

# INTEGRATING ENERGY STORAGE SYSTEMS INTO THE NEM

OPTIONS PAPER STAKEHOLDER SESSION

---

4 FEBRUARY 2021

AEMC

# Agenda

---

1. Context of today
  2. Registration and participation framework
  3. Recovery of non-energy costs
  4. New issues raised
-

# CONTEXT FOR TODAY

—

## Project key milestones

---

1. Project initiated/consultation paper released: 20 August 2020  
(38 submissions received to consultation paper)

Summary of submissions: Most agreed there are issues to resolve, unclear on the right solution

2. Options paper released seeking further feedback: 17 December 2020  
(submissions due on 11 February 2021)

3. Draft determination published: 29 April 2021

4. Final determination published: August 2021

# REGISTRATION AND PARTICIPATION FRAMEWORK



## verlapping work programs

---

### **Integrating energy storage systems into the NEM**

- Remove barriers to energy storage and hybrid facility participants entering and participating in the NEM.
- AEMO's proposed solution was to define storage and hybrid facilities in the NEM to allow bi-directional-specific obligations to be assigned to participants

### **Two-sided market reforms**

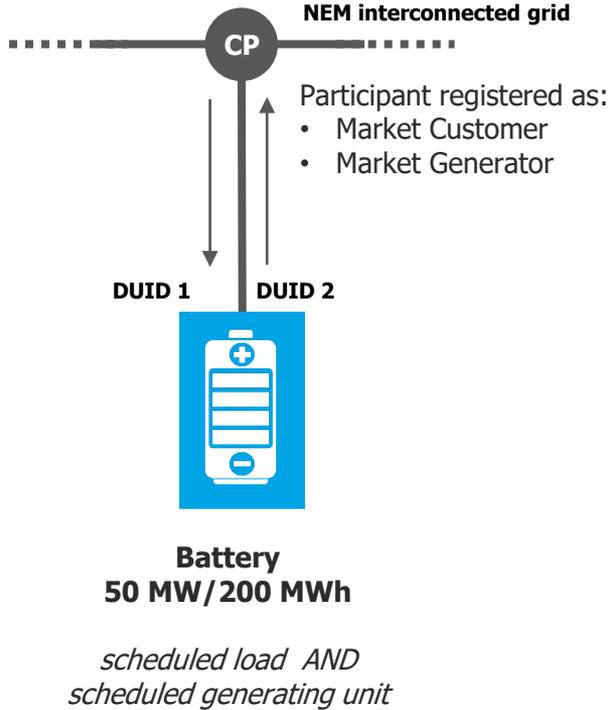
- Simplify the existing participation framework, including registration process, by accommodating existing categories into a single 'trader' category.
- Assign obligations to services at the connection point (rather than registration categories and assets), allowing greater flexibility that supports innovation.

The Two-sided market reform is one of a number of Market Design Initiatives (MDIs) being implemented by the ESB as part of its post-2025 work program. While the concept of a two-sided market has been developed, the detail will be developed and considered in conjunction with the rule change process, and will be ongoing for a number of years. The Integrating energy storage systems into the NEM rule change is the first to consider two-sided market reforms.

# Option spectrum considered in the options paper

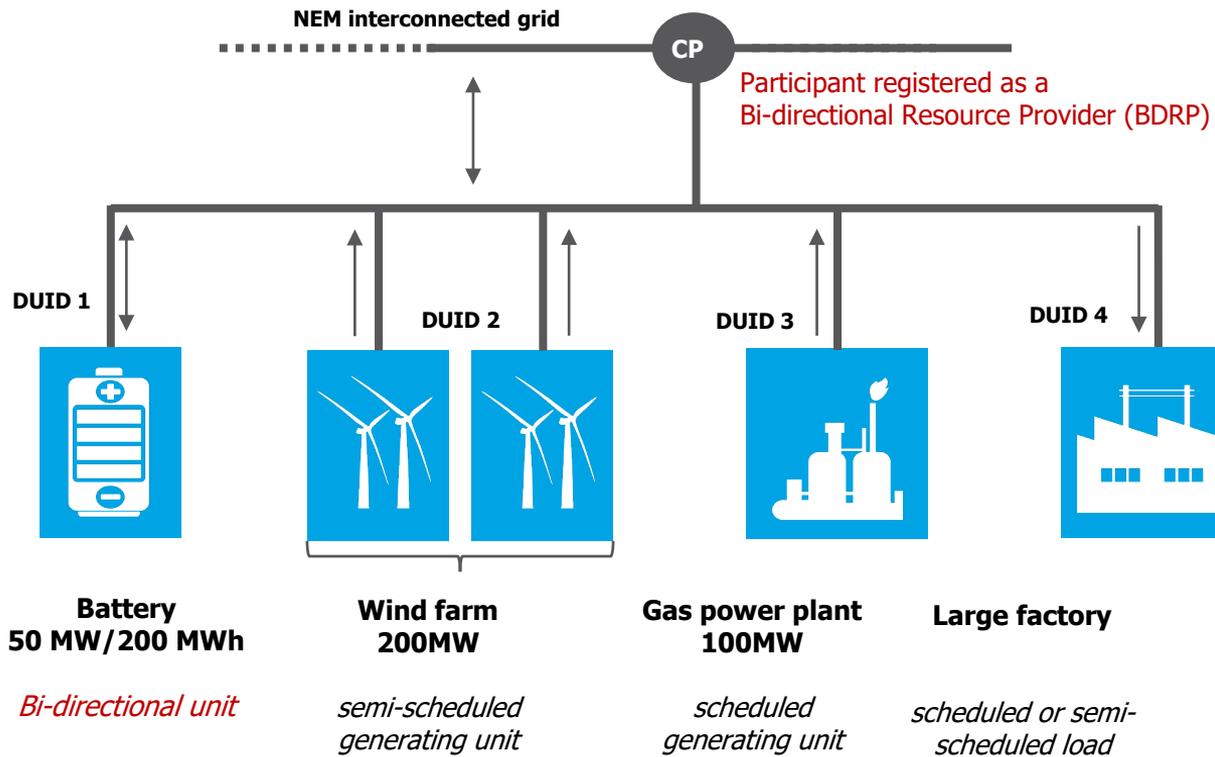
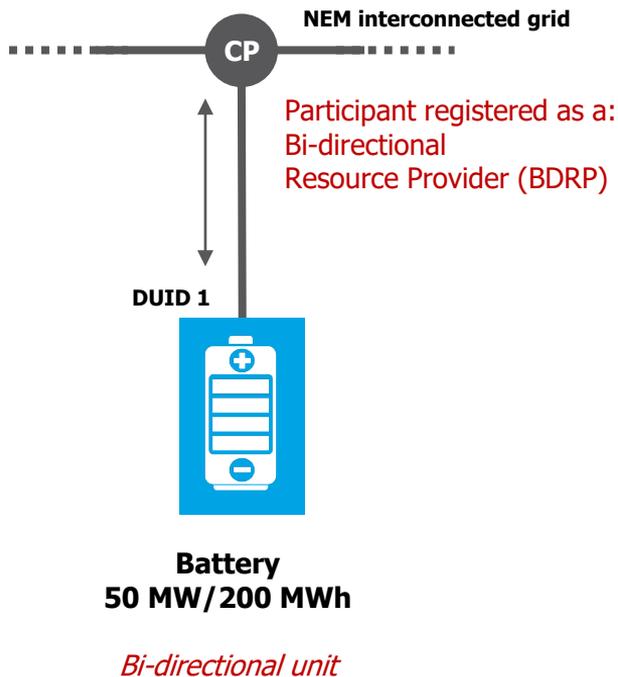
Features	Option 1: No change.	Option 2: BDRP (new participant category and AEMO's proposed solution)	Option 3: Modifications to existing categories	Option 4: IRP (new participant category)
<b>Number of categories registered in?</b>	Two (Market Generator <u>and</u> Market Customer).	One (BDRP).	One (Market Generator <u>or</u> Market Customer).	One (IRP).
<b>Are new technology-specific definitions required?</b>	No.	Yes.	No.	No.
<b>Number of DUIDs?</b> <i>Number of price bid bands?</i>	Two.	One for each unit (one-way or bi-directional unit).	One for each one-way energy flow unit. Two for bi-directional units where the energy flows are above a threshold.	Two for an IRP (one for sent out energy and one for consumed energy).
<b>How do classifications apply (scheduling)?</b>	For each asset/unit.	For each asset/unit.	For each service provided at the connection point but seeking feedback on this.	For each service provided at the connection point but seeking feedback on this.
<b>Dispatched at the connection point or asset?</b>	At the asset/unit.	At the asset/unit, but may be able to aggregate like-assets behind a connection point (for hybrids).	Preferably at the connection point, but seeking feedback on this.	Preferably at the connection point, but seeking feedback on this.
<b>Is it clear how hybrids can participate?</b>	No.	Yes, but AEMO discretion would apply for aggregating units in hybrids.	Yes.	Yes.

## Option 1 – no change (how storage and hybrids currently register)

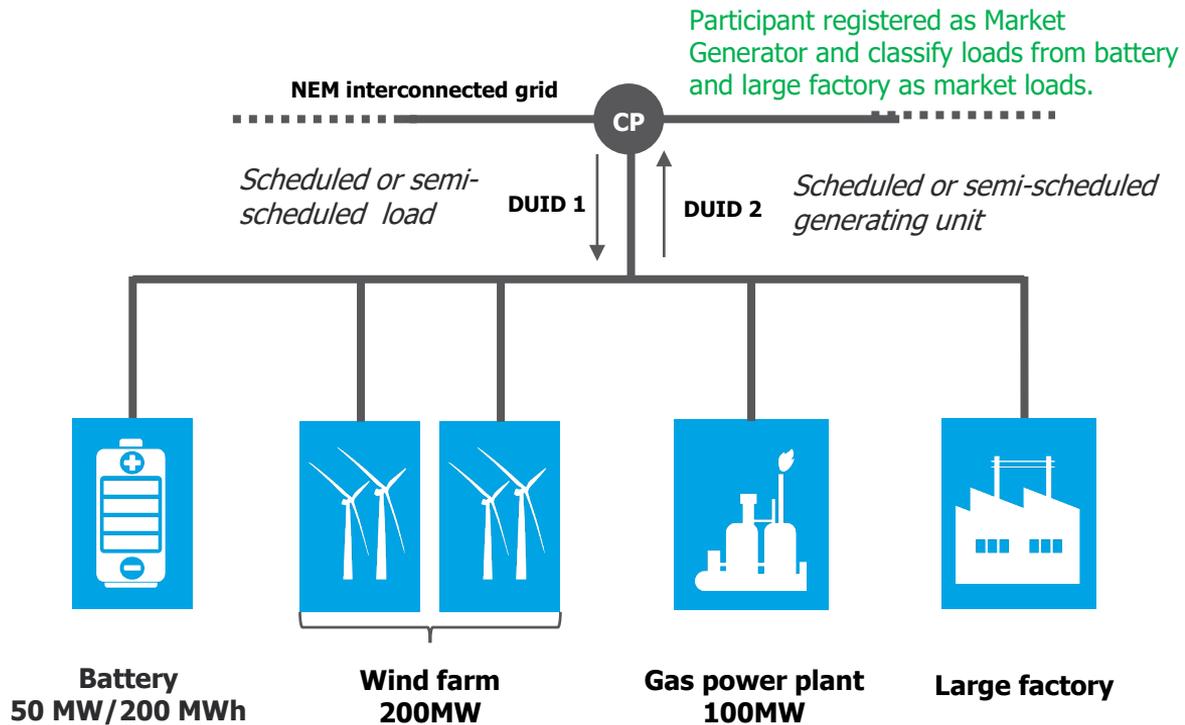
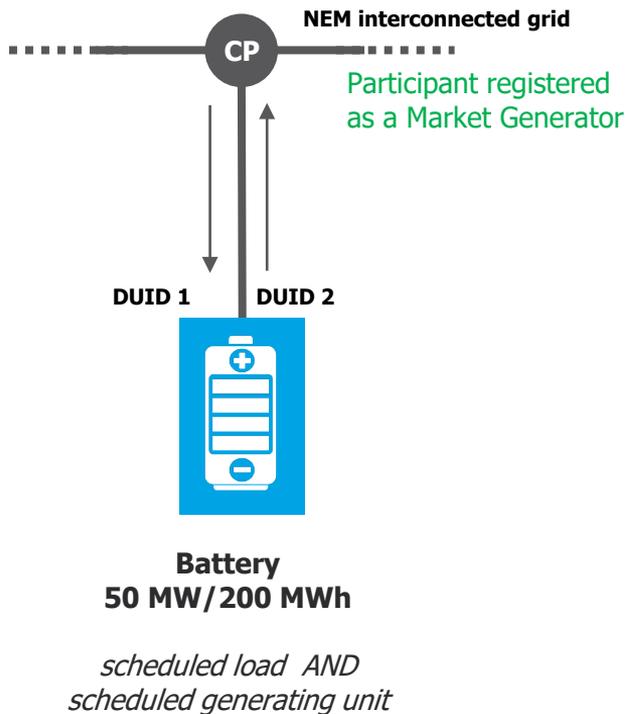


Currently unclear in some circumstances how a hybrid facility would register.

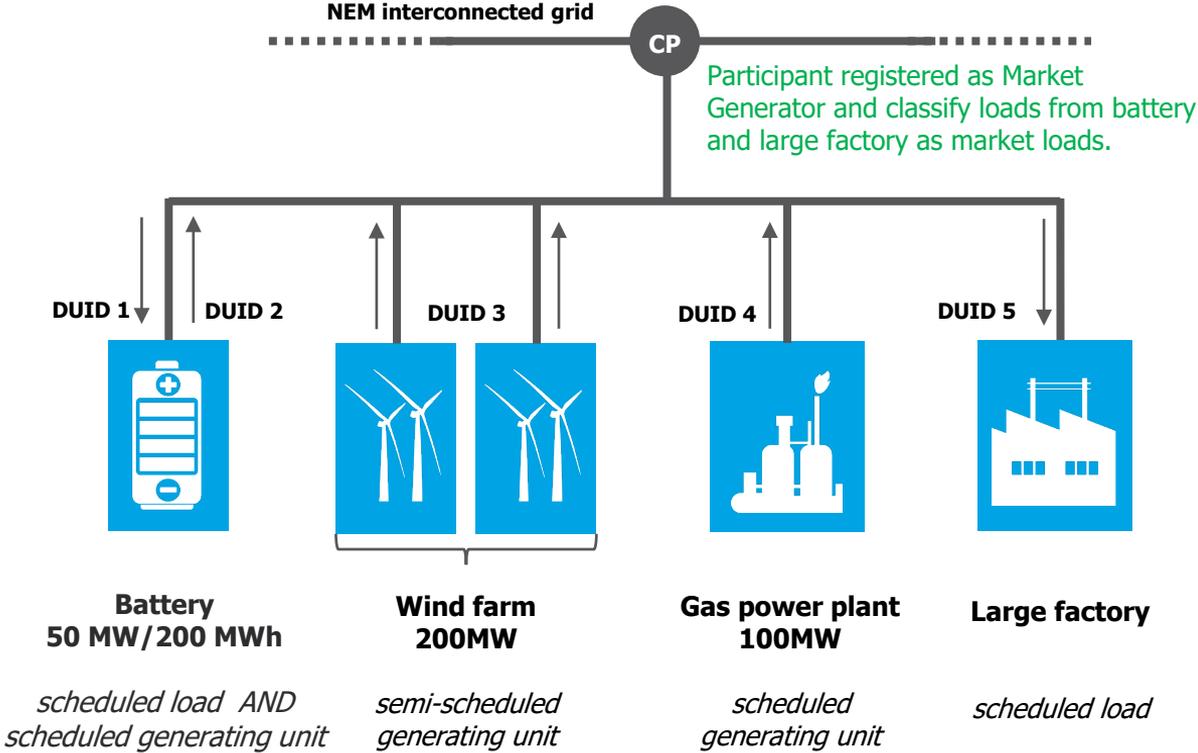
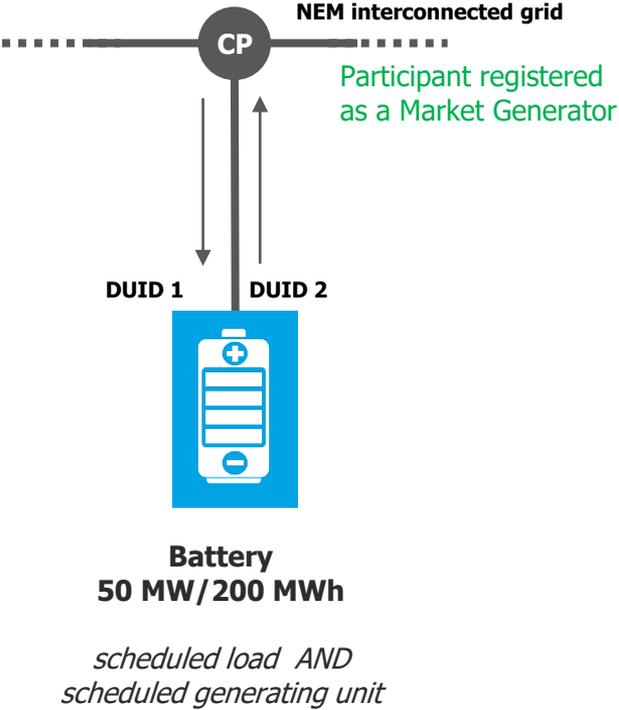
# Option 2 – Bi-directional Resource provider (AEMO’s proposed solution)



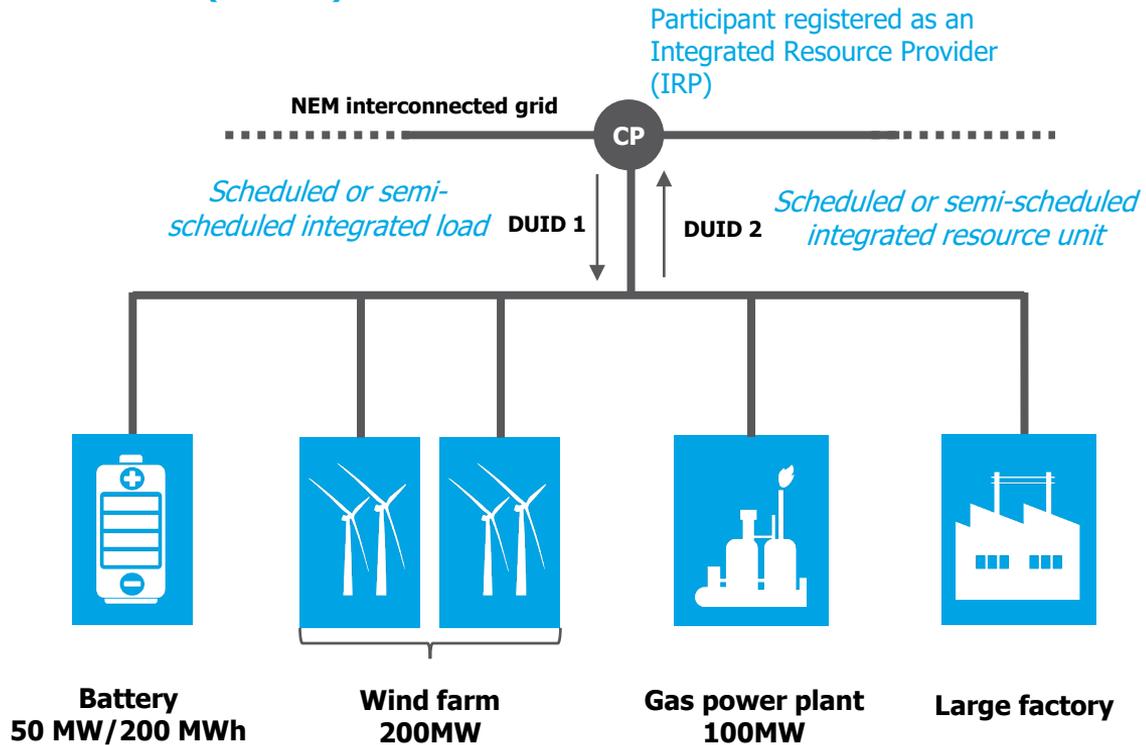
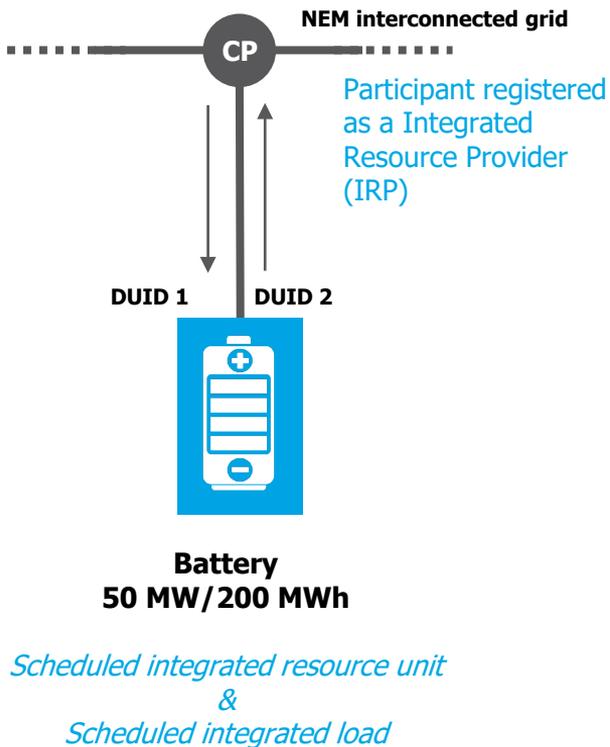
## Option 3 – modify existing categories



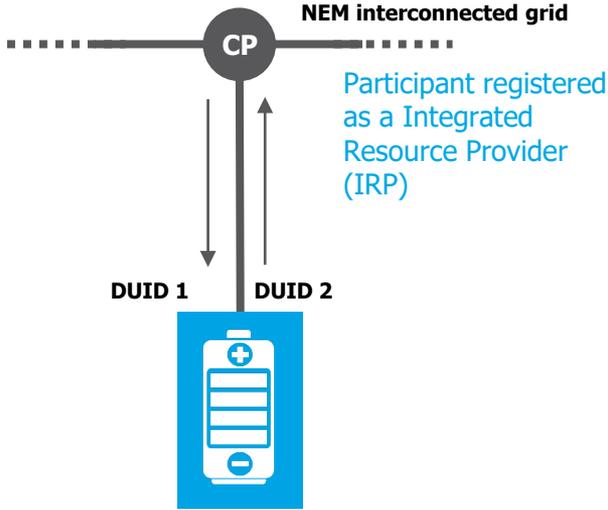
# Option 3 – modify existing categories



# Option 4 – Integrated Resource Provider (at CP)

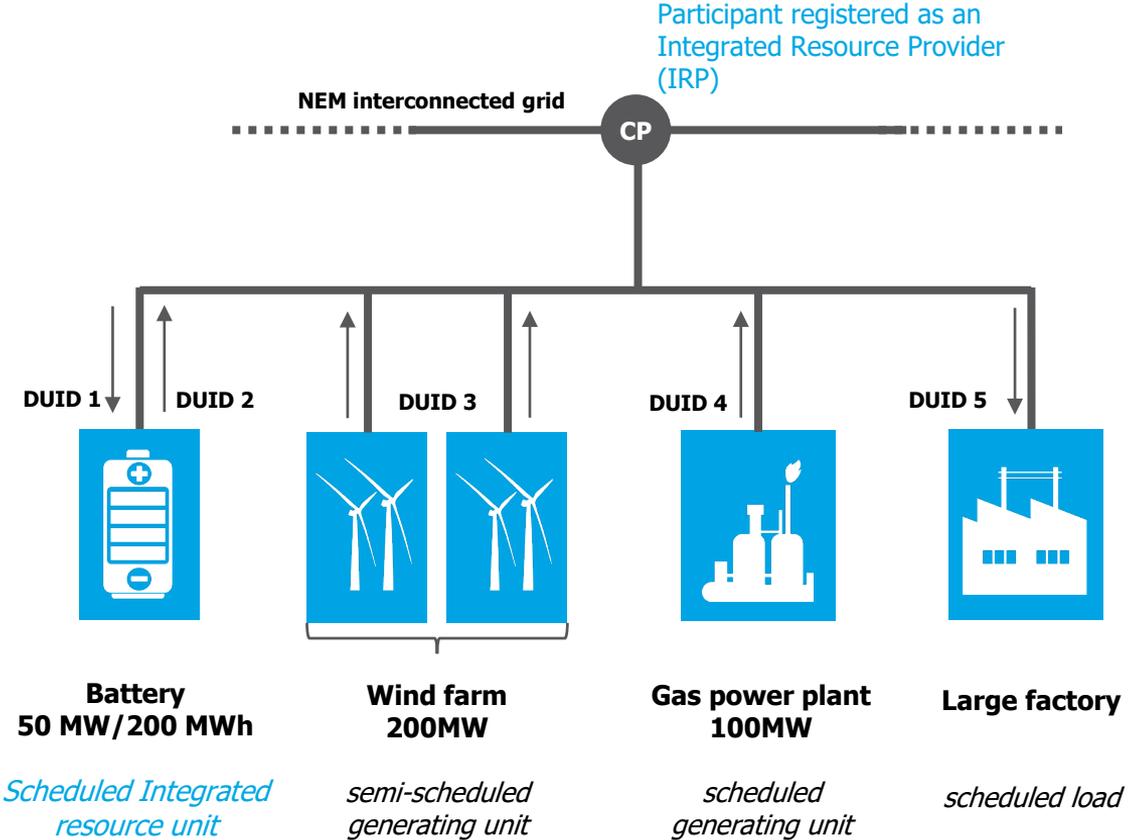


# Option 4 – Integrated Resource Provider (at unit/load)



**Battery**  
50 MW/200 MWh

*Scheduled integrated resource unit  
&  
Scheduled integrated load*



**Battery**  
50 MW/200 MWh

*Scheduled Integrated resource unit*

**Wind farm**  
200MW

*semi-scheduled generating unit*

**Gas power plant**  
100MW

*scheduled generating unit*

**Large factory**

*scheduled load*

# Questions asked in the paper

## Registration and classification

**Question 1:** Is introducing a new participant category, an Integrated Resource Provider (option 4), better to facilitate entry and participation of storage and hybrid facility, more preferable than modifying existing participant categories (option 3)? Are either option 3 or 4 more preferable to options 1 and 2?

**Question 2:** Do you agree that, if the Integrated Resource Provider category (option 4) is established, battery aggregators should use that category and MSGAs should not be allowed to classify storage units exempt from the requirements to register as a Generator? And in that case, should the current arrangements regarding the provision of market ancillary services by MSGAs be maintained?

**Question 3:** Should existing storage participants be transitioned to a single participant category (as they are currently registered as both a Market Generator and Market Customer)?

# Key questions asked

## Scheduling and dispatch

**Question 4: (paraphrased)** What criteria should be met for a hybrid facility to be scheduled, rather than semi-scheduled? Should it be one or the other, or should a dynamic approach be considered? Should the same approach be used for scheduling load?

**Question 5:** Do you agree that 20 price bands would be appropriate for grid-scale batteries or would another number of bands be more appropriate?

**Question 6:** Are there certain configurations of hybrid facilities that cannot or should not be dispatched at the connection point? What benefits are achieved from dispatching at the connection point and what issues arise?

## Key questions asked

### Performance standards

**Question 7:** What issues may arise if performance and access standards are set at the connection point for hybrid facilities? Would these standards need to be amended to provide appropriate flexibility for hybrid facilities?

# RECOVERY OF NON-ENERGY COSTS



## Summary of the recovery of non-energy costs issue

---

- AEMO proposed changes sought to create a level playing field for large and small storage participants.
- AEMO also noted that it may be appropriate to consider the recovery of non-energy costs from all participants, not just those with storage.
- The AEMC is considering an alternative option that seeks to recovery non-energy costs from all participants based on their separately measured consumed and sent out energy at the connection point, irrespective of their registration category and would not allow participants to net across connection points.

# Option spectrum considered in the options paper

Features	Option 1: No change/current arrangements	Option 2: Apply causer pays approach to small and large batteries (AEMO's proposal)	Option 3: Apply causer pays approach to all participants
<b>Summary</b>	<p>Non-energy costs are recovered based on the participant category you are registered in, and from:</p> <ul style="list-style-type: none"> <li>• grid-scale batteries based on separately measured consumed and sent out energy</li> <li>• other participants based on net metered energy data.</li> </ul>	<p>AEMO's proposed solution which seeks to amend the current arrangements to recover non-energy costs in the same way from grid-scale batteries, hybrid facilities and MSGAs (where consumed and sent out energy is measured separately).</p>	<p>Same as option 2 but applied to all market participants. Recovery of nonenergy costs to be based on a participant's consumed and sent out energy in an interval, irrespective of what participant category they are registered in. Consumed and sent out energy would be measured separately for all market participants</p>
<b>Consistent with causer-pays principle?</b>	Mixed.	Mixed.	Yes.
<b>How does it align with two-sided market work?</b>	Least aligned. Grid-scale storage are treated differently.	Not aligned. All storage treated differently. Not a technology-neutral approach.	Most aligned. Technology neutral approach.
<b>What is the impact on market participants?</b>	No change, so no impact on participants.	MSGAs and pumped hydro (as auxiliary load would be included in the recovery of non-energy costs.	Likely to impact all participants in some way, although the amount of costs recovered will not increase.

# Option 1: Current non-energy costs recovery framework

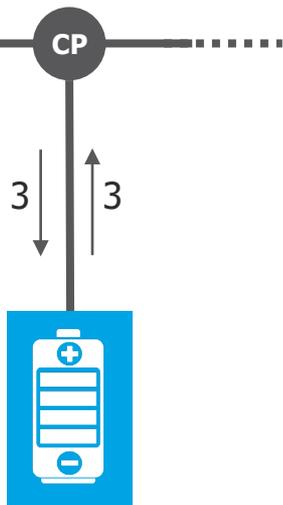
Consumption = 3  
Generation = 3

Consumption = 1  
Generation = 4  
Net generation = 3

Consumption = 6  
Generation = 6  
Net consumption = 0

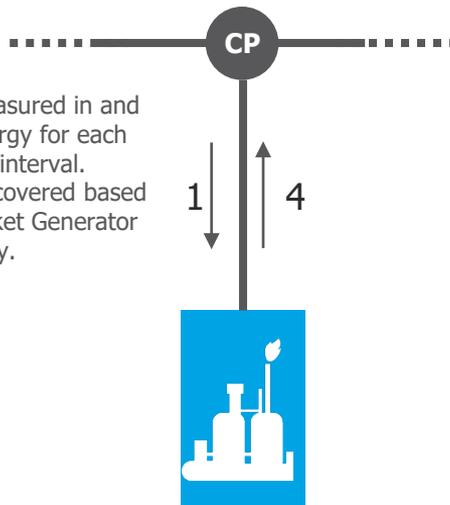
## NEM interconnected grid

Separately measured in and out energy for each trading interval. Cost recovered based on both participant categories

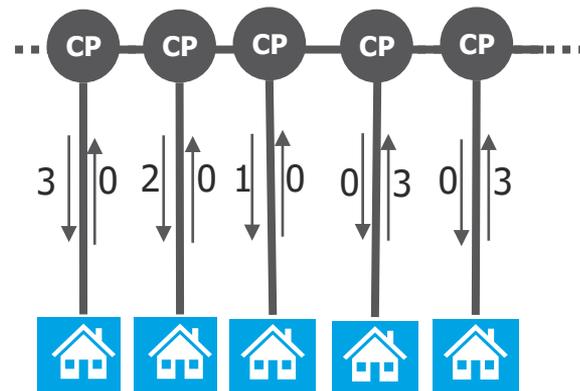


**Market Customer and Market Generator (Battery)**

Net measured in and out energy for each trading interval. Cost recovered based on Market Generator category.



**Market Generator (and MSGAs)**



### Market Customer

Net measured in and out energy for each trading interval. Able to net among connection points. Cost recovered based on Market Customer category (even though at times can be a net generator).

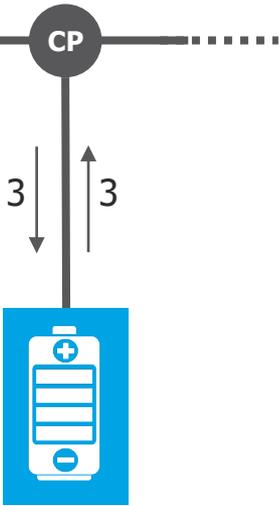
# Option 3: non-energy costs recovery framework where all participants are treated the same

Consumption = 3  
Generation = 3

Consumption = 1  
Generation = 4

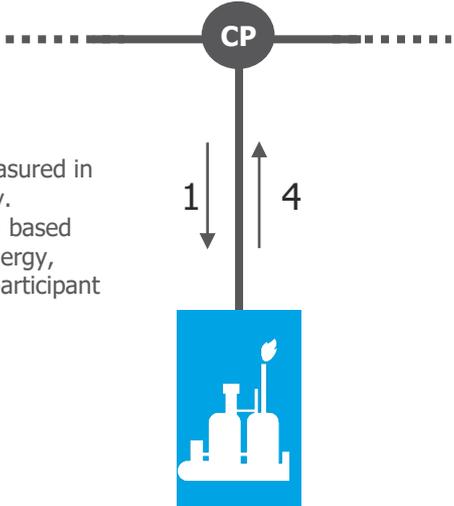
Consumption = 6  
Generation = 6

## NEM interconnected grid



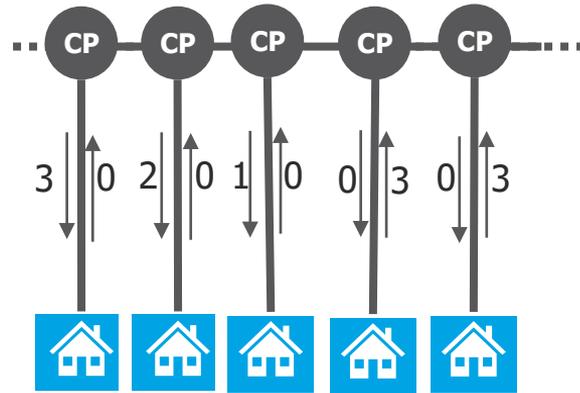
Separately measured in and out energy. Cost recovered based on in or out energy, regardless of participant categories.

**Market Customer and Market Generator (Battery)**



Separately measured in and out energy. Cost recovered based on in or out energy, regardless of participant category.

**Market Generator (and MSGAs)**



### Market Customer

Separately measured in and out energy. Cost recovered based on in or out energy, regardless of participant category.

# Key questions asked

## Scheduling and dispatch

### **Question 8: Options for recovery of non-energy costs**

1. Which option do you consider to be the most appropriate for the recovery of non- energy costs from market participants?  
Please provide detail on why it would be the most appropriate option.
2. Are there any other factors the Commission should consider when deciding how non-energy costs should be recovered from market participants?
3. Are there any implementation issues the Commission should consider?

# NEW ISSUES



# Network service provider connection points

---

## What is the issue?

- AEMO noted:
  - The NER currently do not contemplate a situation for connecting storage systems where the asset owner is also the local NSP as the definition of a connection agreement requires for the applicant and local NSP to be separate parties.
  - By breaking the NER's definition of a connection agreement there is no clear mechanism for NSP-owned storage projects to connect to the NEM.
- This has prompted AEMO to request that a clear pathway be made for NSP-owned energy storage to establish a set of performance standards and system strength requirements for operation in the market.
- This has not been an issue until now because the NSP owned batteries currently operating in the NEM have formally leased a certain proportion of their capacity to a third party to conduct competitive market operations (as per ringfencing arrangements) who then become responsible for filing the connection agreement with the local NSP.

# Network service provider connection points

---

## Possible solution

- Require AEMO to have a role in establishing the relevant standards and requirements, in conjunction with the NSP, where the local NSP is also the connection applicant.
- Functionally, this could be achieved by amending the obligations of NSPs and AEMO to account for circumstances where technical standards are required for assets which are owned by and connected to the same NSP.
- This would require having AEMO to take on the following additional responsibilities in the connection process:
  - Negotiate technical standards for NSP-owned storage
  - Approve automatic and minimum access standards for relevant new connections
  - Approve the system strength impact assessment.
- This would incur additional costs onto AEMO's operations, where it would likely be appropriate to recover these costs directly from the relevant NSPs, as NSPs currently do from conventional connection applicants.

# Network service provider connection points

---

## Questions we are seeking feedback on

1. Do stakeholders support the proposed solution for resolving the potential issues with establishing standards for NSP owned energy storage?
2. Do stakeholders consider there to be other potential solutions for resolving this issue?

## DC coupled systems

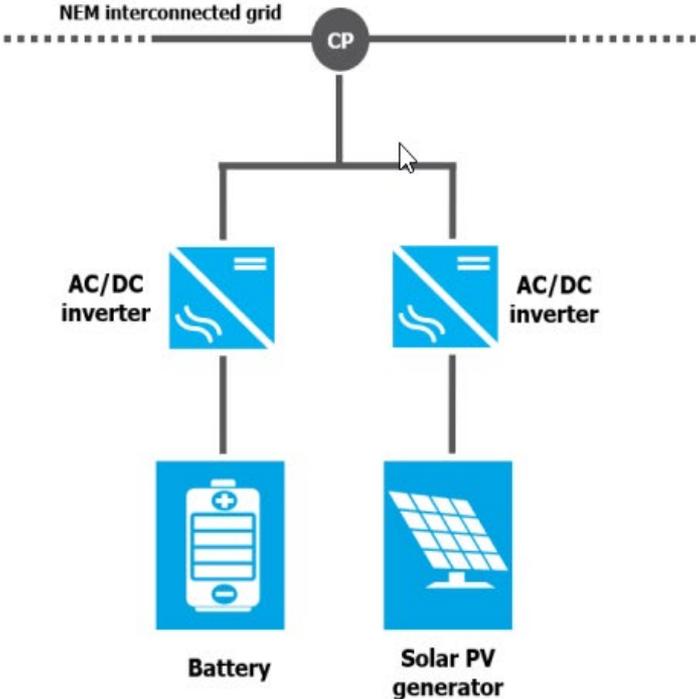
---

### What is the issue?

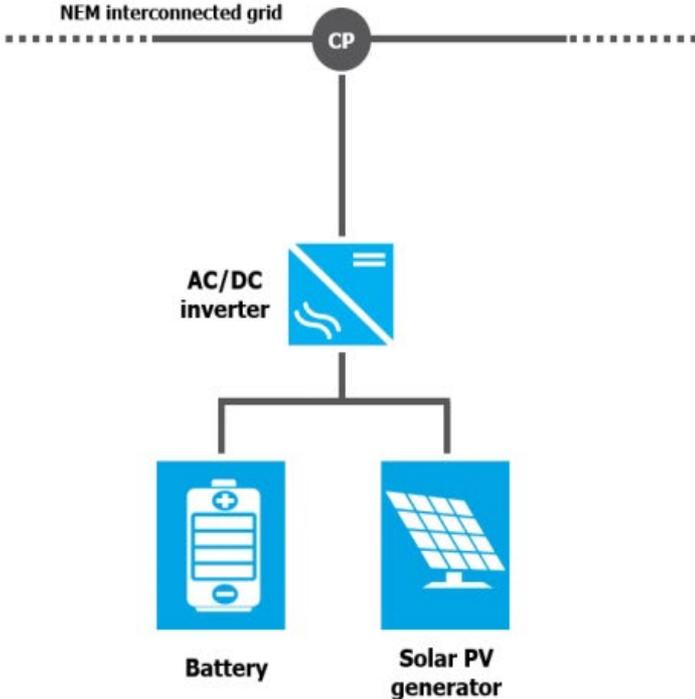
- AEMO has received enquires from proponents seeking to connect facilities where generating units and energy storage share a single inverter – known as DC coupled systems.
- The NER currently provide no guidance for how these systems should register and participate in the NEM and AEMO has requested the Commission to consider this issue as part of this rule change request as it relates to the integration of hybrids.
- The issues for integrating these systems in the NER are particularly challenging where they are grid-scale as they typically seek to combine different assets with two different sets of obligations behind the inverter: scheduled generating units (storage asset) and semi-scheduled generating units (variable renewable energy).

# DC coupled systems

## AC coupled



## DC coupled



# DC coupled systems

## Possible solutions

The Commission has proposed two different ways of resolving this issue:

### 1. Assigning a single set of system obligations

- Assigning the generation components of DC coupled systems scheduled or semi-scheduled central dispatch obligations.
- Assigning these obligations at the connection point would allow them to participate together cohesively.
- AEMO is of the view that these systems should operate as scheduled participants.
- It might be appropriate under certain circumstances for these systems to operate as semi-scheduled participants.
- One submission to the consultation paper (Kinelli) considered it inappropriate to classify the generation component of these systems as scheduled where storage affects a minor portion of output and cannot charge directly from the grid.

### 2. Establishing dynamic trigger-based obligations

- It might be inefficient to assign DC-coupled systems a single set of obligations at all times.
- An efficient outcome could be for obligations to switch between scheduled and semi-scheduled when the facility triggers some dynamic operational threshold.
- Examples of these triggers might be when a storage unit's state of charge (SoC) reaches a certain threshold or having different obligations for different hours of the day.
- This would permit the obligations to reflect the operational constraints of the system at any point in time.

# DC coupled systems

## Possible solution

Each solution has its own advantages and disadvantages:

### 1. Assigning a single set of system obligations

- Major advantage is that it would permit the registration and participation of DC coupled systems and allow their generation components to be aggregated together to operate in the NEM within AEMO's existing systems.
- It might be inefficient to assign different generation technologies a single set of operational obligations at all times.

### 2. Establishing dynamic trigger-based obligations

- Advantages and disadvantages concern a trade-off between optimizing system participation and administrative complexity.
- Dynamic obligations would allow DC coupled systems to dynamically optimize their output in real time according to their operational constraints.
- The costs of implementing a new system to achieve this would be very large and would likely require massive process and system changes for a type of hybrid configuration that doesn't currently make up a significant proportion of capacity in the NEM.

## DC coupled systems

---

### Questions we are seeking feedback on

1. What capital, operational or efficiency benefits do DC-coupled systems provide participants and the NEM, and how might these benefits help consumers in line with the NEO?
2. Do you support amending the NER to permit the registration and operation of DC coupled systems? If so, how should they register and operate?

## Chapter 2 ancillary service provisions

---

### **What is the issue?**

- In its rule change request, AEMO proposed a drafting approach for ancillary service provisions in Chapter 2 of the NER that would set requirements based on assets.
- In its submission to the Consultation Paper, AEMO provided a simplified drafting approach for ancillary service provisions and considered this would be more consistent with direction of future market reforms such as the “trader-services” model being explored by the ESB’s two-sided market work.

## Chapter 2 ancillary service provisions

### Possible solution

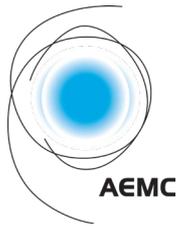
- In its rule change request AEMO proposed introducing an 'ancillary services bi-directional unit' to assign ancillary service provisions as a part of its Bi-Directional Resource Provider (BDRP) registered participant category
- Instead, AEMO proposes to consolidate various clauses in the NER which relate to ancillary service provisions to simplify this process relative to the current arrangements
- Whilst the options paper sets out the specific advice AEMO provided the Commission to achieve this, this solution essentially involves defining an umbrella term for ancillary service facilities in which all relevant market participants would be able to participate from
- AEMO notes this approach would be more consistent with a two-sided market where NER frameworks are more adaptable to change and better able to facilitate innovation.

## Chapter 2 ancillary service provisions

---

### Questions we are seeking feedback on

1. Do you support AEMO's proposal to redraft the ancillary service provisions in Chapter 2 of the NER to make them more consistent with the services approach to regulation currently being considered by the ESB's two-sided market work?



**Office address**

Level 15, 60 Castlereagh Street  
Sydney NSW 2000

ABN: 49 236 270 144

**Postal address**

GPO Box 2603  
Sydney NSW 2001

**T** (02) 8296 7800