Network Innovation Advisory Committee Meeting #13

16 June 2022

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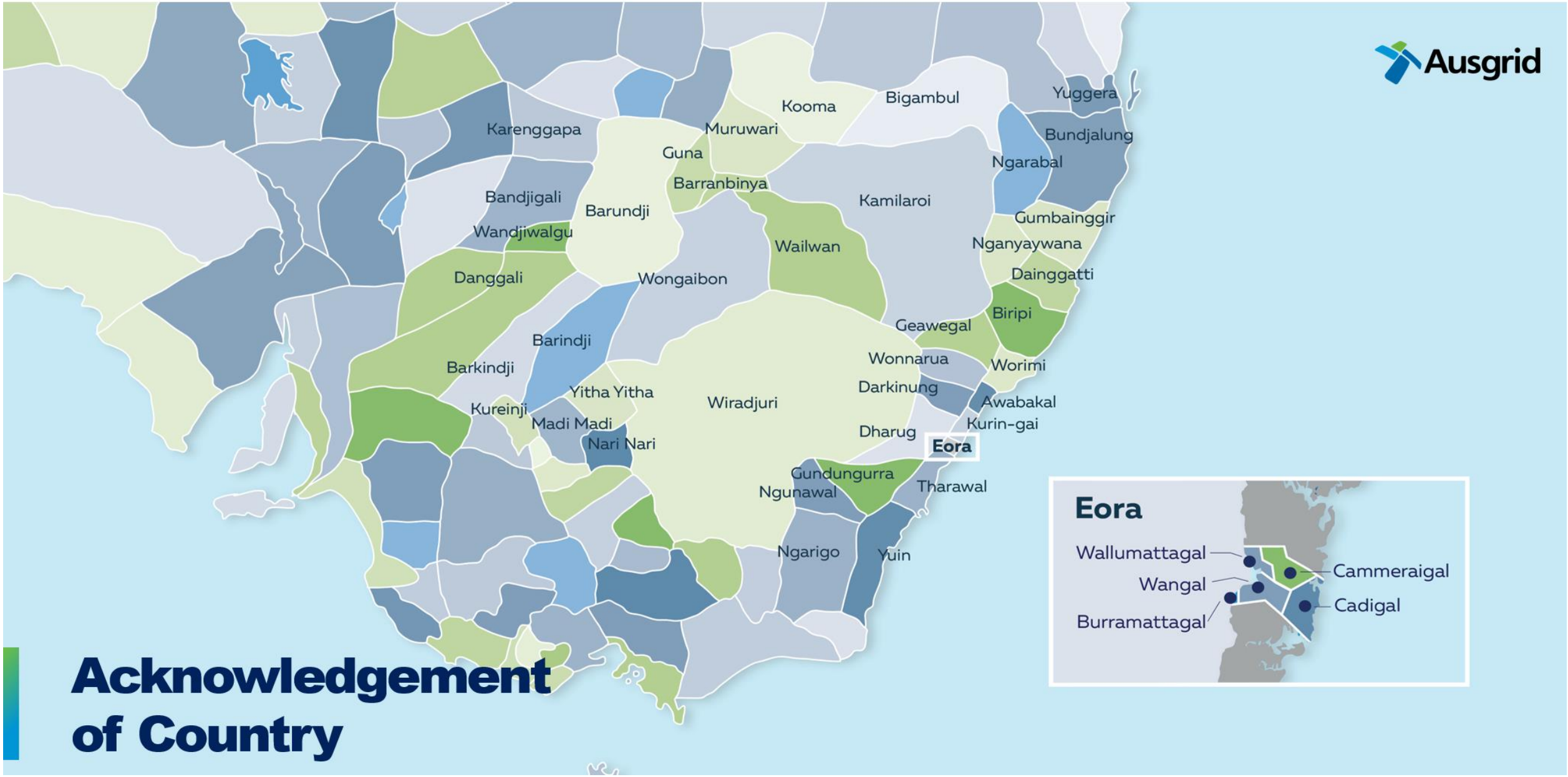
Acknowledgement of Country



Safety Share

Agenda

#	SESSION	FACILITATOR	TIMING
1	Welcome, Acknowledgement of Country, Safety Share & Updates from Committee	Murray Chandler	2:00 – 2:15
2	Review of actions	Murray Chandler	2:15 – 2:30
3	Network Innovation Program Dashboard and Highlights	Alex Watters	2:30 – 2:45
4	Community Battery Project Update	Alida Jansen van Vuuren	2:45 – 3:15
5	Ausgrid's Learnings from the International Utilities Working Group	Murray Chandler/ Alida Jansen van Vuuren	3:15 – 3:30
6	Post Implementation Review – Proposed Process & Timeline	Alex Watters	3:30 – 3:40
7	Proposed Reallocation of Funding within the Network Innovation Program	Alex Moran	3:40 – 3:50
	BREAK		3:50 – 4:00
8	Development of 2024-29 Innovation Program • Supporting DER & Resilience strategies • Network Innovation Miro feedback • Feedback from Customer Panels • Network Innovation Principles • Proposed portfolios & Program Investment Options	Alex Moran	4:00 – 4:50
9	Recap and next steps	Murray Chandler	4:50 – 5:00

	For Information Attachments	Slide No.
A	Resilience Uplift Project Descriptions	40
B	Microgrids & River Communities Lessons Learnt	49
C	Network Innovation Program Lessons Learnt Register	54
D	IEEE2030.5 within Edith (extract from reference group slides)	62

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Review of Actions

Review of Actions

	Action Items	Date Raised	Status	Comments
16	Consideration of IEEE2030.5 and/or CSIP-Aus in connection policy & DSO services review	Sept 2021	Complete	Being considered as part Project Edith – Refer Attachment D for Project Edith reference group slides
23	Add Microgrid analysis solution development to Lessons learnt	Mar 2022	Complete	Refer Attachment B
24	Program decision mapping • Add new triggers - community sensitivity, commercial driver • Include community input (is technical maturity enough) before splitting to BAU and NIAC • Bring NIAC review in at 'progress detailed evaluation' • Map example of flow for one project	Mar 2022	Complete	Refer Agenda Item 8
25	Consider adding communications / community engagement innovation into approach to innovation – research and trials	Mar 2022	In progress	Microgrid project engagement - focus group to inform community views and Co-design solution
26	Develop Post Implementation Review for NIAC 2019-2024 program	Mar 2022	In progress	Refer Agenda Item 6
27	Share outcomes of miro boards – provide prioritised list for NIAC review	Mar 2022	Complete	Refer Attachment A
28	Action from RCP: Address program level lessons learnt and draw links to proposed future program	May 2022	In Progress	Refer Agenda Items 6 & 8

Network Innovation Program Dashboard

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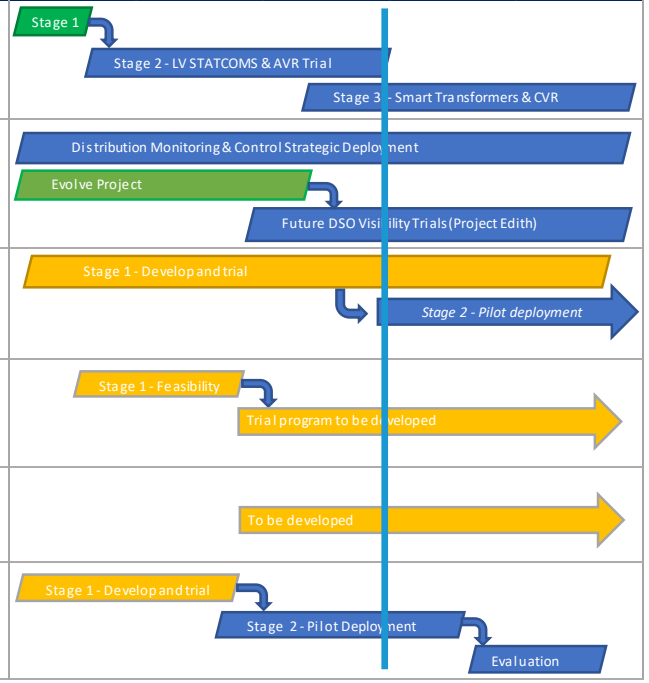
Innovation Program Highlights since last meeting

Advanced Voltage Regulation	• Final site selection and planning work completed for STATCOM Phase 2 trial. Supporting NSW Govt Clean Technology Commercialisation grant to support further R&D in this area. • Adaptive voltage regulation trial progressing with preliminary activity (zone VT accuracy testing, meter data acquisition) underway.
Community Batteries	• Made second round payments to customers for Q1 2022 participation. • Bankstown (Tesla) battery commissioned. Cameron Park (Tesla) battery commissioned 10 June. • AER confirmed ring-fencing waiver not required for batteries as installed before 3 Nov 2021 (i.e. previous ring-fencing guideline applies).
Microgrids	• Project Lessons Learnt completed for River Communities Microgrid investigation and engagement. • Draft feasibility report on candidate Hunter Valley sites completed with community engagement and co-design to commence via focus groups to be scheduled in late June to progress to next decision points.
Standalone Power Systems	• Detailed site designs in progress with lease signed and order placed for first customer unit. Commissioning targeted for September 2022. • Commencing further engagement for expansion into Phase 2 including discussions with major regional agribusiness.
Dynamic Load Control – Solar Soak	• Trial successfully completed with positive results achieved, including significant offset of daytime solar energy with hot water load • Product roadmap commenced, following engagement with AER on tariff schedule modifications, and retailer engagement to commence in June

Network Innovation Program Dashboard (1 of 2)

Workstream	Project Score	Estimated Budget $m	Actual Spend $m	Committed Spend $m	Status	Update/Comments/Feedback	High Level Project Timeframes
Advanced Voltage Regulation	3.45	$3.58	$0.83	$2.37		STATCOM Phase 2 sites identified with commissioning planned from late Q1 FY23. CVR trial sites identified and preliminary works underway.	
Network Insight Program	3.82	$12.18	$5.18	$7.15		DM&C Integration and refurbishment underway. Project Edith commenced. Additional pole tx sensor lab evaluation complete and business case for trial deployment under review.	
Fringe of Grid Optimisation	3.71	$4.97	$0.95	$2.38		Detailed SAPs and site layout designs in progress with one customer sign-up complete. Commissioning planning underway. A large agribusiness approached to participate in trial with positive early feedback.	
HV Microgrid Trial	3.44	$9.10	$0.15	$0.35		Draft technical feasibility study completed and undergoing Ausgrid review. Community engagement progressing to execution stage via focus groups with communities	
Advanced EV Charging Platform Trial	3.53	$1.05	$0.00	$0.00		Scoping of program has begun with development of potential trial focus areas.	
Grid Battery Trials	3.81	$8.65	$5.87	$5.04		All batteries successfully commissioned and undergoing operational testing. Customer payments commenced.	



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 31/05/2022

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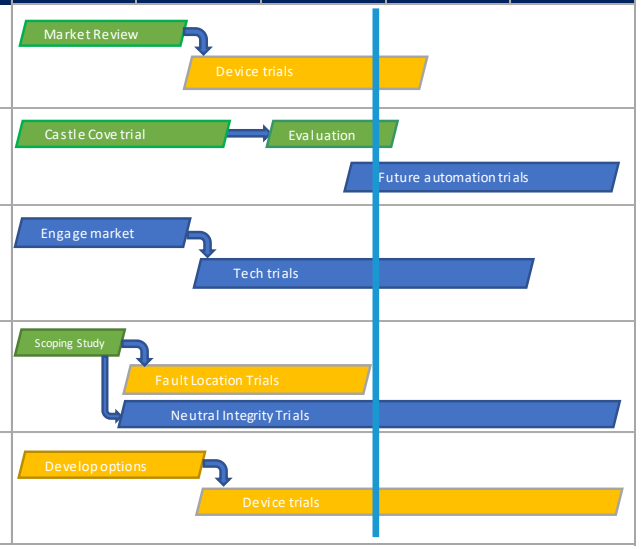
Network Innovation Program Dashboard (2 of 2)

Workstream	Project Score	Estimated Budget $m	Actual Spend $m	Committed Spend $m	Status	Update/Comments/Feedback	High Level Project Timeframes
Portable All-in-One Off-Grid Supply Units	2.51	$0.70	$0.00	$0.03	●	Desktop review and field inspections completed and working with identified supplier on design changes to meet Ausgrid safety and reliability standards.	
Self-Healing Networks	3.58	$0.33	$0.17	$0.35	STOP	Equipment solution failed testing, project terminated. Lessons Learnt report to be developed.	
Dynamic Load Control	2.83	$0.49	$0.00	$0.04	●	Product proposal developed for more flexible daytime controlled load service. Engagement with retailers to commence in June with capability to be made available on an opt-in basis from July.	
Asset Condition Monitoring	3.17	$7.04	$1.32	$2.90	●	Travelling Wave relays commissioned and under evaluation. Business case development for large scale pilot for smart meter data in progress considering both safety and DER integration benefits.	
Line Fault Indicators	2.75	$0.70	$0.15	$0.34	●	Initial trial sites commissioned in June. Further testing of advanced LFI products required following some testing failures.	



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Community Battery Project Update

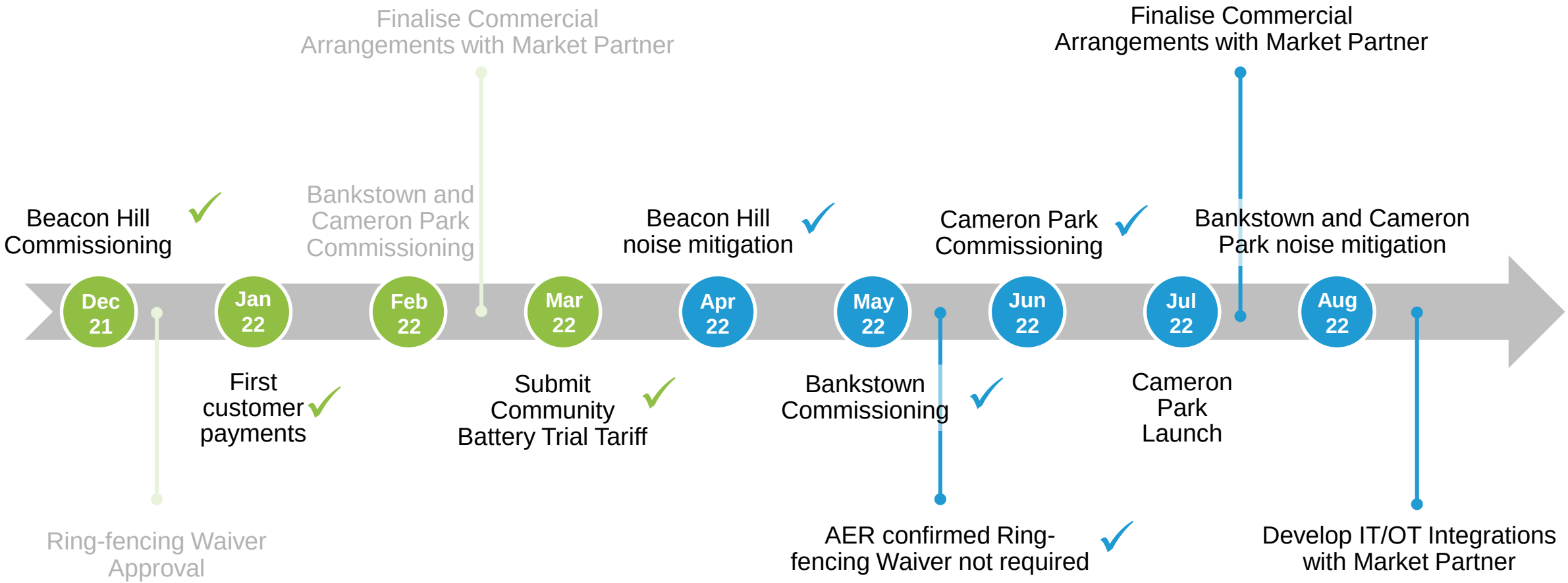
How the NIAC can assist

What we will cover today:

1. Update on progress and overview of key lessons learned (customer engagement, noise, battery control, ring-fencing)

2. Seeking NIAC endorsement to increase Community Battery funding allocation to $8.65m.

Key upcoming dates for Community Battery trial (update from November 21)



Customer Engagement Update

Current status of customer enrolment (as at 1 June 2022)

Total
- 62 customers have signed trial agreement.
- 56 droplets (monitoring devices at homes) have been installed.

Beacon Hill
- 25 customers have signed trial agreement.
- 21 droplets have been installed.

Bankstown
- 16 customers have signed the trial agreement.
- 15 droplets have been installed.

Cameron Park
- 21 customers have signed trial agreement.
- 20 droplets have been installed.

Next steps

- Prepare for next round of payments.
- Discuss future product with retailers, considering trial feedback.

We have undertaken two Community Battery Customer Surveys

The question asked is; How likely are you to recommend the Community Battery Trial to a friend, family member, or colleague?

9 January (9 respondents)

Mean score: 9.1

31 April (28 respondents)

Mean score: 8.4

The Net Promoter Score (NPS) is answered on a scale of 0-10. An answer of 9-10 is considered a promotor, 7-8 is passive, and 0-6 is a detractor

Beacon Hill Update (MTU battery)

Addressing water ingress issue: Ausgrid has been consulting with internal SME's, Penske, MTU Australia and MTU Germany as well as other industry specialists (i.e. in roofing) to address water ingress issue. The next steps are to assess safety of battery lifting lugs (photos next slide), and safely relocate battery to the Penkse warehouse for rectification work.

Beacon Hill noise mitigation panels.

Beacon Hill battery trapped and fenced off due to water ingress.

Beacon Hill Update (MTU battery)

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Cameron Park and Bankstown Update (Tesla batteries)

Resolution of CILC issue: Negotiation with Tesla on communication and control solutions that meet Ausgrid's Critical Infrastructure Licencing conditions stalled in February 2022. An alternative solution has been developed with appropriate risk controls and Home Affairs has been briefed on non-compliance. Risk deemed as appropriately controlled if limited to these two locations.

Bankstown Battery successfully commissioned on 27 May 2022. Noise testing continuing through to end of June.

Cameron Park Battery on track to be commissioned 10 June.

Sample Learnings from the 2022 International Utilities Working Group (IUWG)

Sample innovation learnings from 2022 International Utilities Working Group

Climate / asset aging laboratory – France

public link

‘Future grid’ test lab – Chicago

public link

11kv Superconductor – Chicago

public link

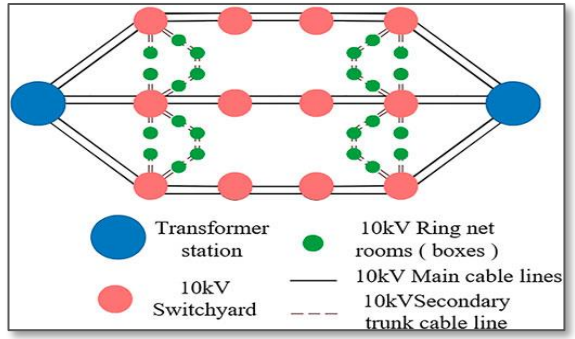
Accelerating removal of SF6 switchgear – UK

public link

Mobile gas turbine generators – China

public link

Resilient ‘diamond’ network blueprint – Shanghai



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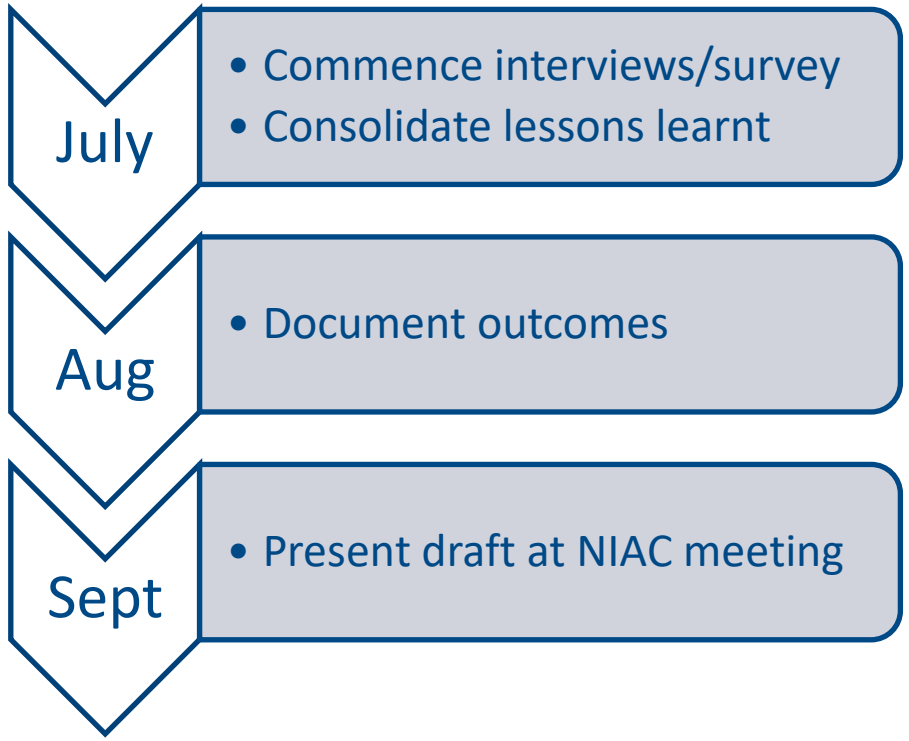
Post-Implementation Review Process for Network Innovation Program

Post Implementation Review Proposal

PIR Methodology

- **Desktop review of:**
  - Lessons learnt registers and reports
  - Outcomes and benefits realised (both qualitative and quantitative)
- **Survey of all stakeholders**
  - Internal partners (planning, delivery, IT etc)
  - External stakeholders – including NIAC, suppliers, collaborators etc
- **1-1 interviews with key stakeholders**
  - NIAC members
  - Ausgrid executive
  - Other key internal or externals e.g. key customers, councils, etc
- **Document and prioritise recommendations for remainder of this period and next period**
  - What is already included?
  - Other findings?

Proposed Timing



Reallocation of Funding within the Network Innovation Program

Drivers of Funding Reallocation

1. Supporting additional resilience solutions

- You asked us to consider expanding our innovation program to test additional resilience solutions prior to next regulatory period
- Our workshop in the March meeting ranked 7 potential projects identified through workshops and surveys against the innovation principles.
- We propose progressing as part of this regulatory period the top 5 items for detailed investigation and execution if viable.
- Attachment A shows additional detail and scope on these potential projects
- We estimate that this is approximately $2m if the top 5 projects proceed to trial stage

2. Additional funding for community battery trial

- As per the detail in Agenda Item 4

Proposal: Reallocate a total of $4.8m from underspent programs to fund the two listed items. Reallocation will come from the following programs:

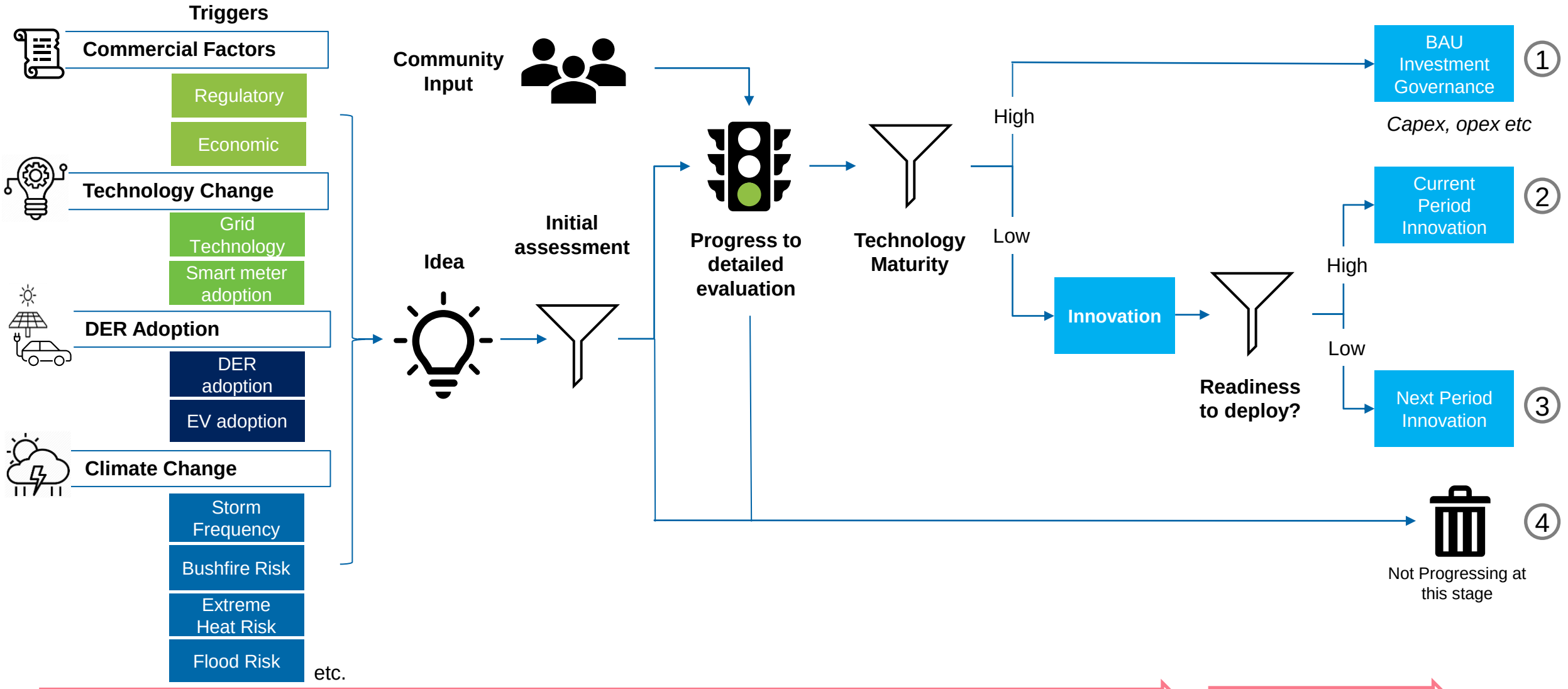
- Microgrids
- Dynamic load control
- Self healing networks

Does the NIAC endorse re-allocation of funding from these workstreams to these items?

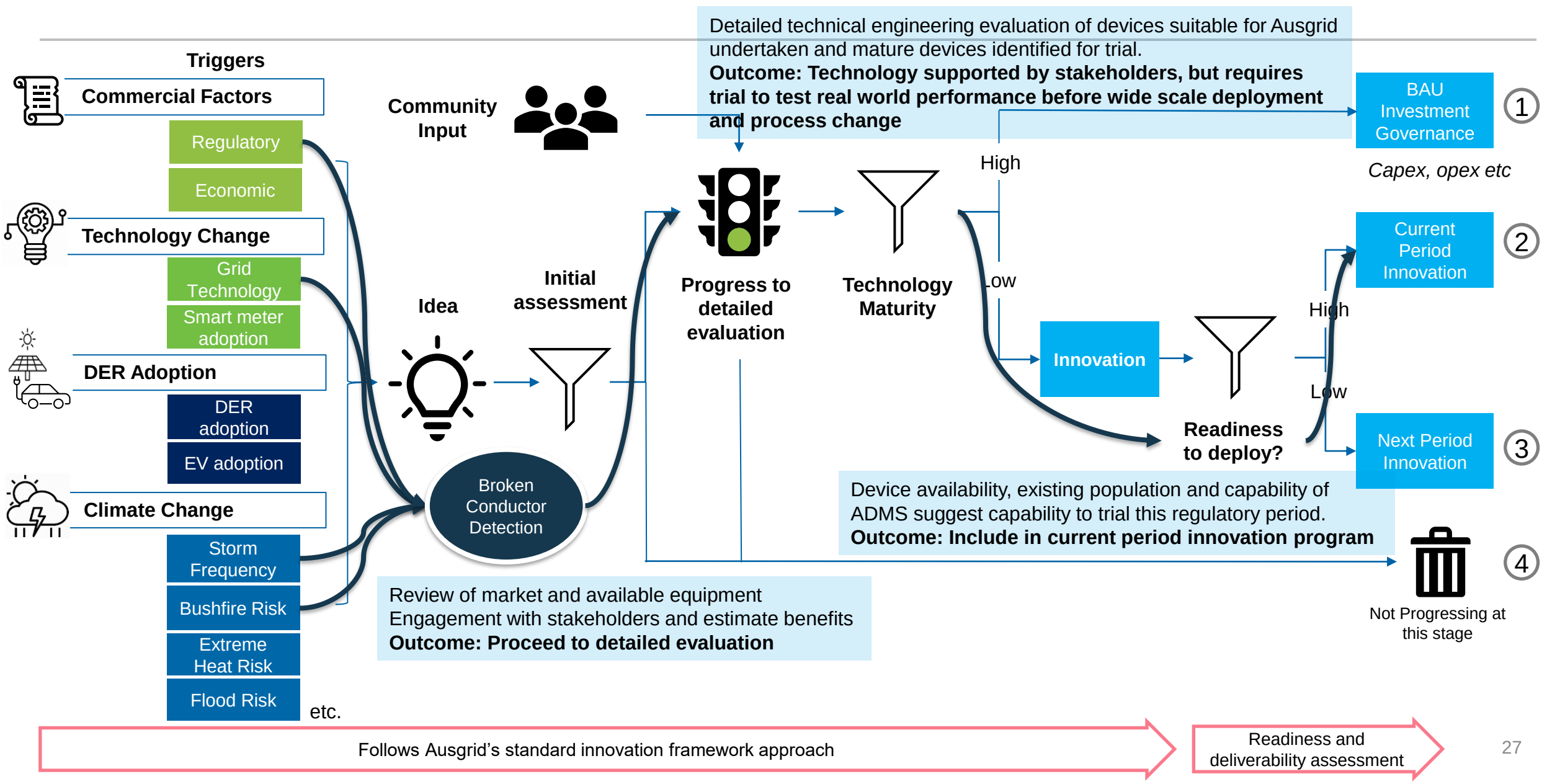
Break

2024-29 Network Innovation Program Development

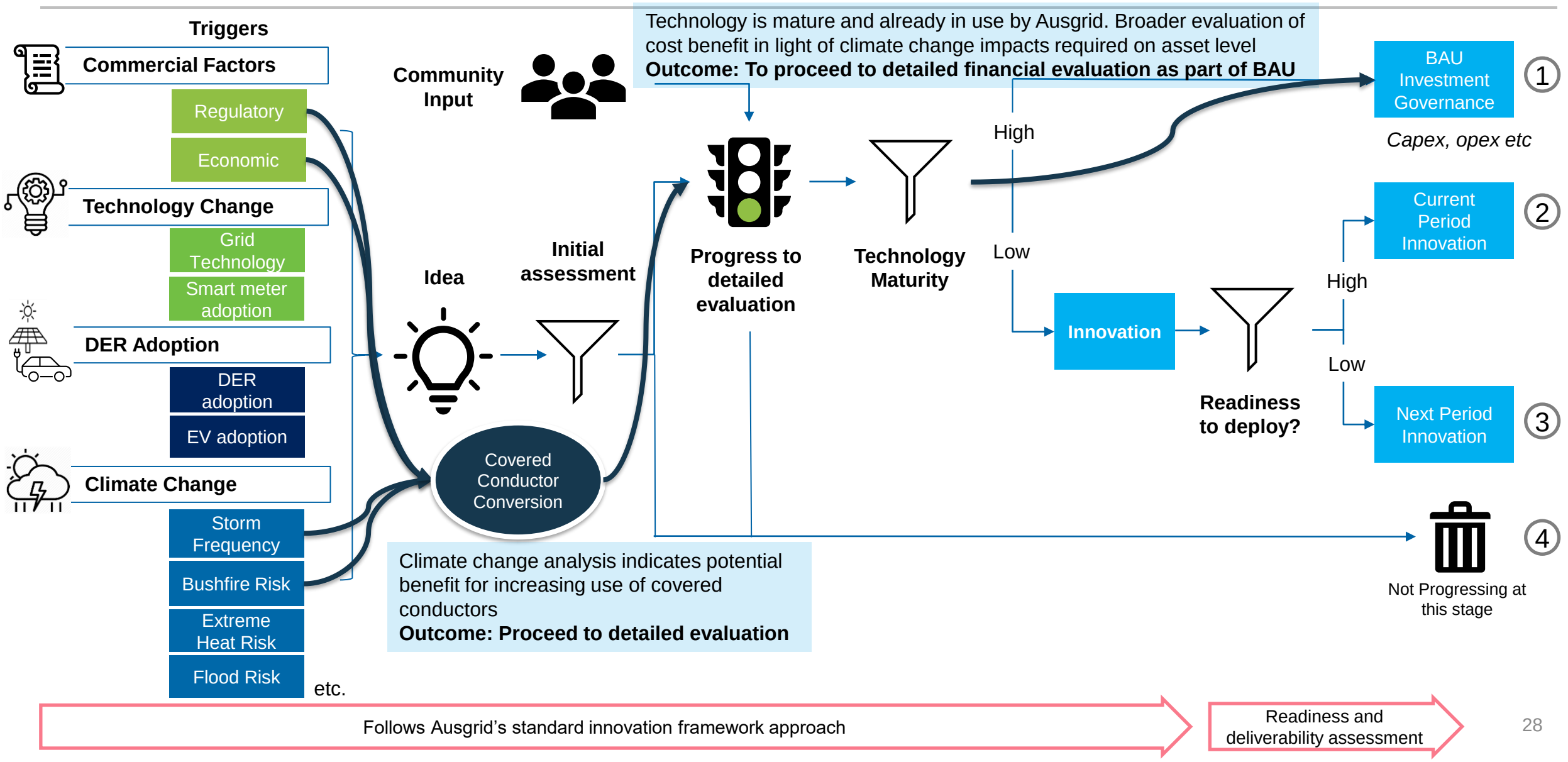
Recap – Consideration of DER & Resilience initiatives link to Network Innovation Program



Worked Example – Innovation – Broken Conductor Detection



Worked Example – BAU Resilience Project – Covered Conductor Conversion



NIAC Miro board feedback on Network Innovation Program structure

Topic	Question	Response
Structure of program	**Is a portfolio approach with a focus on benefits and outcomes rather than specific technologies better than a technology specific program?**	Supportive of taking a portfolio approach to 24-29 Innovation program although they would like some projects identified. Support undertaking a PIR on one of the trials from the 2024-29 period
	Include an allowance to both trial and implement solutions – roll successful trails out at a larger scale?	Supportive of including both trial and implementation of innovation programs, with clear scope and boundaries identified Supportive of including non-asset based innovation – such as community engagement and concept testing
	Include both Capex and Opex components for optimum delivery?	Supportive of including both Opex and Capex components in the 2024-29 innovation program.
Priorities and Principles	**Are the innovation investment principles still relevant for the next period?**	Support the revision of NIAC innovation principles also supportive to review the weighting of innovation principles
	Are the weightings still right?	Should review
Scope and Charter	**Is the existing advisory nature the appropriate balance of oversight and involvement?**	Supportive of continuing with the advisory nature of the NIAC, agree that the group has been very collaborative in their approach to input on projects
Membership	**Is the membership diverse enough?**	Support expanding membership eg, PIAC, Council rep or ASP rep??
	Are we missing any key stakeholders?	
Format	**Is the frequency of meetings sufficient?**	
	Are there other ways that members would like to get involved in the process?	

Refresh Network Innovation Principles – initial discussion

Currently, the purpose of the Network Innovation Program is to deploy a range of trials and pilots covering emerging energy technologies to support the rapidly evolving electricity sector.

Guiding Principle	Weighting
• Maintains safety for employees and the community	17%
• Improves fairness	14%
• Accelerates de-carbonisation	14%
• Lowers costs for customers	13%
• Improves resilience	12%
• Solves a specific problem	11%
• Improves the economic utility of new and existing assets	10%
• Uniqueness of problem and collaborative opportunities	9%
	100%

NIAC DISCUSSION

- Which principles are still relevant?
- Which would you like to refresh?
- We will share a survey on principles and after this meeting with results to inform next program revision to be presented at 15 September NIAC meeting

Customer feedback on innovation

NIAC feedback (March):

- Demonstrate lessons learnt from current period
- Define governance process and decision making framework for investment in innovation
- Need to be clear on boundaries between resilience, DER and innovation spend

Reset Customer Panel feedback (May):

- Generally supportive of continuing innovation program
- Need to track benefits and effectiveness
- Program and forward plan to be developed in collaboration with NIAC

Voice of Customer feedback (June):

INNOVATION
Find the most cost-effective technologies and how to implement them.

Allow proven financial benefits of NIAC to be recycled back into new initiatives in the following year. (rather than pass on benefits to customers directly)

We want Ausgrid to move from the proposed increase in spend (12m pa capex + 1.5m pa opex) to the higher increased spend (16m pa capex + 2m pa opex) to achieve increased innovation *IF* the annual bill cost difference is not a lot. We understand this is a 30c per year difference for an average non-solar household.

Community projects around new tech (eg: Yackandanda battery) provides a shortcut to invaluable knowledge about what works and what to avoid.

Ausgrid can reduce the cost of finding and implementing new technologies by collaborating or adopting solutions tested and implemented by other grid operators, other states, even other countries.

2024 – 29 Program Development – Proposed Portfolio Streams

DER Support & Enablement

This workstream is focussed on the trialling of new, untested technology that helps integrate and support more distributed energy resources to connect to the Ausgrid network – enabling customers to extract more value from their assets.

Priorities include:
- Local autonomous networks, using customer and network equipment in concert to improve local network performance
- Economically efficient DER integration (e.g. EV chargers, batteries) into network assets (e.g. poles, substations, pillars) to maximise societal benefits
- Research focused on community attitudes, expectations and preferences related to innovative DER assets and services

Community Resilience

This workstream is focussed on the trialling of new, untested technology that helps to increase the resilience of our network and our customers to severe weather events and other incidents such as bushfires.

Priorities include:
- Mobile response capability using new fuels such as hydrogen
- New technology to monitor and alert for environmental conditions which may impact assets, including extreme weather and fire starts.
- Research focused on community attitudes, expectations and preferences related to innovative options to meet resilience needs

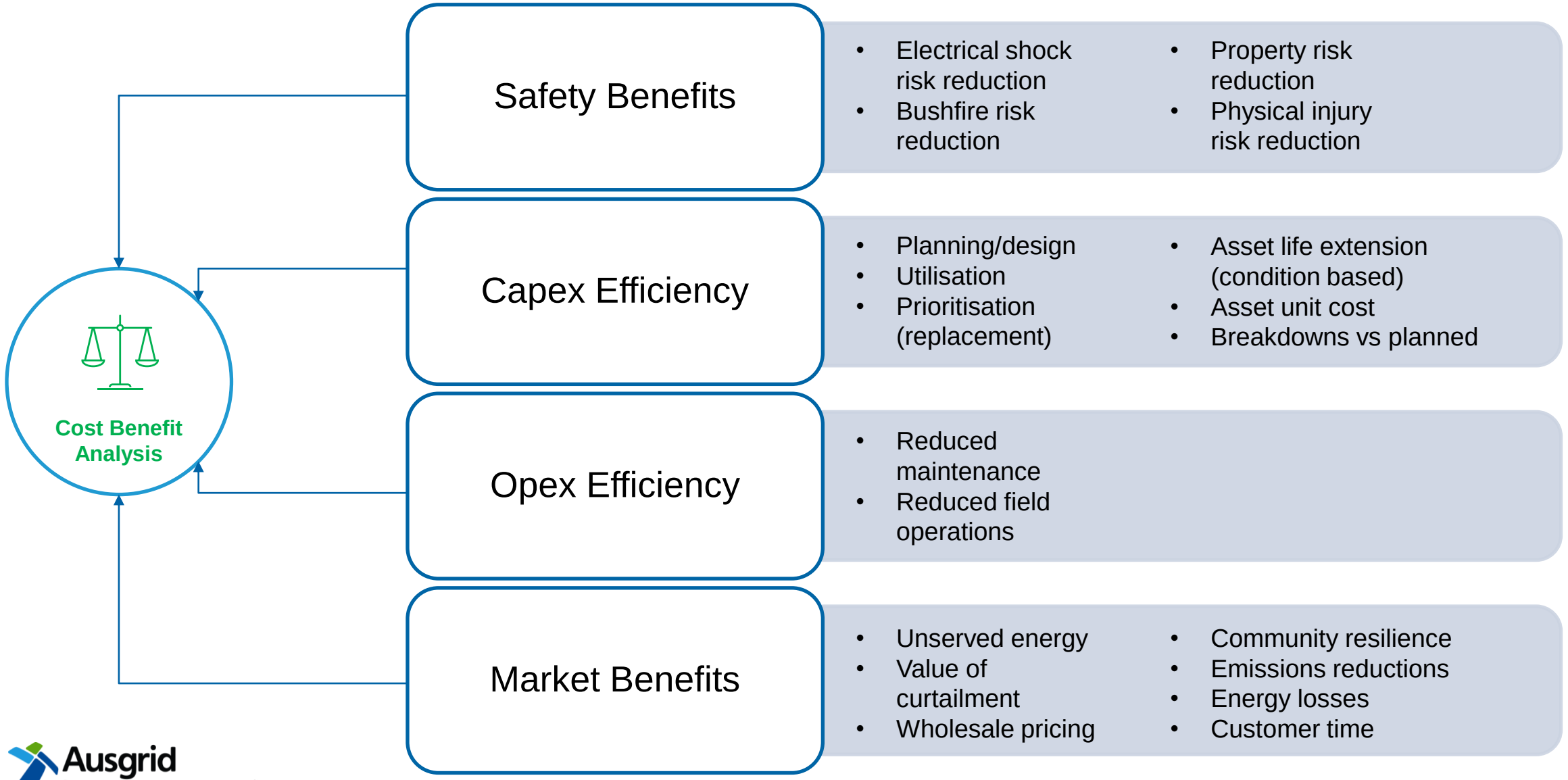
Safe, Intelligent Networks

This workstream is focussed on:
- Developing and testing new field assets that deliver safe, reliable and sustainable energy for our customers
- Developing technology and capability in Ausgrid to better plan, maintain and operate the network. This includes an uplift in capability to use the increasing amounts of data available to us through customer and network devices

Priorities include:
- Predictive capabilities to identify emerging network and asset faults
- Network state estimation and forecasting capabilities
- Increased utilisation through dynamic ratings and real time optimisation
- Modernising field assets such as relays and control equipment
- Reducing carbon footprint through alternative technologies
- Modern switching technology in place of traditional, manual assets
- R&D related to standards, design and deployment of modern assets in light of changing community expectations

We are seeking the NIAC's view on these workstreams

2024 – 29 Program Development – Cost Benefit Analysis Approach



2024 – 29 Program Development – Proposed Portfolio Roadmap

DER Support & Enablement

Community Resilience

- Community batteries and Advanced Voltage Regulation
- Dynamic Operating Envelopes
- Standalone Power Systems
- Dynamic Pricing
- Flexible load control
- Microgrids
- Low Loss Equipment
  - Tx & cable trials
  - Non-SF6 swgr trials
- Ongoing customer research
- Situational Monitoring
  - Ultrasonic Discharge Detection
  - Thermal monitors
  - Weather monitors
- Market & Customer Services Integration
  - DERMS & VPPs
  - EVs
  - Controlled Load
- Local Autonomous Networks
  - Dynamic & local load shedding
  - Customer Islanding Support
- Hydrogen Energy
  - Disaster Recovery Units
  - Hydrogen SAPS
  - Hydrogen Microgrid

Pre 2019 | **2019-2024 Regulatory Period** | **2024-2029 Regulatory Period** | **2030+**

Safe, Intelligent Networks

- Condition monitoring & data analytics
- Network Insights
- Self Healing Network Trials
- Fault Detection & Prediction
- Operational integration of network edge monitoring
- Digital Substations & adaptive relays
  - Relay upgrades for dynamic operation
  - Substation protection rationalisation
- Advanced network visibility & automation
  - Phasor measurement unit trial
  - Wires down disconnection
  - HV/LV automation & remote switching
  - Cable condition monitors
- Network Analysis & Optimisation System
  - State estimation
  - Dynamic topology optimisation
  - Closed loop voltage control

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Recap & Next Steps

Key Milestones at Next Meetings

Meeting	Content
16 June	• Draft innovation program and proposed future NIAC scope / remit

14 September	• Review revised innovation program proposal incorporating:
	  • NIAC and RCP feedback on draft program
	  • Review and refresh of innovation principles

1 December	• Present final innovation program proposal to be included in draft submission

Attachment A
Resilience Uplift Project Descriptions

NIAC feedback – outcome of project prioritisation against innovation principles

NIAC Guiding Principles Assessment

	Project Prioritisation Principles	Weight	Rapid generator deployment facilities - Faster community response in major disasters	Fire Start monitoring - Reduced bushfire risk and faster response to fires	Improved fault location technology - Faster outage restoration and safer network	Broken conductor detection trials - Faster outage restoration and safer network	Network digital twin uplift - Network digital twin uplift - More efficient, safer customer connection work. Faster assessment of emerging asset risks	SAPS review - More efficient, safe and reliable supply in climate change affected areas	Local weather stations - Improved reliability and restoration ability in adverse conditions
1	Maintains safety for employees & the community	17%	4.5	4	3.5	4	2	1	1
2	Improves fairness	14%	3	2	3	2	2	1	3
3	Accelerates de-carbonisation	14%	1	1.5	1	1	1	1	1
4	Lowers costs for customers	13%	3	3	3	3	4	1	2
5	Improves resilience	12%	4.5	4	4	3	4	4	3
6	Solves a specific problem	11%	5	5	4	5	3	4.5	4
7	Improves the economic utility of new and existing assets	10%	2	3	2.5	3	4	4	2.5
8	Uniqueness of problem and collaborative opportunities	9%	5	5	3	2	3	3	2
Project prioritisation score		100%	3.46	3.34	2.99	2.88	2.76	2.23	2.22

Rating	Rating Description
1	Project does not impact progress on this principle
2	Project will have a minor impact on advancing this principle for Ausgrid and our customers
3	Project will have a moderate impact on advancing this principle for Ausgrid and our customers
4	Project will have a significant impact in advancing this principle for Ausgrid and our customers
5	Project will have a major industry wide impact on advancing this principle

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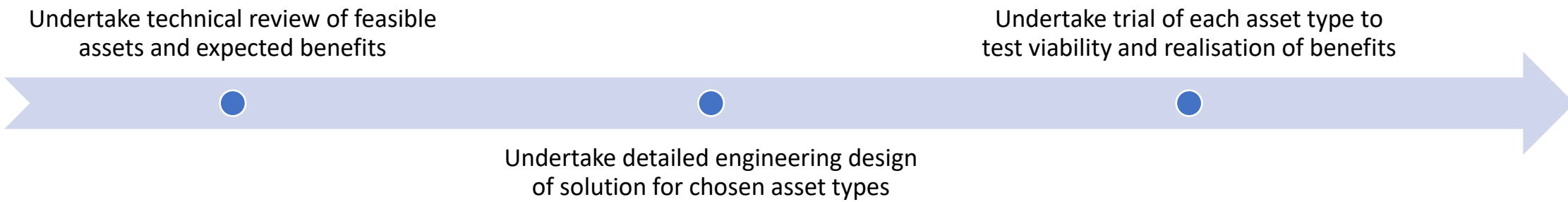
Resilience Uplift Project Descriptions

Project Title:	**Rapid Plug & Plug generator deployment facilities**	**Project Principles Score: 3.46**
Project Description:	Develop capability to integrate rapid generator connection points into suitable standard Ausgrid asset designs in disaster prone areas (e.g kiosks, pillars, PTs etc)	
Benefits Expected:	Will improve emergency response processes by accelerating the deployment of mobile generators or portable SAPS.	

Project roadmap



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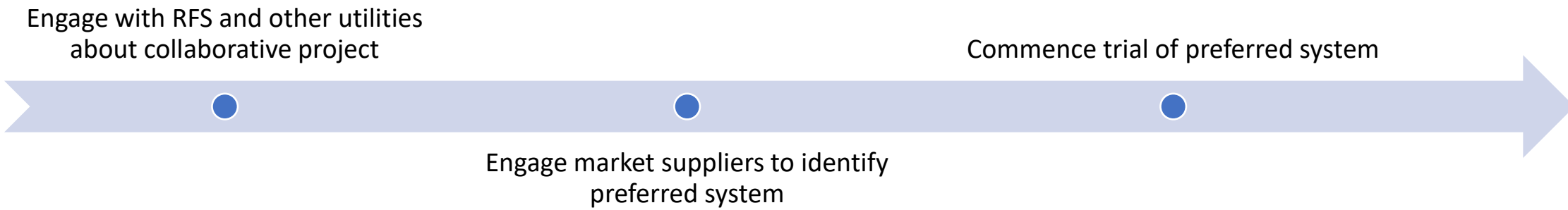
Resilience Uplift Project Descriptions

Project Title:	**Fire Start Monitoring**	**Project Principles Score: 3.34**
Project Description:	Deploy high resolution camera system with AI capable of detecting fire starts within the target area. Initial focus on high bushfire risk areas in the Hunter and Central Coast	
Benefits Expected:	Potential, with RFS engagement, to provide both situational awareness to Ausgrid on assets in remote areas as well as provide early warning system for fire starts – powerline initiated or otherwise. This will ultimately reduce both bushfire consequence risk to Ausgrid from our assets as well as improve community resilience in the face of increasing fire danger.	

Project roadmap



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Resilience Uplift Project Descriptions

Project Title:	**Improved Fault Location Technology**	**Project Principles Score: 2.99**
Project Description:	Expand our investigations into fault location technology including early detection of insipient faults which have not yet caused asset failure.	
Benefits Expected:	Improved reliability and resilience of the network by detecting emerging faults, allowing prioritisation of maintenance and avoiding breakdown expenditure	

Project roadmap

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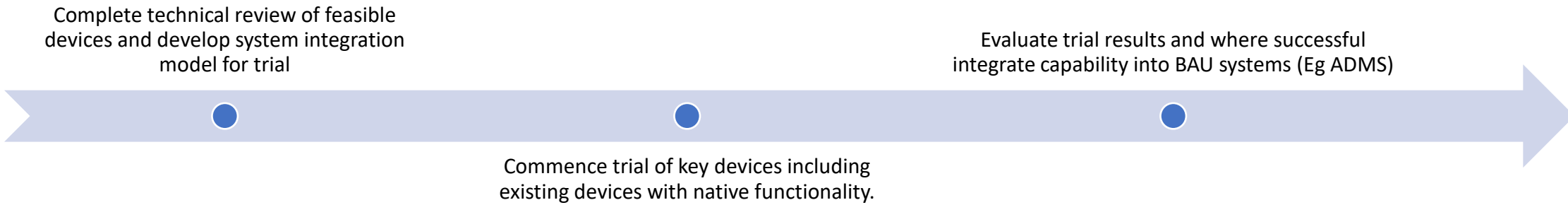
Resilience Uplift Project Descriptions

Project Title:	**Broken Conductor Detection Technology**	**Project Principles Score: 2.88**
Project Description:	Assess, design and trial broken conductor detection technology to reduce fire and safety risks associated with broken conductors	
Benefits Expected:	Will result in faster restoration of supply through better intelligence of fault type and location, as well as increased safety and reduced bushfire risk as live downed mains will be disconnected faster.	

Project roadmap



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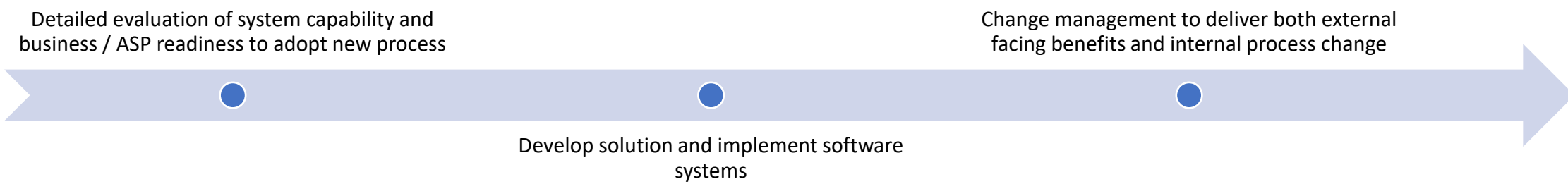
Resilience Uplift Project Descriptions

Project Title:	**Digital Twin Uplift – Defect Detection and Design Improvements**	**Project Principles Score: 2.76**
Project Description:	Expand scope of Ausgrid's digital twin project to include optional capability to enable faster and more accurate assessment of connection designs, as well as tools to identify emerging defects on assets using trend analysis of LIDAR data.	
Benefits Expected:	Will facilitate safer ASP designs including regional areas, and enable Ausgrid to identify emerging risks on existing assets – thereby reducing probability of faults on the network.	

Project roadmap



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Resilience Uplift Project Descriptions

Project Title:	**Reprioritisation of Standalone Power Systems Phase 2 pilot with revised climate variables**	**Project Principles Score: 2.23**
Project Description:	Re-develop and re-prioritise SAPS Phase 2 program of works within the current period with a focus on areas more likely to be impacted by climate change, supported by improved cost-benefit modelling considering changing input factors	
Benefits Expected:	Improved value from existing SAPS program, improved reliability and potentially avoiding traditional renewal investment in inappropriate areas most affected by climate change	

Not proposing to proceed

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Resilience Uplift Project Descriptions

Project Title:	**Local Weather Stations**	**Project Principles Score: 2.22**
Project Description:	Increase visibility of local weather conditions by deployment and integration of local weather station data in decision making. This project would involve trialling a small number of local weather stations to ascertain value of situational awareness at specific critical locations	
Benefits Expected:	Will result in faster restoration of supply through better operational intelligence of local conditions. This may support increased use of dynamic ratings to avoid overloads and more targeted field response in major events.	

Not proposing to proceed

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Attachment B
Microgrids & River Communities
Lessons Learnt

Ausgrid Innovation Program – River Communities Microgrid Case Study

Introduction

This case study has been prepared to show, through the example of the Rivers Communities Microgrid program, how customer and community engagement and lessons learnt during project development can shape and influence program outcomes and direction.

Working to ensure innovation delivers for customers

In July 2019 Ausgrid established the Network Innovation Advisory Committee (NIAC) to collaborate with customer advocates and industry experts to provide guidance for delivery of the 5 year $42m Ausgrid innovation program.

Committee members work to determine prioritisation of trials, shape the trial and monitor trial outcomes. NIAC was established to allow technology projects that may lead to better outcomes for customers, but have a degree of investment uncertainty, to be trialled and tested.

Innovation projects may result in technologies that can be implemented as standard options or may show not to deliver expected network or customer outcomes. A key consideration is for progressing a project under the program is for it to be unique, where lessons learnt can be shared with other networks to advance network innovation across the energy system.

This case study tracks one of the 11 innovation programs – the **High Voltage Microgrid** stream.

Lord Howe Island Microgrid

What is the Microgrid Workstream?

The Microgrid workstream was focused on investigating the feasibility of developing a microgrid – a system which includes generation that can sustain supply to a small local network area in the event of a broader outage of supply. Investment decisions made by NIAC members are guided by a set of 7 ranked innovation principles. Customer and Ausgrid developed weighting for the investment principles to assist in prioritising innovation programs. The Microgrid program was ranked 3.44 (5/11), and planning work was prioritised along-side higher ranked projects.

Who are the River Communities and what is the customer issue to resolve?

Ausgrid supplies electricity to a number of communities who live along major river waterways within our franchise area. These communities often have limited access (many are boat only) and typically experience worse than average supply reliability. This was highlighted in storm events such as the February 2020 and July 2020 storms during which communities in the Hawkesbury experienced significant and extended duration outages. Residents and community organisations contacted Ausgrid, local members and Ministers to seek solutions to improve energy supply to their community.

Following these concerns, Ausgrid proposed to pivot the HV Microgrid program to focus on developing a solution for Hawkesbury River Communities. Initial Ausgrid investigations identified that innovative solutions such as microgrids and SAPS could be installed improve the reliability and resilience of supply.

Trial Purpose

The purpose of this project was to investigate locations and technology solutions to help improve reliable energy supply for communities located along the Hawkesbury River.

Overview of process undertaken

Consultation

Feb 2020 – Initial engagement to support storm response – issuing of generators.

Mar 2020 - Discussions with Berowra Waters community groups

Ongoing discussions with the Berowra Waters Progress Association on impact of microgrid installation.

March 21 – presentation to NIAC

November 21 – update to NIAC on pivot to Upper Hunter investigations

March 22 – NIAC update advising focus shifting to behind the meter and traditional augmentation solutions.

Planning has commenced on continued engagement with Hawkesbury community on alternate solutions.

Prelim Proposal

Mar 2021 – Programmatic approach implemented that considered over 43,000 combinations of rectification options of microgrids, SAPS and traditional network solutions to determine the optimal investment. A shortlist of sites and different combination of solutions was presented to NIAC.

NIAC supported applying the Microgrid solution in community with reliability concerns.

Ausgrid determined to proceed with a Microgrid solution in Berowra waters.

Discovery

Sep 2021 - Detailed assessment of microgrids and SAPS feasibility based on various microgrid implementations around Australia and commenced identification more broadly of potential candidate sites in Ausgrid's network area.

Outcomes

Nov 2021 - Determined microgrids and SAPS are not feasible options for the River Communities area.

Microgrid project pivoted to Hunter area.

April 2022 - Commenced feasibility study of shortlist sites in Hunter area.

Moving forward

March 2022 – River Communities community consultation and investigation will continue with a focus on behind the meter batteries, smart switches and traditional augmentation

Microgrid lessons learnt

Microgrids (MGs) are able to operate ‘islanded’ from the normal network.
They can be: ‘grid-connected’ where MG generation is a backup to the normal network supply or ‘stand-alone’ where the MG is the only source of supply.

Typical MG infrastructure:			River Communities MG infrastructure:
	**Battery**	Batteries are typically suitable for 2-6 hours MG “island” operation	Impacted by longer duration outages and it is likely that a battery, solar array and generator are required to provide a resilient supply
	**Solar**	A solar array will increase the island operation by several hours depending on the array size, impact of shading and availability of sunshine at the time of an outage	
	**Generator**	Diesel generation provides for an ongoing supply source but typically requires daily re-fuelling during prolonged outages	
Typical MG infrastructure physical requirements:			**River Communities MG site constraints**
	**Network topology**	MGs used to improve network reliability are suited to centralised communities located at the end of extremely long overhead lines (50-250km) which are prone to faults	There are few centralised loads with the majority of the load being distributed. During significant weather events there are multiple faults which can be both inside and outside the microgrid. The microgrid cannot be switched in if faults exist within the microgrid.
	**Space**	MG infrastructure consisting of a battery, solar array and diesel generation can have considerable land requirements	Inadequate space for all MG infrastructure without considerable impact on the environment or landowners.
	**Fire risk**	Battery fires cannot be extinguished and are contained until they burn out. A 10m firebreak is typically provided around the MG infrastructure.	Located in dense national park bushland. A 10m firebreak would be required by clearing vegetation.
	**Sunshine**	The solar array needs to have the appropriate orientation and minimal impact from shading to have a high yield	Surrounded by tall dense trees that would have significant shading issues if not removed.
	**Access**	Sufficient access is required to install, maintain, re-fuel and operate the MG infrastructure.	Boat only access, located on very steep blocks making installation and operation complex
Outcomes and Recommendations for River Communities:			
	**Outcome**	The river communities area does not possess the physical requirements needed for MG and similarly SAPS infrastructure, without creating unacceptable community impact. The community have chosen not to progress with Microgrid option. Community consultation and investigation will continue with a new focus on behind the meter batteries, smart switches and traditional reinforcement options to improve customers’ supply reliability.	
	**Moving forward**	Sites identified in the Hunter region that would benefit from improvements in reliability and resilience (e.g bushfire impacted) which also meet the physical requirements for MG infrastructure. Feasibility study currently being undertaken by microgrid consultants on the short-listed sites.	

Attachment C

Network Innovation Program Lessons Learnt Register

Lessons Learnt Summary

Workstream	Lessons to Date	What next?	Expectations for next regulatory cycle
Advanced Voltage Regulation	• Cost-benefit of LV STATCOMS for resolving network constraints on LV distributors • Development of safe live work design and installation procedures to reduce installation costs • Development of control methods conforming to licence conditions which is suitable for integration into control room or monitoring systems • Identification of capability required to uplift hosting capacity and resolve legacy voltage management issues	• Develop understanding of broader STATCOM capabilities under different use cases, and package learnings and materials for BAU deployment • Continue to work with Home Affairs Department to promote a risk based approach to managing cyber security. • Explore on-load Dist. TX tap changer applications, and develop capability for broad based flexible network voltage control. • Pilot adaptive voltage control technology to ready for BAU deployment in zone substations	Likely to largely progress into BAU investment portfolio. Potential additional need to examine greater integration of customer side equipment (including 3rd party grid-connected batteries or microgrids, DOEs integration) into a holistic voltage management strategy

Lessons Learnt Summary

Workstream	Lessons to Date	What next?	Expectations for next regulatory cycle
Network Insights	• Developed granular model to identify cost-benefit of monitoring and control at each location on the network • Established standards and drawings for retrofit of DM&C devices in older style kiosks • Developed process efficiencies for installation and commissioning	• Continue targeted deployment at key sites identified by modelling • Further progress greenfield standards and brownfield retrofit designs for additional monitoring and develop options for pole-mounted sites	• Likely to continue roll-out of distribution monitoring & control devices where cost effective for DER integration and increased LV visibility.
	• Streamlined comms security processes including use of 3rd party networks i.e telecom carriers. • Challenges with proprietary equipment and protocols.	• Work with Home Affairs Department to promote a risk based approach to managing cyber security, differentiating monitoring and control risks	• Cyber security investment likely to ensure data systems support the range of data sources likely, with appropriate cyber security provisions
	• Challenges in developing trust in remote indication of faults on the HV network – criticality of reliable information and operator trust in emergency situations	• Improve asset management practices around monitoring devices and develop strategies to increase confidence in reliability of information.	

Lessons Learnt Summary

Workstream	Lessons to Date	What next?	Expectations for next regulatory cycle
Grid Fringe Optimisation	• Identifying areas in Ausgrid network where SAPS may be cost-benefit positive • Realising customers' expectations and behaviours towards SAPS through a survey and meetings with some of them • Identifying opportunities to integrate customer side optimisation to reduce costs for SAPS • Regulatory limitations and challenges (including planning processes) for deployment of SAPS under current legislation • Understanding technical requirements and development of technical specification for SAPS • Supplier capability and maturity for supply, installation and maintenance and emergency response scenarios • Customer installation safety and compliance to code	• Improve holistic modelling for optimising the fringe of the grid. • Continue to explore demand side management opportunities at trial sites • Work with supplier on a solution for integrating customer existing DER • Work with councils and state government on the development approval process and requirements • Supplier chosen • Engaging on capabilities for on-going maintenance and emergency response in line with customer expectations for reliable energy. • Work with customers to ensure installations are fit for purpose • 4 customers agreed to sign an agreement.	Likely to progress into BAU investment portfolio – scope to continue innovation trials on emerging technologies such as Hydrogen

Lessons Learnt Summary

Workstream	Lessons to Date	What next?	Expectations for next regulatory cycle
HV Microgrid Trial	• Microgrids that are dependent on renewables (solar/batteries) are better suited to areas exposed to frequent shorter duration outages. For longer outages the battery will typically run out of storage and be dependent on diesel generation. • Solar and physical access are critical to viability of microgrids, and current cost-benefit equation means generally limited to very remote communities with little/no network redundancy and poor reliability. • Often community focus on microgrids more often seen for environmental benefits and being less reliant on the 'grid' rather than explicitly being driven by poor reliability.	• Engage with internal stakeholders that will be directly involved with the project delivery and integration with existing systems • Investigate customer "behind-the-meter" integration into the microgrid to improve operational performance and extend islanded run-time capability • Investigate optimisation of all microgrid sources and potentially operating as an 'island' during normal operation with a grid backup • Understand protection and safety requirements to operate without the network for extended periods • Engage the communities that have been shortlisted as feasible options from a desktop assessment	Innovation funding requirements likely to extend into next regulatory period to explore feasible scenarios and technologies for microgrid or microgrid-like solutions

Lessons Learnt Summary

Workstream	Lessons to Date	What next?	Expectations for next regulatory cycle
Advanced EV Charging Platform	• Significant industry movement, including new direction from ESB • Many solutions involve opex to purchase a service, rather than capex	• Continuing our re-assessment of knowledge gaps and areas for investment to maximise value. • Investigate options to include opex allowance specifically for Network Innovation projects in future to enable capture of greatest benefits	Likely investment required to support integration of EV and other DER into the grid
Grid Batteries Trial	• NSW Distribution Critical Infrastructure Licence Conditions and federal cyber security requirements can complicate integration with overseas suppliers. • Different in-field control designs required for each vendor. Two suppliers were selected to reduce vendor risks, but this added design time. • Up-front surveys and engagement required to understand community views. Customers are understanding of changes and local councils remain highly supportive if they are kept informed as trials progress.	• Establish relationships with local suppliers and update specification document with clear requirements identified during trial. • Incorporate lessons learned into specification document to provide clear guidance to supplier and support a future scale up. • Continue to engage with customers, communities and local councils.	• Leasing Community Battery capacity included in request to AER to replace Framework and Approach – this would enable customer and market use cases. • Incorporating Community Batteries into DER Integration Strategy.

Lessons Learnt Summary

Workstream	Lessons to Date	What next?	Expectations for next regulatory cycle
Dynamic Load Control	• Maturity and limitations of contestable metering market • Significant energy volume shifts to daytime (solar soak) using hot water • Potential scope for EV charging • Many solutions involve opex to purchase a service, rather than capex	• Assist retailers and metering providers develop capability which support customers and networks • Explore broader shifts of hot water energy to daytime to offset solar generation impacts • Further explore EV tariff options and capability to support • Investigate options to include opex allowance specifically for Network Innovation projects in future to enable capture of greatest benefits	Expect an on-going need to uplift capability to respond to emerging market trends and functions (including those identified through ESB post 2025 market review), increasing capability of home energy management systems and other flexible loads
Asset Condition Monitoring	• Smart meter data acquisition challenges – commercial, technical and supplier limitations • Developed understanding of key use cases and data requirements for use cases • HALIM – prototyped ability to detect minute changes in neutral integrity successful	• Expand current program of smart meter data acquisition and commence detailed analysis of data streams in analysis systems • Integration of data and analytics into BAU systems and processes • Continue regulatory engagement around access to and quality of smart meter data • Expand HALIM to field trials to assess outcome in the field on high risk feeders and to validate smart meter analytic results	Expect on-going need to invest in trials and pilots in line with increasing capability and availability of market services from smart meters and other advances in monitoring technology and analytics (including AI).

Lessons Learnt Summary

Workstream	Lessons to Date	What next?	Expectations for next regulatory cycle
Portable All-in-one off-grid supply units	• The market has advanced significantly in last 2 years but still maturing. • The cost differential with diesel generation is still prohibitive in many use cases. • There is a niche role but applications may be less broad than initially envisaged until costs decline further.	• Trials over remaining period will determine the extent to which this equipment can compliment the existing fleet of mobile generators and substations as that fleet evolves	Likely to roll into BAU investment for network resilience and emergency response. Potential scope for new technology (e.g. Hydrogen based) as part of Innovation Program
Self Healing Networks	• Challenge and cost associated with establishment of localised control systems – preference a centralised scheme • Proprietary equipment risk – difficulty integrating devices into system • Supply chain risks for complex engineering solutions where expertise is not local • Operational process control – need to consider operational state, data management and field communications to ensure system can operate safely (e.g certainty around LV parallels)	• Establish roadmap and capabilities required for centralised scheme, including prioritising standardised protocols in equipment and compatibility with ADMS and local support. • Explore potential to test operational processes using existing equipment and pre-production ADMS.	Likely to require additional pilots and trials in the next regulatory period to investigate advances in control technology and systems for optimisation of network configuration.
Line Fault Indicators	• Cost benefit and safety implications of hot-stick deployable LFIs • Process management for operators	• Continue to roll out phase 1 of the trial to establish learnings	Likely to be rolled into BAU investment

Attachment D
IEEE2030.5 within Edith

(extract from Project Reference Group meeting)

March 2022

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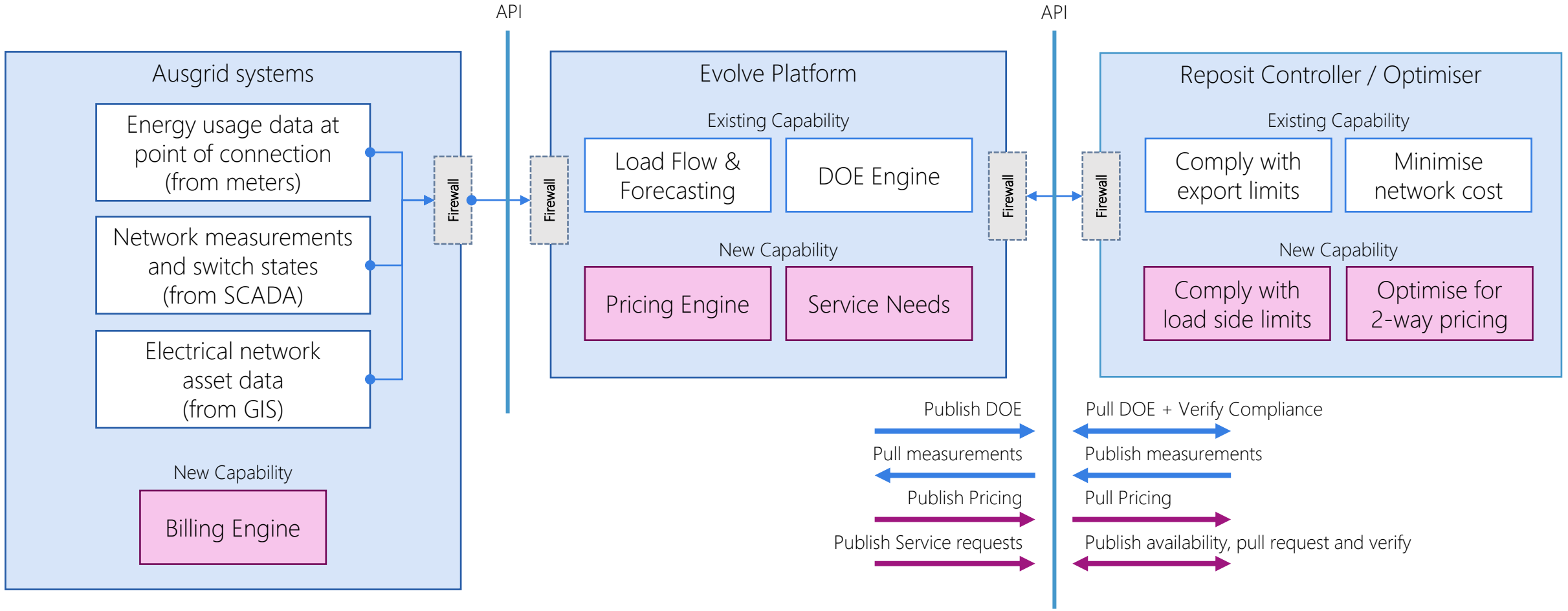
Integration with Evolve platform



We are expanding on **Evolve** and other existing solutions to accommodate new **Edith** features.

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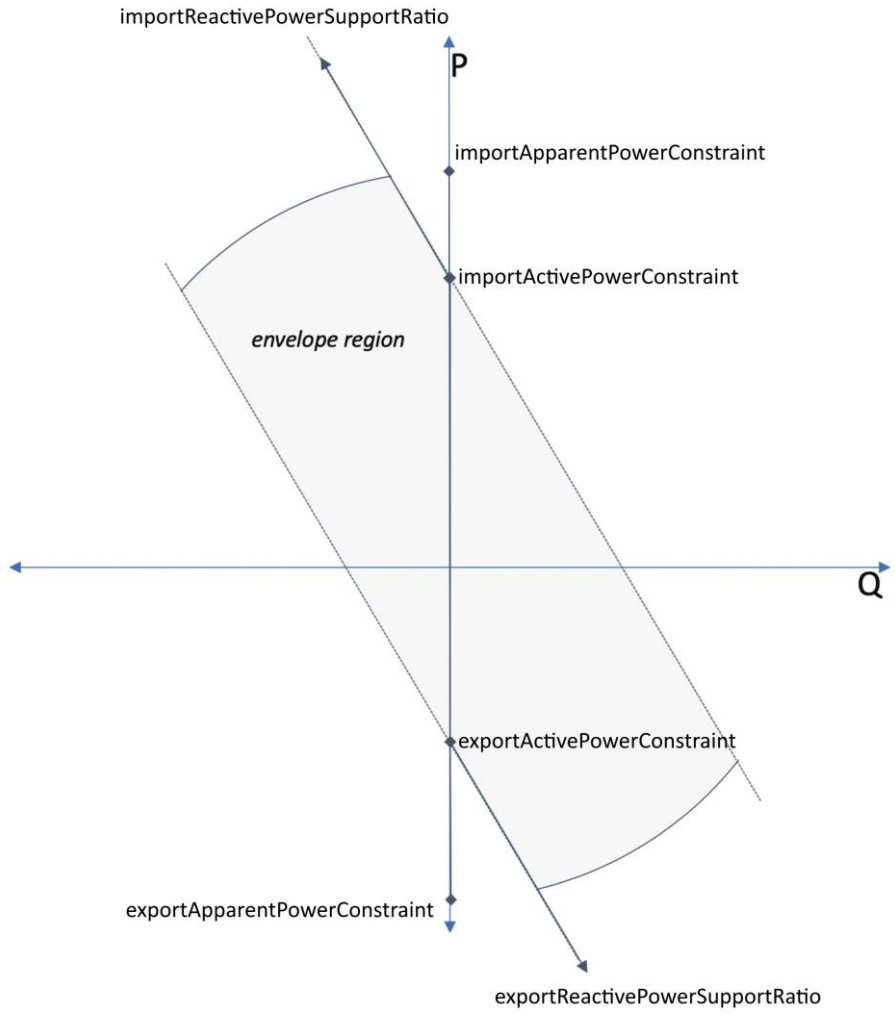
Recap on Evolve IEEE 2030.5 interface

The Evolve platform developed by ANU and Zepben is sending DOEs to aggregators using an interface based on IEEE 2030.5 (Smart Energy Profile).

Two modes available for envelopes:

- Real Power mode provides a one-dimensional constraint envelope for real power import and export, and
- Apparent Power mode defines a reactive power support ratio in addition to the real power constraints above.

An envelope applies to a given time period (i.e. 5 min intervals).



How will dynamic network pricing be integrated?

For rapid demonstration:

- Add two additional parameters for network export and import prices and sent per interval, in conjunction with dynamic envelope.

New parameter
Network export price ($/kWh)
Network import price ($/kWh)

To standardise dynamic pricing:

- Could use IEEE 2030.5 pricing function set – it has been designed to support a variety of tariff types from multiple pricing providers.
- In practice this means CSIP-Aus could include a section on implementing dynamic network prices.
- Insights from Edith aim to inform this development.

IEEE 2030.5 Pricing function set supports:

- Flat-rate pricing
- Time-of-use tiers
- Consumption blocks
- Hourly day-ahead pricing
- Real-time pricing
- Combinations of the above