

28 July 2025

Future Security and Resilience Project
Electricity Authority
By e-mail: fsr@ea.govt.nz

Dear Future Security and Resilience Project,

Lodestone Energy appreciates the opportunity to provide feedback on the Electricity Authority's consultation on common quality information. This letter forms the entirety of our submission and includes both our position and supporting technical commentary.

As New Zealand's first utility-scale solar developer, Lodestone Energy has a strong interest in ensuring that grid requirements are technically justified, commercially feasible, and aligned with international best practice.

Lodestone Energy was founded in 2019 with the mission to "harness the sun's energy to power Aotearoa's zero carbon future". We currently operate three solar farms in Kaitia, Edgumbe, and Waioatahe with two more under construction in Whitianga and Clendebaye and a pipeline to deliver another nine sites over the next few years. Our experience as an early mover gives us practical insights into the challenges of connecting inverter based resources (IBRs) to the grid, particularly within distribution networks.

Lodestone Energy believes in being a responsible grid participant. We support paying reasonable compliance costs where these demonstrably improve system reliability and fairness. However, compliance requirements must be proportionate, evidence-based, and not impose unnecessary burdens that hinder New Zealand's uptake of new renewable generation.

Executive Summary of Lodestone Energy's Position on the Proposed Code Amendments

Lodestone Energy **does not support** the proposed Code amendment in its current form. Although we support the principle of **standardising information requirements**, the proposed changes outlined in the new CACTIS introduce **significant costs, technical complexity, and uncertainty** without clearly articulated or quantified benefits. We urge the Authority to reconsider and adopt a more targeted, internationally aligned approach.

Our key concerns:

1) Modelling Requirements are Excessive

The requirement for four validated power system models—especially the inclusion of TSAT—is out of step with international practice and unjustified by clear system benefits.

2) The new Communication and High-Speed Data Monitoring Requirements are Poorly Justified

The proposed requirements add cost and complexity without a transparent cost-benefit case or clarity on operational integration.

3) Lack of Clear Model Assessment Criteria

The CACTIS fails to specify objective benchmarks for model accuracy or acceptance, undermining predictability for developers.

4) No Grandfathering Provisions for Existing IBRs

The proposal does not address how legacy IBRs will be treated, creating regulatory uncertainty and commercial risk.

We recommend an **alternative risk-based, and internationally aligned approach**:

1. **Modelling:** Require a benchmarked and validated PowerFactory RMS model for all projects; require PSCAD EMT models only where the system strength is low, defined using agreed metrics.
2. **High-speed Recording:** Introduce only with clear justification; better consideration of in-flight and legacy projects should be introduced to recognise unique challenges such as limited connectivity and expensive retrofitting.
3. **Legacy IBRs:** Apply grandfathering provisions or transitional compliance pathways for existing IBRs.
4. **Governance of the CACTIS:** Ensure future CACTIS updates are subject to formal consultation and rigorous cost-benefit analysis.

In summary, we think the proposal is unaligned with the Authority's statutory objectives. It will add cost to consumers and reduce the efficiency of the grid connection process. In a grid that needs new renewables to be built as fast as possible, these changes represent an unwelcome new barrier that will slow the energy transition for NZ consumers and create additional risks and uncertainty.

Detailed Feedback

Modelling Requirements are Excessive and Unproven

The requirement within the CACTIS to submit **four validated models**, including TSAT, is excessive and lacks international precedent. In Australia (the NEM), considered to have among the most rigorous regimes, only two validated models are required. Moreover:

- **TSAT is not widely supported**; few NZ consultants have experience or access. Consequently, there will be a heavy reliance on expensive overseas resource to produce these models.
- The modelling burden scales **non-linearly** with software format diversity. Model tuning and maintenance across three platforms and four models is disproportionately complex.
- The system operator's claim that multiple models improve reliability lacks supporting analysis. On the contrary, this may **reduce system integrity** due to inconsistency and increased risk of misaligned model behaviour.
- The system operator appears **under-resourced** to handle the volume and complexity of these submissions effectively.

We do agree that the development of the CACTIS as a single document incorporated into the Code by reference is an improvement on the current status quo. The document will allow the system operator to respond more effectively with appropriate modifications that incorporate changes in technology over time. However, the document needs to start in a place that is reasonable and representative of good international practice.

We do agree with the statement that modelling requirements for IBRs are generally more complex than their synchronous counterparts as these generating systems are somewhat “software defined”.

The proposal states that conversion between platforms e.g. PowerFactory -> TSATools is increasingly difficult. We concur with this assessment and feel that the proposal under-estimates the magnitude of this problem. By asking asset owners to supply four models in three different software platforms, they risk compounding this problem and creating considerable additional expense and delays for the industry. Furthermore, independent generators are disadvantaged relative to larger incumbents as smaller industry players generally have relatively smaller engineering teams. This forces heavy reliance on external consultant expertise and its associated expense.

There is an analogy in the software world to developing and maintaining generator models in multiple software formats. It is somewhat related to the challenge of maintaining a software product compatible with multiple operating systems e.g. Windows, Linux, Mac, iOS. In this regard, it is widely known that complexity scales non-linearly. For example, one tuning update to an IBR’s frequency controller may demand recalibration in all four model formats; each with their own quirks and validation pipelines.

Platform specific expertise is needed. PowerFactory expertise is widespread within NZ and to a lesser extent PSCAD. TSAT expertise across the country is minimal, especially outside of the system operator. Most of the major power systems consultants do not have software licenses, nor staff trained in the software. This will likely force the use of overseas resource, adding considerable expense and difficulty to model development.

The proposal states that the industry would benefit from cross-platform compatibility measures. We agree. However, such cross platform compatibility measures do not currently exist at a meaningful maturity level with regulatory endorsement.

The proposal states that information imposes a cost on the system operator. We agree. The statement goes on to say that multiple low-quality models increase the risks. However, we don’t agree that submitting four models in three different platforms resolves this risk and itself introduces the potential for a plethora of low quality unmaintained models and therefore seems more likely to exacerbate this problem rather than resolve it.

Confidentiality Concerns

We agree with the proposal that confidentiality concerns create barriers to sharing information. We also think the proposal is understating the commercial challenges. EMT models in many cases run the exact source code of the inverter and therefore are critical intellectual property of the OEMs. It is reasonable to expect OEMs to support one or two software model formats, but unreasonable to require support for more than this.

The nature of inverter resources means that any given OEM will have tens of products each with hundreds of firmware versions. Each of these require quality control and model development meaning that the OEMs need to maintain hundreds to thousands of models even to support one software modelling format. The industry already struggles with model accuracy and errors within popular modelling formats, so requiring unrestricted models for many software formats seems like a requirement that is destined to fail.

Cost Estimates are Inadequate and Misleading

The proposal states that the material net benefit to the power system is larger than the cost, yet provides a simplified quantification of the material net benefit and significantly under-estimates the compliance costs. Our view, based on the direct experience of our team, is that the estimated model conversion and development costs of \$15,000-50,000 are a significant under-estimate. As a counter-point, a typical grid connection approval in Australia, that requires only a benchmarked RMS and EMT model, will cost >\$1M.

We think validation costs of PSCAD models of \$15,000-20,000 are significantly understated. Typical experience from Australia suggests that such validation on real projects would normally be in the range of \$50,000-\$100,000.

The proposal states that TSAT model conversion costs would be in the range of \$50,000-\$100,000 with an extra \$10,000 to \$15,000 for model validation. Again, we think the model validation costs are understated. Additionally, reliance on an overseas entity for model conversion is problematic for multiple reasons. Burdening a project with an additional \$115,000 of cost to produce a model that has not been demonstrated by international best practice as being needed would be an unfortunate consequence of this version of the CACTIS.

Ultimately all additional compliance costs flow on to consumers in the form of higher energy prices. Hence, unless such costs are met with commensurate benefits, we think the proposal is in direct conflict with the Authority's statutory objective: "To promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers".

The proposal states that the system operator will continue to provide translation services (for no cost) for models of synchronous machines. This unfairly singles out IBRs and is not in the spirit of an open access grid. In the interests of fairness and transparency, at a minimum, the system operator should be seeking cost-recovery of synchronous machine model conversion costs.

The proposal's estimated benefits lack rigour and explanation. Even if they are taken at face value, we have estimated that these benefits are significantly below real estimated costs. Table 1 below, shows our estimate of additional costs associated with the CACTIS information requirements based on the number of IBR sites >10 MW that are expected to be commissioned in 2026. This is approximately three times the proposal's estimate for quantified benefits. If we were to add in the additional compliance costs for the existing grid connected IBR, then the costs of compliance could be expected to inflate to more than \$7M¹. These costs clearly exceed the benefits outlined in the proposal.

¹ Based on 12 operating windfarms, five operating solar farms and two BESS > 10 MW.

Table 1: Electricity Industry cost estimate of new CACTIS data requirements

Category	
IBR sites commissioned in 2026 ²	6
TSAT site model conversion cost	\$ 100,000
TSAT site model validation cost	\$ 50,000
PSCAD model site validation cost	\$ 50,000
High speed data recorder site cost including design and other soft costs	\$ 100,000
Additional site comms requirements	\$ 10,000
Total (2026)	\$1,860,000

Unclear Model Requirements

We agree that there is benefit in clarifying the requirements and enforcing consistent standards. Clarifying the timing for submission of M1 and M2 models is helpful and also the time the system operator has to review these.

However, the CACTIS does not identify objective criteria by which models will be judged and accepted by the system operator. It provides some general statements about accuracy, timesteps and the like, but does not clarify how adequacy of benchmarking will be determined. In comparison, AEMO in Australia produces a comprehensive document, the Dynamic Model Acceptance Guideline (DMAG), which outlines objective criteria that models will be assessed against³ and the tests that must be undertaken.

High Speed Monitor Installation

The proposed introduction of new communication and high-speed data recording requirements within the CACTIS framework represents a material increase in both capital and operational costs for asset owners, particularly independent generators.

Although the policy rationale gestures toward improved event response and situational awareness, the proposal lacks a detailed justification of how these new data streams will be integrated into operational practice, or how they will materially improve system reliability in a way that justifies their cost. For example, the proposal does not provide quantitative analysis or case studies demonstrating how historical grid events would have been better managed had these devices been in place. This absence of a clear benefit narrative makes it difficult for participants to assess whether the return on investment for these systems is proportionate or necessary.

Furthermore, the proposal's cost estimates appear optimistic and may significantly understate the true expense of complying with the new requirements. The indicative cost range of \$20,000 to

² source: <https://electricitymap.frenchsta.gg/pipeline>

³ https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2024/iess-rule-terminology-changes-to-national-connection-documents/dynamic-model-acceptance-test-dmat-guideline-v30.pdf?la=en

\$30,000 per high-speed monitoring device fails to account for the broader system integration costs, including auxiliary equipment (such as instrument transformers, signal converters, and dedicated data links), site-specific engineering design, cybersecurity hardening, and ongoing maintenance. These costs may scale steeply for smaller or remote generating sites where retrofitting infrastructure is more complex and expensive. In some cases, especially for smaller independent generators, the cumulative burden may materially impact project viability or investor confidence.

Finally, the proposal assumes a relatively uniform baseline of existing monitoring infrastructure across the industry, which does not reflect the diversity of generator configurations. For example, many smaller or earlier-phase IBR projects were commissioned under legacy requirements and do not have the physical space or communications bandwidth to accommodate these new systems without delay, redesign, and significant additional expense. As such, we are concerned that the rollout of this requirement could inadvertently delay new projects or force costly midstream design changes to projects already in advanced stages of development. A clearer articulation of benefits, a realistic total cost assessment, and a proportionate, risk-based implementation pathway would better align the proposal with the operational realities faced by independent developers.

Grandfathering Provisions

A critical omission in the current CACTIS proposal is the absence of guidance regarding how existing inverter-based resources (IBRs) will be treated under the new information and modelling requirements. Although the document clearly outlines obligations for new connections and modified assets, it remains silent on whether IBRs that are already commissioned and operational will be required to retroactively comply. This lack of clarity creates significant regulatory uncertainty for independent generators, many of whom operate legacy assets commissioned under earlier, less data-intensive standards. Without explicit provisions for “grandfathering” or transitional compliance periods, asset owners are left to assume the most conservative interpretation – that all IBRs, regardless of age or configuration, may soon be required to meet the full suite of new data, testing, and model validation obligations.

This creates both practical and commercial risks. Many legacy IBRs—particularly those commissioned more than five years ago—may not have the manufacturer support, firmware compatibility, or access to detailed control system documentation necessary to build or validate the four types of models now proposed. In some cases, original equipment manufacturers (OEMs) may no longer provide technical support, or the technology may have changed sufficiently that model reconstruction would require reverse engineering at considerable cost and uncertainty. Imposing full compliance on these assets, without acknowledging their constraints or providing a pathway for partial or risk-based compliance, could result in stranded investments or force asset owners into expensive upgrade cycles that are disproportionate to the system risk those assets pose.

Furthermore, the absence of a transitional timeline – even one with staged obligations – could create an enforcement bottleneck and reduce the willingness of owners to voluntarily collaborate with the system operator. A more effective approach would involve clearly defined grandfathering provisions for legacy assets, coupled with a flexible compliance framework that allows owners to demonstrate functional equivalency through representative testing or simplified modelling for older equipment. This would support system reliability goals without placing undue burden on operators of otherwise well-performing assets. Clarifying this aspect in the next phase of consultation is critical to maintaining investor confidence and ensuring regulatory fairness across the generation fleet.

Operational Communication Requirements

We note the requirement to provide solar horizontal irradiance (GHI) for forecasting purposes. However, we would note a few points on this:

1. The EA has engaged DNV to provide centralised forecasting services for solar and wind farm sites. It is unclear what benefits would be obtained from the SO developing its own real time forecasting with live data obtained from generation sites and duplicating this work.
2. While GHI is possibly useful for approximate determinations of PV output, alone it is not sufficient to determine expected PV system output. Ideally you would need: GHI + DHI + DNI + Temperature + Wind Speed + Albedo to accurately determine output.
3. Other factors that influence the output include the tracking angle, specific overbuild (DC/AC ratio), module efficiency, and so forth.
4. In accordance with IEC61724, large scale solar farms typically have more than one weather station and a minimum of two. Would the system operator like both measurements, just one, or the average of the on-site sensors?

Questions	Comments
Q1. Do you support the Authority's proposal to clarify the Code's common quality information requirements and describe the technical specifications in a document incorporated by reference in the Code?	In principle we agree that consolidation, clarifying and standardizing common quality information in an external document incorporated by reference is a positive move. However, we have some reservations about the governance of this process and would like to emphasise the importance that these documents are still subject to appropriate feedback and consultation with industry. In other words, it is important that the CACTIS does not become a means of giving the system operator unregulated power to alter common quality requirements without due process and adhering to best industry practice.
Q2. Do you have any comments on the drafting of the proposed amendment?	We do not support the proposal in its current form. Please refer to detailed comments within our covering submission.
Q3. Do you see any unintended consequences in making such an amendment?	Yes, compliance costs will considerably escalate without proportionate system benefits. Please refer to detailed comments within our covering letter submission.
Q4. Do you agree with the objective of the proposed amendment? If not, why not?	Yes, the objective is reasonable, but we don't think the proposal achieves it. Please refer to detailed comments within our covering submission.

Questions	Comments
Q5. Do you agree the benefits of the proposed amendment outweigh its costs? Please provide evidence to support your view. This may include incremental benefits and costs associated with the draft CACTIS.	We strongly disagree that the benefits of the CACTIS outweigh its costs. We feel the proposal has significantly under-estimated the costs of implementing the requirements outlined in the CACTIS. Furthermore, many of the benefits described appear to be mostly qualitative without a rigorous basis for how they were determined. Please refer to detailed comments within our covering submission for more detail.
Q6. Do you agree the proposed amendment is preferable to the other options? If you disagree, please explain your preferred option in terms consistent with the Authority's statutory objective in section 15 of the Electricity Industry Act 2010.	We feel that this Code amendment is counter to the Authority's statutory objective and will layer in additional costs to consumers. We have provided a recommended alternative approach within our covering letter.
Q7. Do you agree the Authority's proposed amendment complies with section 32(1) of the Act?	The additional compliance costs, particularly the additional modelling costs, do not comply with section 32(1) of the act. These requirements will add considerable time and cost to electricity connections and thereby reduce the efficient operation of the power system.
Q8. Do you have any comments on the drafting of the proposed amendment?	No
Q9. Do you have any comments on the draft Connected Asset Commissioning, Testing and Information Standard?	Please see our detailed comments with our covering submission.

Kind regards

Peter Apperley
General Manager, Engineering

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