

# FAULT RIDE-THROUGH REQUIREMENTS OF UTILITY-SCALE DATA CENTRES

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## 1. OVERVIEW

This joint initiative between **AusNet Services** and **Monash University** investigates the integration considerations of utility-scale data centres into the Victorian power grid. The following topics are the focus of this university-industry partnership:

- **Grid Code Compliance Studies:** Evaluation of connection requirements such as Fault Ride Through (FRT) capabilities during system disturbances.
- **System-Level Stability Analysis:** Assessment of the interaction between data centre loads and broader grid security.
- **Mitigation Strategies:** Identification of technical solutions, such as energy storage integration and dynamic reactive power support, to ensure robust grid operation under a high data centre penetration.

## 2. PROJECT MILESTONES

Project duration: 6 months.

**PHASE 1**  
Review of Data Centre Models and Components

1

**PHASE 2**  
Grid-code Review and Compliance Requirements

2

**PHASE 3**  
Preliminary Data Centre Modelling in PSSE/PSCAD

3

**PHASE 4**  
System-level Impact Studies

4

**PHASE 5**  
Evaluation of Mitigation Solutions

5

**PHASE 6**  
Recommendations for Future Work

6

## 3. RIDE-THROUGH OPERATION OF DATA CENTRES

- An analysis from Texas (ERCOT) showed that large power-electronic loads frequently fail to ride through grid faults<sup>1</sup>.
- As more data centres connect to the network in Australia, similar behaviour may be observed.

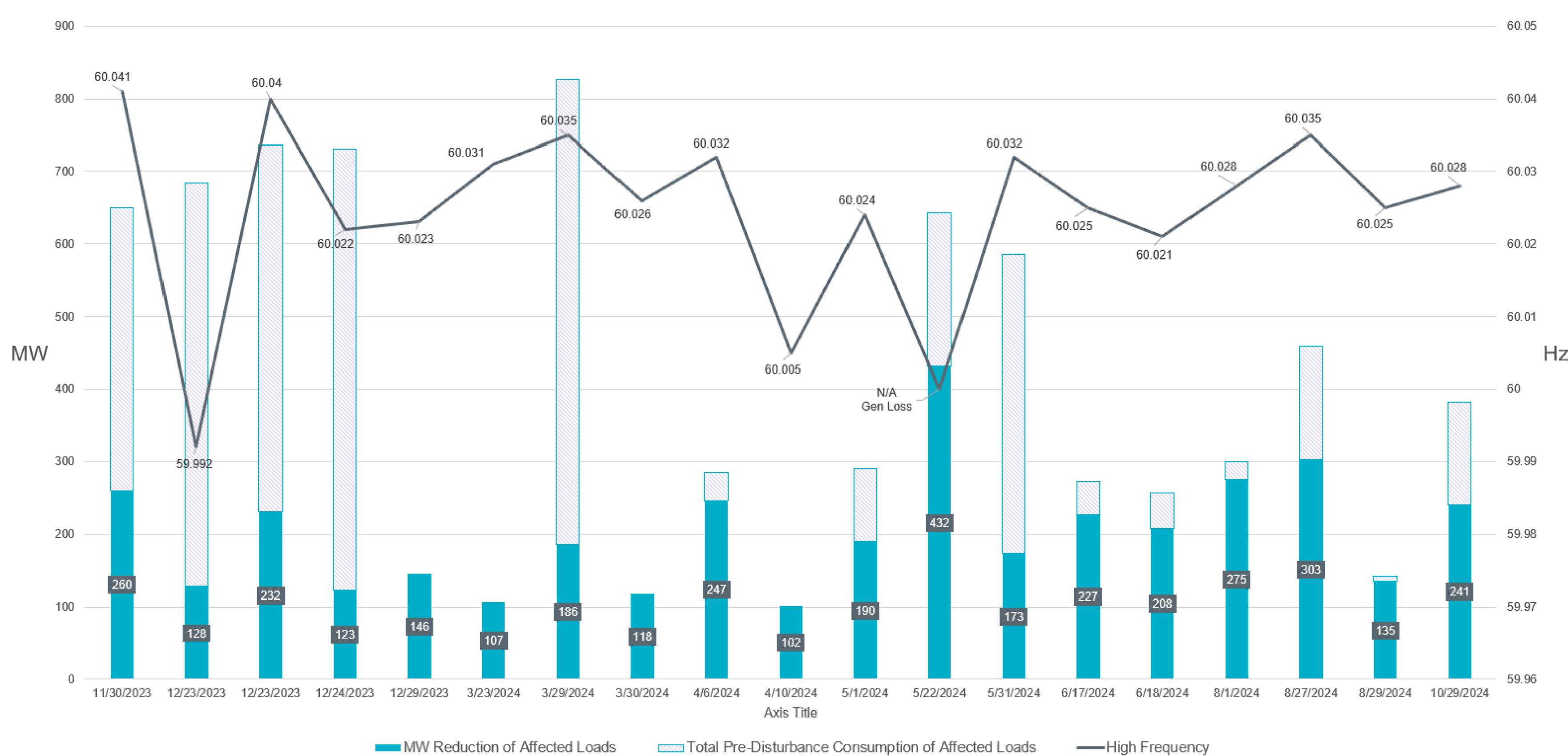


Figure 1: Power Electronics-Based Large Load Ride-Through Events<sup>1</sup>.

## 4. REVIEW OF AUSTRALIAN NATIONAL ELECTRICITY RULES (NER) FOR LARGE LOADS

Existing grid code requirements for transmission-connected loads, including utility-scale data centres, are detailed in the National Electricity Rules (NER), Chapter 5.3<sup>2</sup>.

The current rules include:

### 3.1. MANDATORY LOAD SHEDDING

- Clause S5.3.10: Transmission-connected loads >10MW must shed ≥60% of expected demand in "manageable blocks" between 49Hz–47Hz.

### 3.2. POWER QUALITY

- Clause S5.3.5: Loads consuming ≥30% of connection point capacity must remain within permissible power factor range.

### 3.3. BALANCING OF LOAD CURRENTS

- Clause S5.3.6: Load current must be balanced across phases, with a maximum allowable deviation of 2% from the average.

## 5. AUSTRALIAN RIDE-THROUGH REQUIREMENTS FOR LARGE LOADS

- The NER includes requirements for disturbance ride-through capabilities for **generating units**<sup>3</sup>.
- **No equivalent requirement exists for large loads** including utility-scale data centres.
- This may pose a critical risk as the NEM operates as a weak grid with **declining system strength**.
- **Future rule amendments are expected** to introduce mandatory FRT capabilities for large loads.

## 6. WHAT IS BEING PROPOSED IN DIFFERENT JURISDICTIONS?

In this study, the following system operators are taken into account:

- **FINGRID:** Transmission System Operator (TSO) in Finland
- **Southwest Power Pool (SPP):** Regional Transmission Organization (RTO) in the USA
- **Alberta Electric System Operator (AESO):** Independent System Operator (ISO) in Canada
- **RTE:** Transmission System Operator (TSO) in France
- **TenneT:** Transmission System Operator (TSO) in the Netherlands and Germany

Table 1: Inclusion of voltage ride-through in proposed large load requirements.

	Fingrid	SPP	AESO	RTE	TenneT
Voltage Ride-Through					

## 7. OVERVIEW OF PROPOSED INTERNATIONAL STANDARDS

The **Information Technology Industry Council (ITIC) Curve** describes the AC input **voltage envelope** which typically can be tolerated by most **IT equipment**<sup>4</sup>.

The curve includes:

- **Low voltage "no damage region"**, where equipment operating capacity will be reduced.
- **High voltage "prohibited region"**. Operating in this region leads to damage for IT equipment.

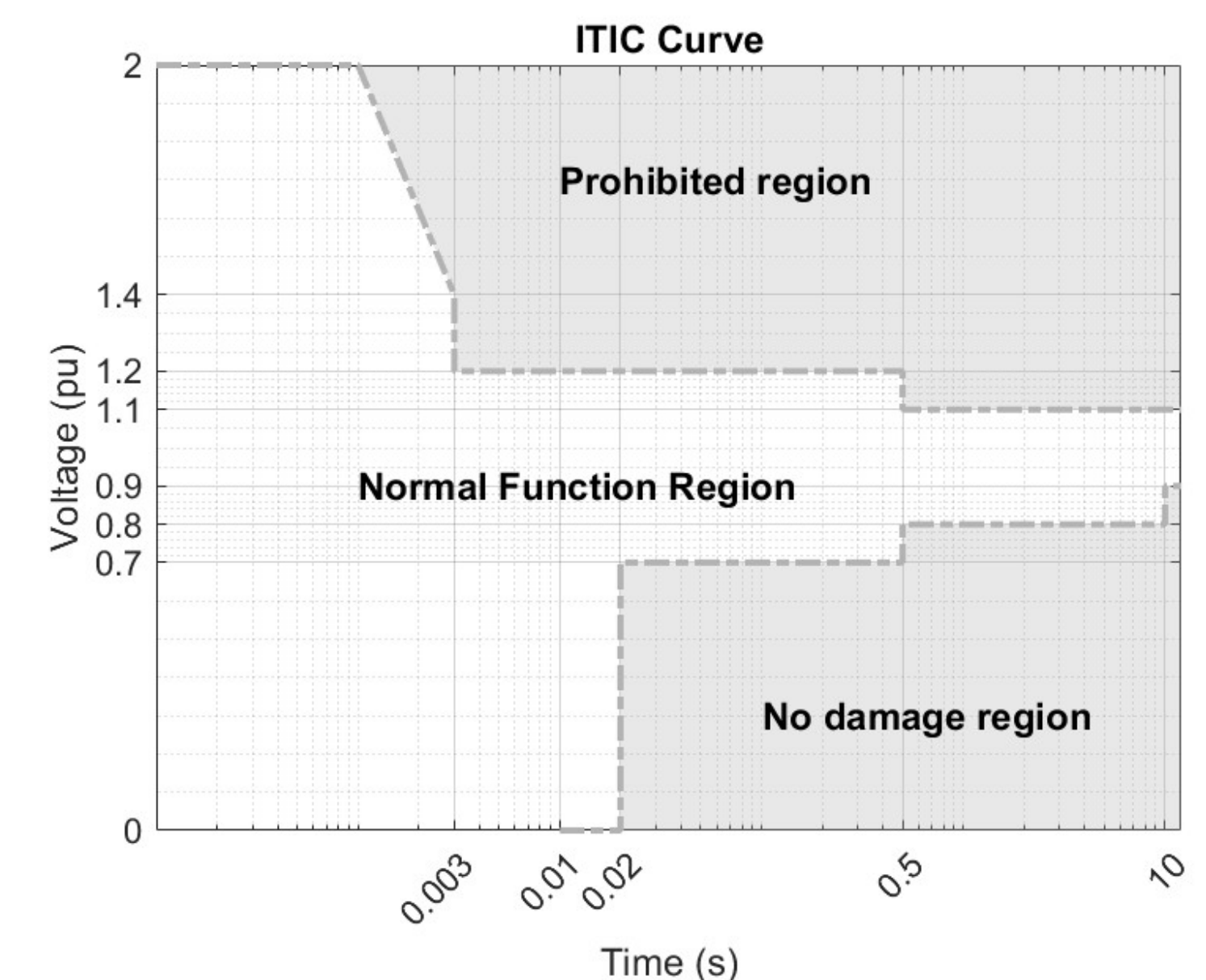


Figure 2: Information Technology Industry Council (ITIC) curve<sup>4</sup>

## 8. THE COMPLIANCE GAP

Proposed grid requirements exceed the voltage sensitivity limits of standard IT equipment, creating a **fundamental discrepancy** between power system requirements and IT infrastructure capability.

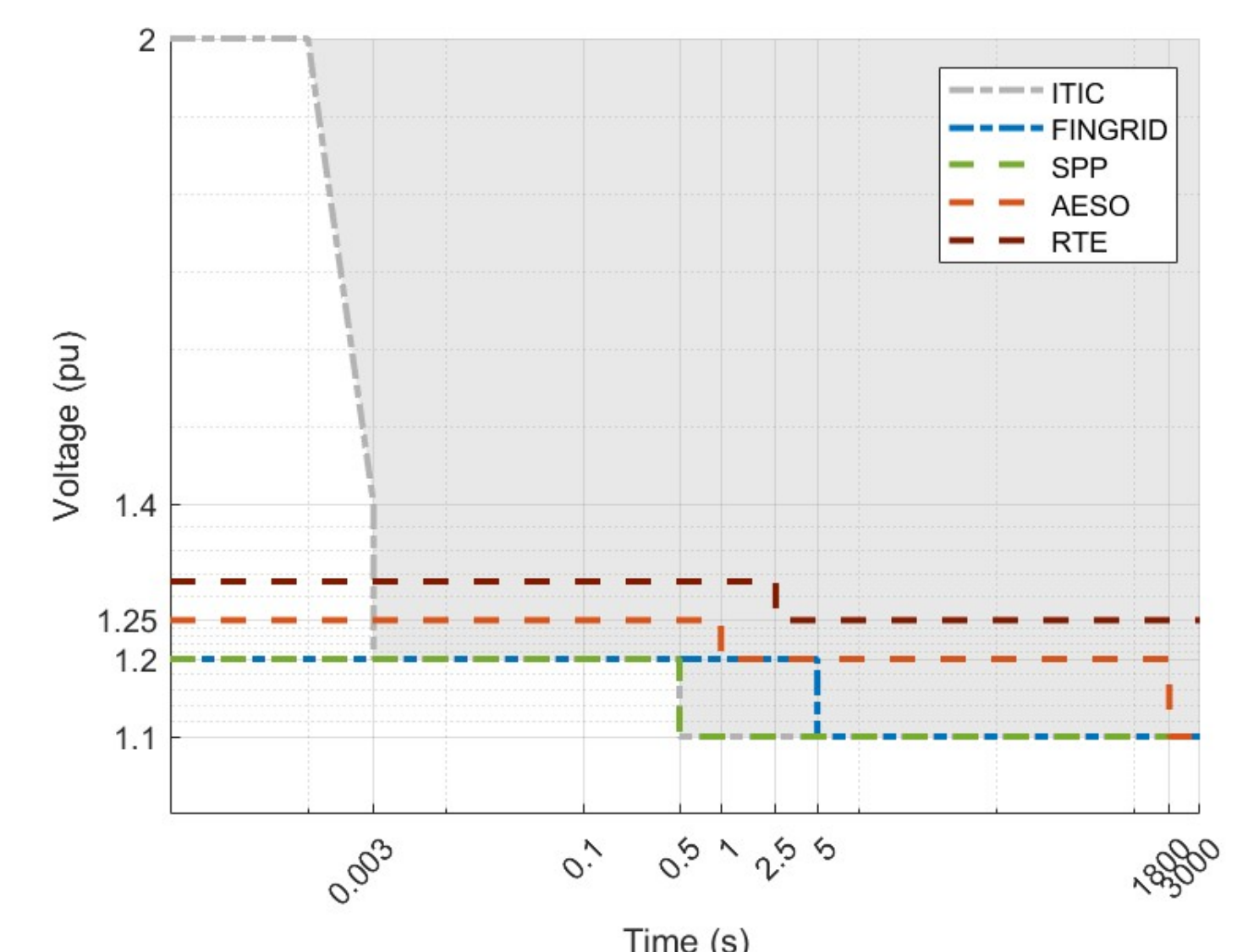


Figure 3: **High voltage ride-through** requirements comparison between different system operators.

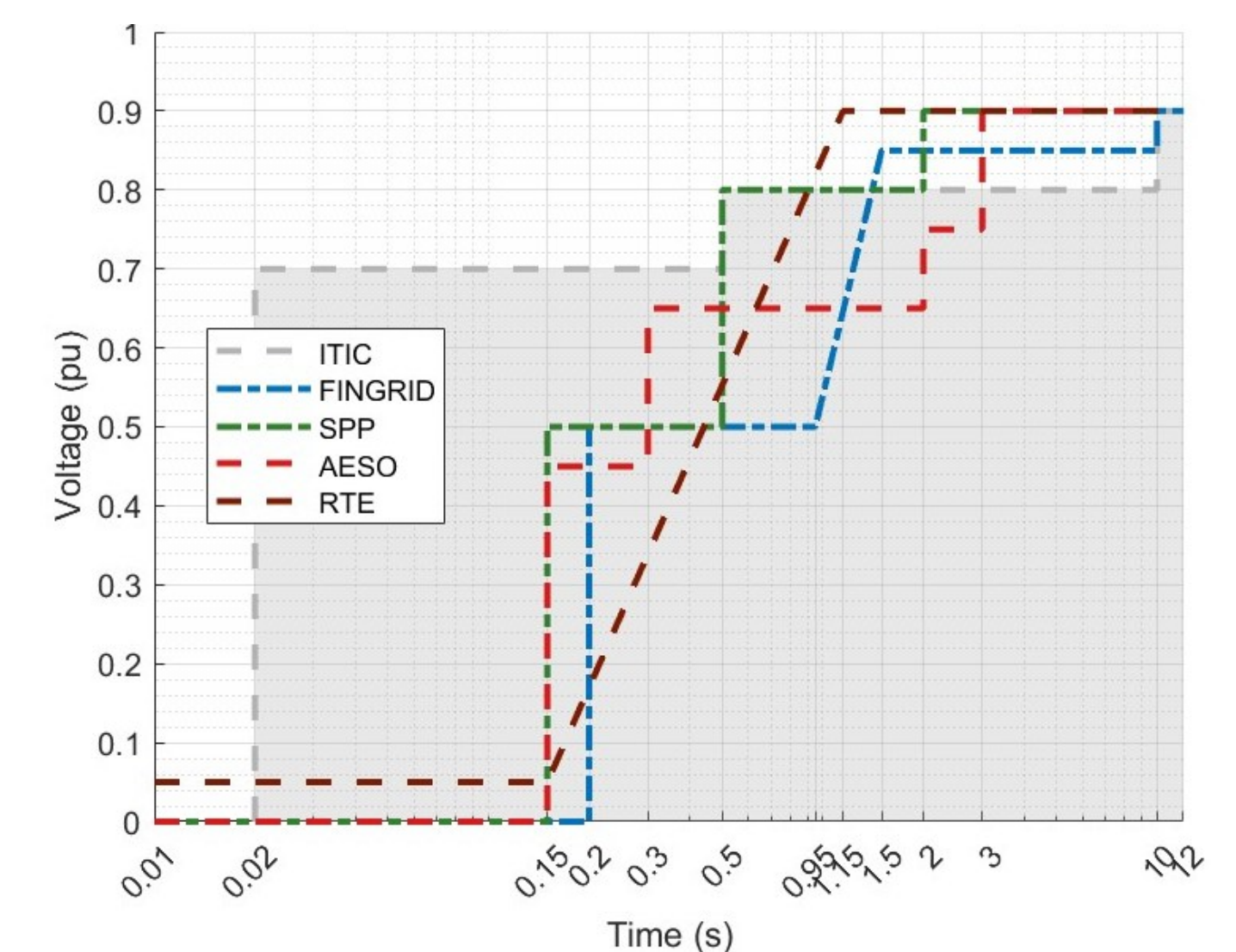


Figure 4: **Low voltage ride-through** requirements comparison between different system operators.

## 9. CONCLUSION

1. Large loads including utility-scale data centres may struggle to ride through system faults.
2. Australia does not have ride-through requirements for large loads, which may be needed as digital infrastructure expands.
3. The discrepancy between technology protection requirements and power system ride-through requirements should be investigated to facilitate updating the grid code requirements.

## REFERENCES

- [1] P. Gravois, "ERCOT Large Load Loss/Reduction Events".
- [2] AEMC, NER Schedule 5.3 (Version 243). Available: [energy-rules.aemc.gov.au/ner/current/Schedule 5.3](https://energy-rules.aemc.gov.au/ner/current/Schedule%205.3)
- [3] AEMC, NER Schedule 5.2 (Version 243). Available: [energy-rules.aemc.gov.au/ner/current/Schedule 5.2](https://energy-rules.aemc.gov.au/ner/current/Schedule%205.2)
- [4] ITIC Curve – Voltage Disturbance. Available: <https://voltage-disturbance.com/voltage-quality/itic-curve/>