# Essential system services contract procurement through ESEM

Submission to the NEM Wholesale Markets Settings (Nelson) Review

November 2025

# Contents



**Disclaimer:** This paper was developed with input from members of the Australian Energy Council (AEC) and the Clean Energy Council (CEC) Essential System Services Working Group (AEC-CEC ESS WG). We also received valuable comments from staff at Energy Networks Australia (ENA), the Australian Energy Market Operator (AEMO), and the Australian Energy Market Commission (AEMC). These comments do not necessarily reflect the views of these organisations. The Electricity Services Entry Mechanism (ESEM) Essential System Services (ESS) procurement framework outlined in this paper will require further detailed design, refinement, and consultation with members and the broader industry.

# Executive Summary

This paper proposes a new framework for procuring Essential System Services (ESS) through the Electricity Services Entry Mechanism (ESEM), aiming to address critical gaps and inefficiencies in the current National Electricity Market (NEM) approach. ESS—such as frequency control, voltage regulation, system strength, inertia, and restart capabilities—are vital for maintaining grid stability, especially as thermal generation retires and inverter-based resources increase. Power system security takes precedence over reliability as the electricity market cannot operate without a secure power system.

Currently, most ESS categories have not been specified or holistically valued.[1] Therefore, no market incentives or price signals exist for most ESS categories. For ESS that is currently procured, the framework is fragmented, inflexible, opaque, and lacks adequate consequences for the parties accountable. There is no strategic or coordinated NEM-wide plan for ESS. The current approach of relying on direct procurement of long lead time assets is reactive and shortsighted, as it neglects the need to provide signals for investment and development of non-network solutions. This creates a real risk that the NEM could fall short of ESS in the near future.

This paper advocates extending the ESEM framework to include ESS procurement in a coordinated manner with AEMO and Transmission Network Service Providers (TNSPs) by elevating ESS contracts to the same level as those for bulk energy, shaping, and firming services, while accommodating the unique characteristics of ESS.

Extending the ESEM framework to ESS would involve:

- Developing specifications and standards for relevant ESS.
- Creating long-term standardised contracts for categories of ESS.
- Setting clear procurement trajectories informed by integrated modelling of reliability and security needs.
- Ensuring eligibility for ESS contracts is technology agnostic.
- Setting clear procurement trajectories informed by integrated modelling of reliability and security needs
- Establishing a competitive bidding process to promote transparency and cost-effectiveness.

Adopting ESEM for ESS procurement offers multiple advantages. Such approach aligns with the National Electricity Objective (NEO) by ensuring secure, and reliable electricity. It also improves transparency and accountability, enhances investment certainty, promotes competition in ESS service provision, and reduces the use of patterned interventions2 and thermal plant extensions.

We understand that the Expert Panel is supportive of this approach but has not been able to progress the detailed work required in the time available. We are keen to work with Government through 2026 on the detail required, whether that be directly with Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) or through market bodies tasked with further developing the ESS framework.

---

[1] We acknowledge that there are various market arrangements for some of the ESS categories, such as the eight Frequency Control Ancillary Service (FCAS) markets and frequency performance payments. These services would not be the subject of procurement through the ESEM.

[2] Interventions in the NEM are intended to be under rare circumstances, they are intended to be ad hoc in response to difficult to predict circumstances.

# 1. Introduction

Essential system services (ESS) are critical to maintaining a secure and reliable power system. Currently, no explicit market signals exist to encourage and uplift the capability of new technologies to provide ESS.[3] As thermal generation retires from the system, the need, frequency and breadth for security service providers will increase. The nature of system security services and the most efficient and practical way to procure, enable and dispatch them has been discussed and debated over at least a decade.

The Nelson Review proposed in its draft report an Electricity Services Entry Mechanism (ESEM) to support bulk, shaping, and firming energy services, aiming to address the current lack of long-term investment in these areas. The Review also recognises the need for timely investment in ESS.

While bulk, shaping, and firming energy services are vital, ESS play an equally important role in enabling grid stability and reliability. Without credible and enduring investment signals for ESS, the energy transition cannot progress in an orderly, efficient or affordable way.

This paper offers initial thoughts on how a streamlined procurement mechanism for non-network ESS solutions could be developed. Specifically, it explores how the ESEM could be leveraged to more transparently signal power system needs, guide investment in ESS and promote price discovery.

Our objective is to adopt the ESEM framework to ESS to achieve a procurement that is simpler, more holistic, responsive, and efficient—especially when compared to relying solely on the Regulatory Investment Test for Transmission (RIT-T) process.

## What are essential system services?

ESS are critical for securing and stabilising the electricity grid. They encompass a range of functions, including frequency control, voltage regulation, minimum system load balancing, system strength, system restart and inertia. As technologies evolve, the types, definitions and service providers of ESS may change over time.

Currently, only a subset of these services—such as Frequency Control Ancillary Services (FCAS)—are supported by established markets. Most other essential services like inertia, voltage control, system strength, and system restart capabilities lack clear market signals and structured procurement pathways.

This paper seeks to address these gaps by exploring how the ESEM may be adopted to better signal investment needs and facilitate procurement for relevant ESS categories for which there is currently no market.

[3] In fact, provisions in the current National Electricity Rules contribute to the opaqueness and suppression of market signals regarding intervention/directions for ESS services. The Rules provide that if service provider was directed to provide energy or market ancillary service and while doing so it also provided ESS (such as inertia, voltage control, and system strength) then it should not receive payment for those services that it provided as a 'byproduct' regardless of whether there were system benefits from these services. See NER 3.15.7(a2)(4).

# 2. Issues with current approach to ESS

The current framework for ESS in the NEM fails to adequately link investment decisions with operational delivery needs. Despite emerging planning tools and reforms, there is no single accountable entity ensuring that ESS are procured with sufficient lead time to meet real-time system demands — particularly in the context of accelerating coal closures and increasing inverter-based generation. This misalignment between investment and operational timeframes and lack of transparency in procurement processes and costs creates systemic risk, under-procurement, and inefficient market outcomes. Further details of the current issues are provided in the Box below.

**Box 1. Issues with current ESS arrangements**

- **Lack of clear accountability:** No single party is responsible for ensuring sufficient ESS. While multiple entities (e.g., networks, AEMO) have roles under the NER, no one is ultimately "on the hook" if there's a shortfall. There are currently only 'reasonable endeavours' obligations on network businesses to meet their system strength and inertia requirements.
- **No strategic plan for ESS:** There's no comprehensive roadmap for ESS during the energy transition or beyond. Existing reporting (e.g., AEMO's TPSS) is inadequate and there are no clear, long-term statements on ESS needs, especially in response to major events like coal plant closures. AEMO currently has no obligation or incentive to lead this planning.
- **Fragmented national approach:** ESS arrangements vary across jurisdictions, with different specifications and guidelines. States are pursuing their own models and processes (e.g., for REZs and for synchronous condenser procurement) and may derogate from the NER, further fragmenting the system.
- **Disjointed and opaque planning and procurement:** Current processes are fractured and lack transparency. This makes it hard for developers to incorporate ESS into project design. As a result, projects are often "plain vanilla" configurations aimed at fast grid connection rather than optimal system support.
- **No framework for risk-based procurement:** There is no mechanism to weigh costs against the asymmetric risks of under-procurement. Shortfalls are more costly—leading to congestion and constraints, delayed retirements of synchronous units, delayed investment, and system security risks. AEMO does minimal modelling of worst case scenarios—yet these often become central scenarios.
- **Inflexibility of the current RIT-T Process:** There is no consistent method for valuing ESS. The RIT-T process results in opaque pricing and tends to favour network solutions over non-network alternatives. Its lengthy, multi-step nature discourages price discovery, innovation and responsiveness.
- **Potential conflict of interest with TNSP-led procurement:** The current arrangements place TNSPs in the privileged and somewhat conflicted position of having access to, and ultimately making recommendations between, third party system strength offerings and non-network solutions versus their own direct investments in network assets.
- **Long lead times for new resources:** Synchronous condensers take ~5 years from order to operation. Grid-forming inverter capable Battery Energy Storage Systems (GFM BESS) can be deployed faster, but not always in the right locations. Furthermore, the complex connection process makes it challenging to install BESS with the optimal design to provide system support. This is hard or even impossible to change later.
- **Lack of clear definitions and standards for ESS:** The Reliability Panel is responsible for developing power system standards. Based on these standards, AEMO is tasked with creating the specifications that must be met to participate in the market or to be awarded a service contract. While some standards and specifications have already been established, many are still outstanding. Defining the relevant ESS and providing a standard/specification for each type of ESS is a critical first step to procurement.
- **Lack of incentives and motivation to test new technology:** Lack of modelling and urgency in transition means newer technologies are not being tested widely, pushing us toward conservative pathways (e.g., more synchronous condensers, fewer GFM BESS than optimal). This also does not send the right signal to encourage OEMs, technology providers, and developers to innovate and invest in new technology/solutions.
- **Compliance guidelines lack sufficient clarity and do not seem to take into consideration the risks:** For example, in the context of system strength being provided by a System Strength Service Provider (SSSP) the AER notes that "the qualification of 'reasonable endeavours' means that the system strength standard does not need to be met [by the SSSP] at any cost and in all circumstances…In this regard, if a SSSP takes a reasonable package of steps, but ultimately fails to meet the standard in time, it may still have used reasonable endeavours to meet the standard." (see p.10 of AER's 2024 Guidance Note on Efficient management of system strength framework)

# 3. Extending the ESEM framework to ESS contracts

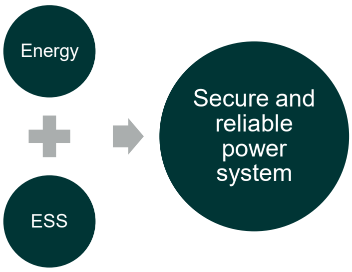
In the absence of a consistent, NEM-wide approach to ESS procurement, investment in these services is currently driven by fragmented schemes. This has created a complex and fractured investment landscape that risks falling short of the evolving system's needs.

The ESEM was primarily designed to overcome long-term investment barriers in bulk energy, shaping, and firming services. However, several ESS face similar challenges:

- They are increasingly needed as synchronous generators retire.
- Lack of clear price signals to guide investment decisions to provide these services.
- Lack of framework to value these services.
- They are often procured through ad hoc bilateral contracts or out-of-market directions.
- There is a misalignment with investment timelines.

Despite these similarities, there are important differences. Whilst the key purpose of bulk energy, shaping and firming is to meet reliability targets, ESS is for power system security. The two are inherently interlinked. In economic parlance, reliability and system security are **complements**.

**Figure 1. Energy and ESS are complements**

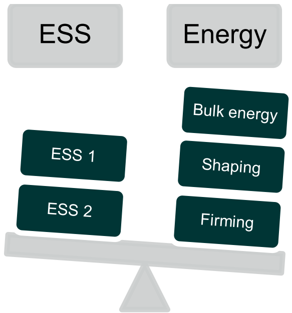



Furthermore, for bulk energy, shaping, and firming services, the most persistent barrier is the "tenor gap"—a mismatch between the duration of contracts available through private offtakes and the certainty of revenue over an asset's investment horizon.

In contrast, ESS face more fundamental barriers: most services are not transparently valued or incentivised, lack formal markets altogether, and procurement has been ad hoc and piecemeal. Furthermore, the long-term service requirements have not generally been quantified, and the near-term trade-off between procurement costs and asymmetric risks are not transparent.

This has led to a disconnect between the certainty required by ESS providers to finance the installation of equipment during the design phase of a plant that could later enable the provision of ESS. In most cases, the provision of ESS also involves trade-offs (or co-optimisation) with other energy services a plant can provide. Using economic parlance again, the provision of energy or ESS can be characterised as production side **substitutes**, i.e. the service provider must make a decision about how much of energy or ESS to produce. The absence of structured avenues to monetise the ESS services and the lack of price signals prevent this trade off (or co-optimisation) to be considered.

**Figure 2. Trade-offs between producing energy and/or ESS**




The Box below provides a case study of the clear trade-offs that developers must consider when assessing the design of their assets.

**Box 2. Trade-offs of providing energy and ESS when installing a clutch in a new gas turbine system**

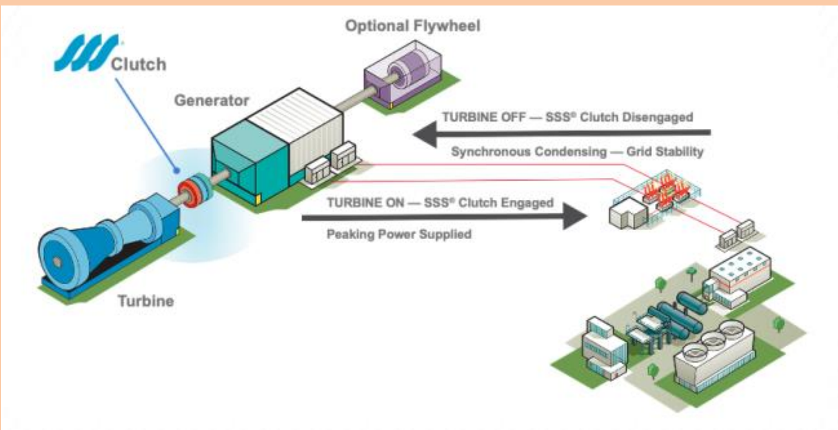
The installation of a synchro-self-shifting (SSS) clutch in a gas turbine system is commonly regarded as a cost-effective and straightforward non-network solution to provide ESS. While this is likely the case for existing gas plants (e.g. the Townsville Power Station), there are complex economic and engineering trade-offs involved for new gas turbine systems.

For a combined-cycle system, CS Energy's investigation found that the installation of a clutch on a larger gas turbine (400MW to 600MW), while theoretically possible, is engineeringly untested as such an option has never been deployed in practice. This unproven solution to provide ESS carries inherent engineering risks, likely leading to performance and reliability issues or even failures. An alternative option is to install clutches on two smaller gas turbine systems (150MW to 300MW for each system) to provide ESS. While such a solution has been implemented overseas, it involves substantial cost, capacity and efficiency trade-offs. Specifically, while such configuration can provide ESS, the two-turbine configuration involves the following trade-offs:

- **Costs:** The two-turbine configuration is significantly more expensive to construct and the operate.
- **Capacity and revenue:** It is around 10% to 20% lower in capacity and thus results in reduced revenue from the wholesale market.
- **Fuel efficiency:** The two-turbine configuration is 2% to 4% less fuel efficient relative to a single larger turbine configuration.

In addition to being more expensive to build and operate, a two-turbine configuration would generate less revenue from the wholesale electricity market than a single, larger turbine. This is because it offers lower available capacity and higher short-run marginal costs due to reduced efficiency—meaning it would operate less frequently and only during periods of higher spot prices.

**Figure 3. Diagram demonstrating the operation of SSS clutch**




Source: SSS Gears.

These complex trade-offs described in the Box above are likely to be applicable generally across non-network solutions from multi-use assets. Without a level playing field for ESS, there is a risk that the ESEM could inadvertently introduce an “energy bias”—where the improved monetisation of energy services through the ESEM contracts overshadows the critical need for investment in ESS, particularly across a broad suite of technologies.

## Addressing the ‘capex bias’

Additionally, the well-documented “capex bias” among network service providers tends to favour capital-intensive network ESS solutions, often crowding out more cost-effective non-network alternatives. The RIT-T processes run by the networks are often bespoke and opaque tender processes, providing little transparency, information reporting and price discovery followed by an equally challenging contract negotiations process.

Without a procurement framework (or market) providing marginal and scarcity signals to account for these trade-offs, it will be more challenging for non-network solutions to be viable, thereby leading to an uneven playing field between network and non-network options for ESS service provision. A transparent and technological agnostic procurement framework can assist in levelling the playing field by facilitating efficient price incentives that reflect the prevailing supply-demand balance, which will encourage the participation of a wider range of different assets and technologies.

The absence of transparent investment signals locks-in more well-established network technologies (that may become less efficient or obsolete over time) and stifles innovation (due to the lack of incentive to explore more novel and cost-effective non-network solutions). For example, the risk of over-procuring network assets arises as TNSPs are likely less concerned about the efficient utilisation of their assets as they recover their costs regardless of the rate of asset utilisation. These outcomes are inconsistent with the NEO to promote the efficient investment in and operation of electricity services in the long-term interests of consumers.

# 4. Adopting the ESEM for ESS procurement

We consider there is a key role for the Panel to elevate ESS procurement to the same level as energy (bulk, shaping, firming) procurement, while noting the precise mechanism requires further analysis.

The core of this requirement is that the ESEM Administrator should work with AEMO and the TNSPs to determine an ESS procurement trajectory and to co-optimise procurement of energy resources with the procurement of ESS. The key recommendations are:

A. The ESEM Administrator should be the responsible party for ESS procurement
B. The ESEM Administrator should determine the service shortfalls and long-term system security risks
C. The ESEM Administrator should standardise the procurement of ESS
D. The ESEM Administrator should consider establishing ESS contracts in line with the needs of the power system

Further details are outlined below. Critically, each component would independently deliver value.

---

## A. Responsible party for ESS procurement

As noted earlier, one key challenge in the NEM is that no one body has accountability for investment or operational shortfalls in ESS.

We strongly recommend that responsibility for ESS procurement should also reside with the ESEM Administrator. As discussed below, this would incorporate both a long-term planning and a short-term procurement function.

Participants can then have confidence that services will be available when required (on a risk adjusted basis). This confidence will support not just investment in ESS, but also in energy (which requires ESS to operate efficiently). We note that system strength constraints are now regularly binding in the NEM, creating uncertainty for new investment in bulk energy in particular.

This responsibility is currently missing from the NEM. For example, there is currently a shortfall of system restart services in Queensland, and no coordinated framework for how this should be addressed (or further shortfalls avoided in the future). Placing this responsibility with the ESEM Administrator would allow it to coordinate with other NEM bodies to identify and manage these risks, and ultimately procure the necessary services. They would also be tasked with understanding how existing resources can be most efficiently utilised and incentivised (e.g., headroom on existing PHES or BESS).

# B. Determine the service shortfalls and long-term system security risks

The ESEM Administrator should coordinate with AEMO and the TNSPs to develop a long-term plan with one or more scenarios (e.g. system normal and system stress) for procuring ESS. This would be an NER obligation, similar to the ISP, which requires an actionable plan for delivering ESS. The plan would be updated over time and may involve scenarios (again, similar to the ISP), but would:

- Support investors in knowing the likely ESS service gaps
- Provide confidence to governments that a lack of ESS will not create a reliability or security risk, delay the transition (and the exit of coal), or require costly interventions
- Inform and guide the ESEM Administrator as to the quantity of ESS to be procured, and how this might be coordinated with the procurement of other services.

For example, if the ESEM Administrator identifies that shaping services are required, it should also consider the ESS procurement plan to inform the co-optimisation of energy and ESS service. Alternatively, the long-term plan might identify that there are risks of shortfalls in an ESS service.[4]

## ESS trajectory setting

To support effective planning and investment, the ESEM Administrator will need to establish a clear procurement trajectory for each ESS category, informed by the same whole-of-system modelling used for other ESEM energy contracts. Modelling principles will remain consistent in line with the NEO. This forward-looking approach would improve visibility for market participants and help proponents prepare competitive bids.

The Nelson Review recommended that the ESEM Administrator provide an indicative 15-year trajectory for each energy service—bulk energy, shaping, and firming—across regions. A similar trajectory will need to be developed for each ESS category, but with timelines tailored to reflect the unique characteristics of ESS.[5]

### Reliability and security co-optimised trajectory

Energy reliability and ESS needs are inherently interlinked. As discussed above, they complement each other. To set appropriate trajectories, the ESEM Administrator will need to undertake integrated modelling that jointly considers reliability outlooks, ESS system needs, and emissions targets. A shortfall in ESS can impact network curtailment and delay the retirement of thermal generators, directly impacting reliability and revenue from energy only services. This underscores the need to coordinate ESS procurement with bulk energy, shaping, and firming procurement under the ESEM.

[4] For example, there may be a need for system restart services that cannot be managed through the short-term System Restart Ancillary Service (SRAS) procurement mechanism.

[5] As noted above, given the limited 'in-market' opportunities to monetise ESS, the appropriate planning horizon for ESS may differ from that of energy services.

For these reasons, the ESS trajectory would need to be determined using a reliability and security co-optimisation process. Also, the ESS trajectory would need to be transparently informed by AEMO modelling[6] via a process with ISP-type rigor.[7]

The ISP is a highly consulted and transparent document that outlines the least-cost development pathway and associated transmission build out. The ESS ESEM procurement would similarly require a transparent and rigorous modelling process to determine appropriate targets and the technical assumptions that underpin them.

### Joint energy and ESS Roadmap

The joint energy and ESS modelling effort that would underpin the setting of the energy and ESS trajectory could serve as the foundation for a longer-term roadmap to guide the energy transition, with technical input from AEMO and TNSPs, and the Reliability Panel.

Like energy services, ESS procurement trajectories should be regularly updated to reflect changes in key factors such as technology costs, policy targets, and market developments. When setting these trajectories, the ESEM Administrator must act in accordance with the National Electricity Objective (NEO), particularly by ensuring system security is maintained at the lowest cost to consumers and is procured on a timely basis and available to meet system security needs as they arise.

The ESS trajectories should be updated on a rolling basis—ideally in line with the tender cadence.[8] These updates would help align ESS requirements with evolving technology costs, policy positions, and system needs.

## C. Standardise the procurement of ESS

There are currently multiple, unrelated processes for procurement of ESS. This includes:

- System strength by TNSPs, through RIT-T
- System restart services through short-term tenders by AEMO
- Minimum inertia level procurement by AEMO or TNSPs, with additional inertia levels potentially procured through additionality on system strength via RIT-T

Even within those categories, procurement is complex, with each TNSP having different planning and procurement frameworks.

Furthermore, individual bodies are each being required to make complex risk/benefit assessments, with lengthy procurement arrangements. For example, TransGrid recently identified the need for multiple synchronous condensers and grid forming batteries for system strength, but the existing

[6] These modelling include those undertaken as part of the existing annual system security reporting for inertia, system strength and Network Support and Control Ancillary Services (NSCAS).
[7] The planning and trajectory setting could be further enhanced, by considering a range of scenarios, such as system normal and under system stress. Such modelling would further enhance, inform and guide the ESS ESEM planning processes.
[8] This approach should not limit the ability of the ESEM Administrator to procure ESS out of cadence if a need emerges.

planning framework did not allow them to move quickly enough to procure these on the schedule needed.

## Options of standardising procurement

Detailed design work can consider the most efficient way to standardise the procurement of these services, which may vary for different services, including:

- **The ESEM Administrator could be responsible for standardising the procurement process for various ESS services.** A number of standardised ESS contracts would be defined and procured (co-optimised with other ESEM energy contracts) in line with modelling undertaken with inputs provided by TNSPs and AEMO. How this option may or may not work together with current RIT-T arrangements need further consideration. It may be more efficient to delegate the decision making directly to the ESEM Administrator.[9]
- **The ESEM Administrator could standardise the procurement process, working through the other bodies.** For example, TNSPs could deliver system strength procurement plans for scenarios consistent with the ESEM procurement scenarios, with the ESEM Administrator being responsible for approving the plans (and then working with TNSPs to co-optimise, for example, shaping or firming and system strength procurement). We envision this would typically bypass the need for a separate RIT-T.
- **AEMO and TNSPs work together to standardise the procurement process of ESS services with input from ESEM Administrator.** For example, through standard processes or defined services with cost information provided by the ESEM Administrator.

Critically, the ESEM Administrator needs to ensure there is genuine consideration for the most efficient way to deliver the full package of services. This can be delivered through competitive tension in auctions (where appropriate), or through increased coordination.

## Interaction with energy service procurement through ESEM

The proposed ESS procurement and contracting framework could follow the blueprint of ESEM energy contracting, with key differences that must be addressed during the detailed design phase. Similarly to the energy services procurement through ESEM, the ESS procurement process would be one that facilitates:

- cost-reflective prices for ESS services
- timely investment decisions, and
- efficient outcomes.

Consultation to date has found that building competitive tension is more challenging when ESS services are highly locational (e.g., system strength, reactive power, and SRAS), but feasible for more global services such as inertia. We consider that ESS contracts would be:

- long-term,
- service-focussed,

[9] We note that the ESS cost figures may be relatively small, but the impact of getting the needed ESS wrong is very high.

- technology-agnostic,
- eligible to be provided by both existing plant and new capabilities of existing plants,
- sufficiently standardised for appropriate categories of ESS to allow price comparisons between bids.

Tendering for energy contracts should not be a pre-requisite for tendering for ESS contracts. Tenders may be conducted jointly or separately from energy service tenders, depending on the ESS type. Proponents should be able to:

- Bid for individual services (either energy or ESS only) or
- Bid for combined services (energy and ESS jointly).[10]

Subject to addressing ESS shortfall in a timely manner, the ESEM Administrator should retain discretion to assess and award fewer or more contracts than anticipated and to decline to award contracts if bids are not cost-effective. This may be, for example, to make provision for ESS replacement in response to a short notice closure of plant providing ESS or a plant being unavailable for an extended period of time. When considering ESS ESEM tender bids, the ESEM Administrator should consult AEMO and the respective TNSP to which the project's geographic location aligns.

The detailed design phase should define:

- How bids are formulated
- How trade-offs between services are evaluated
- How procurement decisions align with system security and consumer cost objectives

### Trade-offs and risk management

The ESEM Administrator should explicitly consider trade-offs between cost and the asymmetric risks of under-procurement. These trade-offs will be critical in ensuring system security, reliability and avoiding costly interventions and constraints to deal with ESS shortfalls.

## D. Establishing ESS contracts for appropriate services

Our proposed approach involves establishing a procurement pathway for ESS within the ESEM. In this paper, the term ESS contract is used as a placeholder to describe a long-term agreement that incentivises the provision of specific system security services in alignment with system needs. Much like shaping and firming contracts, ESS contracts are intended to provide price or revenue certainty and guide provider behaviour to support system security.

To enable developers to identify or develop possible ESS solutions, ESS needs to be defined and detailed standard/specification developed. The standard/specification quantifies the physical requirements of the ESS service and is what the engineers require to determine whether a particular piece (or combination of) technology could physically deliver the required ESS. Defining the ESS and providing a standard/specification for the ESS that are relevant to this proposal is a critical first step.

[10] For example, a hybrid wind-and-battery project might submit a bid for energy services only, a bid for ESS services only or a bid for both energy and ESS services.

The development of ESS standards should be undertaken via a co-design process between AEMO and industry.

There are important differences between energy and ESS contracts. For example, unlike energy service contracts, ESS contracts would not have to be recycled onto retailers or be subject to MMO obligations.

Further work is needed to determine which ESS categories are suitable for procurement through the ESEM. During the detailed design phase, the most appropriate contract terms and design features for each relevant ESS category must be developed, assessed, and refined. Furthermore, the most efficient framework for availability of the service, including the scheduling and dispatch of the service, will require detailed consideration. The primary objective is to ensure that each contract incentivises the availability and delivery of ESS in alignment with system needs.

We also note that there has been significant consultation over the past 5 years on how services should be procured, and the viability of various forms of markets vs centralised procurement. Given the proposed ESEM framework, there may be opportunities to re-visit some of these design options (while not risking delaying the necessary investment in the near-term).

### NEM-wide technical standards that align with AEMO and TNSP needs

As noted above, the ESS contracts serve to support the safe, compliant and efficient operation of the power system. AEMO as the NEM operator would be responsible for power system security and accountable for setting parameters for the specifications to meet the standards set by the Reliability Panel enabling ESEM Administrator to follow in the contract design and in each procurement round.

ESS contracts are envisaged to be:

- Long-term
- Standardised for categories of ESS
- Transparent
- Technology-agnostic – eligible to new and existing plant
- Service-focused

Key design questions for each service to be addressed include:

- Can markets be defined over time?
- Should contracts be financial or physical?[11]
- How can prices be defined for the service (e.g. variable $/unit of service, fixed (e.g. fixed $/MW/h), capacity-based (availability payments) or something else?)
- How should the price be derived and set? (e.g. pay-as-bid or uniform price)
- What should be the contract duration and coverage period?[12]
- For each ESS, should contracts be location-specific, regional, or system-wide or a combination, considering the different technical characteristics of each ESS?

---

[11] Due to the nature of the ESS service and the lack of 'spot market' for ESS, we expect the ESS contracts to include physical requirements.

[12] Whilst the Review proposed that for energy contracts the ESEM would be active for years 8 – 15/20, it is expected that the ESS contracts will need an earlier start date, possibly even from year 1. This is because while energy services can be currently monetised through commercial arrangements and PPAs, no such 'in market' opportunity currently exists for ESS contracts.

- Whether ESS services should be individually procured or bundled together when appropriate.[13]
- How could contractual compliance be monitored and verified (in case of physical delivery)?[14]
- Should TNSPs be allowed to bid into the ESEM process? If so, what are the flow-on implications for network regulation?

Importantly, the above list of contract design features may vary across ESS categories depending on the nature of the ESS service.[15] More work is also required to explore the appropriateness of developing either region-specific or NEM-wide technical standards considering the unique nature of each ESS services, such as locational requirements.

### Operational delivery of ESS

As mentioned above, an *ESS contract* is used as a placeholder to describe a long-term agreement that incentivises the provision of specific system security services in alignment with system needs. Detailed design work is required to identify and refine the appropriate contracts. A logical 'offtaker' of the contracts may be AEMO or TNSPs. The detailed design phase, therefore, should explore options as to how the ESS contracts could be novated to TNSPs or AEMO and enabled operationally in a manner that is consistent with AEMO's security enablement procedure.

It is expected that the operational delivery of the ESS would align with AEMO's *Improving security frameworks for the energy transition* work program which is expected to go live on 2 December 2025. A brief description of this work program is provided in the Box below.

**Box 3. AEMO – Improving security frameworks for the energy transition**

To purpose of the work program is to improve existing security frameworks to deliver essential system services, through the energy transition. The project includes the development of a scheduler and related procedures for AEMO to enable security services in operational timeframes.

More specifically, AEMO is developing a tool or system for enablement which:

- identifies system security needs close to operational time.
- decides which is the lowest-cost set of security contracts to meet these needs.
- communicates enablement decisions to participants.

See further details here.

[13] An example of how ESS services may be bundled together is provided in Appendix A.
[14] The AER has already developed Guidelines for FCAS compliance. This would need to be expanded to include the new categories.
[15] We do not expect these contracts to be 'exchange-tradeable' primarily because the demand for ESS is currently driven by regulatory/system requirements and not by commercial needs. In a world where, for example, system security impacts by one generator can be offset by another generator's system security services (including front of meter system strength remediation if implemented through changes to the System Strength Impact Assessment Guidelines (SSIAG)), then there may be opportunities to improve the market by 'exchange trading'. This would also improve investment signals.

### ESS contract co-design

Just as the Review recommended periodic re-establishment of bulk, shaping, and firming contracts, ESS contracts may also require regular review and refinement. Given the rapid evolution of technologies and system needs, a co-design process involving ESEM Administrator, Reliability Panel, AEMO, TNSPs, and industry stakeholders is recommended. In addition, the ESEM Administrator may be granted flexibility to define the form and specifications of ESS contracts, ensuring responsiveness to system developments, following consultation with AEMO and TNSPs.[16]

### Individual or 'bundled' ESS provision

Ideally, each relevant ESS should individually provided and valued through the procurement. However, an option that has been proposed includes 'bundled ESS" provision. An example of what is involved in such option is included in Appendix A. We consider that several possible options should be canvassed and explored at the detailed design phase.

[16] For example, a more flexible inverter rating and headroom capacity contracting could be explored at the detailed design stage.

# 5. Role of TNSPs in the ESEM

Whilst the proposed approach in this paper is for the ESEM Administrator to determine and award ESS contracts for non-network ESS solutions, the TNSP in each region would continue to play an integral role. Importantly, the TNSP would retain the legal responsibility for maintaining system security, as well the operational function of 'receiving delivery' of the service. Once contracted, the ESS contracts could, therefore, be novated to TNSPs for operational delivery (in the same manner as the Panel canvasses in its draft report). Alternatively, AEMO may manage the availability, scheduling, dispatch, and settlement of the ESS services contracted by the ESEM Administrator. Under either approach, TNSPs would need to be satisfied, before contracts are entered into, that the parameters were appropriate.

Besides the operational delivery, TNSPs' role could also include, for example,

- Providing input into the modelling that underpins the determination of ESS trajectories and any other modelling required by, for example, the ESEM Administrator, the Reliability Panel, and AEMO.
- Coordinate with AEMO, AER, and the ESEM Administrator on matters relating to planning and procurement.

There will also be a need to consider transitional arrangements for existing system security contracts held by TNSPs.

## Role of RIT-T

Several further details need to be also worked out at the detailed design stage. These include for example how the ESEM ESS could be co-optimised with RIT-T and how projects with ESS contracts in place might be subject to a more streamlined assessment, or even exempted from the RIT-T. It is recognised that the RIT-T may need to be amended to remove the requirement of it to act as the mechanism to value and procure ESS.

# 6. Other considerations

### Cost recovery

The detailed design phase would need to explore options for how the ESS contract costs should be recovered. These could include similar options considered for energy contracts.

### Transparency and accountability

Similar to how it is proposed for energy services, the ESEM should provide an assessment of its performance through the publication of long-term price curves for ESS categories. This will ensure efficient levels of investment and prevent over/under procurement. Transparency will drive accountability and provide the market with confidence that efficient investments will be able to recover their reasonable costs.

Furthermore, the Reliability Panel should act as a point of accountability.

# 7. Benefits of proposed approach

Adopting the proposed responsibilities for ESS contract procurement will have the following benefits:

- A long-term ESS procurement trajectory developed by a central body will give jurisdictions more confidence in the adequacy of future ESS supply and therefore reducing/eliminating the need to extend the operation of existing thermal plants.
- It benefits electricity users by ensuring that consumers and businesses alike can access secure, reliable and affordable electricity.
- It enables greater benefits from ESEM supported projects, by providing access to multiple services from these assets, reducing the need for duplicative network investments.
- By holistic procurement of shaping, firming and bulk energy and ESS contract needs, the ESEM Administrator can deliver all services currently provided by large thermal plant.
- It promotes competition in service provision by being technology agnostic and being eligible for new assets and new services by existing assets.
- It respects the federated structure of the NEM by harmonising approaches to ESS in order to avoid fragmentation, duplication or inefficient outcomes
- More transparent pricing and co-optimised procurement complements the existing wholesale market by preserving efficient price signals that guide operational decisions.
- It enhances transparency in contracting by centralising the assessment and award of ESS ESEM contracts, working closely with AEMO and the TNSPs.
- Where efficient markets can be developed, it provides AER with access to pricing information for non-network options against which RIT-Ts which cover network options can be assessed – helping to address the CAPEX bias for network options.
- It provides greater coordination and flexibility, which reduces the risk of ESS shortfalls if one technology is not available (e.g., if syncons are delayed, there may be greater opportunity to accelerate the roll out of BESS, where technically viable[17]).

A set of ESS contract and procurement design principles would also need to be developed. It is envisaged that these would be aligned with the principles currently proposed for energy service procurement through ESEM (e.g. alignment with the NEO).

[17] Australia's giant syncon bet | The Energy

# Appendix A. Case Study – 'Bundled ESS' contract procurement

As outlined above, further detailed design work is needed to define the specifics of an ESS contract for each ESS category. This case study explores the option of contracting a 'bundle of ESS', rather than individual ESS. This case study is provided for the purpose of supporting further discussion and it does not represent a preferred position.

In some cases, service providers can deliver multiple ESS services using the same capacity—either **headroom capacity** (measured in MW) or **apparent power rating** (measured in MVA). One proposed procurement approach is to allow inverter-based service providers to offer a **bundle of ESS services** tied to a single measurement (MW or MVA).[18]

Let's assume that, in collaboration with AEMO, TNSPs, and the Reliability Panel, the ESEM Administrator identifies a trajectory for ESS needs—such as reserves, inertia, system strength, voltage control, and reactive power.

- **Reserve and inertia** can be delivered by allocating steady-state headroom capacity so bids are requested in the form of $/MW.
- **System strength, voltage control, and reactive power**[19] can be provided by adjusting a plant's apparent power rating so bids are requested in the form of $/MVA.

These are further detailed in the table below

| | | |
|---|---|---|
| **Steady state headroom** | $/MW | • Contingency Capacity Reserves<br>• Inertia |
| **Overload capability** | $/MVA | • System strength<br>• Voltage control and reactive power |

Let's assume the ESEM Administrator issues a tender for specific Bundled ESS services.

Service providers may submit bids for:

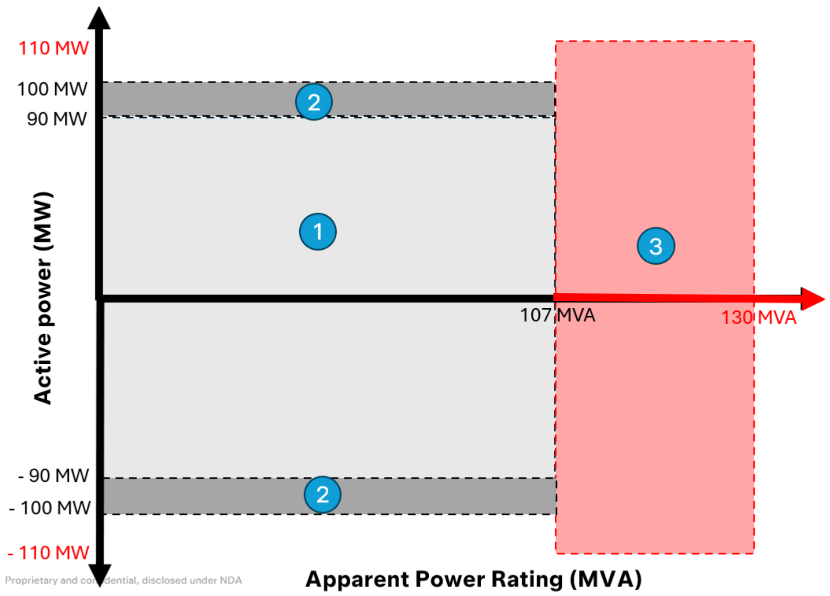
- Headroom capacity services (measured in MW),
- Apparent power rating services (measured in MVA), or
- A combination of both.

[18] It is likely that a range of procurement approaches will be needed given the varying characteristics of ESS and technologies capable of delivering these services.
[19] Further detailed work will be needed to define these services such that they are more aligned with engineering requirements, including whether these services consist of stable voltage waveform support, three phase fault current, reactive power capability etc.

In response, a potential service provider prepares a bid[20] structured as follows, detailing the services offered and the associated capacity:

| | | | Primary Use | Secondary Use | Example |
|---|---|---|---|---|---|
| 1 | Market-facing | $/MW | • Energy market<br>• Frequency control | • Reserves | Merchant, not bid into ESEM |
| 2 | Steady state headroom | $/MW | • Contingency Capacity Reserves<br>• Inertia | • Frequency control | **Bid $/MW** |
| 3 | Overload capability | $/MVA | • System strength<br>• Voltage control and reactive power | • Inertia | **Bid $/MVA** |

How these map into the plant's active power (MW) and apparent power rating (MVA) are depicted in the graph below:




[20] In this specific case the service provider decides to keep the energy market-facing and does not bid in any of its capacity to ESEM energy contracts. However, it would not be prevented to do so.

## A Standardised and Transparent Approach to Procurement

By enabling AEMO to adjust the tuning parameters for a plant's apparent power rating as well as reserving headroom, they can address multiple ESS in a centralised manner. The feasibility of such an approach is currently being explored with AEMO.

| | |
|---|---|
| **Long-term** | This procurement approach will enable AEMO to continue to meet the evolving types and amounts of ESS over time, because they can adjust the tuning parameters within their existing long-term contract. |
| **Standardised** | The values of the contract in $/MW and $/MWh are published and can be compared across regions for categories of ESS. |
| **Transparent** | As above, plus given they are not valued in MWs, this reduces the risk of gaming. |
| **Technology-agnostic** | New and existing assets are able to participate. |
| **Service-focused** | The procurement is linked to specific ESS services and it is driven by the ESS trajectory. |

These contracts would:

- Be held by the central entity and not recycled into the market.
- Avoid double-dipping with the market-facing section of the asset bidding into shaping/firming/bulk energy contracts.
- Measured in ($/MVA) and ($/MW), with the required ratio of MVA to MW dependent on the respective system strength nodes.

## Benefits of ESS Bundle procurement

While there is value in clearly defining the requirements for each ESS, by handing AEMO the controls to tune and adjust plants[21] as needed, this approach will future-proof procurement as ESS needs evolve. For instance, if there is a greater need for certain ESS inter or intra-year, AEMO can adjust the parameters of the plants to meet those needs.

[21] Requires a rule change for S5.2.2. to reduce the burden to do so.