



Network Innovation Advisory Committee

1 June 2021



Agenda

#	SESSION	FACILITATOR	TIMING
1	Introductions & updates from Committee	Junayd Hollis	13.00 – 13.10
2	Review of actions	Junayd Hollis	13.10 – 13.20
3	Network Innovation Program Dashboard	Alex Watters	13.20 – 13.35
4	Community Battery Update	Mark Appleton & Felix Keck	13.35 – 13.50
5	Potential DSO Demonstration Project	Alida Jansen van Vuuren	13.50 – 14.10
	BREAK		14.10 – 14.20
6	Voltage Management Strategy	Matt Webb	14.20 – 14.50
7	SAPS update	Alex Watters	14.50 – 15.10
8	Consumer Engagement Panels	Selina O'Connor & Junayd Hollis	15.10 – 15.20
9	Recap & next steps	Junayd Hollis	15.20 – 15.30

	For Information	Slide No.
A	Asset Condition Monitoring Update	37



Review of Actions

Review of Actions

	Action Items	Date Raised	Status	Comments
1	Compare innovation priorities to the feedback on priorities from customers in the CCC and report back by exception.	July 2020	● In Progress	No exceptions identified to date, to be considered under co-design process
2	Provide a view on the potential benefits of the travelling wave technology and the potential scale of a rollout if the trial is successful	July 2020	● Complete	Overview in Agenda Item A (pg 38)
3	Provide committee with any technical documentation available for neutral integrity monitoring trial	Oct 2020	● In Progress	Overview in Agenda Item A (pg 39) . Further documentation can be provided when available.
4	Provide a community battery update at next NIAC covering - the steps from now to rollout including evidence of how the batteries can help to decarbonise	March 2021	● Complete	Refer to Agenda Item 4
5	To provide more information on what the customer's lived experience is with DSO trial - how might this be different from direct load control	March 2021	● In Progress	Refer to Agenda Item 5 . In progress as part of project development
6	Update dashboard 'Dynamic Load Control' item to reflect broader view across load and DER (e.g. inverter) control	March 2021	● Complete	Incorporated into workstream planning
7	Apply future looking forecast to River Communities benefits analysis	March 2021	● In Progress	In progress as part of project development



Network Innovation Program Dashboard

Network Innovation Program Dashboard

Workstream	Project Score	Estimated Budget \$m	Actual Spend \$m	Committed Spend \$m	Status	Update/Comments/Feedback	High Level Project Timeframes				
							2020	2021	2022	2023	2024
Advanced Voltage Regulation	3.45	\$3.50	\$0.38	\$0.50	●	First LV STATCOM commissioned at Nords Wharf and is successfully operating. Project proposals for broader voltage regulation trials in development.					
Network Insight Program	3.82	\$12.7 \$14.04	\$2.50	\$5.12	●	DM&C retrofit designs developed, project proposal in development. Project "Edith" DSO market trial approved and development work has commenced.					
Fringe of Grid Optimisation	3.71	\$4.97	\$0.30	\$2.38	●	Suppliers shortlisted for Tender stage, and customer survey and Expression of Interest closed with ~ 75 interested customers currently going through analysis.					
HV Microgrid Trial	3.44	\$19.00 \$16.48	\$0.00	\$0.05	●	Feasibility studies underway, including through the River Communities strategy development.					
Advanced EV Charging Platform Trial	3.53	\$1.30 \$1.05	\$0.00	\$0.00	○	Not yet commenced.					
Grid Battery Trials	3.81	\$3.00 \$5.86	\$2.29	\$5.04	●	Second community battery installed in Bankstown in April. Continuing to develop customer offerings.					

LEGEND

- Project not yet commenced. Remains within timeframes
- Project on track to meet budget and key milestones
- Project may be at risk if issues are not addressed. Attention required.
- Project is at risk of being over budget and/or significantly behind in meeting key milestones.

- Task completed
- Task on track
- Task not on track
- NIAC input required

Note: Expenditure as at 30/04/2021

Network Innovation Program Dashboard

Self-Healing Networks	Project Score	Estimated Budget \$m	Actual Spend \$m	Committed Spend \$m	Status	Update/Comments/Feedback	High Level Project Timeframes				
							2020	2021	2022	2023	2024
Portable All-in-One Off-Grid Supply Units	2.51	\$0.50	\$0.00	\$0.03	●	Some candidates identified during SAPS RFI process with evaluation to commence in first half of 2021.					
Self-Healing Networks	3.58	\$0.60 \$0.33	\$0.17	\$0.20	●	Testing of some equipment failed, Castle Cove project to be terminated.					
Dynamic Load Control	2.83	\$0.49	\$0.00	\$0.04	●	Reviewing scope of workstream to include greater consideration of inverter controls. Developing proposal for engagement with retailers and metering providers					
Asset Condition Monitoring	3.17	\$2.79	\$0.33	\$2.79	●	Bulk smart meter data ingestion into Ausgrid systems has commenced, analysis software selected and system design commenced.					
Line Fault Indicators	2.75	\$0.70	\$0.05	\$0.04	●	Low cost non-communicating device identified and tested, trial proposal under development. Communicating LFI requires new modems - awaiting manufacturer.					

LEGEND

- Project not yet commenced. Remains within timeframes
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- Project may be at risk if issues are not addressed. Attention required.
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- Task completed
- Task on track
- Task not on track
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Note: Expenditure as at 30/04/2021

NIAC Feedback: What other information would the committee like to see as projects progress? An example could be notification of external media opportunities.



Community Battery Project Update

Progress to Plan

Stage 1 criteria

- ✓ Positive Cost Benefit Analysis results (KPMG feasibility study)
- ✓ Implementation team confirmed

Stage 2 criteria

- ☐ Positive customer feedback
- ✓ Suitable sites identified
- ✓ Hardware solution confirmed
- ✓ Regulatory exceptions approved
- ✓ Research partners confirmed
- ✓ Commercial partners confirmed
- ☐ Settlement solution confirmed

Stage 3 criteria

- ☐ Successful hardware testing
- ☐ Successful software testing

Total estimate: \$5.8m

Stage 1

Key activities



Q4 '19 – Q1 '20

- Customer testing
- Implementation preparation
- Contract & terms negotiation
- Partnership agreements

Stage 2



Q2 2020 – Q2 2021

- Contract execution
- Order placement
- Construction & installation

Stage 3



Q2 2021 onwards

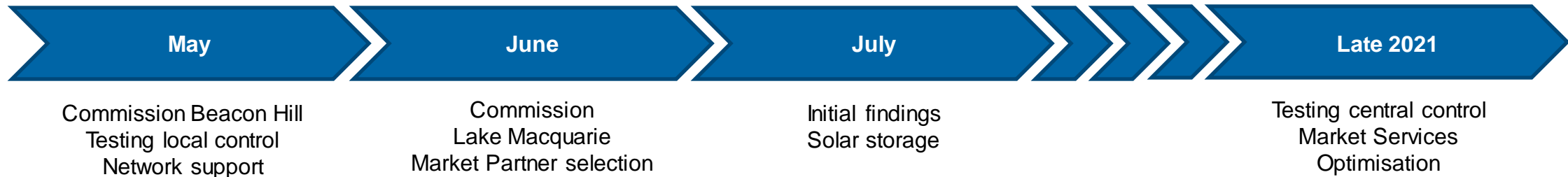
- Commercial & technical operation

Progress to Plan

Engineering

- Commissioning delays due to operating requirements and Critical Infrastructure Licence Conditions
- Local control requirements and settings finalised
- Data monitoring of battery performance cyber security in development
- Centralised control requirements for later phases in development

Timeline



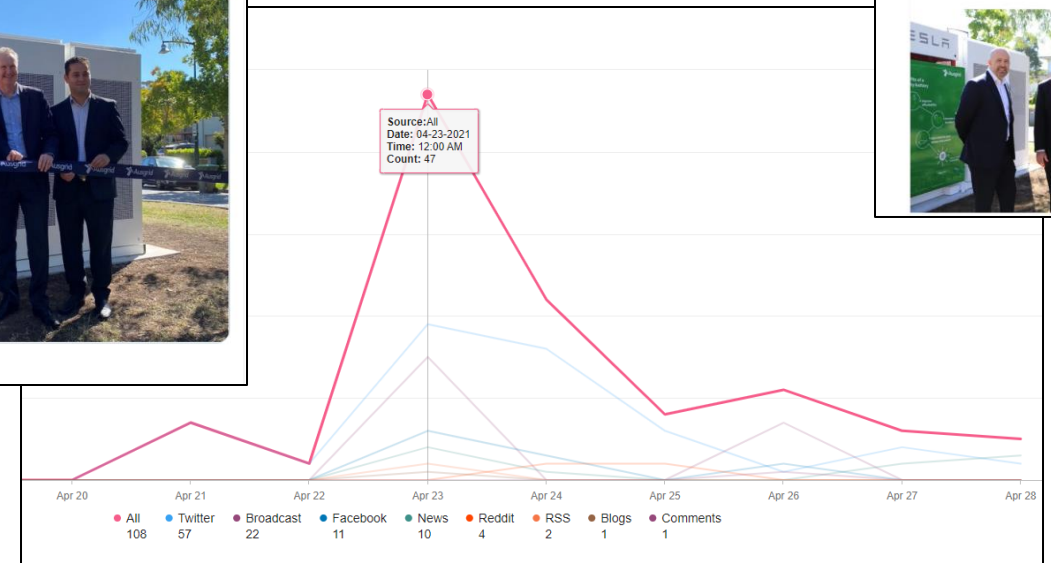
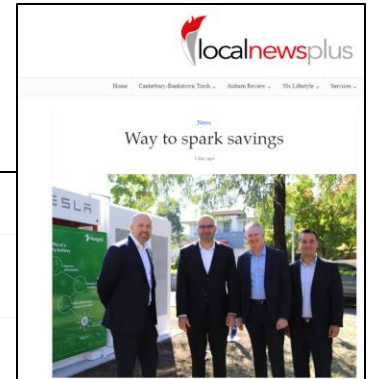
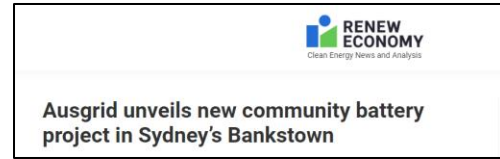
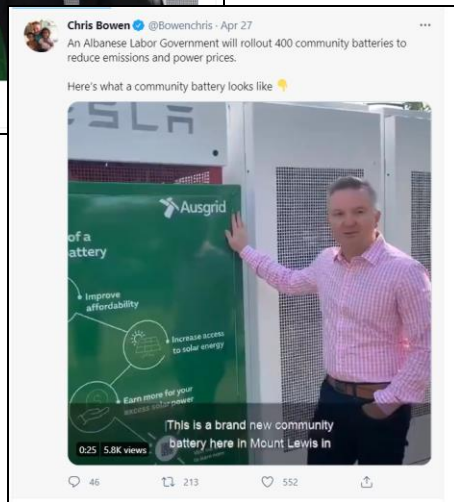
Critical Infrastructure Licence Conditions requirements

- Data monitoring and control of network assets must be on shore
- Data security including Bulk Personal Data
- Ausgrid control of battery operation

Bankstown Community Battery Media

Media summary

- Media event
 - 47 mentions of Ausgrid community battery in media since 23 April
 - Channel 7 story reached 200,000 people
 - 5.8k views of Chris Bowen's post
 - Total potential reach of broadcast and online coverage: 1.5 million people (Source: Meltwater)



Bankstown Community Battery Update



- 13 customers registered in trial area – 21 May
- 10 have provided their electricity bills
 - 6 ToU and 1 Flat (3 to be reviewed)
- Current benefit range \$60-\$200

- Orange** – registered solar customers (13)
- Blue** – registered considering installing solar (4)
- Green** – solar customers who have not registered their interest (35)

Beacon Hill Community Battery Update

1. Registrations

28 of 29 solar customers have supplied electricity bills for estimating benefits

- Time of Use (14)
- Seasonal TOU (3)
- Single Rate (10)

Benefits ranges from \$0 to \$275.

2. Solar Assessments

20 of 29 solar registrees have requested solar assessments;

9 not yet booked (6 who received \$0-25, appear unlikely to progress; 3 have not responded to follow up calls)



Thinking beyond the trial – key considerations for the wider rollout

Regulatory changes required

- **Tariff reform:** need for ‘local use of system’ charge to avoid paying for broader network costs that they do not contribute to.
- **Settlement:** electricity flows need to be settled locally so customers do not pay retail rates to draw down from batteries.
- **Cost allocation:** capex and opex need to be allocated between regulated and unregulated services.
- **Ring-fencing:** customer storage services and battery access for market participants are currently not permitted.
- **Cyber security:** obligations on DNSPs to operate batteries not fit for purpose

Implementation pathway

- **Collaboration with partners:** design and confirm long-term roles, incl communities/councils and integration with retailers.
- **Identifications of sites:** suitable sites for different battery types (kiosk, pole top, zone substation) required.
- **Value engineering:** learnings from trial need to feed into optimised designs.
- **Equipment supply:** lessons learned to inform suppliers of future requirements. Wider roll-out needs to be aligned with delivery capacities of suppliers
- **Funding:** subject to regulatory reform adequate funding sources for regulated and unregulated parts need to be allocated

Impact on decarbonisation

- **Benefits for decarbonisation:**
 - increase hosting capacity for distributed solar PV
 - >20% of registrants are looking at installing solar
 - provide firming for higher levels of centralised variable renewable energy, i.e. wind & solar
 - reduce distribution network losses¹
- As with any other battery **they cause emissions** as well:
 - Losses due round-trip efficiency – only with non-renewable electricity supply.
 - Manufacturing & recycling, however lower than individual batteries.



Project “Edith” DSO Demonstration Update

Edith update

Since last meeting

- Presented DSO Vision to AER, AEMC and AEMO - well received by all.
- Established scoping budget for Edith.
- Project EDGE aiming to include dynamic network pricing in trial, but architecturally struggling to make it fit.

Action from last meeting

- To provide more information on what the customer's lived experience is with DSO trial - how might this be different from direct load control.
 - This under development and will be covered in Validation Workshop in July (see next slide). Will present summary at next NIAC.

Edith Engagement approach

Edith aims to align with the NEO and leverage previous work to show how incremental improvements can deliver an efficient DSO model for highly active customers. It is not all things to all people, but a demonstration that DER integration is possible without a central DER Market Place.

The project team will seek to validate the scope (and customer's lived experience) with stakeholders, including:

- Specifying what is in-scope,
- Specifying what is not in scope and why, and
- And addressing any major concerns from consumer advocates and external stakeholders incl. AEMO.

We will not be undertaking a full co-design process, but will seek advice, be transparent and be open to feedback.

Edith engagement plan

Questions for NIAC

- Do you agree with Proposed External Reference Group composition?
- Who should we invite to join? Aiming for both supporters and sceptics.

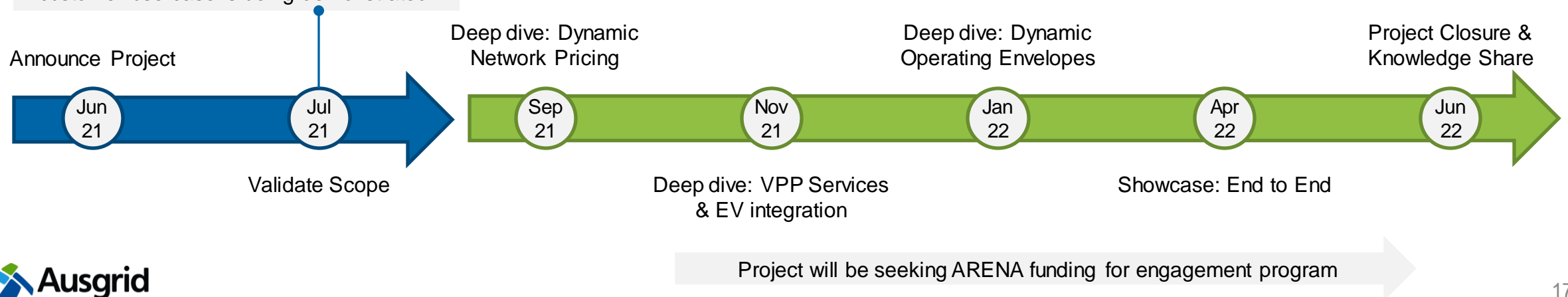
Proposed **External Reference Group** composition

- Consumer reps (3-4)
- NSW and QLD DNSPs (part of Evolve)
- AEMO, AER, AEMC (and ESB)
- Other (NSW Government, CEC, ARENA etc.)

Internal Steering Group

- Ausgrid, Reposit (and AEMO)

During scope validation workshop the customer experience for Edith will be unpacked, including why this particular customer use case is being demonstrated.





Voltage Management Strategy

Introduction: Voltage Management & Our LV Customers

- The number of customers with solar has increased by more than 100,000 (taking our customer base from approximately 6% to 11%) over the past 5 years and this is forecast to continue.
- The increase in small scale solar is changing customer awareness and expectations of their electrical supply as high voltages can cause customer solar inverters to trip off.
- Customer's network experience does not meet their expectations in all areas of the network, all of the time.
- Ausgrid's voltage management has matured to move with this change, in the short term bridging the gap between network performance and customer expectations whilst developing a voltage management strategy to provide an adaptable network.
- In NSW, compliance with the Australian Standard is voluntary and based on network wide performance not a local sub-set of results.
- Ausgrid's objective for the operation of its network has historically been to maintain supply voltage (measured as a ten-minute average) within the Australian Standard range of 216V to 253V at customers' points of supply under normal operating conditions. To do this we manage the voltage within the network (where we have visibility) in a tighter bound as we have limited visibility at the customer supply point.

Addressing customer concerns

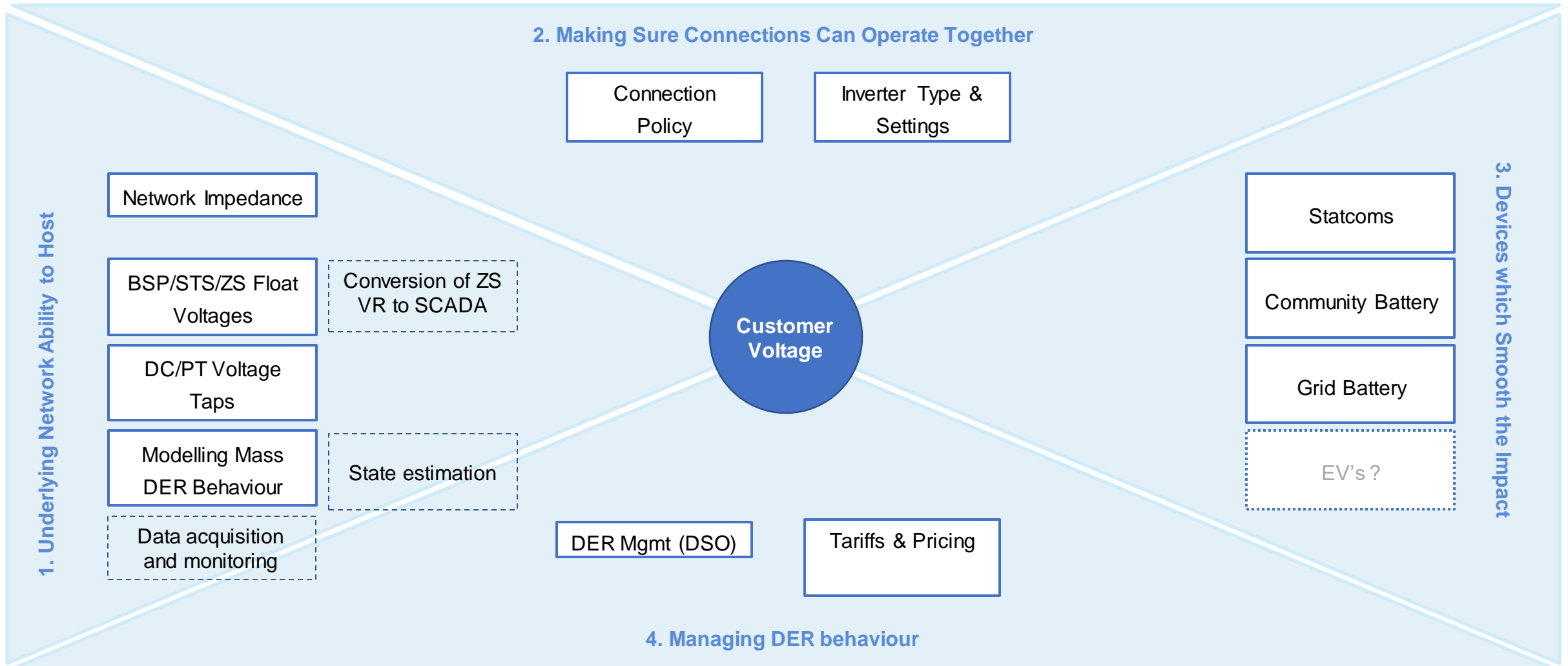
Media coverage

- Solar may not be to blame for system issues, solar has little impact on voltage
- The underlying grid voltage is the problem which is a compliance issue (ESB report supports this)
- High voltage causes wasted energy, bigger power bills, burnt out appliances
- Higher voltages also means solar can't export, the network voltage shuts down systems
- Networks aren't doing much about the issue

Responses

- We do have network voltages outside the upper voltage limit during certain load times as the network was historically designed to cope with high load conditions.
- Voltage outside the upper limit primarily impacts solar. Before the significant uptake in solar we had limited complaints about voltages and the lowest cost way to manage the network and keep bills down was to statically set voltages for high load conditions.
- Solar can increase voltage on certain network types, but this primarily impacts local surrounding solar systems.
- In remote areas the cost (that flows through to customers) to upgrade the network to accommodate large increases in solar is can be prohibitive.
- Rooftop solar is increasingly becoming a significant part of the energy mix in Australia and we are taking proactive steps to evolve our network operations to accommodate more solar.
 - Our upper limit voltage conformance has increased from 80% to 93% over the last 5 years.
 - We have reset the voltages on 12 of our zone substations which supply the areas where we have the highest solar penetration and are on track to complete 24 more over the next 2 years.
 - We are targeting local distribution centres with high solar penetration to change tap positions, lowering voltages and increasing capacity to host more solar.
 - We are working internally to improve customer experience during voltage complaint investigations.

Voltage Management has four broad dimensions

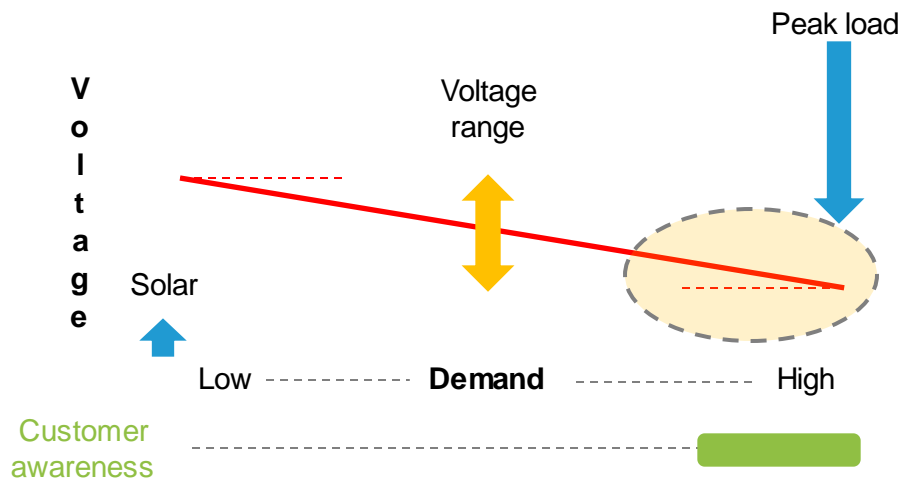


Voltage Management: Brief History

Voltage management has matured, moving away from a reactive approach with peak demand focus to a more proactive approach with focus over the demand cycle. This maturation is a response to changing network use, changing customer expectations, and to prepare our network for future changes.

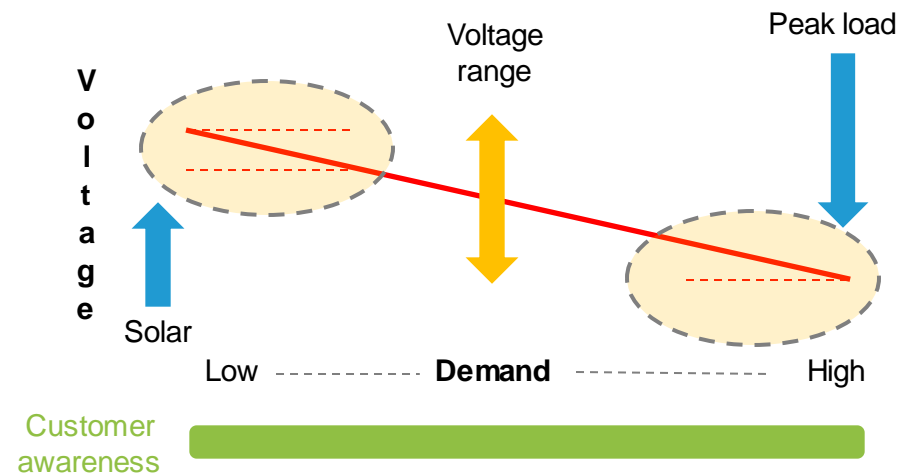
Historic voltage focus

- Over the last three decades managing network voltage was heavily influenced by the need to support air conditioning load and the historic 240V nominal standard.
- Focus was placed on managing voltage at peak loads to ensure voltages stayed above minimum bounds. This approach was fit for purpose at the time.



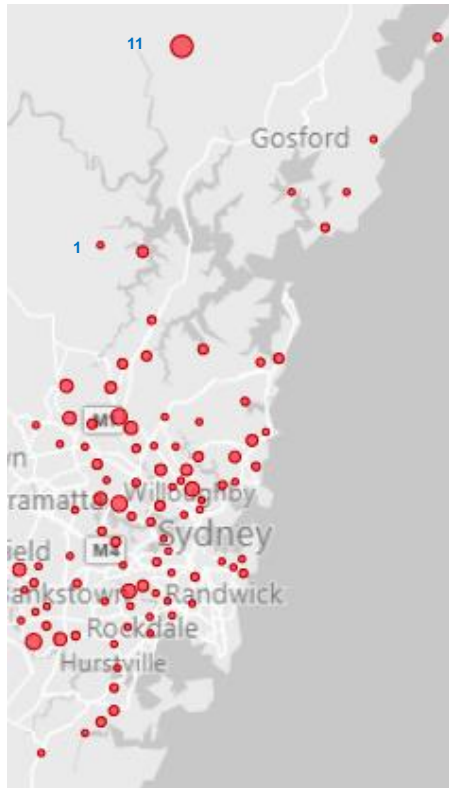
Matured voltage focus

- Change's in load patterns, uptake of solar and increased customer awareness requires a change in focus to the whole demand cycle (i.e. low and high load times).
- Changes in technology and the way customers use the network reinforce the need for a proactive adaptable approach to managing voltage.

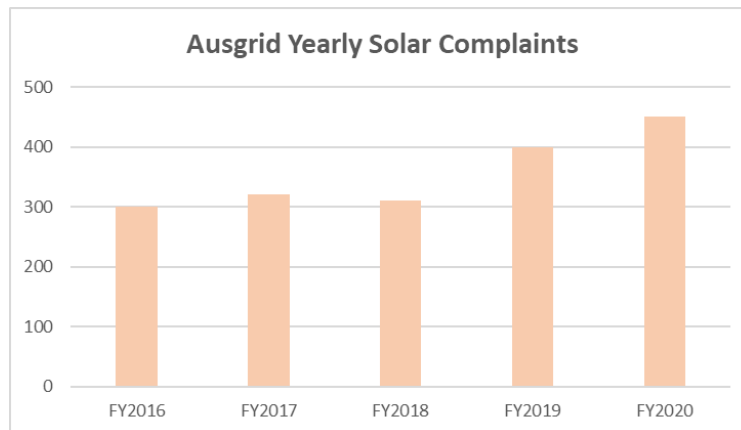
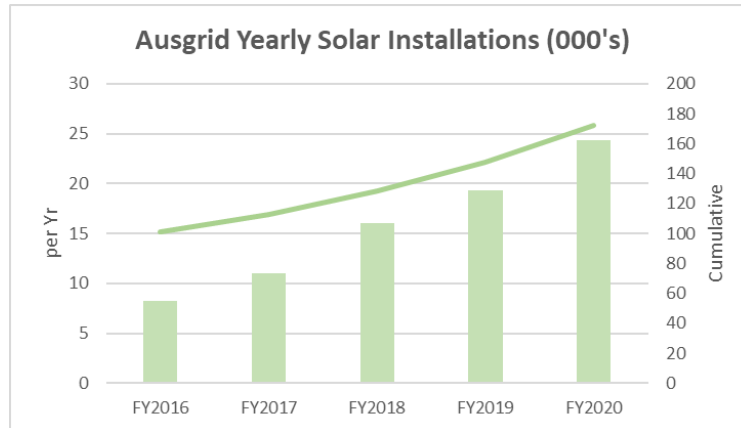


Customer Experience: Voltage Complaints

Ausgrid has observed an increase in voltage complaints with the majority relating to customers with solar systems. There are several factors that contribute to customer experience which can result in a voltage complaint. Whilst our network is one, several factors related to the customers' connection are outside our control. We have also seen an increased customer awareness of network voltage.



Solar complaints per post code (last 12 months)



Contributing Factors



Our Network

- Bulk supply point voltages
- Voltage regulation in Ausgrid network
- Transformer tap settings
- Network characteristics



Customer network

- Non-compliant installation
- Service & consumer mains voltage rise
- Faulty service mains, bad joints



Inverters

- Incorrect settings causing tripping
- Faulty equipment



Customer awareness

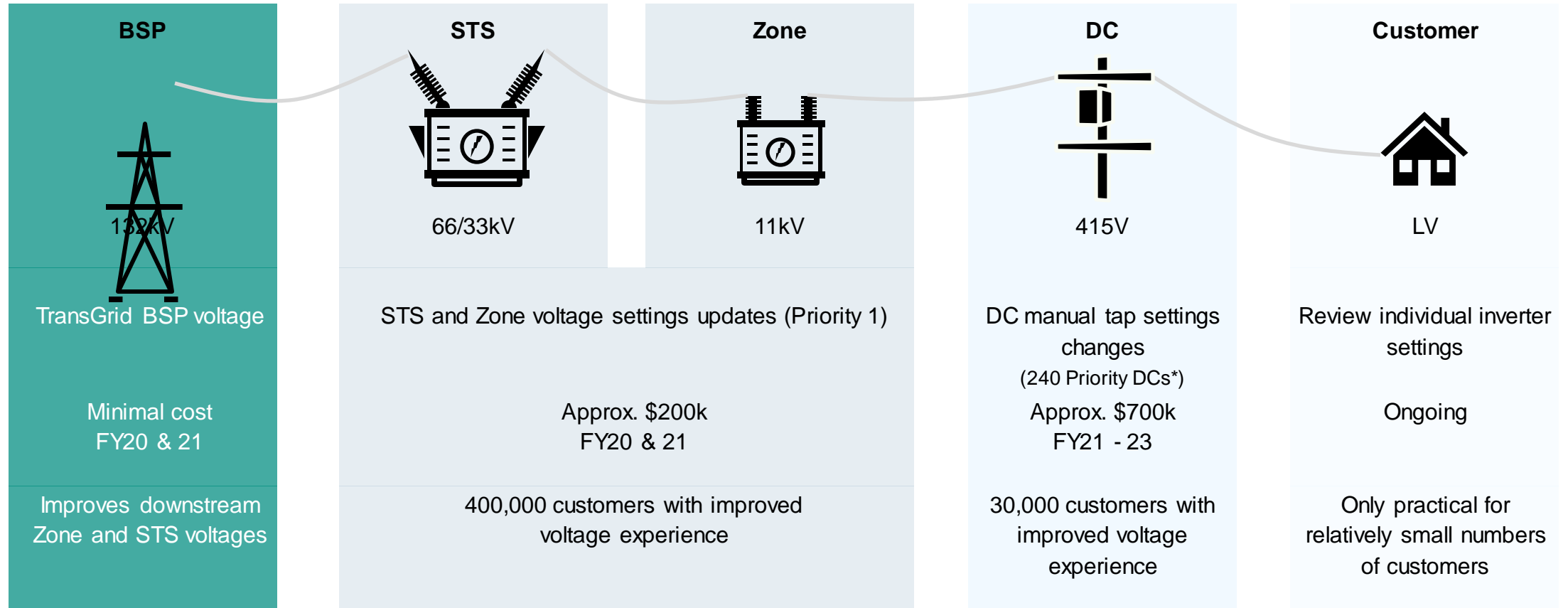
- Smart Solar Systems alert customers of high voltages
- Customers becoming increasingly focused on solar output whereas previously the focus was on air conditioning operating during peak times

All customer voltages involve a contribution from Ausgrid's network and customer installation.

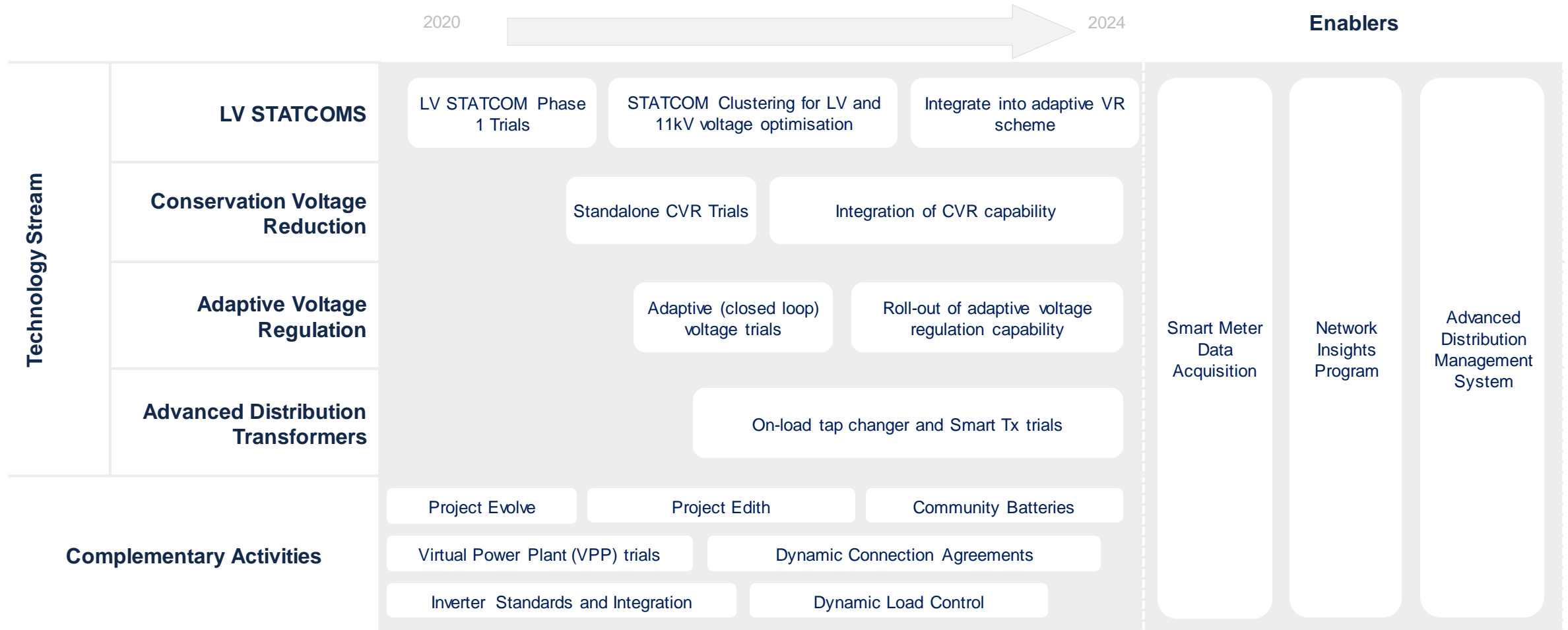
Approximately 50% of complaints are attributable to Ausgrid's network and 50% of complaints are attributable to customer installation.

Holistic Approach: BSP to the LV Customer

An end to end holistic approach managing voltages from our connection points with TransGrid through to our customers connection point, ensures upstream network settings minimise downstream work, and down stream works take into consideration planned upstream changes.



Advanced Voltage Regulation – Proposed Workstream



Questions about our voltage management strategy

- We are very aware of customer concerns related to voltage levels and DER, as well as the criticality of understanding network performance with higher DER levels, in the context of DER enablement
- Whilst our voltage is within strict regulatory requirements, in some areas it is not meeting customer expectations
- We have initiated a number of short to medium term strategies with existing technology which are cost effective
- We are trialling a number of new technologies through our Advanced Voltage Regulation innovation project
- We believe we will need to further evolve our tools and approach as DER levels continue to rise

Questions for the NIAC

- What are the NIAC members' views on the significance of voltage management issues?
- What measures, if any, does the NIAC believe DNSPs should take to:
 - Gain greater visibility of voltage and minimum loads on the low voltage network, including solar export levels
 - Model the behaviour of the network to fully understand the response of solar DER at scale and high penetrations
 - Support AEMO objectives to maintain overall grid stability via aggregated DER
 - Manage vs facilitate solar DER

A close-up photograph of a hand gripping a black power tool handle. The background is dark and out of focus, featuring a prominent blue ring and the letters 'LB' in blue. The overall image has a dark, moody aesthetic.

Stand Alone Power Systems Update

Stand Alone Power Systems Trial Update – Achievements

Community Engagement

- Customer survey complete, preliminary results back with EOs to participate
- Have briefed most councils in the target areas
- Commencing individual customer engagement in June to confirm trial sites

Equipment

- Suppliers shortlisted for limited tender
- Development of technical requirements and supplier scope of works underway
- ENA guideline on SAPS drafted, next working group session in June.

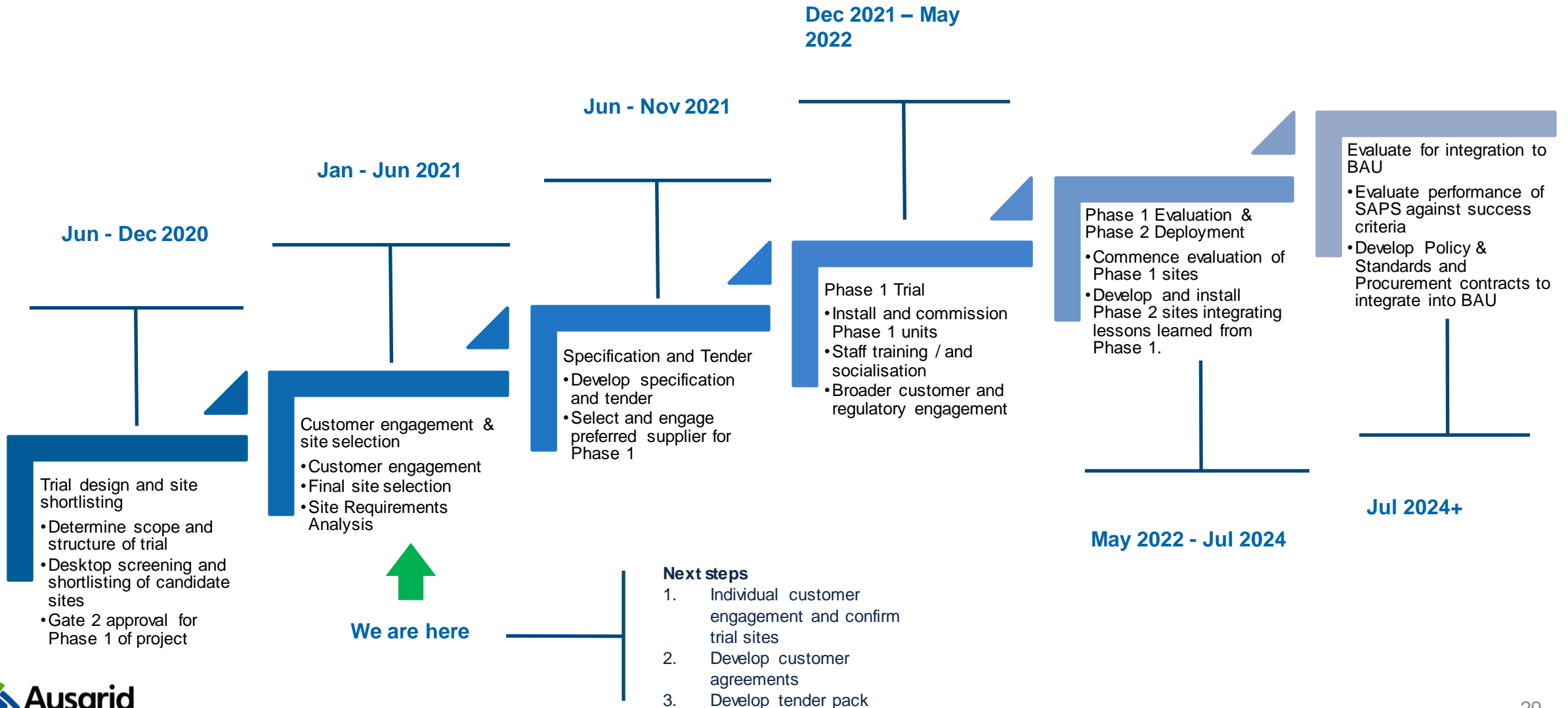
Legal

- Preliminary advice received on likely development approval pathways
- Development of customer agreement to commence in June

Regulatory

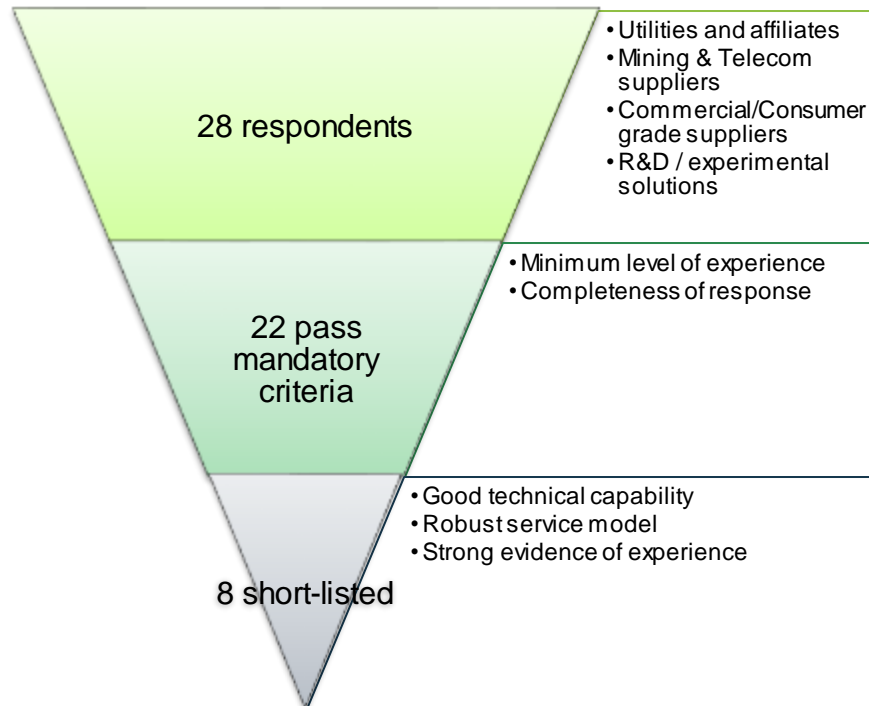
- Commencing engagement with NSW DPIE on SAPS approach within NSW
- On-going engagement with AER ring-fencing review of SAPS and batteries
- Watching brief on AEMC rule change process

SAPS trial timeline update



Supplier / Market update

RFI Process – Nov 2020 to April 2021



NIAC Feedback: Do you have any particular feedback on the shortlist process or the AEMC framework issues?

Key design and operating decisions

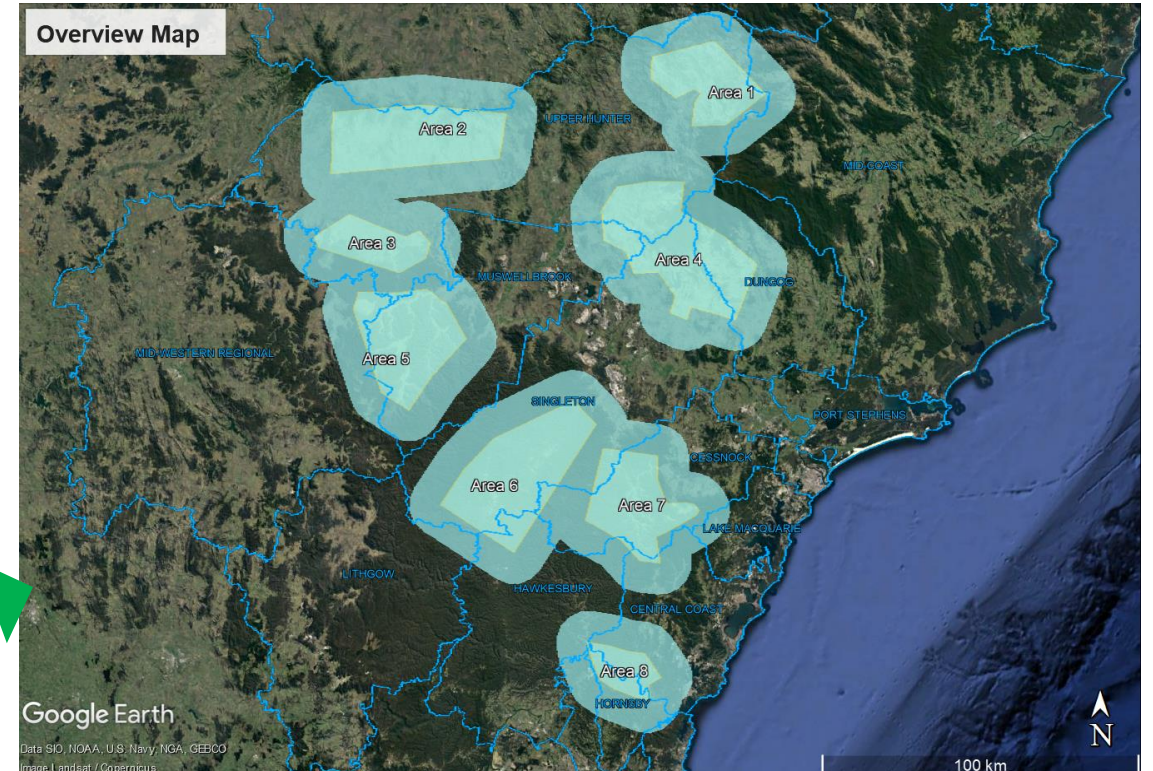
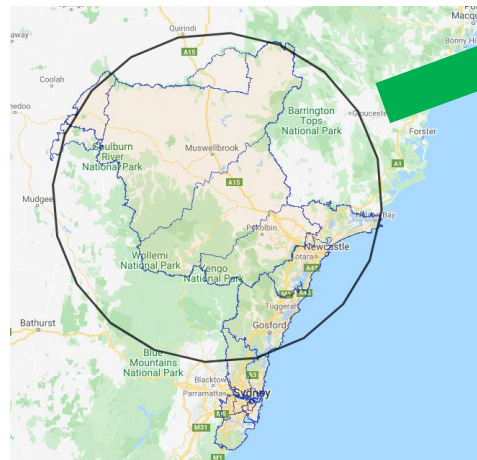
- “Turn-key” approach to managing the trial
 - Inclusive of maintenance and potentially fault response – unclear of market capability here
- Modular solution with light footprint:
 - Adaptable if size requirements change
 - Readily removable if system needs to be relocated or removed during or after the trial
- Limited SCADA system integration initially:
 - Reduce cyber risk
 - Limit integration costs
 - Relies on supplier monitoring system to assess performance

Implications of the AEMC Framework on supply and operation of SAPS

- Key implications of the current proposed framework include:
 - Service classification and ring-fencing application requiring waivers for DNSPs to provide SAPS
 - Maintaining SAPS retail contestability and the service delivery model limits opportunities to optimise SAPS and customer demand
- NSW Government is preparing a consultation paper on the implementation of the AEMC SAPS framework
 - An opportunity to provide feedback on how it should be applied in NSW, including potential variations

Update from customer survey

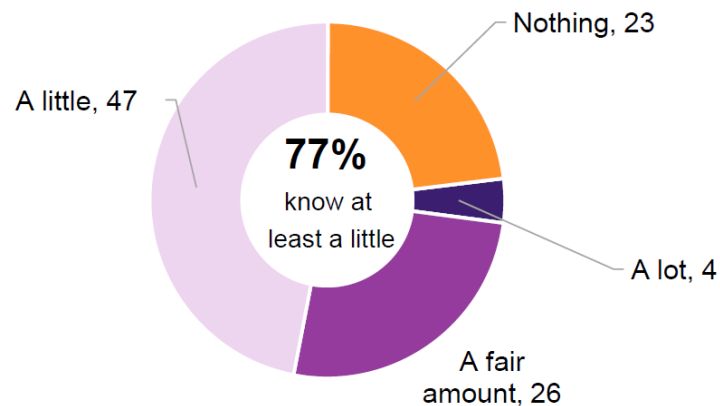
- Survey of 2100 customers across remote / difficult to access network areas
- Mix of residential, business and holiday homes
- Survey closed 17th May, 78 responses, 67 expressed interest in participating in trial
- Evaluation of expressions of interest underway to identify suitable trial sites



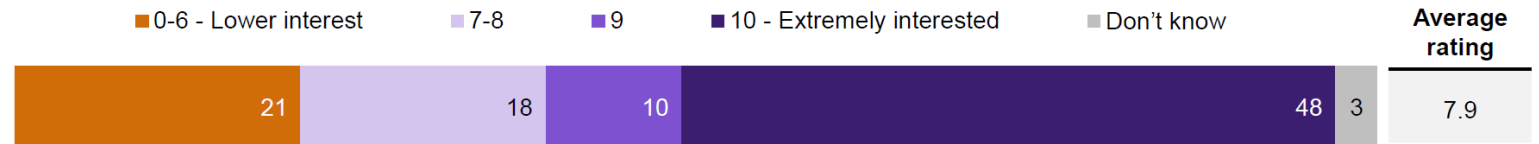
Key Survey Findings

- Customers in these regions were generally already aware of ‘Stand alone’ or ‘Off Grid’ Power Systems
- Mixed views on network reliability, particularly for customers from the Hawkesbury River Valley – improving reliability was one of the key reasons why many of the surveyed participants were interested in SAPS
- More education needed about the proposed cost/billing model – 25% questioned the model or requested more information on how it would work

Knowledge of SAPS-type systems (%)



Interest in SAPS after reading the detailed description (%)



RATIONALE FOR RATING
(Vs. those giving a different rating)

LOWER RATINGS OF 0-8 (n=30)	HIGHER RATINGS OF 9-10 (n=45)
<p>Main reasons against:</p> <ul style="list-style-type: none"> • Not the best solution / not reliable enough (20% vs. 2% of those giving a higher rating*) • No knowledge of ongoing costs (13% vs. 0%*) • Ugly / unsightly / eyesore (10 vs. 0%) • Don't have a suitable location for it (10% vs. 7%) • Too big and bulky (7% vs. 0%) 	<p>Main reasons for:</p> <ul style="list-style-type: none"> • Reassurance of a stable power supply (51% vs. 17% of those giving a lower rating*) • Good idea (18% vs. 13%) • Become independent of the grid (16% vs. 0%*) • Interested in new technology (9% vs. 0%) • Good as a back up / alternative (9% vs. 7%) • Reduces carbon emissions (environmentally friendly) (9% vs. 7%)

Stage 1 trial site selection

Category	Weight	Importance	Criteria
Characteristic	45%	1	Open to SAPS
		2	Existing Reliability
		3	Prefer Pole connection
		4	Open to Efficiency
		5	Interested to Learn
		6	Number of tenants
		7	Load Type
		8	Medical Equipment
		9	Livestock
Technical	33%	1	Location on Feeder
		2	Spur Length
		3	Benefit
		4	Load Size
		5	Meter Type
		6	RCD
		7	Existing DER
		8	Tariff
Environment	22%	1	DA Required
		2	Outside Waterways
		3	Difficult Access
		4	Tree Clearing
		5	Flat Land
		6	Comms Network

Criteria derived from:

- Customer EoI / survey responses
- Desktop analysis of site and customer demand
- In field confirmation of attributes (to be completed)

Next step:

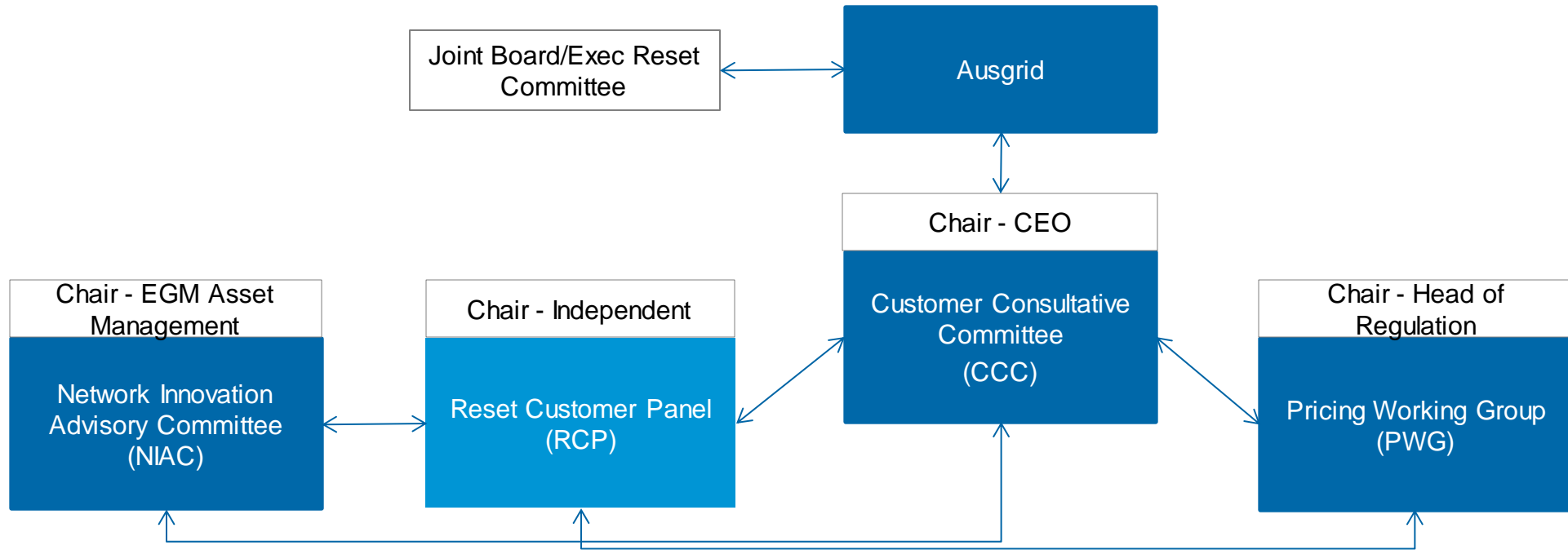
Direct engagement with top 10 shortlisted sites over June and July to confirm customer suitable for trial and commence sign-up process

NIAC Feedback: What are your views on the approach to prioritising Stage 1 trial sites and weighting of criteria for selection and engagement process?

A hand is holding a black handheld device, possibly a scanner or diagnostic tool, over the engine compartment of a car. The engine cover is open, revealing various components. A blue glow is visible on a part of the engine, and the letters 'LB' are printed in blue on a nearby component. The background is dark and slightly blurred.


Customer Engagement Panels Update

Proposed customer engagement model



- **CCC** retained as peak consultative body – membership to be refreshed.
- Establishment of the **RCP** with Independent Chair to focus on 2024-29 Reset
- Ausgrid to collaborate with **RCP** and:
 - **NIAC** on current period and 2024-29 innovation program; and
 - **PWG** on 2024-29 Tariff Structures Statement
- Key 2024-29 Reset positions require **CCC** alignment.
- Ausgrid Board members engage primarily with **CCC** on business and Reset strategic issues and decisions

- Role: Members:** Maintain current membership.
Ausgrid Rep: EGM Asset Management, Manager Network Innovation.
Key activities:
- Development of innovation chapter for Regulatory Proposal and input into transformation narrative
 - Provide advice on the execution of network innovation program and network transformation initiatives.
 - Opportunities for collaboration with other networks may also be identified.

A close-up photograph of a person's hand holding a black handheld device, possibly a scanner or diagnostic tool, over the engine compartment of a vehicle. The engine cover is black with a blue circular logo and the letters 'LB' in blue. The background is dark and slightly blurred, focusing attention on the hand and the device. The overall image has a dark, semi-transparent overlay.

For Information: Asset Condition Monitoring Update

Asset Condition Monitoring Projects Update



Recap of workstream objectives

- To test a variety of modern on-line asset condition monitoring technologies to provide real time assessment of asset condition for critical assets, including integration into the ADMS.
- These technologies can increase efficiency due to advanced predictive failure capabilities. They may also allow capex deferral where it can be deployed to facilitate techniques such as dynamic ratings.



Smart meter data analytics

- **Trial objective:** Developing data analysis platform for detection of neutral integrity issues using market sourced smart meter data.
- **Trial Status:** Smart meter data platform selected and acquisition in progress, due to commence trials in June.



High Accuracy Loop Impedance Monitor

- **Trial objective:** Develop high accuracy loop impedance monitor to aid detection neutral detection on distribution mains and calibrate smart meter data analytics.
- **Trial Status:** Prototype developed with good initial results, accurately detecting variations in neutral impedance.



Travelling Wave Relay Trial

- **Trial objective:** Test viability and benefits of travelling wave relays to improve fault response time and detect insipient faults before they occur.
- **Trial Status:** Trial site designs completed, installation and testing in conjunction with Endeavour Energy expected next quarter.

Travelling wave trial benefits and scope for future deployment

Key Benefits

- Reduced fault finding time
 - Improved reliability
 - Lower operating costs
- Detection of insipient faults
 - Avoided outages and customer interruptions
 - Reduced corrective/breakdown maintenance costs
 - Improved asset management outcomes with better knowledge of asset failure modes and outage causes

Future roll-out potential

- At present capability and benefits limited to 66kV & 132kV overhead circuits due to sensitivity limitations of devices.
 - Ausgrid has approximately 1,500km of overhead 66 and 132kV sub-transmission network, approximately 50% of our overhead sub-transmission network and 30% of our sub-transmission network overall.
- Future potential to deploy at 33kV circuits requires manufacturer R&D to improve sensitivity of relay.
- Rollout is generally expected to be 'organic' as existing relays are due for replacement, except in special circumstances.

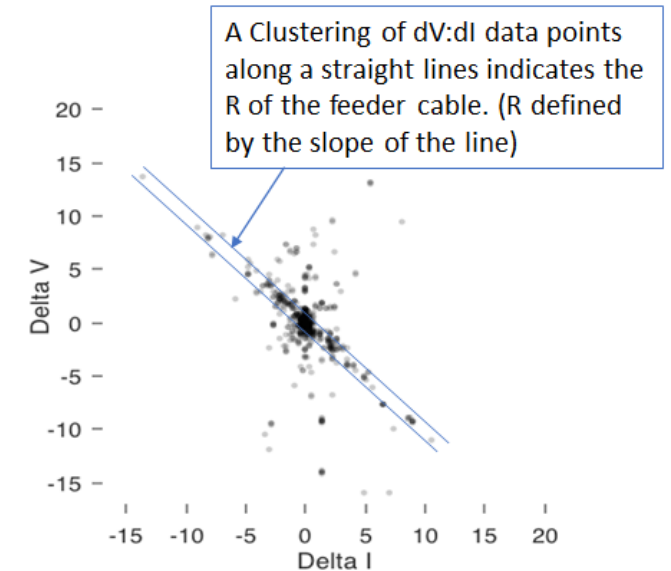
Neutral integrity detection with smart meters

Why is it important?

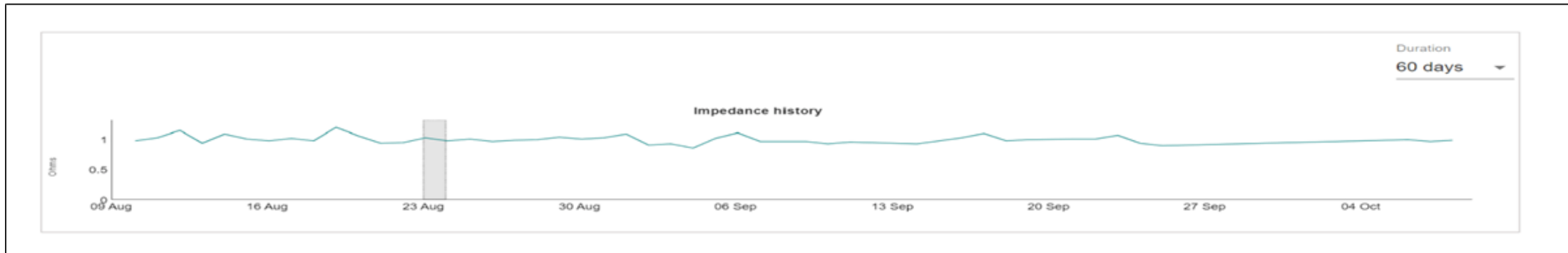
- The neutral wire or conductor is an integral part of a safe, reliable network and is important to minimise the risk of electric shocks in the household or on network equipment.
- Degraded wires (for example due to corrosion or damage) can lead to safety hazards and risk of electrocution.
- Determining the integrity of a neutral circuit can be done with on-site testing, but this isn't practical across the whole existing in service network.

How do we detect neutral integrity issues with a smart meter?

- A deteriorating neutral conductor will present as an increase in electrical resistance of the conductor.
- Monitoring of the low voltage network and looking for small, unexpected changes in voltage and current can assist in identifying integrity issues. These changes may be very small as the degradation may be very localised.
- For reliable detection, analytical techniques on large data sets are required to detect underlying changes over time that are not typical of day-to-day network operations.



Correlating many measurements of current and voltage to estimate the network electrical resistance.



Trend analysis over time is used to identify underlying changes in the network which may indicate a decaying or defective neutral connection

Thank you

