SYSTEM OPERATOR ENGINEERING FORUM 2026

Greetings & Welcome

Health and Safety

- Emergency procedures
- Bathrooms and exits

If unsure: ask a Transpower staff member for help

2026 System Operator Engineering Forum Schedule: The CACTIS in Practice

	SESSION	PRESENTER(S)	ORGANISATION
9:00-9:30	Arrival and Coffee/Tea		
9:30-9:40	Mihi Whakatau: Greetings and Introductions	Cris Cucerzan	Transpower
9:40-10:00	Opening Address	Katherine Moore Sheila Matthews	Transpower Electricity Authority
10:00-11:00	Part 8 Code Amendment Changes & Compliance Management	Rob Mitchell, Phillip Beardmore, Otis Boyle	Electricity Authority
11:00-11:15	Morning Tea		
11:15-12:00	Legacy Clause Provisions & How to Apply	Otis Boyle, Phillip Beardmore Varun Nand	Electricity Authority Transpower
12:00-12:30	Connection Study Requirements	Chris Challen	Transpower
12:30-13:00	Testing Requirements	Nadya Putri	Transpower
13:00-13:45	Lunch		
13:45-14:30	Modelling Requirements	Anjana Madurapperuma Snehalkumar Joshi	Transpower
14:30-15:00	Operational Communications and High-speed Data Requirements	Kanishka Fonseka	Transpower
15:00-15:15	Afternoon Tea		
15:15-15:45	Updates to Information and Guidelines	Cris Cucerzan	Transpower
15:45-16:15	General Discussion and Q&A	Everyone	Transpower
16:15-16:30	Closing Address	Katherine Moore	Transpower


Nimble and
considered


Inclusive
and decisive

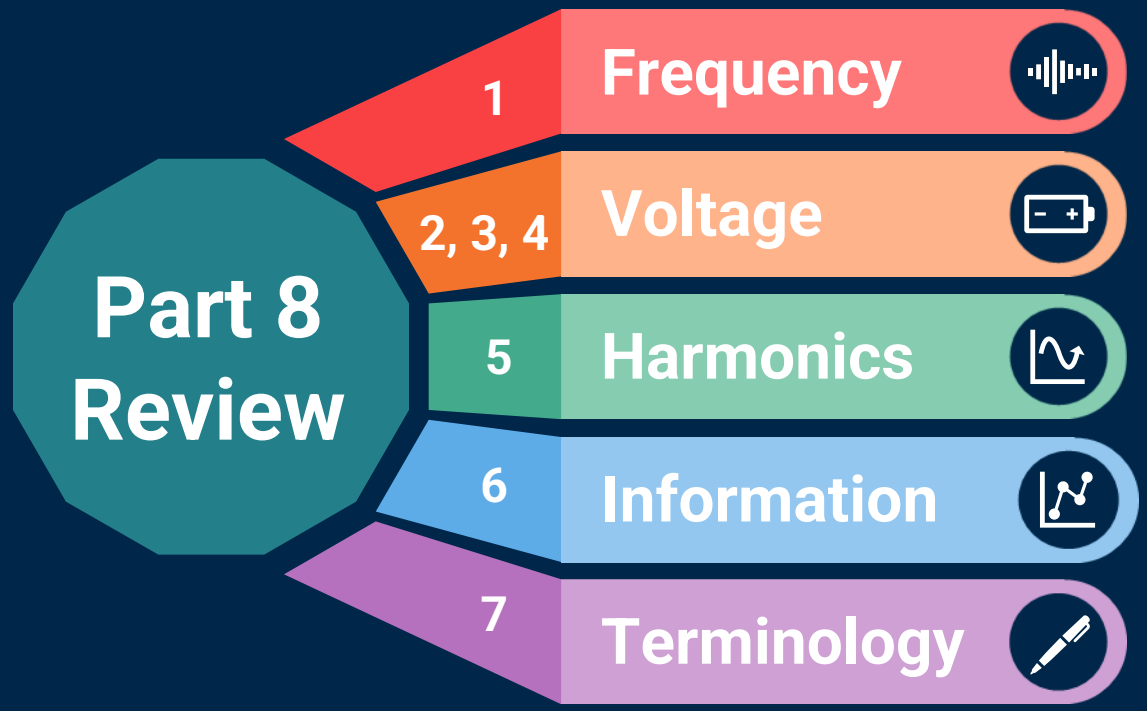

Courageous
and caring

Opening Address

Anna Li Manager, Engineering Assurance | System Operator (Transpower)

Sheila Matthews Manager, Future Security & Resilience (Electricity Authority)

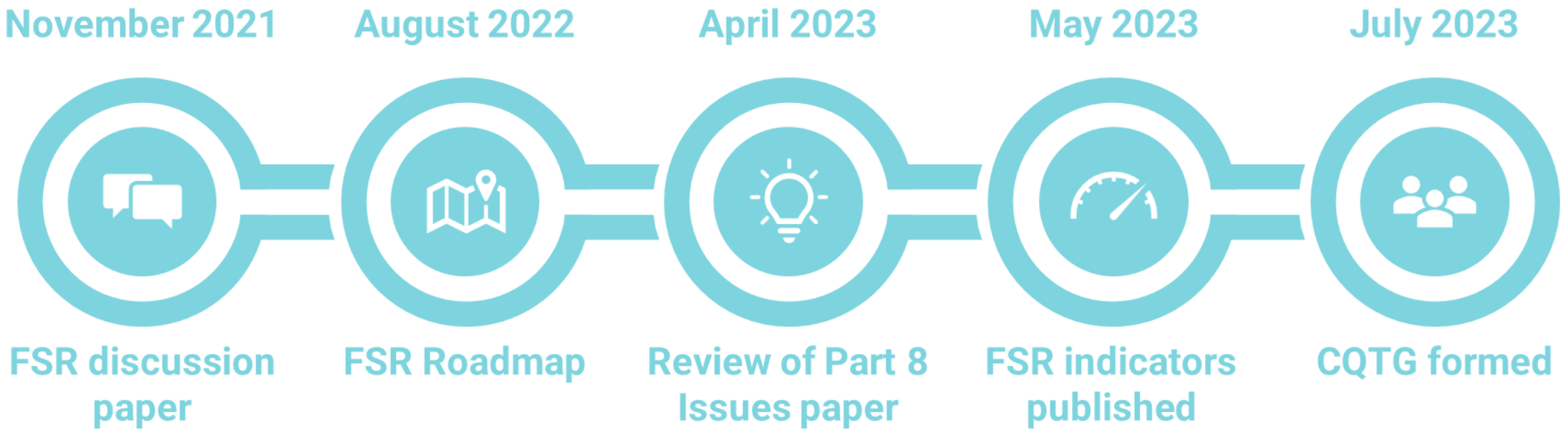
Future Security and Resilience: Part 8 review and Code amendments



01 July 2026

ELECTRICITY AUTHORITY
TE MANA HIKO

FSR programme: Background



FSR programme: Work to date (Part 8)

- **24 consultations to date comprising issues, options, Code amendment proposals and decisions.**
- **Decisions:**

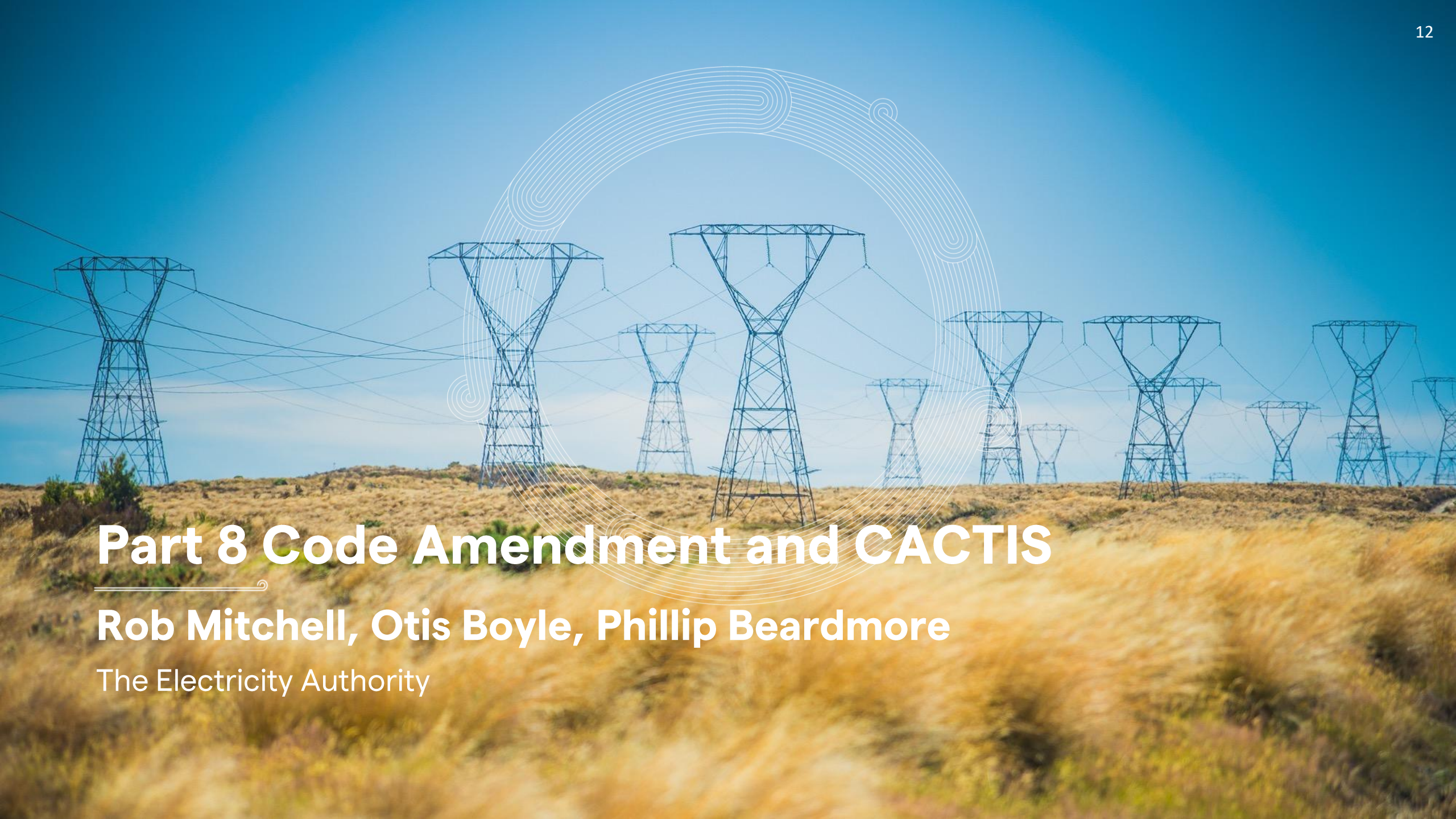
Description	Effective from
Remove the exclusion for wind-powered generation from periodic testing requirements.	1 May 2025
Clarify that embedded generators must provide an asset capability statement in a format specified by the system operator.	1 May 2025
Include all participants as potential causers of under-frequency events.	1 May 2025
Amend the requirement to have a speed governor.	1 May 2025
Amend the requirement to have an excitation system.	1 May 2025
Amend Code to refer to dynamic reactive power compensation devices.	1 May 2025
Amend the Code to treat energy storage systems as only generation for the purposes of Part 8.	1 May 2025
Smaller generating stations to comply with frequency-related obligations.	**1 July 2026**
A maximum dead band beyond which a generating station must contribute to frequency management and support.	**1 July 2026**
Voltage support & FRT elements for voltage obligations.	**1 July 2026**
Incorporating CACTIS by reference into the Code.	**1 July 2026**

FSR programme: Work to date (FSO)

- February 2024: Published a discussion document
- June 2025: Published an issue and high-level options paper
- June 2026: Published a roadmap for Distribution System Operation (feedback closes 31 July)

FSR programme: Prioritisation of work

Challenges & Opportunities	Activity	Year 1 22/23	Year 2 23/24	Year 3 24/25	Year 4 25/26	Year 5 26/27	Year 6 27/28	Year 7 28/29	Year 8 29/30	Year 9 30/31	Year 10 31/32
Accommodating future changes within technical requirements	Review and update Part 8 of the Code										
	Review and update Parts Parts 6, 7, 13, 14 of the Code to ensure they align to Part 8										
	Identify standard to support technical requirements in the Code										
	Update the Policy Statement to manage emerging risks										
	Update the System Operator's policies, procedures, guidelines and tools										
Managing reducing system inertia	Create a frequency reserve strategy to manage low inertia										
	Ensure that the Code and market system can accommodate new reserve types										
	Incorporate new reserve types into the Procurement Plan & testing methodology										
	Update operational procedures and tools										
Operating with low system strength	Investigate system strength challenges and opportunities										
	Amend the Code to support performance criteria										
	Develop suitable market products and tools										
Balancing renewable generation	Improve market system and generation/demand forecast										
	Consider new or revised ancillary services to maintain balancing										
Coordination of increased connections	Update Grid Owner and System Operator commissioning processes and benchmark agreement										
	Review the approach to planning connection studies										
	Review operational study tools										
Enabling DER services for efficient power system operations	Enhance the Code and market system dispatch capability to accommodate DER offers										
	Improve real-time security modelling within operaitonal tools										
	Investigate new DER services to support efficient operation of the power system										
Visibility and observability of DER	Establish the impact of DER										
	Determine the credible event risk of DER										
	Update the Code to clarify DER obligations and operational requirements										
	Update procedures and tools to include DER asset information										
Leveraging new technology to enhance ancillary services	Investigate changes to ancillary services										
	Ensure tools monitor the performance of the power system										
	Update the Code, market system and Procurement Plan to enable new technology to provide ancillary services										
Maintaining cyber security	Continually review and update cyber security measures										
Growing skills and capabilities of the workforce	Encourage and train the workforce's next generation										

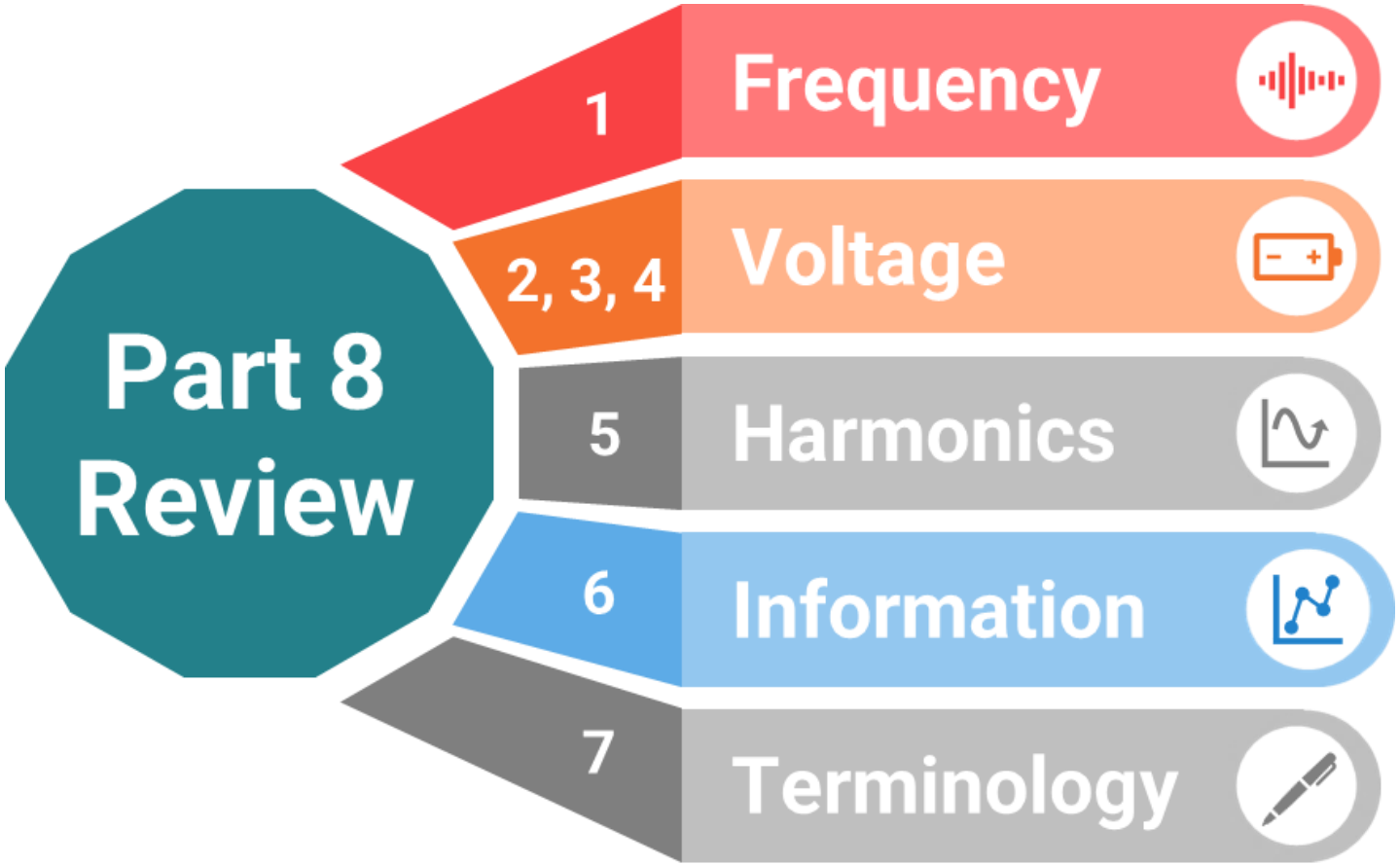


Part 8 Code Amendment and CACTIS

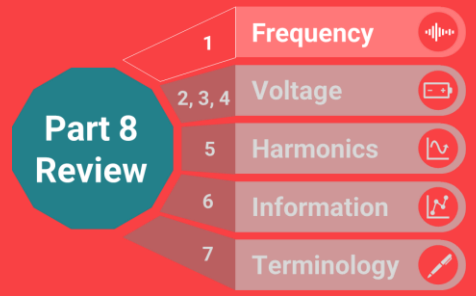
Rob Mitchell, Otis Boyle, Phillip Beardmore

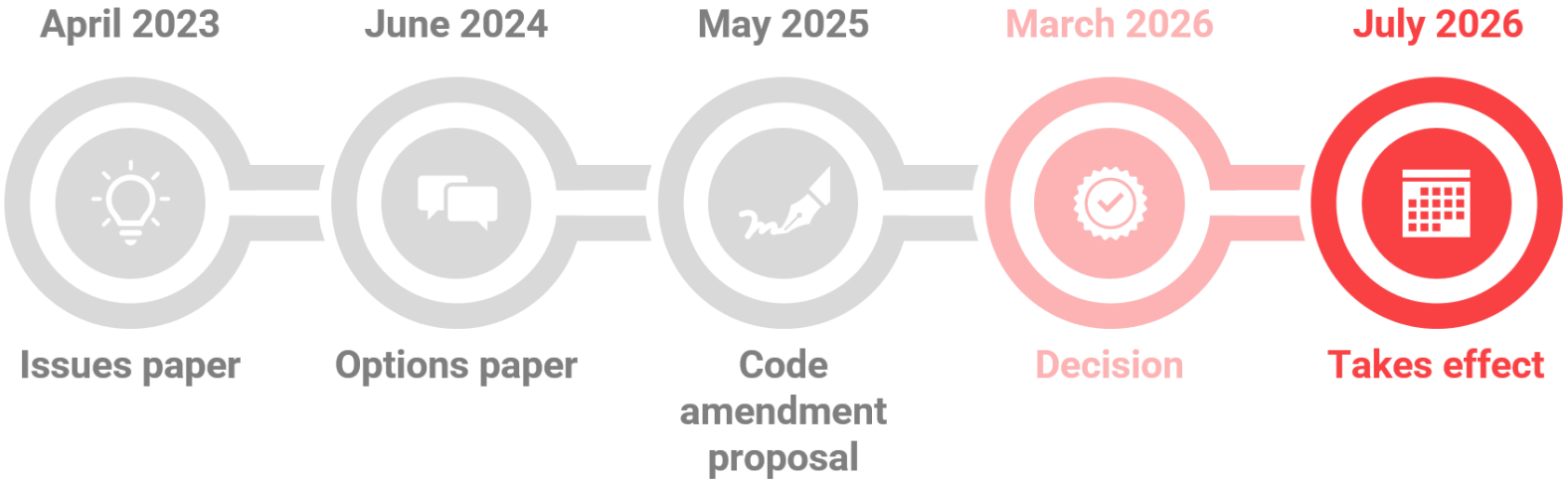
The Electricity Authority

Review of common quality requirements in Part 8 of the Code



Issue 1: Frequency



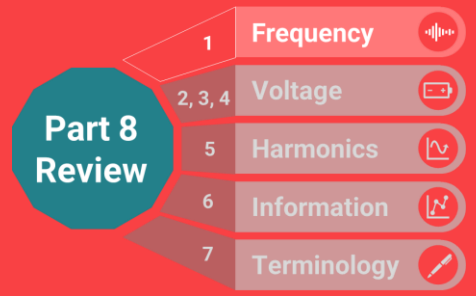


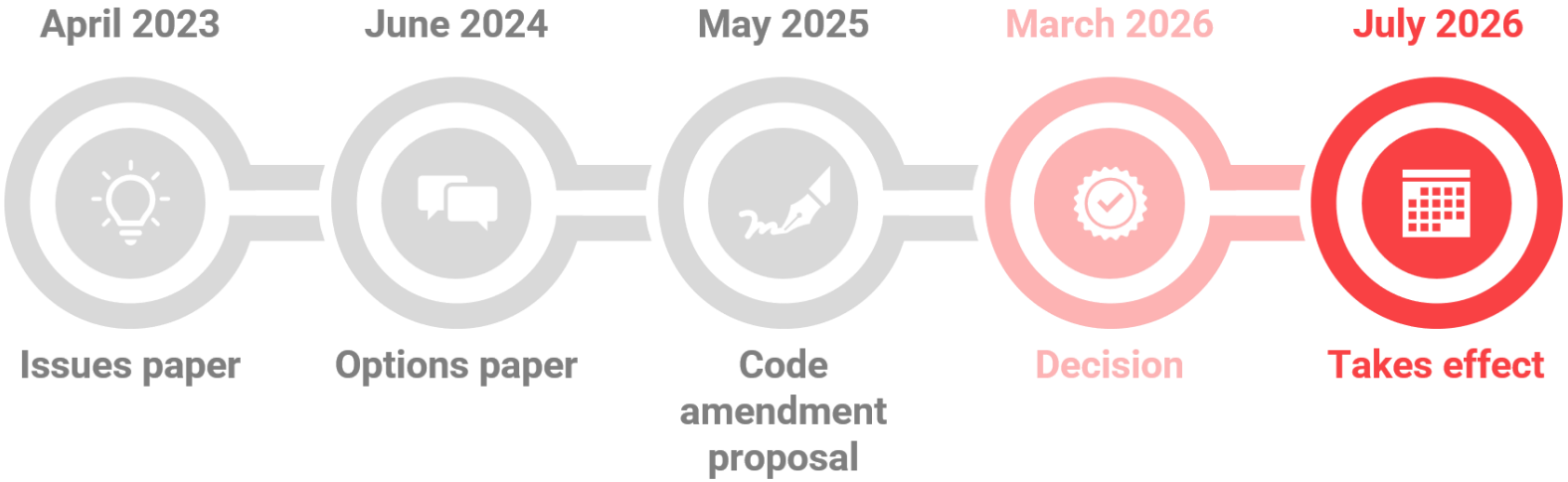
Code amendment

1. ≥10MW generating stations to comply with Code's frequency-related asset owner performance obligations

2. maximum dead band of ±0.1Hz or the inherent dead band of the generating unit, as agreed with the System Operator, acting reasonably.

Issue 1: Frequency



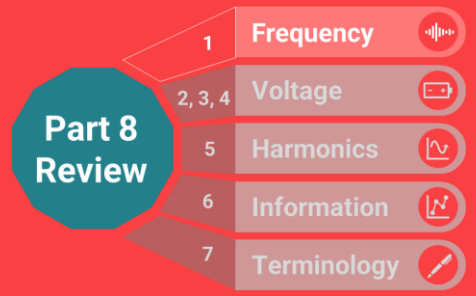


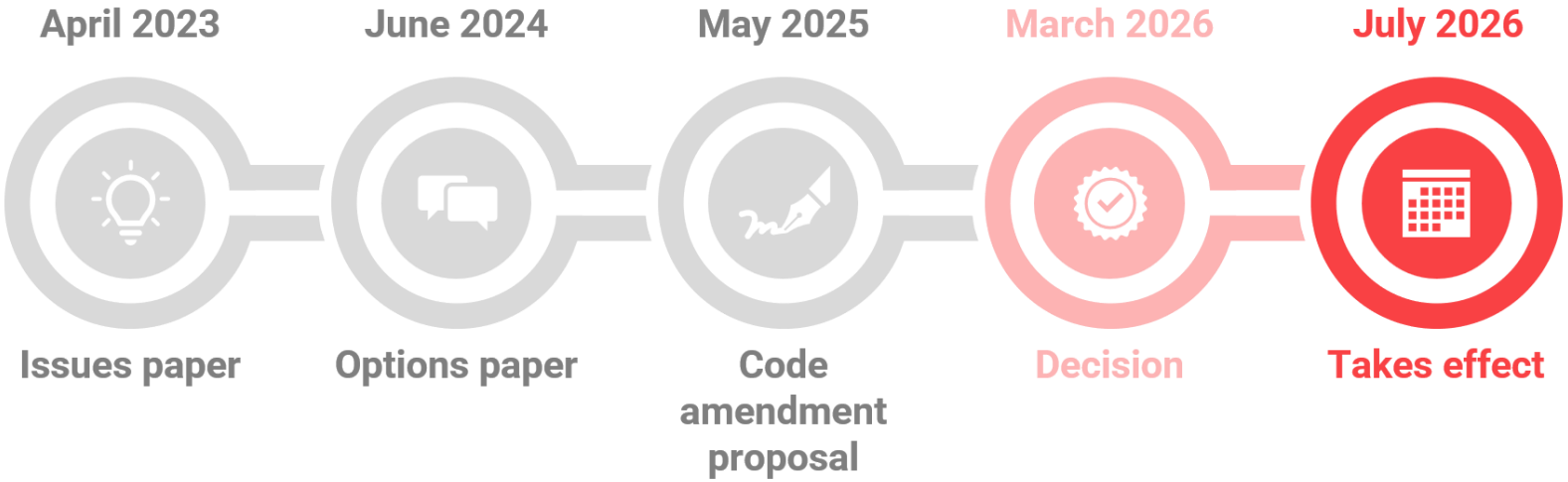
Key changes from consultation to final decision

Code amendment 1: Lower threshold for excluded generating station, from 30MW to 10MW

- The new term “maximum continuous MW output power” has been defined and used, instead of amending the existing defined term “maximum export power”
- A generating station subject to the ‘legacy clause’ provisions in the Code amendment will not lose its ‘legacy’ status should its maximum continuous MW output power increase by less than 5MW above its 30 June 2027 level.

Issue 1: Frequency

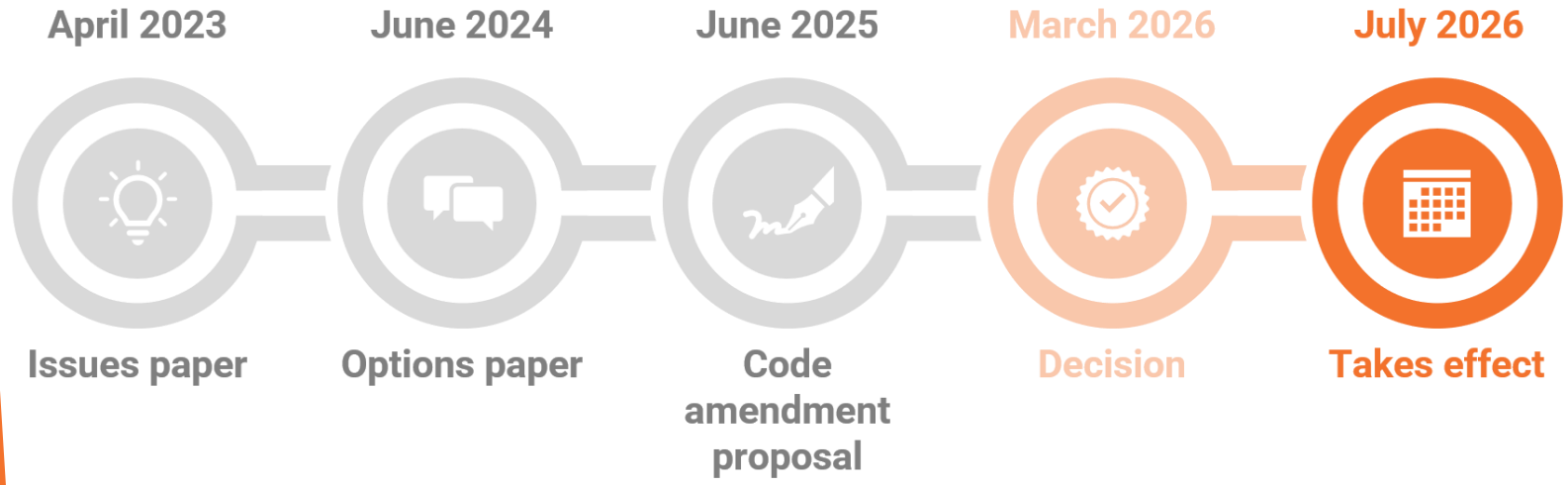




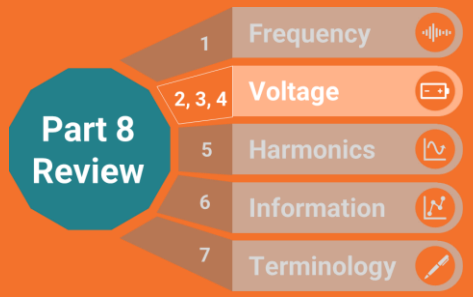
Key changes from consultation to final decision

Code amendment 2: Maximum dead band of ±0.1Hz or the inherent dead band of the generating unit

- Generators must comply with a maximum dead band of the greater of ±0.1Hz or the generating unit's inherent dead band, as agreed with the System Operator acting reasonably, at the time of the generating unit's next routine test.
- Geothermal generating units are excluded from the dead band requirement due to their inherent inability to comply.



Issues 2, 3 & 4: Voltage



Code amendment

1. ≥10MW embedded generating stations operate in default voltage control mode, exporting/importing reactive power to maintain voltage at point of connection (POC) when synchronised and with POC voltage within applicable range:
   a) Default reactive power requirement = ±33% of station's maximum continuous MW output power
   b) Unless agreed otherwise with local distributor
2. ≥10MW generating stations comply with Code's fault ride through obligations

When the voltage regulation obligation applies

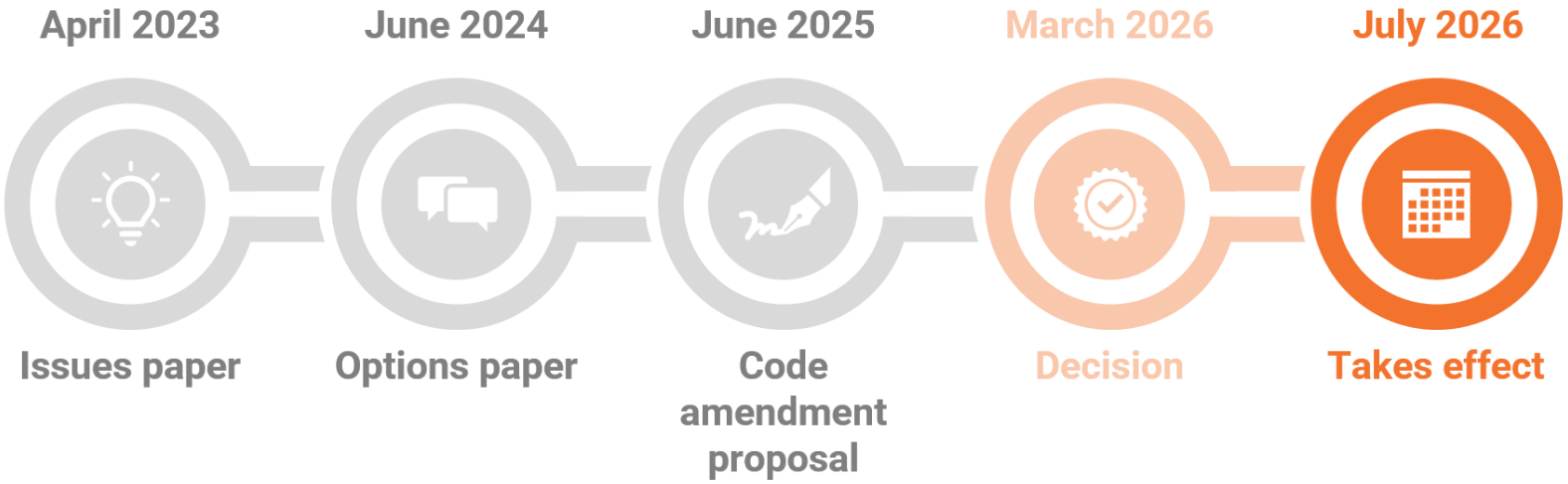
Following conditions must hold:

1. Station electrically connects to local network at nominal voltage of the electrical busbar—
   i. at which (transmission) grid owner has agreed to provide services to local distributor; and
   ii. that is electrically closest* to embedded generating station

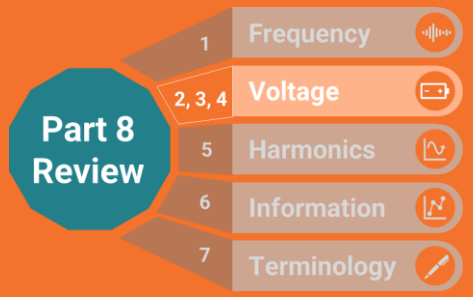
   ** meaning lowest total impedance between the embedded generating station's POC and the GXP busbar*
2. Station's maximum continuous MW output power is ≥10 MW

Also:

- Distributor has not directed that the embedded station operate in alternative voltage control mode (eg, constant reactive power or constant power factor), to enable distributor to operate local network according to good electricity industry practice
- For embedded stations first electrically connected to local networks before 1 July 2027, the station is able to comply, without modification, with voltage regulation requirements



Issues 2, 3 & 4: Voltage

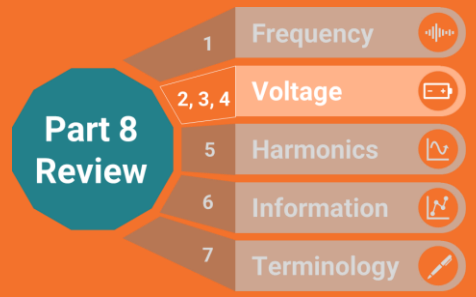


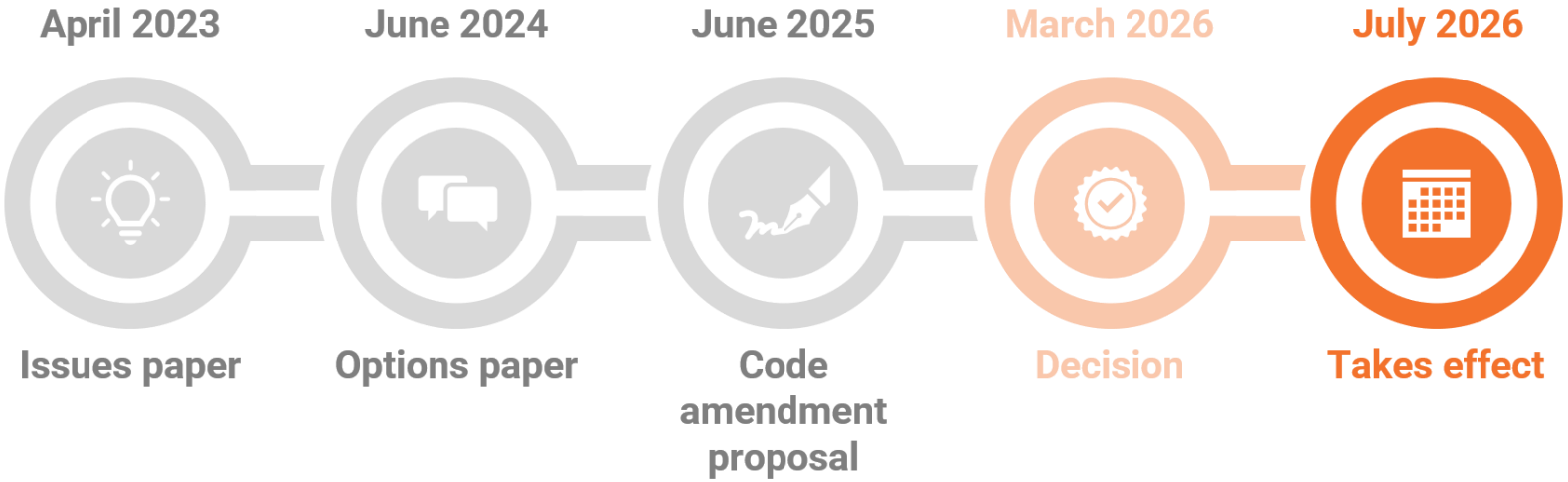
Changes made following consultation

1. Default voltage support obligation applies when:
   a) voltage at embedded generating station's POC is within relevant 11–110 kV range in new clause 8.23A
   b) embedded generating station is synchronised with the local distribution network

   These changes are to align with existing clause 8.23

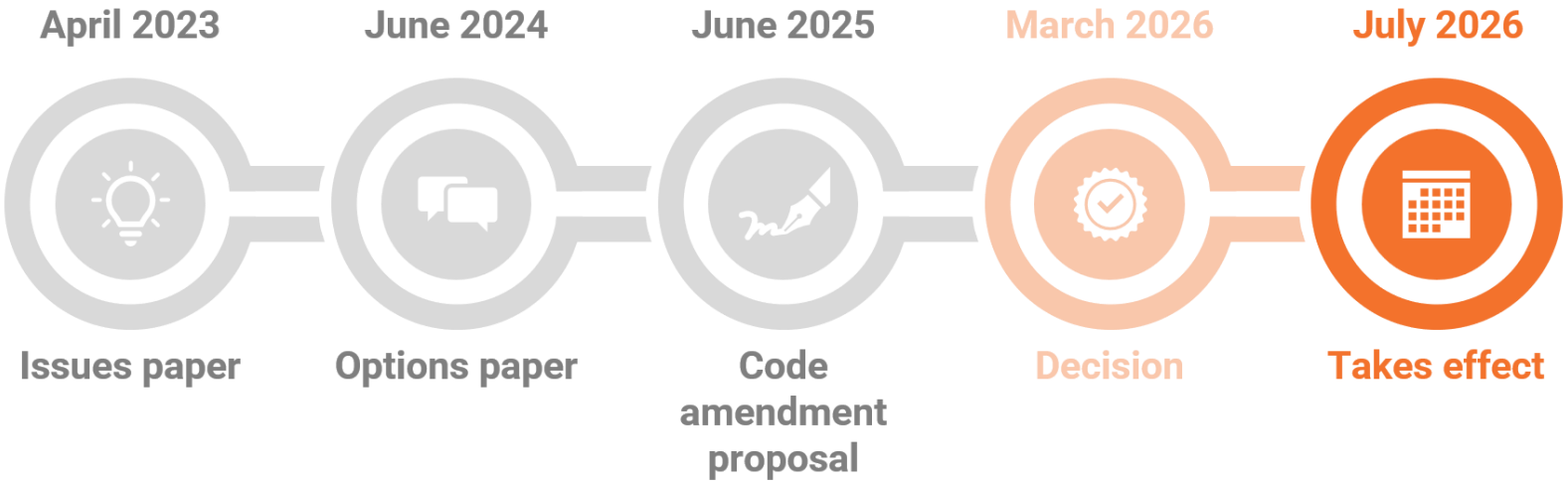
Issues 2, 3 & 4: Voltage



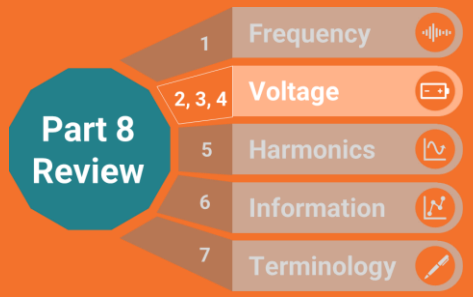


Changes made following consultation

2. Define ‘maximum continuous MW output power’ instead of amending existing defined term ‘maximum export power’
3. Cut-off date for generating stations to be subject to ‘legacy clause’ provisions moved from 1 July 2026 to 1 July 2027
4. Generating stations subject to ‘legacy clause’ provisions will not lose ‘legacy’ status should maximum continuous MW output power increase by <5MW above 30 June 2027 level

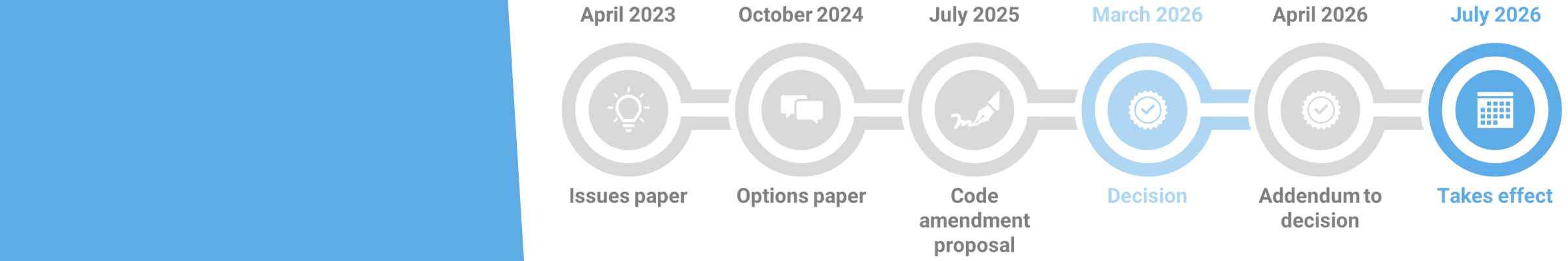


Issues 2, 3 & 4: Voltage

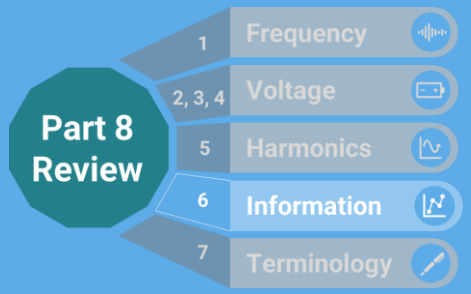


Changes made following consultation

5. Authority has requested System Operator amend FRT studies it gets generators to do to prove compliance with Code's FRT requirements
   - For generating stations with maximum continuous MW output power of ≥10MW but <30MW
   - May prove compliance by doing a single machine infinite bus test, using FRT curve in Code

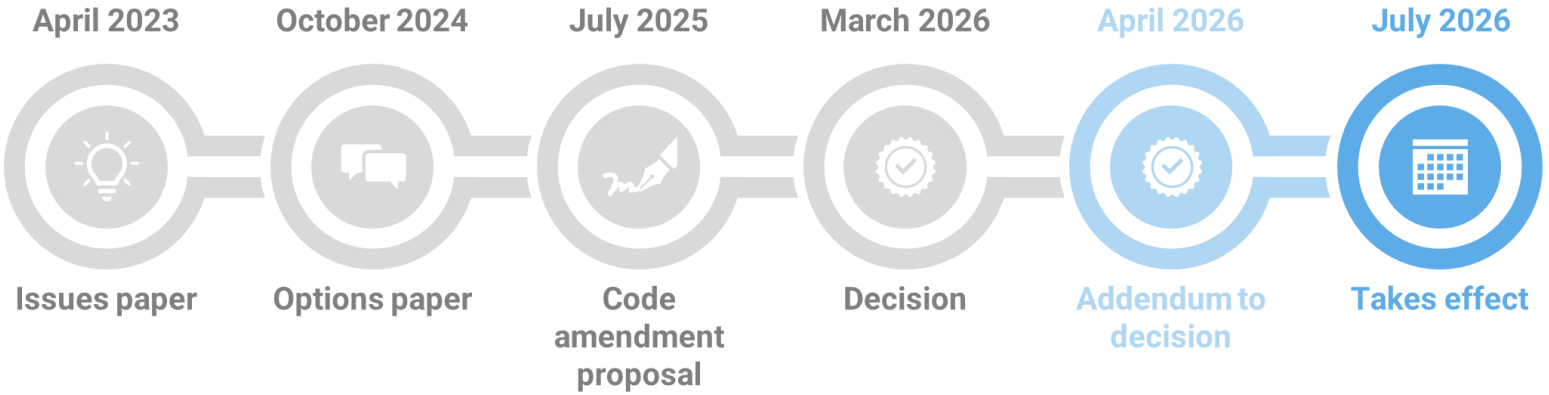


Issue 6: Information

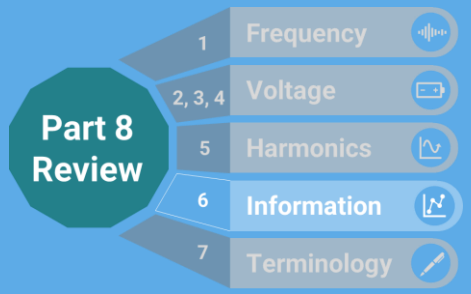


Code amendment

1. Connected Asset Commissioning, Testing and Information Standard (CACTIS)
2. 10MW threshold for modelling, operational communications and high-speed data
3. Legacy clause arrangements



Issue 6: Information



Changes to Code amendment

1. Original Equipment Manufacturers (OEMs) may provide modelling information to System Operator on behalf of asset owners

2. Strengthen protections for OEMs' intellectual property

3. Distributors and direct consumers have until 1 July 2027 to comply with controllable load indications and measurements obligation

Compliance with Part 8 of the Code

ASSET OWNERS

- Understand applicability
- Update asset capability statement
- Demonstrate compliance

SYSTEM OPERATOR

- Monitor compliance obligations
- Maintain list of legacy stations
- Escalate Code breaches to the Authority

ELECTRICITY AUTHORITY

- Initial screening of any breach allegations
- Formal investigation
- Rulings panel

RULINGS PANEL

- Independent body
- Enforces the Code
- Can order pecuniary penalties or compensation

Rulings panel: Members

Mel Orange
Chair

Matthew Dunning KC
Deputy Chair

Dr Stephen Jay
Member

Paul Webber
Member

Lee Wilson
Member

More information: [Rulings panel members | Electricity Authority Rulings Panel]

What asset owners should be doing now

Existing assets (or assets that will first electrically connect before 1 July 2027):

- Determine whether legacy provisions apply
- Review compliance with new Code requirements
- Confirm asset capability statement is current and, if not, provide updated version to the System Operator.

New assets (electrically connecting from 1 July 2027 onwards):

- Design for compliance from the outset
- Consider new Code requirements during commissioning
- Ensure controls and testing programmes adequately demonstrate compliance.

ELECTRICITY AUTHORITY
TE MANA HIKO

THANK YOU

Useful links

- Future security and resilience webpage
- Future security and resilience roadmap- August 2022
- Frequency-related Code amendments – Decision paper
- Voltage-related Code amendments – Decision paper
- Connected Asset Commissioning, Testing and Information Standard (CACTIS) – Decision paper
- Connected Asset Commissioning, Testing and Information Standard (CACTIS)

For any queries on the FSR programme, please email the team at fsr@ea.govt.nz

Legacy Clause Provisions

Otis Boyle, Phillip Beardmore, Varun Nand

The Electricity Authority & Transpower

Legacy clause arrangements

- Legacy clause arrangements under the 1 July 2026 frequency and voltage Code amendments
- Legacy clause arrangements under the 1 July 2026 CACTIS Code amendment

Legacy arrangements under frequency & voltage Code changes

Existing excluded generating stations

(transmission and distribution connected)

- Continue to be an excluded generating station from 1 July 2026 if:
  - station unable to comply, without modification, with ≥1 requirements an excluded generating station is subject to
  - asset owner updates station's asset capability statement (ACS)

Generating stations first electrically connecting over 1 July 2026 – 30 June 2027

(transmission and distribution connected)

- Are an excluded generating station from 1 July 2026 if:
  - station unable to comply, without modification, with ≥1 requirements an excluded generating station is subject to
  - asset owner updates station's ACS
  - before 1 August 2026 asset owner confirms 3 things in writing to System Operator…

Legacy arrangements under frequency & voltage Code changes

Generating stations first electrically connecting over 1 July 2026 – 30 June 2027

…that the asset owner has:

1. secured financing that enables asset owner to develop and commission station
2. obtained all consents necessary to enable asset owner to develop and commission station
3. obtained rights to use land on which station is to be located

Legacy arrangements under frequency & voltage Code changes

Legacy clause provisions cease applying to a generating station if:

- a modification is made to station that means it can comply with ***all requirements*** it would be subject to if not an excluded generating station
- station's maximum continuous MW output power increases by ≥5 MW above its pre 1 July 2027 level

Legacy arrangements under CACTIS Code changes

Existing generating stations and generating stations first electrically connecting over 1 July 2026 – 30 June 2027

Legacy clause provisions apply if:

- station continues to comply with existing Part 8 requirements; and
- station unable to comply, without modification, with ≥1 CACTIS requirements; and
- asset owner updates station's ACS

Generating stations first electrically connecting over 1 July 2026 – 30 June 2027

For legacy clause provisions to apply, asset owners must confirm:

- secured financing
- obtained all necessary consents
- obtained rights to use land on which station is to be located

Legacy arrangements under CACTIS Code changes

Legacy clause provisions do not apply to:

- CACTIS time frame requirements (Chapter 1)
- CACTIS requirement for connected asset owners to provide System Operator with indications and measurements (Chapter 8)

Legacy clause provisions cease applying to a generating station if:

- a modification made to station that results in a ≥5% change to station's—
  i. MW rating; or
  ii. frequency response curve for ≥100 milliseconds; or
  iii. voltage response curve for ≥100 milliseconds

Legacy arrangements under CACTIS Code changes

Generating station	Complies with existing Part 8	Unable to comply with CACTIS without modification	Updates ACS	Secures financing	Obtains consents	Obtains land rights
Connected before 1 July 2026	✓	✓	✓			
Connected before 1 July 2027	✓	✓	✓	✓	✓	✓

Legacy clause provisions do not apply to:

- CACTIS time frame requirements (Chapter 1)
- CACTIS requirement for connected asset owners to provide System Operator with indications and measurements (Chapter 8)

Legacy clause provisions cease applying to a generating station if a modification is made to station that results in a ≥5% change to station's—

i. MW rating; or

ii. frequency response curve for ≥100 milliseconds; or

iii. voltage response curve for ≥100 milliseconds

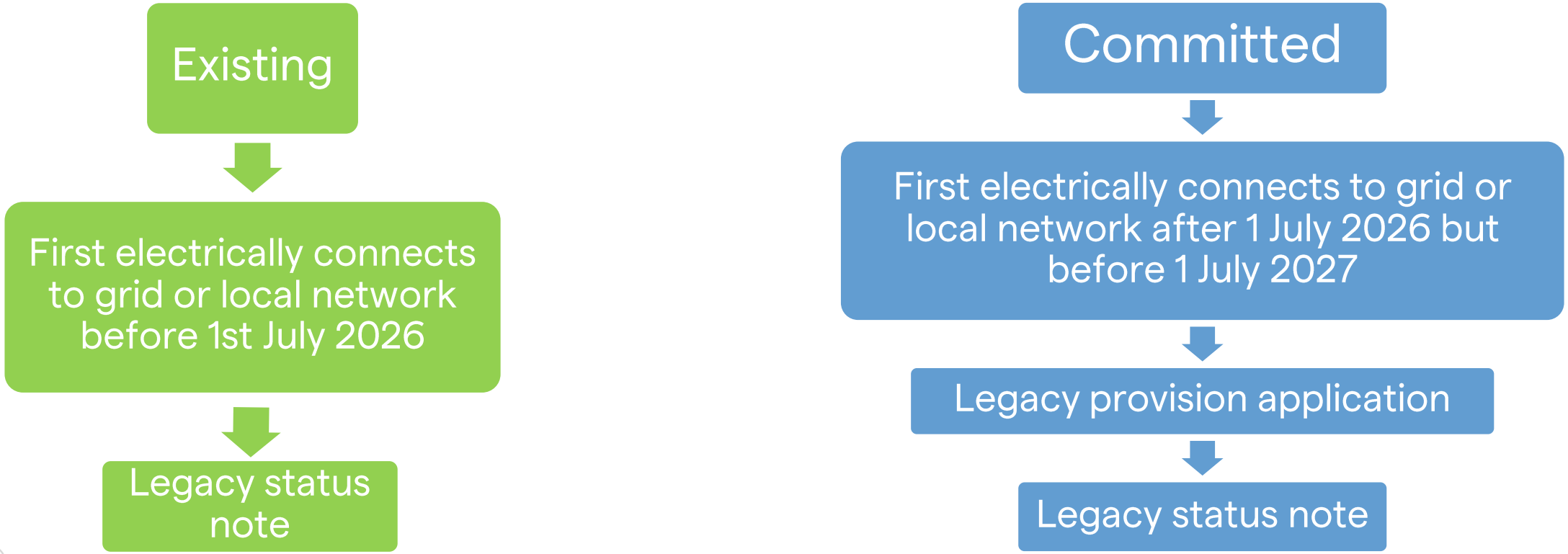
How to apply for legacy?

Varun Nand

Senior Engineer | Power Systems Group

Who can apply for legacy?

Voltage & Frequency and CACTIS legacy application process been split into two categories based on when you first electrically connect.



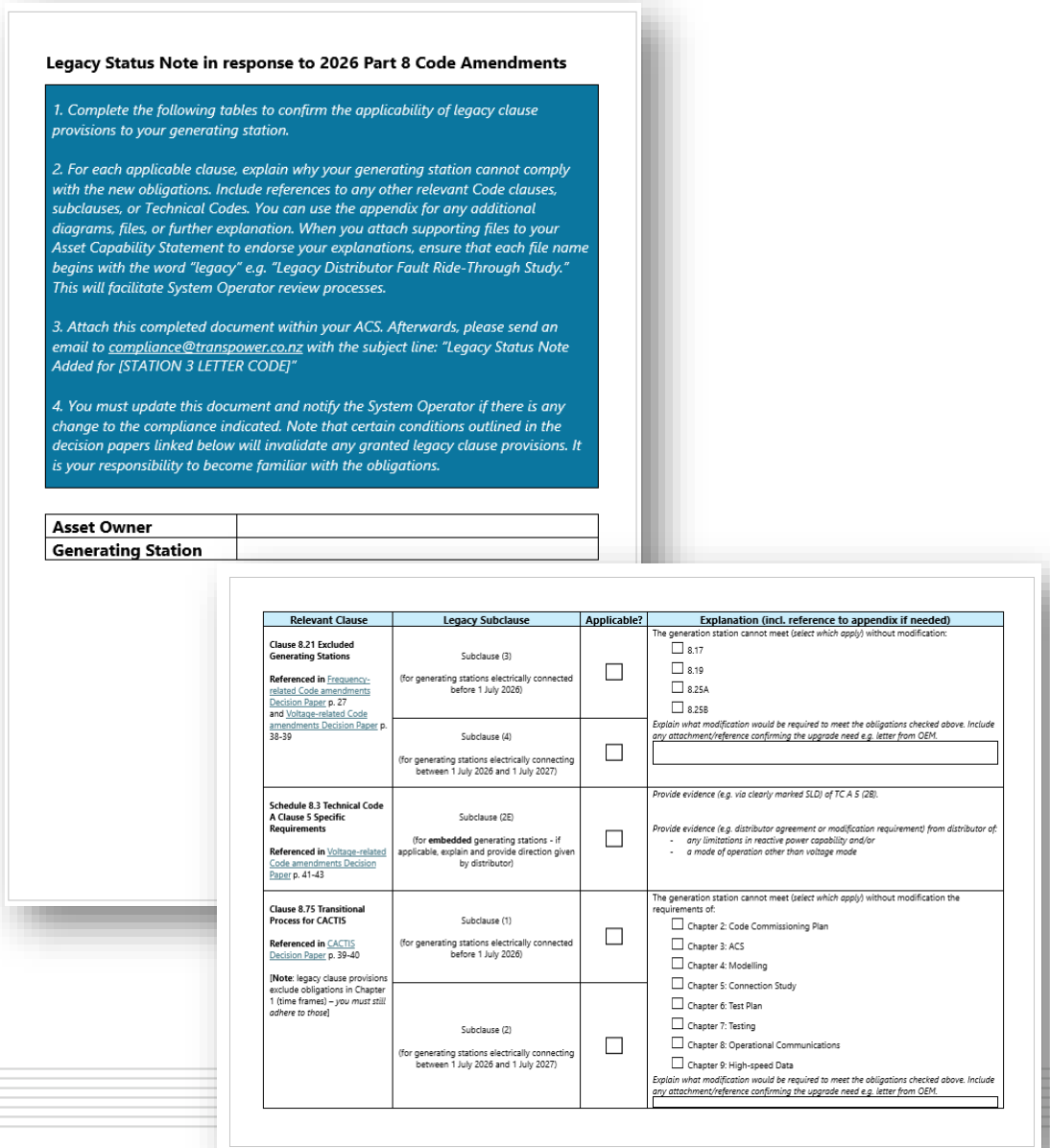
How to apply? → Legacy Status Note

Ensure ACS is up to date.

Legacy Status Note: available on the SO's CACTIS webpage

1) Excluded generating station

- Clause reference and brief explanation of modification (any attachment or reference).



Legacy Status Note in response to 2026 Part 8 Code Amendments

1. Complete the following tables to confirm the applicability of legacy clause provisions to your generating station.

2. For each applicable clause, explain why your generating station cannot comply with the new obligations. Include references to any other relevant Code clauses, subclauses, or Technical Codes. You can use the appendix for any additional diagrams, files, or further explanation. When you attach supporting files to your Asset Capability Statement to endorse your explanations, ensure that each file name begins with the word "legacy" e.g. "Legacy Distributor Fault Ride-Through Study." This will facilitate System Operator review processes.

3. Attach this completed document within your ACS. Afterwards, please send an email to compliance@transpower.co.nz with the subject line: "Legacy Status Note Added for [STATION 3 LETTER CODE]"

4. You must update this document and notify the System Operator if there is any change to the compliance indicated. Note that certain conditions outlined in the decision papers linked below will invalidate any granted legacy clause provisions. It is your responsibility to become familiar with the obligations.

Asset Owner	
Generating Station	

Relevant Clause	Legacy Subclause	Applicable?	Explanation (incl. reference to appendix if needed)
Clause 8.21 Excluded Generating Stations **Referenced in** Frequency-related Code amendments Decision Paper p. 27 and Voltage-related Code amendments Decision Paper p. 38-39	Subclause (3) (for generating stations electrically connected before 1 July 2026)	☐	The generation station cannot meet *(select which apply)* without modification: ☐ 8.17 ☐ 8.19 ☐ 8.25A ☐ 8.25B *Explain what modification would be required to meet the obligations checked above. Include any attachment/reference confirming the upgrade need e.g. letter from OEM.*
	Subclause (4) (for generating stations electrically connecting between 1 July 2026 and 1 July 2027)	☐	
Schedule 8.3 Technical Code A Clause 5 Specific Requirements **Referenced in** Voltage-related Code amendments Decision Paper p. 41-43	Subclause (2E) (for **embedded** generating stations - if applicable, explain and provide direction given by distributor)	☐	*Provide evidence (e.g. via clearly marked SLD) of TC A 5 (2B).* *Provide evidence (e.g. distributor agreement or modification requirement) from distributor of:* - *any limitations in reactive power capability and/or* - *a mode of operation other than voltage mode*
Clause 8.75 Transitional Process for CACTIS **Referenced in** CACTIS Decision Paper p. 39-40 [**Note**: legacy clause provisions exclude obligations in Chapter 1 (time frames) – *you must still adhere to those*]	Subclause (1) (for generating stations electrically connected before 1 July 2026)	☐	The generation station cannot meet *(select which apply)* without modification the requirements of: ☐ Chapter 2: Code Commissioning Plan ☐ Chapter 3: ACS ☐ Chapter 4: Modelling ☐ Chapter 5: Connection Study ☐ Chapter 6: Test Plan ☐ Chapter 7: Testing ☐ Chapter 8: Operational Communications ☐ Chapter 9: High-speed Data *Explain what modification would be required to meet the obligations checked above. Include any attachment/reference confirming the upgrade need e.g. letter from OEM.*
	Subclause (2) (for generating stations electrically connecting between 1 July 2026 and 1 July 2027)	☐	

How to apply? → Legacy Status Note (continued)

2) Embedded generating station voltage obligations

- Provide confirmation of Tech Code A, 5 (2B) – e.g. SLD
- Extent of compliance with 8.23A and Tech Code A, 5 (2A) – e.g. capability curve, model etc.
- Agreement with EDB in relation to voltage control or brief explanation of modification (any attachment or reference)

3) CACTIS

- Chapter and paragraph reference
- Brief explanation of modification (any attachment or reference)

Next

- Upload Legacy Status Note to ACS, publish ACS and email Compliance mailbox

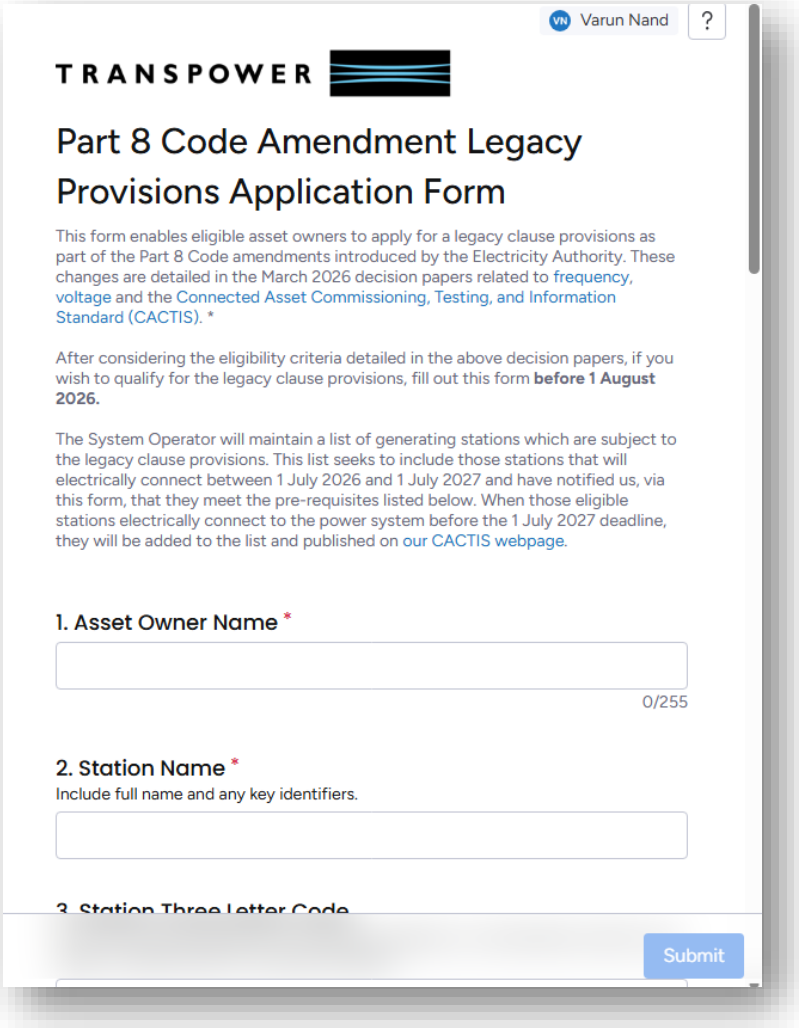
How to apply? → Legacy Provision Application

Legacy Provision Application: form available on the SO's CACTIS webpage

Confirm:

- AO and station information
- Connection date is after 1st July 2026 but before 1st July 2027
- Finance, Consent and Rights to use of land
- Attach any other relevant information

- Submit Legacy Note **after** first electrical connection



When to apply for legacy?

	Legacy Provision Application	Legacy Status Note
Existing	**n/a**	**Before 1st August 2026**
Committed	**Before 1st August 2026**	**After first connects (before 1st July 2027)**

The SO will maintain a list of generating stations with legacy status on the CACTIS webpage.

Connection Study Requirements

Chris Challen

Engineer | Power Systems Group

Asset Owner Performance Obligations

Connection	Station Capacity (x)	Frequency obligations 8.17 - 8.21	Voltage range obligations 8.22	Voltage support obligations 8.23	Voltage support obligations 8.23A	Fault ride through obligations 8.25A
Grid	x ≥ 30 MW	☑	☑	☑	☒	☑
Grid	10 ≤ x < 30 MW	☒ → ☑	☑	☑	☒	☒ → ☑
Grid	x < 10 MW	☒	☑ [1]	☑ [1]	☒	☒
Embedded	x ≥ 30 MW	☑	☒	☒	☒ → ☑ [2]	☑
Embedded	10 ≤ x < 30 MW	☒ → ☑	☒	☒	☒ → ☑ [2]	☒ → ☑
Embedded	x < 10 MW	☒	☒	☒	☒	☒

[1] These voltage obligations are not required to be demonstrated in a Connection Study
[2] Refer to EIPC Schedule 8.3, Technical Code A, Clauses 5(2A) and 5(2B) for further information

Voltage Support for Embedded Generation

New EIPC Obligation 8.23A

- If the station meets the conditions specified in EIPC Schedule 8.3, Technical Code A, Clauses 5(2A) and 5(2B), then
- Unless otherwise agreed with the distributor,
- Station must be capable of exporting and importing a minimum of 33% of its MW capacity as reactive power,
- Measured at station's point of connection

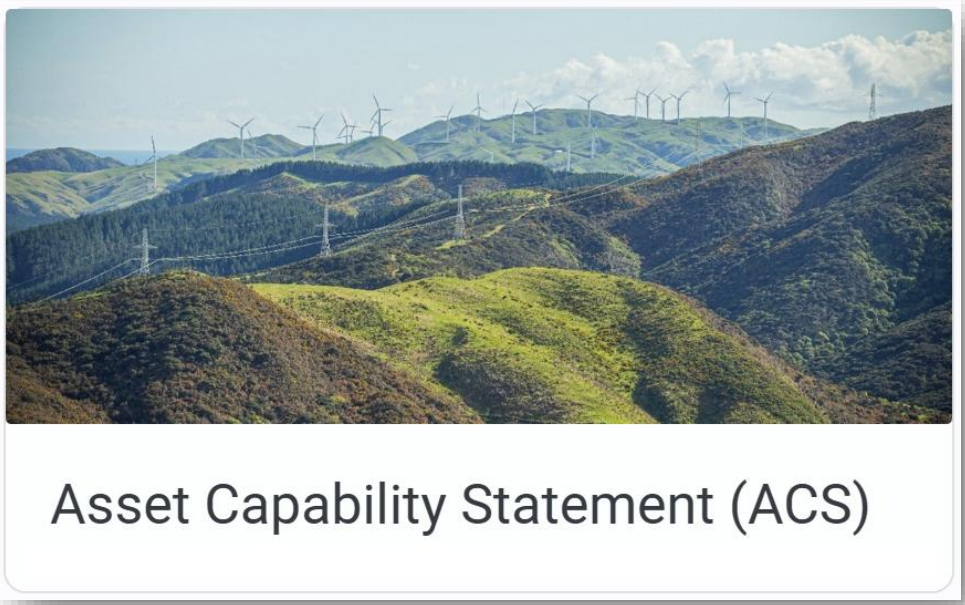
Connection Study requirements

Connection	Station Capacity (x)	Power-flow study	Reactive power capability study	Frequency regulation & tuning study	Voltage regulation & tuning study	Short circuit study	Fault ride through study	Transient stability study	M1 model
Grid	x ≥ 30 MW	☑	☑	☑	☑	☑	☑	☑	☑
Grid	10 ≤ x < 30 MW	☑	☑	☒ → ☑	☑	☑	☒ → ☑	☑	☑
Grid	x < 10 MW	☒	☒	☒	☒	☒	☒	☒	☒
Embedded	x ≥ 30 MW	☑	☒ → ☑ [1]	☑	☒ → ☑	☑	☑	☑	☑
Embedded	10 ≤ x < 30 MW	☒ → ☑	☒ → ☑ [1]	☒ → ☑	☒ → ☑	☒ → ☑	☒ → ☑	☒ → ☑	☒ → ☑
Embedded	x < 10 MW	☒	☒	☒	☒	☒	☒	☒	☒

[1] Refer to EIPC Schedule 8.3, Technical Code A, Clauses 5(2A) and 5(2B) for further information

- If commissioning a Dynamic Reactive Power Compensation Device ≥ 10 Mvar, please discuss your Connection Study requirements with System Operator
- Any station with at least one generating unit ≥ 1 MW must also provide an Asset Capability Statement (ACS)

General Changes to Connection Study Process



Asset Capability Statement (ACS)

Submission

- Connection Study ➔ ACS
- m1 model (non-confidential) ➔ ACS
- m1 model (confidential) ➔ Fileshare link to lead engineer

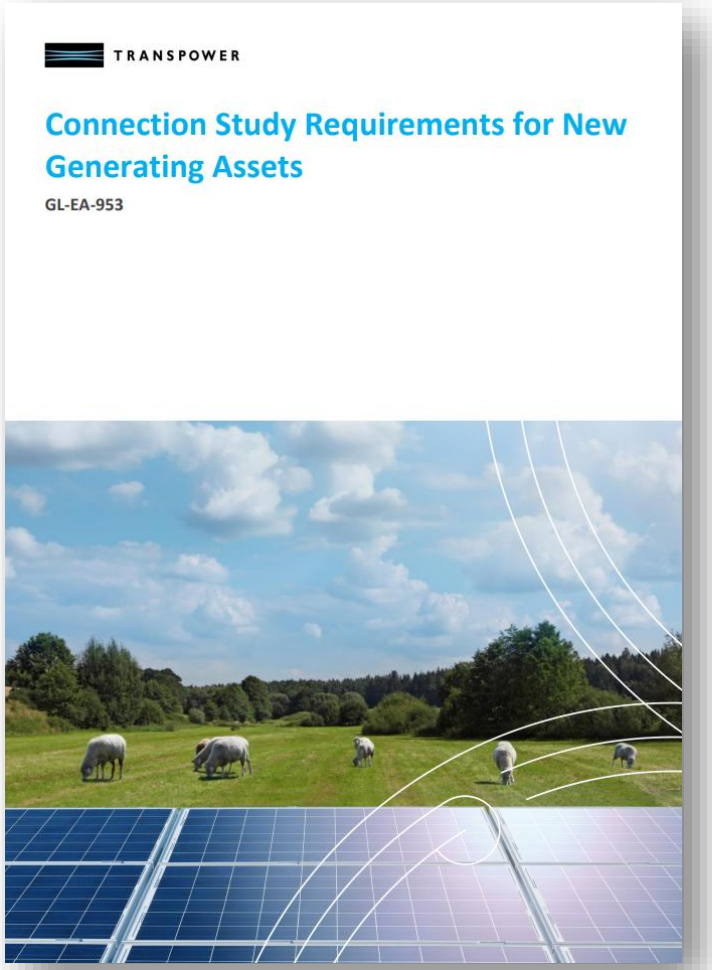
Deadlines

- Submit final copies at least 2 months prior to electrical connection to a network, we recommend submitting initial version 6 months prior to connection
- System Operator must review final copies within 20 business days

Encrypted models

- Consent may be sought for sharing encrypted models with other asset owners for FRT study only

Key Changes to Specific Study Requirements



Power-Flow Study

- Minimum 3-year horizon is now mandatory

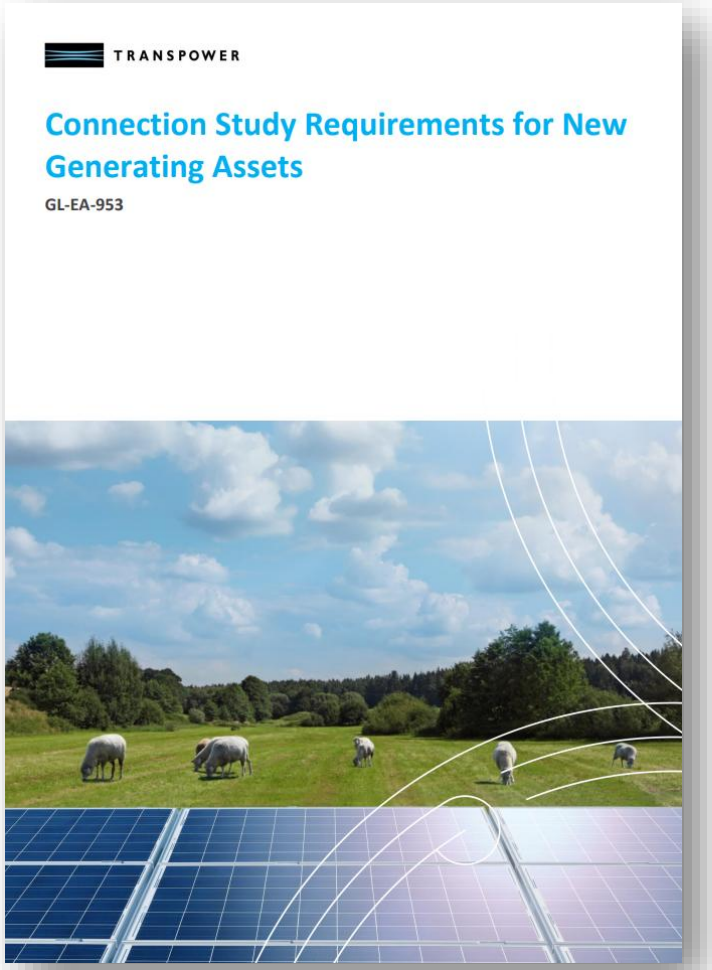
Reactive Power Capability Study

- Study must be undertaken with asset generating at 100%, 50% and 30%
- BESS study must be undertaken with asset charging at 100%, 50% and 30%

Frequency Regulation and Tuning Study

- Mandatory to assess performance for disconnection of:
  - the largest generating unit on the island, and
  - the HVDC bipole

Key Changes to Specific Study Requirements



Voltage Regulation and Tuning Study

- No material changes

Short Circuit Study

- Calculating ESCR (Effective Short Circuit Ratio) at the asset's point of connection is now mandatory

Transient Stability Study

- For IBR, an unbalanced fault must be applied

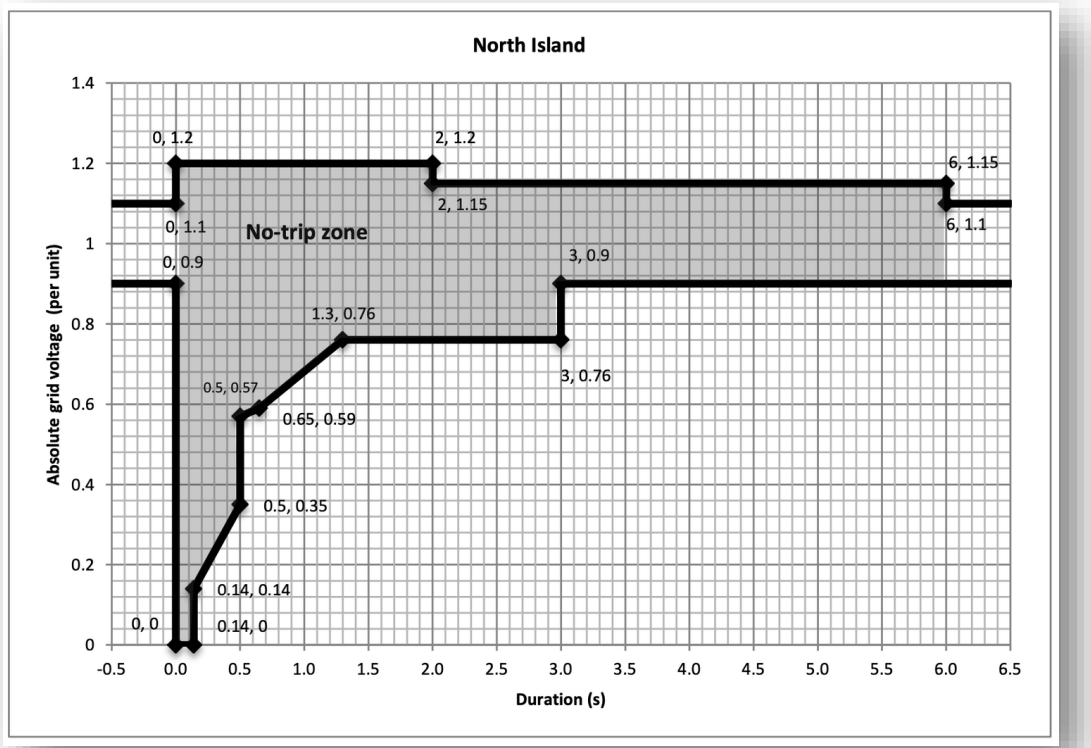
Fault Ride Through Study

- Control system settings must be finalized
- If these change during the lifetime of the asset, relevant sections of the study must be repeated

Reduced Scope for Fault Ride Through Study

Existing Requirement

- Synchronous generation must complete PowerFactory RMS simulations
- IBR must complete PowerFactory RMS and PSCAD EMT simulations



Revised PSCAD Requirement

Following feedback from AO Forum 2025:

- IBR must still complete RMS and EMT simulations,
- but if station capacity (x) is 10 ≤ x < 30 MW, the EMT simulation scope is reduced to SMIB

Useful links

Connection Study Guidelines

- GL-EA-953 - Connection Study Requirements for New Generating Assets

CACTIS - Chapter 5: Connection Study Requirements

- Connected Asset Commissioning Testing and Information Standard

EIPC - Asset Owner Performance Obligations

- Part 8 - Common quality | Electricity Authority

Testing Requirements

Nadya Putri

Engineer | Power Systems Group

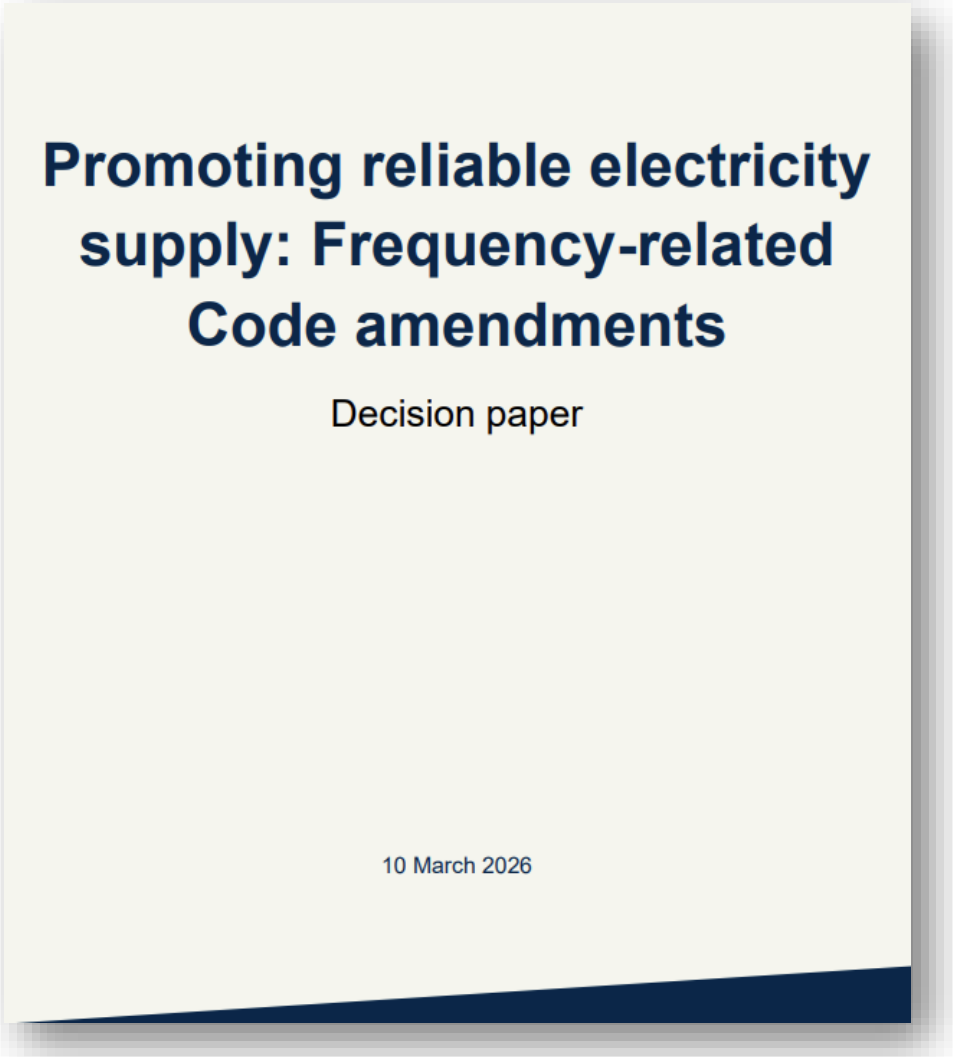
Summary of Obligation Changes

Change to Excluded Generating Stations

- MW < 10

Stations 10 ≤ x < 30 MW now must:

- comply with expanded obligations
- perform routine testing



Summary of Test Requirement Changes

Generators

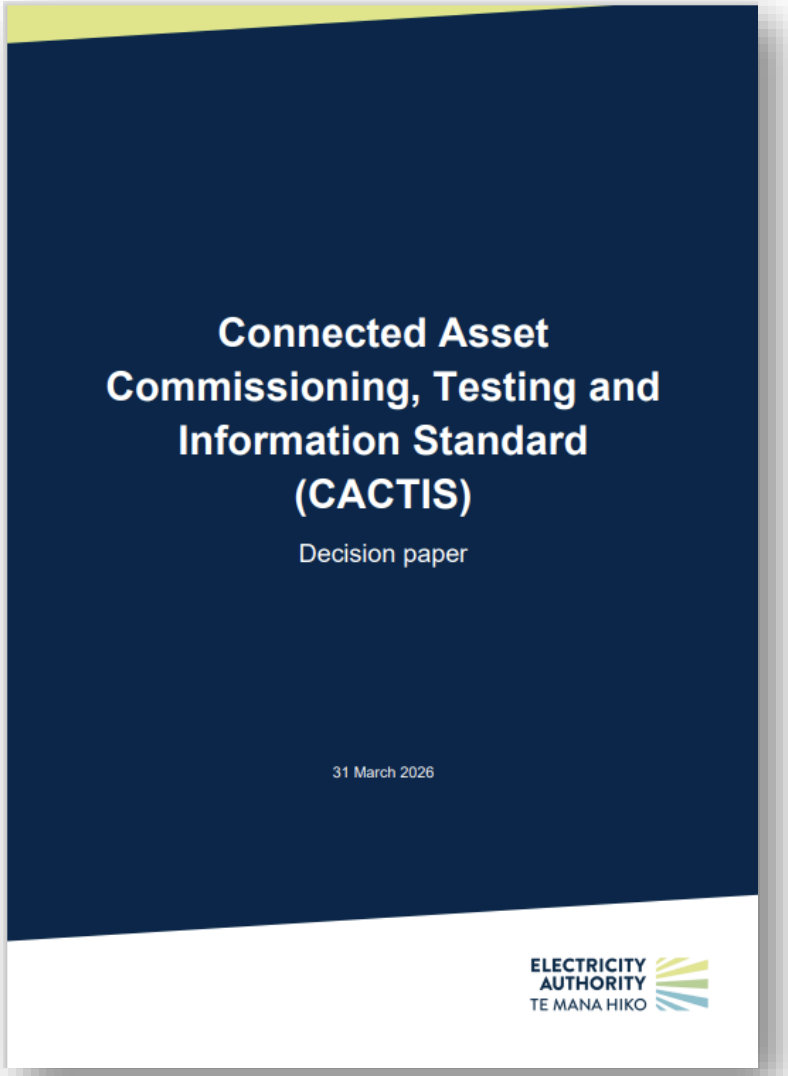
- Deadband +-0.1 Hz
- Event data in lieu of testing
- Engineering methodology

Capacitors

- Now applies to each asset owner with a shunt capacitor directly connected to a network

Reactive Power Devices

- ≥10 MVARs must perform routine tests
- Applies to grid connected and embedded



Generator Test Requirements

Connection	Station Capacity (x)	Generating Unit Frequency response	Generating Unit* Frequency control system	Generating Unit* Transformer voltage control	Generating Unit* Voltage response and control
Grid	x ≥ 30 MW	☑	☑	☑	☑
Grid	10 ≤ x < 30 MW	☒ ➔ ☑	☒ ➔ ☑	☑	☑
Grid	x < 10 MW	☒	☒	☑	☑
Embedded	x ≥ 30 MW	☑	☑	☒ ➔ ☑	☒ ➔ ☑
Embedded	10 ≤ x < 30 MW	☒ ➔ ☑	☒ ➔ ☑	☒ ➔ ☑	☒ ➔ ☑
Embedded	x < 10 MW	☒	☒	☒	☒

For all inverters **≥ 10 MW with voltage obligations**, a change of firmware of **control system** must be followed **immediately** by the appropriate tests, where the change has the potential to materially affect the performance of the generating station – rather than test within 3 months of the change.

Generating Unit vs Station

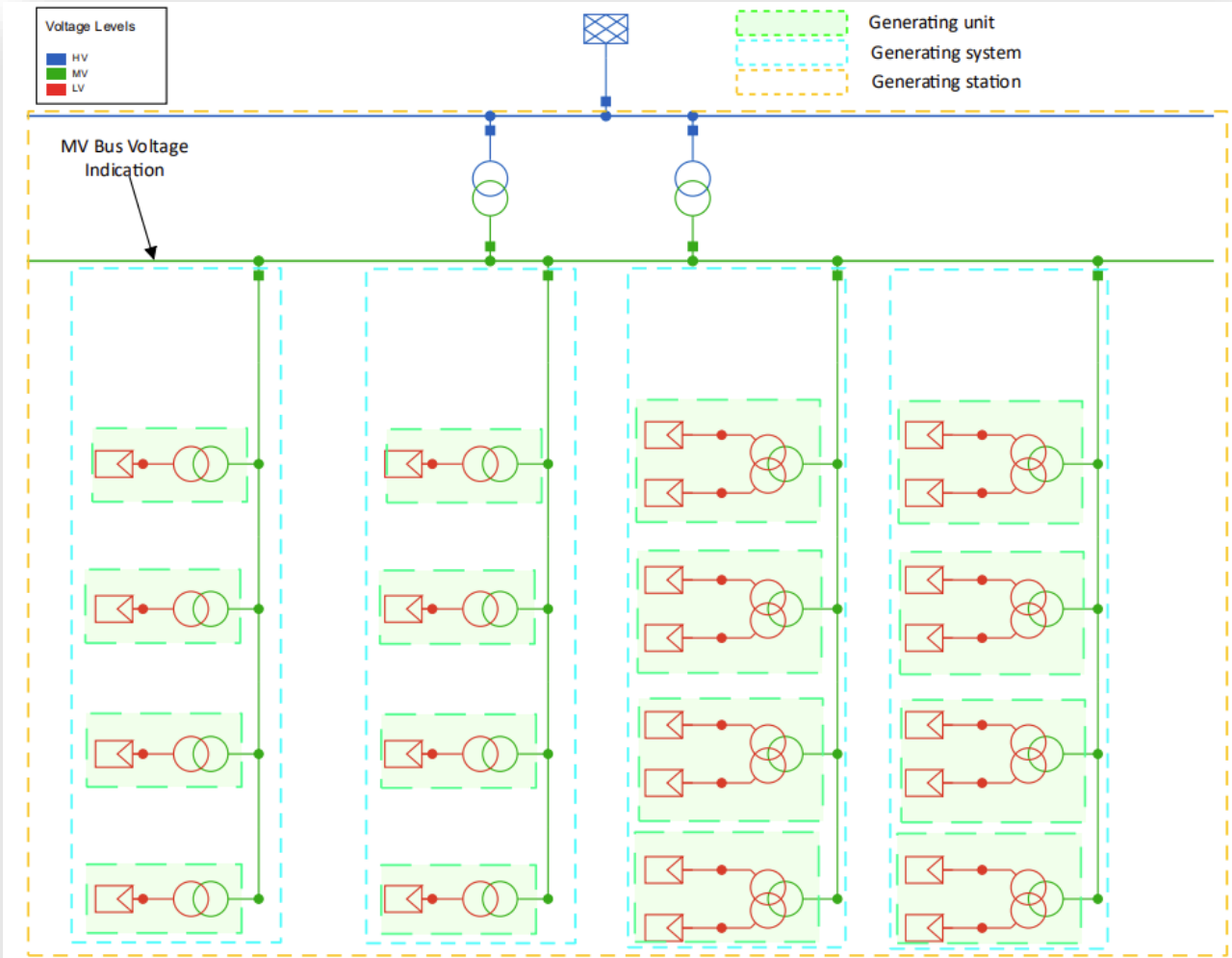


Figure A4: Typical configuration of a solar farm with central inverters

Testing Guideline

Generators

- Frequency deadband (GEN_DBD)
- Frequency step response (GEN_FSP)
- Voltage step response (GEN_VSR)
- Generator Capability (GEN_CAP)

IBRs

- Frequency deadband (ING_DBD)
- Frequency step response (ING_FSP)
- Voltage step response (ING_VSR)
- Reactive power capability (ING_RPC)

Testing Guideline

Static Shunt Reactive Compensation

- Test to confirm general parameters
  - Nominal rating
  - Impedance

STATCOM Dynamic Reactive Compensation

- Test to confirm general SVC or STATCOM parameters
- Voltage control
  - Voltage step response (DVS_VSR)
  - Reactive power capability (DVS_RPC)

Event Data in Lieu of Testing

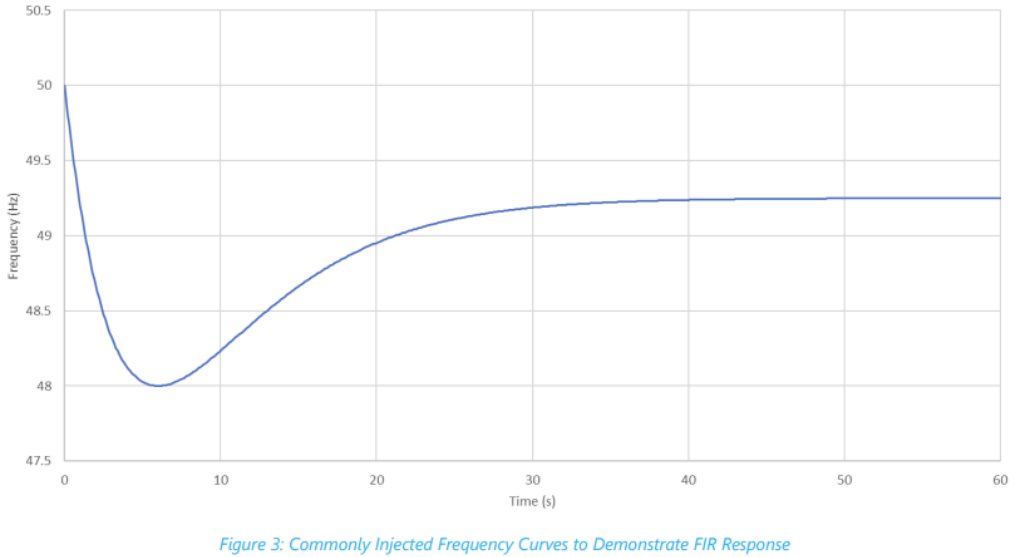


Figure 3: Commonly Injected Frequency Curves to Demonstrate FIR Response

Verify the Control System of the Generating Station

- High speed monitor
- Provide event data within 10 business days of event
- Event must have occurred within the required testing interval

The event data must show:

- The station meeting its AOPOs
- The station meeting its technical requirements

Summary

All required assets to change their frequency deadband to +-0.1 Hz at their next routine test.

10-30 MW stations must demonstrate compliance through:

- Frequency response/control testing
- Voltage response/control testing.

Each asset owner with reactive power devices larger than and equal to 10 MVAR must perform routine testing.

Modelling Requirements

Anjana Madurapperuma and Snehalkumar Joshi

Engineer and Senior Engineer | Power Systems Group

CACTIS Chapter 4 - Overview

Modelling Requirements

- m1 (connection study) and m2 (validated model) models required for **all** assets in asset group 2
- PowerFactory (PF) and PSCAD m2 models must be validated against test data
- TSAT model must be benchmarked against validated PSCAD model
- Key settings must be available for the System Operator to change
- User guides, among other documentation, **must** be provided

Model	What must be modelled?	Model Software Packages	
		Synchronous	BESS/Wind/Solar
m1	control system with: - control modes - protection systems (F and V protection at a minimum)	PowerFactory	PSCAD PowerFactory
m2	control system with: - intended control mode - transition between controls - protection systems	PowerFactory	PSCAD TSAT PowerFactory **(Unencrypted)**

Model Numerical Stability Requirements

RMS Models

- Stable for frequencies between 45-55 Hz, and voltages between 0-1.3 p.u
- Stable for a 120s non-disturbance
- Stable for 60s following any setpoint changes or a contingency
- Stable with a minimum 5ms integration timestep

EMT Models

- Initialisation must match loadflow solution closely
- Must initialise within 3 seconds, and have snapshot capability
- Stable for a 30s non-disturbance
- Support a 10 µs or greater timestep

Model Documentation

Must Include:

- A full description of the model
- Instructions on model use and limitations, including software-related limitations
- Descriptions of the control functions and specific features of the models
- Values and ranges of all configurable settings
- Mapping of PF and TSAT control blocks, and PSCAD model control blocks where applicable
- Instructions to re-compile the model when the System Operator migrates to new software package versions

Model Updates and Maintenance

Update Your Models If:

- The SO indicates it is updating software package versions **or**
- An event investigation uncovers issues with a model, and the SO requests it be updated

Complete model updates within 3 months of request.

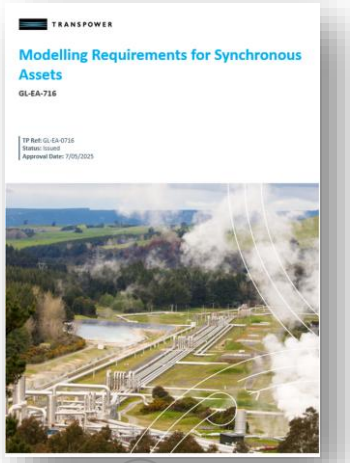
New Modelling Guidelines

~~GL-EA-716 Power Plant Dynamic Model Validation and Submission Prerequisites~~

~~Mathematical models and associated documentation when making submissions to the system operator~~

Modelling Requirements for Synchronous Assets

GL-EA-716

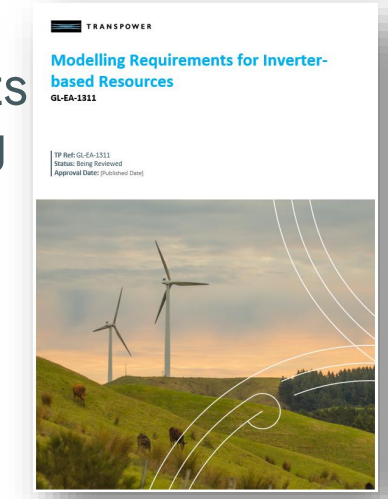


- **Previously** the guideline for both synchronous machines and IBR
- **Now** contains requirements for synchronous machine modelling

Modelling Requirements for Inverter-based Resources

GL-EA-1311

- **Now** contains requirements for IBR and DFIG modelling



Modelling Guidelines: Commonalities and Changes

Unchanged

- Intended model use
- Model performance and reliability requirements
- Model adequacy requirements
- Validation report requirements

Changed

- Model acceptance criteria
- More detailed network model integration section
- User guide requirements
- New subsection on both:
  - testing parameter integrity,
  - model validation parameter integrity

Changes – Model Acceptance Criteria

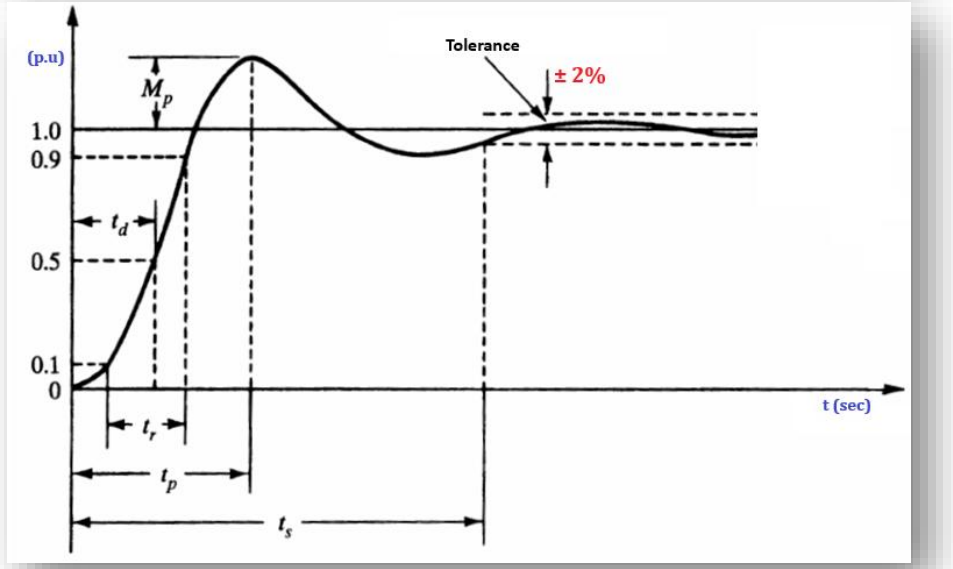
Steady-state (non-disturbance)

- P, Q, V, and F remain within given ranges for 120s (RMS) or 30s (EMT)

Quantity	Acceptable range
Generator MW and MVAR	With in ±1% of MW and MVAR setpoint
Synchronous generator speed (where applicable)	With in 1 pu ± 0.005 pu
Controlled voltages	With in ±0.005 pu of Voltage setpoint

Transient Response

- Requirements on various times (e.g. delay, rise, peak, settling) and other control system responses
- IBR have additional small signal response (oscillation test) acceptance criteria for TSAT benchmarking



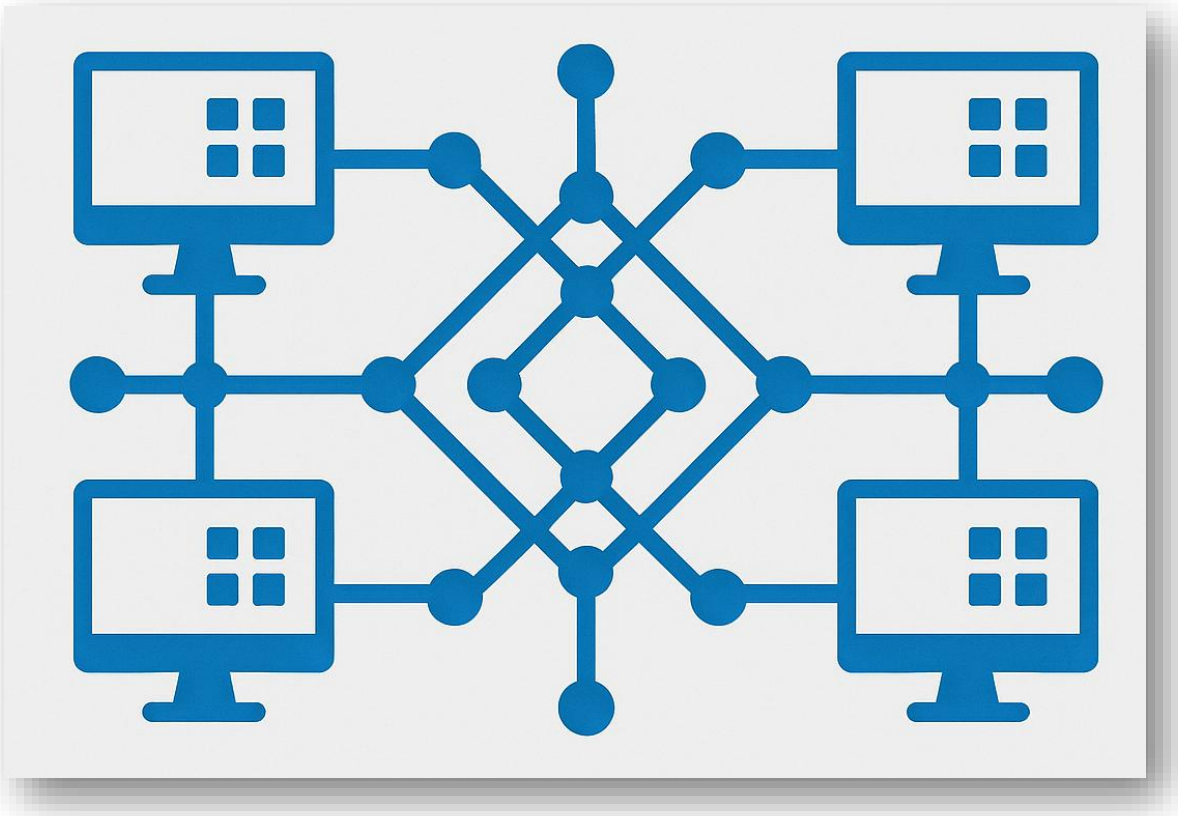
Changes – Network Model Integration

Non-disturbance Simulation

- 120s (RMS) or 30s (EMT) simulation time
- Simulation will confirm stable P, Q, V, and F

Disturbance Simulations

- 3ph-g and 2ph-g faults
- Under- and over-frequency events
- Model should remain stable following fault clearance and system recovery



GL-EA-716 – Synchronous Assets

Unchanged

- Required detail on generator model parameters, voltage control systems, and frequency control systems and turbines.
- Request for **unencrypted** Powerfactory models

Changes to the guideline

- No longer has TSAT or PSCAD sections as these are not required model software packages for synch machines

GL-EA-1311 – IBRs, BESS and DFIGs

Unchanged

- RMS model initialisation requirements
- Scope for modelling static VAR systems

Changes to the guideline

- More detail on EMT model performance requirements
- New section for benchmarking TSAT model against PSCAD model
- New section on impedances required to be modelled
- More detail on aggregation requirements

GL-EA-1311 – EMT Models: Performance

Large disturbance

The model must:

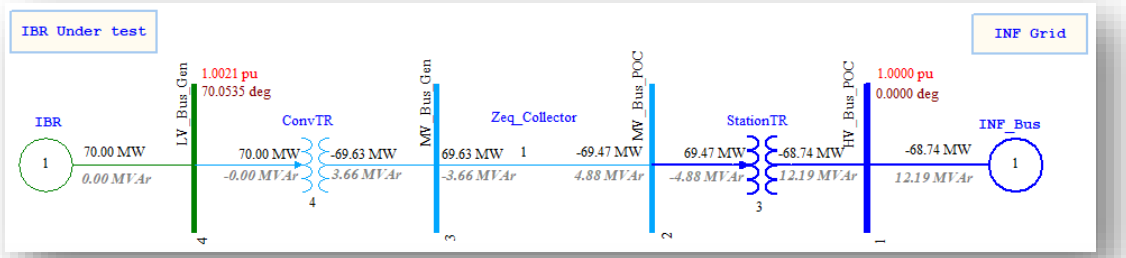
- Correctly represent converter current responses
- Demonstrate stable and physically realistic PLL behaviour
- Correctly represent the dynamic behaviour of the plant

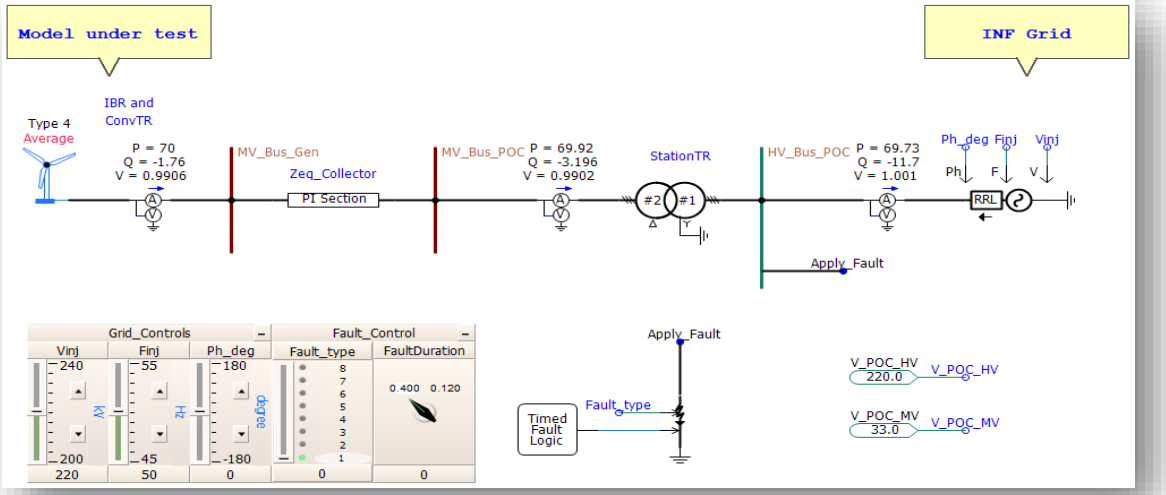
Small disturbance

The model must:

- Accurately represent small-signal and control interaction dynamics
- Support frequency or dq-frame interrogation (eg impedance/admittance scanning)

GL-EA-1311 - Benchmarking





Measured Quantities

- POC RMS bus voltage and frequency
- Plant active and reactive power
- Control signals (as applicable)
- Vd, Vq, id, iq, PLL angle and frequency
- FRT flags, protection flags

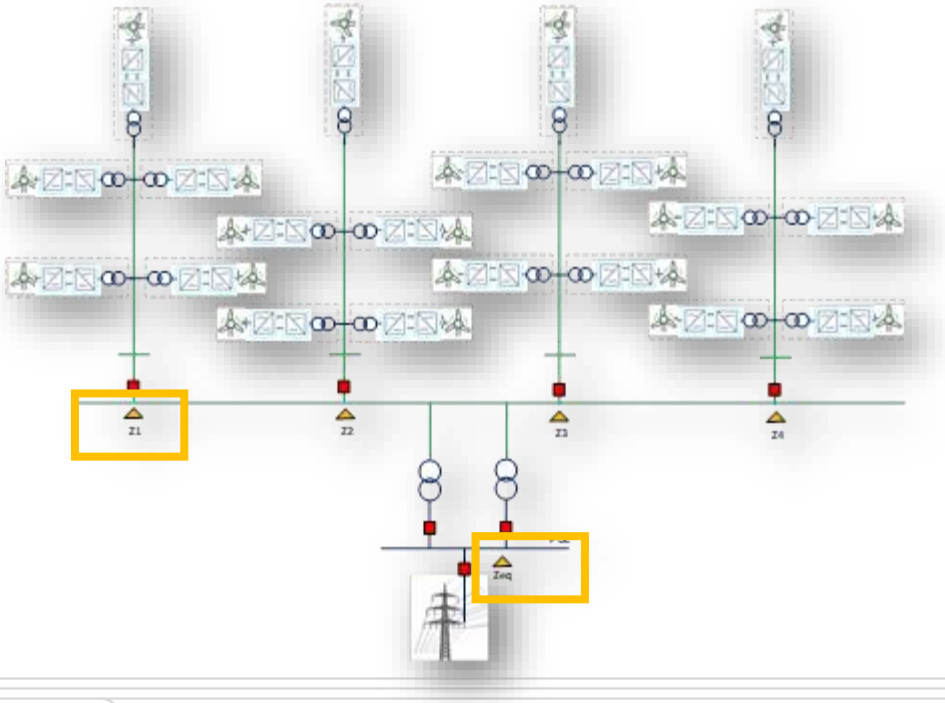
Tests

- Non-disturbance
- Voltage step, frequency step
- Fault response
- Frequency controller priority
- Modulation/Oscillation Test

GL-EA-1311 - Impedances

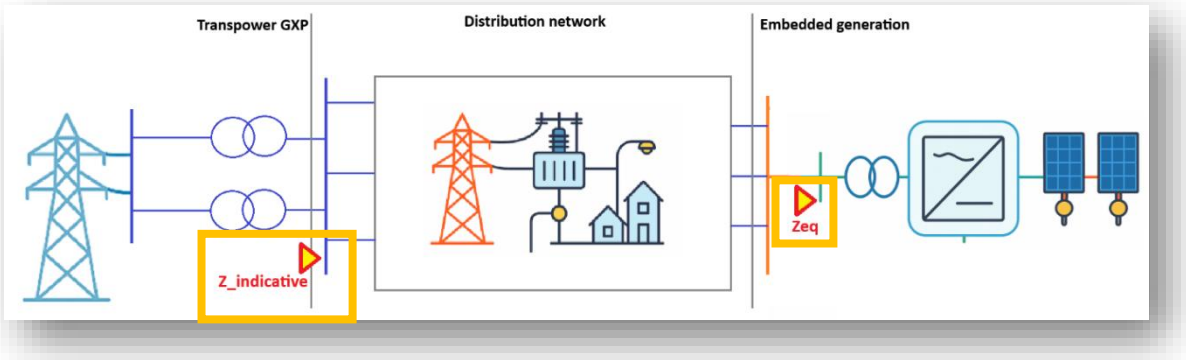
Grid-connected

- Zeq – Total station impedance, as seen from the PoC
- Impedance of each string of inverters from the collector bus.

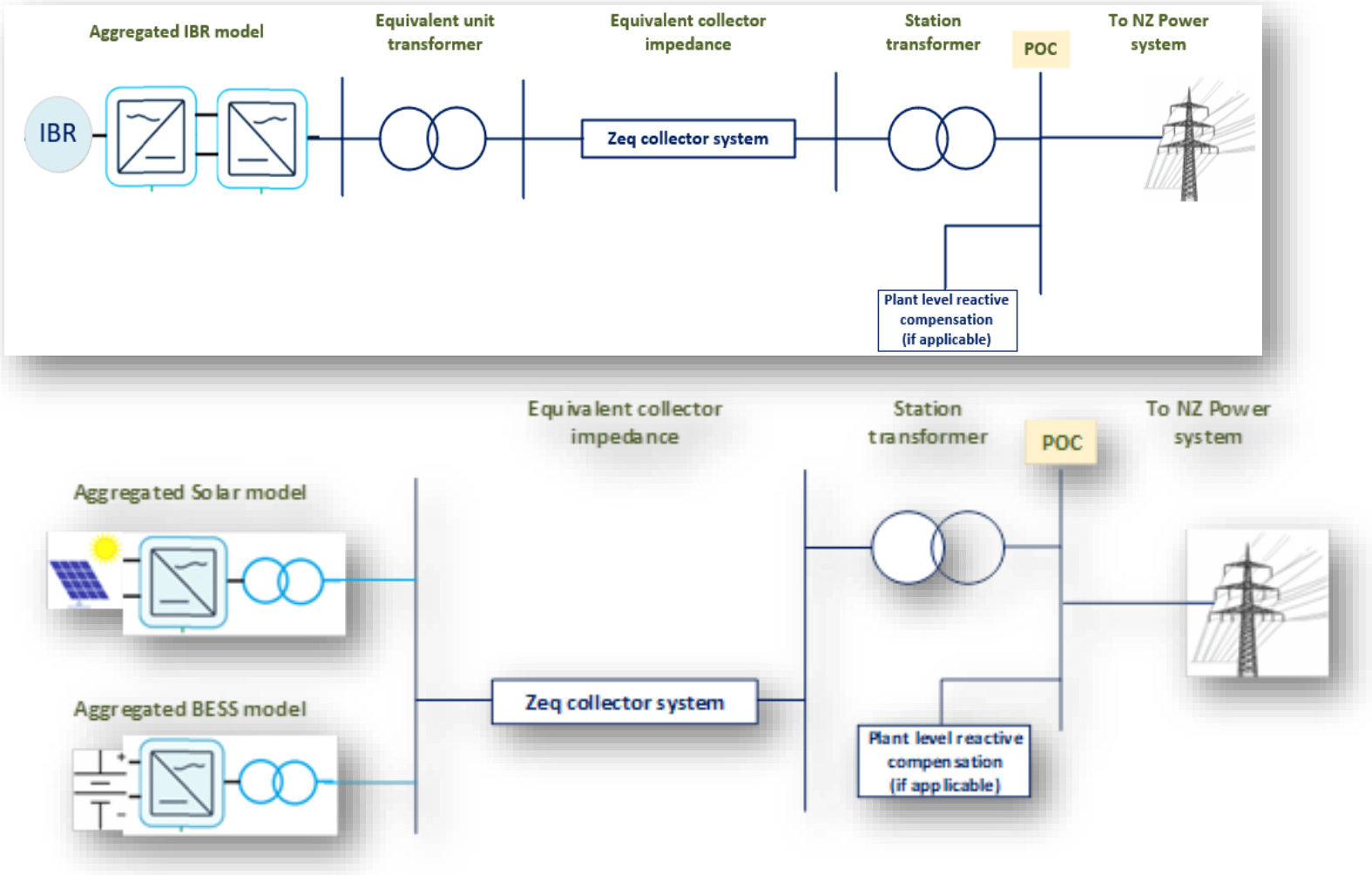


Embedded

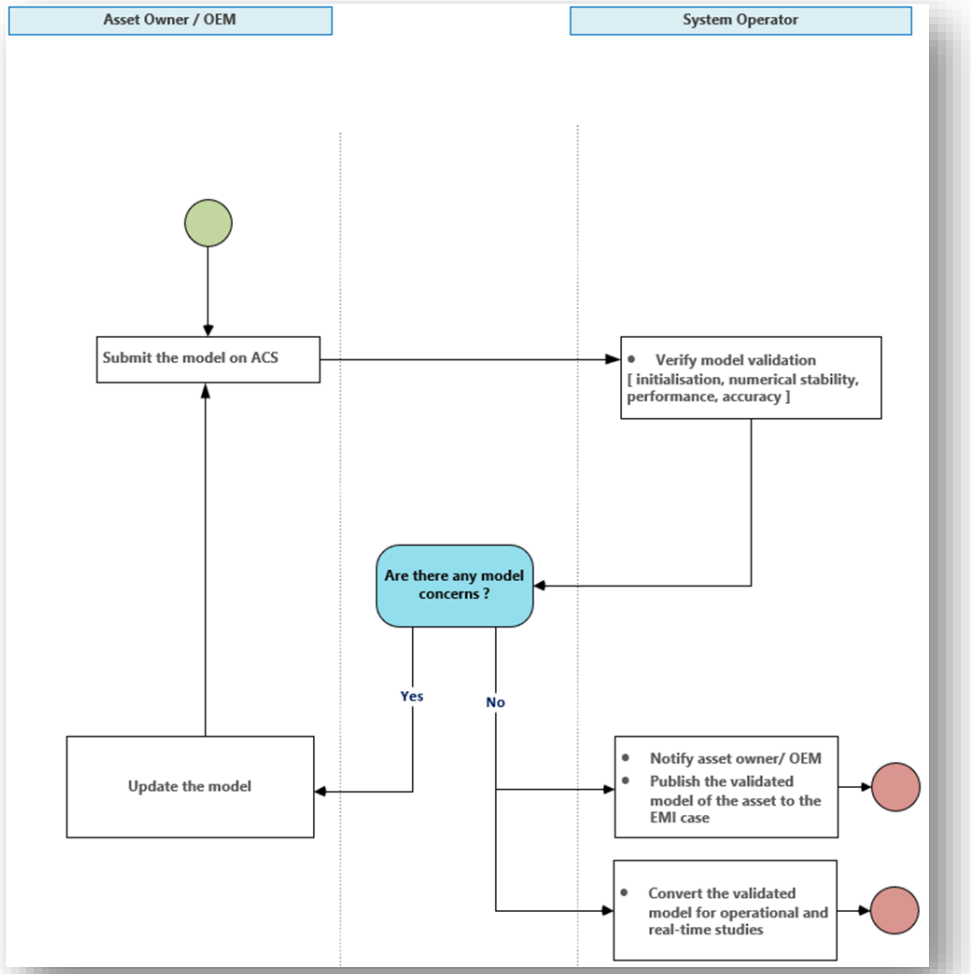
- Z_indicative - an approximate impedance of the distribution network, as seen from the GXP.
- Zeq – Total station impedance, as seen from the PoC



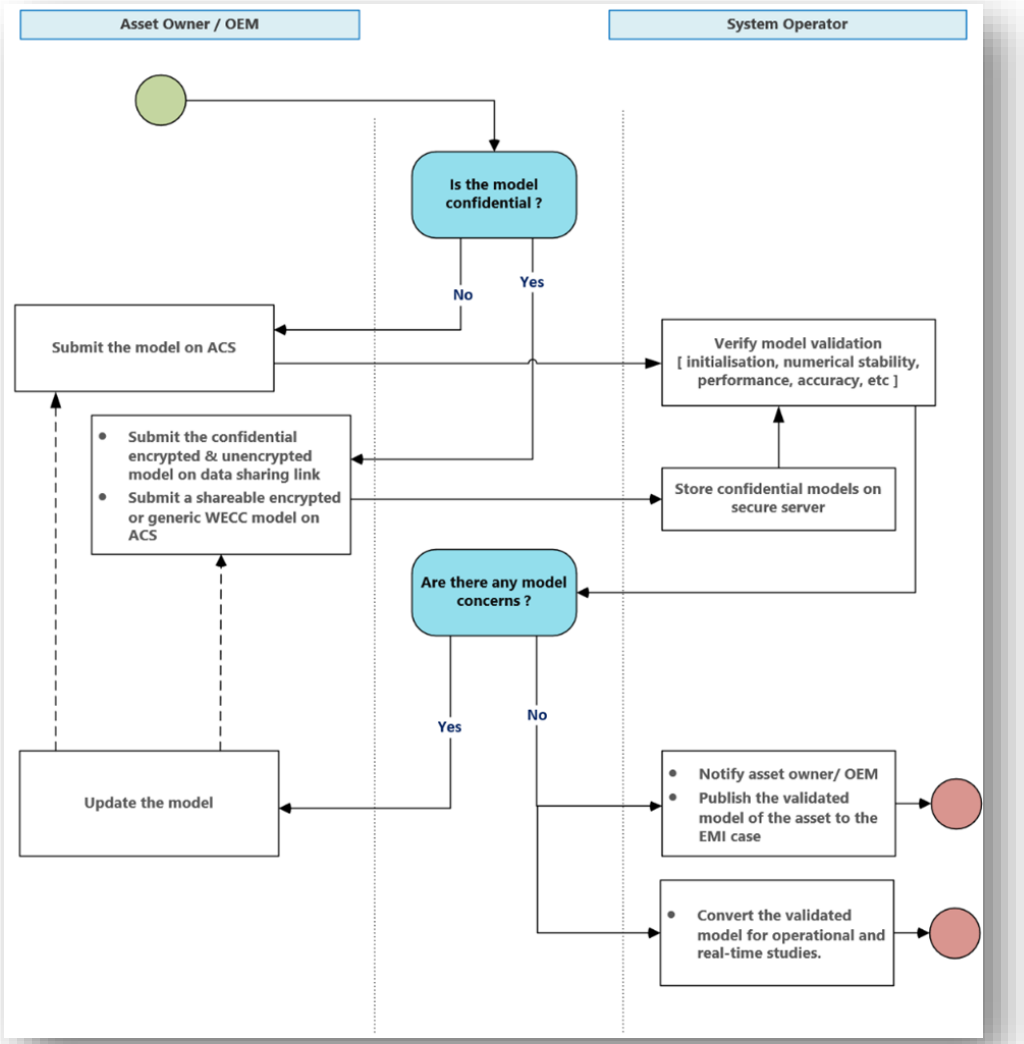
GL-EA-1311 - Aggregation



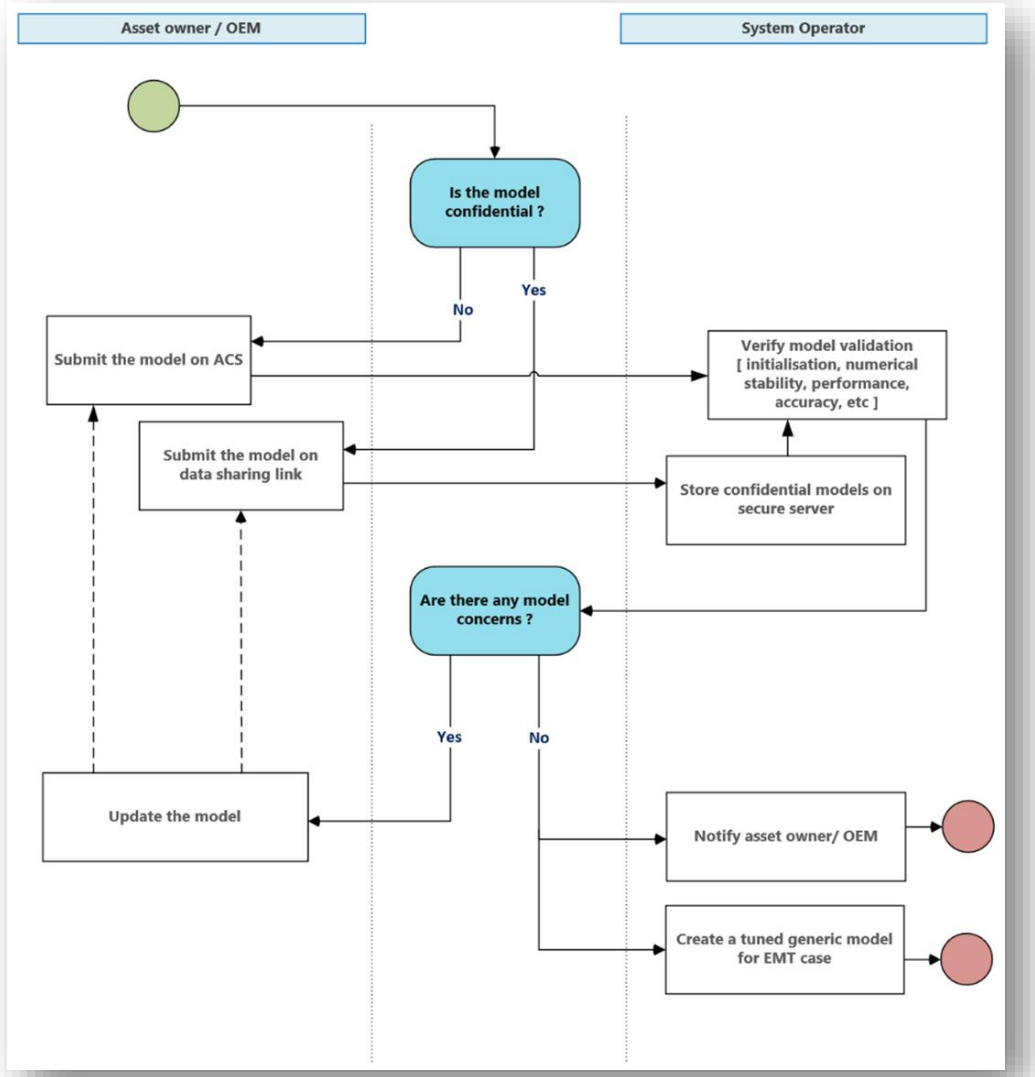
RMS Model Submission – Synch Machines



RMS Model Submission – IBR



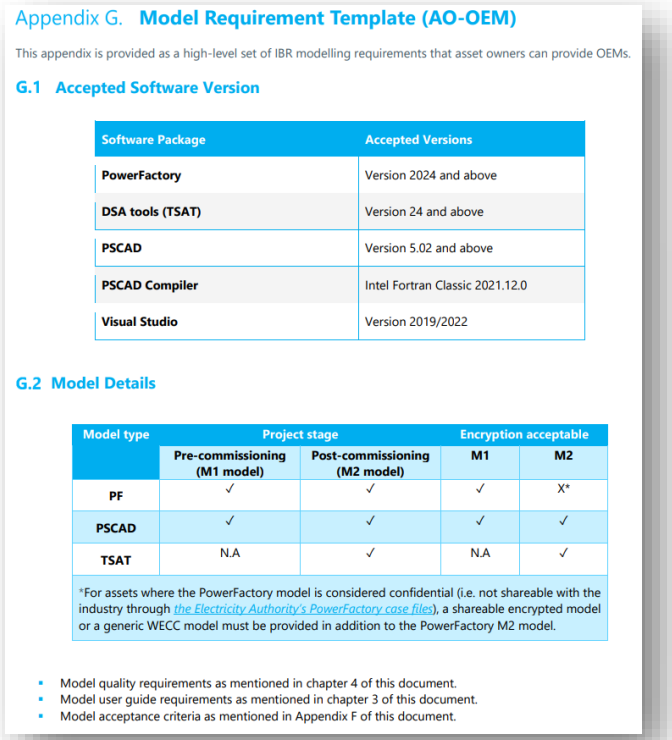
EMT Model Submission – IBR



Model Confidentiality

Confidentiality of Models

- Captured in the Code itself (Decision paper)
  - (Clause 3(2A)(a) and (b) of Technical Code A)
- OEM feedback – EA-SO-OEM discussion



Appendix G. **Model Requirement Template (AO-OEM)**

This appendix is provided as a high-level set of IBR modelling requirements that asset owners can provide OEMs.

G.1 Accepted Software Version

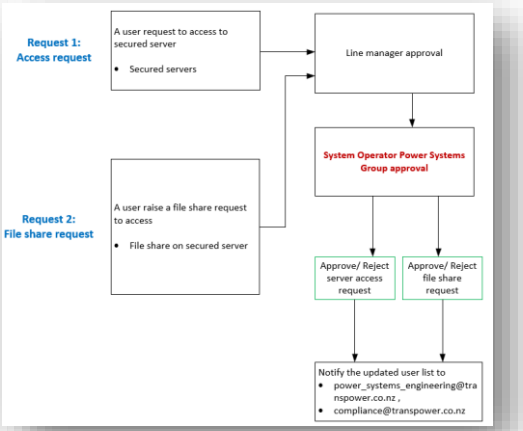
Software Package	Accepted Versions
PowerFactory	Version 2024 and above
DSA tools (TSAT)	Version 24 and above
PSCAD	Version 5.02 and above
PSCAD Compiler	Intel Fortran Classic 2021.12.0
Visual Studio	Version 2019/2022

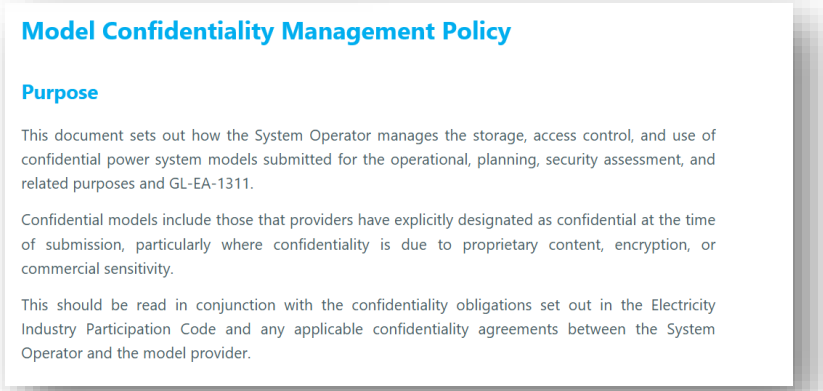
G.2 Model Details

Model type	Project stage		Encryption acceptable	
	Pre-commissioning (M1 model)	Post-commissioning (M2 model)	M1	M2
PF	✓	✓	✓	X*
PSCAD	✓	✓	✓	✓
TSAT	N.A	✓	N.A	✓

*For assets where the PowerFactory model is considered confidential (i.e. not shareable with the industry through the Electricity Authority's PowerFactory case files), a shareable encrypted model or a generic WECC model must be provided in addition to the PowerFactory M2 model.

- Model quality requirements as mentioned in chapter 4 of this document.
- Model user guide requirements as mentioned in chapter 3 of this document.
- Model acceptance criteria as mentioned in Appendix F of this document.





Model Confidentiality Management Policy

Purpose

This document sets out how the System Operator manages the storage, access control, and use of confidential power system models submitted for the operational, planning, security assessment, and related purposes and GL-EA-1311.

Confidential models include those that providers have explicitly designated as confidential at the time of submission, particularly where confidentiality is due to proprietary content, encryption, or commercial sensitivity.

This should be read in conjunction with the confidentiality obligations set out in the Electricity Industry Participation Code and any applicable confidentiality agreements between the System Operator and the model provider.

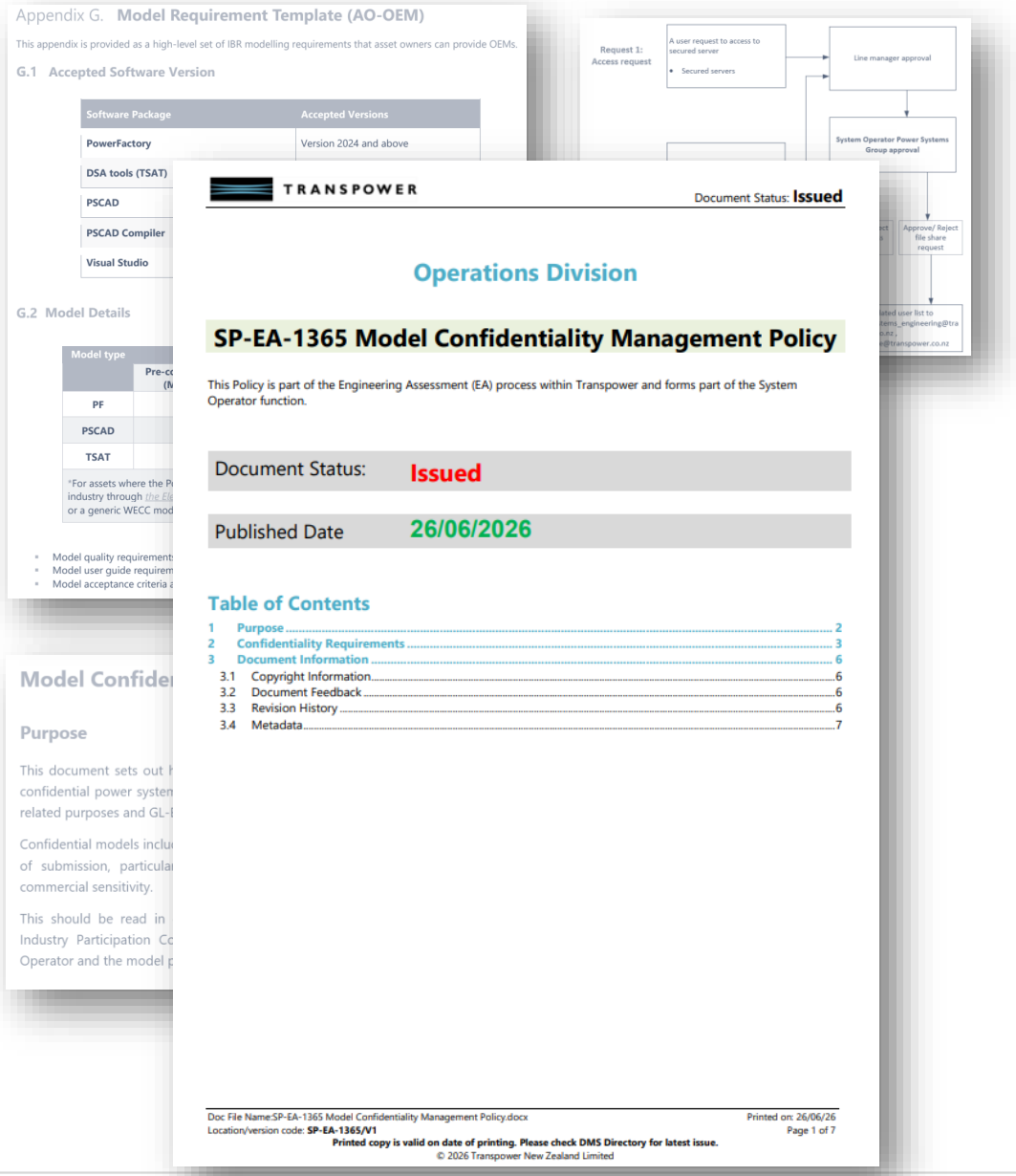
Model Confidentiality

Confidentiality of Models

- Captured in the Code itself (Decision paper)
  - (Clause 3(2A)(a) and (b) of Technical Code A)
- OEM feedback – EA-SO-OEM discussion

SP-EA-1365

- New document published
- SO confidentiality provisions
- Storage of models
- Access to model storage
- Use of models



Operational Communications and High-speed Data Requirements

Kanishka Fonseka

Senior Engineer | Power Systems Group

CACTIS Chapter 8
Operational Communications Requirements

Context

- Chapter 8 replaces Tech Code C in Schedule 8.3
- All requirements in the Tech Code C are included
- **Plus** some new measurement and indication requirements

Additional Operational Communications Requirements

	Indication or measurement	Values required
Generators (common for all types of generators)	Frequency Control Operation Mode	Enabled/disabled
	Voltage Control Operation Mode	Enabled/disabled
	Power System Stabiliser or Power Oscillation Damper Status	Enabled/disabled
	Station HV Bus voltage (if HV bus is not owned by the GO)	kV (+/-2% accuracy)

	Indication or measurement	Values required
Wind, solar and BESS	Number of active inverters or wind turbines in the generating station	
	Station available MW	The available active power if generating the maximum active power possible given the available fuel resource
	Station MV busbar voltage	kV

Additional Operational Communications Requirements

BESS	Indication or measurement	Values required
	Generating station state of charge (%)	Must be the energy stored in the BESS as a percentage of nameplate rated capacity, irrespective of any state of charge limit

Solar	Indication or measurement	Values required
	Solar irradiance horizontal (W/m^2)	Must be the average of all sensors on the site

Wind	Indication or measurement	Values required
	Wind speed at nacelle height (km/h)	Must be the average of every nacelle or group of nacelles

Additional Operational Communications Requirements

	Indication or measurement	Values required
Hybrid plant	Generation station intermittent generation MW	Import and export (+/-2%)
	Generation station BESS Injection/Load MW	Import and export (+/-2%)

	Indication or measurement	Values required
Grid Owner	Reactive Power Controller status	Enabled/disabled
	Reactive Power Controller setpoint	kV or MVAr

Additional Operational Communications Requirements

	Indication or measurement	Values required
Connected asset owner	Controllable load available MW	Any controllable load that is not currently off or armed for interruptible load Actual or calculated (±5% accuracy) *
	Controllable load currently off MW	Actual or calculated (±5% accuracy) *
	Controllable load armed for interruptible load MW	Actual (±2% accuracy) *

*Per GXP unless agreed otherwise by the asset owner and the System Operator

What Asset Owners Need to Do

Connected Asset Owners - provide controllable load data by 1 July 2027

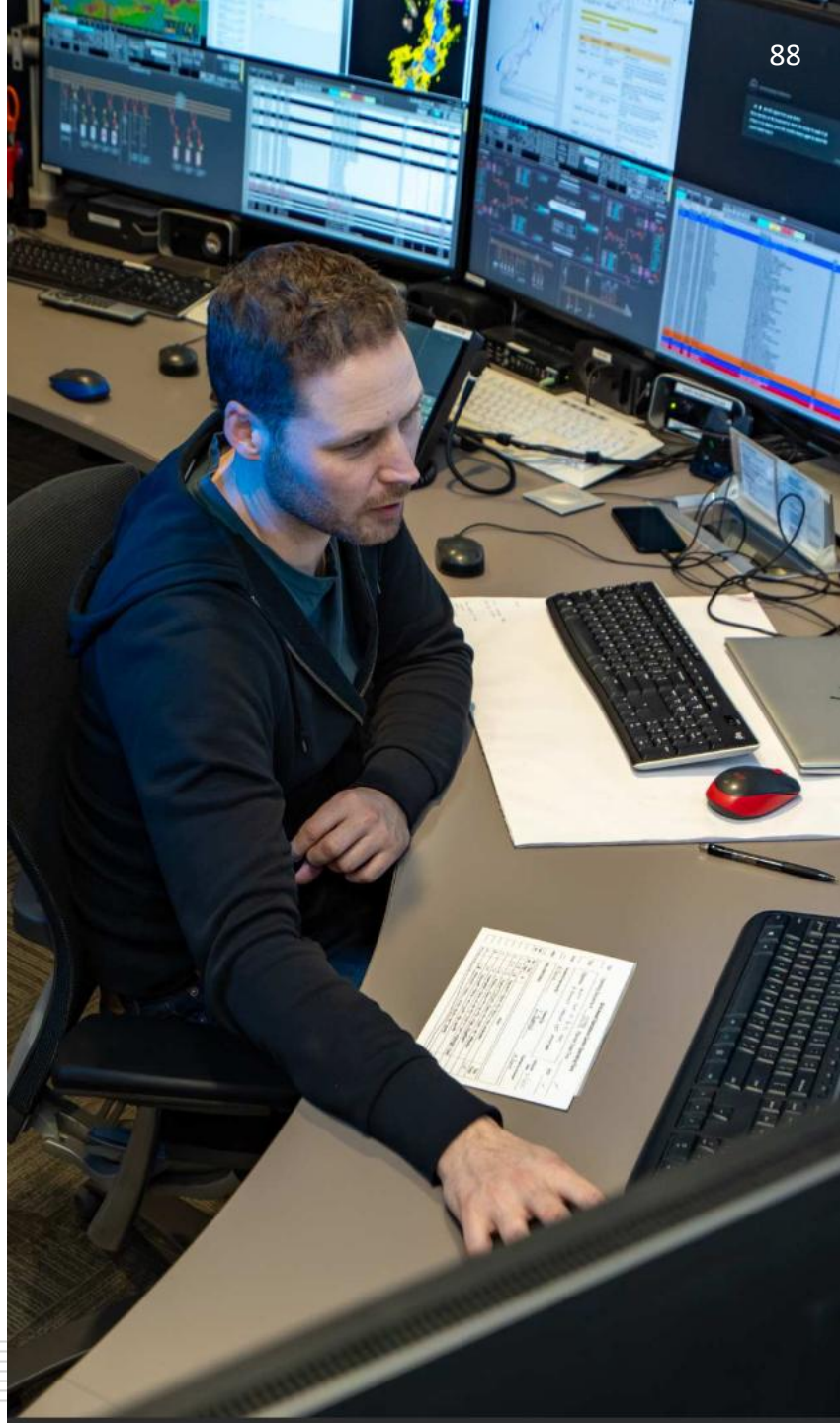
- Through the existing or new ICCP configuration, or
- Through a third-party provider

Other Asset Owners – Existing or committed

- Add additional data through ICCP data set, or
- Seek relief through legacy clause

Other Asset Owners – New

- Comply all data requirements though ICCP



TRANSPOWER

CACTIS Chapter 9
High-speed Data Requirements

Context

- New requirement
- AOs to provide post event data for event analysis/investigation
- AOs to provide routine test data in accordance with CACTIS Chapter 7

High-speed Data Requirements

Indication or measurement	Notes
Generating station active power (MW)	Must provide all values other than frequency per-phase
Generating station reactive power (MVAr)	
Generating station frequency (Hertz)	
Generating station transformer HV voltage (kV)	
Generating station transformer HV current (A)	

High-speed Data Requirements

Triggers

Trigger type	Setting
Under-voltage	90% Nominal voltage
Over-voltage	110% Nominal voltage
Under-frequency	49.5 Hz
Over-frequency	50.5 Hz

GPS time stamped data recording

- Pre-trigger, 10 s
- Post-trigger, 120 s
- At a resolution of 20ms or better

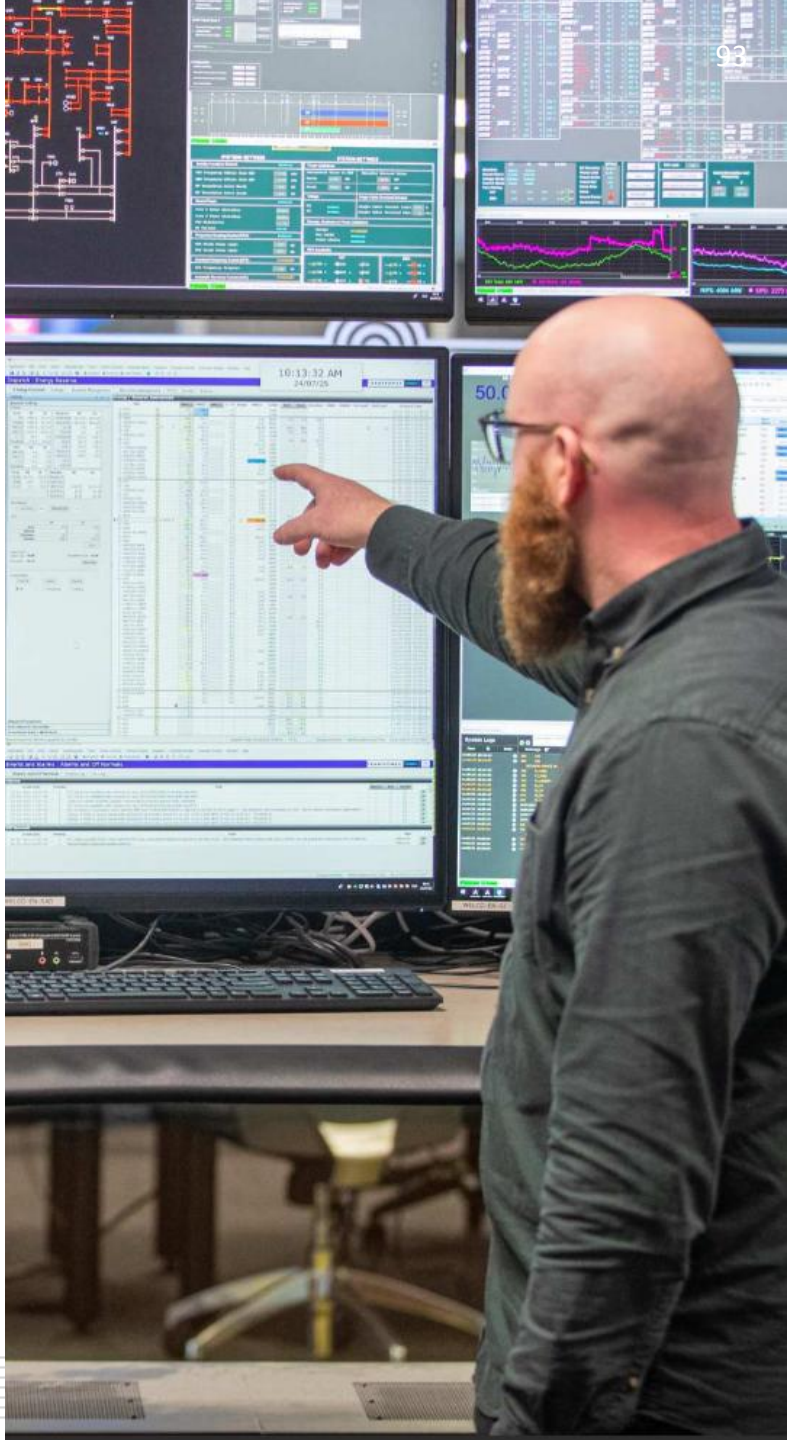
What Asset Owners Need to Do

Generators – Existing or committed

- If not present, install high-speed data monitors, or
- Seek relief through legacy clause

Generators – New

- Comply with high-speed data monitoring requirement



Operational Communications and High-speed Data Requirements

Discussion

Updates to Information and Guidelines

Cris Cucerzan

Technical Enablement Specialist | Power Systems Group


CACTI'S

1st Point of Access Information

Generation Connection Guide

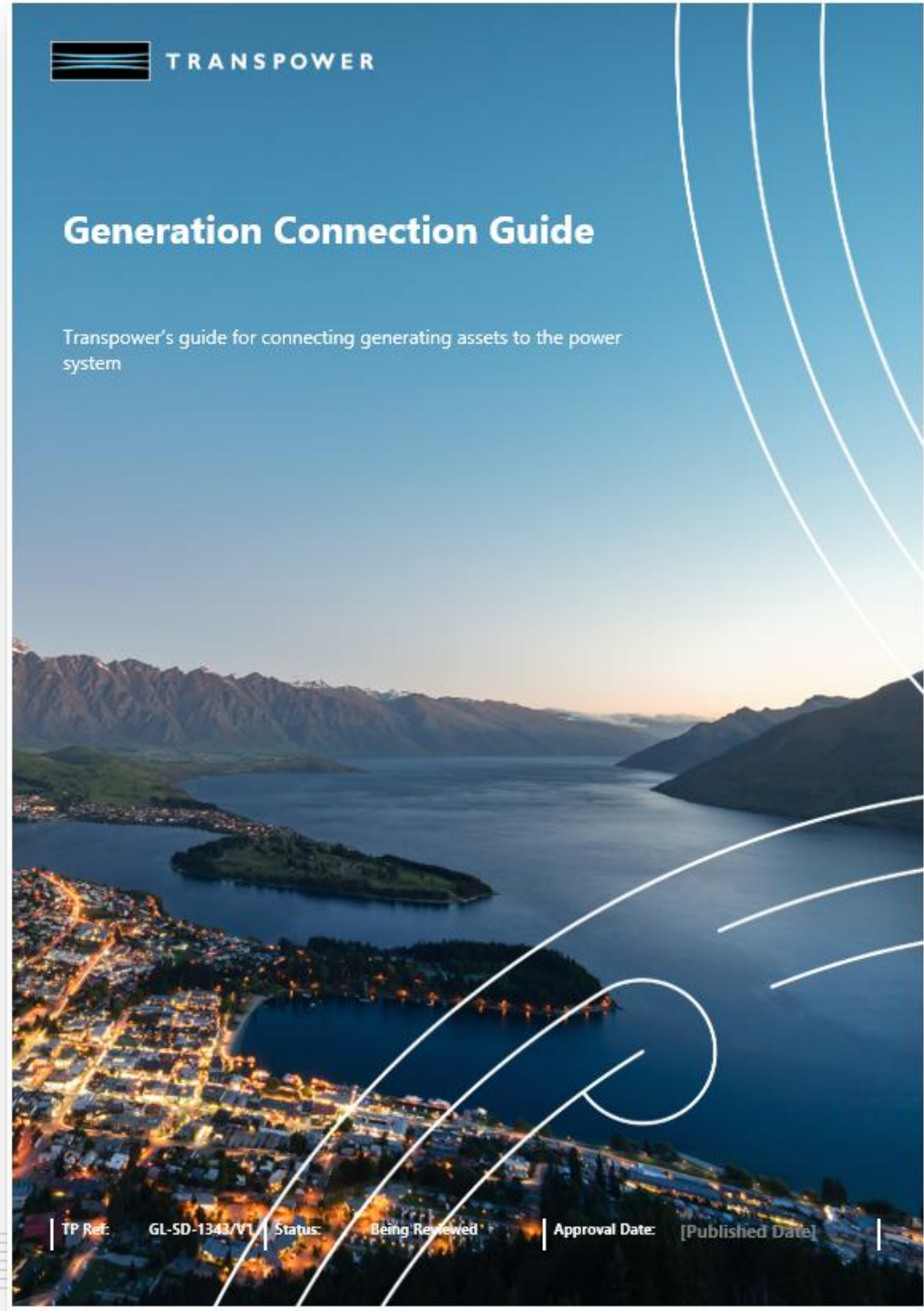
Webpages

Generation Connection Guide

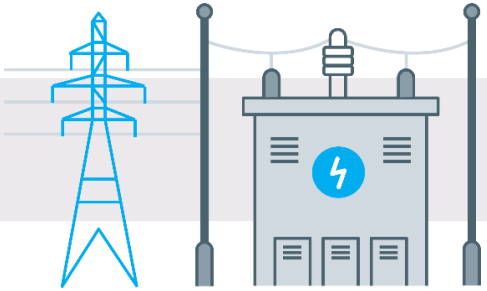
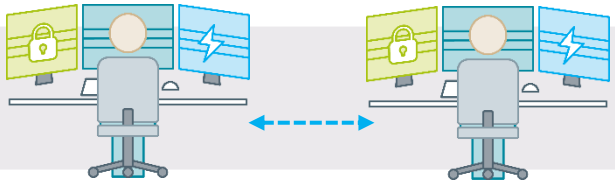
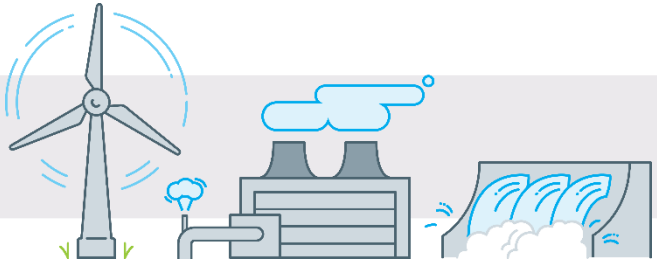
- Consolidated processes into three workstreams:

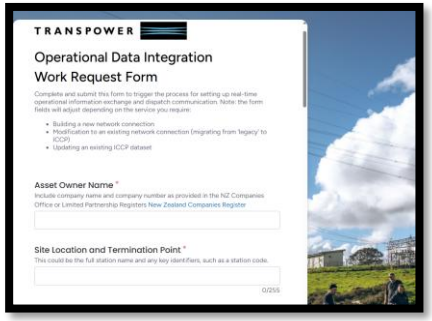
A: Transmission Connection	for all generating stations connecting **directly** to Transpower's grid
B: Operational Data Integration	for all generating stations connecting **directly** to Transpower's grid *and* **embedded** generating stations > 10 MW capacity.
C: Generation Commissioning	for all generating stations with > 1 MW capacity.

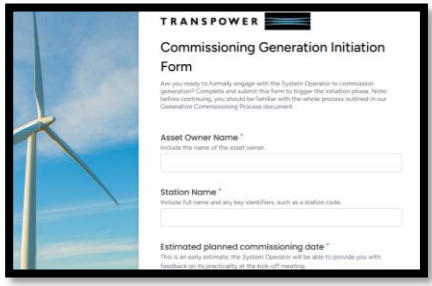
- Market registration information integrated within Workstream C.
- Dispatch information shifted online.



How to Connect

		Entry Point
Workstream A: Transmission Connection		Enquiry to Transpower's Customer Solutions Team (if grid-connected)
Workstream B: Operational Data Integration		Operational Data Integration Work Request Form
Workstream C: Generation Commissioning		Commissioning Generation Initiation Form

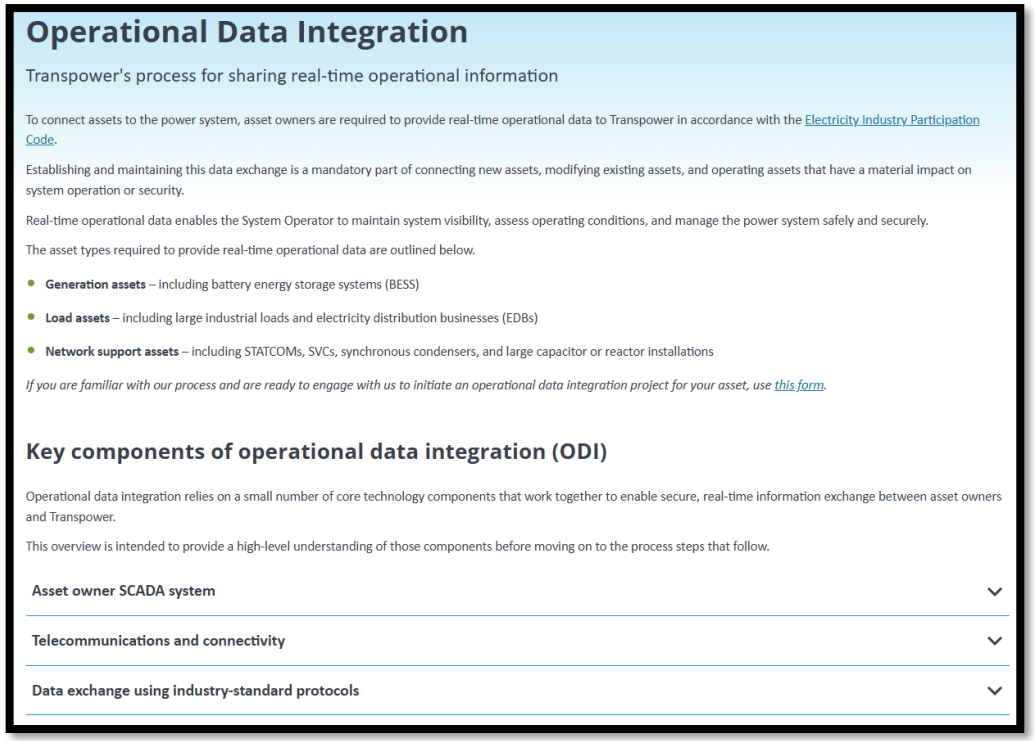




Questions along the way? Contact Customer Solutions at **customer.solutions**@transpower.co.nz.

New Webpages

- Operational Data Integration
- About Generation Offers and Dispatch



Operational Data Integration

Transpower's process for sharing real-time operational information

To connect assets to the power system, asset owners are required to provide real-time operational data to Transpower in accordance with the Electricity Industry Participation Code.

Establishing and maintaining this data exchange is a mandatory part of connecting new assets, modifying existing assets, and operating assets that have a material impact on system operation or security.

Real-time operational data enables the System Operator to maintain system visibility, assess operating conditions, and manage the power system safely and securely.

The asset types required to provide real-time operational data are outlined below.

- **Generation assets** – including battery energy storage systems (BESS)
- **Load assets** – including large industrial loads and electricity distribution businesses (EDBs)
- **Network support assets** – including STATCOMs, SVCs, synchronous condensers, and large capacitor or reactor installations

If you are familiar with our process and are ready to engage with us to initiate an operational data integration project for your asset, use this form.

Key components of operational data integration (ODI)

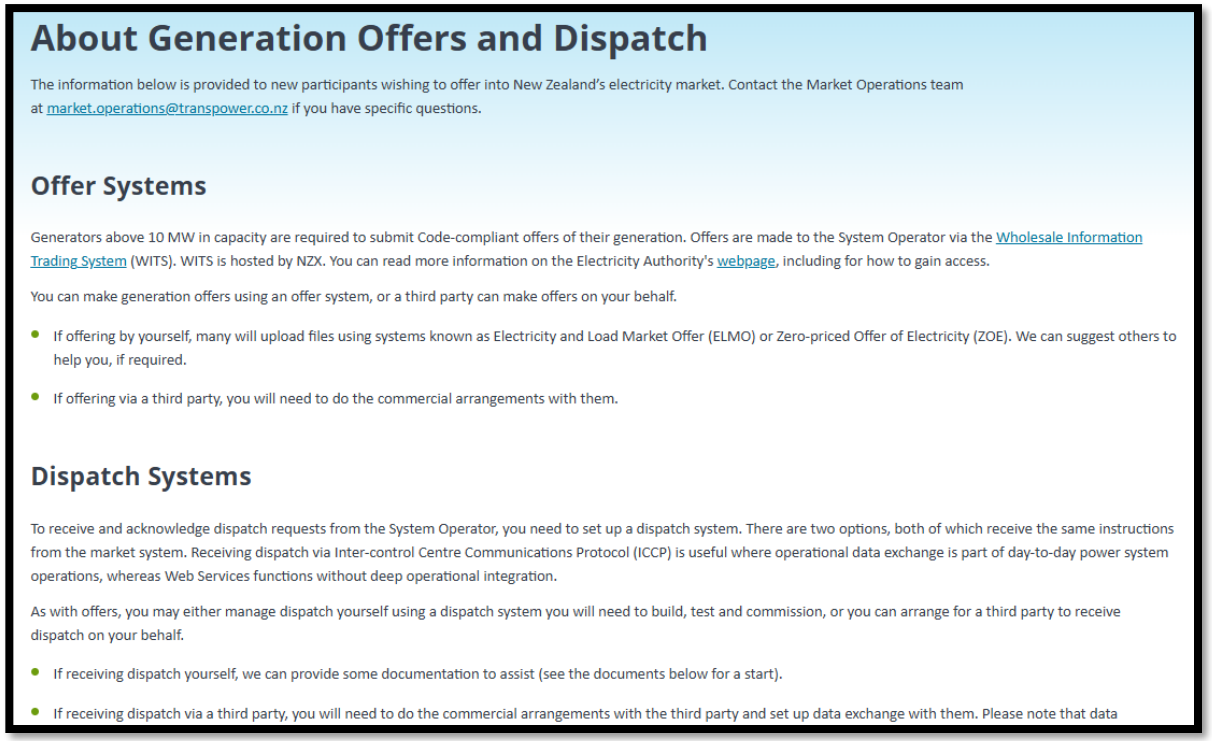
Operational data integration relies on a small number of core technology components that work together to enable secure, real-time information exchange between asset owners and Transpower.

This overview is intended to provide a high-level understanding of those components before moving on to the process steps that follow.

Asset owner SCADA system

Telecommunications and connectivity

Data exchange using industry-standard protocols



About Generation Offers and Dispatch

The information below is provided to new participants wishing to offer into New Zealand's electricity market. Contact the Market Operations team at market.operations@transpower.co.nz if you have specific questions.

Offer Systems

Generators above 10 MW in capacity are required to submit Code-compliant offers of their generation. Offers are made to the System Operator via the Wholesale Information Trading System (WITS). WITS is hosted by NZX. You can read more information on the Electricity Authority's webpage, including for how to gain access.

You can make generation offers using an offer system, or a third party can make offers on your behalf.

- If offering by yourself, many will upload files using systems known as Electricity and Load Market Offer (ELMO) or Zero-priced Offer of Electricity (ZOE). We can suggest others to help you, if required.
- If offering via a third party, you will need to do the commercial arrangements with them.

Dispatch Systems

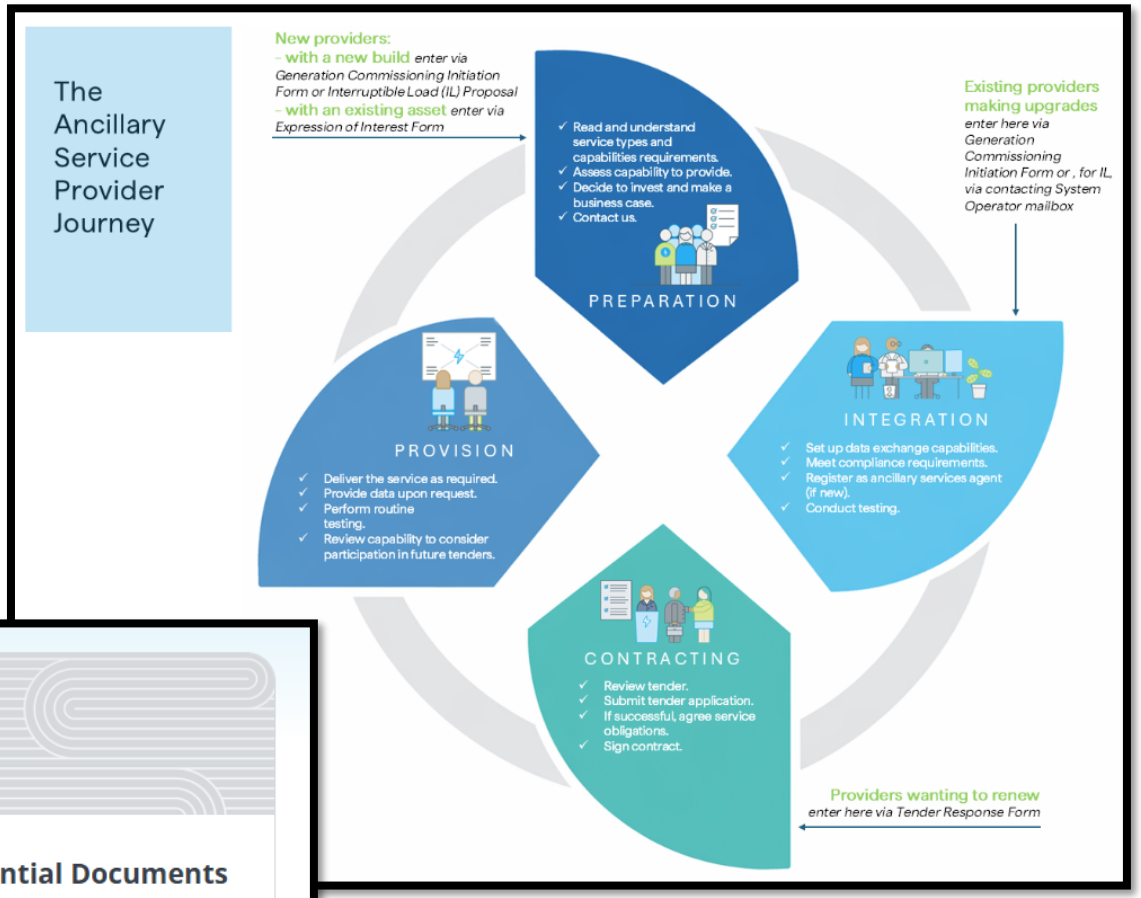
To receive and acknowledge dispatch requests from the System Operator, you need to set up a dispatch system. There are two options, both of which receive the same instructions from the market system. Receiving dispatch via Inter-control Centre Communications Protocol (ICCP) is useful where operational data exchange is part of day-to-day power system operations, whereas Web Services functions without deep operational integration.

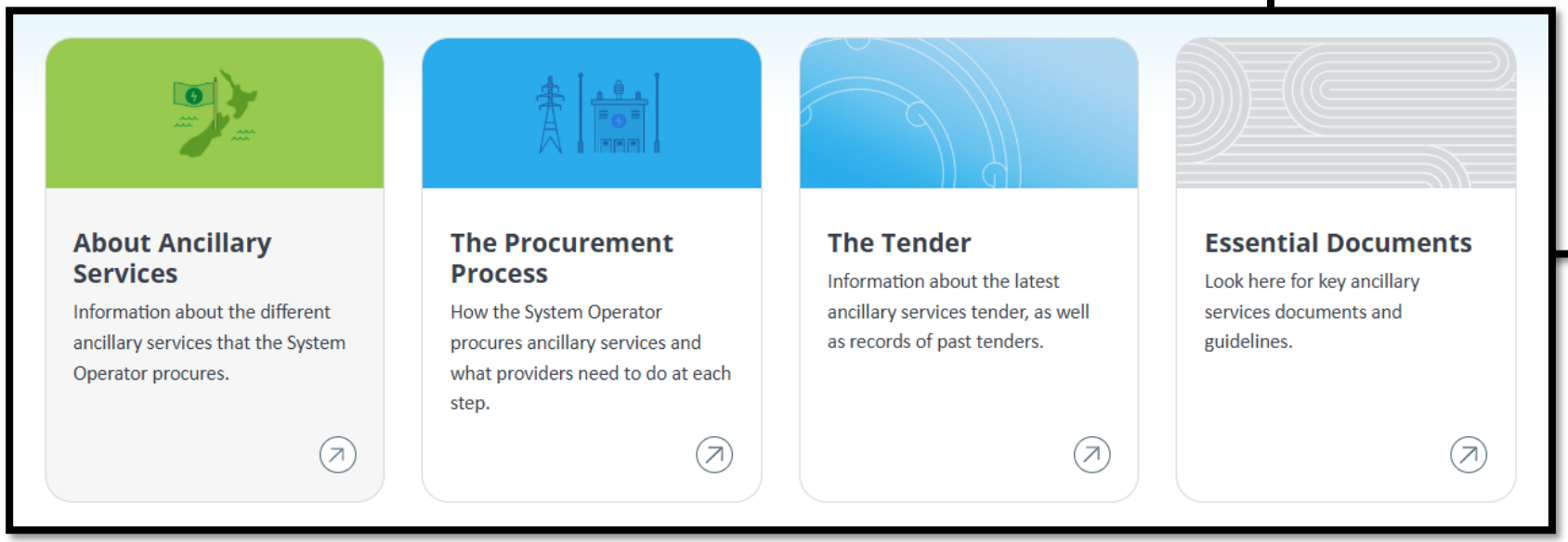
As with offers, you may either manage dispatch yourself using a dispatch system you will need to build, test and commission, or you can arrange for a third party to receive dispatch on your behalf.

- If receiving dispatch yourself, we can provide some documentation to assist (see the documents below for a start).
- If receiving dispatch via a third party, you will need to do the commercial arrangements with the third party and set up data exchange with them. Please note that data

New Webpages

- Ancillary Services





New Webpages

- CACTIS

Connected Asset Commissioning, Testing and Information Standard (CACTIS)

Transpower, in its role as System Operator, maintains the Connected Asset Commissioning, Testing and Information Standard (CACTIS), which the Electricity Authority (the Authority) has incorporated into the Electricity Industry Participation Code (the Code). The CACTIS specifies the technical requirements related to asset capability information, commissioning, modelling, testing, and operational communications. The CACTIS takes effect on 1 July 2026.

The CACTIS will apply to asset owners connecting new assets to the power system or modifying existing connected assets, including:

- Generation
- Batteries
- Loads
- Other connected assets subject to Code obligations

Frequency Deadband Information Requirements

As part of the information obligations in the CACTIS, asset owners must provide additional frequency control data to the System Operator by updating their generating station's asset capability statement (ACS). Under "Governor system" or under the "frequency control system" subsection in the Generator section, update the following:

- Positive frequency deadband*
- Negative frequency deadband*
- Your latest governor/frequency control system test date

* Note: in accordance with Technical Code A, clause 5 (1) (4), the frequency deadband must be set so that it does not exceed the greater of ± 0.1 Hertz or the inherent deadband of the generating unit, as agreed with the System Operator acting reasonably. Geothermal generating stations are excluded from this requirement.

This information will help us to manage the transition process for frequency control arrangements and accurately model deadband characteristics within our operational tools.

Applicability

For generating stations that are not excluded and were electrically connected to a network prior to 1 July 2026, this requirement applies **from the time of the next routine test** of the generating station.

Owners of generating stations connecting to a network from 1 July 2026 onwards must perform the **GEN_DBD** (for synchronous assets) or **ING_DBD** (for inverter-based resources) tests as part of commissioning and routine test sequences. Both tests can be found in our GL-EA-010 Generator Testing Requirements document.

Legacy Clause Provisions

Some asset owners may be eligible for their assets to be grandfathered under new legacy clause provisions that exempt them from complying with parts of the new obligations. The Part 8 Code amendment decisions released in March 2026 set out eligibility criteria for legacy clause provisions. Owners of generating stations that meet the criteria must update their asset capability statement (ACS) to record the application of any legacy clause provision. To do this, download and fill out our Legacy Status Note template, then upload it to the ACS application along with any supporting material.

Additionally, asset owners of in-flight commissioning projects above 10 MW that connect to the power system between 1 July 2026 and 1 July 2027 may also be eligible to be grandfathered, provided they meet further project feasibility criteria outlined in the frequency, voltage, and CACTIS decision papers. Asset owners must indicate their eligibility by filling out the application form so that the System Operator may assess eligibility.

The deadline to update your ACS with the Legacy Status Note and submit the above application form is **1 August 2026**.

The Code mandates that we maintain a list of generating stations qualifying for the legacy clause provisions. This list includes existing stations connected before 1 July 2026 that are unable to meet the new requirements, and generating stations that meet the prescribed criteria and connect to the power system before 1 July 2027. Once available, the list will be published here.

Note: Once a generating station qualified for legacy clause provisions, those provisions may cease to apply if the asset is materially changed. If the generating station's output changes by more than 5 MW (e.g. via an upgrade or modification), the legacy clause provisions related to frequency and voltage obligations will no longer apply. Additionally, the legacy clause provision related to the CACTIS will no longer apply if there is a 5% change in MW rating, or frequency response curve for 100ms or longer, or voltage response curve for 100ms or longer. See the above decision papers for more detail.

Updated Webpages

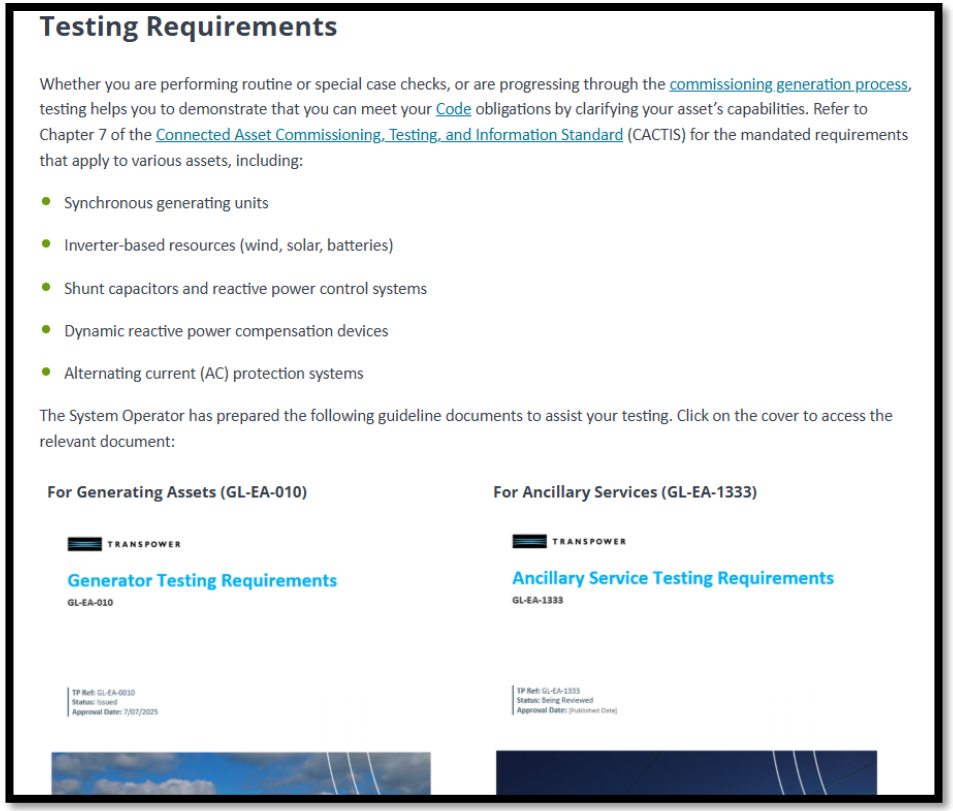
- Commissioning Generation & FAQs
- Asset Testing

The Six Phases of Commissioning

Our commissioning process can be broken down into six phases. Our GL-EA-404 Generation Commissioning Process document provides an overview and how each phase flows into the next. It also provides a clear indication of all the timings involved in the process - both the mandated time frames listed in the CACTIS, as well as recommended timings for preparation activities or drafting documents.

For a more detailed look at each of phase, click on the phases below to reveal a summary of what activities to expect and links to the documents you should consult.

- Feasibility
- Initiation
- Planning
- Delivery
- Commissioning
- Closeout



Testing Requirements

Whether you are performing routine or special case checks, or are progressing through the commissioning generation process, testing helps you to demonstrate that you can meet your Code obligations by clarifying your asset's capabilities. Refer to Chapter 7 of the Connected Asset Commissioning, Testing, and Information Standard (CACTIS) for the mandated requirements that apply to various assets, including:

- Synchronous generating units
- Inverter-based resources (wind, solar, batteries)
- Shunt capacitors and reactive power control systems
- Dynamic reactive power compensation devices
- Alternating current (AC) protection systems

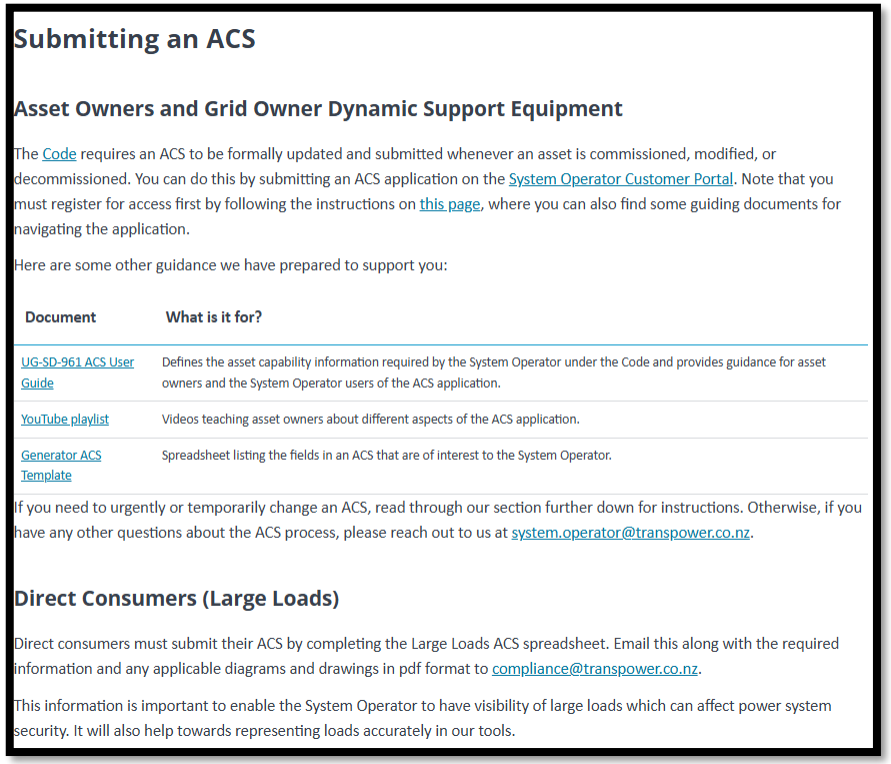
The System Operator has prepared the following guideline documents to assist your testing. Click on the cover to access the relevant document:

For Generating Assets (GL-EA-010)

For Ancillary Services (GL-EA-1333)

Updated Webpages

- Asset Capability Statements
- Power System Studies and Modelling



Submitting an ACS

Asset Owners and Grid Owner Dynamic Support Equipment

The Code requires an ACS to be formally updated and submitted whenever an asset is commissioned, modified, or decommissioned. You can do this by submitting an ACS application on the System Operator Customer Portal. Note that you must register for access first by following the instructions on this page, where you can also find some guiding documents for navigating the application.

Here are some other guidance we have prepared to support you:

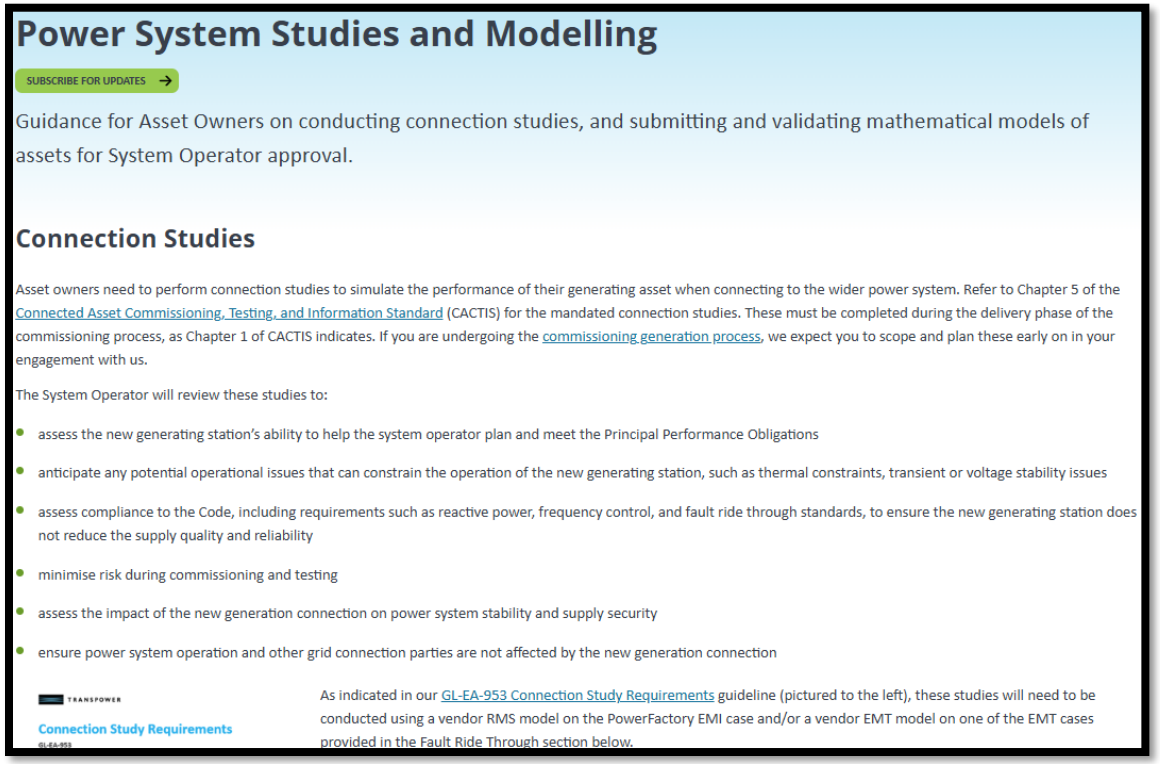
Document	What is it for?
UG-SD-961 ACS User Guide	Defines the asset capability information required by the System Operator under the Code and provides guidance for asset owners and the System Operator users of the ACS application.
YouTube playlist	Videos teaching asset owners about different aspects of the ACS application.
Generator ACS Template	Spreadsheet listing the fields in an ACS that are of interest to the System Operator.

If you need to urgently or temporarily change an ACS, read through our section further down for instructions. Otherwise, if you have any other questions about the ACS process, please reach out to us at system.operator@transpower.co.nz.

Direct Consumers (Large Loads)

Direct consumers must submit their ACS by completing the Large Loads ACS spreadsheet. Email this along with the required information and any applicable diagrams and drawings in pdf format to compliance@transpower.co.nz.

This information is important to enable the System Operator to have visibility of large loads which can affect power system security. It will also help towards representing loads accurately in our tools.



Power System Studies and Modelling

SUBSCRIBE FOR UPDATES →

Guidance for Asset Owners on conducting connection studies, and submitting and validating mathematical models of assets for System Operator approval.

Connection Studies

Asset owners need to perform connection studies to simulate the performance of their generating asset when connecting to the wider power system. Refer to Chapter 5 of the Connected Asset Commissioning, Testing, and Information Standard (CACTIS) for the mandated connection studies. These must be completed during the delivery phase of the commissioning process, as Chapter 1 of CACTIS indicates. If you are undergoing the commissioning generation process, we expect you to scope and plan these early on in your engagement with us.

The System Operator will review these studies to:

- assess the new generating station's ability to help the system operator plan and meet the Principal Performance Obligations
- anticipate any potential operational issues that can constrain the operation of the new generating station, such as thermal constraints, transient or voltage stability issues
- assess compliance to the Code, including requirements such as reactive power, frequency control, and fault ride through standards, to ensure the new generating station does not reduce the supply quality and reliability
- minimise risk during commissioning and testing
- assess the impact of the new generation connection on power system stability and supply security
- ensure power system operation and other grid connection parties are not affected by the new generation connection

TRANSPOWER

Connection Study Requirements

As indicated in our GL-EA-953 Connection Study Requirements guideline (pictured to the left), these studies will need to be conducted using a vendor RMS model on the PowerFactory EMI case and/or a vendor EMT model on one of the EMT cases provided in the Fault Ride Through section below.

Detailed Information

Guidelines
Templates
Forms

Generation Commissioning Compliance Deliverables

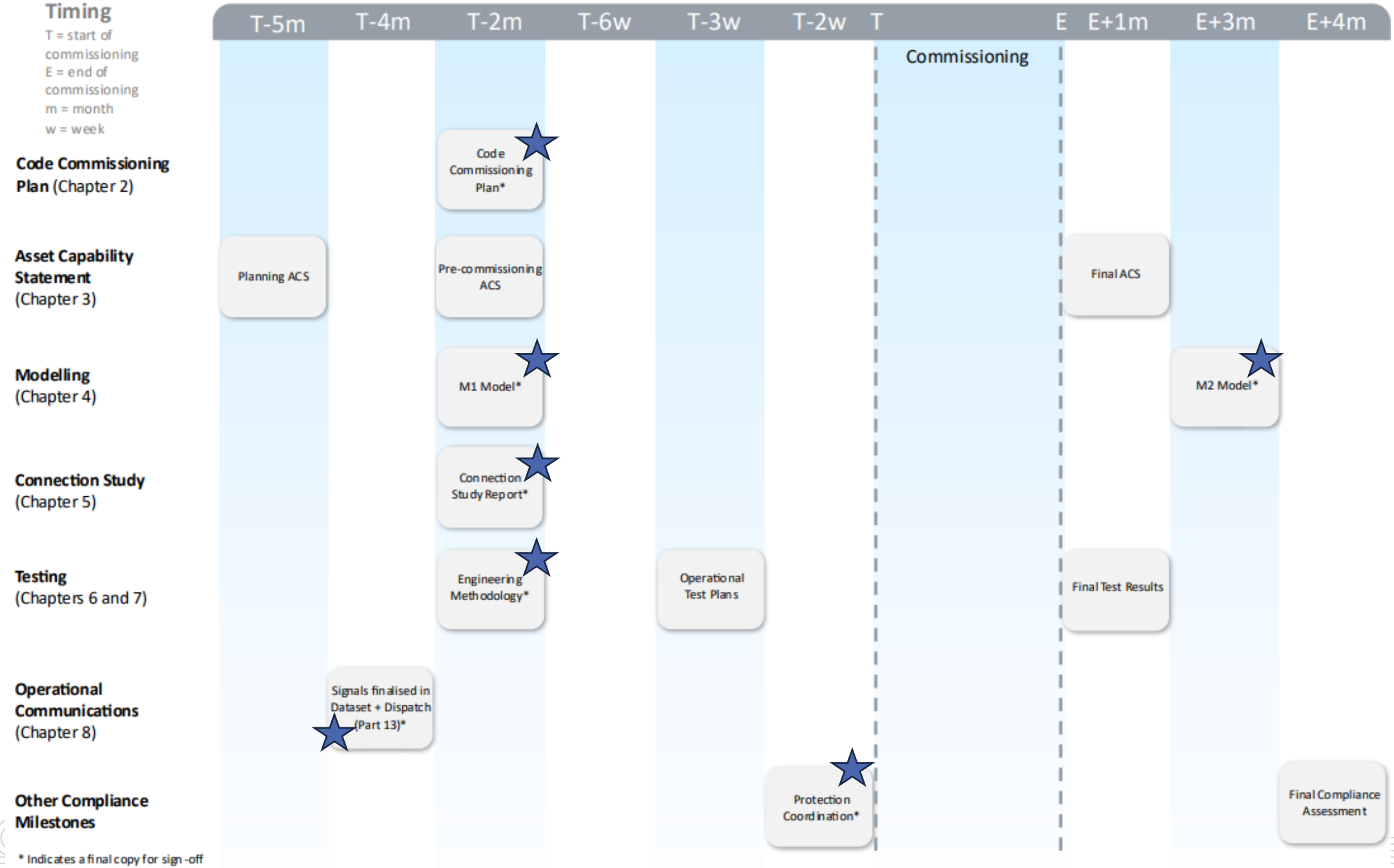
Draft → Final copy

- Code Commissioning Plan
- Engineering Methodology
- M1 Model
- Connection Study Report
- Operational Test Plans
- Final Dataset and Dispatch
- Protection Coordination Statement

Planning ACS → Pre-commissioning ACS

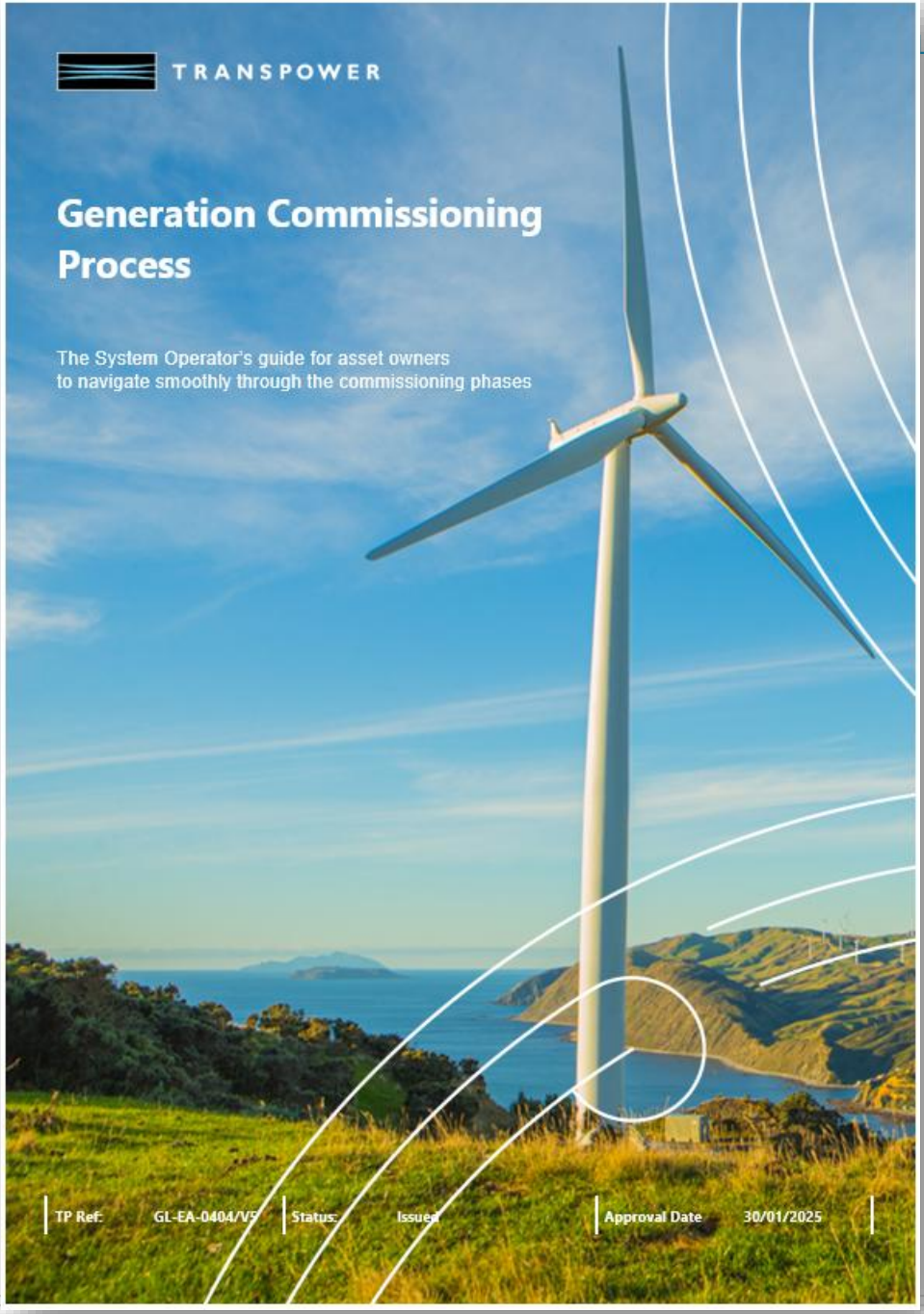
- Final ACS
- Final Test Results
- M2 Model
- Final Compliance Assessment

Figure 1: Timeline of Commissioning Requirements



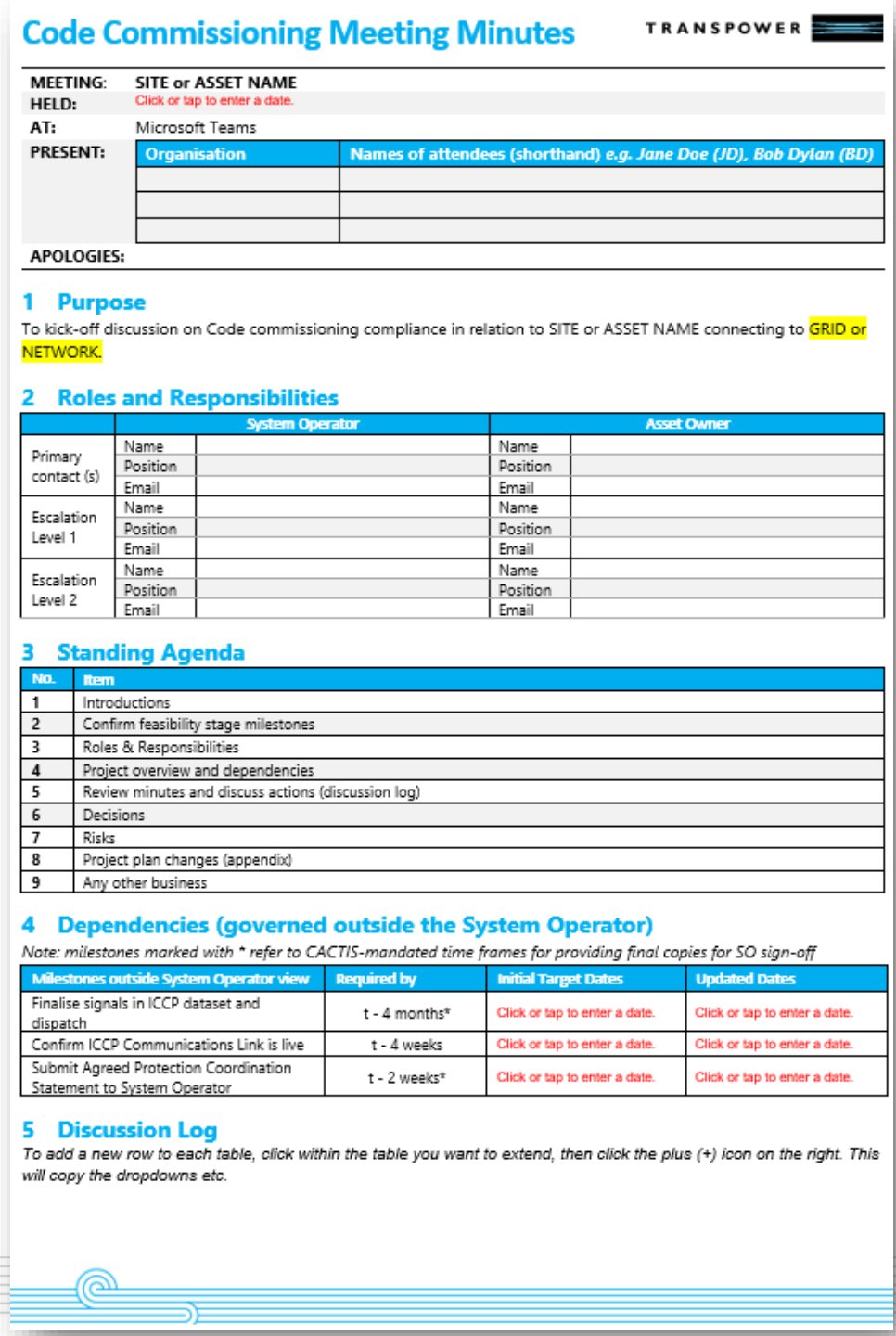
Generation Commissioning Process (GL-EA-404)

- Adjusted time frames:
  - CACTIS-mandated timelines
  - Recommended timings for starting and drafting
- Aligned with new Operational Data Integration workstream



Code Commissioning Meeting Minutes Template (DT-EA-1146)

- Adjusted to CACTIS time frames
- Redesigned functionality



Code Commissioning Meeting Minutes

TRANSPOWER

MEETING:	**SITE or ASSET NAME**
HELD:	Click or tap to enter a date.
AT:	Microsoft Teams

PRESENT:	**Organisation**	**Names of attendees (shorthand) *e.g. Jane Doe (JD), Bob Dylan (BD)***

APOLOGIES:

1 Purpose

To kick-off discussion on Code commissioning compliance in relation to SITE or ASSET NAME connecting to GRID or NETWORK.

2 Roles and Responsibilities

		System Operator		Asset Owner
Primary contact (s)	Name		Name	
	Position		Position	
	Email		Email	
Escalation Level 1	Name		Name	
	Position		Position	
	Email		Email	
Escalation Level 2	Name		Name	
	Position		Position	
	Email		Email	

3 Standing Agenda

No.	Item
1	Introductions
2	Confirm feasibility stage milestones
3	Roles & Responsibilities
4	Project overview and dependencies
5	Review minutes and discuss actions (discussion log)
6	Decisions
7	Risks
8	Project plan changes (appendix)
9	Any other business

4 Dependencies (governed outside the System Operator)

*Note: milestones marked with * refer to CACTIS-mandated time frames for providing final copies for SO sign-off*

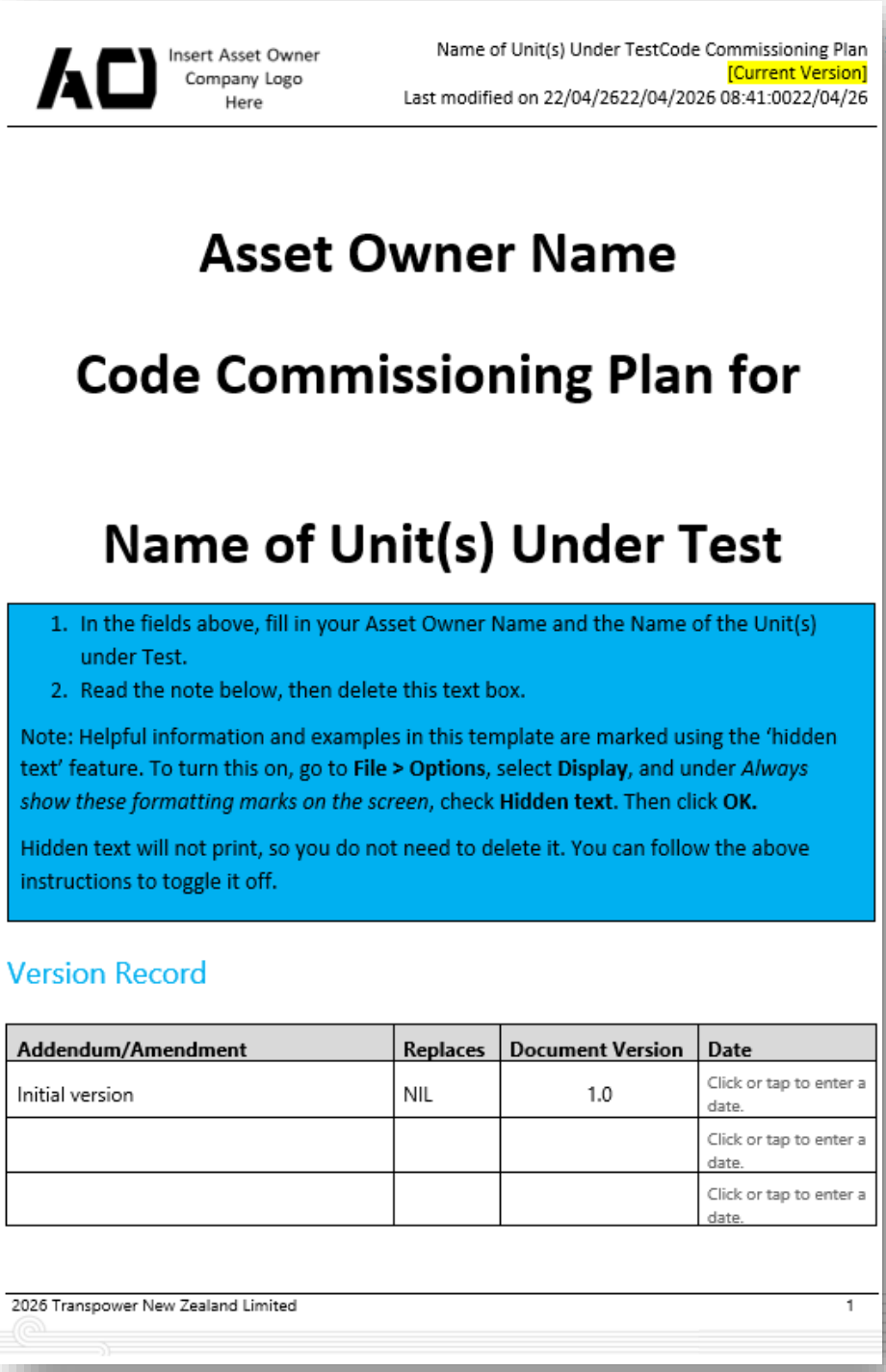
Milestones outside System Operator view	Required by	Initial Target Dates	Updated Dates
Finalise signals in ICCP dataset and dispatch	t - 4 months*	Click or tap to enter a date.	Click or tap to enter a date.
Confirm ICCP Communications Link is live	t - 4 weeks	Click or tap to enter a date.	Click or tap to enter a date.
Submit Agreed Protection Coordination Statement to System Operator	t - 2 weeks*	Click or tap to enter a date.	Click or tap to enter a date.

5 Discussion Log

To add a new row to each table, click within the table you want to extend, then click the plus (+) icon on the right. This will copy the dropdowns etc.

Code Commissioning Plan Template (DT-EA-338)

- Redesigned functionality
  - “Hidden” text for instructions and examples
  - Removed collapse/expand feature
- Aligned with CACTIS references



Insert Asset Owner Company Logo Here

Name of Unit(s) Under TestCode Commissioning Plan
[Current Version]
Last modified on 22/04/2622/04/2026 08:41:0022/04/26

Asset Owner Name

Code Commissioning Plan for

Name of Unit(s) Under Test

1. In the fields above, fill in your Asset Owner Name and the Name of the Unit(s) under Test.
2. Read the note below, then delete this text box.

Note: Helpful information and examples in this template are marked using the ‘hidden text’ feature. To turn this on, go to **File > Options**, select **Display**, and under *Always show these formatting marks on the screen*, check **Hidden text**. Then click **OK.**

Hidden text will not print, so you do not need to delete it. You can follow the above instructions to toggle it off.

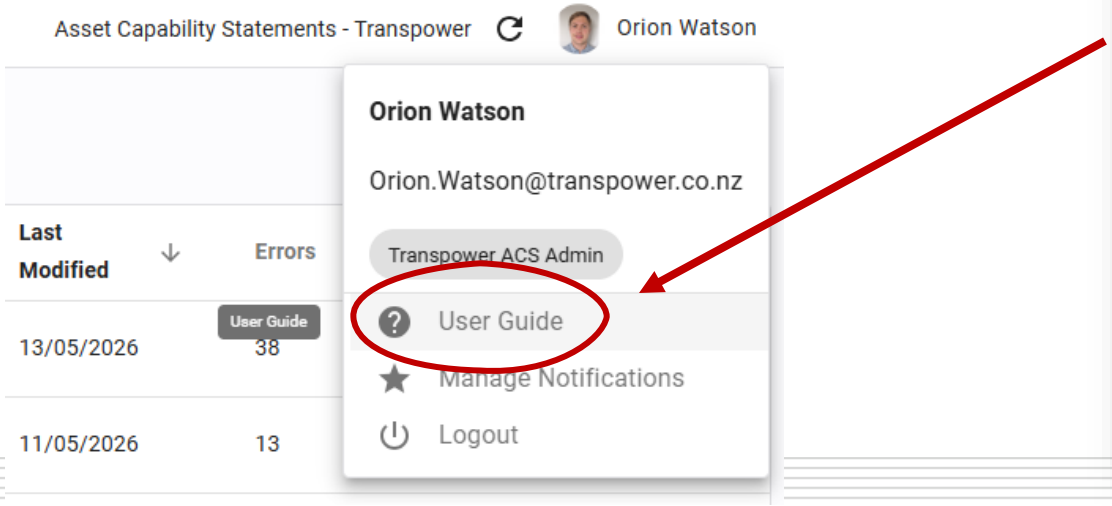
Version Record

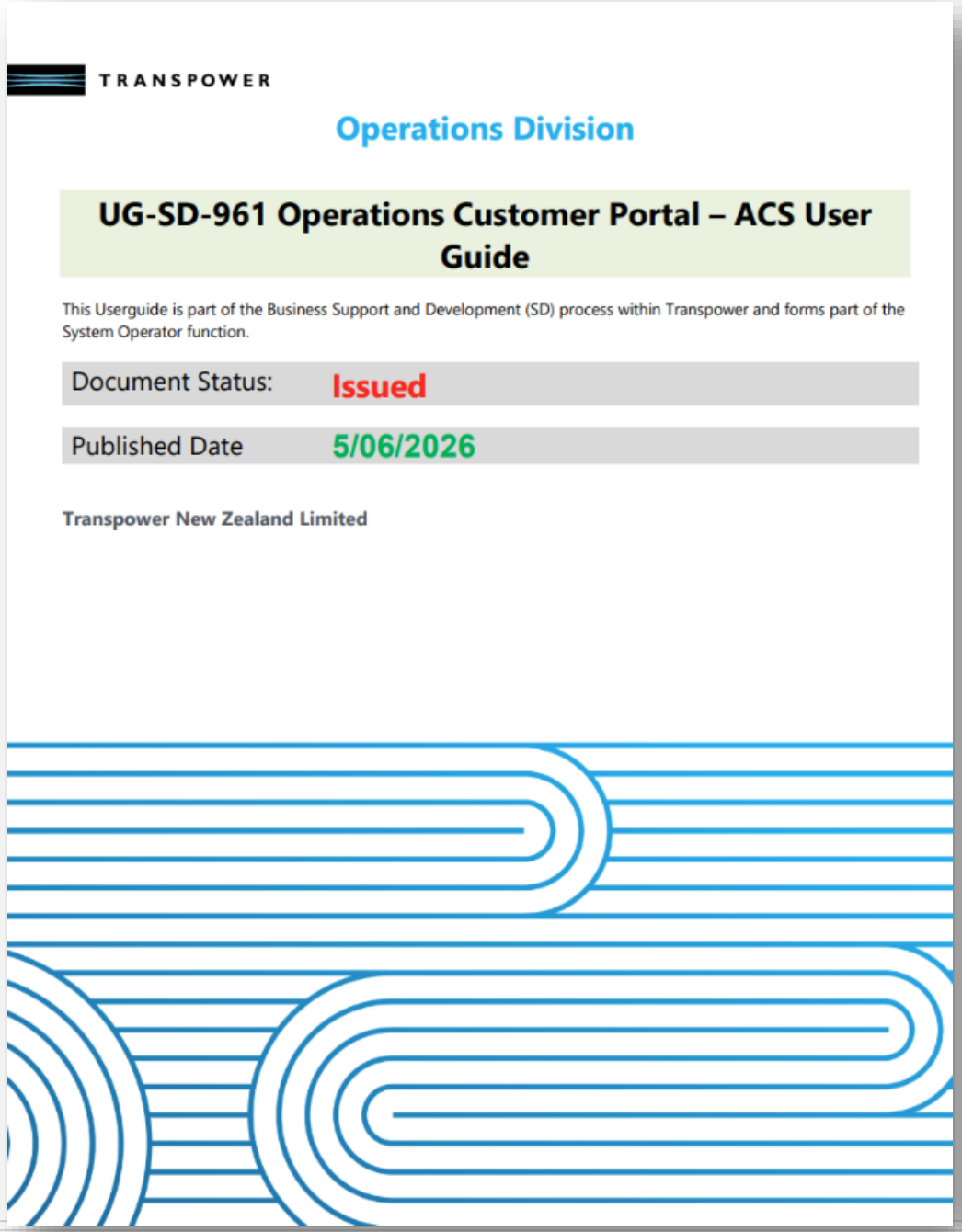
Addendum/Amendment	Replaces	Document Version	Date
Initial version	NIL	1.0	Click or tap to enter a date.
			Click or tap to enter a date.
			Click or tap to enter a date.

Deliverable: Planning, Pre-commissioning, and Final ACS

ACS User Guide (UG-SD-961)

- Merged Asset Owner and System Operator guides
- Updated references to CACTIS, especially Chapter 3 (ACS)
- Updated some images to align with June 2026 version of ACS





TRANSPOWER

Operations Division

UG-SD-961 Operations Customer Portal – ACS User Guide

This Userguide is part of the Business Support and Development (SD) process within Transpower and forms part of the System Operator function.

Document Status:	Issued
Published Date	5/06/2026

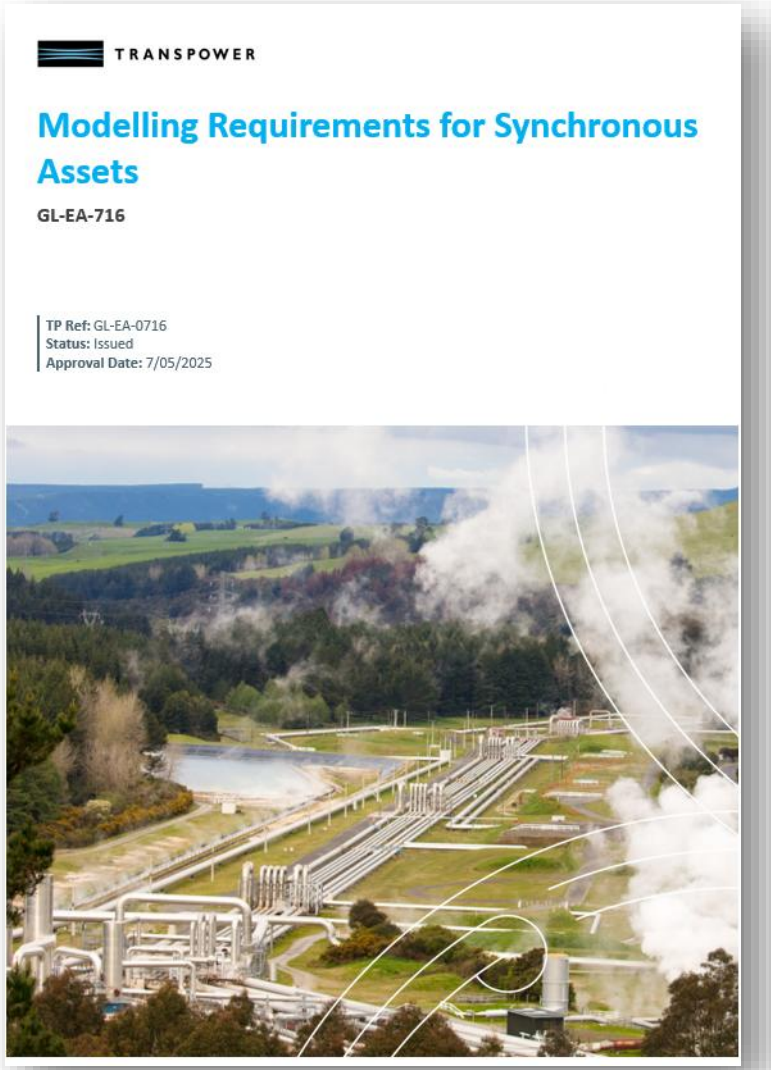
Transpower New Zealand Limited

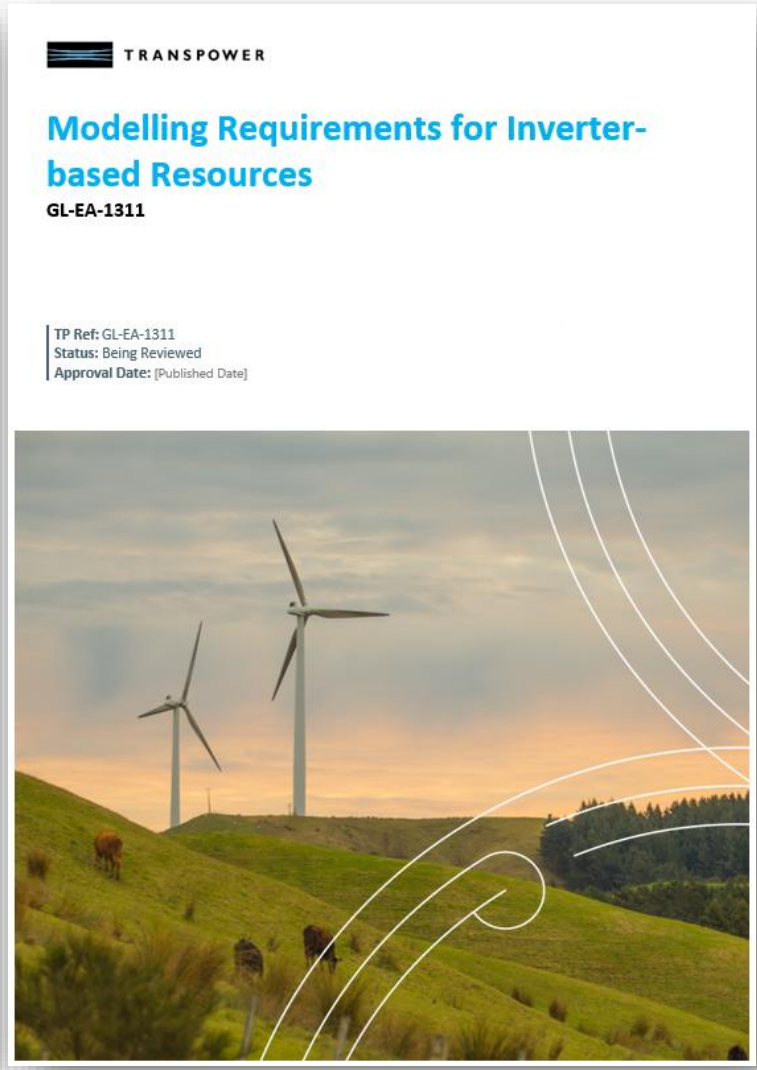
Connection Study Requirements (GL-EA-953)

- Aligned with Chapter 5 of CACTIS
- Various study updates
- Revised FRT study scope

Modelling Requirements – there are two guidelines now:

- synchronous generating units, and
- synchronous condensers





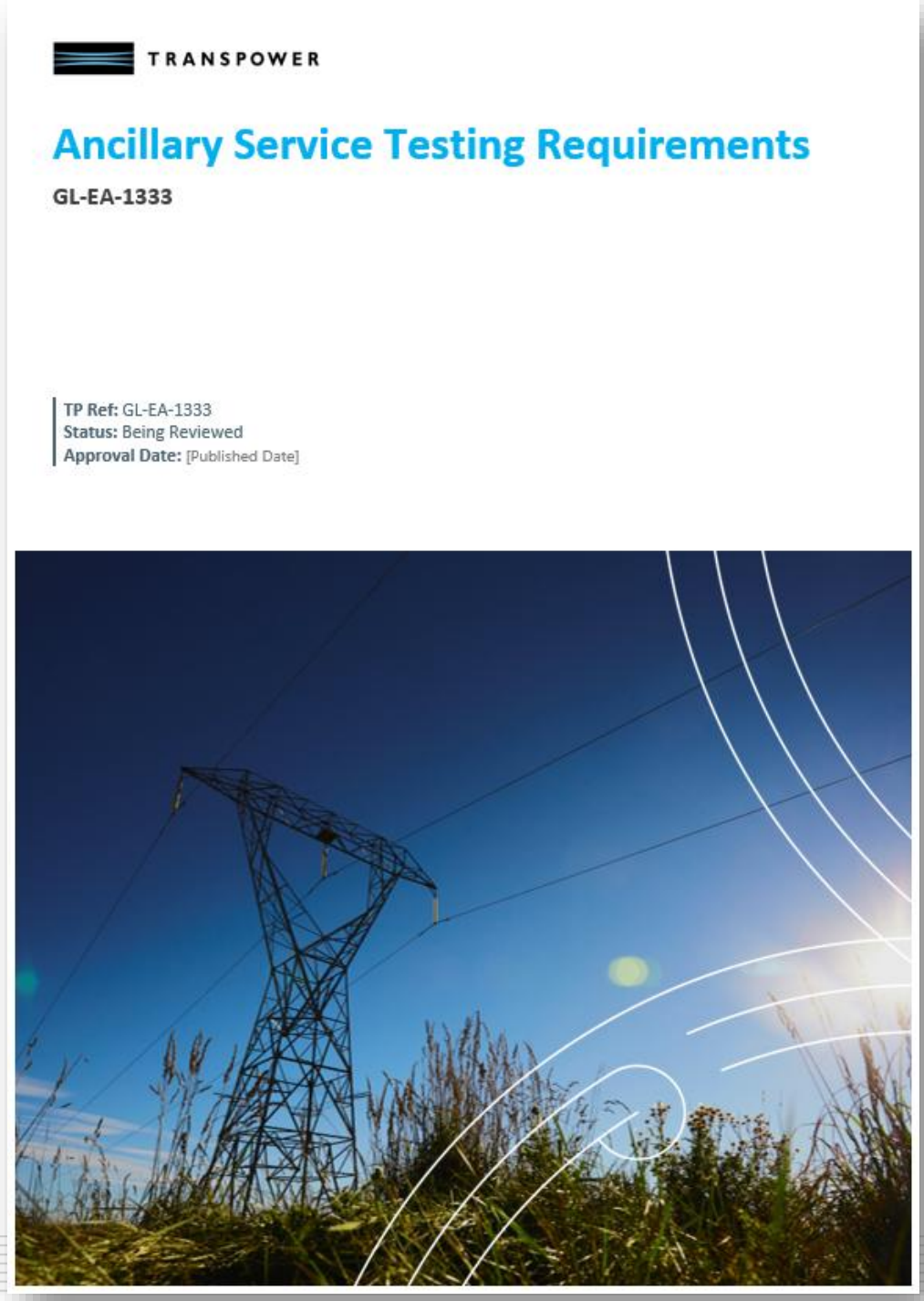
- wind and solar generating units,
- batteries (BESS),
- dynamic reactive power compensation devices, and
- doubly-fed induction generators (DFIG)

Generator Testing Requirements (GL-EA-010)

- Aligned with Chapter 7 of CACTIS
- Ancillary services tests moved to new GL-EA-1333 guideline
- Two new IBR tests

Ancillary Services Testing Requirements (GL-EA-1333)

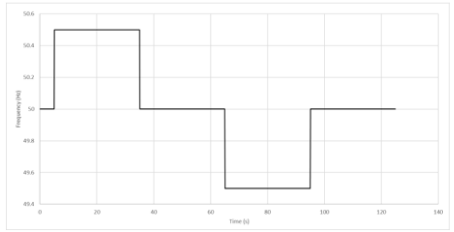
- Moved ancillary services tests from GL-EA-010
  - Including signal injection curves
- Moved interruptible load tests from GL-EA-766
- Refined various test details



Engineering Methodology Template (DT-EA-1337)

- Aligned with CACTIS and testing guidelines
- Aligned functionality with Code Commissioning plan:
  - "Hidden" text for instructions and examples

Offline Test Methodology Example

No. / Test ID and Name / Pre-testing Requirements / Control Mode / Hold Point / Purpose	Methodology	Comments / Test Resolution / Monitoring Signals	Expected Results	Expected Impact of Test	Mitigation
1 **GEN_FSP** Offline Frequency Step Response Test Control Mode: Governor Mode Frequency Control **Hold Point X (if applicable)** This test aims to: • demonstrate the correct operation of the governor • demonstrate governor stability, valve/gate control behaviour, turbine characteristics, and governor droop characteristics • determine governor and turbine parameters	1. Run the generator offline at full speed no load 2. Inject a positive step of 1% (0.5Hz) to the governor speed reference. 3. Record the Monitoring Signals 4. Allow adequate settling time to reach new steady-state conditions 5. Remove the step signal 6. Wait until the response stabilises 7. Inject a negative step of 1% (0.5Hz) to the governor speed reference 8. Record Monitoring Signals 9. Wait until the response stabilises	As per the GEN_FSP test in GL-EA-010. Injection as per graph below:  Test Resolution: 20ms Monitoring Signals: 1. Generator Terminal Active Power – Pt 2. Gate/valve position – POS (%) 3. Mechanical Speed – SPt (rpm) 4. Electrical Frequency - Hz 5. Frequency reference – fref (pu or Hz) 6. Governor output command - GOVcom (p.u. or %)	The generator speed will change relative to the step injection. Response should be stable with adequate damping.	No impact to the system frequency as the test is offline	Not required

Asset Owner Name

Engineering Methodology for

Name of Unit(s) Under Test

1. In the fields above, fill in your Asset Owner Name and the Name of the Unit(s) under Test.
2. Read the note below, then delete this text box.

Note: Helpful information and examples in this template are marked using the 'hidden text' feature. To turn this on, go to **File > Options**, select **Display**, and under *Always show these formatting marks on the screen*, check **Hidden text**. Then click **OK.**

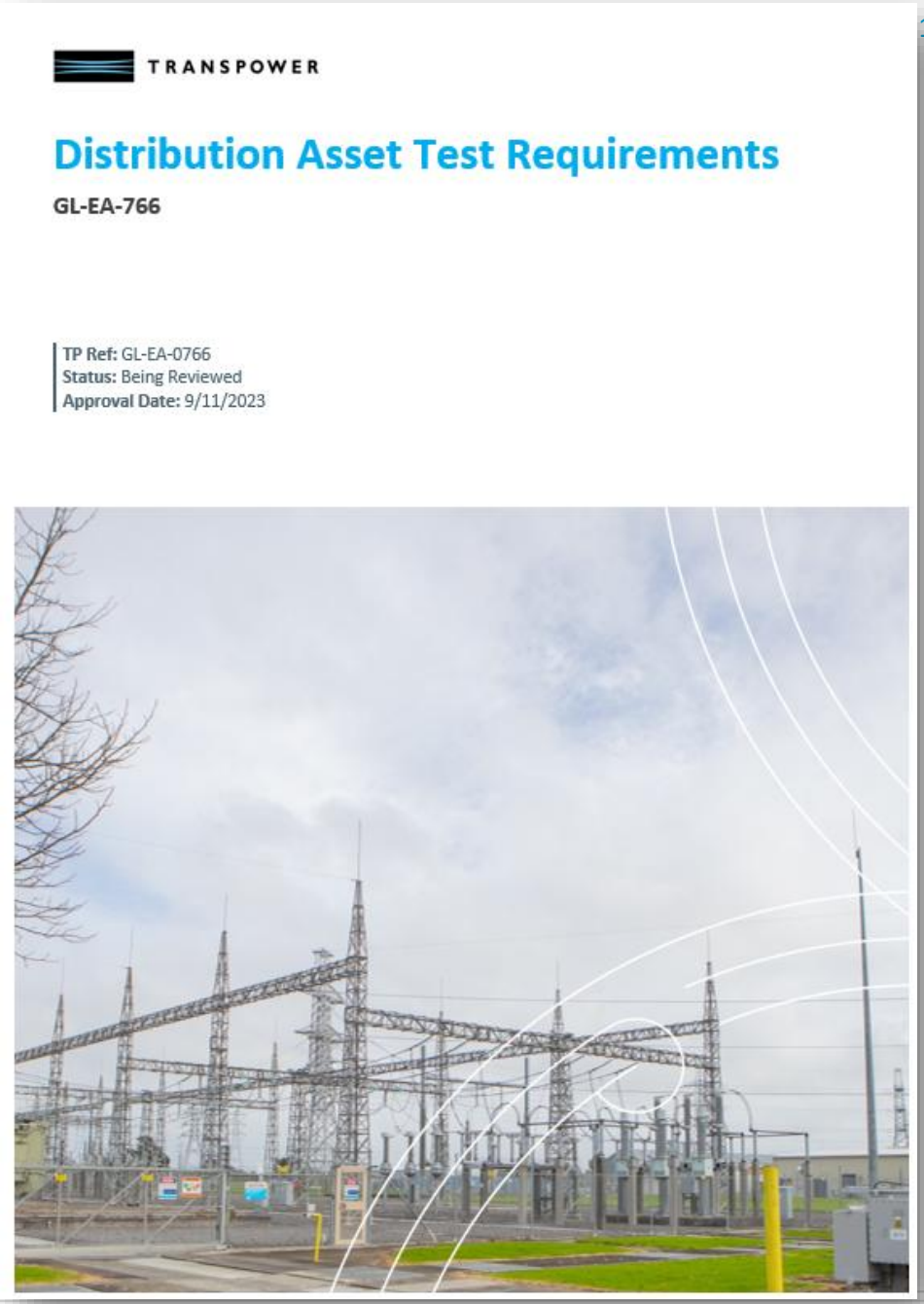
Hidden text will not print, so you do not need to delete it. You can follow the above instructions to toggle it off.

Version Record

Addendum/Amendment	Replaces	Document Version	Date
Initial Draft	NIL	1.0	Click or tap to enter a date.
			Click or tap to enter a date.
			Click or tap to enter a date.
			Click or tap to enter a date.

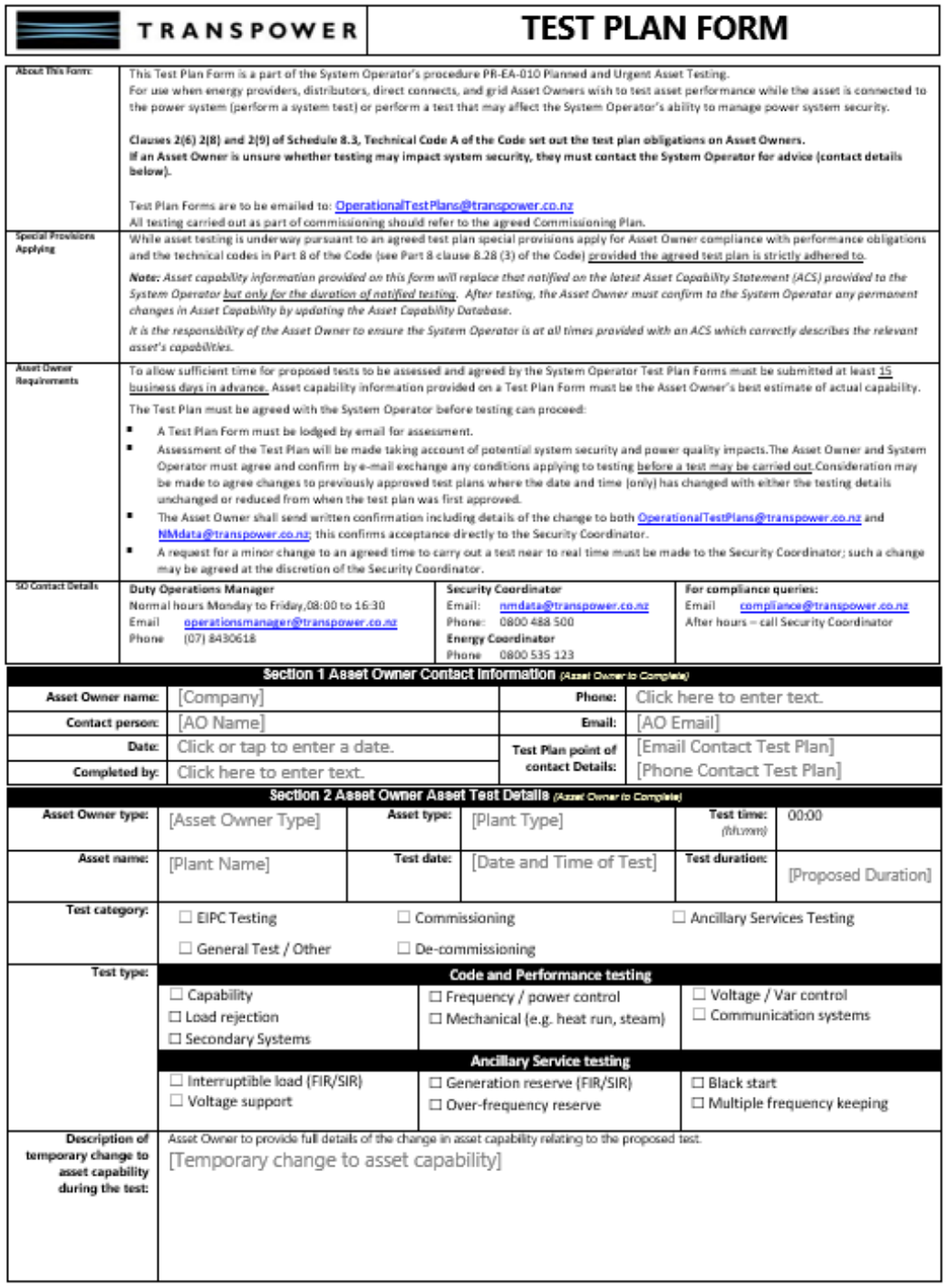
Distribution Asset Testing Requirements (GL-EA-766)

- Clarity improvements
- Removed interruptible load tests (now housed in GL-EA-1333 Ancillary Services Testing Requirements)
- Updated AUFLS testing specifications and guidance



Operational Test Plan Form (FM-EA-010)

- Aligned with CACTIS (can use the form to seek relief from CACTIS clauses)
- Added black start and multiple frequency keeping



TRANSPOWER

TEST PLAN FORM

About this Form:

This Test Plan Form is a part of the System Operator's procedure PR-EA-010 Planned and Urgent Asset Testing.
For use when energy providers, distributors, direct connects, and grid Asset Owners wish to test asset performance while the asset is connected to the power system (perform a system test) or perform a test that may affect the System Operator's ability to manage power system security.

Clauses 2(6) 2(8) and 2(9) of Schedule 8.3, Technical Code A of the Code set out the test plan obligations on Asset Owners.
If an Asset Owner is unsure whether testing may impact system security, they must contact the System Operator for advice (contact details below).

Test Plan Forms are to be emailed to: OperationalTestPlans@transpower.co.nz
All testing carried out as part of commissioning should refer to the agreed Commissioning Plan.

Special Provisions Applying

While asset testing is underway pursuant to an agreed test plan special provisions apply for Asset Owner compliance with performance obligations and the technical codes in Part 8 of the Code (see Part 8 clause 8.28 (3) of the Code) provided the agreed test plan is strictly adhered to.

Note: Asset capability information provided on this form will replace that notified on the latest Asset Capability Statement (ACS) provided to the System Operator but only for the duration of notified testing. After testing, the Asset Owner must confirm to the System Operator any permanent changes in Asset Capability by updating the Asset Capability Database.

It is the responsibility of the Asset Owner to ensure the System Operator is at all times provided with an ACS which correctly describes the relevant asset's capabilities.

Asset Owner Requirements

To allow sufficient time for proposed tests to be assessed and agreed by the System Operator Test Plan Forms must be submitted at least 15 business days in advance. Asset capability information provided on a Test Plan Form must be the Asset Owner's best estimate of actual capability.

The Test Plan must be agreed with the System Operator before testing can proceed:

- A Test Plan Form must be lodged by email for assessment.
- Assessment of the Test Plan will be made taking account of potential system security and power quality impacts.The Asset Owner and System Operator must agree and confirm by e-mail exchange any conditions applying to testing before a test may be carried out.Consideration may be made to agree changes to previously approved test plans where the date and time (only) has changed with either the testing details unchanged or reduced from when the test plan was first approved.
- The Asset Owner shall send written confirmation including details of the change to both OperationalTestPlans@transpower.co.nz and NMdata@transpower.co.nz; this confirms acceptance directly to the Security Coordinator.
- A request for a minor change to an agreed time to carry out a test near to real time must be made to the Security Coordinator; such a change may be agreed at the discretion of the Security Coordinator.

SO Contact Details

Duty Operations Manager	Security Coordinator	For compliance queries:
Normal hours Monday to Friday,08:00 to 16:30	Email: nmdata@transpower.co.nz	Email compliance@transpower.co.nz
Email operationsmanager@transpower.co.nz	Phone: 0800 488 500	After hours – call Security Coordinator
Phone (07) 8430618	**Energy Coordinator**	
	Phone 0800 535 123	

Section 1 Asset Owner Contact Information (Asset Owner to Complete)

Asset Owner name:	[Company]	**Phone:**	Click here to enter text.
Contact person:	[AO Name]	**Email:**	[AO Email]
Date:	Click or tap to enter a date.	**Test Plan point of contact Details:**	[Email Contact Test Plan]
Completed by:	Click here to enter text.		[Phone Contact Test Plan]

Section 2 Asset Owner Asset Test Details (Asset Owner to Complete)

Asset Owner type:	[Asset Owner Type]	**Asset type:**	[Plant Type]	**Test time:** (hh:mm)	00:00
Asset name:	[Plant Name]	**Test date:**	[Date and Time of Test]	**Test duration:**	[Proposed Duration]

Test category: ☐ EIPC Testing ☐ Commissioning ☐ Ancillary Services Testing ☐ General Test / Other ☐ De-commissioning

Test type:

Code and Performance testing

☐ Capability	☐ Frequency / power control	☐ Voltage / Var control
☐ Load rejection	☐ Mechanical (e.g. heat run, steam)	☐ Communication systems
☐ Secondary Systems		

Ancillary Service testing

☐ Interruptible load (FIR/SIR)	☐ Generation reserve (FIR/SIR)	☐ Black start
☐ Voltage support	☐ Over-frequency reserve	☐ Multiple frequency keeping

Description of temporary change to asset capability during the test:

Asset Owner to provide full details of the change in asset capability relating to the proposed test.
[Temporary change to asset capability]

Final Compliance Checksheet (CL-EA-1147)

- Aligned with CACTIS
- Included changes to voltage and frequency obligations

Clause	Subclause	Clause Description	Asset Owner Evidence [e.g. ACS, Connection Study etc.]	Asset Owner Comment [Where in the evidence is compliance
8.17		**Contribution by injections to overall frequency management:** Each generator (while synchronised) and the HVDC owner must at all times ensure that its assets, other than any generating units within an excluded generating station, make the maximum possible injection contribution to maintain frequency within the normal band (and to restore frequency to the normal band). Any such contribution must be assessed against	Control Parameters	Control parameters are outlined in page 10, in table 2 of the model validation report.
8.19 (1)	(a)	at all times when the frequency is above 47.5 Hertz; and	Protection Coordination Report	Under Frequency settings are outlined in section 5.5.2.3 Underfrequency (UF(DefT)) in the protection coordination report.
8.19 (1)	(b)	for at least 120 seconds when the frequency is 47.5 Hertz; and	Protection Coordination Report	Under Frequency settings are outlined in section 5.5.2.3 Underfrequency (UF(DefT)) in the protection coordination report.
8.19 (1)	(c)	for at least 20 seconds when the frequency is 47.3 Hertz; and	Protection Coordination Report	Under Frequency settings are outlined in section 5.5.2.3 Underfrequency (UF(DefT)) in the protection coordination report.
8.19 (1)	(d)	for at least 5 seconds when the frequency is 47.1 Hertz; and	Protection Coordination Report	Under Frequency settings are outlined in section 5.5.2.3 Underfrequency (UF(DefT)) in the protection coordination report.
8.19 (1)	(e)	for at least 0.1 seconds when the frequency is 47.0 Hertz; and	Protection Coordination Report	Under Frequency settings are outlined in section 5.5.2.3 Underfrequency (UF(DefT)) in the protection coordination report.
8.19 (1)	(f)	at any frequencies between those specified in paragraphs (b) to (e) for times derived by linear interpolation.	Acknowledged (provide supporting notes in comments)	The relay works in in discreet steps which covers the points that are linearly extrapolated.
8.19 (2)		If the inherent characteristics and design of a generator's generating unit are such that it is reasonably able to operate beyond the above requirements, the generator must declare such capabilities in accordance with clause 2(5) of Technical Code A of Schedule 8.3.	Asset Capability Statement (ACS)	The general specification of the V-ABC XX MW generator can be found under the attachments on ACS under Manufacturer Specification. Page 5, Table 9-4 outlines the operating envelope w.r.t frequency for the WTG connected to the grid i.e. nominal frequency (Hz), frequency gradient (Hz/sec) and Table 9-5 outlines the minimum and maximum operating frequency, mechanical deadbands and inherent frequency deadband
8.19 (3)	(a)	at all times when the frequency is above 47 Hertz; and	Not Applicable/Not Required	NI Connected Asset
8.19 (3)	(b)	for 30 seconds if the frequency falls below 47 Hertz but not below 45 Hertz.	Not Applicable/Not Required	NI Connected Asset
8.22	(2)	Each generator with a point of connection to the grid must at all times ensure that its assets are capable of being operated, and do operate, when the grid is operated within the range of voltages set out in subclause (1).	Protection Coordination Report	Pg 19 of the protection coordination report (attached to the ACS) shows the Under voltage setting of the generator in section 5.5.2.1. **Model Validation Report**: During the Open Circuit test, the generator was subjected to it's voltage rage capability determine its saturation curve. The results for this test can be found in Appendix A, Pg 32 of the model validation report. **ACS**: The manufacturer specification document ("Manufacturer Specification - V-XYZ - 4MW") is attached to the ACS also shows the

Extra Information

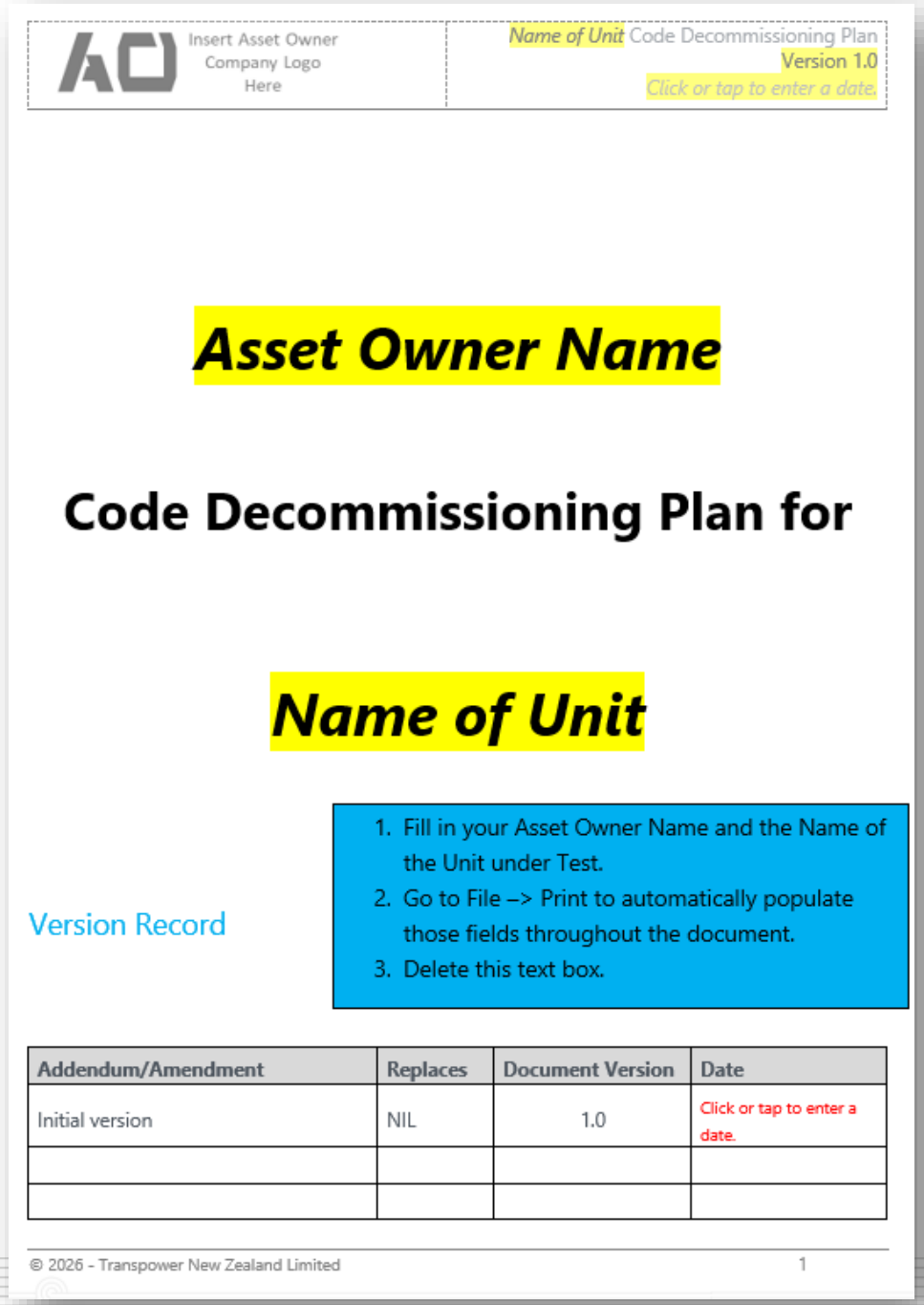
ICCP Dataset Template

- Part of Operational Data Integration workstream

		Customer to Complete		
Analog No.	Customer Co	Customer Tag Description	Value required	Notes
1	XXXX_HEARTI	Customer to Transpower ICCP Heartbeat if not exist		
2		Station **Nett** MW	Import and export (±2% accuracy	* All Generators
3		Station **Nett** Mvar	Import and export (±2% accuracy	* All Generators
4		Station HV Bus Voltage (if HV bus not owned by Transpower	kV (±2% accuracy)	* All Generators
5		Circuit Amps (if circuit is not owned by a grid owner)	Current at each termination point	* All Generators
6		Circuit MW (if circuit is not owned by a grid owner)	MW at each termination point of	* All Generators
7		Circuit Mvar (if circuit is not owned by a grid owner)	Mvar at each termination point of	* All Generators
8		Generating unit **Gross** MW	Import and export (±2% accuracy	* Synchronous Generating Units
9		Generating unit **Gross** Mvar	Import and export (±2% accuracy	* Synchronous Generating Units
10		Generating unit Terminal Voltage kV	kV (±2% accuracy)	* Synchronous Generating Units
11		Generating system **Nett** MW	Import and export (±2% accuracy	* Wind, Solar or BESS Generating units
12		Generating system **Nett** Mvar	Import and export (±2% accuracy	* Wind, Solar or BESS Generating units
13		Number of active inverters or wind turbines in the generating station		* Wind, Solar or BESS Generating units
14		Station available MW	the available active power if gene	* Wind, Solar or BESS Generating units
15		Station MV bus voltage (kV) (only if applicable)		* Wind, Solar or BESS Generating units
16		Station state of charge (SOC) (%)	Must be the energy stored in the	* Battery Energy Storage Systems (BESS) and Hybrid plants
17		Solar irradiance horizontal (W/m^2)	Must be the average of all senso	* Solar Generation Assets
18		Wind speed at nacelle height (m/s)	Must be an average of every nac	* Wind Turbine Assets
19		Station intermittent generation MW	Import and export (±2% accuracy	* Hybrid Plant
20		Station BESS Injection / LOAD MW	Import and export (±2% accuracy	* Hybrid Plant
21				
22	MFK_XXX_SP	XXX heartbeat feedback from Customer to Transpower		used for MFK * to be advised by Markets team
23	TP_HB_SP_X	REG SPFB an analogue (Regulation MW setpoint feedback)		used for MFK * to be advised by Markets team
24				

Code Decommissioning Plan (DT-EA-389)

- Aligned with CACTIS



Insert Asset Owner Company Logo Here

Name of Unit Code Decommissioning Plan
Version 1.0
Click or tap to enter a date.

Asset Owner Name

Code Decommissioning Plan for

Name of Unit

Version Record

1. Fill in your Asset Owner Name and the Name of the Unit under Test.
2. Go to File –> Print to automatically populate those fields throughout the document.
3. Delete this text box.

Addendum/Amendment	Replaces	Document Version	Date
Initial version	NIL	1.0	Click or tap to enter a date.

Commissioning Onboarding Videos

- Commissioning Roles and Responsibilities
- Key Commissioning Deliverables
- Getting Ready for Commissioning


CACTI'S
https://tinyurl.com/
cactisupdates

General Discussion Q&A

Closing Address

Anna Li

Manager, Engineering Assurance | Power Systems Group

Closing **Karakia**

Unuhia, unuhia,
Unuhia ki te uru tapu nui
Kia wātea, kia māmā, te ngākau,
Te tinana, te wairua, i te ara tangata
Koia rā e Rongo, whakairia ake ki runga
Kia tina! Tina! Hui e! Tāiki e!

Translation

Draw on, draw on
draw on the supreme sacredness
to clear, to free the heart,
the body and spirit of humankind
That is Rongo suspended high above us
Draw together! Affirm!