



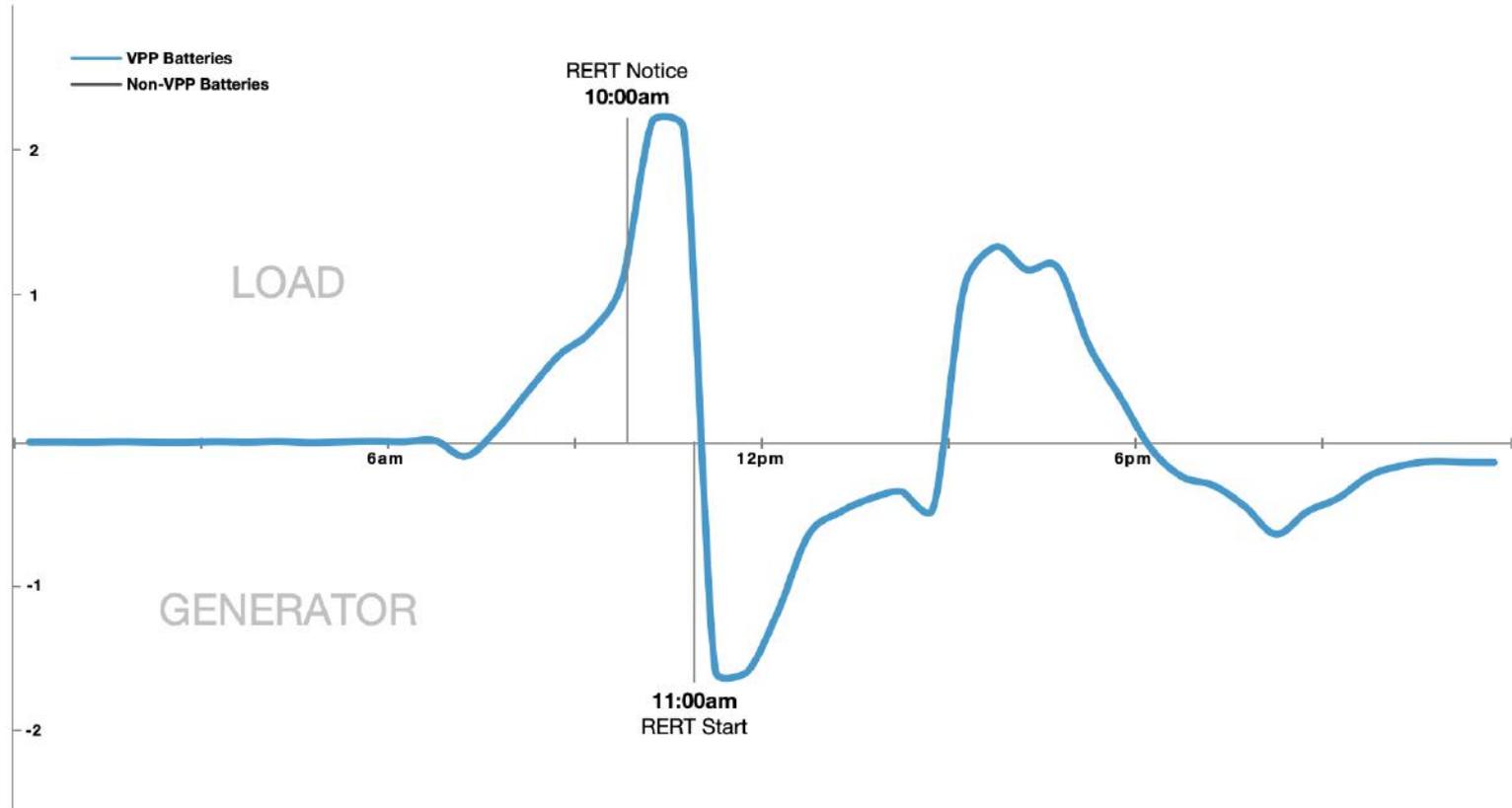
# Victoria Jan 24<sup>th</sup>



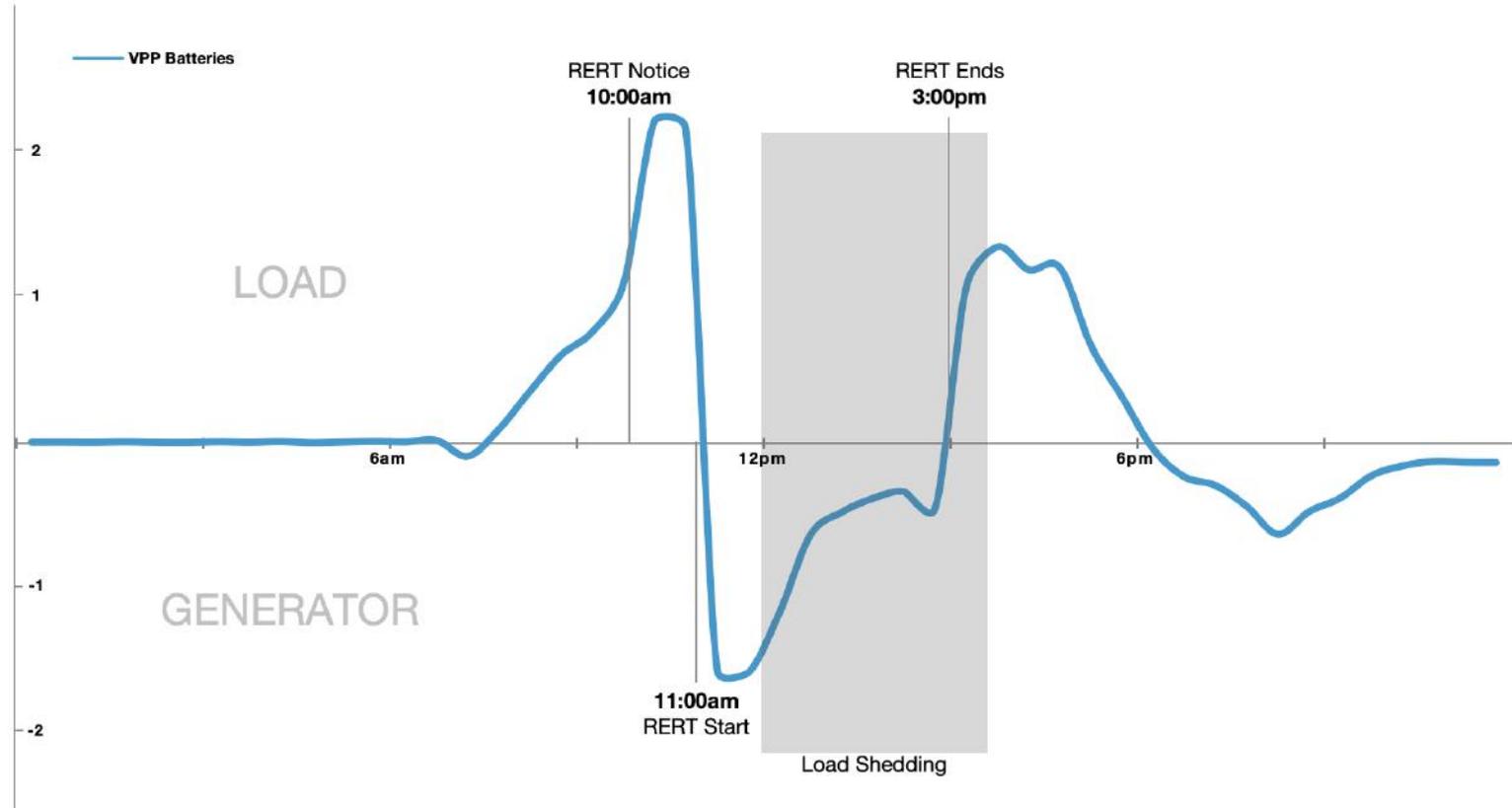
# Victoria Jan 25<sup>th</sup>



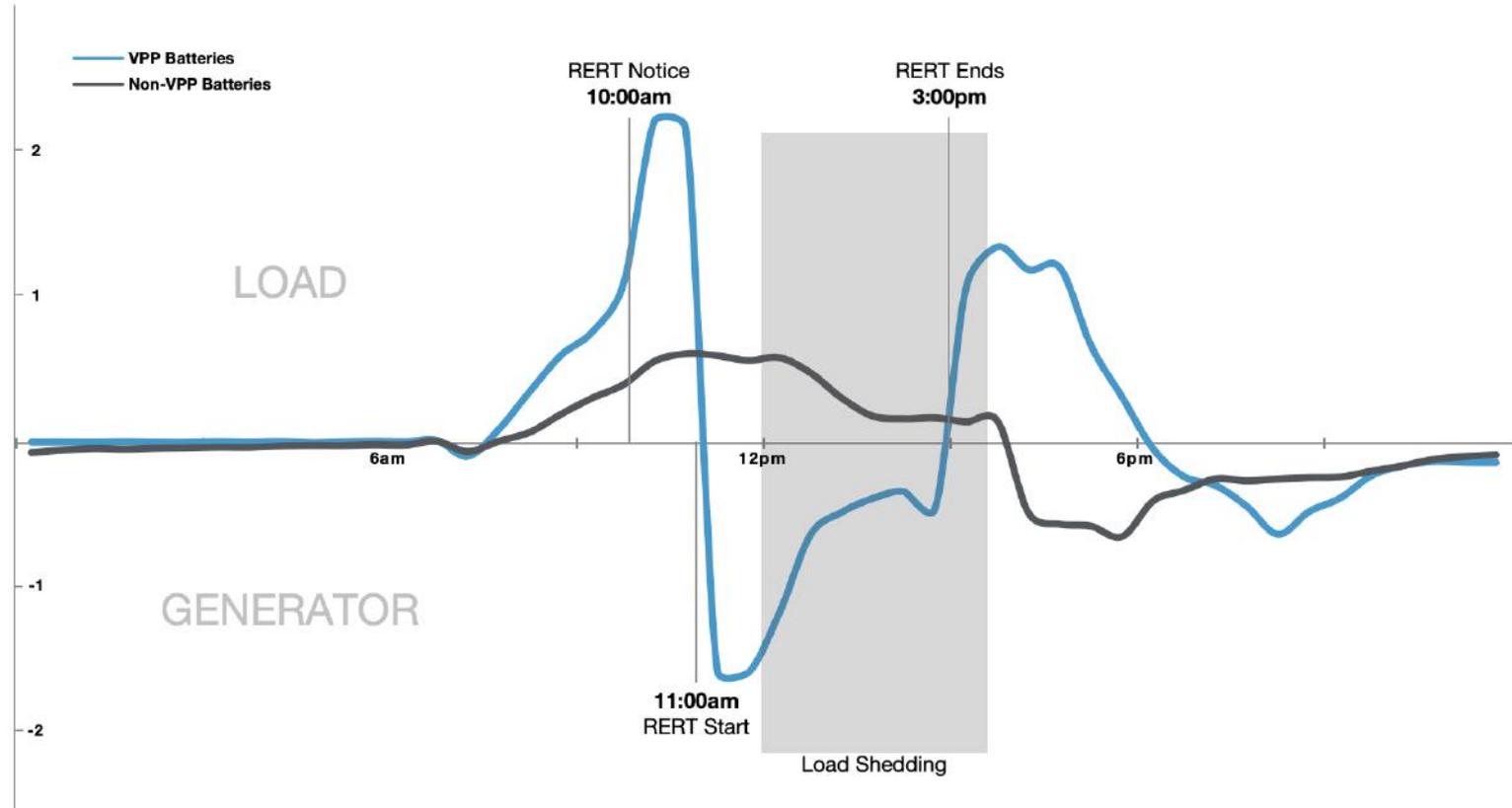
# Victoria Jan 25<sup>th</sup>



# Victoria Jan 25<sup>th</sup>



# Victoria Jan 25<sup>th</sup>



Non-VPP batteries created 0.6KW average extra load during load shedding

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If we assume 3,000 Non-VPP batteries in VIC

Non-VPP batteries created 1.8MW extra load during loading shedding

Non-VPP batteries created 0.6KW average extra load during load shedding

If we assume 3,000 Non-VPP batteries in VIC

Non-VPP batteries created 1.8MW extra load during loading shedding

Assume houses use 5KW on average

**Non-VPP batteries caused an extra ~350 houses to experience blackouts**

# Factors that increase (or decrease) VPP participation rates

Two things are required for a customer to participate in a VPP:

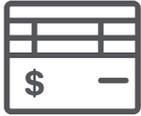
- The ability to be in a VPP (correct hardware, software, retail plan, etc)
- The desire to be in a VPP

Decisions around the structures and goals of programs will effect the percentage of customers who have the ability and desire to be in a VPP, and therefore the total VPP participation rates.

# The ability to be in a VPP

(Hard constraints)

# The Complexities Of Retrofits



Higher cost due to installation overhead



Increased complexity with multiple installers



Customer highly motivated during initial install

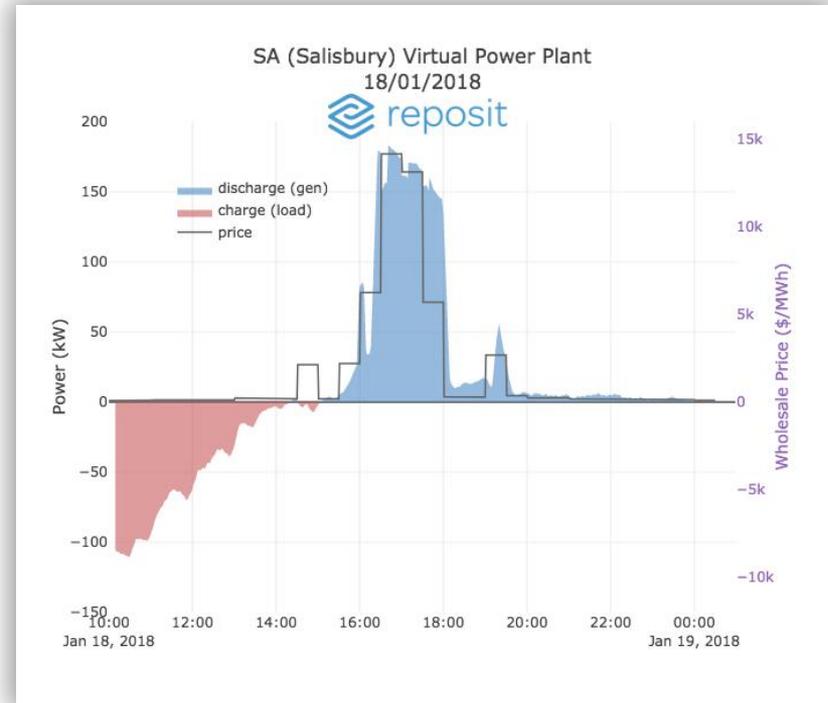


# Demonstrations Prove Capability

“Technically capable” to actually in a VPP can be a large chasm to cross

Customers are left with systems that can't meet their expectations

Low risk option: Do what AEMO does, prove capability through demonstrations



# The desire to be in a VPP

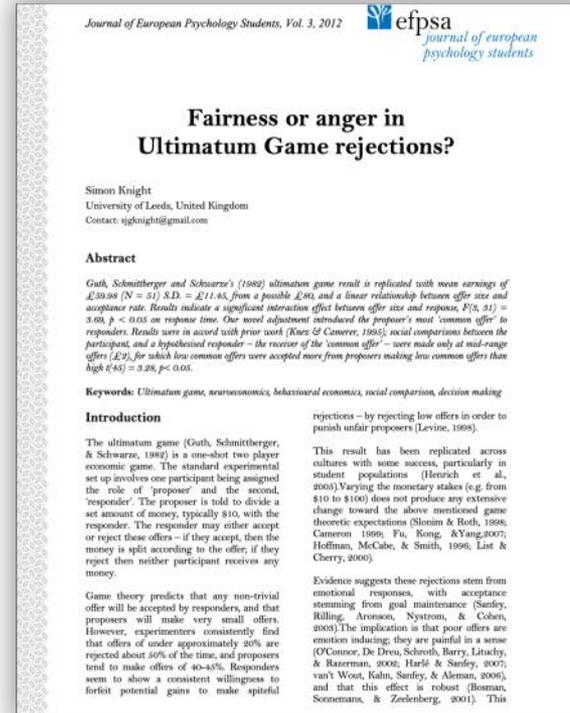
(Soft constraints)

# Participation strongly correlated to perception and trust

How a program is perceived (e.g. giving my energy vs taking my energy) matters

No existing mental model for customers to understand and compare programs

Increasing the financial value on offer won't overcome poor trust or perception



MENU THE AGE SUBSCRIBE 0

NATIONAL VICTORIA

## Tiny home batteries propping up Victoria's coal-fired power plants

By Adam Carey

Updated January 30, 2018 — 5:50pm, first published at 12:15am

f t e A A A

Bill Childs switched on the airconditioning inside his Williamstown house on Sunday to ward off the sticky heat, just like hundreds of thousands of other Victorians.

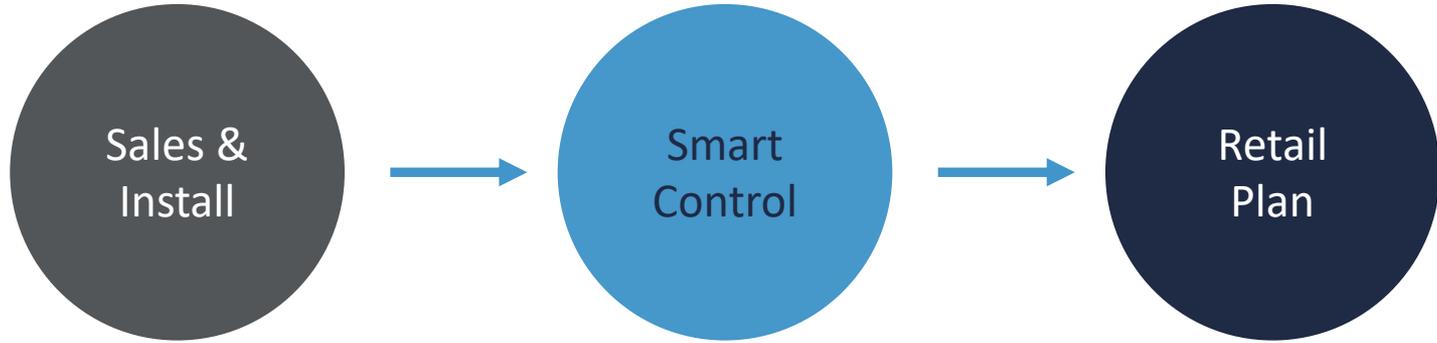
But unlike most of us who pay a price for keeping cool on hot days, Mr Childs made a bit of money out of the electricity retailers, as he has on most of the hottest days this summer.



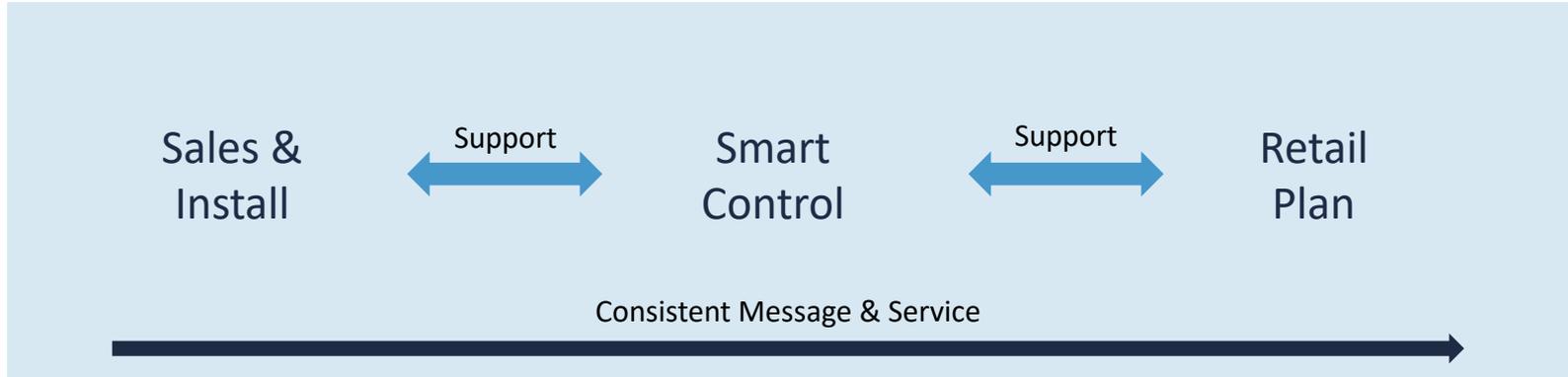
## VPPs offer more to customers than just financial value

"It's not going to buy me a new car but the thing that it did give us was ... a little nice feeling that we've done something useful, we've helped the Victorian power system just get over a little hurdle," Mr Childs said.

# The customer journey is a continuous process



# The customer journey is a continuous process



Trust is built throughout the process

Customers are prone to dropout if they hit a barrier

The customer journey is as strong as your weakest link

	Factors that decrease VPP participation rates	Factors that increase VPP participation rates
Hard Constraints	Retrofits	Encouraging all-in-one install
	Tech specs only	Demonstrated capability
Soft Constraints	Low trust and perception	High trust and perception
	Weak links in customer journey	Strong customer journey



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VPP Knowledge Sharing Workshop

Opportunities and issues in customer/installer relationship

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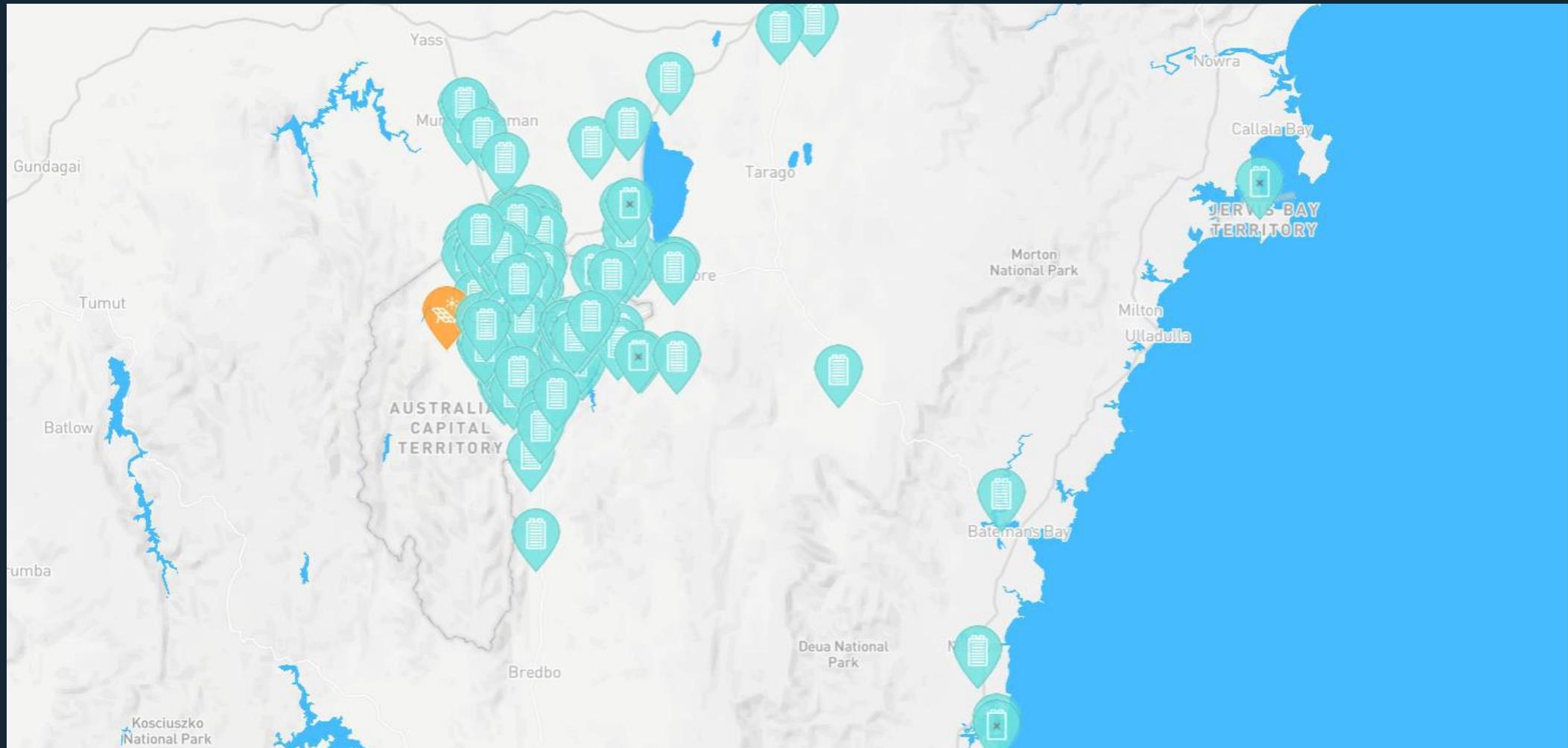
# Capital Region VPP

- Initiated in 2016 following launch of ACT NextGen program
- Grown to over 800 batteries – ~4MW
- SolarHub has installed around 580 batteries in the VPP all connected to Reposit
- Growing at 15 new installs per week
- A number of grid events responded to throughout 2018 in trials with EVO Energy, ActewAGL retail and Reposit
- VPP was the winner of the Sir William Hudson award Australian Engineering Excellence Awards



solarhub

# VPP Node Map





solarhub

# What does an installation look like





solarhub

# What does an installation look like



# The lure of the \$0 bill

- Solar on its own can only reduce bill by 40-50%
- Battery improves this to 80-90% - some have managed 100% across an entire year
- Improved self-consumption alone unlikely to get to \$0 bill
- VPP provides another income stream for battery owners:
  - Time-of use feed-in tariffs
  - Payments to respond to grid events (frequency, voltage, load)
  - Demand response incentives
- Being part of a collective/community also a powerful driver

# Impediments to faster uptake

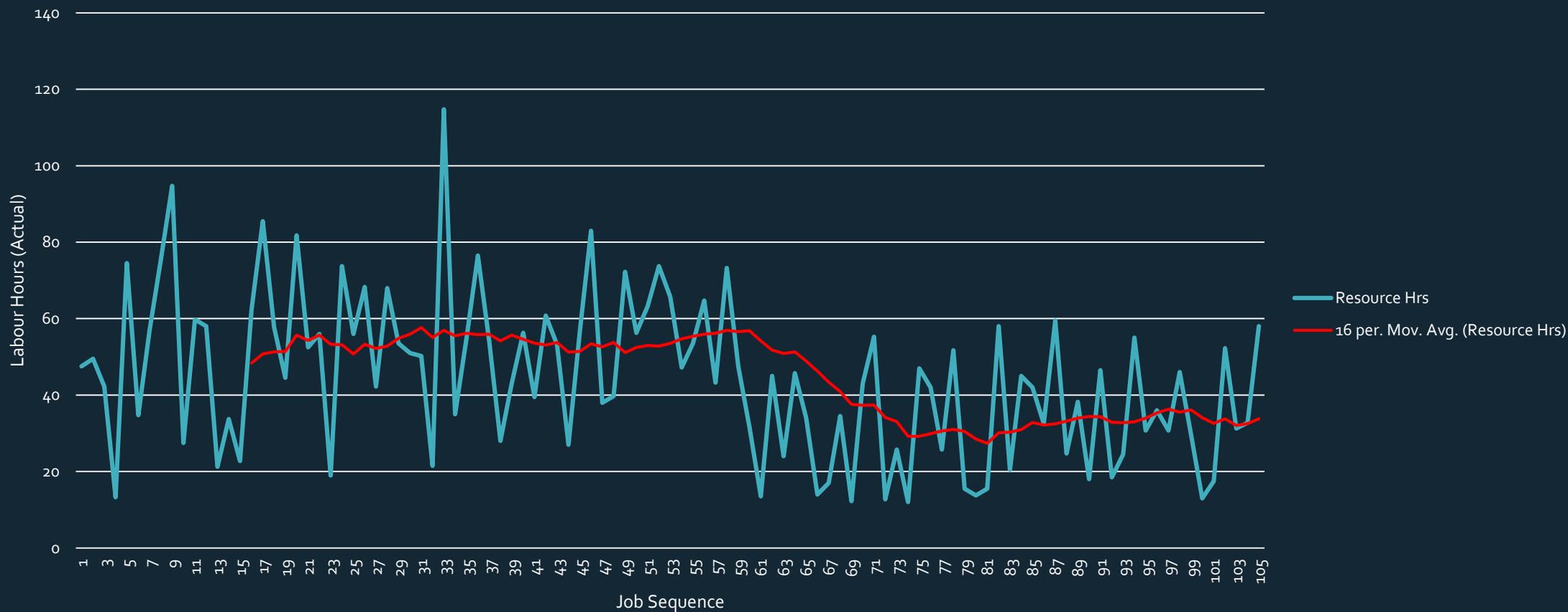
- High upfront costs
  - Still \$15k+ to install battery and solar
  - ROI 10+ years in most cases
- Brand confusion and technical complexity
- Grid connection process
- Fast moving policy landscape – customers waiting for rebates
- Cost of batteries not coming down quickly

# The challenge for installers

- Integration – getting all the components to play nicely together
  - Firmware upgrades
  - Connecting everything to the internet – long commissioning process
  - Stability of system
- Lack of experience/training
- Poor support from manufacturers
- Power of choice reforms / metering process
- Standards are being developed on the run – electrical inspectors not sure how to enforce regulation
- Unscrupulous sales and install practices

# Steep learning curve...

Hybrid Solar Job Productivity (9 months)



# Accelerating VPP rollout

- Retail plans that monetise the value of a battery to the network
- Consistent policy setting
- Reduced system complexity – single manufacturer, all-in-one solutions
- Mandatory code of conduct for behind the meter services
  - CEC and SEC seemingly at loggerheads on way forward
- Higher safety standards and more rigorous inspection regime

# CSIRO National Energy Analytics Research (NEAR) Program

[Formerly Energy Use Data Model (EUDM)]

Kate Cavanagh | Stakeholder Engagement Manager

12<sup>th</sup> February 2019

ENERGY  
[www.csiro.au](http://www.csiro.au)



**ARENA VPP workshop Canberra**

# CSIRO National Energy Analytics Research (NEAR) Program

Department of Environment and Energy  
Australian Energy Market Operator

\$20M research program

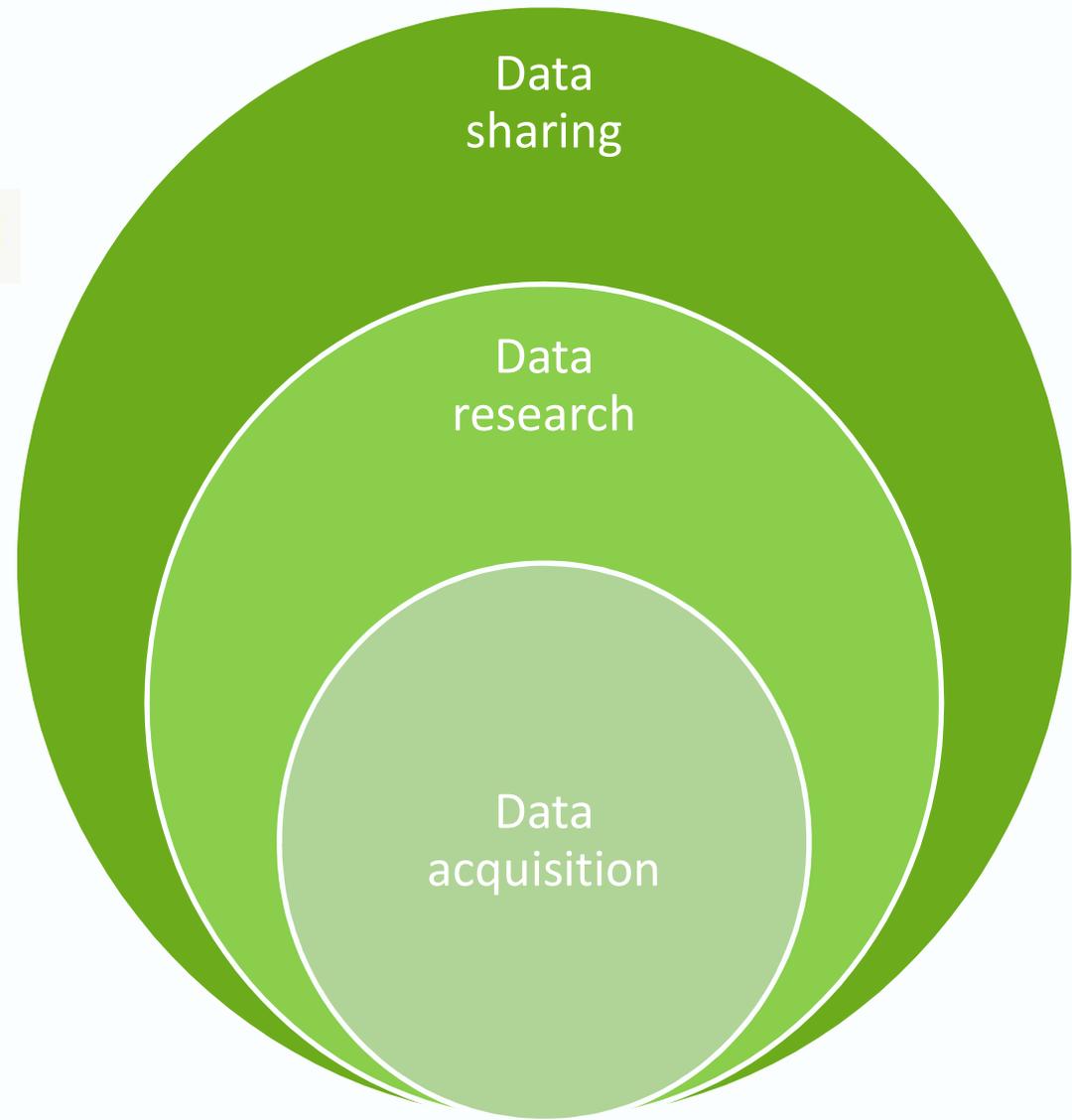


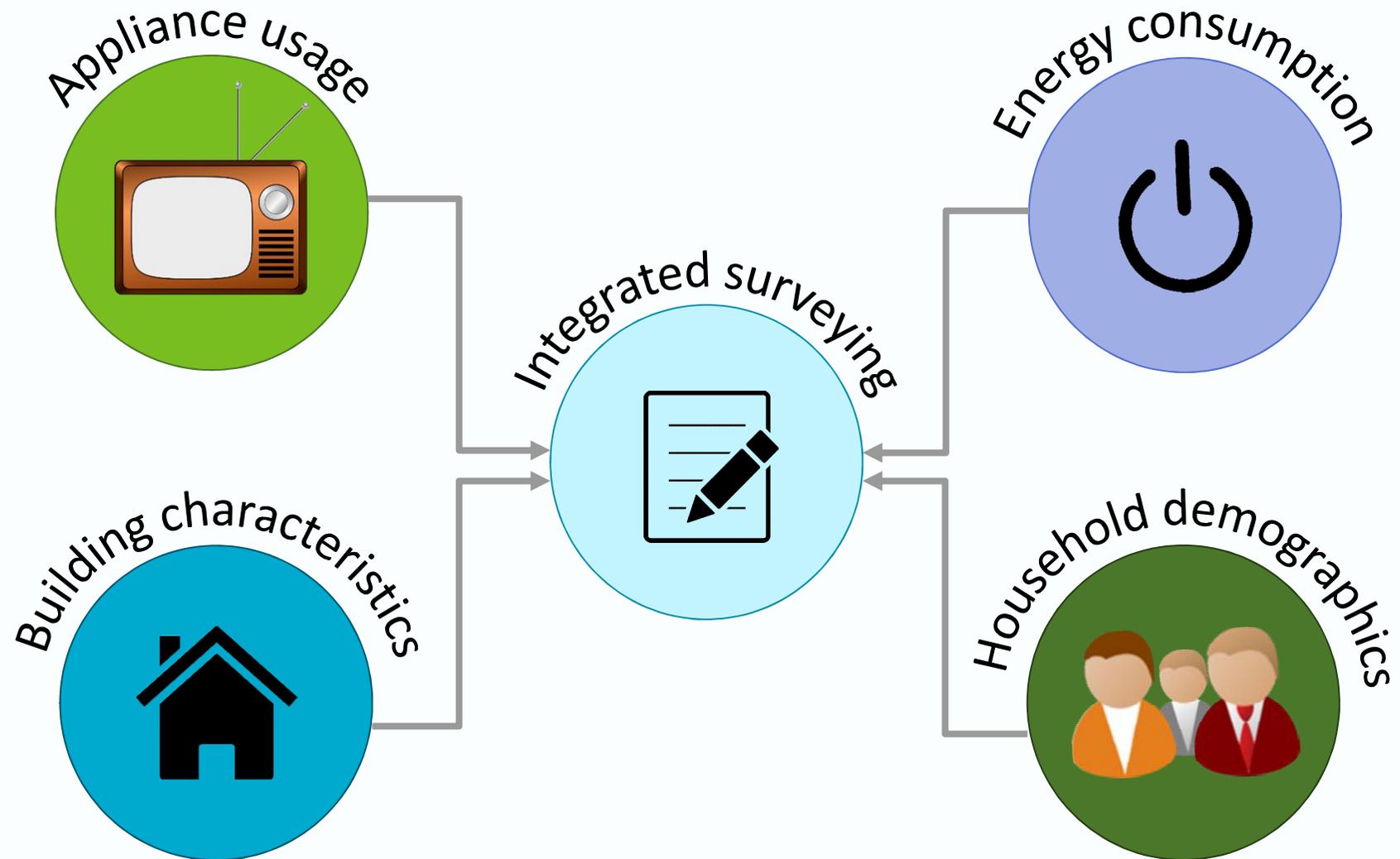
*Australia's future energy system?...*

# Searching for data...

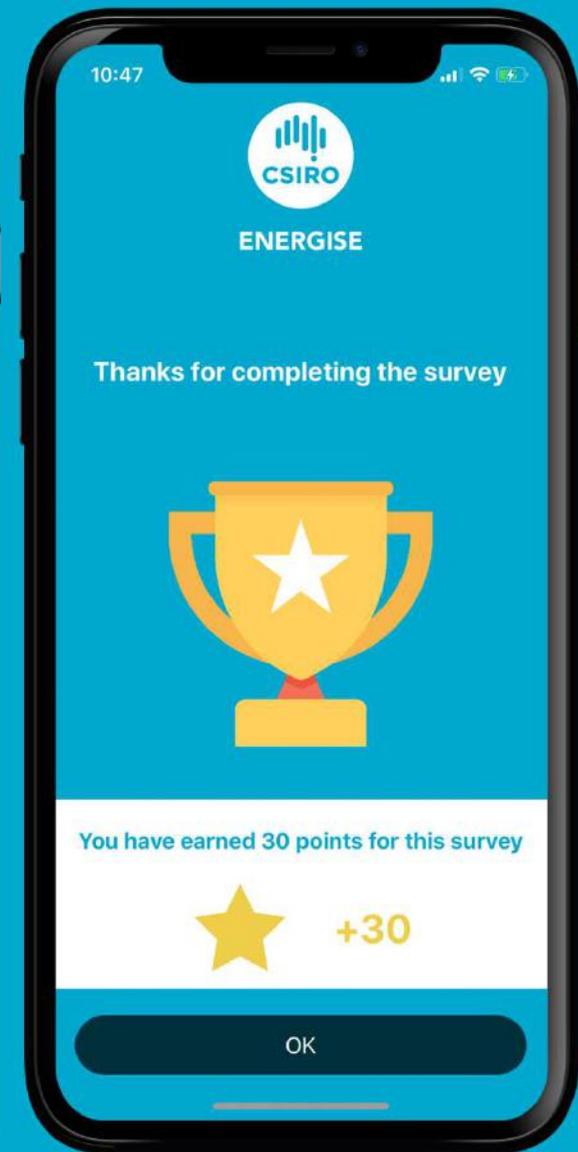
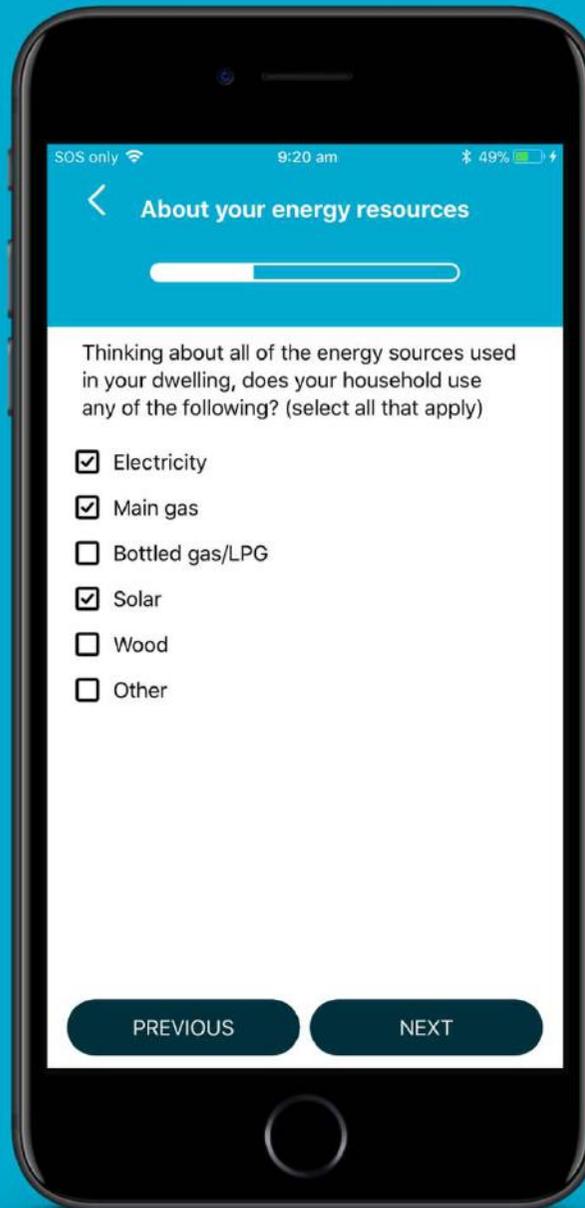


# Vision of National Energy Analytics Research (NEAR) Program



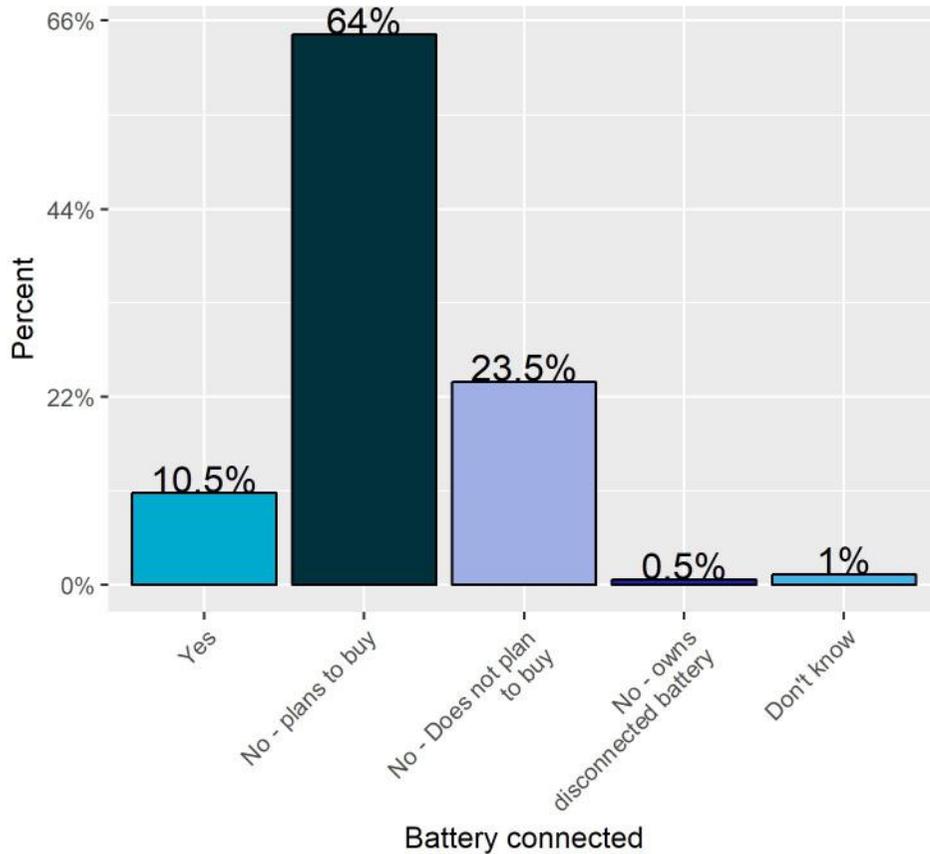


# Introducing CSIRO Energise App...

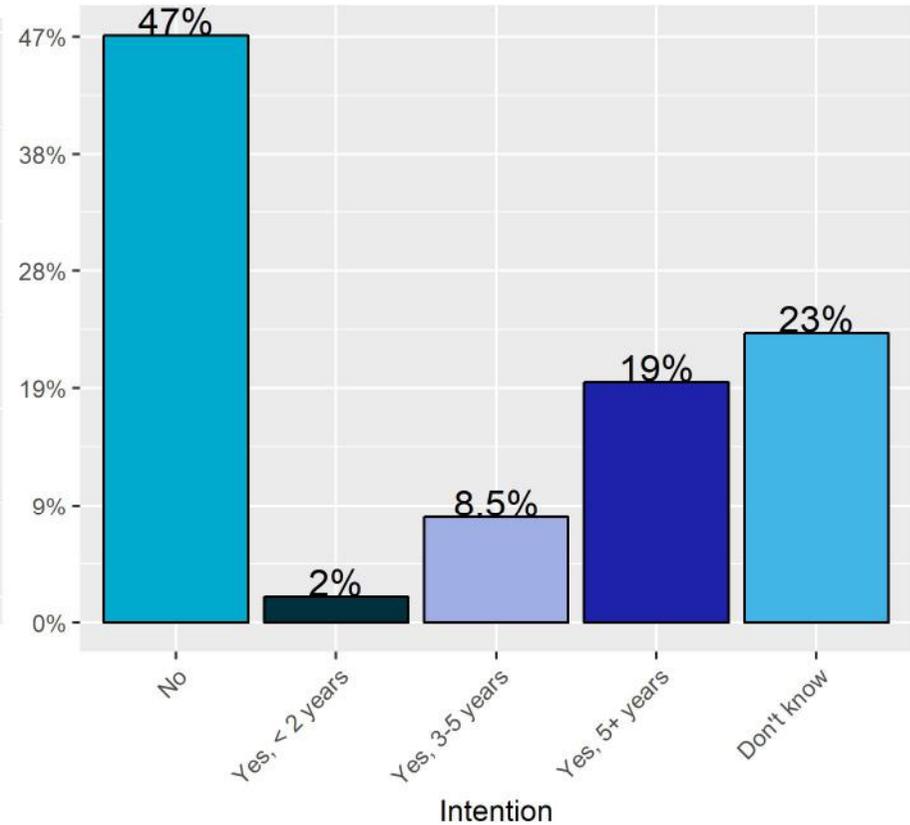


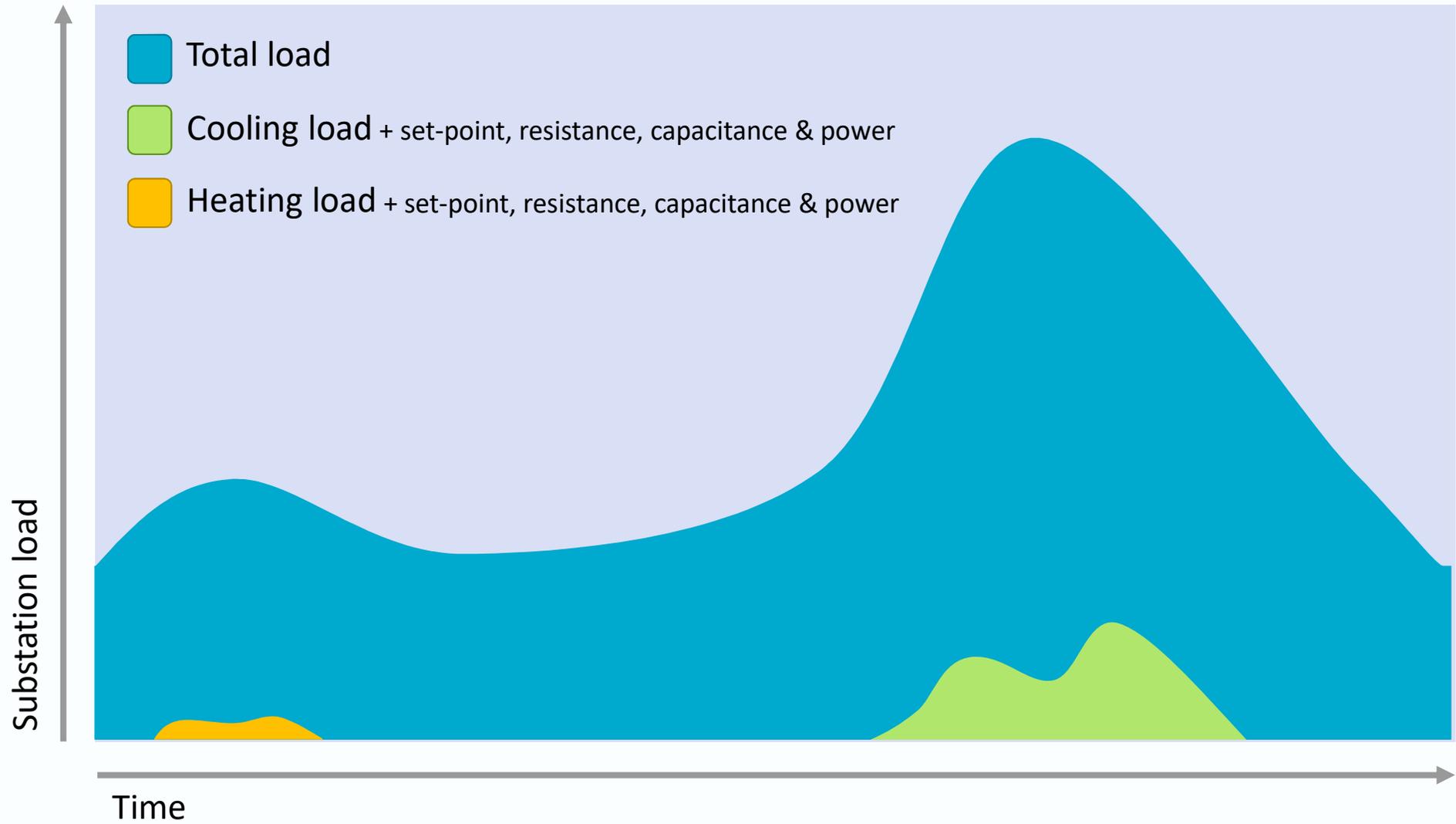
# Sample results

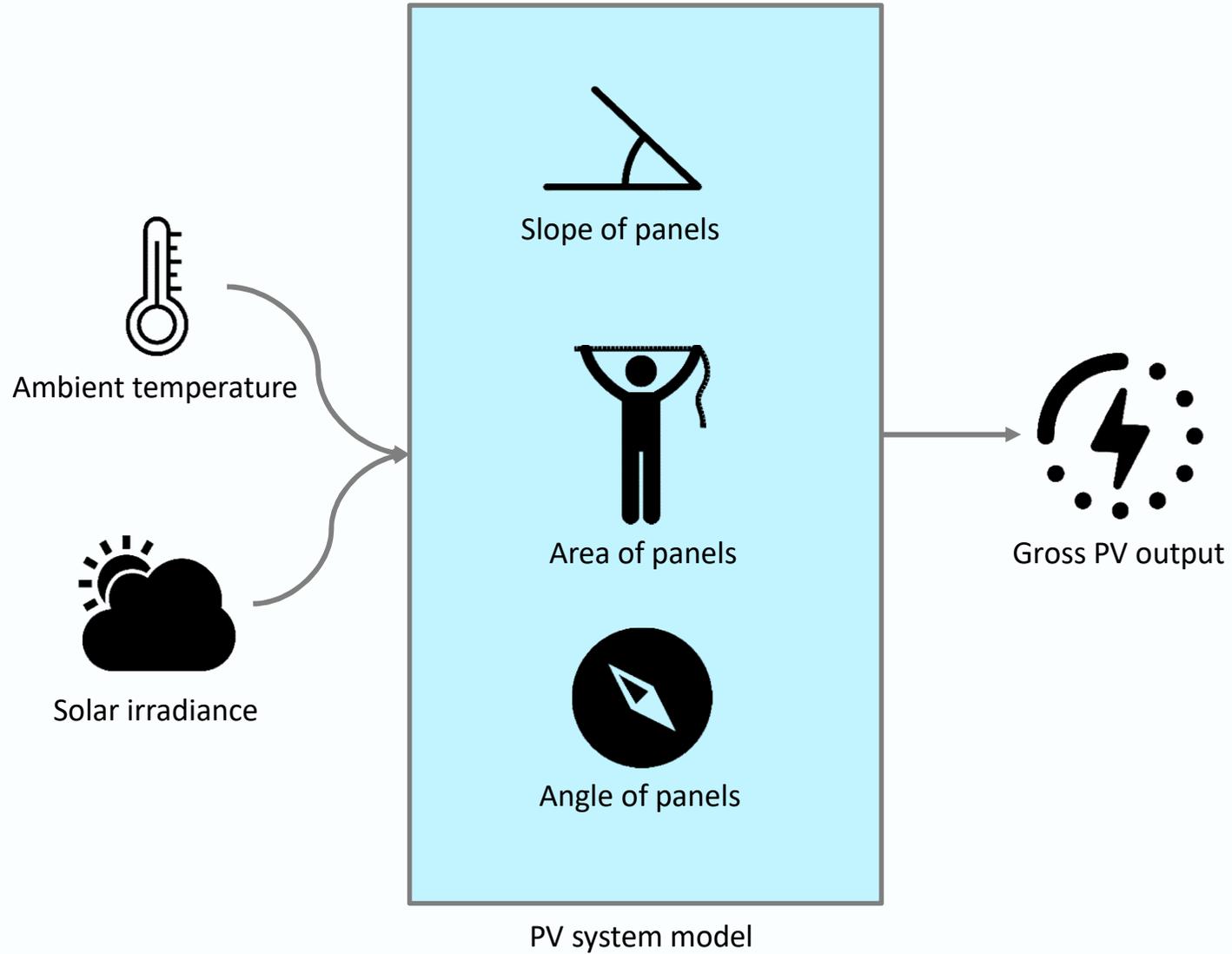
Are your solar panels connected to a battery storage system?



Does your household plan to disconnect from the electricity grid (i.e. go 'off-grid') sometime in the future?



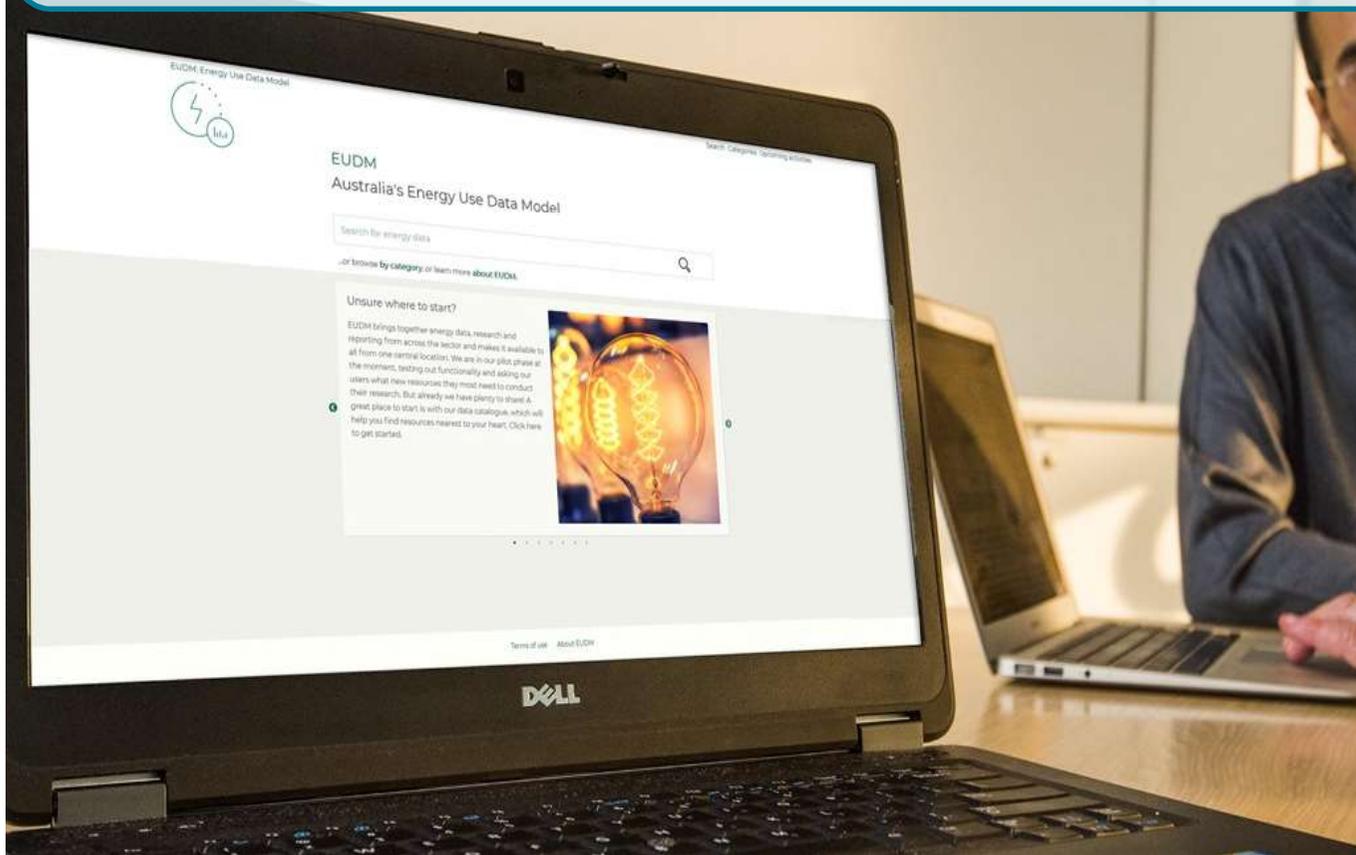






# How can YOU use NEAR Program?

<https://near.csiro.au>



## In summary...

- Energise surveys
- PV and AC estimations
- Demand response



- **What can we do (opportunities)?**
  - Survey
  - Data linkage and analyses
  - Publishing more data

<https://near.csiro.au>

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Special acknowledgement and thank you to Lachlan O'Neil for charting CSIRO Energise survey results

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CSIRO National Energy Analytics Research (NEAR) Program |  
Kate Cavanagh