ESIG presentation: DER Integration Down Under

Matt Armitage
Manager DER Market Integration
Acknowledgment of Country

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.
About AEMO

AEMO operates Australia’s National Electricity Market and power grid in Australia’s eastern and south-eastern seaboard, and the Wholesale Electricity Market and power grid in south-west WA.

Both markets supply more than 220 terawatt hours of electricity each year.

We also operate retail and wholesale gas markets across south-eastern Australia and Victoria’s gas pipeline grid.

Collectively NEM & WEM traded over A$20 billion in the last financial year.

Ownership

40% Market participants
60% Governments of Australia
Australia is the world leader in household solar per capita

The NEM has approximately 12,250MW of distributed PV (17% of total generation capacity). The WEM has approximately 1,740MW (23%).

Most distributed PV across Australia is residential.

Australia has over 2 million rooftop solar installations. Equates to about 1 in 4 homes, but ~40% of homes in SA, QLD & WA.
SA underlying demand met by 100% solar (Grid Scale + rooftop PV) – Sat. 2\textsuperscript{nd} October 2021

- Minimum operational demand of 239MW just 3MW above the record on Sun 26\textsuperscript{th} Sep. 2021
- Between the 11:00 and 12:00 intervals solar generation (grid scale + rooftop PV) could supply all of the SA underlying demand (operational demand + rooftop PV)
NEM and QLD operational demand record – Sunday 3rd October 2021

- **NEM** – 13,972 MW during interval ending 11:00
  - Estimate rooftop PV: 7,266 MW at min. demand supplying 34% of underlying demand

- **QLD** – 3,784 MW during interval ending 11:30
  - Estimated rooftop PV: 2,772 MW at min. demand supplying 42% of underlying demand
Forecast minimum demand in the NEM

- Distributed PV uptake continues to exceed expectations.
- AEMO now forecasts an additional 8.9 GW of distributed PV capacity to be installed by 2025.
- AEMO now forecasts earlier tipping points for secure operation of the NEM.
## Operational and planning items to consider

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<th>Item</th>
<th>Details</th>
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<tr>
<td>Improve DER ride-through standards</td>
<td>• Reduce unintended disconnection of future distributed PV installations – AS4777.2.2020</td>
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<td>Increase frequency control enablement</td>
<td>• Enable sufficient frequency reserves to manage larger contingencies – e.g. if generator trip causes PV to trip</td>
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<td>Re-assess under-frequency load shedding schemes</td>
<td>• Reverse flows make UFLS exacerbate a frequency decline</td>
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<td>• Implement dynamic arming to avoid tripping reverse flows</td>
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<td>Update load models</td>
<td>• To ensure load models adequately represent growing distributed PV levels</td>
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<tr>
<td>Transmission network limits</td>
<td>• Operate network within stability limits, taking into account larger contingencies</td>
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<td>• Publish information regarding minimum demand risks</td>
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<td>Distribution network limits (Dynamic Operating Envelopes)</td>
<td>• Dynamic connection agreements &amp; operating envelopes</td>
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<td>• Increase utilisation of network capacity (e.g. 10kW exports)</td>
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<td>• Ensures minimum demand/peak PV can be managed</td>
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SA Power Networks:
- From 2017, systems which export >200kW under SCADA control
- From 28 September 2020, all new PV systems must be capable of disconnection and reconnection through a remote agent (Smarter homes regulation).
- Legacy PV curtailed by inducing overvoltage tripping (Enhanced Voltage Management)

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<th>Mechanism</th>
<th>Amount (MW)</th>
<th>Total amount</th>
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<td>Smarter Homes (Relevant Agents/Aggregators)</td>
<td>~14</td>
<td>~50MW</td>
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<td>SCADA-controlled DPV (All systems which export &gt;200kW)</td>
<td>~17</td>
<td>~60MW</td>
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<tr>
<td>Enhanced Voltage Management (2 EVM blocks, total 7 substations)</td>
<td>~40</td>
<td>~300MW</td>
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<td><strong>Total</strong></td>
<td><strong>~71</strong></td>
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### AEMO VPP Demos

#### Overarching Objective
Test Virtual Power Plants delivering Contingency FCAS, obtain operational visibility and use learnings to inform changes to regulatory and operational frameworks.

#### Stakeholder engagement & industry advisory groups
- **Funding**
  - Distributed Energy Integration Program
- **Cyber Security**
  - Customer Research Working Group
  - AEMC, AER, ESCOSA
- **Inputs & Engagement**
  - Consumer Research Working Group
  - Monthly VPP FAQs working group

#### Objectives
- Participants demonstrate basic control and orchestration capability for VPPs providing real time energy and FCAS
- Develop systems to deliver operational visibility of VPPs
- Assess current regulatory and operational arrangements affecting market participation of VPPs
- Provide insights on how to improve consumers’ experience of VPPs in future.
- Understand what cyber security measures VPPs currently implement, and whether they should be augmented in future.

#### Overarching Objective
- Test Virtual Power Plants delivering Contingency FCAS, obtain operational visibility and use learnings to inform changes to regulatory and operational frameworks.

#### Project Participants
- **Inputs & Engagement**
  - AEMC, AER, ESCOSA
  - Flagship Consumer Research Working Group
  - Monthly VPP FAQs working group

#### Project Participants
- **Project Participants**
  - VPP Demos on a page
  - Cyber Security
  - Customer Research
  - Funding
  - Stakeholder engagement & industry advisory groups

#### Timeline
- **Nov 2018**
  - Consultation, Design & Tech Development
- **July 2019**
  - VPP Demos Launch
- **Sep 2019**
  - SA VPP joins, then AGL (Dec)
- **July 2020**
  - 1 year extension
- **Sep 2020**
  - 7 VPPs registered
- **Jan 2021**
  - Launch MASS review
- **Dec 2021**
  - Close VPP Demos & MASS

#### Overarching Objective
- Test Virtual Power Plants delivering Contingency FCAS, obtain operational visibility and use learnings to inform changes to regulatory and operational frameworks.

#### Outcomes
- **Outputs**
  - Four knowledge sharing reports published
  - Evidence to support policy and regulatory reform
  - Flagship Customer Research
- **Outcomes**
  - Uplifted VPP sector capability WRT market services delivery
  - DER Reforms (P2025, 2SM, WDR, ST-PASA, IESS, Sch. ‘lite’) informed by evidence
  - Action on RIS recommendations 2.2, 2.3, 6.2: Visibility and confidence of aggregated DER dispatch capability

#### Website link
[Website link]
VPP Demos learnings for planning studies

Previous Integrated System Plans applied the following assumptions for modelling VPPs:

- A proportion of batteries are associated with VPPs
- Aggregated batteries are included in the market models and are optimised with perfect foresight to maximise their benefit to the system
- All rooftop PV is modelled as uncurtailed

The VPP Demonstrations will help improve future ISP modelling around VPPs:

- The proportion of batteries in VPPs has been underestimated previously
- Response of VPP batteries to both high and negative price events is smaller and less predictable than currently assumed in AEMO’s models.
- Emergence of dynamic connection agreements may increase size/exports of DPV
**Project EDGE**

An efficient, scalable and integrated technology ecosystem that enables DER to deliver wholesale and local services within Distribution & Transmission network limits.

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Aggregator

Aggregators use EDGE to access and deliver electricity services on behalf of consumers, including wholesale services to AEMO and local network services to DSOs.

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**DSO – the Distribution System Operator** is a role that the Distribution Network Service Provider transitions to as they dynamically manage capacity and operate the network to optimise value to customers and the energy system, including increased hosting of DER.
Distributed Energy Integration Program

DEIP Steering Group

DEIP overview

PURPOSE
The Distributed Energy Integration Program (DEIP) is a collaboration of government agencies, market authorities, industry and consumer associations aimed at maximising the value of Distributed Energy Resources (DER) for all energy users.

VISION
DEIP members have a shared interest in supporting our evolution toward a distributed energy system that is secure, reliable, resilient, affordable and efficiently integrates and utilises customer’s DER.

WHO IS INVOLVED
The DEIP Steering Group involves 13 organisations who communicate regularly (see logos on right) and collaborate with a wider cross section of stakeholders.

Four Working Groups

1. Network Access & Pricing
2. Interoperability Steering Committee
3. Dynamic Operating Envelopes
4. EV Grid Integration

Website link
ESB – DER Implementation Plan

**Website Link**

**Horizon One – Things we will do now**
- Introduction of Dynamic Operating Envelopes (existing trials)
- Emergency backstops for Min System Load
- Deliver enhanced Information provision
- Build Turn-Up capability (new ARENA trials)
- Develop DSO/SO interface and data sharing protocols

**Horizon Two – Things we will do next**
- Phased implementation and guidance to support uptake of enduring DOE capabilities
- Monitor and report emerging risks (cyber / interoperability) – share insights across technical regulators and jurisdictions
- Further definition of DSO responsibilities re community storage tariffs, load control and procurement and delivery of DER network services
- Increase visibility of DER to increase certainty and reduce costs
- Define and develop shared capabilities through IT systems roadmap

**Horizon Three – Things in the future**
- Implementation of DOE guidelines and standards for new DER installs
- Reform network tariff arrangements
- Cyber standards for DER
- Fit for purpose reg frameworks

**Customer outcomes**
- Consumers have access to secure, reliable, affordable and sustainable energy no matter how they choose to participate
- Consumers are able to realise the value of their flexible demand and DER
- Protection is fit for purpose and meet emerging needs for customers with or without DER

**Increasing uptake of DER (PV, Batteries, Electric Vehicles) and removing barriers**
- Flexible Demand and DER is rewarded in the market – starting with large customers
- New technologies or service providers can easily enter the market
- Customers can engage more than one service provider to meet their energy needs if they choose to do so
- Customers of all sizes can easily access choice and switch between service providers to optimise their DER or flexible demand

**Iterative assessment of potential benefits and risks to customers using the risk assessment tool**
- Risks assessment of emerging harms to consumers is built into regulatory processes
- Customers have fair and equitable access to export their DER to the grid
- Clear obligations on parties to ensure customer protections where there is more than one provider
- Protections are fit for purpose and meet emerging needs for customers with or without DER

**Fit-for-purpose protections framework improves experience for all customers**