Schedule 5.3 Large Loads

03 December 2024

Access Standards Review Kick-off

We acknowledge the Traditional Custodians of the land, seas and waters across Australia. We honor the wisdom of Aboriginal and Torres Strait Islander Elders past and present and embrace future generations.

We acknowledge that, wherever we work, we do so on Aboriginal and Torres Strait Islander lands. We pay respect to the world's oldest continuing culture and First Nations peoples' deep and continuing connection to Country, and hope that our work can benefit both people and Country.

'Journey of unity: AEMO's Reconciliation Path' by Lani Balzan

AEMO Group is proud to have launched its first Reconciliation Action Plan in May 2024. 'Journey of unity: AEMO's Reconciliation Path' was created by Wiradjuri artist Lani Balzan to visually narrate our ongoing journey towards reconciliation – a collaborative endeavour that honours First Nations cultures, fosters mutual understanding, and paves the way for a brighter, more inclusive future.

Read our RAP

The Competition and Consumer Act 2010

- The Act prohibits anti-competitive and restrictive trade practices.
- Specific prohibitions include:
    - Sharing of information in relation to prices and the mechanisms for setting of prices;
    - Agreements not to deal with a particular business or class of business;
    - Collective negotiations that have an anti-competitive effect;
    - Attempts to influence competitors or supplier or customer behaviour in an anti-competitive behaviour;
- Anti-competitive agreements do not need to be in writing. An understanding or arrangement to take or refrain from taking a course of action may be prohibited.
- All participants and representatives must take care not to do anything which may result in a breach of the Act. A breach may lead to financial or criminal penalties for individuals, or the organisation they represent.
- The above explanation of the Act is not intended to be exhaustive, and legal advice should be sought if uncertain about the obligations imposed by the Act.

Agenda

1. Introduction and workshop objectives
2. Context of this review
3. Previous review
4. Disturbance ride-through requirements
5. Additional issues for consideration
6. Next steps

1. Introduction and workshop objectives

Introduction and workshop objectives

- There is a high likelihood of significant new large loads in the NEM in the next 10 years.
- Currently, NER Schedule 5.3 has limited technical requirements for large load connections, particularly ride-through requirements.
- AEMO is actively investigating what technical requirements will be necessary in the near term to facilitate the anticipated growth and effects to the National Electricity Market (NEM).

Workshop objectives

- Introduce the review of Schedule 5.3 - Large Loads
- Review the 2023 Cl. 5.2.6A
- Outline the proposed approach
- Seek stakeholder feedback

2. Context of this review

1. New large load connections are increasing
2. International standard developments
3. NSPs currently managing system security impacts
4. Current NER requirements and the aim of the review

New large load connections are increasing

- These large loads have a potential to significantly impact the power system commensurate with their size.
- The power system is generally more resilient to load tripping than to generators tripping.
- At present, NSPs are responsible for managing the impact of loads on their network, regardless of load size.

Hydrogen Production

Data Centres

Other Large Loads

International standard developments

AEMO is aware of the development of some relevant international standards for large loads, which it will consider during this review:

- The Electric Reliability Council of Texas (ERCOT) (August 2023) standard for Registration, Interconnection, and Operation of Customers with Large Loads. This includes voltage ride through capabilities, based on both RMS and instantaneous voltages.

- EU has proposed new technical requirements for vehicle chargers, new heat pumps and power to gas demand units including limited frequency sensitive mode (underfrequency) requirements, frequency ride through, RoCoF, fault ride through (voltage profile).

Current NER ride-through requirements

Current NER ride through requirements for large loads:

- NER S5.3 does not include ride-through requirement for large loads.
- The only relevant requirement in S5.3.9 is for the associated substation to be capable of continuous uninterrupted operation with the levels of voltage, harmonics, unbalance and voltage fluctuation specified in the system standards.

The review needs to consider:

- The level of technical requirements with the aim of maximizing the net benefits, focusing on the dynamic performance during system disturbances.

3. Previous Review recommendations

Improving the NEM Access Standards - Rule Change Request

1. Initial recommendations being considered by the AEMO
   - AEMC standard rule change request – package 2 link
2. Initial policies that required further consideration in this review
3. Single facility loads

Initial recommendations

- Require the disturbance ride-through capability of new loads to be established and recorded, at the discretion of the NSP in consultation with AEMO.
- Amend NER S5.3.11 to make the minimum SCR requirements more flexible.
- Require protection settings with performance capability, considering reasonable safety margins.
- Permit fast ramp down of active power as part of an emergency frequency control scheme where AEMO and the NSP agree.
- Require monitoring on IBL projects for control stability.

Initial policies that require further consideration

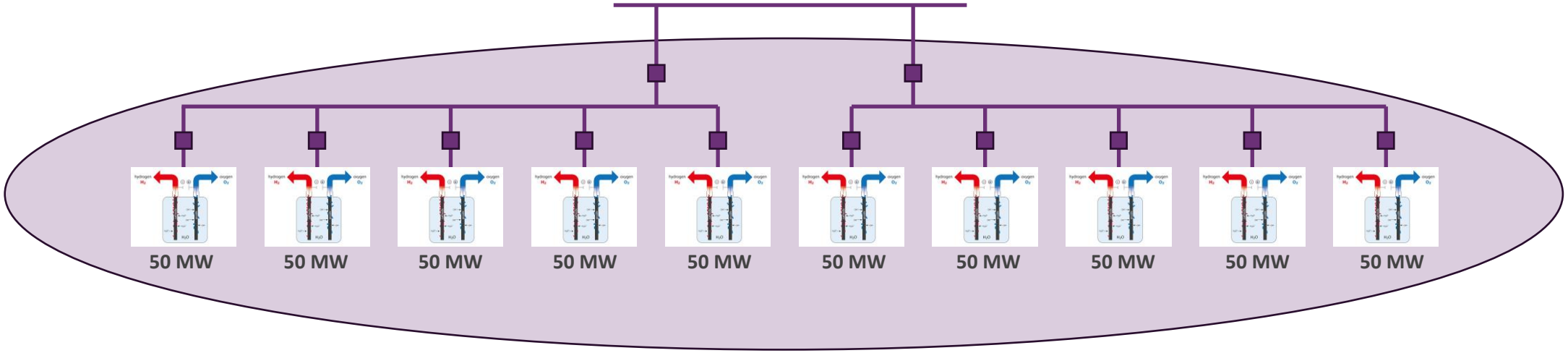
- Apply the access standards to **single load facilities above a threshold size level**.
- Use the access standards, **irrespective of the technology.**
- Use a **lighter handed definition** of continuous uninterrupted operation for the access standards for large loads.
- **Apply a size threshold for existing plant alterations** based on the size of the alteration rather than the size of the whole facility, unless AEMO and the NSP consider that power system security would be impacted by the performance of the whole plant.

Single facility load

A single facility load:

- forms part of a single installation (as distinct from, say, the connection between a transmission and distribution network)
- may have one or more physical connection points, which are in electrical proximity to each other, and the plant within the facility can be described as one geographical location i.e. most power system disturbances affect the facility as a whole
- may have different types of load technologies.

For the purposes of the technical requirements of Schedule 5.3, a single facility load is 5 MW or greater.



4. Disturbance ride-through requirements – open issues

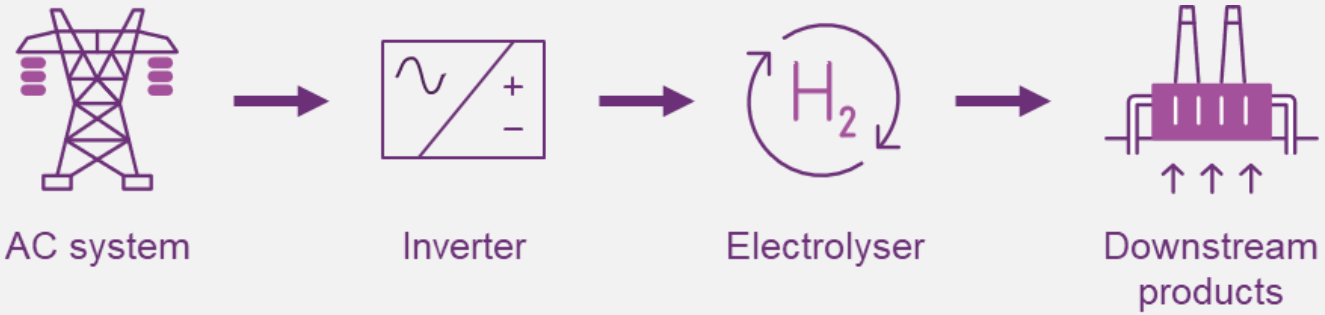
1. Treatment of different technologies
2. Size threshold for applying ride through requirements
3. Definition of light-handed CUO
4. Options for setting ride through requirements
5. Possible approach for MAS and AAS
6. Size threshold for existing plant alterations

1. Recommended approach to different load technologies

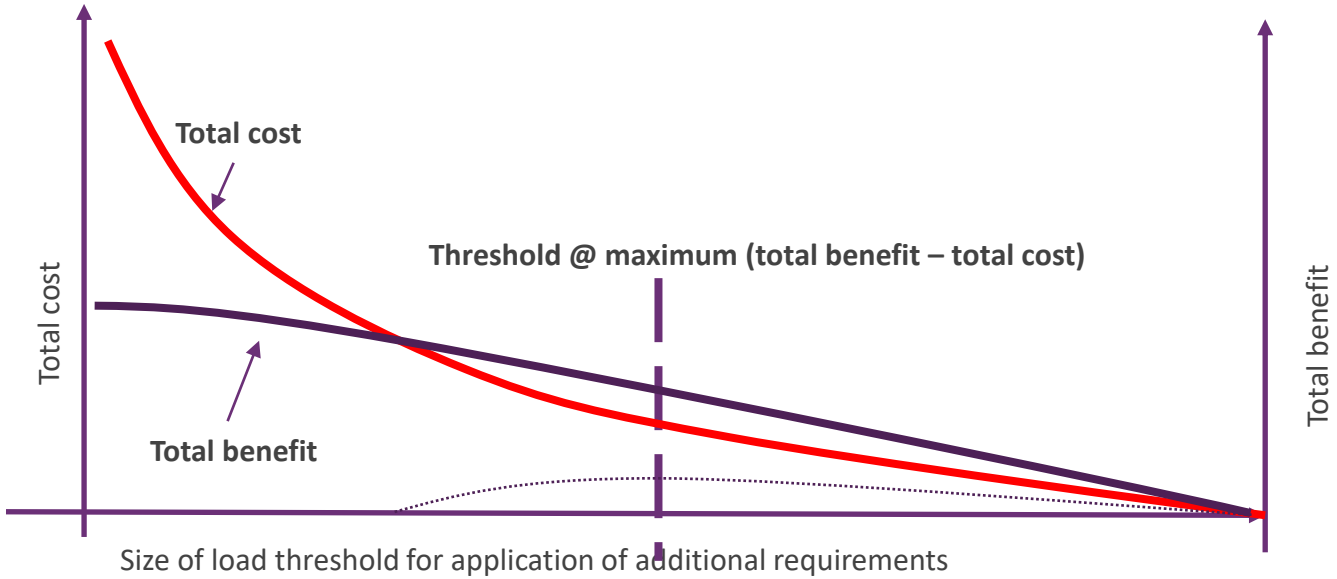
AEMO's initial recommendations:

- Use common ride through access standards for all load types,
- Use the same size thresholds for defining a large single facility load, and
- Including UPS loads (such as data centers).

An example of why the performance of an Inverter Based Load (IBL) depends on more than just the inverter:



2. Size for threshold (conceptual)



- Shape of curves depends on distribution of load sizes.
- Benefits depend on the extent that captured loads affect network constraints, FCAS requirements etc.
- Costs and benefits depend on how arduous the requirement are.
- Could potentially have different thresholds for different circumstances, technologies etc.

Selecting optimal threshold size:

- Huge costs with a low threshold
- With a very high threshold (do nothing):
  - no loads are considered
  - no benefits occur
  - no costs are incurred
- As threshold reduces:
  - more loads are considered
  - diminishing incremental benefits accrue
  - increasing costs
  - NSP solutions likely to be efficient
- Theoretically optimal threshold when:
  - marginal benefits from last loads captured equals additional costs associated with these loads

Possible options - basis for size threshold(s)

Current considerations:

Should the size threshold for ride though capability be based on a portion of the largest contingency size?

- If yes, what is it based on?
- If yes, what proportion of the largest contingency size?
- If no, what threshold should apply?

Example:

A threshold of 10% of maximum credible contingency size on the mainland or in Tasmania.

- The use of 10% of the maximum contingency size implies that the cumulative impact of up to 10 loads is more efficiently mitigated by the loads, rather than a centralized NSP solution.
- The 750 MW maximum credible contingency size is a proxy for the robustness of the power system.

This would give thresholds of:

- 75 MW in the mainland considering 750 MW (based on Kogan Creek)
- 14.4 MW in Tasmania (based on the frequency operating standards).

4. Options for setting ride through requirements

1. Do nothing – except recording the ride through capability.	
2. Target setting of protection and control systems to minimise impact of load tripping during disturbances.	• No capital costs • Uses only inherent capability
3. Target continuous operation for normal voltage and frequency ranges.	• 0.9 to 1.1 pu voltage • 49.75 to 50.25 Hz (note a wider frequency range is likely to be easily achieved by most loads)
4. Target ride through of specified voltage and frequency ranges and durations.	• Explicit voltage and frequency levels and durations (may not cover all credible contingencies)
5. Target normal operational conditions.	• + single credible contingency events and associated frequency ranges
6. Target same requirements as for generation.	

5. Possible approach for Minimum Access Standards

The Minimum Access Standards (MAS) for large loads are important.

- Too arduous a MAS for large load ride through could block some projects connecting on technical or economic grounds.

Therefore:

- An appropriate MAS is likely to be based on options 1 – 4 above.
- May vary for different aspects of the ride-through.

5. Possible approach for Automatic Access Standards

An onerous automatic access standard (AAS) requires extensive negotiation:

- The proponent of a large load needs to either meet the AAS or provide a justification for a less arduous level of performance.
- This would potentially require an extensive negotiation process to determine the Customer Performance Standards (CPS).

Therefore, either:

- The AAS should not be too onerous so most loads can achieve it. This would reduce the negotiation required but may not capture all available performance.
- Changing the negotiation process for large loads to start at the native performance characteristic of the facility to reduce the negotiation required.

Discussion 1

1. Any general comments on the approach for requiring ride-through capability for large loads?
2. Do you think the approach is appropriate for:
   - large data centres operating together?
   - large hydrogen facilities operating in a hub?
3. What approach should we consider for setting performance levels for:
   - Frequency disturbance ride-through?
   - Voltage disturbance ride-through (including faults)?

5. Additional issues for consideration

1. Reactive power support from large loads
2. Frequency support from large loads
3. Co-location of generation and large loads

1. Reactive power support from large loads

- AEMO understands that inverter-based large load technologies may have some capability to control their reactive power injection or absorption in a similar manner to inverter based generating systems and bi-directional units.

- Therefore, AEMO intends to explore whether the access standards for large loads could also include a similar capability to that for generating systems and bi-directional units (not in the MAS).

2. Frequency support from large loads

AEMO intends to explore whether the access standards for large loads could also include a capability for frequency control, noting that many loads would not have this capability.

- The MAS could either be no capability, as many loads may not include that capability, or not to exacerbate a frequency disturbance.

- The AAS could be similar to S5.2.5.11, where the load facility has the capability.

3. Co-location of generation and load

Some large load facilities will be developed in conjunction with large generation facilities and would minimize additional transmission network costs and transmission losses.

A system protection scheme (SPS):

- could act to disconnect, or reduce the output of, the associated generation when there is a sudden reduction of load following a disturbance.
- may be more cost effective than imposing ride through requirements.

Discussion 2

1. Could an SPS be used to manage the system security impact of a large load facility suddenly disconnecting?
2. Should SPS be limited to where the large load and associated generation facilities are located behind the same connection point?
3. Do you see value in increasing the scope of the review to include large loads being able to support the system, including:
   - voltage or reactive support and capability?
   - reactive current injection/absorption during ride-through events?
   - active power response to frequency?
4. Are there any changes needed to the system strength clause?

7. Next steps

Next Steps

Your contribution	Industry & AEMO collaboration	Milestone 1: Approach paper for consultation
You are invited to become part of the process. Your contributions to this work are highly valued.	In 2025, we will begin holding additional workshops and 1:1 conversations as we dive deeper into the key issues discussed today.	From these discussions, AEMO will be releasing an approach paper for greater industry consultation in Q1 2025.

For more information visit

aemo.com.au