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Connected Asset Commissioning, Testing and Information Standard (CACTIS)

This submission is provided by Transpower in its role as the grid owner. The grid owner supports the purpose of CACTIS, aiming to ensure that commissioning and testing processes, and the provision of information from connected inverter-based technologies assist the system operator to meet its principal performance obligations (PPOs) and facilitate efficient energy dispatch.

The grid owner is working to connect new generation sources, batteries, and load to meet New Zealand's future electricity requirements. Recently, there has been a notable increase in generation (and battery energy storage system) developers and distribution network projects seeking connection to the national grid.

Efforts are underway to accelerate connection processes and reduce wait times. Efficiencies in grid owner processes are central to enabling new grid connections and modifying existing grid assets, to ensure connections are completed promptly to help ensure an affordable and secure electricity system.

Although the title "Connected Asset Commissioning, Testing and Information Standard" suggests its focus is on parties connecting **to** the grid, the broad terms in CACTIS, using *asset owner* and *assets*, will capture the grid owner in every requirement. Some of these requirements would be new to the grid owner with anticipated adverse impacts to its established commissioning processes, test processes and change processes. These changes could result in additional costs which will ultimately fall on consumers. Therefore, we do not support these requirements being applied universally across all *asset owners*.

Accurate problem definition to support proportionate information obligations

We agree information provision needs have changed with the increase of inverter-based resources (IBR) such as wind, solar and BESS technologies. The Authority describes the problem statement as: *"Our discussions with stakeholders have highlighted challenges in obtaining asset information, particularly modelling data for IBRs like wind generation, solar*

photovoltaic generation, and battery energy storage systems (BESSs)." [1] *As New Zealand's electricity generation mix becomes increasingly dominated by IBRs, the complexity and risk associated with inaccurate models grows."*[2]

As grid owner we also require better information about the performance of connecting IBRs. The Code recognises the specific nature of the grid owner's needs for connected asset information, to also understand effects on the grid, pursuant to the Connection Code (clause 2.1). We look forward to the Authority's stage 2 consideration of information provision such that operational efficiencies may be created by enabling the grid owner to access asset capability and modelling information held by the system operator.[3]

The CACTIS would be better specified and proportionate, if it can link what type of information is required from which type of asset owner, whether as grid owner, connected asset owner, generator or embedded generator (both generators include BESS).

- **Grid owner recommendation** Use participant type specific references to ensure obligations are proportionate to the identified problem of information needs from inverter-based generation resources.

Timing provisions inadvertently captures efficient grid asset commissioning processes

We consider the timely delivery of the large volumes of grid asset commissioning, including for new or upgraded connections, would be inadvertently and significantly impacted by applying the minimum timeframes proposed under Chapter 1 to grid owner activities.

Part 8 currently provides that a commissioning plan is to be *agreed* with the system operator, including a timetable containing the sequence of events.[4] The grid owner has established all its operational processes and timing procedures with the system operator to ensure grid assets are commissioned (and tested and changed) in a timely manner, on this basis. For commissioning, the process starts by asking whether there is more than six weeks to the commissioning date.[5] More than six weeks are needed for grid reconfiguration or changes to asset capability statements. Changes to grid asset capabilities are governed by another system operator operational process.[6]

These existing internal processes ensure:

- Grid assets are readily available to newly connecting parties for their export (as generator) or demand (as load) needs
- Grid assets damaged in catastrophic events can be restored as quickly as possible
- Grid topology is the most precise framework for the system operator to evaluate PPOs and manage dispatch for connected entities.

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[1] Electricity Authority Promoting reliable electricity supply – a Code amendment proposal on common quality-related information para. 2.15.
[2] Ibid, para. 6.4.
[3] TP Sub Common Quality Information 12 August 2025
[4] Schedule 8.3, Technical Code A clause 7.
[5] PR-EA-218 Assessing grid owner Commissioning Plans.
[6] Refer PR-EA-023 Assessing Ratings Change and Updating SO Models.

Extending prescribed timeframes for grid modifications would directly impact all associated connection and commissioning activities and their governance (including their timeframes), for both the grid owner and system operator.

Further, if mandated generator schedules occur before grid owner timelines for commissioning related grid assets, the system operator may need to reassess generator performance and dispatch to align with asset availability.

- **Grid owner recommendation** Chapter one timelines should not apply to the grid owner, and instead existing operational processes and procedures between the grid owner and system operator should continue to apply for the reasons above.

Retain the date of "commissioning date" as the reference point for timelines

The system operator proposes to use "electrically connect"[7] as the reference date for all its process timings. The consequence of not adhering to the timeframes is that the participant must get approval from the system operator to electrically connect.[8] Electrical connection is necessary to perform commissioning.

However, changing the reference date from *commissioning* to *electrically connect* will impact on the grid owner's connection processes. The grid owner is responsible for electrical connection to the grid under Part 10.[9] Using the term "electrically connect" also creates ongoing implications for the grid owner as it needs to electrically connect and disconnect for outages e.g. for maintenance, to modify an asset, to test an asset, and to add an asset.

The grid owner's commissioning processes all adhere to commissioning date as the reference point.

- **Grid owner recommendation** The CACTIS should use the defined term *commissioning*[10] to avoid adverse unintended consequences for the grid owner's activities from using the term *electrically connect*.

Broader matters – potential breach processes and the "reasonableness" standard

We consider that clarity on timeframes and information provision requirements is useful for generator IBR. However, we note that more prescription in the Code will increase the number of potential Code breaches. While this may be intended, there will be increased risks for parties (asset owner and the system operator) from breach processes and, at a minimum, lead to additional administrative cost. We wonder if there are some areas particularly around the timeframes which would benefit from clarity on whether the intent is a Code breach or some other consequence i.e. commissioning is delayed.

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[7] **electrically connect** means to operate a device so that **electricity** is able to flow.

[8] CACTIS Clause 1.4 "Where the time frames in this Chapter for providing the system operator with documentation and information are not adhered to, the asset owner must not first electrically connect an asset to a network, without prior written approval from the system operator."

[9] Clause 10.29A (temporary electrical connection), 10.29B (electrical connection) and 10.29C (electrical disconnection).

[10] **Commissioning** means to verify the correct operation of (a) an **asset**; or (b) a **point of connection**; (c) metering equipment installed in a **metering installation.**

Finally, we note the Authority has proposed to strike out the "reasonableness" standard for information provision.[11]As an asset owner, we consider the system operator should only be able to require under the Code a level of information that is reasonable to acquire to meet its PPOs. Eliminating this standard opens the door to overly broad or unreasonable information requests, which could place undue burden on asset owners. We consider references to reasonableness should be retained in Part 8 Code CACTIS.[12]

At Appendix A we answer the system operator's questions.

At Appendix B we analyse the CACTIS clauses for its potential consequences for grid owner activities with suggestions for improvement to create a proportionate (to the articulated problem) and operable (avoiding adverse consequences) set of rules.

We would be happy to discuss our submission with the system operator and the Electricity Authority.

Yours sincerely

Joel Cook

Head of Strategy and Regulation

[11] Electricity Authority Promoting reliable electricity supply – a Code amendment proposal on common quality-related information refer Technical Code A 2 (1) (c), the clause now suggests the SO can require any level of information.

[12] The system operator indicates it needs to act reasonably in clause 1.3, but this is a specific, not general, context.

Appendix A – Transpower as grid owner and asset owner response to questions on the CACTIS

Question	Transpower as grid owner / asset owner comments
Q1. Do you agree that failing to provide key information will have an impact on the commissioning of an asset, power system security and the system operator's ability to meet the PPOs and dispatch objective?	We think the consultation could be clearer on where the information provision failure lies. The Authority describes *"Our discussions with stakeholders have highlighted challenges in obtaining asset information, particularly modelling data for IBRs like wind generation, solar photovoltaic generation, and battery energy storage systems (BESSs)"* [13] *As New Zealand's electricity generation mix becomes increasingly dominated by IBRs, the complexity and risk associated with inaccurate models grows."*[14] We agree that information provision from generator IBRs is key to ensuring the system operator can meet its PPOs and dispatch objective. As grid owner we also require better information about the performance of connecting IBRs. The Code recognises the specific nature of the grid owner's needs for connected asset information, to also understand effects on the grid, pursuant to the Connection Code (clause 2.1). We look forward to the Authority's stage 2 consideration of information provision such that operational efficiencies may be created by enabling the grid owner to access asset capability and modelling information held by the system operator. • **grid owner recommendation** Use participant type specific references to ensure obligations are proportionate to the identified problem of information needs from generator IBRs.

[13] Electricity Authority Promoting reliable electricity supply – a Code amendment proposal on common quality-related information para. 2.15.
[14] Ditto, para. 6.4.

Question	Transpower as grid owner / asset owner comments
Q2. Do you agree with the proposal to mandate minimum time frames for the activities in Chapter 1 of the proposed CACTIS?	No. The Chapter 1 timeframes should not apply to the grid owner. We are concerned that the mandated timeframes will adversely affect the timeliness for grid owner's own commissioning of its assets to support new connections, to deliver its investment programme, and for responding to adverse events. If the grid owner's commissioning happens after the generator's, later changes to the grid could affect the system operator's PPOs and dispatch assessment. As the grid topology is the means for assessing PPOs and meeting the dispatch objective, we consider commissioning processes for grid assets need to be more flexible and expedited to ensure that system operator analysis can occur over the appropriate grid, especially for IBR connections. Commissioning processes, test processes and change processes are routinely managed between the grid owner and system operator through its internal operating documents (including timeframes). These processes are established, efficient, effective, and understood.
Q3. Do you agree with the proposed time frames for asset owners to submit a commissioning plan and for the system operator to review them?	See question 2 for our views on timeframes for the grid owner as asset owner. • **grid owner recommendation** The CACTIS should continue to use the defined term *commissioning*[15] to avoid adverse unintended consequences for the grid owner's activities from using the term *electrically connect*.
Q4. Do you agree that requiring asset owners to use a standard commissioning plan template would help streamline the preparation and review process?	The template states "This document is designed to guide asset owners to create a Code commissioning plan for your *generating* asset" [emphasis added] so we assume the template is not for the grid owner.

[15] **Commissioning** means to verify the correct operation of (a) an **asset**; or (b) a **point of connection**; (c) metering equipment installed in a **metering installation.**

Question	Transpower as grid owner / asset owner comments
Q5. Do you agree with the proposed time frames for asset owners to submit asset capability statements at the planning, pre-commissioning, and final stages of the commissioning process, and for the system operator to review them?	See question 2 for our views on timeframes for the grid owner as asset owner.
Q6. Do you agree that formalising the asset capability statement assessment requirements will provide clarity for asset owners?	The introduction to Chapter 3 states *This Chapter specifies the requirements for asset capability statements that must be provided by an asset owner to the system operator under clause 2(2) of Technical Code A of Schedule 8.3 of the Code.* However, the Authority has proposed to delete clause 2(2) so the reference would be incorrect. Further, Chapter 3 proposed clause 3.4 states "*For the purpose of clause 2(5A) of Technical Code A of Schedule 8.3 of the Code, the asset owner must provide asset capability statements for…:*" The Authority has proposed to delete clause 2(5A), so the reference would be incorrect.
Q7. Do you agree with the proposal to formalise requirements for asset owners to provide urgent or temporary changes to asset capability statements?	The intent to *notify* the system operator about temporary or urgent changes to assets appears reasonable, but updating the ACS for such a short time is not, as the ACS would have to be changed back again. Notification should be sufficient. However, the test on which that notification relies, appears too narrow (because it is an "and" test). Is that intended? **Clause 3.5** (emphasis added) "… an urgent or temporary change in asset capability is a change where the asset owner: (i) *unexpectedly* becomes aware the capability of the asset may differ from the capability described in the asset's asset capability statement and there is no practicable opportunity to update the asset capability statement in

Question	Transpower as grid owner / asset owner comments
	accordance with this CACTIS; *and* (ii) the asset owner needs to perform further investigations to determine or confirm the capability of the asset after the change. "Unexpectedly" excludes "expected" changes"? Should the text just be "becomes aware"? Further, the test at proposed clause 3.5 could be difficult to apply as it depends on the extent of the change. An asset owner might know that the change would affect its ability to *meet its asset owner performance obligations* but is unlikely to be able to deduce whether that change *will affect the system operator's ability to meet the principal performance obligations*. If the asset owner can conclude its asset owner performance obligations (AOPOs) continue to be met then one should infer that the PPOs are also able to be met.
Q8. Do you agree with the proposed time frames for asset owners to submit m1 and m2 models, and for the system operator to review them?	For Chapter 1 timeframes see our response at question 2. We note the Chapter 4 introduction states "*This Chapter specifies the requirements for modelling data that must be provided by asset owners to the system operator and under clauses 2(5A) and 2(5B) of Technical Code A of Schedule 8.3 of the Code and in connection with other requirements in this CACTIS*. However, the Authority has proposed to delete clause 2(5A); and clause 2(5B) does not exist in the Code. Therefore, it is unclear what the Code requirements are for modelling against which the modelling detail is set. Please refer to Appendix B for grid owner comments on Chapter 4 Modelling Requirements.
Q9. Do you agree that the updated modelling requirements are necessary to reflect the increasing complexity and changing generation mix within the New Zealand power system?	Yes, please refer Appendix B for grid owner comments on Chapter 4 Modelling Requirements. As grid owner we also require better information about the performance of newly connecting IBRs. The Code recognises the specific nature of the grid owner's needs for connected asset information, to also understand effects on the grid, pursuant to the

Question	Transpower as grid owner / asset owner comments
	Connection Code (clause 2.1). We look forward to the Authority's stage 2 consideration of information provision such that operational efficiencies may be created by enabling the grid owner to access asset capability and modelling information held by the system operator.
Q10. Do you agree that the system operator needs TSAT and PSCAD software models to conduct the studies needed to maintain power system security and meet the PPOs?	Yes. However, we consider it could be more efficient for the system operator as the party to convert models in PowerFactory format into a Transient Security Assessment Tool (TSAT), rather than all parties doing it themselves. This could be looked at by the system operator and the Authority. Noting that the system operator would need to be funded if it had to take on this additional activity.
Q11. Do you agree with the proposed time frames for asset owners to submit a final connection study report, and for the system operator to review it?	See question 2 for our views on timeframes for the grid owner as asset owner.
Q12. Do you agree with the proposed approach of using RMS studies for scenario screening and EMT studies for detailed fault ride through analysis of IBRs?	Yes.
Q13. Do you agree with the proposal to require asset owners to repeat fault ride through studies when control system parameters are modified during or after commissioning?	Yes, we would expect repeating fault ride-through (FRT) studies is necessary given changes to control system parameters.
Q14. Do you support the proposed process for accessing encrypted models from other asset owners when needed for fault ride through studies?	As grid owner we also require better information about the performance of newly connecting IBRs. For the system operator sharing encrypted models from other asset owners: this should be permitted to be shared with the grid owner. If not the system operator will become

Question	Transpower as grid owner / asset owner comments
	the central analyser of the entire power system, all the time. This result is contrary to the intent for participants to do more of their own studies. While the grid owner can already require models from other asset owners under the Connection Code, we consider it would promote efficient operation if the grid owner can access models held by system operator. Clause 5.22 (b) appears time-consuming for the system operator. The clause could have the qualifier "consent not unreasonably withheld."
Q15. Do you agree with the proposed time frames for asset owners to submit a commissioning plan and for the system operator to review it?	See question 2 for our views on timeframes for the grid owner as asset owner.
Q16. Do you agree with the proposed time frames for asset owners to submit a final engineering methodology, and for the system operator to review it?	See question 2 for our views on timeframes for the grid owner as asset owner. Chapter 7 purpose statement states *This Chapter specifies the requirements for testing that must be undertaken by asset owners and communicated to the system operator under clauses 8(2)(a) and 8(3) of Technical Code A of Schedule 8.3 of the Code.* However, the clauses 8(2)(a) has been proposed to be redrafted to refer to the CACTIS, so the reference is circular. Should the reference be to the new clause 8.74 proposed by the Authority in its July 2025 consultation.[16] For the grid owner as an asset owner, this engineering methodology would be a new requirement; we are currently unclear on its significance to routine asset testing and the grid owner's investment program to modify existing assets through replacement, refurbishment or enhancement.

[16] Promoting reliable electricity supply – a Code amendment proposal on common quality-related information

Question	Transpower as grid owner / asset owner comments
	We are also unclear of the benefits the system operator of the grid owner submitting an engineering methodology for commissioning its many assts. If it is intended for the grid owner to produce an engineering methodology then a rationale with costs and benefits should be articulated.
Q17. Do you agree with the proposed testing requirements for wind, solar photovoltaic and BESS technologies?	No comment.
Q18. Do you agree that the system operator needs the additional data identified in this section to maintain power system security and meet the PPOs?	No comment.
Q19. Do you agree with the proposal to use high-speed monitoring data to verify asset performance and reduce the need for routine testing of generating stations between 10 MW and 30 MW?	No comment.
Q20. Do you agree with the data quality requirements as described in Chapter 9 of the proposed CACTIS for high-speed monitoring and operational reporting?	The Part 1 Authority-proposed definition and the measurements expectations in chapter 9 appear misaligned. The proposed definition refers to high resolution *waveform* data of voltage and current signals. The measurements under clause 9.4 include frequency, active power and reactive power. In contrast, the data resolution in 9.5 implies rms (root mean square) measurements, not waveform.
Q21. Do you currently have the ability to provide the additional information proposed in the draft CACTIS? If not, when do you	As noted in our response to questions 1 and 2, we consider that some of the new requirements and timeframes should not apply to the grid owner. We have not assessed any timing aspects at this stage as we do not consider the proposed requirements on

Question	Transpower as grid owner / asset owner comments
expect to be able to meet these requirements?	the grid owner align with our purpose of accelerating our connection of generation assets, responding to catastrophic events, and/or repairing and replacing assets. Any new requirements would be advanced as unplanned expenditures under our RCP4 Commerce Commission approvals, with flow on cost impacts to consumers. The CACTIS would be better specified and proportionate, if it can link what type of information is required from which type of asset owner, whether as grid owner, connected asset owner, generator or embedded generator (both generators include BESS). • **grid owner recommendation** Use participant type specific references to ensure obligations are proportionate to the identified problem of information needs from inverter-based generation resources.

Appendix B - Grid owner feedback to system operator on CACTIS clauses

This feedback is made considering the Code change proposals by the Authority for deletions and additions to Part 8, Promoting reliable electricity supply – a Code amendment proposal on common quality-related information.

Chapter /Clause number	Content	Grid owner as asset owner comment
Interpretation clause 8	In the event of any inconsistency between the provisions of this CACTIS and the provisions of the rest of the Code (excluding other material incorporated by reference into the Code), the provisions of the rest of the Code will prevail to the extent of the inconsistency.	Add "or absence of provisions in the rest of the Code" to ensure that the CACTIS remains a document that is incorporated by reference and is not at risk of creating its own new provisions outside its governing legislation (i.e. Part 8 Code provisions).
Connection study report	means a report on connection study cases for an asset that complies with the specifications in Chapter 5.	This term has been imported from system operator guidelines for connecting generators *Connection Study Requirements for New Generating Assets* As such, assume these studies are not required of the grid owner. The grid owner does not currently do connections studies for the system operator.
Engineering methodology	means a document that includes a full description of all tests to be performed on an asset including the methodology for each test, the signals to be recorded, the sampling rates to be used, and the format for submitting test results to the system operator.	New term that has been imported from system operator guidelines for connecting generators *Connection Study Requirements for New Generating Assets* For the grid owner as an asset owner, this would be a new requirement; we are currently unclear on its significance to routine asset testing and the grid owner's investment program to modify existing assets through replacement, refurbishment or enhancement.

Chapter /Clause number	Content	Grid owner as asset owner comment
Chapter 1	**Timeframe requirements**	
1.1	This Chapter specifies the time frames in which an asset owner must provide the system operator with the documentation and information required by this CACTIS and the Code before and after commissioning an asset and when an asset is decommissioned.	Please refer to cover letter and answer to question 2.
1.4	Where the time frames in this Chapter for providing the system operator with documentation and information are not adhered to, the asset owner must not first electrically connect an asset to a network, without prior written approval from the system operator	The current setting under Technical Code A clause 4 is that the system operator gives permission to conduct *commissioning*. We consider this term is well understood and should remain as the date from which all other processes refer to, and consistent with Figure 1. Our interpretation of the clause: • If timeframes are not adhered to, the asset owner can only electrically connect with approval i.e. potentially no consequence of not adhering to the timeframe as the system operator could still approve? • if timeframes *are* adhered to, is approval not required? Under Part 10, the grid owner owns the **electrically connect** process at the grid connection point. Electrically connect (closing a switch) may happen in several locations over time, depending on where the asset is. We consider the term less suitable than "planned commissioning date" for setting information provision timeframes.

Chapter /Clause number	Content	Grid owner as asset owner comment
		We also note Figure 1 indicates a *period* for commissioning [T – E] rather than a single date. All grid owner processes are based on pre-commissioning and commissioning dates. Using 'electrically connected' could cause significant complexity for grid owner delivery and excessive information requirements to the system operator, especially during multi phased/staged projects with multiple partial commissioning.
1.5	A planning stage asset capability statement for an asset must be: a) provided by the asset owner to the system operator at least 12 months prior to when the asset is electrically connected to a network; and (b) reviewed by the system operator within 20 business days of receiving the planning stage asset capability statement.	Does *review* include producing a concluding document for the asset owner. Under (a) could put "*proposed to be commissioned.*" a) provided by the asset owner to the system operator at least 12 months prior to when the asset is *proposed to be commissioned;* and
1.6	A pre-commissioning stage asset capability statement for an asset must be: (a) provided by the asset owner to the system operator at least 2 months prior to when the asset is electrically connected to a network; and (b) reviewed by the system operator within 20 business days of receiving the pre-commissioning stage asset capability statement.	Under (a) could put "*proposed to be commissioned.*"

Chapter /Clause number	Content	Grid owner as asset owner comment
1.8	A final copy of a commissioning plan for an asset must be: (a) provided by the asset owner to the system operator at least 2 months prior to when the asset is electrically connected to a network; and	Under (a) could put "*proposed to be commissioned.*"
1.10	A final copy of a connection study report for an asset must be: (a) provided by the asset owner to the system operator at least 2 months prior to when the asset is electrically connected to a network; and (b) agreed by the system operator within 20 business days of receiving the connection study report.	The existing approach is for connection studies to apply to generators e.g. Connection Study Requirements for New Generating Assets The grid owner does not do connections studies for the system operator, for its own assets. The CACTIS should be specific about which participants perform connection studies i.e. change the term asset owner, to generators. Under (a) could put "*proposed to be commissioned.*"

1.13	The following requirements in relation to an asset must be demonstrated to the system operator at least 10 business days prior to when the asset is electrically connected to a network….
	
	(a) SCADA for the asset is fully modelled and operational in the system operator's production server.
	
	(b) Dispatch communications for the asset are operational.
		For (a) and (d) Our understanding is that the system operator currently does these changes/updates.
		
		If the objective is for system operator servers and RMT to be updated prior to commissioning, then it would be more accurate to require that *based on the information received from the asset owner, the system operator must update its production servers and RMT 10 days prior to commissioning.*
		
		For (c)*:* The grid owner supports the more formal approach to protection coordination.

Chapter /Clause number	Content	Grid owner as asset owner comment
	(c) Protection coordination for the asset at the grid interface is confirmed in writing by each participant electrically connected to a network at the relevant point of connection in the format agreed by the grid owner. (d) If required, the Reserves Management Tool (RMT) is updated for the asset.	However, protection settings policy is governed by Schedule 8.3 Technical Code A clause 4. This clause remains in force. (*Each asset owner and grid owner must co-operate with the system operator to ensure that protection systems on both sides of a grid interface, which include main protection systems and back up protection systems, are co-ordinated*…) Applying the *interpretation* section clause 8 means this sub-clause could be viewed as not consistent with the existing Code. The Code may need to be consequentially changed to update to the new more formal policy.
Figure 1	Timeline of commissioning requirements	There's no chapter 6 indicated in the left-hand column, chapter 6 covers the engineering methodology and test plan. The Chapter 7 testing should appear in the space T - E. Electrical connection must occur at T.
Chapter 2	**Commissioning Plan Requirements**	
2.3	The asset owner must provide a commissioning plan for an asset in the following situations: (a) when the asset is to be electrically connected to a network; and (b) when changes are made to the asset that alter any of the following at the grid interface...	[**electrically connect** means to operate a device so that electricity is able to flow.] For (a), the grid owner routinely electrically connects assets to a network, the grid, when switching assets off and on to create outages for maintenance, replacements, and additions. Could the grid owner's many routine outages repeatedly trigger this requirement.

Chapter /Clause number	Content	Grid owner as asset owner comment
		For (b) if a change is made to an existing (and electrically connected) asset, does the 12-month commissioning timeline of Chapter 1 apply again e.g. following a change to an HVDC control systems. For (a) we consider the phrase "*proposed to be commissioned*" should be used instead of electrically connect, to avoid unintended consequences for grid owner activities.
2.5	A commissioning plan for an asset must: .... (d) contain all other information required by the form for the commissioning plan from time to time published by the system operator.	Is "the form" in this clause, the proposed commissioning plan template (page 13 of the consultation document). If so then (d) is n/a to the grid owner?
Chapter 3	**Asset Capability Statement Requirements**	
3.1	This Chapter specifies the requirements for asset capability statements that must be provided by an asset owner to the system operator under clause 2(2) of Technical Code A of Schedule 8.3 of the Code.	Clause 2(2) of Technical Code A is proposed to be deleted by the Authority.
3.4	For the purpose of clause 2(5A) of Technical Code A of Schedule 8.3 of the Code, an asset capability statement for an asset must:	Clause 2(5A) is proposed to be deleted by the Authority. The existing clause includes that the information must be reasonably requested. Either Clause 2(5A) should not be deleted or this clause 3.4 needs to retain "reasonableness" as the (recognised legal) standard for requiring information.

Chapter/Clause number	Content	Grid owner (grid owner) as asset owner comment
Chapter 4	**Modelling Requirements**	
Encrypted	encrypted means a control system model in which the control block(s) and signal flow are accessible, but the logic, mathematical equations, and programming Code are not accessible to the system operator.	The system operator sharing encrypted models from other asset owners: this should be permitted to be shared with the grid owner. If not, the system operator will always be the central analyser of the entire power system, all the time. This result is contrary to the intent for participants to do more of their own studies.
4.1	This Chapter specifies the requirements for modelling data that must be provided by asset owners to the system operator and under clauses 2(5A) and 2(5B) of Technical Code A of Schedule 8.3 of the Code and in connection with other requirements in this CACTIS.	The Authority has proposed to delete Schedule 8.3 Technical Code A clause 2(5A), and Clause 2(5B) does not exist.
4.2 – 4.4	M1 and M2 models	The CACTIS should be specific about which participants perform connection studies i.e. in these clauses, change the term asset owner to generators, consistent with the clauses that follow (and the system operator consultation).[17]
4.8	4.8 If an original equipment manufacturer deems a model is not to be shared publicly…,	The grid owner should not be considered "the public" as this will mean the grid owner may not be able to access accurate models for its work. This highlights the need to recognise the grid owner's existing rights to modelling information for its planning studies under the Connection Code. The grid owner needs the same models

[17] System operator consultation The m1 model would serve as a preliminary representation of a generating asset and would be submitted as part of connection studies before commissioning [page 15]

Chapter/Clause number	Content	Grid owner (grid owner) as asset owner comment
		and access as does the system operator, to conduct studies appropriately.
4.10	All models an asset owner provides to the system operator must:.. (c) (ii) a generating unit producing power from wind or solar or BESS can be aggregated with generating units of the same design…	*If* the system operator wants to require inverter control models, the clause drafting does not convey that. (c) (ii) - is there a requirement to show the aggregation methodology to be checked by the system operator, to assure accuracy in representation.
4.11	A PowerFactory and TSAT model submitted by an asset owner to the system operator must…	Should minimum control block time constants be captured in RMS models? Also as numerically stable does not mean accurate; is the intent that models should be accurate for the prescribed simulation times?
4.16	Model maintenance and update For the purpose of clause 2(5B) of Technical Code A of Schedule 8.3 of the Code, the asset owner must:	There is no clause 2(5B) in Schedule 8.3 Technical Code A.
4.19	If, after the completion of routine testing of the asset, the performance of the asset has not changed, the asset owner must submit to the system operator an updated validation report incorporating the existing model and most recent routine test results.	This appears to be new policy, as the current Code about routine testing under Appendix B does not indicate the process described at 4.19. This updating requirement will introduce new and ongoing compliance and the impact to grid owner is significant; the grid owner does not do this now, so it has significant resource, expediency, compliance and cost implications.

Chapter/Clause number	Content	Grid owner (grid owner) as asset owner comment
Chapter 5	**Connection Study Requirements**	
5.2	Asset owners must submit connection study reports to the system operator…	This clause an example for where participant type identifiers should be used; in this case "generators."
5.8	If the asset is a BESS, the reactive power capability study must also be undertaken while the asset is charging at 100%, 50%, and 30% active power level.	Some BESS systems might never want to charge at rated power of its inverters so does 100% apply to inverter ratings or maximum operating point?
5.14	SHORT CIRCUIT STUDY A short circuit study must be undertaken to determine the Effective Short Circuit Ratio (ESCR) at the asset's point of connection under the following operating conditions: … (a) Covering a minimum 3-year horizon and; (b) Full intact power system and n-1-1 outage scenarios; and (c) Maximum and minimum short circuit levels at the point of connection and nearby buses under various power system conditions, including relevant power system reconfiguration	At (a), would the system operator provide forecast project commissioning and decommissioning to be factored into the analysis. At (b) should include n-1. Consider (c) is already covered by (b)?
5.22	If a fault ride through study for an asset requires the asset owner to assess how other assets impact the asset's fault ride through capabilities, the asset owner must either:	While the grid owner can already require models from other asset owners under the Connection Code, we consider it would promote efficient operation if the grid owner can access models held by system operator.

Chapter/Clause number	Content	Grid owner (grid owner) as asset owner comment
	(a) seek consent directly from the other asset owners to obtain encrypted models of the relevant assets; or (b) request the system operator seek consent from the other asset owners to share their encrypted models held by the system operator with the asset owner.	Both clauses could have the qualifier "consent not unreasonably withheld."
Chapter 6	**Test Plan Requirements**	

6.3	The asset owner must provide a test plan to the system operator in the following situations:
	(a) when the asset is either to be electrically connected to, or is to form part of, a network, and
	(b) when a change is made to an asset that alters any of the following at the grid interface…
	…
	(d) if the testing or connection of an asset may affect the system operator's ability to plan to comply, or to comply with, the principal performance obligations;
		[**electrically connect** means to operate a device so that electricity is able to flow.]
		For (a) the term "electrically connect" creates ongoing implications for the grid owner because every activity the grid owner undertakes requires it to electrically connect (and electrically disconnect) for its many outages.
		Propose (a) when the asset is to be *commissioned*.
		For (b) assume for *changes* to assets (at the grid interface), assume the timeframes under Chapter 1 do not apply again?
		For (d) how does an asset owner know if its testing will impact the system operator's ability to meet its PPOs?

Chapter 7	**Testing Requirements**	
7.7	7.7 An asset owner must submit an **engineering methodology** to the system operator for review if:	**engineering methodology** means a document that includes a full description of all tests to be performed on an asset including the methodology for each test, the signals to be recorded, the sampling

Chapter/Clause number	Content	Grid owner (grid owner) as asset owner comment
	(a) the asset owner intends to electrically connect a new asset to a network; or (b) the asset owner intends to modify an existing asset that is connected to a network; or (c) the asset owner is carrying out routine testing of an asset and is unsure if its proposed testing will meet the requirements in this Chapter	rates to be used, and the format for submitting test results to the system operator. Currently this term is used in the Generation Commissioning Process For the grid owner as an asset owner, this would be an onerous new requirement; currently unclear on its significance (and benefits) to routine asset testing and its investment program to modify existing assets through replacement, refurbishment or enhancement.
7.12	An asset owner with a shunt capacitor directly connected to a network must… (c) test the operation of each of its reactive power control asset's digital control systems at least once every 10 years	This clause appears to apply to the grid owner, despite the system operator comment in its consultation about reactive power devices[18] (see below). Insert "*excluding the grid owner.*" Would need to understand what level of testing is expected. Testing the HVDC reactive power controller by removing it from the market would have major availability and cost implications. We propose verification should be via retrospective system events, to minimise risk to the system and cost to the market. The grid owner consider there are enough actual system events every 10 years to capture good data and validate the HVDC responses.
7.12, 7.13	Specific testing requirements: Shunt capacitors and reactive power control systems and	**Testing Settings:** As these testing settings are from a previous technological (analogue) era, immediate review would be beneficial. For example,

[18] System operator consultation The draft CACTIS specifies that certain asset owners must test: • shunt capacitors and reactive control systems • dynamic reactive power compensation device transient response and control. This applies to asset owners, other than transmission network owners… [page 20]

Chapter/Clause number	Content	Grid owner (grid owner) as asset owner comment
	Dynamic reactive power compensation device transient response and control	• routine testing for digital equipment may not be necessary for relays which have self-diagnosis capabilities; testing could create greater system risk from taking outages, and/or not returning the equipment to service correctly • performance improvements for analogue systems over time, could mean different testing frequencies. The grid owner has previously submitted to the Authority for Code Change, refer CAR161 *Routine asset testing interval changes* submitted 28/01/2020 Schedule 8.3. This proposal would be a candidate for system operator review under the CACTIS.
7.27	A grid owner must… (a) test each of its synchronous compensators' analogue and electromechanical voltage control systems at least once every 5 years	This clause is redundant and should be deleted, all systems are now digital.
7.28	The HVDC owner must… (a) test the operation of each of it HVDC link's analogue control systems at least once every 4 years	This clause is redundant and should be deleted, all systems are now digital.
Chapter 8	**Operational Communication Requirements**	
Table I	New requirements on grid owner for inidcations and measurements for Reactive power controller status (enabled / diabled) and	Yes can provide this information.

Chapter/Clause number	Content	Grid owner (grid owner) as asset owner comment
	Reactive Power Controller Setpoint kV or MVar	
Chapter 9	**High Speed Data Requirements**	
High speed monitors	Proposed definition from Authority's consultation: **high-speed monitor** means a device capable of capturing and storing high-resolution waveform data of voltage and current signals during power system events or disturbances, with sufficient sampling frequency and accuracy to support detailed analysis of power system behaviour	There seems to be a misalignment between the Part 1 Authority proposed definition and the expectations in chapter 9. The proposed definition refers to high resolution waveform data of voltage and current signals. The measurements under clause 9.4 include frequency, active power and reactive power. The data resolution in 9.5 implies rms (root mean square) measurements, not waveform.