AEMO Consumer Forum

Tuesday 5 May 2021

Microsoft Teams only

PLEASE NOTE THIS MEETING WILL BE RECORDED FOR THE PURPOSE OF PREPARING MINUTES

We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and culture.

We pay our respects to their Elders past, present and emerging.

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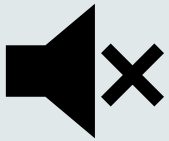
Online forum housekeeping



1. Please mute your microphone, this helps with audio quality as background noises distract from the information being shared.
2. Video is optional, but having it turned off helps with webinar performance and minimises distractions.
3. We ask that you utilise the Chat function for any questions or comments you may have if you are unable to use audio.
4. If you have dialled in via phone, could you please email your name and organisation to stakeholderrelations@aemo.com.au for our records.
5. Be respectful of all participants and the process.

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AEMO Competition Law Meeting Protocol

AEMO is committed to complying with all applicable laws, including the Competition and Consumer Act 2010 (CCA). In any dealings with AEMO regarding proposed reforms or other initiatives, all participants agree to adhere to the CCA at all times and to comply with this Protocol. Participants must arrange for their representatives to be briefed on competition law risks and obligations.

Participants in AEMO discussions **must**:

1. Ensure that discussions are limited to the matters contemplated by the agenda for the discussion
2. Make independent and unilateral decisions about their commercial positions and approach in relation to the matters under discussion with AEMO
3. Immediately and clearly raise an objection with AEMO or the Chair of the meeting if a matter is discussed that the participant is concerned may give rise to competition law risks or a breach of this Protocol

Participants in AEMO meetings **must not** discuss or agree on the following topics:

1. Which customers they will supply or market to
2. The price or other terms at which Participants will supply
3. Bids or tenders, including the nature of a bid that a Participant intends to make or whether the Participant will participate in the bid
4. Which suppliers Participants will acquire from (or the price or other terms on which they acquire goods or services)
5. Refusing to supply a person or company access to any products, services or inputs they require

Under no circumstances must Participants share Competitively Sensitive Information. Competitively Sensitive Information means confidential information relating to a Participant which if disclosed to a competitor could affect its current or future commercial strategies, such as pricing information, customer terms and conditions, supply terms and conditions, sales, marketing or procurement strategies, product development, margins, costs, capacity or production planning.

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AGENDA

	TIME	TOPIC	PRESENTER
1	9:00am – 9:05am	Welcome and overview	Antara Mascarenhas (Chair)
2	9:05am – 9:35am	NEM Engineering Framework update	Chris Davies & Rama Ganguli
3	9:35am – 9:55am	Wholesale Demand Response update	Emily Brodie
4	9:55am – 10:25am	DER workstream update	Matt Armitage
5	10:25am – 11:05am	Integrated System Plan update: ISP consumer panel and methodology	Andrew Nance (Chair, ISP Consumer Panel) and members
BREAK			
7	11:10am – 11:50am	Project MATCH (Monitoring & Analysis Toolbox for Compliance in a High DER future) AEMO/UNSW/ARENA	Naomi Stringer (UNSW) & Paddy Aiken (CER)
8	11:50am – 12:00pm	Other business and close	Antara Mascarenhas (Chair)

Welcome and overview

Antara Mascarenhas

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NEM Engineering Framework update

Chris Davies and Rama Ganguli

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Objectives of this session

- To inform attendees of the March 2021 Engineering Framework report
- Introduce the concept of operational conditions
- To explore where to from here and how to get involved
- Q&A

Engineering Framework March 2021 Report

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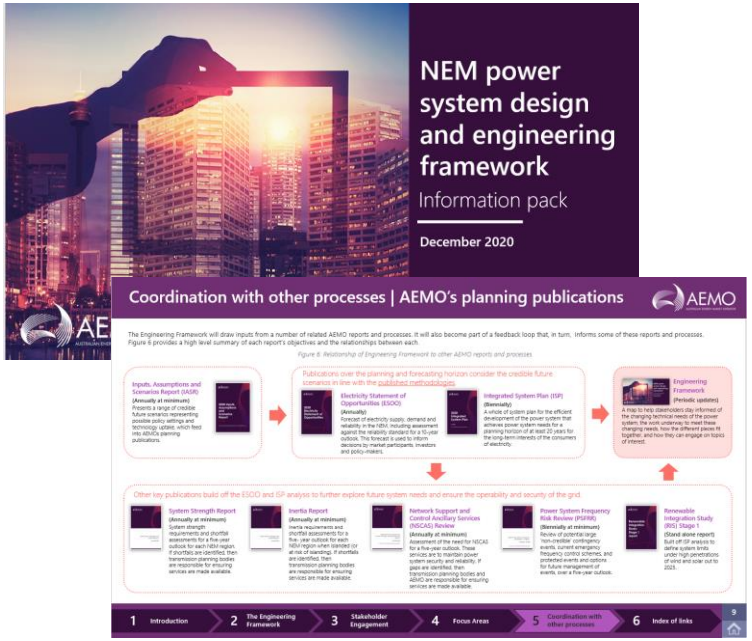
Background

- Renewable Integration Study published in April 2020
- Early feedback from stakeholders in Nov 2020
- In December 2020 AEMO published an information pack outlining our desire to start working with industry on the development of an Engineering Framework
- In December 2020, an update was published on the status of Renewable Integration Study actions, and how these will be tracked going forwards as part of the Engineering Framework
- In February 2021, an industry workshop was run on the information pack

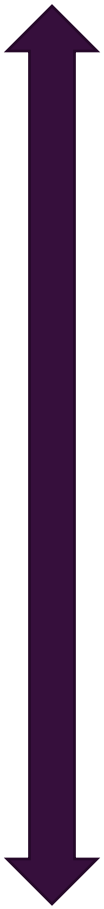


The Engineering Framework takes a holistic view of the changing characteristics of our energy system to help ensure the operability of the NEM throughout its transition.

Where the Framework fits

Planning

Real Time



Scenarios are inputs to planning and forecasting publications (e.g. ESOO, ISP)

Integrated System Plan is an actionable roadmap for eastern Australia's power system to optimise consumer benefits through a transition period of great complexity and uncertainty.

Engineering Framework takes a holistic view of the changing characteristics of the energy system to help facilitate an orderly operational transition of the NEM.

Planning for Operability includes declaration of need for services to ensure a secure and operable system over the next five years (NSCAS, inertia, system strength)

Operational Planning includes a range of preparatory actions for the system and control room personnel, leading up to real-time.

Real Time Operations involves running the system securely and reliably day-to-day.

March 2021 report | Feedback from stakeholders

Early engagement with stakeholders yielded a strong level of support for the proposed concept.

Suggestions on how the Framework could be modified to provide maximum value going forwards, included:

- Ensuring clarity on how the framework fits with other processes
- Greater visibility on how goals will be set and progress measured
- Greater transparency on AEMO activities and development of future AEMO priorities
- A desire for collaboration on the development of future industry plans and future AEMO priorities

Engineering Framework | What is it?

A Facilitate a discussion to identify possible **future operational conditions** for the NEM power system

B Consolidate a common view of the **current work underway** to adapt the system and existing avenues for **engagement**

C Collaborate on **identifying where increased industry focus is needed** to bridge the gap between current work and future operational conditions

A Facilitate a discussion to identify possible **future operational conditions** for the NEM power system

B Consolidate a common view of the **current work underway** to adapt the system and existing avenues for **engagement**

C Collaborate on **identifying where increased industry focus is needed** to bridge the gap between current work and future operational conditions

Consolidating information about the major efforts already underway across industry

Consulting on future operational conditions

March 2021 report | Work underway

- Resource Adequacy
- Frequency Management
- System Strength
- Voltage Control
- System Restoration

- Control Room and Support
- System Analysis

- Resilience
- Performance Standards
- Distributed Energy Resources

Operational conditions

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Using operational conditions

Operational conditions are a tool to help us, as an industry, map a pathway to an operable future

Identifying conditions

Distil combinations of generation and load to a short list of conditions that you can test against key risks

GENERATION MIX

- High DPV
- No synchronous units
- Other

and/or

LOADING

- Low underlying demand
- Price responsive demand management
- Other

OPERATIONAL CONDITIONS

- Operating with high DPV and low underlying demand
- Operation with no synchronous units
- Other

KEY OPERATIONAL RISKS

- Network configuration *(normal, abnormal, extreme abnormal)*
- Weather events *(cloud cover, wind, other)*
- Cyber attack
- Price events *(negative price event, other)*
- Other

Next steps

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Opportunities, gaps and the operational pathway

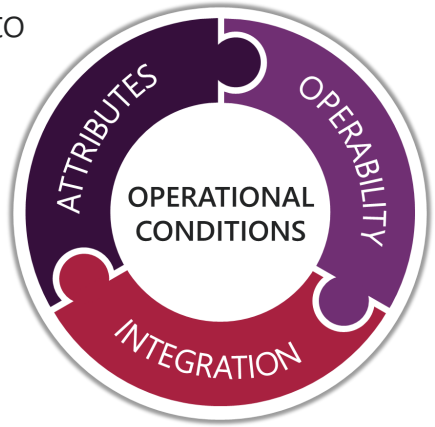
Operational conditions

- What is the operational condition and any transitional conditions?
- Why does it matter?
- Where will this condition occur?
- What focus areas does this condition touch?

Bridging the Gap

Gaps and opportunities

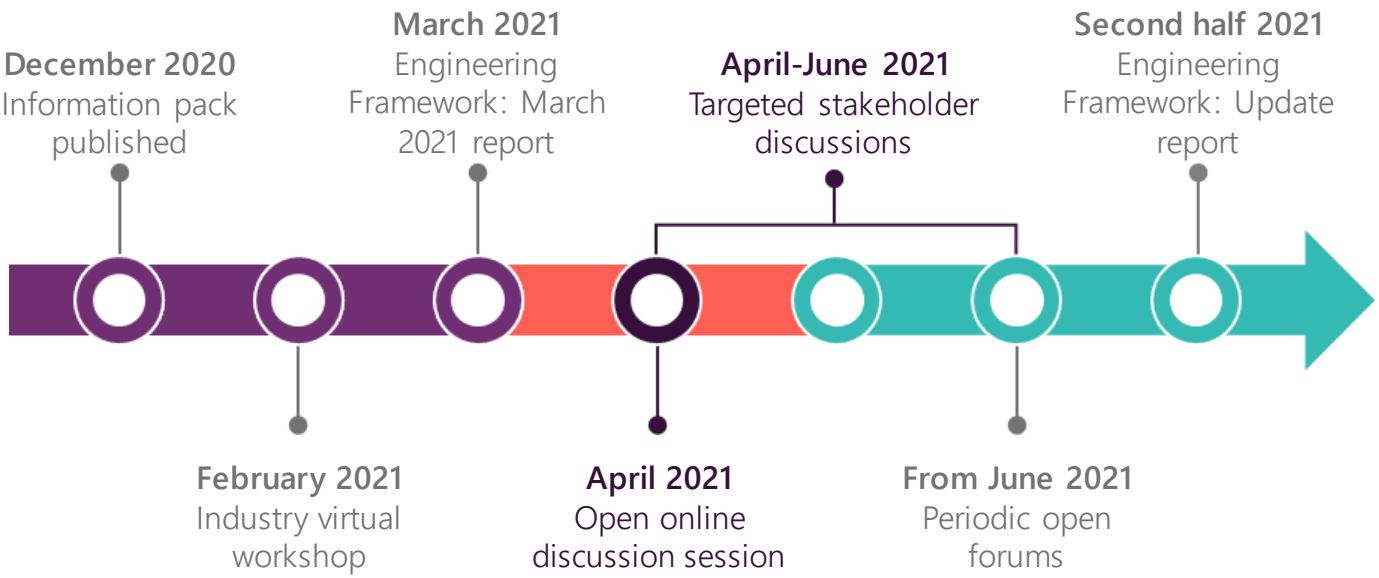
- What is required to operate under each condition?
- What are the gaps and opportunities compared to today?



Operational pathway

- How do we prioritise identified activities across all operational conditions *(materiality, cost, timing)*?
- Who should lead the work on the gaps and opportunities identified?

Stakeholder engagement | Get involved



For more information

please visit our project page on AEMO's website

contact us at FutureEnergy@aemo.com.au

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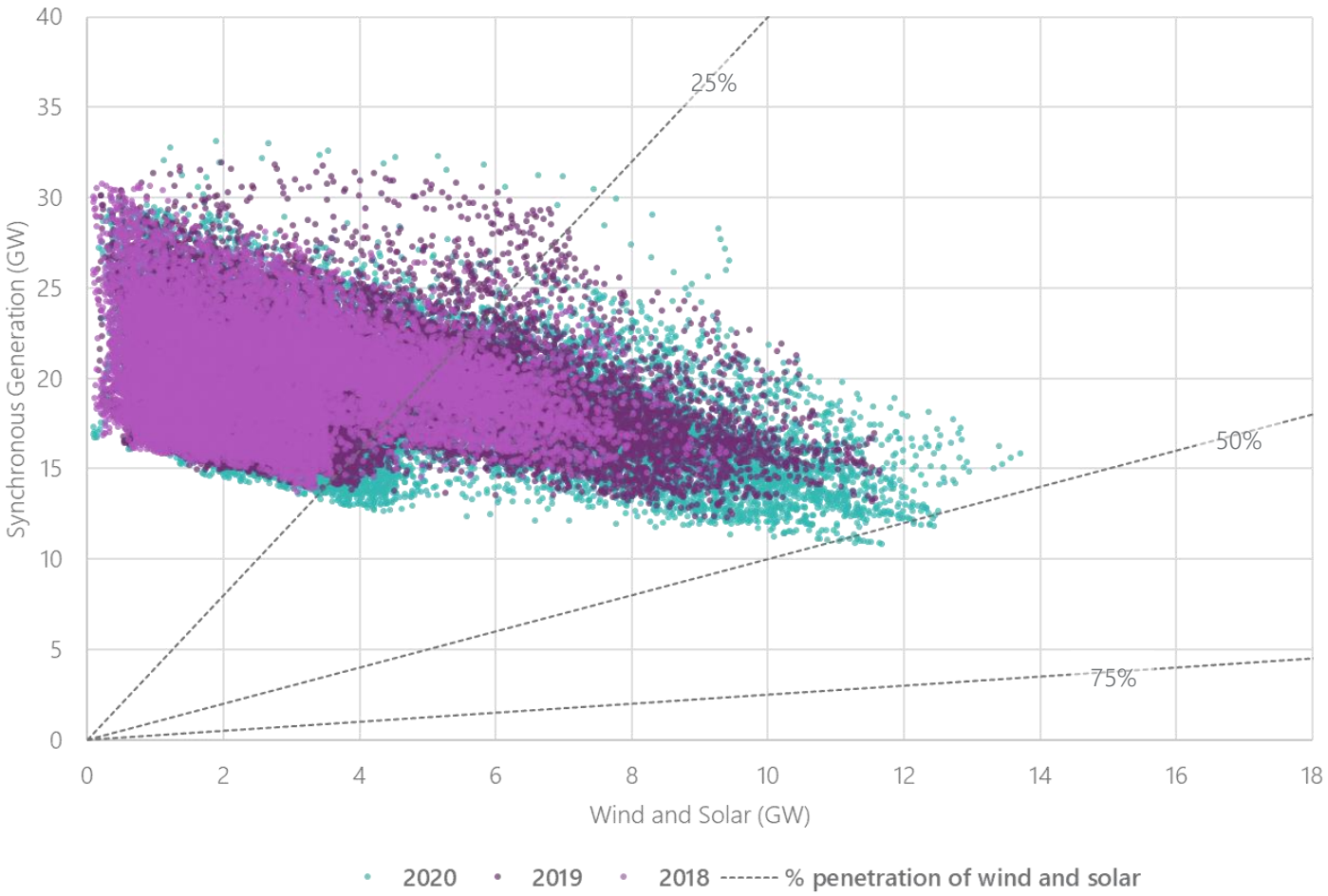
Supplementary slides

Historic change



- More frequent operation at high penetrations of wind and solar
- Lower minimum synchronous generation
- Already in the realm of new and challenging operational conditions
- Also on a rapid trajectory towards new operating conditions
- Need to actively plan and consider what changes are needed, so we're prepared to operate during these periods

Sample slide | Resource adequacy

Balancing supply and demand is essential to operating a secure power system. Key changes underpinning both the supply and demand side are challenging reliable system operation. There is ongoing work looking at mechanisms to manage peak demand and balance a system with increasing variability and uncertainty.

Resource adequacy, as defined in AEMO's Power System Requirements paper[57], relates to having a sufficient overall portfolio of energy resources to continuously achieve the real-time balancing of supply and demand. The requirements to achieve this are:

- Flexibility to respond to changes in the supply-demand balance.
- Sufficient available energy across the system to meet demand.

Key changes

Variability – the RIS[61] showed that supply and demand variability in the NEM is increasing. As the penetration of wind and solar goes above 50%, based on current firming generation and operation, system flexibility limits may bind.

Uncertainty – the RIS[61] also showed that uncertainty (the ability to predict future supply, demand and grid conditions) is increasing. The level of accuracy and precision in predicting variable renewable energy (VRE) output is limited, even when using best practice forecasts. As the system becomes more reliant on wind and solar, this uncertainty will need to be managed to balance supply and demand.

Displacement of online thermal plant – some thermal generators may not be dispatched in periods of high penetration of VRE. Thermal generation is the largest source of firming flexible energy in the NEM. If these plant are offline they can take minutes to days to start up. This means that the right mix of resources may not be available when needed to meet ramping requirements.

Thermal generator retirement – the NEM has an ageing thermal fleet with plant approaching end of life. As this generation retires, resource availability needs to be managed to ensure there is sufficient firm, flexible capacity to keep the system reliable.

Work in progress

Market design

As supply and demand uncertainty continues to rise, additional operating reserves may be required to ensure secure system operation. These additional reserves could be obtained through changes to existing regulatory frameworks, or through the development of reserve services markets. These options are being explored by the AEMC and ESB.

The AEMC is currently consulting on rule changes for an operating reserve market[15] and ramping services[12]. These markets mechanisms should help ensure there are sufficient flexible system resources to assist operation in times with high uncertainty.

The ESB, through its post-2025 market design program[97] is exploring a range of market and regulatory enhancements through its essential system services (operating reserve mechanism), resource adequacy mechanisms, and ageing thermal transmission workstreams.

The ESB's January 2021 directions paper[98] highlighted a range of possible policy options to ensuring the right mix of resources is available to service the system needs at any given time. These include:

- Mechanisms to ensure the orderly exit of thermal plants as they retire.
- Investigation into a NEM-wide approach to jurisdictional investment schemes for new investment in the market.

Sample slide | Resource adequacy

System operation

AEMO has several systems that work together to ensure sufficient energy is dispatched across the system to meet demand. This includes systems for solar, wind and load forecasting, PASA, and dispatch. However, increasing variability and uncertainty has focused our attention on ensuring there is also sufficient flexibility to continually respond to changes in energy requirements. This is where the current work in progress is focused.

There is an ongoing body of work to improve forecast accuracy, which was identified in the RIS as a key enabler to operation with a high penetration of VRE. Additionally, forecasting accuracy of wind and solar has improved since the introduction of participant self-forecasting[52] in 2018.

Insight into system reliability in operational timeframes is achieved through the ST PASA system. Replacement of the ST PASA system[62] has been identified as a critical project, which will allow a real-time assessment of ramping requirements and modelling of newer technologies such as batteries and VPPs, among other improvements. This will better inform participants of system needs so they can respond or allow power system controllers to take appropriate actions if necessary.

This work described in this section is further detailed in the control room and support focus area.

Planning

Forecasts and planning over a longer time horizon are important to support strategic investment in new generation and transmission infrastructure, so consumers can access energy when and where they need it, now and in the future.

The Electricity Statement of Opportunities (ESOO)[39] provides a forecast of electricity supply, demand and reliability in the NEM, including an assessment against the reliability standard for a 10-year outlook. This forecast is used to inform investment decisions by market participants, investors and policy-makers.

The ESOO has also been evolving to include new sensitivities, climatic and weather patterns, and operational patterns to take account of reliability under different futures. Such scenarios allow industry preparation and investment for these potential events.

In 2019, the implementation of the Retailer Reliability Obligation[74] provided a process to ensure retailers (or other relevant entities) have sufficient quantity of contracts to cover their demand where a material reliability gap is identified in the ESOO. Further enhancements to this framework are also being explored though the ESB's post-2025 market design program[97] in the resource adequacy mechanisms workstream.

The ISP[20] highlights a range of opportunities, including connection of new renewable energy zones (REZs) and development of new interconnection between adjoining regions (such as Project EnergyConnect between South Australia and New South Wales). The completion of these projects provides additional system flexibility by improving sharing of resources between adjacent regions.

Sample slide | Work underway summary

This Section 4 summarises work underway for each of the 10 focus areas. Sections 5-7 then provide an overview of the key changes occurring for each focus area, more detail of the work underway across industry in response to these changes, and an outline of existing avenues for engagement.

A summary of the key work in progress, with links to the relevant sections for more detail, is provided below.

Attributes

Resource Adequacy	• The **Projected Assessment of System Adequacy** (PASA) is AEMOs principle method of forecasting adequacy of the power system in an operational timeframe. AEMO is currently redeveloping this system to better serve the future NEM. To learn more about the Short Term (ST) PASA system, see this webpage[60], and to learn about the ST PASA replacement project, see this webpage[62]. • The AEMC is progressing two reserve services rule changes: an **operating reserve market** and the **introduction of ramping services**. The draft determination for both rule changes is scheduled for 24 June 2021. To have your say, please visit the AEMC's dedicated webpage[10]. • The ESB is running a **Resource Adequacy** focus area under the Post 2025 Market Design project. For more information see its dedicated webpage[97] and latest directions paper[98], released in January 2021. The next ESB options paper is anticipated in April 2021.
Frequency Management	[redacted] find out more, see the ESB's dedicated webpage[97] and latest directions paper[98], released in January 2021. The next ESB options paper is anticipated in April 2021.

Wholesale Demand Response update

Emily Brodie

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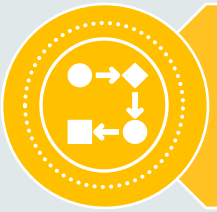
Overview: On-track for WDR start

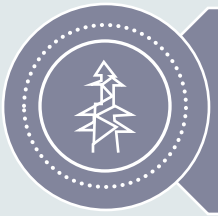
Indicative WDR participation

Several companies have strongly indicated intent to participate from 'day one'

Initial WDR **volume** likely in 10s of MW in total



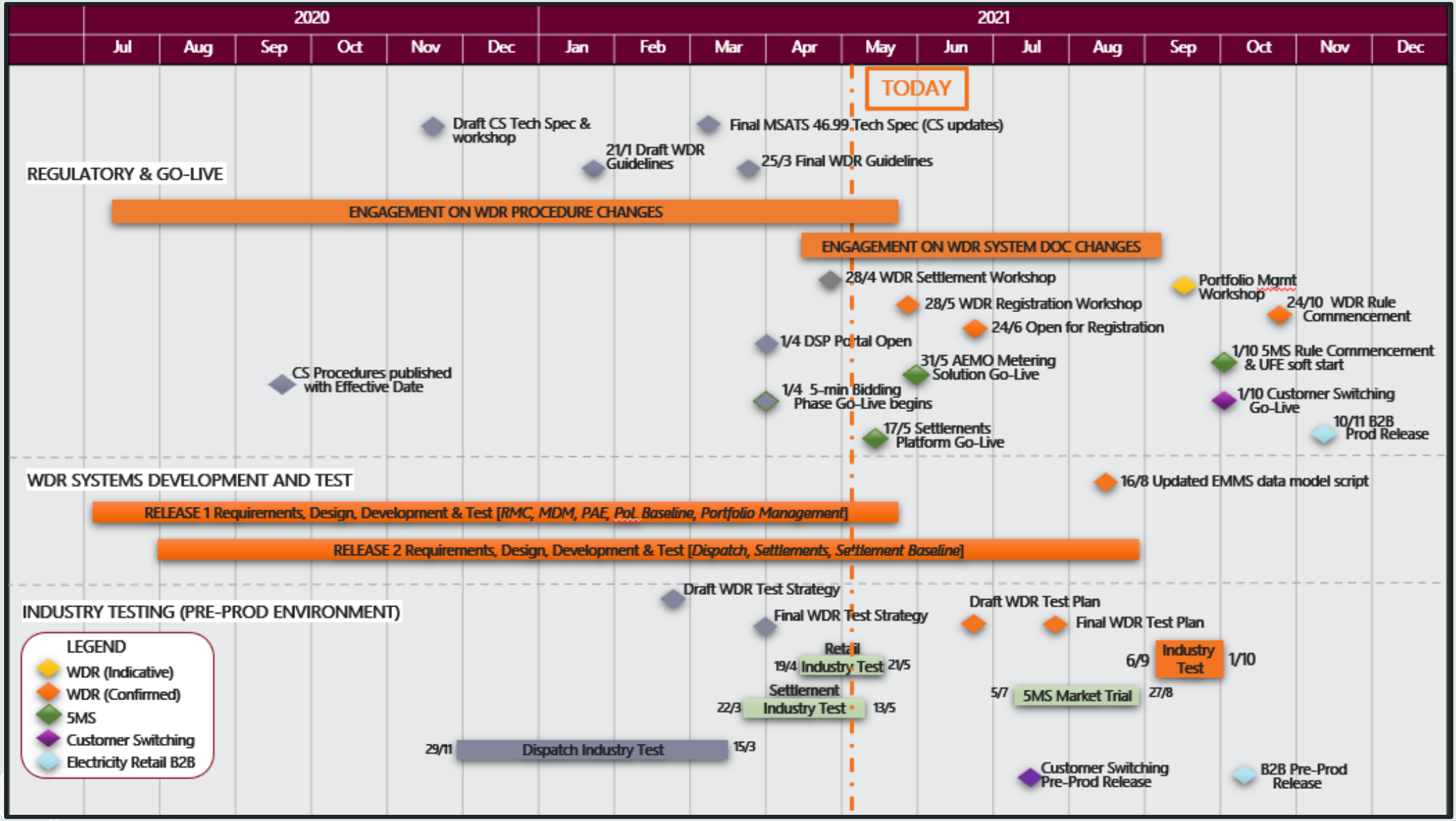
More **baseline methodologies** can be considered from April 2022 (where requested), potentially widening opportunity for participation



"**DNSP endorsement**" step required for distribution-connected WDR aggregations >= 5MW behind a single TNI, as check for potential **distribution system impacts**

Program schedule

Current as of 03 MAY 21



WDR engagement

**All meeting packs and notes can be found here:

https://aemo.com.au/consultations/industry-forums-and-working-groups/list-of-industry-forums-and-working-groups/wdr

WDR Consultative Group meetings – second Tuesday of each month

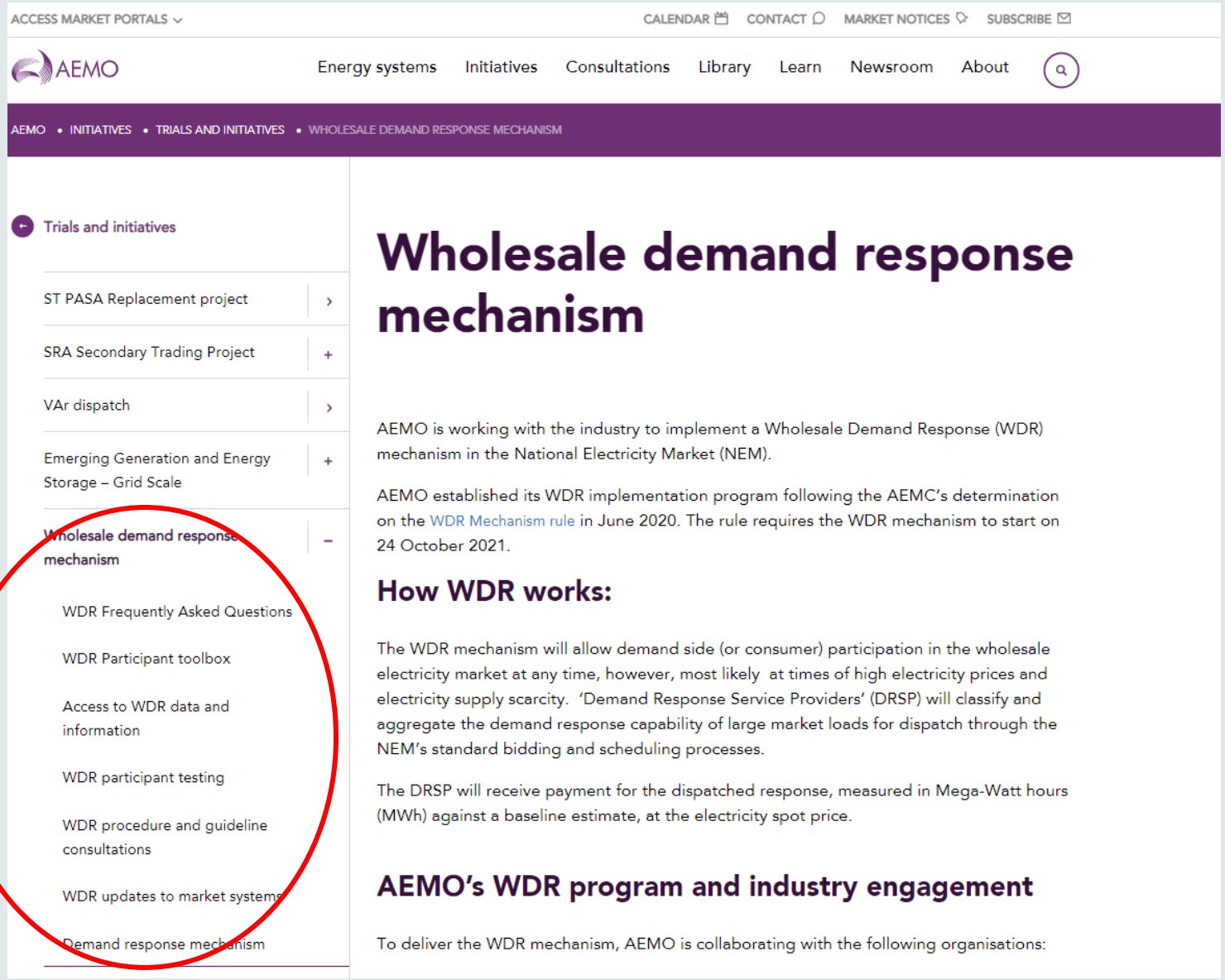
Since last Consumer Forum

DATE	FORUM	PURPOSE
11 Dec 20	WDR/DNSP Workshop	Forum for sharing information on and discussing potential WDR impacts on distribution networks.
08 Feb 21	Q&A on draft WDR guidelines	Open discussion on the *draft* WDR Guidelines
29 Mar 21	Q&A on final WDR guidelines	• Final WDR guidelines policy approaches and technical settings • Key changes from draft WDR guidelines
28 Apr 21	WDR Settlements Workshop	• Refresher on WDR settlement process • Examples of WDR settlement against baselines • Details of WDR settlement reports

Upcoming

DATE	Forum	Purpose
11 May 21	WDR endorsement process workshop	Energy Networks Australia will lead a workshop to seeking input into the DNSP endorsement process for WDR aggregations.
28 May 21	WDR Registrations workshop	• Detailed explanation of the DRSP registration process and WDRU classification and aggregation processes • Where to find forms and guides.
September	Portfolio Management System workshop	How DRSPs access and use the Portfolio Management System

WDR web material



WDR contact and information

Mailbox

wdr@aemo.com.au

WDR program information

https://aemo.com.au/initiatives/trials-and-initiatives/wholesale-demand-response-mechanism

WDR stakeholder engagement options

https://aemo.com.au/consultations/industry-forums-and-working-groups/list-of-industry-forums-and-working-groups/wdr

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Procedure change timelines

Current as of 03 MAY 21

Procedure package	Consultation Paper	Round 1 Consultation	Draft	Round 2 Consultation	Final
WDR Guidelines	Thu 22 Oct 2020	Fri 27 Nov 2020	Thu 21 Jan 2021	Fri 19 Feb 2021	Thu 25 Mar 2021
Settlements and Prudentials procedure – CLP	Fri 04 Sep 2020	Fri 16 Oct 2020	Thu 12 Nov 2020	Fri 4 Dec 2020	Mon 18 Jan 2021
Settlements and Prudentials procedure - Estimations	Thu 05 Nov 2020	Fri 18 Dec 2020	Mon 18 Jan 2021	Wed 10 Feb 2021	Thu 4 Mar 2021
Retail procedures & B2B guide	Mon 12 Oct 2020	Tue 17 Nov 2020	Tue 15 Dec 2020	Tue 02 Feb 2021	Tue 16 Mar 2021
Market & System Operations procedures	Fri 09 Oct 2020	Tue 17 Nov 2020	Fri 11 Dec 2020	Fri 29 Jan 2021	Fri 12 Mar 2021
Demand-side participation information guidelines	Wed 26 Aug 2020	Wed 30 Sep 2020	Wed 11 Nov 2020	Wed 25 Nov 2020	Fri 18 Dec 2020
Baseline Eligibility, Compliance and Metrics Policy	Fri 18 Dec 2020	Fri 5 Feb 2021	Thu 18 Mar 2021	Thu 8 Apr 2021	Thu 20 May 2021

Project and system document change timelines

Current as of 03 MAY 21

Area	Document	Early version released	Comments due	Updated version published
DISPATCH CONFORMANCE	Post-event dispatch conformance policy	01 Apr 2021	22 Apr 2021	21 May 2021
TESTING	WDR Industry test strategy	25 Feb 2021	11 Mar 2021	01 Apr 2021
	WDR Industry test plan	Jun 2021	Jul 2021	Jul 2021
WHOLESALE – EMMS	EMMS technical specification	Apr 2021	mid May 2021	31 May 2021
	Data Interchange (DI) online help	Aug 2021	n/a	Sep 2021
PORTFOLIO MANAGEMENT SYSTEM	Guide to Portfolio Management System (PMS)	mid Aug 2021	late Aug 2021	mid Sep 2021
	Markets Portal online help (PMS updates)	mid Aug 2021	late Aug 2021	mid Sep 2021
RETAIL – MSATS/eMDM	MSATS technical specification	mid Jun 2021	early Jul 2021	mid Jul 2021
	New or updated MSATS/eMDM guides	early Aug 2021	mid Aug 2021	early Sep 2021

Project EDGE

(Energy Demand & Generation Exchange)

Scott Chapman and Matt Armitage

Project EDGE: Overview

Distribution System Operator (DSO)

AusNet services

Aggregator

mondo

EDGE Energy Demand & Generation Exchange

AEMO Project Lead

Project EDGE is a jointly funded project with support from the Australian Renewable Energy Agency (ARENA).

Australian Government Australian Renewable Energy Agency

ARENA

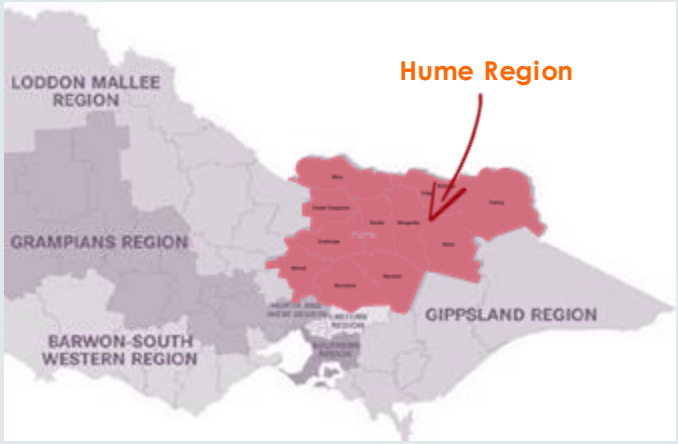
Supporting Partners

THE UNIVERSITY OF MELBOURNE
Networks and Markets

DEAKIN UNIVERSITY
Customer Insights

nous
Independent Project Manager

Project EDGE seeks to demonstrate a proof-of-concept DER Marketplace that efficiently facilitates DER delivering both wholesale and local network services within the constraints of the distribution network at the grid edge.



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Project Objectives

1. DER participation in wholesale markets at scale
2. Distribution network limits in dispatch
3. Efficient and scalable trade of Local Network Services
4. Efficient and scalable data exchange
5. Integrated technology ecosystem
6. Roles & Responsibilities
7. Cost benefit analysis
8. Customer insights
9. Best practice stakeholder engagement
10. Evidence based recommendations

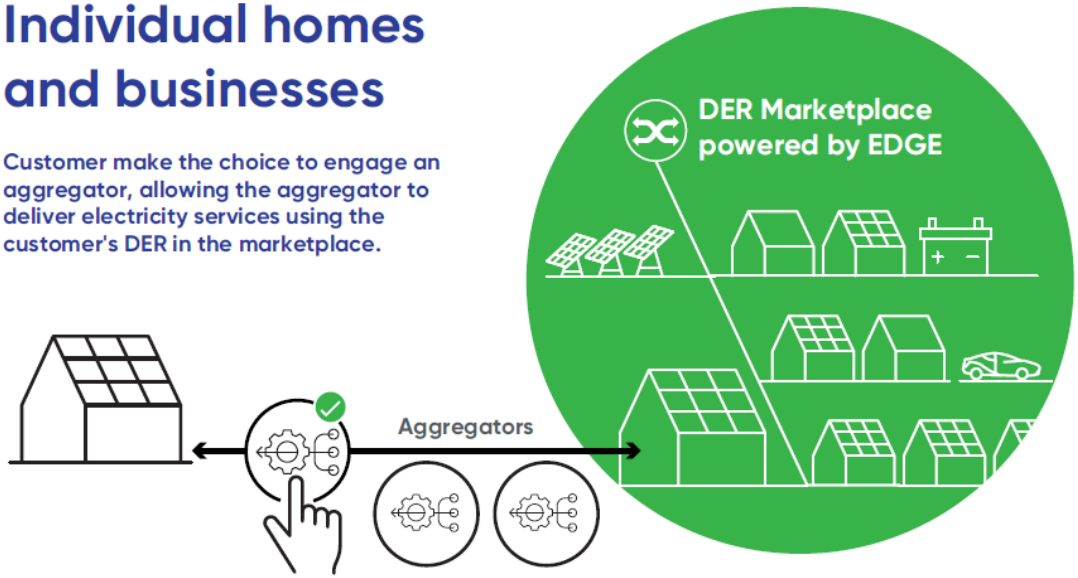
Consumer Participation

Energy Demand & Generation Exchange

DER Marketplace enabling aggregators to access and deliver electricity services using customer's DER

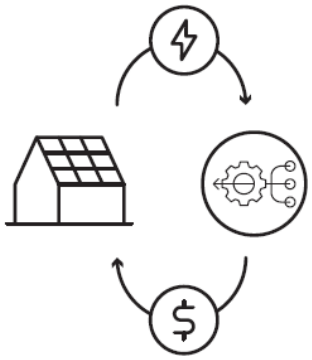
Individual homes and businesses

Customer make the choice to engage an aggregator, allowing the aggregator to deliver electricity services using the customer's DER in the marketplace.



The customer is in control of how their DER is used by choosing which aggregator to engage.

Aggregators will only use DER in the way agreed to by the customers.



The aggregator will provide value to the customer based on how their DER is used in the marketplace.

DER – Distributed Energy Resources: consumer-owned devices that can produce electricity or have 'smarts' to manage demand. For example solar, batteries, hot water, pool pumps, electric vehicles.
Aggregator: a retailer or 3rd party that coordinates many DER in a portfolio to deliver electricity services.

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EDGE Deliverables & Outcomes

Deliverables

Proof Of Concept integrated technology ecosystem

- Working DER Marketplace that integrates Aggregator, DSO and AEMO systems/capabilities

Knowledge sharing

- CBA, Customer Insights, Design docs, Lessons learned, Recommendations

Outcomes

Consumer interests met in line with NEO

- Identify efficient DER integration pathway

Regulatory decisions informed by evidence

- AER determinations & P2025

Industry agreed roles & responsibilities

- Between DNSPs (DSOs) & AEMO

Technical implementation roadmap

- Detailed plan to operationalise concepts

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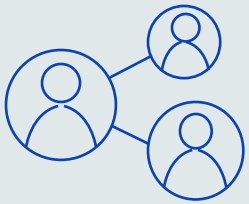

Contact:

EDGE@aemo.com.au

AEMO's Project EDGE webpage:

https://aemo.com.au/initiatives/major-programs/nem-distributed-energy-resources-der-program/der-demonstrations/project-edge

Mondo's Project EDGE webpage:

https://mondo.com.au/edge

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ISP Consumer Panel and methodology

2022 ISP Consumer Panel

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Objectives of this session

- To Introduce the ISP Consumer Panel and provide an update of the 2022 ISP Process
- To provide an overview of the DRAFT ISP Methodology published by AEMO last week
- To answer questions on what's most important for consumers
- To seek feedback on Consumers' engagement with the ISP

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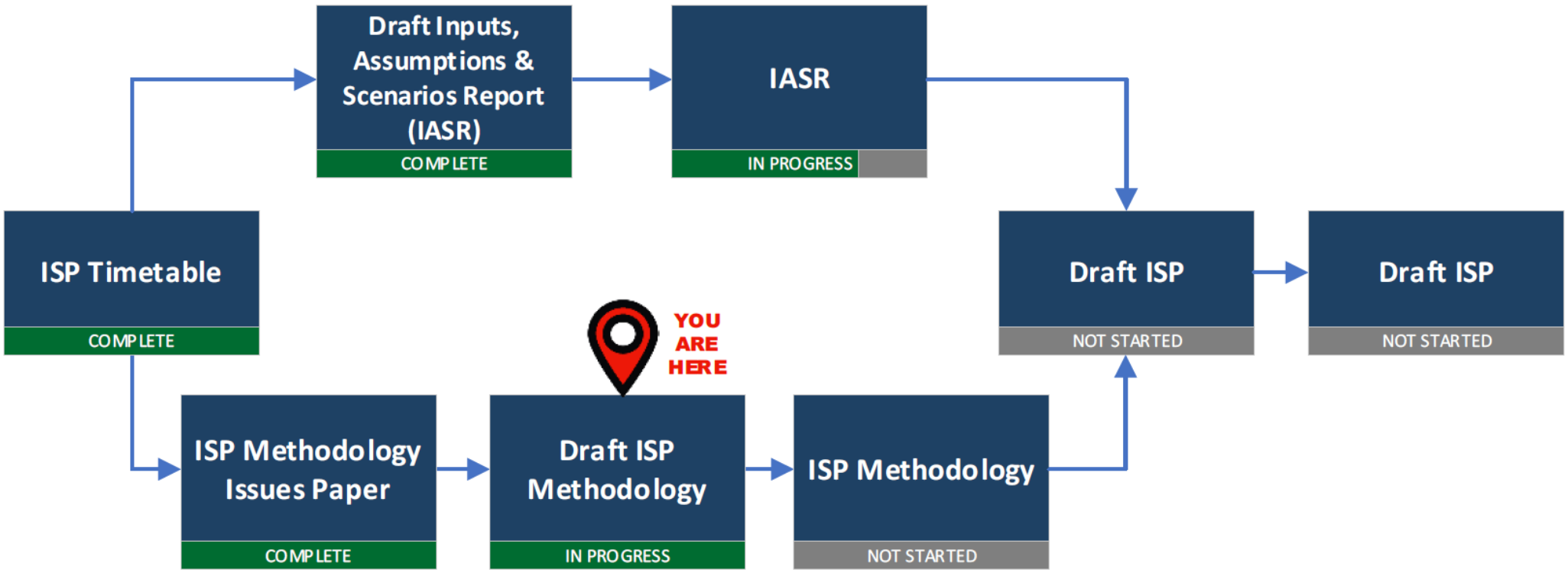
About Us

- ISP Consumer Panel established in 2020 under the NER, part of the ISP Oversight Framework
- We are not a substitute for consumers' engagement with the ISP
- We have two main reports to write and maintain a focus on process AND content
- We presented to the Consumer Roundtable last week:

  Do you agree that a "whole of system" plan for the NEM is important? If so, how can AEMO improve its approach to capturing and reflecting the consumer interest?
- AEMO has just released the DRAFT ISP Methodology
- This will combine with the Inputs, Assumptions and Scenarios (IASR) work to generate the 2022 ISP

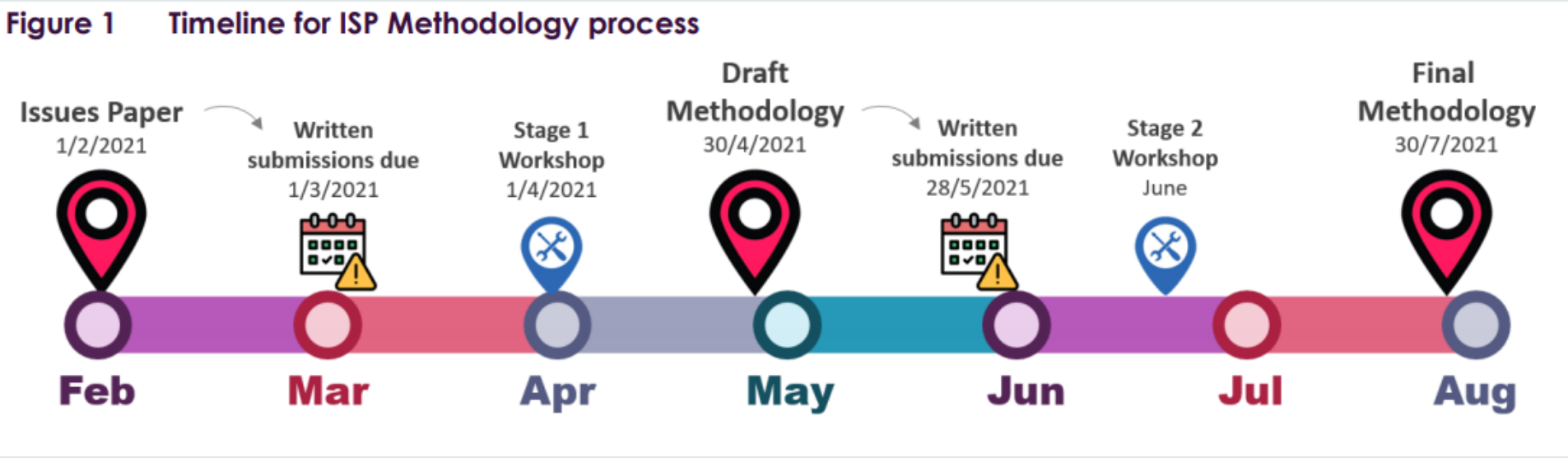
2022 ISP Progress

Figure 2 Parallel ISP consultations



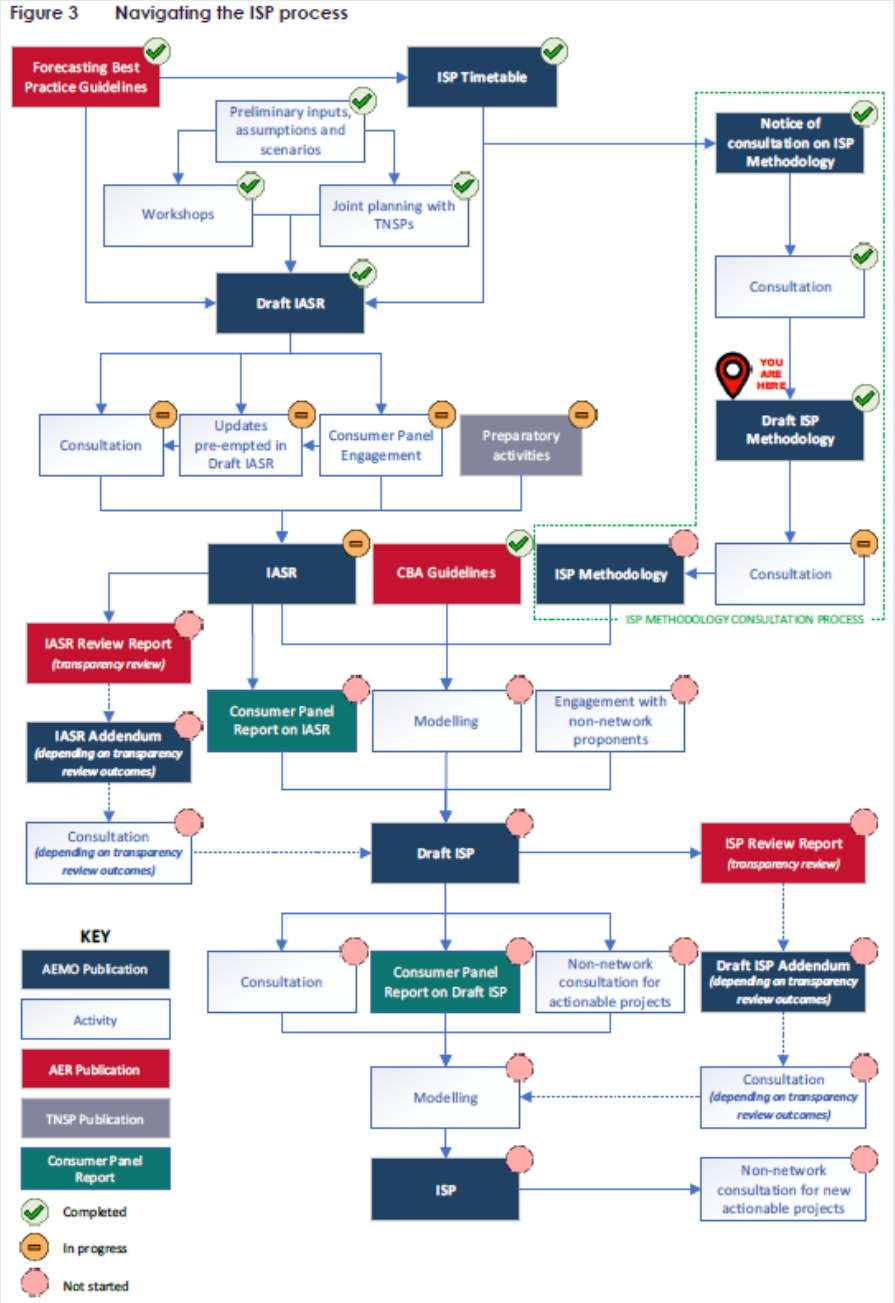
Methodology consultation timeline

Figure 1 Timeline for ISP Methodology process



Keeping up?

More information here.



2022 ISP consultation milestones

AEMO Publication
AER Publication
TNSP Publication
Consumer Panel Report

Publication	Timing	Responsibility
ISP Timetable	30 October 2020	AEMO
Establish ISP Consumer Panel	By 30 November 2020	AEMO & ISP Consumer Panel
Draft IASR	11 December 2020	AEMO
ISP Methodology Issues Paper	1 February 2021	AEMO
Draft ISP Methodology	30 April 2021	AEMO
Preparatory Activity Reports	By 30 June 2021	TNSPs
ISP Methodology	30 June 2021	AEMO
IASR	30 July 2021	AEMO
AER's IASR Review Report	By 30 August 2021	AER
Consumer Panel Report on IASR	By 30 September 2021	ISP Consumer Panel
Draft 2022 ISP	10 December 2021	AEMO
AER's ISP Review Report	By 10 January 2022	AER
Consumer Panel Report on Draft ISP	By 10 February 2022	ISP consumer panel
2022 ISP	30 June 2022	AEMO

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Methodology 101

- The ISP is underpinned by integrated energy market modelling and power system analysis. The objective of the suite of models and analysis is to determine an Optimal Development Path (ODP) that optimises benefits to consumers.
- Combines IASR with 'capacity outlook model', 'time sequential model', engineering assessment, gas supply model AND then, does a cost-benefit-analysis (CBA) to select the ODP.
- The CBA is the approach AEMO uses to develop and test alternative development paths, and ultimately determine the ODP.

What's Most Important ?

- There is a lot of detail, but an overarching theme is managing uncertainty: selecting an 'ODP' that balances the risk of over- or under-investment given all the possible energy futures.
- Inevitably the modelling and analysis makes assumptions about the risk appetite of consumers. Encourage a strong consumer voice.
- Consumer risk appetite is reflected in the weighting of scenarios, sensitivity analyses and through the choice of 'discount rates'
  - AEMO is intending to consult on the scenario weighting later in 2021 as more information becomes available that could inform views on the relatively likelihood of scenarios.
  - AEMO has commissioned a consultancy on discount rates.
- The impact of state-based plans (such as NSW and VIC) – alignment with the ISP to the extent possible is likely to be the best result for all NEM consumers

Consumer Engagement with the ISP

- Panel initiated online survey. 39 Responses but few from consumers
- Key themes to validate with the group …
  1. Stakeholders want meaningful and genuine engagement
  2. Stakeholders want plain English and more information to help them provide informed input
  3. Stakeholders want engagement to be flexible and designed in consultation with them
  4. Engagement needs to be inclusive, relevant, current and timely
  5. Engagement outcomes should be shared and transparent
- How we can we help?

BREAK

AEMO
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Project MATCH

Naomi Stringer

AEMO
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Project MATCH

Monitoring and Analysis Toolbox for Compliance in a High DER future

Naomi Stringer[1,2], Anna Bruce[1,2], Iain MacGill[1,3]
[1]Collaboration on Energy and Environmental Markets (CEEM)
[2]School of PV and Renewable Energy Engineering
[3]School of Electrical Engineering and Telecommunication
UNSW Sydney Australia

AEMO consumer forum, 5 May 2021

Collaboration on Energy and Environmental Markets

Overview

Collaboration on Energy and Environmental Markets

- Context
- Overview of Project MATCH
  - Foundational projects
  - Goals
  - Scope
- Stakeholder Reference Group
- Goals for next six months
- Discussion


Rheem


REDBACK
TECHNOLOGIES


ENERGY
CONSUMERS
AUSTRALIA


SA
Power
Networks


ERGON ENERGY
NETWORK
energex
Part of Energy Queensland


wattwatchers
DIGITAL ENERGY


TESLA


renew.
Leading in sustainability


public interest
ADVOCACY CENTRE


Ausgrid


Energy
Networks
Australia


ABB
FIMER


INTELLIHUB

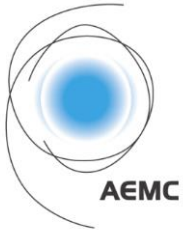

ENERGY
SECURITY
BOARD


CLEAN
ENERGY
COUNCIL


SOUTH
AUSTRALIA
Government
of South Australia
Department for
Energy and Mining

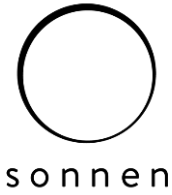

HUAWEI


SMA


AEMC


Australian Government
Clean Energy Regulator
CLEAN
ENERGY
REGULATOR


Fronius


sonnen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ENERGY
REGULATOR

DER and power system security

Collaboration on Energy and Environmental Markets

- Voltage disturbance events
  - 30-40% reduction in D-PV is possible
  - May impact contingencies and therefore FCAS requirements
  - Transmission constraints developed
  - Updates to AS/NZS 4777.2 and South Australian ride-through improvements

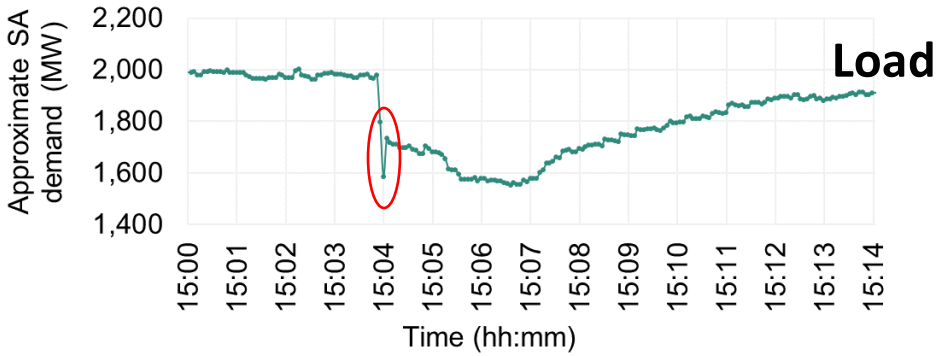
- Frequency disturbance events
  - Useful droop response demonstrated, including in bench testing
  - AS4777.2 not always applied in the field

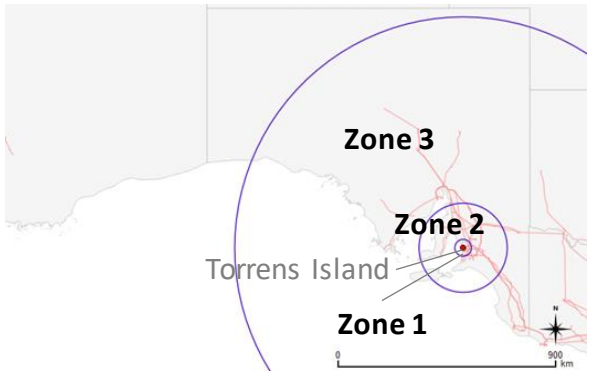
- *Case study events:*
  - *Voltage 3 March 2017, South Australia*
  - *Frequency 25 August 2018, NEM wide*

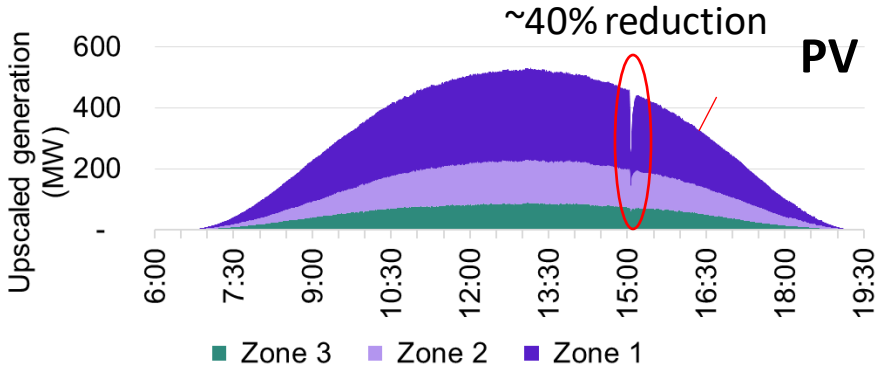
Voltage disturbance event

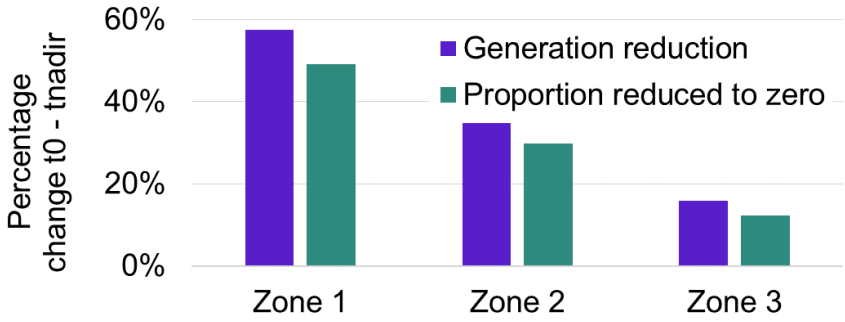
Collaboration on Energy and Environmental Markets

Voltage disturbance case study









- ~200MW of PV reduction possible
- ~50% of systems reduce power to zero in close proximity to disturbance

Frequency disturbance events

Collaboration on Energy and Environmental Markets

Frequency disturbance case studies

- Queensland islanded
  (lightning storms tripped QNI)
- South Australia islanded
  (protection settings, ~6sec after QNI trip)

- **Over frequency** in Queensland and South Australia
- **Under frequency** in Victoria, New South Wales and Tasmania
- **Voltage disturbance** in New South Wales
- **ROCOF** as high as 0.65Hz/s in South Australia

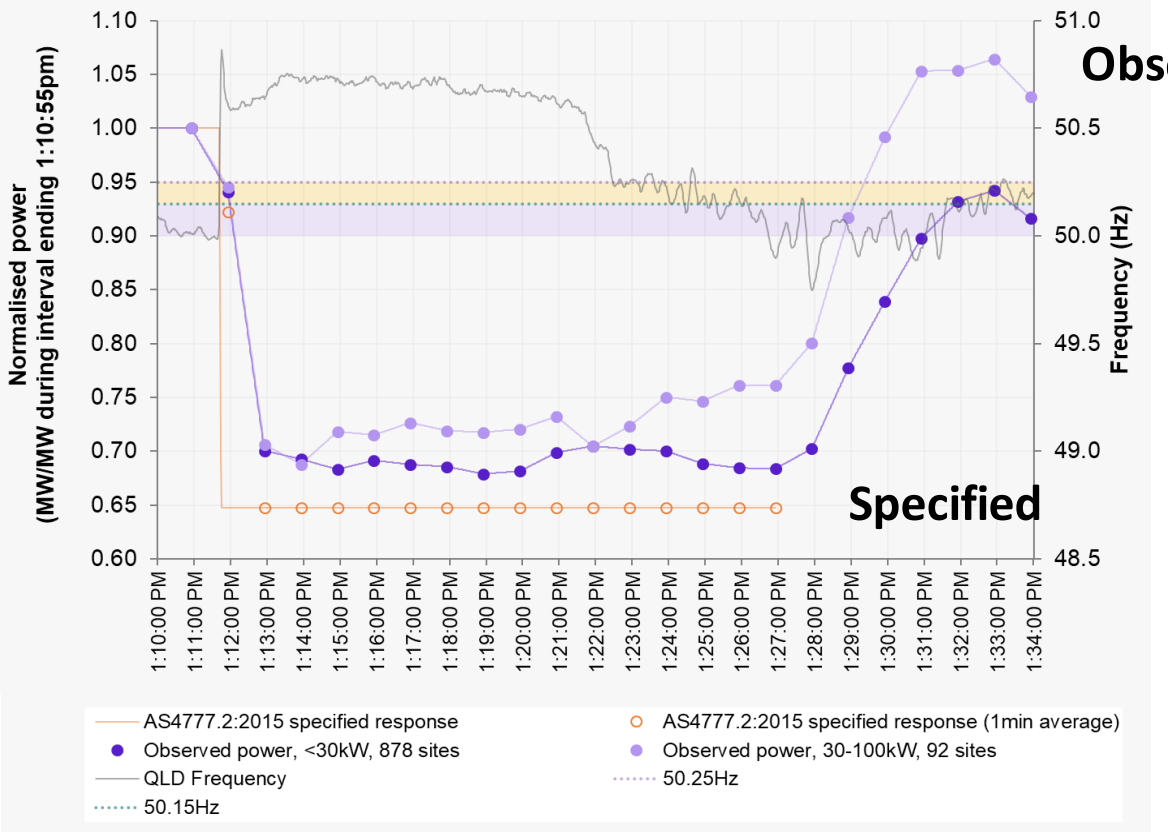
→ How did distributed PV inverters respond?

AEMO incident report: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Market-notices-and-events/Power-System-Operating-Incident-Reports

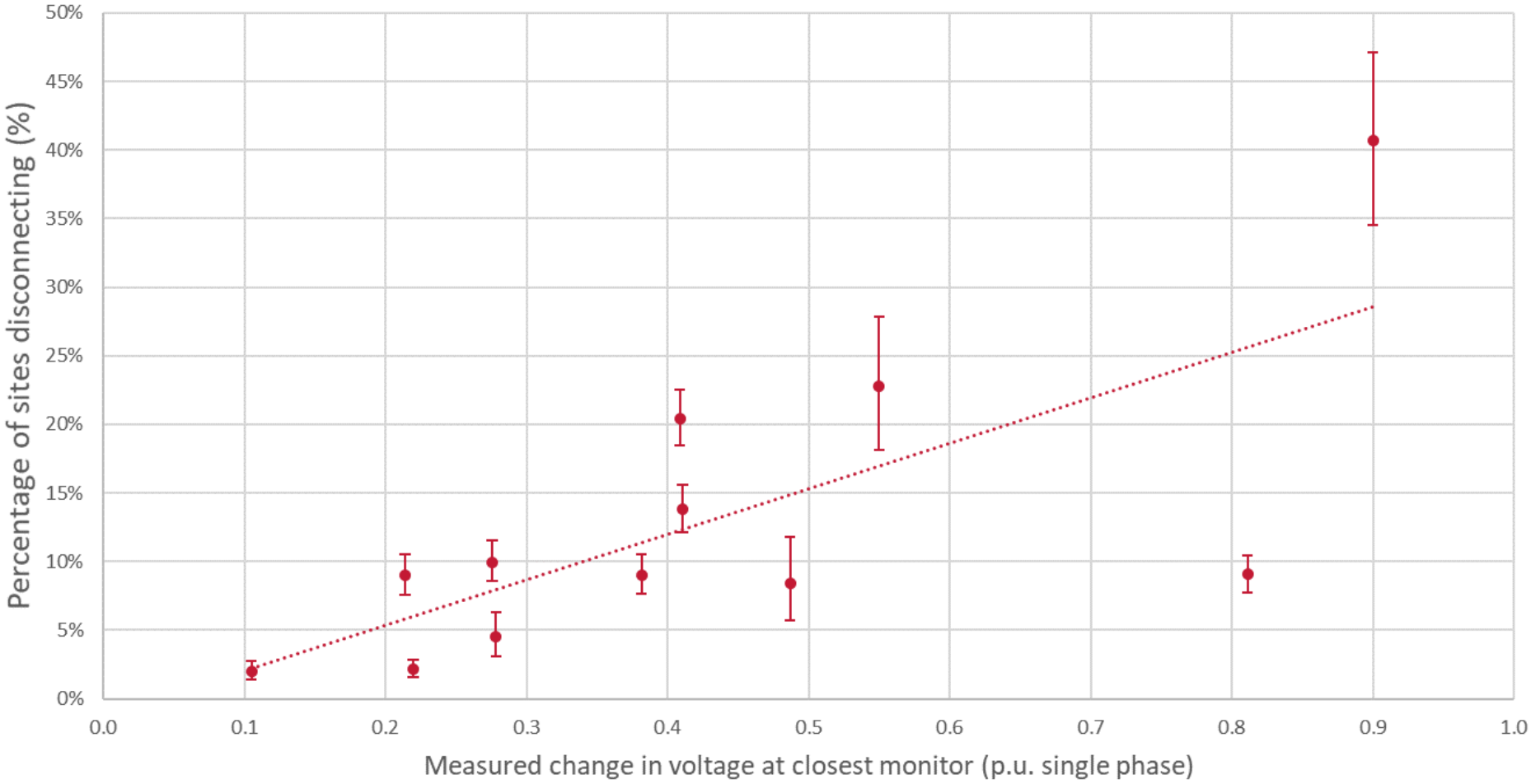
Frequency disturbance events

Collaboration on Energy and Environmental Markets

- Some evidence that distributed PV acted **rapidly, autonomously** and **in concert** to assist in managing power system security
- **However,** 15-30% of Post-2016 systems did not perform droop response



Distributed PV disconnection during voltage disturbances

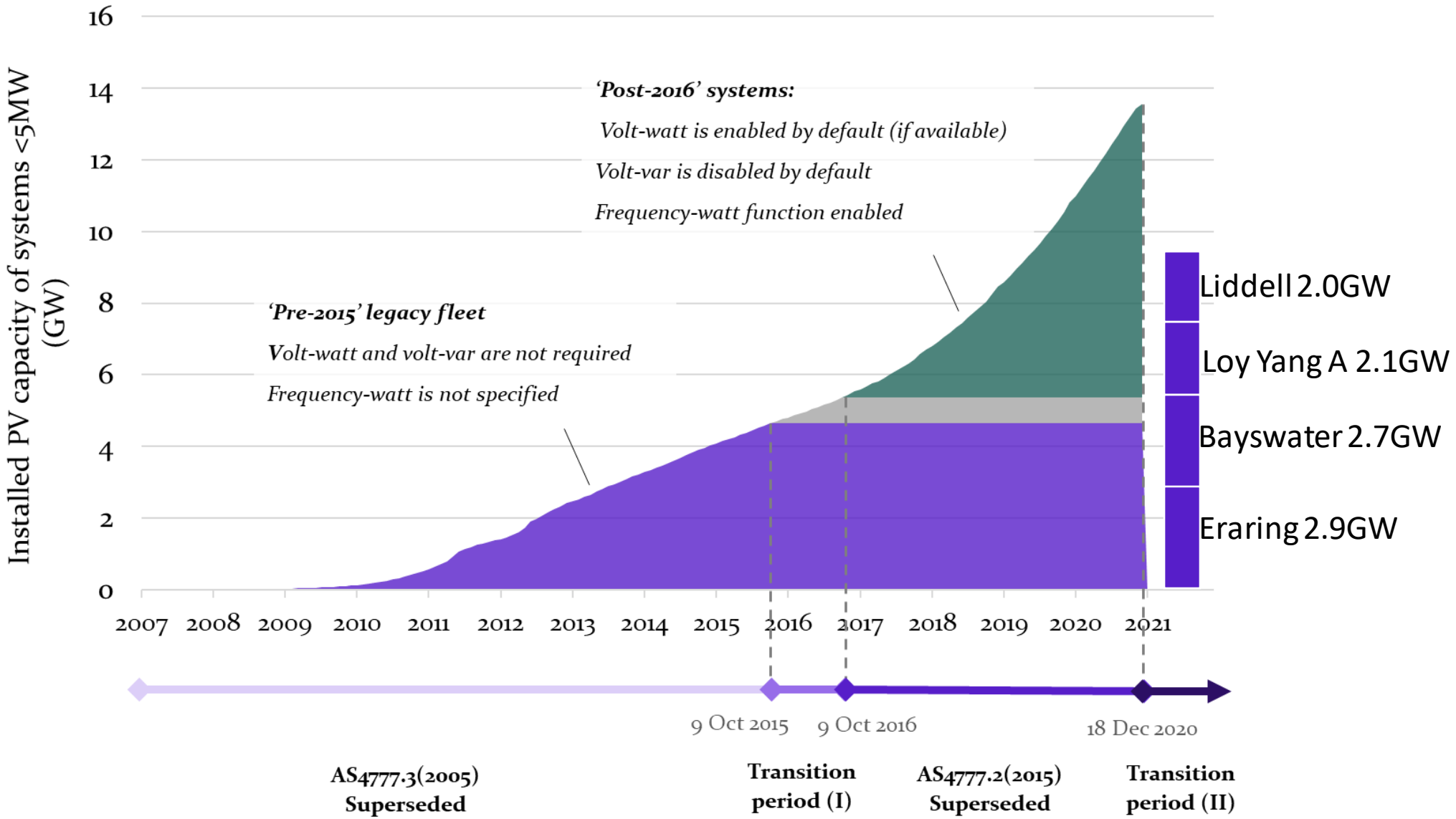


AEMO *'Minimum operational demand thresholds in South Australia'*, May 2020

AEMO DER Operations (link)

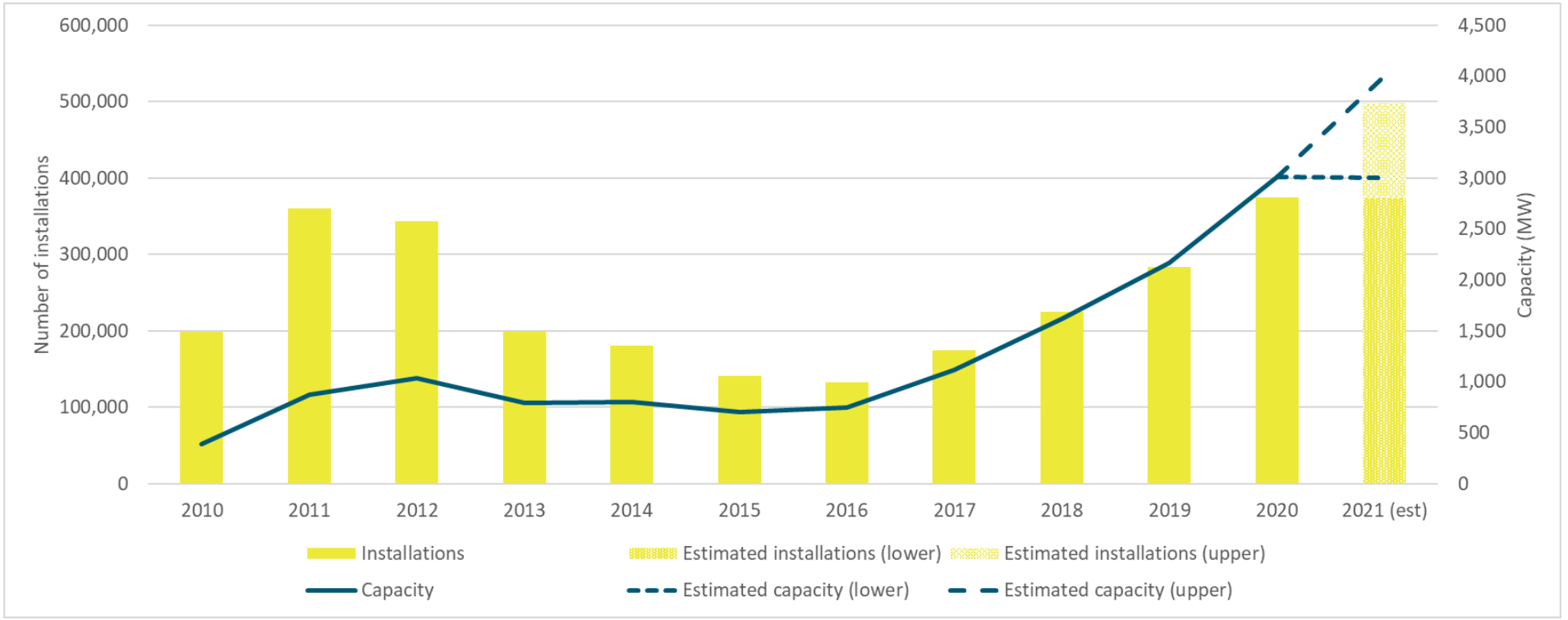
Incident reporting:

Pace of change



Forecast installations (Clean Energy Regulator)

Collaboration on Energy and Environmental Markets



Preliminary findings from inspections of inverter settings (Clean Energy Regulator)

Collaboration on Energy and Environmental Markets

- The Clean Energy Regulator (CER) undertakes an inspection program as part of the Small-scale Renewable Energy Scheme that it administers.
- In October 2020, CER added checklist items related to inverter settings to its inspection program regarding compliance with:
  - AS/NZS 4777.2-2015
  - DNSP specifications re power quality response and grid protection.
- As of January 2021, the CER had conducted nearly 1,500 inspections with the new checklist items, covering installations from May to December 2019. CER has undertaken initial, high-level analysis of the data.

Preliminary findings from inspections of inverter settings (Clean Energy Regulator)

Collaboration on Energy and Environmental Markets

- **Of the 56% of systems that had settings visible to inspectors**, the preliminary, high-level findings were:
  - 53% of systems inspected were correctly configured, or had no errors detected or visible.
  - 4% were not set to AS/NZS4777.2-2015 instead to some other country code or international default (e.g. 50Hz)
  - 16% had incorrectly set 10-minute avg. voltage (vnom-max)
  - 32% of inverters with visible settings had incorrectly configured grid protection settings (e.g. maximum 10-minute average voltage)
  - 37% of inverters with visible settings had incorrectly configured power quality response mode settings (e.g. Volt-Watt or Volt-var).

These findings are preliminary and indicative only. As the first tranche of inspections to incorporate these checklist items, the results must be considered with multiple possible sources of error.

Industry context

Collaboration on Energy and Environmental Markets

H. **Outhred**, "Comments on the International Comparison of Electricity Markets and Market Power Mitigation," in *2007 IEEE Power Engineering Society General Meeting*, 2007, pp. 1-4. Available: https://ieeexplore.ieee.org/document/4275850 , K. **Sue**, I. MacGill, and K. Hussey, "Distributed energy storage in Australia: Quantifying potential benefits, exposing institutional challenges," Energy Research & Social Science, vol. 3, pp. 16-29, 2014/09/01/ 2014. Available: http://www.sciencedirect.com/science/article/pii/S2214629614000826

Project MATCH

Collaboration on Energy and Environmental Markets

Objectives:

→ Establish robust characterisation of DER behaviour during power system disturbances

→ To support a safe, secure and reliable power system with high levels of DER

Outcomes:

- New tools and techniques for data analysis
- Improved understanding of DER fleet behaviour during disturbances
- A range of data streams that help AEMO to maintain security

Foundational projects

Collaboration on Energy and Environmental Markets

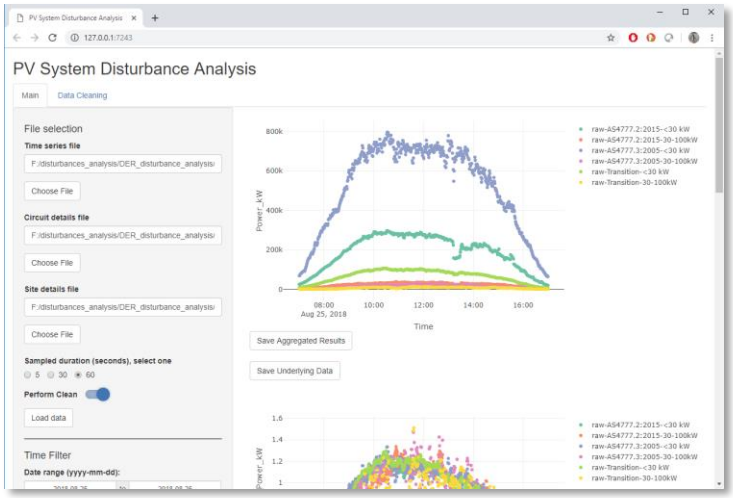
Project MATCH

UNSW, AEMO, Solar Analytics

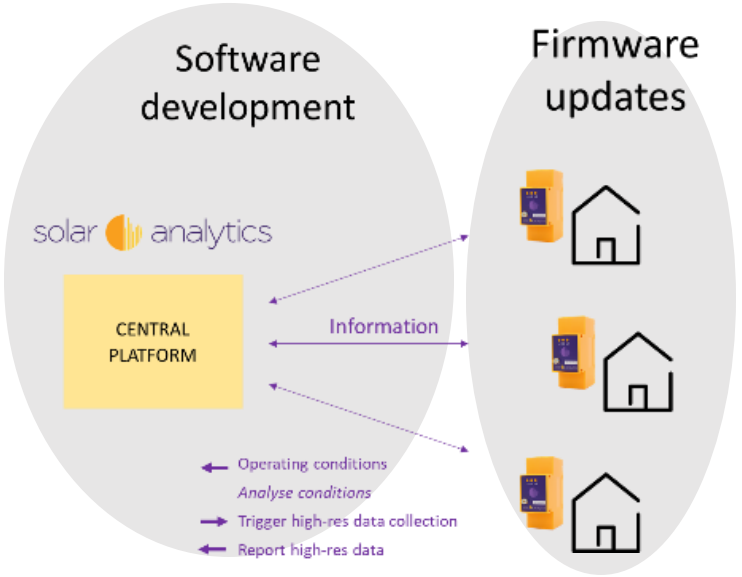
- Broad data sets (inverter OEMs, high res, bench test)
- Improved compliance assessment
- Number of sites for statistical significance

Critical data sets for disturbance analysis

- High resolution data from sites during disturbances
- Ongoing event monitoring



PV Disturbance Tool – Version 1



1. Addressing Barriers to Efficient Renewable Integration

UNSW, AEMO, TasNetworks, ElectraNet

2. Enhanced Reliability through Short Time Resolution Data

Solar Analytics, AEMO, WattWatchers

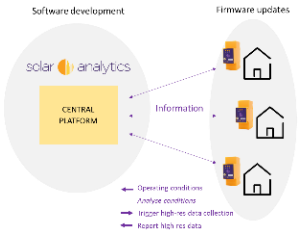
Project MATCH scope

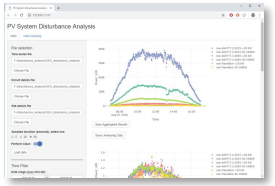
Collaboration on Energy and Environmental Markets

Workstream	Outputs
Workstream 1 Disturbance alerts and automated high-resolution (5s) data collection	• Automated high-res (5s) data collection system • Data collection triggers • New data sets

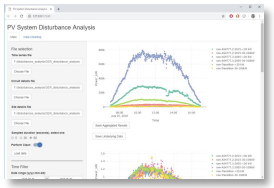
Workstream 2
Understanding inverter behaviour in the field
	• PV Disturbance Tool V2.0
	  • Solar Analytics data
	  • OEM, battery, metering data
	  • Bench testing findings
	→ New inverter compliance estimates
	→ Further understanding of DER behaviours during disturbances

Workstream 3 DER data analysis to support AEMO DER modelling	• PV Disturbance Tool V3.0 • New statistical methods for DER behaviour during disturbances





Inverter behaviours



Statistical methods

Inform AEMO PSSE and PSCAD models

e.g. constraint equations, FCAS procurement

Aid power system security under high penetration DER

Project MATCH timeline

Collaboration on Energy and Environmental Markets

Workstream	2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
SRG meetings	◆		◆		◆		◆		◆		◆	
Workstream 1 Disturbance alerts and 5s data												
Workstream 2 Inverter behaviours and tool development												
Workstream 3 Statistical methods												
Knowledge sharing report #1							◆					
Knowledge sharing report #2												◆

Project MATCH governance

Collaboration on Energy and Environmental Markets

Steering Committee

Chair: A/Prof Iain MacGill

Project Partners

UNSW THE UNIVERSITY OF NEW SOUTH WALES | AEMO AUSTRALIAN ENERGY MARKET OPERATOR | solar analytics | Australian Government Australian Renewable Energy Agency ARENA

Stakeholder Reference Group

Rheem | REDBACK TECHNOLOGIES | ENERGY CONSUMERS AUSTRALIA | SA Power Networks | ERGON ENERGY NETWORK | energex Part of Energy Queensland

wattwatchers DIGITAL ENERGY | TESLA | renew. Leading in sustainability | Ausgrid | Energy Networks Australia

ABB FIMER | INTELLIHUB | public interest ADVOCACY CENTRE | ENERGY SECURITY BOARD | CLEAN ENERGY COUNCIL

HUAWEI | SMA | SOUTH AUSTRALIA | Government of South Australia Department for Energy and Mining | AEMC | Australian Government Clean Energy Regulator | CLEAN ENERGY REGULATOR

Fronius | sonnen | AER AUSTRALIAN ENERGY REGULATOR

Stakeholder Reference Group

Collaboration on Energy and Environmental Markets

Purpose:

- Communicate findings from Project MATCH with relevant stakeholders.

- Seek insights from relevant stakeholders regarding:
  - How findings may support your work?
  - Useful directions for the project to support industry development?
  - Further stakeholders we should bring in?

- Provide a forum to discuss real-world evidence regarding DER contributions to power system security, in order to support industry development.

Goals for the next six months

Collaboration on Energy and Environmental Markets

- **Foundational**
  - Establish Project MATCH (SRG, Steering Committee, hire personnel etc.)
- **Data sources**
  - Progress data sharing (data management plans and NDAs)
  - Progress Solar Analytics software and data collection
- **Knowledge sharing**
  - Establish appropriate consumer representative engagement
  - Concise lessons learnt report (public)

Discussion

Collaboration on Energy and Environmental Markets

- Questions, thoughts and feedback on the project?
- How does this project relate to your ongoing work?
- Other possible sources of useful data?

Thank you

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Dr Anna Bruce
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A/Prof. Iain MacGill
i.macgill@unsw.edu.au

Collaboration on Energy and Environmental Markets

UNSW SYDNEY

Other business and close

Antara Mascarenhas

Thank you for your participation!

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