AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Emerging Generation and Energy Storage

March 2018

Agenda

1. Objectives
2. Key themes
3. Scenarios and learnings
4. AEMO's experience
5. Future arrangements and next steps

Overall objective

To enhance the existing NEM arrangements to:

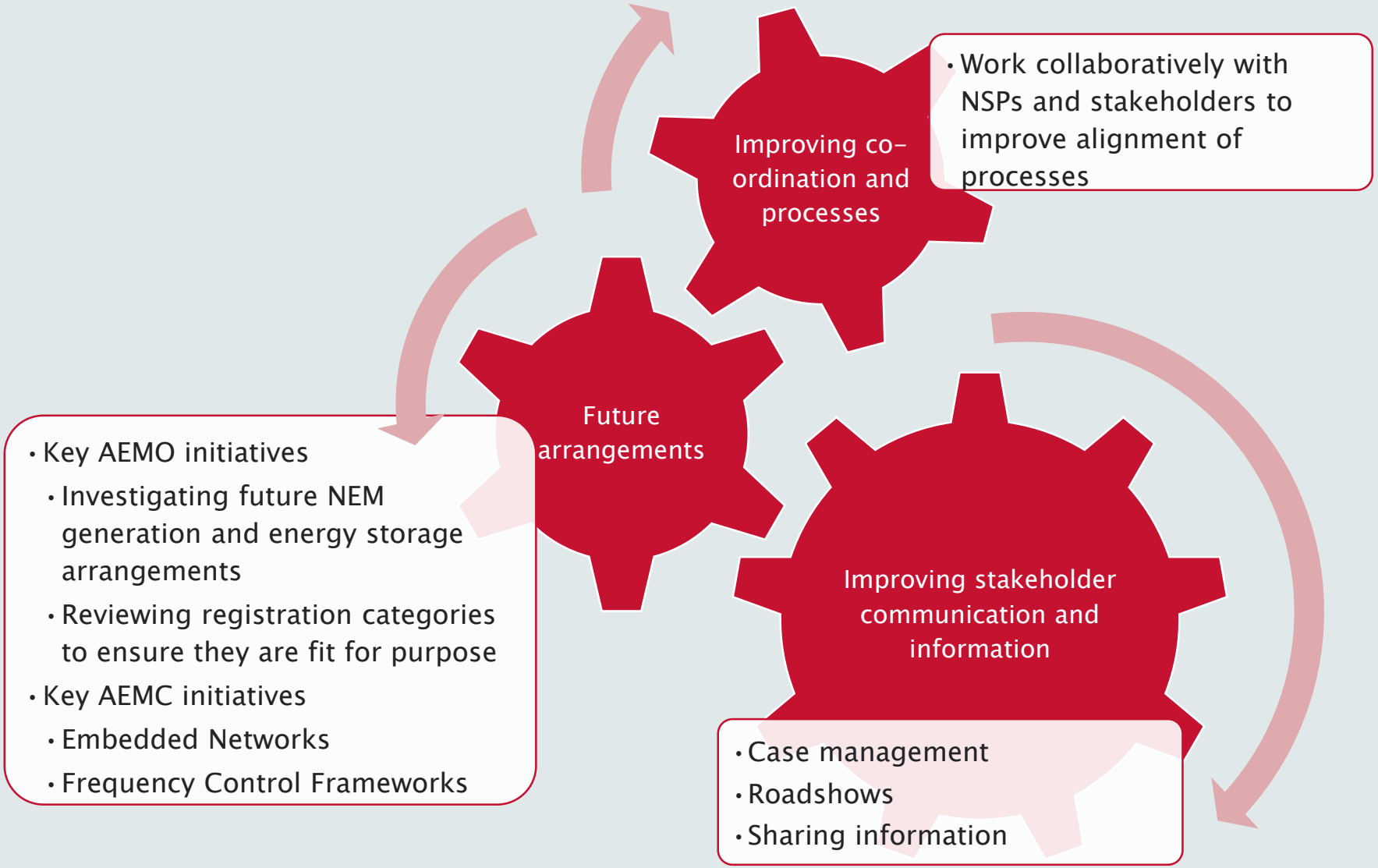
- facilitate and support efficient participation of emerging generation and energy storage
- efficiently integrate technologies on the basis of technical requirements and capability of the technology
- improve process and system efficiency by having flexible, robust and transparent arrangements

In collaboration with stakeholders, we intend to explore the challenges, develop and test ideas

Today's meeting objective

- Provide AEMO feedback on key stakeholder themes from 8 December meeting
- Discuss challenges and experiences with specific grid-scale scenarios - under the existing NEM arrangements
- Obtain stakeholder feedback on new grid-scale generation and energy storage scenarios, including:
  - Scenarios to be planned for
  - Identifying market barriers with the NEM framework
  - Key policy questions
  - Changes needed e.g. rules, systems, procedures

Key themes


Improving co-ordination and processes
• Work collaboratively with NSPs and stakeholders to improve alignment of processes
Future arrangements
• Key AEMO initiatives
• Investigating future NEM generation and energy storage arrangements
• Reviewing registration categories to ensure they are fit for purpose
• Key AEMC initiatives
• Embedded Networks
• Frequency Control Frameworks
Improving stakeholder communication and information
• Case management
• Roadshows
• Sharing information

Scenarios and learnings

Introduction

- By using these scenarios we intend to:
  - explain the approach and identify why some arrangements may work and others may not
  - develop a shared view and understanding of the challenges and current limitations under the existing NEM arrangements
- Discuss scenarios and obtain feedback on stakeholder perspectives and experiences

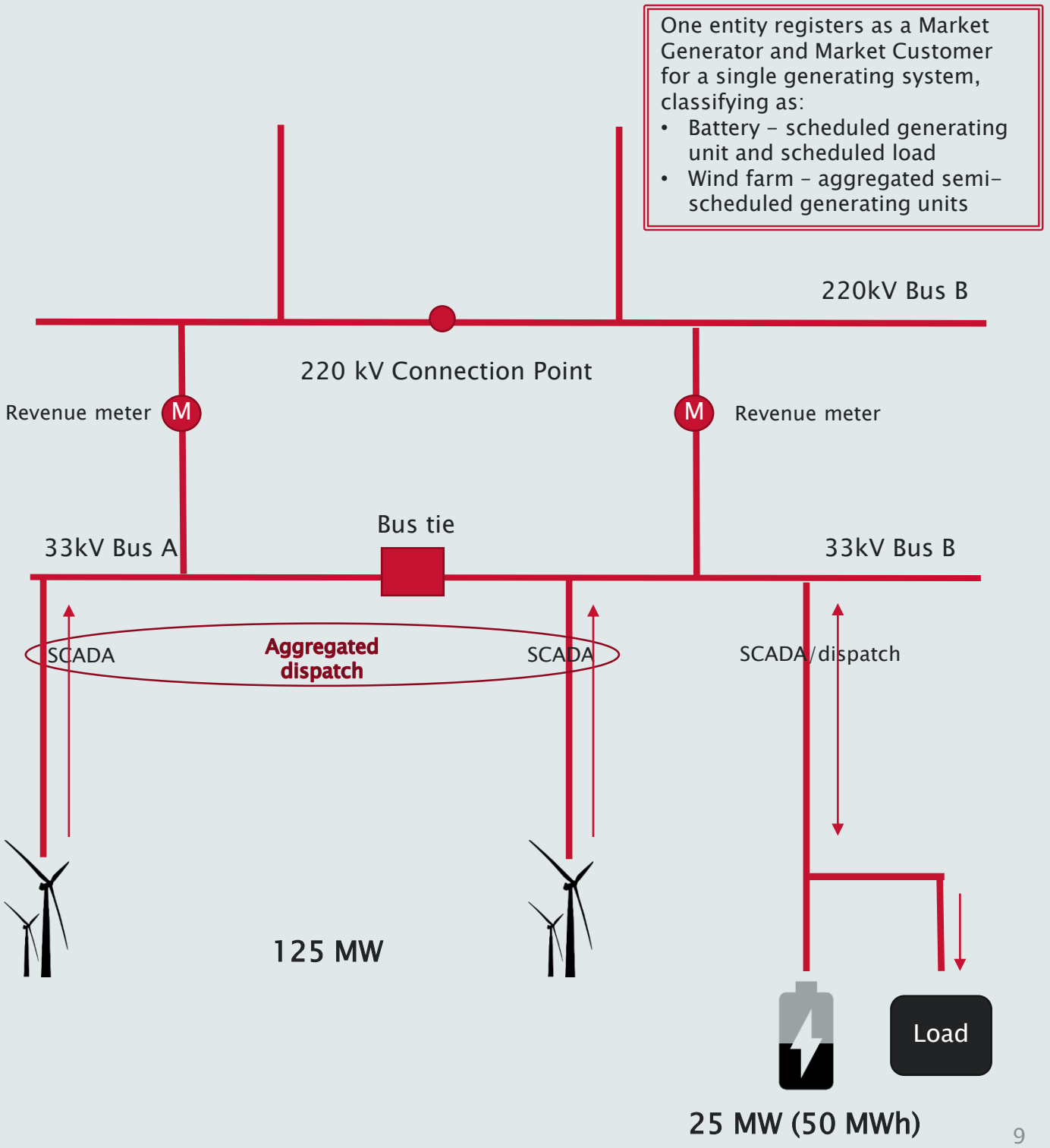
Scenarios

ID	Scenarios
1	Energy storage
2	Wind and/or solar and energy storage
3	Synchronous and wind and/or solar
4	Synchronous, solar and/or wind and energy storage
5	Market load and energy storage
6	Market load and solar and/or wind
7	Market load, solar and/or wind and energy storage

- Are there other scenarios not covered by these?
- Will financial ownership of a generating system be by more than one party behind a common connection point?

Scenario 1

Hybrid – wind, battery and load



Scenario 1 learnings

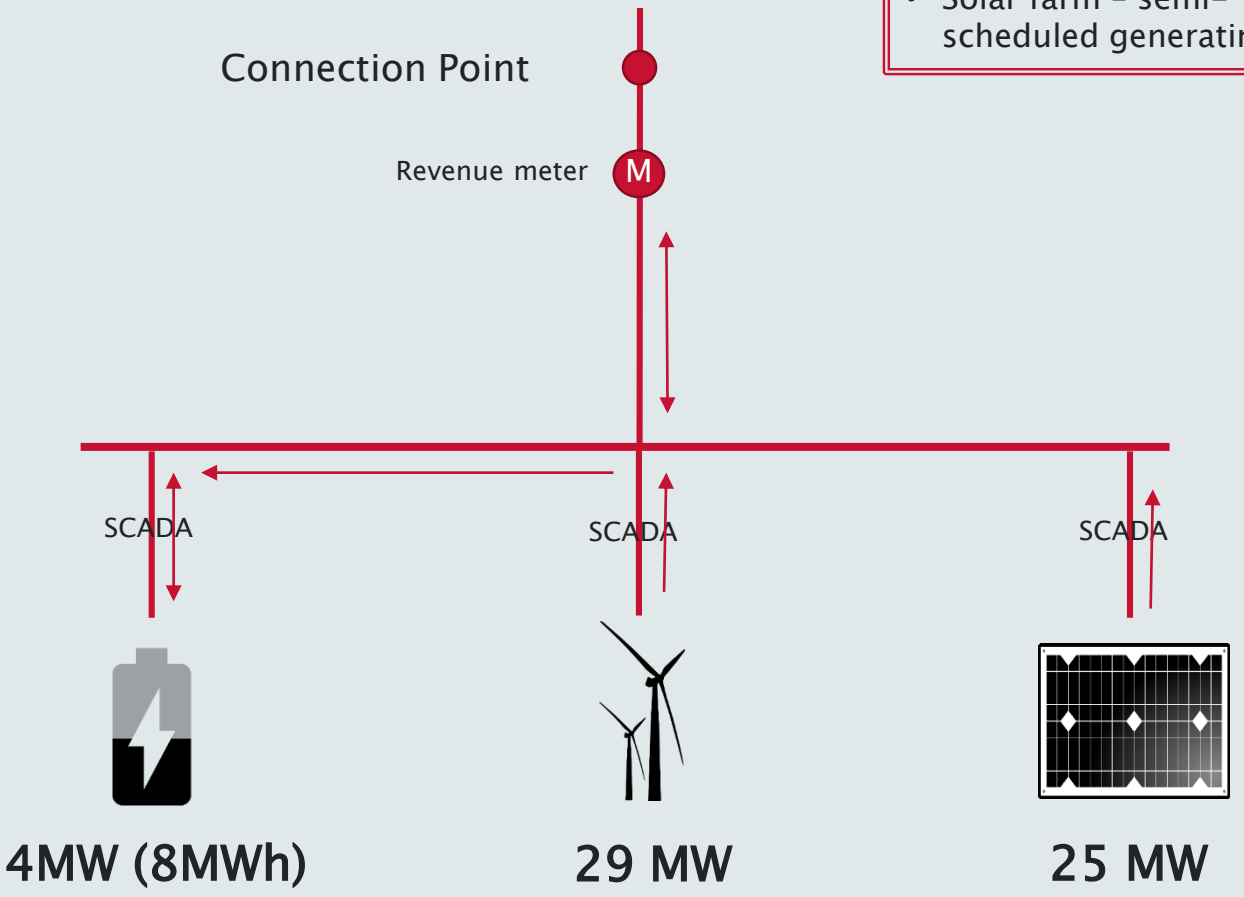
- A single entity registers in two participant categories for the generating system, there is one FRMP
- Two revenue meters only due to operational needs
- Performance standards applicable at the 220kV connection point for the entire generating system, including battery and load
- Separate dispatch of:
  - market scheduled generating unit (battery)
  - market scheduled load (battery)
  - market semi-scheduled generating unit (wind)

Scenario 2

Hybrid – solar, battery and wind

One entity registering as a Market Generator classifying as:

- Battery – non-scheduled generating unit
- Wind farm – semi-scheduled generating unit
- Solar farm – semi-scheduled generating unit



Scenario 2 learnings

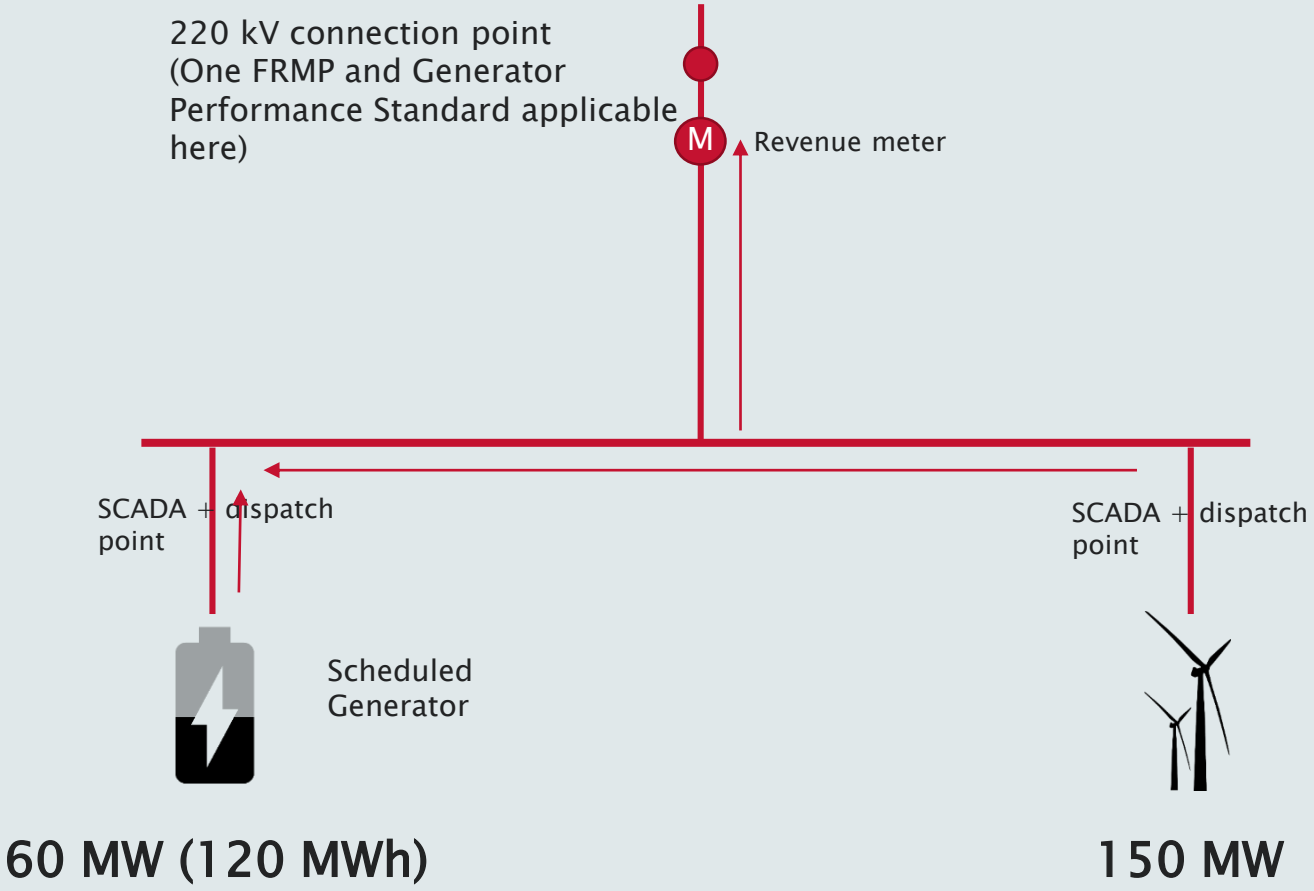
- A single entity registers in one participant category for the generating system, there is one FRMP
- AEMO standing exemption not applicable to a generating unit (in this case the battery) within a generating system
- Performance standard applicable to the entire generating system at the connection point
- Separate dispatch of:
  - market semi-scheduled generating unit (wind)
  - market semi-scheduled generating unit (solar)
- One NEM compliant revenue meter is required
- Cannot currently aggregate different technology types for dispatch, e.g. solar and wind

Scenario 3

Wind and battery (not charging from the NEM)

One entity registering as a Market Generator for a single generating system, classifying as:

- Battery – scheduled generating unit
- Wind farm – semi-scheduled generating unit



Scenario 3 learnings

- A single entity registers as a Generator and classifies generating units as semi-scheduled and scheduled, there is one FRMP
- As the battery is not to be charged from the grid, no requirement to register as a Market Customer however AEMO considers that battery should also be scheduled as if it were a load
- Performance Standard applicable to the entire generating system at the 220 kV connection point
- One NEM compliant revenue meter is required
- Separate dispatch of:
  - market scheduled generating unit (battery)
  - market semi-scheduled generating unit (wind)
  - battery (operating in charging mode)

A snapshot of learnings

Learnings	Scenario 1 – 'Hybrid' – wind, battery and load	Scenario 2 – 'hybrid' – solar, battery and wind	Scenario 3 – Wind and battery (not charging from the NEM)
Registration inefficiencies associated with registering in more than one category, e.g. separate application processes and not being treated as a single or combined asset	✓	✓	✓
Separate dispatch	✓	✓	✓
No aggregation of technology types (wind and solar) in dispatch	n/a	✓	n/a
Battery not drawing electricity from the grid must participate in dispatch	n/a	n/a	✓
SCADA needed at each technology type	✓	✓	✓
Battery < 5MW not automatically exempt in a generating system	n/a	✓	n/a

Battery and hybrid experience

Experience

- AEMO has integrated and are progressing a number of advanced proposals for battery and hybrid facilities, specifically:
  - Dedicated battery installations
  - Hybrid wind and solar
  - Hybrid wind and battery
  - Hybrid solar and battery
- Data shows that battery system response is rapid and precise, and can assist with management of system security through participation in special control schemes (NLCAS)
- More generally, recent project experience has highlighted that the connection process, from initial Enquiry to Connection Agreement (and in some cases, full operation) can be achieved in less than 6 months

AEMO's experience – battery and hybrid (cont.)

Challenges

- Requirement for performance standards to be applicable to an embedded network connection point where there is a different FRMP
- To ensure batteries do not adversely impact AEMO's ability to manage system security (price events leading to contingency events) we expect the following is required:
  - ramp linearly between dispatch targets
  - Control the battery as both a dispatchable generator and as if it were a scheduled load (irrespective of its actual classification)

AEMO's experience – battery and hybrid (cont.)

Opportunities

- Provide multiple services:
  - Energy
  - Regulation FCAS
  - Contingency FCAS
  - NLCAS
- Participate in special control schemes which contribute to power system security
- Improve power system utilisation/reduce congestion with energy storage
- Hybrid facilities with storage and/or load provide additional flexibility to use energy when the network capacity may otherwise be constrained
- Operation in grid-forming mode

Future arrangements

Discussion areas:

- Current registration arrangements for batteries and ‘hybrid’ arrangements
- Single dispatch bids and offers for batteries
- Currently no aggregation of different technology types, e.g. wind and solar
- Separate ownership of ‘resources’ behind a common connection point
- Performance requirements should be applicable to an embedded network connection point where there is a different FRMP
- When does a solar farm or wind farm’s output become ‘predictable’ when it is part of a generating system
- Changes to the Intending Participant category to improve access to information for newer business models e.g. Special Purpose Vehicles

Next steps

Activity	Expected
Finalise the scenarios we are planning for	March
Identify key policy options and undertake further analysis	April/May
Identify IT options and draft strawman	April/May
Stakeholder session to discuss policy options and strawman	May