

20 August 2024

Anna Collyer Chair Australian Energy Market Commission GPO Box 2603 Sydney NSW 2001

Lodged online at: www.aemc.gov.au

Dear Ms Collyer

Rule Change Request: Introducing a new registration category to enable the provision of essential system security services by non-generating units

CS Energy submits the attached rule change request under section 91 of the National Electricity Law (**NEL**) for consideration by the Australian Energy Market Commission (**AEMC**).

Under the National Electricity Rules (**NER**), the Australian Energy Market Operator (**AEMO**) is responsible for determining the required service levels for system strength and inertia.¹ Transmission Network Service Providers (**TNSPs**)² as the System Strength Service Providers and the Inertia Service Providers must then procure network (or non-network) services so that they can reliably deliver the required services at the time and locations (system strength nodes or inertia sub-networks) as specified by AEMO.³

Through service agreements with TNSPs, non-network system strength and inertia services can be provided by National Electricity Market (**NEM**) *Registered Participants* through synchronous generating units or synchronous condensers.⁴

The NER also specifies the types of technology that qualify to provide certain services. For example, under rule 5.20B.4 (d) (1 and 2), services that qualify to provide inertia up to the minimum threshold level must be services made available through:

- A network based synchronous condenser, which is installed, commissioned and operated by the TNSPs; or
- An inertia service agreement with a NEM *Registered Participant*, which provides services through a synchronous generating unit or a synchronous condenser.

Brisbane Office PO Box 2227 Fortitude Valley BC Qld 4006 Phone 07 3854 7777 Fax 07 3854 7300 Callide Power Station PO Box 392 Biloela Qld 4715 Phone 07 4992 9329 Fax 07 4992 9328 Line Kogan Creek Power Station PO Box 41 Brigalow Qld 4412 Phone 07 4665 2500 Fax 07 4665 2599

¹ Clauses 5.20B and 5.20C of the NER.

² TNSPs or jurisdictional planning bodies for transmission.

³ Clauses 4.4.5 and 5.20B.4.

⁴ Clause 5.20B.4.

Thus, under the NER, TNSPs can only enter into a system service agreement with a NEM *Registered Participant.* While synchronous generating units (including units with synchronous condenser mode) would be registered as a *Generator* under the NER, there is currently no appropriate market registration category for non-generating units such as stand-alone synchronous condensers.

To date, this has not been an issue as synchronous condensers installed in the NEM have been either a network asset or part of a larger generating system (i.e., not stand-alone). However, as synchronous generators (such as coal, gas and hydro plants) retire, these generators can potentially be repurposed into stand-alone synchronous condensers.

For example, Transgrid reported that a mix of technological solutions would be needed to effectively meet system security requirements in New South Wales (**NSW**), including the conversion of existing generators to synchronous condensers.⁵ Further, under the Queensland Energy and Jobs Plan (**QEJP**), existing coal-fired generators may be converted to stand-alone synchronous condensers from 2027 onwards.⁶

During this conversion process, the units will be declassified as *scheduled generating units* but do not have an appropriate market category with which to register. Currently, the only option would be for these units to register on the basis that they draw electricity to operate (i.e. as a *market customer* or an *integrated resource provider*). Thereby, potentially precluding their ability to provide the full range of system services in both the existing NEM frameworks and potential future markets that are currently under consideration by the AEMC.

To address this issue, CS Energy is proposing the attached rule change to introduce a new registration category (i.e., a non-generating system service provider) to enable the provision of system security services by non-generating units such as stand-alone synchronous condensers.

CS Energy considers the proposed change to be non-controversial as it is administratively not complex and it has potential net benefits for industry participants, TNSPs, AEMO and consumers. A new registration category would remove any potential ambiguities regarding the ability of non-generating units to provide system services under the NER, which may also incentivise market participants to provide more non-network system services by investing in stand-alone synchronous condensers.

This could also further encourage the conversion of existing synchronous generators to stand-alone synchronous condensers, which can provide a viable and potentially more efficient solution to delivering the required system services. In the longer run, this proposed rule change may also remove barriers to other emerging non-generating technologies providing system security services in the NEM, which may increase the overall level and diversity of such services.

The proposed rule change would contribute to the achievement of the National Electricity Objective (**NEO**) as more widespread repurposing of existing units into synchronous condensers is likely to:

 Improve system security outcomes through more efficient utilisation of existing resources to provide system services, which lowers costs for all consumers in the long run; and

⁵ Transgrid, <u>System Security Roadmap</u>, accessed in October 2023.

⁶ Queensland Government, QEJP, <u>Queensland SuperGrid Infrastructure Blueprint</u>, September 2022.

• Reduce greenhouse gas emissions through a potential increase in the overall availability of system services which not only are lower emissions but would allow a higher level of renewable generators to be connected without compromising system security.

If you would like to discuss this rule change request, please contact Wei Fang Lim, Market Regulatory Manager, at <u>wlim@csenergy.com.au</u> or on 0455 363 114.

Yours sincerely

Dr Alison Demaria Head of Policy and Regulation

Name and address of person making the request

CS Energy Level 12, 31 Duncan Street Fortitude Valley, 4006

Background—The need for system strength and inertia services

The NEM is transforming and will continue to do so as it transitions to a market with a lower carbon footprint. As part of this transition, existing fossil-fuel based synchronous generators (such as coal-fired power plants) have either left or are scheduled to exit the market and are in turn being primarily replaced by inverter-based renewable generators.

The impact of the decline in the number of synchronous generators on power system security attributes such as inertia and system strength has been acknowledged. In its reports published in December 2023, AEMO has declared shortfalls of system strength and inertia in some NEM jurisdictions for the coming years.^{7,8} Based on the 'step change' scenario, AEMO projected that system strength and inertia levels are declining across parts of the NEM due to the withdrawal synchronous generators, further uptake of inverter-based renewable generators and reduction in minimum operational demand. The 'step change' scenario denotes a plausible future operating environment for the NEM, where 90% of coalfired generation capacity are expected to be withdrawn by 2035, and fully by 2040.9

The need for system security services is further demonstrated during recent events in NSW. On 15 November 2023, AEMO issued a direction requiring Bayswater coal plant to provide system security services by maintaining its operation and remaining synchronised (in effect delaying its planned maintenance). This was a result of a sudden shortfall of system strength in NSW due to the forced outage of Earring coal-fired generator. Such a direction is typically commonplace in South Australia and sometimes activated in Victoria, but this is likely the first of its kind in NSW.

Presently, the installation of synchronous condensers to provide essential system security services is one approach to mitigating these impacts given their ability to contribute positively to fault levels, reactive power and provision of inertia and system strength. The reliance on synchronous condensers may potentially increase in the absence of mechanisms that appropriately value essential system services, stymieing the development and investment in these capabilities from other technologies.¹⁰

However, relying only on new synchronous condensers to provide system security services is likely to be costly. For example, Transgrid's analysis suggested, in the next decade, up to 21 new synchronous condensers (each with a rating of 200 Mega Volt Amp (MVA)) will be required to replace system security services from retiring coal plants in NSW, at a cost of \$2.2 billion. Transgrid noted that a mix of different technologies will better meet system security needs at a lower cost to consumers, which includes converting existing synchronous generators to stand-alone synchronous condensers.¹¹ This is also reflected in supply chain concerns for new synchronous condensers.

⁷ AEMO, 2023 Inertia Report, December 2023.

 ⁸ AEMO, <u>2023 System Strength Report</u>, December 2023.
 ⁹ AEMO, <u>2024 Integrated System Plan</u>, June 2024.

¹⁰ For example, under a scenario with high or 100% renewable penetration AEMO anticipated that around 40 synchronous generators, each with a rating of 125 Mega Volt Amp (similar to those installed in South Australia) may be needed to meet system strength and inertia requirements. ¹¹ Transgrid, <u>System Security Roadmap</u>, accessed in June 2024.

In this context, it is imperative that the NER do not create barriers to the potential repurposing of existing synchronous generators (coal, gas and hydro plants) as stand-alone synchronous condensers or other potential technologies which can provide a viable and efficient solution to delivering the required system services.

Description of the proposed rule

The rule change request proposes to introduce a new participation registration category i.e., a non-generating system service provider by inserting clauses under chapter 2 (Registered Participants and Registration) of the NER. This new registration category should be designed for participants (with non-generating units) who intend to provide essential system security services including but not limited to system strength, fault levels and inertia related services.

Participants who provide system security services through generating units (including units with synchronous condenser mode) would continue to be registered as generators as currently defined under the NER.

A non-generating system service provider can be defined as an entity that owns, controls or operates a non-generating facility or system that provides system security services while connected to the transmission or distribution network.

Nature and scope of the issue with the existing rules

Clause 5.20B.4 (d)-(e) specifies the types of services that qualify to provide inertia:

- For inertia up to the minimum threshold level, a TNSP (as the *Inertia Service Provider*) can procure services:
 - Through investing, installing, commissioning and operating a network based *synchronous condenser*, and
 - From a NEM *Registered Participant* that provides services by means of a *synchronous generating unit* or a *synchronous condenser* under an *inertia services agreement*.
- For inertia beyond the minimum threshold level and up to the secure operating level, a TNSP (as the *Inertia Service Provider*) can procure services:
 - Using the same services used to obtain inertia up to the minimum threshold level;
 - Through investing in its network by means other than a synchronous condenser; and
 - From a NEM Registered Participant under an inertia services agreement by means other than a synchronous generating unit or a synchronous condenser.

These restrictions are reinforced through Clauses 4.4.4 and 4.4.5 which outline that AEMO may enable inertia (system strength) services by giving instructions to:

• the TNSP (as the Inertia (System Strength) Service Provider); or

• a NEM registered participant who has agreed with an Inertia (System Strength) Service Provider to supply inertia (system strength) services.

The need to be a registered participant to contract with a TNSP to provide system security services represents a potential barrier to the participation of technologies that do not neatly qualify for any of the existing market registration categories defined in NER Chapter 2:

- Generator;
- Integrated Service Provider (IRP);
- Customer;
- Demand Response Service Provider;
- Stand-alone Power System Resource Provider; or
- Network Service Provider.

Non-network synchronous condensers may be stand-alone or part of a broader generating system (including synchronous condenser mode of some generators). The latter would be encapsulated in the registration of the generating system as a *Generator*, but the former could only potentially satisfy the parameters of the *Customer* or *IRP* category, with synchronous condensers drawing a small load from the grid and thus constituting an unscheduled load or a market connection point.

Transgrid noted the need to explore a mix of different technologies that more effectively meet system security needs, including the repurposing of existing synchronous generators to stand-alone synchronous condensers.¹² Under the QEJP, the Queensland government has indicated its intention to explore the conversion of its publicly owned coal-fired plants to stand-alone synchronous condensers from 2027 onwards.¹³

The *Customer* registration category may inadvertently exclude synchronous condensers from providing system security services as such a category is not designed for nongenerating technologies. Registration as an *IRP* (on the basis of being a market connection point) would likely preclude synchronous condensers from providing their full capacity of market ancillary services as they may be limited to providing ancillary service load only. This would be particularly relevant in the development of a market-based procurement mechanism for inertia.¹⁴

To remove ambiguity in the NER, CS Energy considers there to be an identified need for the development of a market participant category for non-generating technologies such as synchronous condensers that are able to provide synchronous system services.

How the proposed rule change would address the issue

The introduction of a new registration category under the NER (i.e., a non-generating system service provider) will allow stand-alone synchronous condensers or other non-generating units that provide system services to be appropriately registered as participants in the NEM.

CS Energy considers the proposed change to be non-controversial as it is not administratively complex, will not impact other market categories and it has a potential net benefit for industry participants and consumers.

¹² Transgrid, <u>System Security Roadmap</u>, accessed in June 2024.

¹³ Queensland Government, QEJP, <u>Queensland SuperGrid Infrastructure Blueprint</u>, September 2022.

¹⁴ AEMC, Efficient provision of inertia, accessed in June 2024.

Such a registration category would remove any potential ambiguities and uncertainties regarding the ability of stand-alone synchronous condensers to provide services under the NER through a system strength or inertia service agreement with TNSPs or via potential future system service mechanisms. This could incentivise market participants to provide more non-network system services by investing in synchronous condensers, which provides TNSPs with access to a broader pool of system security services that may be more cost effective.

An appropriate registration category may further encourage the conversion of existing synchronous generators to stand-alone synchronous condensers, which can provide a viable and potentially more efficient solution to delivering the required system services. Specifically, such an approach has the benefits of potentially being lower in costs, larger in scale and with faster implementation timeframe relative to procuring new synchronous condensers from the international market.¹⁵

In the longer run, this proposal would also remove barriers to the adoption of other emerging non-generating technologies that can provide system security services in the NEM. This in turn may increase the overall level and diversity of system services.

How the proposed rule change will contribute to the achievement of the National Electricity Objective

The proposed rule change meets the NEO by improving power system security outcomes through more efficient utilisation of existing resources to provide system security services, which lowers costs for all consumers in the long run.

As noted, a new registration category (i.e., a non-generating system service provider) would remove potential ambiguities for stand-alone synchronous condensers to provide system services under the NER. Given that existing coal, gas and hydro generators are synchronous machines, these generators can be converted to stand-alone synchronous condensers after retirement. This would provide a potentially more cost-effective way of providing security services by reusing existing assets such as the voltage and reactive power control systems, cooling and lubrication systems and the point of connection. An existing point of connection already has most of the required infrastructure to support the operation of a converted synchronous condenser.

While the costs of repurposing existing generators to stand-alone synchronous condensers are highly dependent on the original design and condition of existing plants, a paper commissioned by the Australian Energy Renewable Agency (**ARENA**) noted that the indicative conversion costs for thermal generators are likely to be lower than the costs of procuring a new synchronous condenser. More specifically, the conversion costs are expected to be around at least 60% of the costs of a new standard synchronous condensers. The study also noted that the conversion costs may well be significantly less if the existing thermal generator has a higher capacity.

This is consistent with Transgrid's assessment that a mix of different technologies (including repurposing existing units to synchronous condensers) will better meet system security requirements at a lower cost relative to procuring a new fleet of synchronous condensers (at a cost of \$2.2 billion).¹⁶

¹⁵ DIgSILENT Pacific, <u>Repurposing existing generators as synchronous condensers</u>, June 2023.

¹⁶ Transgrid, <u>System Security Roadmap</u>, accessed in June 2024.

Further, converting existing generators to synchronous condensers likely has the following benefits:

- Larger scale as existing synchronous generators (therefore repurposed synchronous condensers) typically have higher ratings compared to new synchronous condensers. The size of a converted synchronous condenser is typically upwards of 750 MVA, which is several times larger than a new standard synchronous condenser (around 125 MVA). This means that one conversion could potentially substitute for up to five or more new synchronous condenser;
- Faster implementation timeframe than competing to procure new synchronous condensers in a tightening international market. The rapid international energy transition and adoption of more inverter-based renewable generation is driving greater demand for new synchronous condensers. Repurposing existing generators to stand-alone synchronous condensers could potentially be achieved in 12 to 24 months at some sites, while procuring a new synchronous condenser may take up more than 30 months.¹⁷

The proposed rule change also contributes to the emissions component of the NEO. The conversion of existing generators into stand-alone synchronous condensers would facilitate the provision of system security services from lower emission sources relative to fossil fuel generators. The operation of synchronous condensers would be less emission intensive as they draw small volumes of electricity from a grid partially powered by renewables. Furthermore, it would likely increase the overall availability of system security services from sources with no minimum generating level, facilitating a higher level of emission-free renewable generators to be connected. A higher level of renewable generation would contribute to reducing Australia's greenhouse gas emissions and facilitate the transition to a system with a lower carbon footprint.

The potential impacts of the proposed rule change on those likely affected

The proposed rule change will directly affect:

- Entities that are interested in providing system services under the NER. With an appropriate registration category in place, entities with existing synchronous generators could be further encouraged to explore the feasibility of converting these generators into stand-alone synchronous condensers. This could lead to a more efficient use of existing resources and infrastructure to provide system security services.
- TNSPs (as the Inertia Service Providers and System Strength Service Providers). If
 more existing generators are repurposed into stand-alone synchronous condensers,
 TNSPs will likely have access to a broader pool of non-network service providers that
 may offer system services that are more fit-for-purpose and cost competitive (due to the
 use of existing resources and infrastructure).
- AEMO (being the entity responsible for maintaining and improving power system security). The conversion of existing generators into stand-alone synchronous condensers could potentially increase the overall availability of system security services in the NEM. This means that more services are available to AEMO to underwrite system security, therefore reducing the need for AEMO to adopt more conservative constraints, such as limiting the number of inverter-based renewable resources. This in turn may enhance reliability (the ability to meet demand) by allowing a higher level of inverterbased renewable generation and providing headroom such that new inverted-based

¹⁷ DIgSILENT Pacific, <u>Repurposing existing generators as synchronous condensers</u>, June 2023.

resources can continue to be connected without compromising system strength. A higher level of emission-free renewable generation would also contribute to the emission reduction efforts.

The above identified potential benefits would most likely outweigh the administrative costs associated with the introduction of a new registration category for non-generating system service providers (such as stand-alone synchronous condensers).

Conclusion

CS Energy considers that this proposed rule change would remove any potential ambiguities regarding the ability of non-generating units (including stand-alone synchronous condensers) to provide system security services under the NER. This proposed rule would yield a net benefit for industry participants, TNSPs, AEMO, customers and the market broadly.

The proposal meets the NEO as more widespread repurposing of existing synchronous generators to synchronous condensers is likely to:

- Improve system security outcomes through more efficient utilisation of existing resources to provide system services, which lowers costs for all consumers in the long run; and
- Contribute to reducing Australia's greenhouse gas emissions through a potential increase in the overall level of system security services, which not only are lower emissions but would allow a higher level of emission-free renewable generators to be connected without compromising system strength.