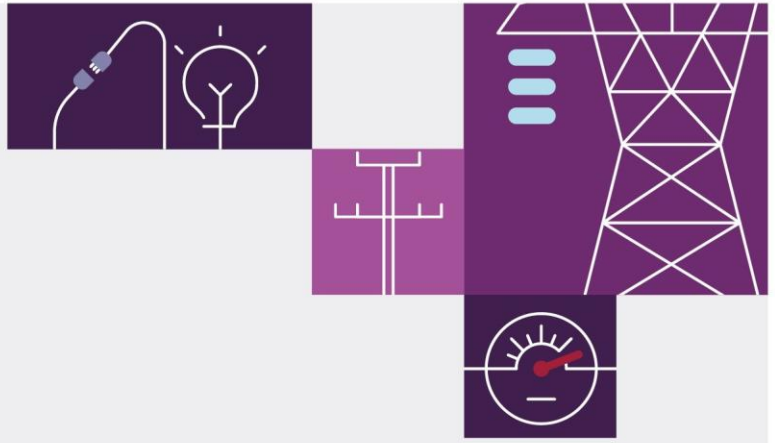


NEM Reform Program Initiative Briefs

April 2023

A reference document for the initiatives in the NEM
Reform Implementation Roadmap





Important notice

Purpose

The purpose of this publication is to provide further information on each of the NEM Reform Program initiatives, including key AEMO strategic or foundational initiatives, to help inform stakeholders understand the scope, assumptions and relationships underpinning the NEM Reform Implementation Roadmap.

Disclaimer

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Version control

Version	Release date	Changes
1	27/04/2022	Initial publication
1.1	28/04/2022	Update to initiative briefs in line with NEM Reform Implementation Roadmap
2	31/08/2022	Update to initiative briefs to update initiative scope, including removal of four initiatives (Operational Decision-Making Tools, Operational Data Store, Business Rules Engine and Forecasting Platform Uplift) and addition of two initiatives (Capacity Mechanism and Congestion Management Mechanism).
3	27/04/2023	Update to initiative briefs to reflect current scope and timing. Removal of Turn-up Services brief following de-scoping from the NEM Reform Program.



1 Overview

One of the main enablers of the Energy Security Board's (ESB's) recommended Post-2025 reforms is the development of IT systems and business processes. An initial assessment of the impacts associated with the delivery of the reforms was prepared by AEMO and formed part of the ESB's final advice to the Energy National Cabinet Reform Committee. The ESB's final advice called for further consideration of how to deliver these changes together with industry stakeholders as part of an integrated roadmap approach for National Electricity Market (NEM) regulatory and IT systems implementation.

AEMO, in partnership with the Reform Delivery Committee (RDC, or the Committee), has since compiled the NEM Reform Implementation Roadmap (the Roadmap) available on AEMO's website¹ which details an integrated timeline for implementing the reform initiatives that comprise the NEM Reform Program, as well as broader NEM and gas related reform initiatives.²

The purpose of the Roadmap is to establish a basis for navigating the breadth of ESB reforms over the coming few years, de-risking delivery and informing implementation timing.

This reference document provides a brief description of each of the Post-2025 reform initiatives and those AEMO strategic or foundational enabling initiatives that make up the NEM Reform Program to help stakeholders understand the scope, assumptions and relationships underpinning the Roadmap. An Initiative Brief has been prepared for each initiative and provides:

- an understanding of the problem statement;
- objective;
- scope;
- value/benefit;
- key relationships, risks and assumptions;
- high-level assessment of AEMO and participant impacts;
- status and estimated timeline; and
- reference link to corresponding rule change, review or other key material.

The Post-2025 reform initiatives included in this reference document have been divided into the four interrelated reform pathways and supporting Data Strategy presented by the ESB in its final recommendation:

- Resource Adequacy Mechanisms (RAMS);
- Essential System Services (ESS);
- Integrating Distributed Energy Resources (DER) and Flexible Demand (DER & FD); and
- Transmission and Access (TA).

¹ At <https://aemo.com.au/consultations/industry-forums-and-working-groups/list-of-industry-forums-and-working-groups/reform-delivery-committee>

² The NEM2025 Implementation Roadmap has been integrated with the Regulatory Implementation Roadmap and East Coast Gas Reform Implementation Roadmap to form the NEM Reform Implementation Roadmap.



In addition to the reform initiatives, AEMO has identified a subset of enabling initiatives. Each of these initiatives represents either a:

- **Foundational** investment in an AEMO legacy system to deliver an uplift to base capability on which reforms are dependent; or
- **Strategic** investment where system uplift is required at some time in the future and AEMO sees the opportunity for this life-cycle type investment to be brought forward and delivered in the same timeframes as the reforms for efficiency purposes.

Finally, AEMO has identified several initiatives that will be monitored as dependent projects and will be delivered in accordance with the AEMO Operational Tools Roadmap.

The details of each initiative are subject to change arising from further policy work or further analysis. As a result, the corresponding Initiative Briefs will need to evolve accordingly. Version control over this document will be used to manage this process.

This reference document aligns with NEM Reform Implementation Roadmap and reflects feedback received from stakeholders as well as updates to the scope of certain initiatives as they progress through policy design and development or rule change processes.



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2 Resource Adequacy Mechanisms

2.1 Increased Medium Term Projected Assessment of System Adequacy (MT PASA) Information

2.1.1 Problem Statement

The energy transition will drive further changes to plant operating regimes where owners of thermal generation seek to reduce their overheads if low wholesale prices are expected. This could include mothballing of units for prolonged periods of time and/or seasonal shutdowns, or cyclical running regimes, e.g. weekday/weekend, day/night.

The challenges arising from these changes to plant operating regimes could include:

- The reduction in the number of units made available at specific plants during certain periods of the day or year could lead to a potential lack of reserve or essential system services.
- Lack of standardised information around when generators are available to supply, and the lead time required for recall from an outage make it difficult for AEMO to effectively plan and operate the system.
- Increased complexity for the Australian Energy Regulator (AER) in assessing compliance under the current notice of closure arrangements.
- Limitations on the ability of participants to use MT PASA reporting for coordinating participant maintenance schedules.
- Weakened investment signals for potential replacement plants if it is unclear why existing units are unavailable.

2.1.2 Objective

- Establishing the reporting of a unit's status through reason codes via MT PASA.
- Establishing the reporting of recall times via MT PASA when triggered through a reason code.

2.1.3 Value/Benefit

Standardised information around when generators are available to supply, and the lead time required for recall from an outage may support:

- AEMO to effectively plan and operate the system.
- The AER in assessing compliance under the current notice of closure arrangements.
- Participants to coordinate maintenance schedules.
- Investors to assess opportunities for replacement plant.

2.1.4 Project Scope/Proposed Solution

- Consultation on design and definition of reason codes and recall times within AEMO's MT PASA framework.

- Consultation and drafting of amendments to key processes and supporting documentation (Reliability Standard Implementation Guidelines (RSIG), MT PASA Process Description, NEM Electricity Statement of Opportunities (ESOO) and Reliability Forecast guidelines, and MT PASA bid format and validation processes).
- Amendments to AEMO's MT PASA systems, models and reports (e.g. Participant Markets Portal).

2.1.5 Key Assumptions

- No changes required to AEMO's approach to assessment of reliability and no additional MT PASA modelling runs will be required.
- Reporting of reason codes and recall times will require IT redesign of the existing submission portal.

2.1.6 Key Initiative Relationships

- No key relationships identified at this time.

2.1.7 Risks

Table 1 Increased MT PASA initiative risks

Risk ID	Risk Type	Description	Mitigation
1	Scope	NSW has requested the addition of formal notification obligations in the rule change. These would require AEMO to formally notify a jurisdiction in a timely manner if its reliability target would be breached.	AEMO has agreed to leverage its position as Energy Security Monitor to provide this service to the NSW Government.

2.1.8 Next Steps

- The AEMC published their Final Rule Determination on 18 August 2022.
- AEMO commenced consultation on its NEM Reliability Forecasting Guidelines and Methodology in October 2022. The consultation provides for changes to the RSIG and MT PASA Process Description in accordance with the AEMC's final determination. This consultation is to be completed by 30 April 2023.
- This rule is scheduled to commence on 9 October 2023.

2.1.9 Reference

AEMC Rule Determination: <https://www.aemc.gov.au/rule-changes/enhancing-information-generator-availability-mt-pasa>

AEMO Guidelines and Methodology Consultation: <https://www.aemo.com.au/consultations/current-and-closed-consultations/2022-reliability-forecasting-guidelines-and-methodology>



2.2 Capacity Investment Scheme

2.2.1 Problem Statement

The ESB's final recommendations to Energy Ministers proposed that detailed design work be undertaken on a capacity mechanism to complement existing arrangements. This recommendation acknowledged the NEM is rapidly transitioning to a lower-emissions generation profile, characterised by higher levels of near-zero marginal cost variable renewable generation.³ To encourage investors to take long-term capacity risk, the ESB noted the need for market arrangements that explicitly value capacity, separately from the energy price, to support the quantum of build required over the next decade.⁴

The aim of the capacity mechanism is therefore to provide a clear price signal for capacity that incentivises timely entry and orderly exit of resources by reducing investment uncertainty.

In December 2022, Energy Ministers endorsed the establishment of a Capacity Investment Scheme (CIS).⁵ The CIS is to complement rather than overlap with existing State schemes such as the NSW Electricity Infrastructure Roadmap, and therefore not alter competitive tenders currently underway.⁶ Further, the scheme will work alongside the National Energy Transformation Partnership underway, and the Rewiring the Nation plan – these policies will work in unison to ease power prices and make energy cleaner and more secure.⁷

2.2.2 Objective

The objective is to establish a new national revenue underwriting mechanism to incentivise investment in clean dispatchable power to support reliability and security as the energy market transitions.

2.2.3 Value/Benefit

The key benefit of the mechanism is in providing confidence to investors, governments and consumers that reliable power will be delivered as the transition continues. If done well this will put downward pressure on prices by avoiding price shocks from unexpected retirements and interventions by governments.

2.2.4 Project Scope/Proposed Solution

The solution implementation scope is highly uncertain until the final design of the CIS is agreed.

As an underwriting mechanism facilitated through a tender process, it is anticipated the IT/implementation scope and therefore implementation requirements of the CIS will be significantly less relative to previously considered centralised capacity mechanism. AEMO therefore do not anticipate this initiative requiring industry wide IT implementation.

³ Energy Security Board. Website: Resource Adequacy Mechanisms and Ageing thermal Retirement. Last Accessed February 2023. Available here: <https://esb-post2025-market-design.aemc.gov.au/resource-adequacy-mechanisms-and-ageing-thermal-retirement>.

⁴ Ibid.

⁵ Department of Climate Change, Energy, the Environment and Water. Website: Capacity Investment Scheme to power Australian energy market transformation. Last accessed February 2023. Available here: <https://www.energy.gov.au/news-media/news/capacity-investment-scheme-power-australian-energy-market-transformation>.

⁶ Ibid.

⁷ Department of Climate Change, Energy, the Environment and Water. Website: Media Releases. Capacity Investment Scheme to power Australian energy market transformation – 8 December 2022. Available here: <https://minister.dcceew.gov.au/bowen/media-releases/capacity-investment-scheme-power-australian-energy-market-transformation>.



2.2.5 Key Assumptions

- The design work is not at a stage where certain assumptions can be made.

2.2.6 Key Initiative Relationships

- Unknown at this stage. Once greater certainty on the design and scope of the initiative is available, AEMO will assess key relationships with other initiatives.

2.2.7 Risks

- Risks will be identified closer to final design and draft rules package (if required) being finalised.

2.2.8 Next Steps

- The Commonwealth in conjunction with states and territories and market bodies is continuing to develop the detailed design for the CIS with a view to the first auction occurring in 2023.
- AEMO will incorporate emerging detailed design into cost estimates and high-level design for implementation as required.
 - This will be completed when detailed design of the CIS emerges later in 2023.

2.2.9 Reference

Commonwealth Government: <https://www.energy.gov.au/news-media/news/capacity-investment-scheme-power-australian-energy-market-transformation>

3 Essential System Services

3.1 Fast Frequency Response

3.1.1 Problem Statement

The power system is in the process of transitioning from a system dominated by centralised coal and gas thermal generation to a system comprised of a diverse portfolio of behind-the-meter and grid-scale inverter-based energy resources as well as a more flexible demand side. This transition is leading to a reduction in inertia which presents operational challenges associated with maintaining a secure power system and controlling system frequency following contingency events.

At lower operating levels of inertia, increased volumes or faster acting frequency control services are required to arrest and stabilise the system frequency within the existing system operating standards. This could lead to a significant increase in the costs for fast six-second Frequency Control Ancillary Services (FCAS), which could be partially mitigated by the procurement of faster responding services.

Fast frequency response (FFR) refers to the delivery of a rapid active power increase or decrease by generation or load in a time frame of two seconds or less, to correct a supply demand imbalance and assist in managing power system frequency. FFR is a relatively new service that can be offered by inverter-based technologies such as wind, solar photovoltaics (PV), batteries and demand-side resources.

3.1.2 Objective

- Establish two new market ancillary services – very fast raise and very fast lower – to operate alongside the existing contingency FCAS markets.
- The market arrangements for the new market ancillary services will be the same as those for the existing fast raise and fast lower services. This includes the arrangements for registration, scheduling, dispatch, pricing, settlement and cost allocation.

3.1.3 Value/Benefit

- An alternative additional frequency control option may reduce the overall costs of managing power system frequency relative to the status quo or other alternative arrangements. For example, through a reduction in the costs for fast six-second FCAS.
- Incentivises investment in resources capable of providing very fast FCAS.
- Encourages innovation and technology development in resources capable of providing very fast FCAS.
- Avoidance of future load shedding or generation curtailment.

3.1.4 Project Scope/Proposed Solution

- The solution will provide the development of spot-market arrangements for the provision of FFR. This will be based on the AEMC's and industry's preferred option – new market ancillary services to procure FFR FCAS using existing contingency FCAS arrangements.

- Develop and consult on FFR Market Ancillary Service Specification (MASS).
- IT related changes to AEMO/Participant FCAS systems/ models, bidding interfaces and reports, NEM Dispatch Engine (NEMDE), and Settlement Systems.
- Updates to relevant AEMO/Participant policies, processes, guidelines.

3.1.5 Key Assumptions

- The proposed solution will leverage existing contingency FCAS market arrangements and design.
- Changes will be made in line with recently implemented 5MS frameworks.

3.1.6 Key Initiative Relationships

Table 2 Fast Frequency Response initiative relationship

Name	Description
Integrating Energy Storage Systems	<ul style="list-style-type: none"> • The IESS rule changes create a new participant category called an Integrated Resource Provider (IRP). This new category allows participants with bi-directional energy flows (such as aggregators of small generation and storage units) to provide energy and ancillary services. • The registration model developed by IESS will be used by FFR. • The recovery of FFR costs will be amended in June 2024 by changes to the Non-Energy Cost Recovery framework in the IESS rule change.
Dispatch Target State	
Bids/Offers Target state	<ul style="list-style-type: none"> • This trio comprises a technology uplift of AEMO backend market platform services to replace legacy technology. The scope of the target state needs to be defined and the needs of FCAS markets considered in that process. There are no requirements as part of the FFR initiative that trigger the need to replace the legacy technology.
Constraints Target State	
Operational-Decision Making Tools (Dependent initiative)	<ul style="list-style-type: none"> • ODMT comprises a new enterprise platform for new decision-making tools used by the AEMO control room operators. Multiple disparate user interfaces converged into single user experience platform, capabilities for improved analytics and handling greater volumes of transactional data. This would extend to FFR related control room operations.

3.1.7 Risks

Table 3 Fast Frequency Response initiative risks

Risk ID	Risk Type	Description	Mitigation
1	Dependencies	Increase in project complexity due to multiple dependencies/synergies and overlapping projects in a similar timeline.	Planning and scheduling

3.1.8 Next Steps

- AEMO has completed its consultation and published a revised version of the MASS in October 2022.
- Consultation on AEMO procedures and guidelines (including Constraints Formulation Guidelines) commenced November 2022 and is scheduled to be completed in June 2023.
- Operation of very fast FCAS markets to commence 9 October 2023.

3.1.9 Reference

AEMC Rule Change: <https://www.aemc.gov.au/rule-changes/fast-frequency-response-market-ancillary-service>

AEMO MASS and FCAS Verification tool: <https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/market-ancillary-services-specification-and-fcas-verification-tool>

AEMO Constraint Formulation Guideline Consultation: <https://aemo.com.au/consultations/current-and-closed-consultations/cfg-and-scvpf>

3.2 Frequency Performance Payments (part of PFR Incentive Arrangements rule)

3.2.1 Problem Statement

A high aggregate level of frequency responsiveness is a critical prerequisite for optimal frequency control outcomes as the supply mix continues to become increasingly decentralised, inverter-based, and variable.

It is challenging to define an exact level of future primary frequency response (PFR) requirements that will be sufficient across all plausible operational conditions. However, the need for PFR can be reasonably expected to grow over time due to factors including increasing price-driven movement in both generation and load, the introduction of five-minute settlement in 2021, increasing generation variability due to growth in variable renewable energy (VRE), and increasing uptake of distributed PV, currently without narrowband PFR enabled.

In September 2022, the AEMC made a final rule determination that:

- Confirmed the mandatory PFR arrangements will continue beyond the sunset date on 4 June 2023. This will mean that all scheduled and semi-scheduled generators will continue to be required to respond automatically to changes in power system frequency.
- Amends the existing provisions for the allocation of costs relating to regulating raise and regulating lower services as well as introduction of a new double-sided frequency performance payments process to encourage plant behaviour that helps to control power system frequency.
- Establishes new reporting obligations for AEMO and AER in relation to the levels of aggregate frequency responsiveness in the power system and the costs of frequency performance payments.

This initiative focuses on the second of these changes and the establishment of a new Frequency Performance Payment system and associated procedures and guidelines (including Frequency Contribution Factor Procedures).

3.2.2 Objective

- To implement a new Frequency Performance Payment system for Regulation FCAS (to replace existing 'Causer Pays' system) to which will provide incentives for participants to support frequency stability.

3.2.3 Value/Benefit

- Reforms to the Frequency Performance Payments process for the allocation of regulation FCAS costs can deliver improved valuation and pricing of plant behaviour that impacts on power system frequency.
- Better alignment of the economic incentives for plant active power performance, with the impact of that behaviour on the need for corrective action through the deployment of regulation services to rebalance supply and demand and restore power system frequency to 50Hz.
- Improved transparency and provision of relevant information to Market Participants and stakeholders to assess the effectiveness and efficiency of the frequency control frameworks over time.



3.2.4 Project Scope /Proposed Solution

- Development and consultation on frequency contribution factors procedure to replace the existing Regulation FCAS Contribution Factor (Causer Pays) procedure.
- Review and consultation on amendments to AEMO’s PFR Requirements.
- Design, build and implement a new IT system; Frequency Performance Payments (FPP), to determine contribution factors, and modify the existing NEM Settlements system to apply these factors during settlement. Effectively replacing AEMO’s existing Causer Pays systems.
- Support a non-financial operation for a period of three to six months prior to the effective date of 8 June 2025 to allow participants to understand and adapt to the new arrangements and also allow AEMO to calibrate the many related operational parameters.

3.2.5 Key Assumptions

- Changes to align with the IESS design (e.g. registration function and rules for dispatch).

3.2.6 Key Initiative Relationships

- No key relationships have been identified.

3.2.7 Risks

Table 4 Frequency Performance Payments initiative risks

Risk ID	Risk Type	Description	Mitigation
1	Data processing	The solution will be required to process a high volume of data (4 second reads) and then aggregate into 5-minute intervals to calculate a contribution factor which must be published as soon as practical which is a major change from the current approach which is based on a 28 day cycle. Solution design will need to consider current and future usage.	Design/Implementation

3.2.8 Next Steps

- The AEMC published its final determination in September 2022
- AEMO’s consultation on frequency contribution factors procedure commenced October 2022 and will be completed by 8 June 2023.
- AEMO’s consultation on Primary Frequency Response Requirements commenced December 2022 and will be complete by 8 May 2023.
- The final rule is to commence June 2025.

3.2.9 Reference

AEMC Rule Change: <https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements>

AEMO FPP Project: <https://aemo.com.au/initiatives/major-programs/frequency-performance-payments-project>



AEMO FCFP Consultation: <https://aemo.com.au/consultations/current-and-closed-consultations/frequency-contribution-factors-procedure>

AEMO PFR Requirements Consultation: <https://aemo.com.au/consultations/current-and-closed-consultations/primary-frequency-response-requirements>

3.3 Operating Reserves Market

3.3.1 Problem Statement

Operating reserve is defined as the capability to respond to large continuing changes in energy requirements.⁸

Operating reserves are currently valued implicitly through the energy spot market. However, current arrangements may not be sufficient to address increased variability and uncertainty as the power system transitions in a manner that is sufficient to prevent AEMO intervention.

There is growing forecast uncertainty and variability in net demand over timescales of minutes to hours contributed to by factors including growing variable renewable energy (VRE) penetrations, weather, participant availability, commitment decisions, storage depth, and coordination of distributed energy resources.⁹

Lack-of-reserve occurrences are increasing, and participant behaviour is not always responding to reduce system risk. A new reserve service market could provide an explicit value for flexible capacity to be available to meet these net demand ramps spanning multiple dispatch intervals. This market may complement the suite of resource adequacy reforms, rather than acting as a mechanism to deliver long term investment signals.

3.3.2 Objective

- The objective of an Operating Reserve market is to reduce the need for out-of-market intervention due to lack of reserves in operational timeframes.
- An operating reserve market would unbundle reserves from energy to separately value flexible, responsive resources, through one or more new markets, and in doing so provide a separate and explicit signal for their provision in-market.

3.3.3 Value/Benefit

Establishing a new reserve services market would aim to:

- Provide a signal for Type 1 and 2 Reliability and Emergency Reserve Trader (RERT) service providers (activation times less than 30 min) to participate in-market instead of through manually administered out-of-market contracts;
- Reduce instances of intervention and some of the associated costs for lack of reserve (including procurement and activation of RERT);
- Signal a scarcity of reserves across the operational horizon, and bring reserves online to respond to unexpected changes in net demand, even if energy prices are low and/or uncertain;
- Support participation of demand side resources as scheduled resources in wholesale markets; and
- Incentivise investment in flexible dispatchable resources and reward resources that provide reserves to the market.

⁸ AEMO Power System Requirements, Reference Paper July 2020.

⁹ AEMO Engineering Framework 2022, AEMO Integrated System Plan 2022, AEMO Renewable Integration Study 2020.



3.3.4 Project Scope/Proposed Solution

- Delivery scope is potentially complex given the requirement to design a new market service requiring new formulation National Electricity Rules (NER), Procedures (including MASS) and guidelines.
- IT related changes to AEMO / Participant systems and models including bidding interfaces, settlement and cost-recovery processes, NEMDE or separate solver, operational tools/interfaces.
- Updates to relevant AEMO/Participant policies, processes, guidelines.

3.3.5 Key Assumptions

- The AEMC direction paper highlighted four alternative reserve procurement models. However, a preferred working model between market bodies was identified (option 2 below):
 - A co-optimised operating reserve market.
 - A co-optimised availability market – the current working assumption is a 30-minute reserve market co-optimised with energy and FCAS, labelled ‘co-optimised availability market’.
 - A callable operating reserve market.
 - A ramping commitment market.
- AEMO prepared technical advice at the request of the AEMC based on the working model of a 30-minute ahead product.
- Project scope is subject to final design recommendations set by the AEMC in their final rule determination.

3.3.6 Key Initiative Relationships

Table 5 Operating Reserves initiative relationships

Name	Description
Dispatch Target State	<ul style="list-style-type: none"> • This trio comprises a technology uplift of AEMO backend market platform services to replace legacy technology. • The proposed change to create a new system service to procure energy reserves would have significant interaction with the dispatch and ST markets systems. It has been proposed that AEMO would procure, on a rolling-basis in every 5-minute dispatch interval, a certain volume of operating reserves with the capability to dispatch it as energy in the dispatch interval 30-minutes ahead.
Bids/Offers Target State	
Constraints Target State	
ST PASA Replacement Project (Dependent initiative)	<ul style="list-style-type: none"> • The replacement project involves a review of the Pre-dispatch (PD) and Short Term (ST) PASA methodology and supporting systems and processes. • The proposed rule change for an Operating Reserves (OR) market includes the development of an operating reserve demand curve. Certain inputs into the calculation of the curve, such as uncertainty measures, may change as a result of ST PASA process changes.
Operational Decision-Making Tools (Dependent initiative)	<ul style="list-style-type: none"> • ODMT comprises a new enterprise platform for new decision-making tools used by the AEMO control room operators. Multiple disparate user interfaces converged into single user experience platform, capabilities for improved analytics and handling greater volumes of transactional data. This would extend to OR related control room operations. • ODMT is being delivered incrementally through an agile delivery model over several years – therefore, changes required by the NEM Reform Program can be accommodated across varying timeframes.

Name	Description
Forecasting Platform Uplift (Dependent initiative)	<ul style="list-style-type: none"> • The uplift includes a converged modelling platform that supports model development, interfaces for forecasting-as-a-service providers and layered blended models across a number of modelling domains e.g. demand and VRE. • An Operating Reserves Market means that AEMO would need to forecast reserves needed to meet net demand forecasts that account for uncertainty and variability.

3.3.7 Risks

- Risks will be identified closer to the AEMC final determination.

3.3.8 Next Steps

- AEMO technical advice on key design elements shared with and published by the AEMC (completed).
- AEMC draft determination anticipated 30 June 2023.

3.3.9 Reference

AEMC Rule Change: <https://www.aemc.gov.au/rule-changes/operating-reserve-market>



3.4 Operational Security Mechanism

3.4.1 Problem Statement

Essential system services (ESS) are critical to maintaining overall power system security and reliability by meeting core power system requirements. The NEM's significant transition away from ageing thermal synchronous fleets, which the power system was designed around, toward increasing amounts of renewables and batteries is pressing the limits of current system security and operational experience. While historically these synchronous generators (such as large coal, gas and hydro generators) supplied essential system services simply as a by-product of energy, new non-synchronous generators (such as solar PV, wind and batteries) do not automatically provide these services.

Consequently, under the current market design, which does not explicitly value all ESS, the changing generation mix is providing fewer of these services, and further engineering understanding is required to determine the appropriate mix, definition and quantification of the services. From there, there is a need to co-ordinate the interaction between these services and the resources providing.

As a result, currently, AEMO is increasingly making operational decisions, such as directing generators to be online when they wouldn't otherwise be to support a secure power system.

3.4.2 Objective

- Establish an operational tool to enable the valuation, procurement, and scheduling of ESS to support the secure operation of the NEM and maximise value for consumers.
- Two broad approaches to scheduling resources to ensure the power system remains secure and consumer costs have been considered:
 - A market ancillary services (MAS) approach – which would introduce new services to be scheduled through the pre-dispatch engine to allow it to produce dispatch schedules that result in secure dispatch.
 - A non-market ancillary services (NMA) approach – which would introduce new services to be procured and scheduled in an optimisation approach outside of the spot market, to ensure secure dispatch in a more efficient manner.

The AEMC's draft determination noted practical limitations at this time means a MAS option is not feasible. Instead, a NMA approach that incorporates key benefits of the MAS approach while recognising the practical current limitations has been proposed.

This approach provides for, among other elements, scheduling of resources to occur as close to real-time as practicable and those services to be scheduled alongside the real-time spot market to utilise current resources efficiently. This would be achieved via a least-cost, inter-temporal optimised dispatch schedule which considers attendant technical constraints and costs for unit commitment and system security.

3.4.3 Value/Benefit

Establishing a structured procurement and scheduling mechanism for ESS is expected to:

- Provide technology neutral investment, retirement and operational signals to new and current market participants for providing security services;

- Provide an additional tool for AEMO to procure for requirements ahead of using directions;
- Provide flexibility and adaptability within the mechanism to allow for future learning about the operation of the system, and as services are unbundled the mechanism should move towards procuring services closer to real-time;
- Reduce labour associated with manual market intervention for real time operators (RTO) and support staff, and improved situational awareness for operators; and
- Improve operational efficiency through transparency of integration of secure unit configurations with pre-dispatch.

3.4.4 Project Scope/Proposed Solution

- Delivery scope is highly complex and subject to ongoing consultation on possible design, rules and implementation options.

Assumptions outlined in the Roadmap currently reflect the AEMC’s draft determination. These assumptions are subject to change as the AEMC progress with the rule change consultation process.

- Prototyping OSM scheduler (i.e. building a simplified model of the OSM algorithm, inputs and outputs).
- IT related changes to AEMO/Participant systems/models, bidding interfaces/settlement and cost-recovery processes (e.g. new solver engine, NEMDE, operational tools/interfaces, settlement, billing and prudentials).
- Updates to relevant AEMO/Participant policies, processes, guidelines.

3.4.5 Key Assumptions

- The final solution provides for an NMAS approach and single optimisation engine to be run ahead of real time, separate to NEMDE.

3.4.6 Key Initiative Relationships

Table 6 Operational Security Mechanism initiative relationships

Name	Description
Operating Reserve	<ul style="list-style-type: none"> • OR proposes the unbundling of reserves from energy to value flexible, responsive resources, through one or more new markets. • There are potential technology synergies.
Dispatch Target State	<ul style="list-style-type: none"> • This trio comprises a technology uplift of AEMO backend market platform services to replace legacy technology.
Bids/Offers Target State	<ul style="list-style-type: none"> • The proposed rule change would create a procurement service in operational timeframes to schedule the system services contracted in planning timeframes. • The procurement and scheduling process would need to produce an inter-temporal optimised dispatch schedule that considers technical constraints and costs for unit commitment and system security.
Constraints Target State	<ul style="list-style-type: none"> • The target state does not have a direct relationship to OSM because it is assumed there will be a single optimisation engine run ahead of time that is separate to NEMDE. However, there are potential opportunities to use the same SCED engine for ST PASA and the Dispatch uplift.
System Strength Planning	<ul style="list-style-type: none"> • System Strength Planning reforms provide an evolved the framework to address the need for a more forward-looking, coordinated solution for the supply and demand of system strength in the NEM. This means there is a relationship with OSM which seeks to provide a procuring and scheduling process for ESS by producing a least-cost, inter-temporal optimised dispatch schedule

Name	Description
ST PASA Replacement Project (Dependent initiative)	<ul style="list-style-type: none"> The replacement project is a review of the Pre-dispatch (PD) and Short Term (ST) PASA methodology and supporting systems and processes. These processes consider system security and reliability over the same timeframes as the proposed OSM. There are technology synergy opportunities to utilise the same solver platform (SCED) but no direct dependencies.
Operational-Decision Making Tools (Dependent initiative)	<ul style="list-style-type: none"> ODMT comprises a new enterprise platform for new decision-making tools used by the AEMO control room operators. Multiple disparate user interfaces converged into single user experience platform, capabilities for improved analytics and handling greater volumes of transactional data. This would extend to OSM related control room operations. ODMT is being delivered incrementally through an agile delivery model over several years – therefore, changes required by the NEM Reform Program can be accommodated across varying timeframes.

3.4.7 Risks

Table 7 Operational Security Mechanism initiative risks

Risk ID	Risk Type	Description	Mitigation
1	Scope	MAS vs NMAS approaches represent different scopes of work and will therefore impact overall implementation	Planning and scheduling

3.4.8 Next Steps

- AEMC draft determination was published 21 September 2022.
- Prototyping OSM Scheduler in conjunction with AEMC's OSM Technical Working Group (completed).
- The AEMC final determination is anticipated in July 2023.

3.4.9 Reference

AEMC Rule Change: <https://www.aemc.gov.au/rule-changes/operational-security-mechanism>

3.5 System Strength Planning

3.5.1 Problem Statement

System strength is the measure of a power system's ability to maintain a stable voltage and is critical to a secure power system.¹⁰ Historically it has been supplied by synchronous generators.¹¹ The rapid changes in the energy market are resulting in these generators retiring from the market or operating less frequently and the supply of system strength has reduced.

Inverter based resources (IBR) such as wind, solar and batteries demand system strength.¹² As more of these generators enter the market, the demand for system strength is also increasing.

This combination has resulted in a decline in supply and increase in demand for system strength, and new solutions for providing system strength services are needed in the NEM.¹³

The current frameworks have been reactive and slow to provide the necessary levels of system strength, leading to deficiencies in this essential service which can create problems in the power system, including wholesale market interventions and the constraint of IBR.¹⁴ As a result, AEMO has needed to intervene and displace IBR by directing typically more expensive thermal generation.¹⁵ This results in increased costs for consumers.

3.5.2 Objective

- Evolve the framework to address the need for a more forward-looking, coordinated solution for the supply and demand of system strength in the NEM.
- Enable a supply side solution through a new transmission standard for the provision of system strength when and where it is needed. A subset of Transmission Network Service Providers (TNSPs), known as system strength service provider (SSS Provider), will need to meet two components of the standard as set by AEMO forecasts.
- Enable a demand side solution through new access standards for relevant generators, loads and market network service providers.
- Enable a charging mechanism where parties who use system strength services pay for them, based on location in the network and the amount of system strength the connecting plant may consume, thereby sending a price signal to connecting parties.

3.5.3 Value/Benefit

- Facilitates the rapid integration of IBR and batteries into the power system to support its transition towards a lower carbon future.
- A forward-looking approach ensures system strength is available when and where it is needed. This facilitates the connection of IBR and reduces the need for interventions.

¹⁰ AEMC. Information Sheet - Efficient management of system strength on the power system. Available [here](#).

¹¹ Ibid.

¹² Ibid.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ Ibid.

- New access standards will ensure that connecting parties reduce demand for system strength by using high quality plant.
- A price signal from the charging mechanism should encourage connections that are coordinated with SSS Provider's system strength investments.

3.5.4 Project Scope/Proposed Solution

- AEMO is required to update its system strength requirements methodology and system strength impact assessment guidelines.
- Relevant TNSPs will meet the new network service obligation in the same manner as they meet other prescribed transmission services.
- The AER is required to develop a guideline for relevant TNSPs to update their pricing methodology documents.

3.5.5 Key Assumptions

- Implementation will be led by transmission network service providers (SSS providers, including AEMO in Victoria in its capacity as transmission network planner).
- AEMO System Design and Engineering have resources to update the requirements methodology, impact assessment guidelines and issue the first system strength requirements by end of Dec 2022.

3.5.6 Key Initiative Relationships

Table 8 System Strength Planning initiative relationships

Name	Description
Operational Security Mechanism	Relationship, not a dependency - provide a procuring and scheduling process for ESS by producing a least-cost, inter-temporal optimised dispatch schedule.

3.5.7 Risks

Table 9 System Strength Planning initiative risks

Risk ID	Risk Type	Description	Mitigation
1	Coordination	Interactions between procurement in operational timeframes (for which AEMO is responsible) and planning timeframes (system strength service providers).	Stakeholder engagement
2	Implementation	The ability to meet regulatory timeframes for the December 2025 system strength planning standard. In light of RIT-T requirements, this will impose tight timeframes on the procurement and installation of any new build associated with network or non-network solutions.	AEMO publishes of system strength requirements in Dec 2022 (completed)
3	Implementation	The system strength (planning) and structured procurement and scheduling mechanism work programs to be finalised well ahead of December 2025 to allow for most efficient implementation of solutions by system strength service providers	AEMO and TNSPs complying with the system strength Rule does not require and is not dependent on another Rule being made.



3.5.8 Next Steps

- Following consultation, AEMO published its System Strength Requirements Methodology in December 2022.

3.5.9 Reference

AEMC Rule Change: <https://www.aemc.gov.au/rule-changes/efficient-management-system-strength-power-system>

4 Transmission and Access

4.1 Enhanced Information, Congestion Relief Market & Priority Access Model

Note in the Roadmap this initiative is shown as two separate initiatives 1) Enhanced Information and 2) Congestion Relief Market & Priority Access reflecting the anticipated implementation timing.

4.1.1 Problem Statement

The ESB has been charged by Ministers with progressing transmission access reform.

Transmission congestion is expected to increase as the NEM transitions towards higher levels of variable renewable energy and flexible resources. Congestion cannot be addressed by the significant investment in transmission network augmentation alone. Moreover, it would not be efficient for the transmission network to be able to accommodate surplus generation. Nor is removing all congestion a desirable objective because to do so would incur significant costs for consumers.

Access reform may deliver a least cost energy transition by supporting investments in the right places, ensuring investors aren't exposed to unnecessary risk, making sure that Renewable Energy Zones (REZ) schemes deliver expected benefits, facilitate investment in storage and flexible loads, optimise the size of the transmission network, and ensure use of the least cost combination of available resources.

4.1.2 Objective

The objectives set out by the ESB of the reform have been delineated into two timeframes – investment and operational.¹⁶

Investment timeframe objectives:

The level of congestion in the system that is consistent with an efficiency level.


- *Investment efficiency:* Provide better long-term signals for market participants to locate in areas where they can provide the most benefit to consumers, considering the impact on overall congestion.
- *Manage access risk:* Support a better balance of investment risk with continued incentives for new resource entry to facilitate effective competition that promotes the long-term interests of consumers.

Operational timeframe objectives:

When congestion occurs, we dispatch the least cost combination of resources that securely meets demand.

- *Operational efficiency:* To remove incentives for non-cost reflective bidding to promote better use of the network in operational timeframes, resulting in more efficient dispatch outcomes and lower costs for consumers.

¹⁶ Ibid.



In addition to the above objectives, there is also one overarching objective that encompasses both timeframes – to create incentives for demand side and two-way technologies to provide congestion relief by locating where they are most needed and to operate in ways beneficial to the broader system.

4.1.3 Value/Benefit

- Connecting new generators and storage in areas of the network that support the full benefit of these resources being dispatched into the NEM when required will support a lower cost and more efficient path to the energy transition.
- Lower access risks to investors including facilitating a market participants' ability to manage that access risk.

4.1.4 Project Scope/Proposed Solution

In February 2023, Energy Ministers:

- Agreed to implement 'enhanced information' reforms to provide east-coast market participants with better information on the optimal location for new generation and storage.

It is anticipated that AEMO will have some responsibility for developing and administering the central information portal to support the 'enhanced information' reforms. Final details including any roles and responsibilities for TNSPs and AEMO and subsequently any portal are to be developed.

- Continue policy development and design of a voluntary Congestion Relief Market (CRM) and priority access model.

4.1.5 Key Assumptions

- The design work is not at a stage where certain assumptions can be made to inform the development of scope for an implementation initiative.

4.1.6 Key Initiative Relationships

- Once greater certainty on the design and scope of the initiative is available, AEMO will conduct work to understand relationships with other initiatives.

4.1.7 Risks

- Risks will be identified closer to detailed design and draft rules package being finalised.

4.1.8 Next Steps

- ESB to work with stakeholders to establish precisely what information should be made available, and the regulatory changes required to give effect to the new framework.
- ESB to continue development of policy design of CRM and Priority Access Model with stakeholders including develop in detail the prototype of the model based on the CRM and Priority Access.

4.1.9 Reference

ESB Transmission Access Reform – Directions Paper November 2022 <https://www.datocms-assets.com/32572/1667984730-tar-directions-paper-final-for-web.pdf>



ESB Transmission Access Reform Project Update: <https://www.datocms-assets.com/32572/1677794660-transmission-access-reform-project-update.pdf>

ESB Technical Working Group: <https://esb-post2025-market-design.aemc.gov.au/transmission-and-access#congestion-management-technical-working-group>

5 Integrating DER and Flexible Demand

5.1 Integrating Energy Storage Systems

5.1.1 Problem Statement

As our electricity system transitions to a net zero system with very high proportions of variable renewable energy, energy storage is set to play an increasingly important role to firm up the expanding volume of renewable energy and deliver the growing need for critical system security services as thermal generators retire. This requires changes to the regulatory framework, as well as to various AEMO systems and processes to remove barriers and accommodate more and improved ways for storage and hybrid facilities to participate in the NEM.

5.1.2 Objective

- Improved integration and participation of energy storage and hybrid systems in the NEM.

5.1.3 Value/Benefit

- Simplifies NEM registration and participation for flexible resources by introducing:
 - A near-universal participant type – the integrated resource provider (IRP).
 - A new unit type – the bi-directional unit (BDU) for plants, such as a battery, that can act as a generator and a consumer of electricity.
 - A streamlined bidding approach for BDUs.
- Provides participants access to additional value streams through opening contingency FCAS markets to Small Generation Aggregators, which in turn promotes increased competition in the contingency FCAS markets.¹⁷
- Provides operational flexibility for hybrid systems to dispatch energy at the connection point from a combination of its units rather than on a unit-by-unit basis (with some restrictions).
- Better reflects how participants use and benefit from AEMO's non-energy services by changing the way non-energy costs are recovered. These costs are currently recovered according to formulas based on participant category. The IESS changes will see non-energy costs being calculated on the share of gross measurements of consumed and sent-out energy, for all participant categories.

5.1.4 Project Scope/Proposed Solution

- The delivery scope is complex, given the substantial changes across the NER, industry procedures and guidelines, which in turn drive changes across AEMO's and participants' processes and systems.
- Establish an IRP registration category to:
 - Allow storage and hybrids to register and participate in a single registration category.

¹⁷ For more information on Small Generation Aggregators see: <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/participate-in-the-market/registration/register-as-a-small-generation-aggregator-sga-in-the-nem>

- Allow aggregators for small generators and bi-directional units to register as an IRP and provide ancillary services.
- Major IT related changes to AEMO’s wholesale and retail systems.
- Minor IT related changes to AEMO systems to integrate new participant category across market systems.
- Updates to relevant AEMO/Participant policies, processes, guidelines. AEMO has identified more than 50 affected procedures and guidelines.

5.1.5 Key Assumptions

- Input from related projects could impact IESS business and technical requirements and design.

5.1.6 Key Initiative Relationships

Table 10 Integrating Energy Storage Systems initiative relationships

Name	Description
Dispatch Target State	<ul style="list-style-type: none"> • This trio comprises a technology uplift of AEMO backend market platform services to replace legacy technology.
Bids/Offers Target State	<ul style="list-style-type: none"> • The IESS rule change allows storage units to participate in dispatch as a single unit, and for hybrid systems to store or consume energy when some constraints apply through aggregated dispatch conformance.
Constraints Target State	<ul style="list-style-type: none"> • The IESS rule introduces a single bid for bi-directional units, with 20 bid bands. • Accordingly, IESS will need to be integrated into the bidding interfaces and dispatch systems.
Fast Frequency Response	<ul style="list-style-type: none"> • FFR will establish two new market ancillary services; very fast raise and very fast lower to operate alongside the existing contingency FCAS markets. • The IESS rule changes create a new participant category called an Integrated Resource Provider (IRP). • This new category allows participants with bi-directional energy flows (such as aggregators of small generation and storage units) to provide energy and ancillary services. • As such, as the IESS initiative is implementing the changes to enable IRP participation in ancillary services, they will need to consider the new FFR services being implemented through the FFR initiative. • The registration model developed by IESS will be used by FFR.
Scheduled Lite	<ul style="list-style-type: none"> • Schedule Lite will establish opt-in framework to provide incentives for flexible demand, aggregated portfolios of DER and small generation resources (between 5 MW and 30 MW) to either provide visibility and/or participate in dispatch. • The registration model developed for IESS will be used by Scheduled Lite. • IESS has a relationship with Scheduled Lite and FPP through updated causer pays system.
SCADA Lite	<ul style="list-style-type: none"> • A low-cost mechanism to support telemetry services. • SCADA Lite will provide a platform for participants, such as VPPs, to communicate with AEMO and provide visibility of their DER device activities and participate in dispatch with lighter telemetry.
Flexible Trading Arrangements Model 2	<ul style="list-style-type: none"> • FTA2 establishes a framework for ‘minor energy flow’ metering installations, to reduce barriers, create greater flexibility for the introduction of new technologies. • The registration model developed for IESS will be used by FTA.
Operational Decision-Making Tools (Dependent initiative)	<ul style="list-style-type: none"> • ODMT is a new enterprise platform for new decision-making tools used by the AEMO control room operators. Multiple disparate user interface converged into single user experience platform, capabilities for improved analytics and handling greater volumes of transactional data. This would extend to IESS related control room operations. • ODMT is being delivered incrementally through an agile delivery model over several years – therefore, changes required by IESS can be accommodated across varying timeframes.

5.1.7 Risks

Table 11 Integrating Energy Storage Systems initiative risks

Risk ID	Risk Type	Description	Mitigation
1	Dependencies	Input from related projects could affect IESS business and technical requirements and design.	Planning and scheduling

5.1.8 Next Steps

- AEMO consultation on various procedures, guidelines, and supporting documents. See the consultation section of AEMO’s website¹⁸ and also the dedicated IESS procedure change web page.¹⁹
- AEMC’s expedited rule change consultation on Implementing Integrating Energy Storage Systems (expected completion 4 May 2023).²⁰
- AEMO implementation and readiness activities in anticipation of Go Live dates in March 2023, August 2023 and June 2024 - See AEMO NEM2025 Program Stakeholder Engagement section of website.²¹

5.1.9 Reference

AEMC Rule Change (December 2021): <https://www.aemc.gov.au/rule-changes/integrating-energy-storage-systems-nem>

AEMC Rule Change Consultation (March to ~May 2023): <https://www.aemc.gov.au/rule-changes/implementing-integrated-energy-storage-systems>

AEMO IESS Project: <https://aemo.com.au/initiatives/submissions/integrating-energy-storage-systems-iless-into-the-nem>

¹⁸ AEMO’s consultation pages: <https://aemo.com.au/consultations/current-and-closed-consultations>

¹⁹ IESS procedure change program: <https://aemo.com.au/initiatives/major-programs/integrating-energy-storage-systems-project/integrating-energy-storage-systems-procedure-changes>

²⁰ AEMC. Implementing integrated energy storage systems. Open rule change. Last accessed 13 March 2023. Weblink: <https://www.aemc.gov.au/rule-changes/implementing-integrated-energy-storage-systems>

²¹ AEMO NEM Reform Program Stakeholder Engagement: <https://aemo.com.au/initiatives/major-programs/nem2025-program/nem2025-stakeholder-engagement>

5.2 Flexible Trading Arrangements (Model 2)

5.2.1 Problem Statement

There are material barriers which prevent or deter customers from accessing services which separate active, price-responsive resources from passive loads (so that they can be aggregated and traded in the market).

The establishment of second connection points to the Distribution Network Service Provider (DNSP) network are often blocked via DNSP policy or costs, upfront and ongoing. Customers are prevented from obtaining competitive products and services for DER, and DER is less able to actively participate in the market.

5.2.2 Objective

- Remove or materially reduce barriers preventing customers obtaining additional retail arrangements for DER, enabling competition and active management of DER, providing customers with rewards for their flexible demand and generation.
- Establish a framework for 'minor energy flow' metering installations to reduce barriers further, create greater flexibility for the introduction of new technologies and enable access to retail competition for legacy connections in the NER.
- Flexible Trading Arrangements (FTA) Model 2 would establish a specific category of connection arrangement, a Private Metering Arrangement (PMA), enabling a NMI to be established within a customer's electrical installation.

5.2.3 Value/Benefit

- Reduced barriers to entry for traders of DER that can help consumers obtain value from their DER assets or their flexible demand.
- This allows the trader to participate in the wholesale market or provide network support on behalf of small customers with EV chargers, batteries, and other controllable DER resources.
- The management of controllable resources can also provide a market-driven response to issues affecting the energy system, such as minimum system load and directly benefiting the customer.

5.2.4 Project Scope/Proposed Solution

- Delivery scope is moderately complex relative to other initiatives.
- IT related changes to AEMO/Participant systems/models and reports (e.g. registration, metering and settlement systems).
- Updates to relevant AEMO/Participant policies, processes, guidelines (e.g. registration and accreditation, metering, settlements, consumer protections).

5.2.5 Key Assumptions

- Implementation leverages IESS project delivery implementing FTA (Model 1).
- Provision of services from market be opt-in under the rule change request.

- No requirements placed on DNSPs to enable FTA Model 2.
- Outcomes from existing or upcoming reviews may impact on scope/design including:
 - AEMC Review of the Regulatory Framework for Metering Services.
 - AER review of Retail Authorisation and Exemptions.

5.2.6 Key Initiative Relationships

Table 12 Flexible Trading Arrangements Model 2 initiative relationships

Name	Description
Integrating Energy Storage Systems	<ul style="list-style-type: none"> • IESS will deliver FTA Model 1 upon which FTA Model 2 will be built.
Scheduled Lite	<ul style="list-style-type: none"> • Scheduled Lite will establish opt-in framework to provide incentives for flexible demand, aggregated portfolios of DER and small generation resources (between 5 MW and 30 MW) to either provide visibility and/or participate in dispatch. • FTA2 enables the management of controllable resources through a second connection point. The framework developed for FTA2 to support the management of controllable resources will be used by Scheduled Lite.
FRC Target State	<ul style="list-style-type: none"> • FTA2 will touch Retail processes, including MSATS (process changes to identify flexible NMIs, reconciliation of network charges). Proposal is an extension of existing embedded network processes. Many of the participants for FTA2 will also be participants in 'traditional' Retail systems.
DOE, DER Data Hub and Registry Services, DER Operational Tools	<ul style="list-style-type: none"> • FTA2 will establish a framework for the management of controllable resources that supports the objectives of the DER Marketplace reforms (integrating DER into wholesale market and systems).

5.2.7 Risks

Table 13 Flexible Trading Arrangements Model 2 initiative risks

Risk ID	Risk Type	Description	Mitigation
1	Dependencies	Delays to implementation of FTA Model 1 via the IESS rule change.	Planning and scheduling
2	Metering review	Scope of the proposal changes following AEMC's metering framework review which might complicate the delivery of the proposal.	Monitor

5.2.8 Next Steps

- AEMC commenced consultation on rule change request submitted by AEMO in December 2022.²²
- It is anticipated a the AEMC will make a draft determination in August 2023.

5.2.9 Reference

AEMC Rule Change Consultation: <https://www.aemc.gov.au/rule-changes/unlocking-CER-benefits-through-flexible-trading>

²² AEMC. Unlocking CER benefits through flexible trading. Last Accessed 17 March 2022. Available [here](#).

5.3 Scheduled Life

5.3.1 Problem Statement

The forecast rapid growth in distributed resources, particularly those owned by household and business consumers, is drastically changing the energy landscape of the NEM. These resources are increasingly being aggregated into large portfolios and operated in response to price signals in a manner that is not visible to the market operator. These resources currently operate outside the NEM dispatch and scheduling processes. This creates a range of operational challenges for AEMO for which its existing toolkit was not designed, particularly in managing complex operational conditions.

5.3.2 Objective

- To establish an 'opt-in' framework through lowering barriers and providing incentives for flexible demand, aggregated portfolios of DER and small generation resources (between 5 MW and 30 MW) to:
 - provide visibility of price-responsive, distributed resources and their market intentions; and/or
 - integrate price-responsive distributed resources into the NEM dispatch and scheduling processes.

5.3.3 Value/Benefit

- Minimise uncertainty within operational timeframes, reducing the need to procure frequency services and emergency reserves and reduce the need for unnecessary use of curtailment and backstop mechanisms and support timely commitment decisions in the market. This more efficient system operation lowers system service costs for all consumers.
- Increased access to markets and revenue opportunities for distributed resources by rewarding service provision and lowering barriers to participation in market scheduling processes.
- Enhanced system-wide forecasting and planning assessments over the long-term, delivering a more efficient mix of resources to meet consumer needs and lowering overall system costs.

5.3.4 Project Scope/Proposed Solution

- The scope and solution is subject to the AEMC's final rule determination.
- The Visibility model may include amendments to AEMO systems and processes including registration, demand forecasting systems/processes, control room displays and tools, as well as updates to corresponding procedures and guidelines.
- The Dispatchability model builds on the Visibility model and may include amendments to dispatch and pre-dispatch systems, bidding interfaces, compliance monitoring and reporting, settlement and prudential systems, MASS, as well as updates to corresponding procedures and guidelines.

5.3.5 Key Assumptions

- As DER integration matures, and as several reviews or work programs currently underway outside of AEMO progress they may impact on the final design and therefore the project scope. Such reviews or work programs include:

- FTA Model 2.
- GridNet Network Infrastructure.
- Distributed Energy Integration Program (DEIP) workstream for Dynamic Operating Envelopes.
- Flexible Export Limits (AER).
- Insights and learnings from Project EDGE.

5.3.6 Key Initiative Relationships

Table 14 Scheduled Life initiative relationships

Name	Description
SCADA Lite	<ul style="list-style-type: none"> • A low-cost mechanism to support telemetry services. • SCADA Lite will provide a platform for participants, such as VPPs, to communicate with AEMO and provide visibility of their DER device activities.
Integrating Energy Storage Systems	<ul style="list-style-type: none"> • Scheduled Lite will establish opt-in framework to provide incentives for flexible demand, aggregated portfolios of DER and small generation resources (between 5 MW and 30 MW) to either provide visibility and/or participate in dispatch. • The registration model developed for IESS will be used by Scheduled Lite. • Scheduled Lite has a relationship with FPP through utilisation of the Causer Pays replacement system.
Flexible Trading Arrangements Model 2	<ul style="list-style-type: none"> • FTA2 enables the separate trading of controllable resources in the market. The framework developed for FTA2 to support the management of controllable resources could be used by Scheduled Lite participants.
DOE, DER Data Hub and Registry Services, DLNS, DER Operational Tools	<ul style="list-style-type: none"> • Scheduled Lite will establish a framework that enables greater visibility and management (dispatchability) of DER devices. • Scheduled Lite design will need to build on solutions delivered through DOE, local services and data hub initiatives.
Operational Decision-Making Tools (Dependent initiative)	<ul style="list-style-type: none"> • Scheduled Lite allows small to medium resources to participate in market processes either through providing additional information on future behaviour and intentions (visibility) or participating in the NEM dispatch process (dispatchability). • This means there may be a need to update control room displays and tools to integrate new data types.
ST PASA Replacement (Dependent initiative)	<ul style="list-style-type: none"> • Scheduled Lite allows more resources to either provide visibility or participate directly in the NEM dispatch process. • This has an impact on the forecasting processes that will need to be able to absorb forecasting information from participating resources, provide more accurate operational forecasts and increase scheduling accuracy.

5.3.7 Risks

Table 15 Scheduled Life initiative risks

Risk ID	Risk Type	Description	Mitigation
1	Dependencies	Delays to other reform initiatives could impact delivery.	Planning and scheduling
2	Uptake	'Opt-in' model may result in limited uptake by users.	Encourage uptake through knowledge sharing of the benefits and value of participation from proof-of-concept trials such as Project EDGE.

5.3.8 Next Steps

- AEMO submitted a rule change request, including high-level design, to the AEMC in January 2023.

- Next steps subject to commencement of rule change consultation process (anticipated Q2 Cal 2023).

5.3.9 Reference

AEMC Rule Change Consultation: <https://www.aemc.gov.au/rule-changes/scheduled-lite-mechanism>



5.4 Dynamic Operating Envelopes

5.4.1 Problem Statement

There is a need for a system-wide standard to apply limits to the import and export at DER connection points to the grid in order to help manage known issues across the power system such as (but not limited to) minimum system load and local congestion.

At present, these limits are static, but dynamic limits have the potential to better manage congestion on the distribution network and allow for more flexibility in exporting. These are referred to as dynamic operating envelopes (DOEs) where maximum levels of exporting and importing are set and change over time.

5.4.2 Objective

- To date, DOEs have been developed through a number of industry trials. Implementing DOEs as a mandatory requirement for all new DERs connecting to the grid requires coordination of several key reforms:
 - Establishing new connection agreements with customers that refer to these dynamic limits, and the obligations of the customer, via the retailer / aggregator to maintain these limits.
 - DNSPs to develop capacity allocation principles on how to fairly allocate these limits to different customers at times when constraints are required.
 - New obligations on the retailer / aggregator to operate DER within these limits, where they are operating DER on behalf of customers.
 - Creating new standards for interoperability and cyber security so that DER devices communicate in a standard manner, support a simple process to switch from one provider to another, and enable any provider to ensure compliance with DOEs.

5.4.3 Value/Benefit

- There are various benefits from the establishment of DOEs including:
 - Increased network utilisation.
 - Improved coordination of access.
 - Improve DER optimisation.
 - Improve investment cases for network investment.
 - Efficient operation of the power system and market.
 - Unlocking value for those customers with DER.

5.4.4 Project Scope/Proposed Solution

- The potential scope of work across industry includes:
 - Establish DER technical standards (e.g. communications and interoperability).
 - Limits and constraint advice.

- Capacity allocation rules, monitoring and compliance advice (Access and Pricing Rule Change – AEMC process, AER policy and regulation).
- Connection agreement framework.
- Metering guidelines/review (Metering Review – through the AEMC process).
- DOE reposit (Projects EDGE and Symphony – through proof-of-concept trials).
- At this stage it is expected that AEMO’s scope of work is limited to the receipt and sharing of DOE related information.


5.4.5 Key Assumptions

- The following is out of scope:
 - Distribution level dynamic limits.
 - Dynamic limit retrieval.
 - Auto-compliance monitoring (DNSP).
 - Local Services Exchange Markets settings.
 - Co-existing network capabilities influencing DOEs.

5.4.6 Key Initiative Relationships

Table 16 Dynamic Operating Envelope initiative relationships

Name	Description
Flexible Trading Arrangements Model 2	<ul style="list-style-type: none"> • FTA2 will establish a framework for the separation and trading of controllable resources. DOE solution will need to support multiple traders operating at a primary connection point.
Scheduled Lite	<ul style="list-style-type: none"> • Scheduled Lite will establish a framework that enables greater visibility and management (dispatchability) of DER devices. • Scheduled lite requirements for DOE include: <ul style="list-style-type: none"> – DOEs are available to DER traders so that they can manage their market bids. – DOEs are available for use in market systems where it is necessary to incorporate limits into short-term forecasts, security or reliability processes. – Where there are multiple traders at a Distribution Connection Point, a mechanism is required to coordinate, share and allocate limit between the traders.
FRC Target State	<ul style="list-style-type: none"> • Many participants in a DER Marketplace are likely to be active across other markets and may include a new cohort of participants (e.g. ‘traders/aggregators’). Therefore, the objectives of FRC target state to provide unified services through a shared, single access platform to AEMO’s retail systems and processes would support a more efficient experience for a market likely to have a greater number of participants compared to the current Retail market.
DER Data Hub and Registry Services	<ul style="list-style-type: none"> • DER Data Hub would provide efficient and scalable data exchange and registry services for DER between industry actors. This could include information related to DOEs
Distribution Local Network Services	<ul style="list-style-type: none"> • This initiative will evaluate how local services interact with dynamic operating envelopes and dynamic network tariffs.
DER Operational Tools	<ul style="list-style-type: none"> • This initiative builds DER operational tools and capabilities to maintain local and overall power system security in a high-DER future. For example, operational forecasts developed by DNSPs to calculate DOEs could be shared with AEMO.



In addition, there are relationships and dependencies with various industry trials (AEMO – Project Evolve, Project EDGE, Project Edith, Project Symphony), market reviews (DEIP DOE Whitepaper, DSPI, Review of the Regulatory Framework for Metering Services).

5.4.7 Risks

- Risks will be confirmed subject to final scope and progress on other reform initiatives and industry trials.

5.4.8 Next Steps

- ESB consultation – Interoperability Policy Framework.
- AER Review of regulatory framework for flexible export limit implementation consultation.
- Progression of ongoing trials and market reviews.

5.4.9 Reference

ESB Final Advice to Ministers: <https://esb-post2025-market-design.aemc.gov.au/32572/1619564172-part-b-p2025-march-paper-appendices-esb-final-for-publication-30-april-2021.pdf>

ESB Interoperability Policy Framework: <https://esb-post2025-market-design.aemc.gov.au/integration-of-distributed-energy-resources-der-and-flexible-demand#development-of-interoperability-policy>

AER Review of regulatory framework for flexible export limit implementation: <https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/review-of-regulatory-framework-for-flexible-export-limit-implementation>

5.5 Distribution Local Network Services

5.5.1 Problem Statement

Large scale penetration of DERs, such as those projected in the 2022 Draft Integrated System Plan (ISP), could be utilised by networks to defer, or displace network augmentations, and assist them in actively managing power flows on their network. Currently, however, DNSPs rarely procure services from DER and do so in bespoke bilateral contracts that lead to high transaction costs.

5.5.2 Objective

- To identify ways to make it easier for DER aggregators to trade local network support services with DNSPs/Distribution System Operators (DSOs), through greater visibility of local network constraints aligning the definitions of local services and how they are traded between regions.

5.5.3 Value/Benefit

- The Network Transformation Roadmap from Energy Networks Australia (ENA) and CSIRO projected that DNSPs could procure up to \$2.5bn per annum of local network support services from DER by 2050.²³
- Various benefits from efficient provision of local network services include:
 - Increased network utilisation and potential deferral of network augmentation.
 - Improved DER optimisation.
 - Improved investment cases for network investment through being able to identify the cost of managing constrained parts of the network.
 - Efficient operation of the power system and market.
 - Unlocking value for those customers with DER.

5.5.4 Project Scope/Proposed Solution

- Potential scope across industry includes:
 - Develop guidelines to align the definition of local services and how they are traded (for instance via standardised bilateral contacts) between regions could make it easier for aggregators operating across regions to engage and deliver local network services for DNSPs as DER penetrations grow.
 - The guideline could also outline the information DNSPs should publish, over and above what is required in the Distribution Annual Planning Reports (DAPRs), in relation to network constraints and network service requirements, and how that information should be made available.
 - Evaluate how local services interact with dynamic operating envelopes and dynamic network tariffs – for instance networks could utilise DOE and dynamic tariffs in the first instance to manage power flows but could then procure a service to give them greater certainty when managing persistent constraints.

²³ Energy Networks Australia. Electricity Network Transformation Roadmap. Final Report April 2017. Available here: <https://www.energynetworks.com.au/resources/reports/electricity-network-transformation-roadmap-final-report/>

- At this stage it is assumed that scope relating to AEMO is limited to a simple platform for DSO and aggregators to exchange information on local service requirements and supply.

5.5.5 Key Assumptions

- Services likely derived by DNSPs entering bilateral contractual arrangements with aggregators or agents of DER for provision of services such as voltage support.
- DNSP seen as DSO and having responsibility for scope and provision of local network services (i.e. transactions are executed and settled between DNSP/DSO and aggregator).
- AEMO has a very limited interaction in this trade. AEMO is not involved in the definition, scheduling or settlement of local services, but is likely to require visibility of scheduled local services at an aggregated level as the trade of local services grows in scale.

5.5.6 Key Initiative Relationships

Table 17 Distribution Local Network Services initiative relationships

Name	Description
DER Data Hub and Registry Services	<ul style="list-style-type: none"> • To facilitate efficient and scalable growth of local network services, it may be beneficial to exchange data and registry information via the DER Data Hub envisaged in this project.
Dynamic Operating Envelopes	<ul style="list-style-type: none"> • DNSPs using DOEs to manage power flows so that network limits are not breached may reduce the need for some local services, but equally where DOEs are being used to persistently constrain PV exports it may be beneficial to procure local services (e.g. voltage support) to enable greater exports at specific times.
SCADA Lite	<ul style="list-style-type: none"> • As a low-cost mechanism to support telemetry services, SCADA Lite may provide a platform for participants to communicate with AEMO and provide visibility of their DER device activities.

5.5.7 Risks

- Risks will be confirmed closer to project commencement.

5.5.8 Next Steps

- To be confirmed.

5.5.9 Reference

ESB Final Advice to Ministers: <https://esb-post2025-market-design.aemc.gov.au/32572/1619564172-part-b-p2025-march-paper-appendices-esb-final-for-publication-30-april-2021.pdf>

ESB CER Implementation Plan: <https://www.datocms-assets.com/32572/1629954551-esb-final-report-explainer-clean-and-smart-power-der-pathway.pdf>

AEMO Project Edge: <https://aemo.com.au/en/initiatives/major-programs/nem-distributed-energy-resources-der-program/der-demonstrations/project-edge>

5.6 DER Data Hub and Registry Services

5.6.1 Problem Statement

DER coordination at scale requires high volumes of data and control signals to be exchanged between many parties. For instance, DNSPs sending DOEs or dynamic tariffs to customer agents, and retailers sending exports limits to customer agents to manage negative spot price exposures.

Exchanging data relating to significant volumes of DER without consistent data models, and commands would add unnecessary and material costs to consumers, whilst restricting innovation and raising barriers to entry. Efficient and scalable DER coordination requires systems thinking and consistent approaches.

5.6.2 Objective

- Establish a DER Data Hub to provide efficient and scalable data exchange and registry services for DER between industry actors (Customer Agents, DNSPs, retailers, AEMO. Customer Agent to device communications is addressed in technical standards processes).
- The DER Data Hub could also use digital identities to enable more efficient and permission-based sharing and access to information, which could link to an augmented DER Register that contains more than just standing data.

5.6.3 Value/Benefit

- More efficient and scalable exchange of data between distribution level actors.
- Enables customer agents/aggregators operating across the NEM to receive DOEs from all DNSPs or export limits from retailers through one connection to the Data Hub.
- Enables consistent command signals to be sent from DNSPs to Customer Agents for dispatch/delivery of local network services.

5.6.4 Project Scope/Proposed Solution

- Project EDGE (a collaboration between AEMO, AusNet Services and Mondo) is trialling a proof-of-concept DER Data Hub. Two approaches are being tested – a centralised hub (that operates similarly to the eHub) and a decentralised data hub.
- Project EDGE is delivering an independent cost benefit analysis examining scalability of the data hub approach versus current point-to-point approaches to data exchange.
- The practical test and a cost benefit analysis (CBA) will inform whether this concept is in consumers' long-term interests.

5.6.5 Key Assumptions

- Further process should be informed by evidence from Project EDGE and other initiatives.

5.6.6 Key Initiative Relationships

Table 18 DER Data Hub and Registry Services initiative relationships

Name	Description
Distribution Local Network Services	<ul style="list-style-type: none"> To facilitate efficient and scalable growth of local network services, it may be beneficial to exchange data and registry information via the DER Data Hub envisaged in this project.
Dynamic Operating Envelopes	<ul style="list-style-type: none"> DNSPs using DOEs to manage power flows so that network limits are not breached may reduce the need for some local services, but equally where DOEs are being used to persistently constrain PV exports it may be beneficial to procure local services (e.g. voltage support) to enable greater exports at specific times.
Flexible Trading Arrangements Model 2	<ul style="list-style-type: none"> FTA2 will establish a framework for the separation and trading of controllable resources that supports the objectives of the DER Marketplace reforms (integrating DER into wholesale market and systems).
FRC Target State	<ul style="list-style-type: none"> Many participants in a DER Marketplace are likely to be active across other markets, and may include a new cohort of participants (e.g. 'traders/aggregators'). Therefore, the objectives of FRC target state to provide unified services through a shared, single access platform to AEMO's retail systems and processes would support a more efficient experience for a market likely to have a greater number of participants compared to the current Retail market.
Identity and Access Management	<ul style="list-style-type: none"> A unified mechanism to authenticate participant users and applications when accessing AEMO services. A more efficient and scalable framework will reduce entry barriers for the anticipated increase in participants as a DER Marketplace develops. The DER Data Hub provides a secure and efficient methods to manage organisational identity and access.
Industry Data Exchange	<ul style="list-style-type: none"> Unified access to AEMO services across all markets using modern authentication and communication protocols. A DER Marketplace is anticipated to require capabilities to manage orders of magnitude more data.
SCADA Lite	<ul style="list-style-type: none"> A low-cost mechanism to support telemetry services. SCADA Lite may provide a platform for participants to communicate with AEMO and provide visibility of their DER device activities

5.6.7 Risks

- Risks will be confirmed closer to project commencement.

5.6.8 Next Steps

- To be confirmed.

5.6.9 Reference

ESB Final Advice to Ministers: <https://esb-post2025-market-design.aemc.gov.au/32572/1619564172-part-b-p2025-march-paper-appendices-esb-final-for-publication-30-april-2021.pdf>

ESB CER Implementation Plan: <https://www.datocms-assets.com/32572/1629954551-esb-final-report-explainer-clean-and-smart-power-der-pathway.pdf>

AEMO Project Edge: <https://aemo.com.au/en/initiatives/major-programs/nem-distributed-energy-resources-der-program/der-demonstrations/project-edge>

5.7 DER Operational Tools

5.7.1 Problem Statement

New operational tools relating to DER, and interactions between AEMO and DNSPs, will be required to maintain power system security at times when the entire NEM demand could be met with distribution connected resources. AEMO, transmission network operators and DSOs will need to collaborate and communicate in a greater capacity to ensure the system services required to maintain security will be provided in the most cost-effective manner²⁴.

5.7.2 Objective

- To identify and develop, in collaboration with DNSPs, new DER operational tools that may be required by each party, which can work together to maintain efficient and secure power system operations at times when up to 100% of system load can be met with DER.

5.7.3 Value/Benefit

- Continued power system security when operating at very high penetrations of DER.
- Enabling more dynamic operations of the distribution network by DNSPs (with visibility shared with AEMO) will enable continued local network security and will maximise the renewables hosting capacity of the distribution network.
- Meanwhile, consumers benefits through:
 - More accurate operational forecasts and management of the supply demand balance, leading to reduced wholesale electricity prices and lower system service costs for all consumers.
 - Improved DER optimisation also facilitates efficient operation of the power system and market and unlocks value for those customers with DER.

5.7.4 Project Scope/Proposed Solution

- AEMO and DNSPs will engage to understand what DER operational tools/capabilities they will each need to fulfil their respective roles in future, and how those tools/capabilities will need to interact to maintain local and overall power system security.
- For AEMO, this project builds on their Operational Decision-Making Tools to specifically engage with DNSPs and address DER operational tools that control room staff will need in future.
- For example, DNSPs will need to develop an operational forecasting function to calculate DOEs; those forecasts, aggregated at an agreed point, could be shared with AEMO to improve their operational forecasting accuracy. Equally, AEMO's operational forecasting expertise could help DNSPs establish their new operational forecasting function.

²⁴ AEMO submission to parliamentary inquiry on Modernising Australia's Electricity Grid. Available: https://www.aph.gov.au/Parliamentary_Business/Committees/House/Environment_and_Energy/modernelectricitygrid/Submissions

5.7.5 Key Assumptions

- AEMO and DNSPs need to work closely with each other to identify what data and systems need to be shared/interact with each other to maintain efficient and secure power system operations in a high DER future.

5.7.6 Key Initiative Relationships

Table 19 DER Operational Tools initiative relationships

Name	Description
FRC Target State	<ul style="list-style-type: none">• Many participants in a DER Marketplace are likely to be active across other markets, and may include a new cohort of participants (e.g. 'traders/aggregators'). Therefore, the objectives of FRC target state to provide unified services through a shared, single access platform to AEMO's retail systems and processes would support a more efficient experience for a market likely to have a greater number of participants compared to the current Retail market.
Flexible Trading Arrangements Model 2	<ul style="list-style-type: none">• FTA2 will establish a framework for the management of controllable resources that supports the objectives of the DER Marketplace reforms (integrating DER into wholesale market and systems).
DOE, DER Data Hub and Registry Services, DER Operational Tools	<ul style="list-style-type: none">• There is a close relationship between DOEs, Distribution Local Network Services, DER Data Hub and Registry Services, and DER Operational Tools in that these four initiatives support a DER Marketplace and facilitate communication and exchange of data related to network limits (DOEs) and local network services and support the efficient and scalable integration of DER.
SCADA Lite	<ul style="list-style-type: none">• A low-cost mechanism to support telemetry services.• SCADA Lite may provide a platform for participants to communicate with AEMO and provide visibility of their DER device activities
Operational Decision-Making Tools (Dependent initiative)	<ul style="list-style-type: none">• DER Operational Tools builds on Operational Decision-Making Tools to specifically engage with DNSPs and provide DER operational tools to maintain local and overall power system security for the control room.

5.7.7 Risks

- Risks will be confirmed subject to final scope and progress on other reform initiatives.

5.7.8 Next Steps and Indicative Schedule

- Ongoing monitoring of other reform initiatives, reviews and work programs.

5.7.9 Reference

ESB Final Advice to Ministers: <https://esb-post2025-market-design.aemc.gov.au/32572/1619564172-part-b-p2025-march-paper-appendices-esb-final-for-publication-30-april-2021.pdf>

6 Data Strategy

6.1 Data Services

6.1.1 Problem Statement

Access to data is rarely sufficient to increase its value and impact, as safely sharing or analysing large-scale data sets requires access to advanced skills and systems, as well as clear data curation, management, and approvals processes. These organisational barriers can limit and delay benefits to a range of stakeholders, including consumers, policymakers and Market Participants.

6.1.2 Objective

- To provide new services models which facilitate greater safe, timely and appropriate access to and public-good benefits from data sets held by AEMO and other market bodies, supporting improved policy, planning and research. The models are to be investigated by a newly created Data Leadership and Coordination working group (DataLAC), led by ESB and market bodies.
- DataLAC will work with agencies and technical advisors to collaboratively develop the data services delivery models.

6.1.3 Value/Benefit

- Data services can increase value from data by facilitating a range of different ways to access data safely and can resolve many barriers such as available skills and standard service arrangements.
- Examples of where data services could usefully be developed include analysis of jurisdictional policies and programs. AEMO is often requested of by jurisdictions to assist in such activities (eg. to enable meter data to be linked to measure impacts). This can be a highly valuable output for policy makers, but often face limitations in the absence of data services due to practicalities such as resourcing constraints, non-standard service agreements requiring (lengthy) legal negotiations, concerns regarding publication of analysis and lack of standard analytical methodologies like control groups.
- Finally, data is critical to better understand how different consumer behaviours and needs are changing and being impacted by the energy transition, informing forecasting, investments, new services, and consumer protections.

6.1.4 Project Scope/Proposed Solution

The ESB has canvassed a range of delivery models and governance options including:

- Giving a data services mandate to AEMO to leverage internal capabilities.
- Adding new dedicated data services capabilities to AEMO, with governance from stakeholders.
- Giving a data services mandate to the National Energy Analytics Research Program (NEAR), an existing energy data research collaboration.
- Creating a new independent data services body with a focused mandate.

- Building data service capabilities in all existing agencies to work collaboratively.

Data services delivered are envisaged to be broad, examples include:

- Shared resources – such as dashboards, metrics or reports for multiple users or the public/market.
- Protected data linking (such as to analyse the impact of a program).
- Facilitating sharing of protected data where appropriate.
- Data management and curation services – providing wider safe access to data from a range of sources.
- Tailored aggregated data sets and advanced data analytics on request.

6.1.5 Key Assumptions

- Initial regulatory reforms are progressed in parallel and, as appropriate enable data sharing models as defined by the Data Services workstream, including:
 - Greater access to prescribed agencies.
 - Clarifying market body capabilities.

6.1.6 Key Initiative Relationships

- No project dependencies have been identified.

6.1.7 Risks

Table 20 Data Services initiative risks

Risk ID	Risk Type	Description	Mitigation
1	Scope	The exact scope of the data services to be delivered and by whom is still to be determined	Planning and scheduling
2	Dependencies	The delivery of this workstream is dependent on the successful delivery of the legal and regulatory reforms workstream	Planning and scheduling

6.1.8 Next Steps

- ESB Data Services Delivery Model Consultation Paper published December 2022.
- Recommendations to Energy Ministers on data services delivery and governance models June 2023.

6.1.9 Reference

ESB Consultation Paper: <https://www.datocms-assets.com/32572/1671059508-esb-data-services-delivery-model-consultation-paper-december-2022.pdf>

6.2 Electric Vehicles Charging Standing Data Register

6.2.1 Problem Statement

Electric vehicle (EV) charging is set to transform our electricity systems. While there is some uncertainty regarding the exact pace of adoption of EVs and the technology and charging choices of EV owners (including the use of public charging infrastructure), there is broad consensus that EV integration presents both major opportunities and challenges for the electricity grid.²⁵

Currently, networks and AEMO do not have access to reliable data on the size, location, and characteristics of electric vehicle supply equipment (EVSE) to enable them to determine and manage these opportunities and challenges effectively.²⁶ The opportunity is to provide a solution for reporting installation, location, and characteristics of electric vehicle supply equipment (chargers). This is an initiative under discussion with the ESB and to be investigated by a newly created Data Leadership and Coordination working group (DataLAC), led by ESB and market bodies.

6.2.2 Objectives

- It is critical to ensure agencies and market participant have sufficient visibility of emerging EV technologies to support efficient and responsive forecasting, planning, and operational management. The EV workstream will ensure that:
 - Uptake and behaviour of emerging EV technologies is well understood, supporting efficient and responsive forecasting, planning, and operational management.
 - Data on Electric Vehicle Supply Equipment (EVSE) installations is timely, available at localised levels to support local network planning, and can be linked to ongoing usage data to support research and forecasting.
 - Processes to gather EVSE data are streamlined with wider reforms supporting EVs, including any new requirements for EVSE standards, installations or connection agreements, DER register and jurisdictional transport data.
 - EV research and program data is coordinated and accessible, providing data on EV behaviour and uptake.

6.2.3 Value/Benefit

- Providing appropriate systems and processes are in place to ensure system planners and operators, or other parties, have the information they need to manage this transition effectively.
- Improved planning and management of operational risks inherent to uncertainty around uptake and behaviour of EVs.
- Improved understanding of the costs, risks and benefits associated with the rollout of EV charger infrastructure, in Australia.

²⁵ ESB. Electric Vehicle Supply Equipment Standing Data. Consultation Paper. December 2022. Available here: <https://www.datocms-assets.com/32572/1670367035-esb-electric-vehicle-supply-equipment-standing-data-consultation-paper-december-2022.pdf>

²⁶ Ibid.

- More informed and therefore targeted network investment such that the location, timing and size of that investment is well matched to the requirement.
- Better management of demand growth including through demand management solutions, potentially reducing total capital expenditure lowering network charges to customers.
- Benefits are likely wider than electricity industry, for example Fire Services may benefit from understanding the location of EVSE installations to improve the effectiveness and manage risk in emergency response.

6.2.4 Project Scope/Proposed Solution

- To establish a minimum viable product for an EVSE standing data register under the existing electricity rules and regulatory frameworks.
- Wider consideration of EV forecasting options, including shared approaches with the transport sector.
- Work with stakeholders including DEIP EV task groups to consider related options and recommendations.
- Potential change will be required to AEMO portal to provide self service capabilities.
- Regulatory changes are expected to be required for this initiative along with integration with third parties for access to EV data.

6.2.5 Key Assumptions

- The ongoing RACE, C4NET and DEIP EV workstreams will have capacity to contribute to this initiative.

6.2.6 Key Initiative Relationships

- No direct dependencies with NEM Reform Program initiatives have been identified.

6.2.7 Risks

- Risks will be identified closer to related policy and regulatory determinations.

6.2.8 Next Steps

- ESB Electric Vehicle Supply Equipment Standing Data. Consultation Paper published December 2022.
- Assessment of options for ongoing reporting of EVSE installations, including policy pathway and triggers and governance considerations (March 2023).
- Recommendations for ongoing reporting of EVSE installations (May 2023).

6.2.9 Reference

ESB Consultation Paper – EVSE Standing Data: <https://www.datocms-assets.com/32572/1670367035-esb-electric-vehicle-supply-equipment-standing-data-consultation-paper-december-2022.pdf>

ESB Data Strategy: <https://www.datocms-assets.com/32572/1630275857-esb-data-strategy-july-2021.pdf>



6.3 Bill Transparency

6.3.1 Problem Statement

As energy market services become more complex there are flow-on considerations for consumer protections. The opportunity exists to address emerging gaps in consumer protections by allowing for better understanding of:

- The way different consumer segments, including vulnerable consumers, are impacted by new technologies and services.
- How consumers and technologies are responding to market price signals.
- The effectiveness of competitive retail markets.

This is an initiative under discussion with the ESB and to be investigated by a newly created Data Leadership and Coordination working group (DataLAC), led by the ESB and market bodies.

6.3.2 Objective

- Efficient arrangements to provide ongoing transparency of consumer bills and the impacts of different services and circumstances, to support better consumer protections and understanding of consumer needs in the market transition and streamline current inefficient retail reporting.

6.3.3 Value/Benefit

- Increase understanding and awareness of consumer billing, supporting retail energy market policy development and associated outcomes, including those associated with energy equity.
- Reduced cost and greater affordability through more transparency in competition and reforms.
- More effective and less costly consumer protections, particularly associated with new technologies and services, such as flexible trading arrangements.
- Streamline price reporting, reducing duplication.
- Support for more accurate forecasting through greater awareness of how consumers respond to price signals.

6.3.4 Project Scope/Proposed Solution

This workstream will cover:

- Options for reporting consumer bill outcomes, engaging closely with stakeholders.
- Identifying streamlining opportunities across existing retail reporting and consumer research, and synergies with reforms such as the Consumer Data Right.

Out of scope:

- Change to regulatory roles – supports existing roles through data sharing.
- Change to privacy settings – builds on existing protected data and aggregate analysis.



6.3.5 Key Assumptions

Initial regulatory reforms are progressed in parallel and, as appropriate enable data sharing models as defined by the Data Services workstream, including:

- Greater access to prescribed agencies.
- Clarifying market body capabilities.

6.3.6 Key Initiative Relationships

- No dependencies with NEM Reform Program initiatives have been identified.
- Possible dependencies on the implementation of Tranche 3 of the Consumer Data Right (November 2023).

6.3.7 Risks

- Risks will be identified closer to related policy and regulatory determinations.

6.3.8 Next Steps

- Define priority customer billing datasets needed to support future consumer protections and market monitoring, and high-level options to deliver it.
- Assessment of options to deliver priority customer billing data sets to be analysed safely by all relevant regulators and policy makers (February 2023).
- Public consultation on Options Assessment (March 2023).
- Recommended reforms to deliver priority billing data sets to all relevant regulators (June 2023).

6.3.9 Reference

ESB Data Strategy: <https://www.datocms-assets.com/32572/1630275857-esb-data-strategy-july-2021.pdf>

6.4 Network Visibility

6.4.1 Problem Statement

Optimising DER integration requires greater visibility of the low voltage network, with needs for networks, network service providers, DER investors/service providers, consumers, and regulators to all manage risks around network and DER capacity and emerging constraints.

Currently networks are required to publish detailed information and consult on how network prices are developed, as well as higher level data on network planning. They do not yet have requirements to publish details supporting DER constraints.

The dual issues of consistency of data availability across the low voltage networks and the access to this data must be solved simultaneously to deliver benefits to network and market operators, consumers and policy makers.

6.4.2 Objective

- Consumers, DER providers and the wider market are empowered and incentivised to optimise benefits from DER and the network, through datasets providing clear visibility of network capacity/constraints, DER and network performance, and related risks and opportunities.
- Datasets are readily available, localised, comparable and ongoing.
- Consumers can see and engage in localised needs across the network, supporting informed consumer decisions and consumer engagement in regulatory requirements, pricing and consumer protections.

6.4.3 Value/Benefit

Greater visibility of the low voltage network will lower network/DER costs by:

- Enabling greater use of existing network capacity: existing data allowing DER and network service providers to target development around emerging constraints, managing their own risks and optimising local outcomes.
- Lowering DER constraints: empowering consumers, DER providers, and regulators to better engage with network to increase efficiency, understanding and acceptance of any DER constraints deemed necessary.
- Better targeting of network expansion: allowing for constraints and DER impacts of localised issues to be more transparently considered by alternative service providers and regulators.

6.4.4 Project Scope/Proposed Solution

- Design and cost options to optimise network data availability.
- Create an efficient path to the shared network data needed to optimise DER and inform decisions of DER providers, consumers, and regulators.

6.4.5 Key Assumptions

- Initial regulatory reforms are progressed in parallel and, as appropriate enable data sharing models as defined by the Data Services workstream, including:

- Greater access to prescribed agencies.
- Clarifying market body capabilities.

6.4.6 Key Initiative Relationships

- Potential links to Data Services workstream – access to AEMO metering data and DER Register data could be inputs, with costs minimised with data coming from a single source.

6.4.7 Risks

- Risks will be identified closer to related policy and regulatory determinations.

6.4.8 Next Steps

- Phase 1: Network dataset and use case definition
 - Define priority datasets and use cases needed to inform markets planning DER investment, particularly in managing network capacity risks.
 - Consultation on initial datasets and use cases (December 2023).
 - Development of proposals / assessment of options to support ongoing delivery of data to inform DER planning in the market and reduce data gaps efficiently.
 - Recommended reforms to support ongoing delivery of data to inform DER planning in the market and reduce data gaps efficiently (May 2023).
- Phase 2: Dataset trials (potential for AER to commence from Q2 onwards).
- Phase 3: Delivery options development and consultation (potential for AER to commence from Q2 onwards).

6.4.9 Reference

ESB Data Strategy: <https://www.datocms-assets.com/32572/1630275857-esb-data-strategy-july-2021.pdf>

7 AEMO Foundational Initiatives

7.1 Identity and Access Management

7.1.1 Problem Statement

AEMO's Identity and Access Management (IDAM) services are disparate, requiring users to retain multiple sets of credentials to access AEMO business services. The legacy IDAM services do not implement best practices in cyber security controls (e.g. multifactor authentication) and are insufficient to meet new industry obligations introduced under the Security of Critical Infrastructure (SOC I) Act.

7.1.2 Objective

- Establish a modern and secure target state IDAM Platform suitable for consuming wide range of AEMO browser and application services
- To enable unified identification, authorisation, and entitlement management while ensuring compliance with industry obligations under cyber security policies such as the SOCI Act.
- Provide a strategy for the transition of legacy authentication interfaces.

7.1.3 Direct Value/Benefit for Participants

- As part of an inter-related work program that includes Portal Consolidation and Industry Data Exchange, the IDAM initiative will enable capabilities for a single pane of glass for Participants accessing AEMO applications.
 - Deduplication of Participant identities provides a data integrity and security value to Participants because it facilitates a more secure and controlled credential and access process.
 - This simplification will reduce friction and facilitate a consistent user experience. Delivering this user experience depends on the implementation of the inter-related initiatives.
- Implementation of consistent cyber security controls for Participants will improve the overall security maturity level or posture.
- Federated access for Participants will enable external identity lifecycle events to be managed entirely by Participants. This not only provides a better user experience but creates time efficiencies for Participants.

7.1.4 Indirect Value/Benefit for Participants

- Enabling the single pane of glass for participants accessing AEMO browser services.

7.1.5 Project Scope/Proposed Solution

- Define the architecture of the target state, including the transition to the target state.
- Provide a high-level technical solution and a transition strategy depicting the path to the target state.

- Define principles, guidelines and consumption patterns that must be adhered to by the upcoming NEM reforms.
- Implement consistent cyber security controls for NEM services consuming target state IDAM.
- Federated access for NEM Participants to enable external identity lifecycle events to be managed entirely by Participants.
- Deliver the transition strategy as agreed in the feasibility phase.
- The implementation effort includes standing up supporting business processes.
- This initiative will employ a phased approach, and the final scope will be subject to the next phase of review.

7.1.6 Key Initiative Relationships

Table 21 IDAM initiative relationships

Name	Description
Portal Consolidation Framework	<ul style="list-style-type: none"> • The framework for Portal Consolidation will integrate with IDAM. • The design of the Portal Consolidation framework will expose number of self-serve IDAM features e.g., password reset.
Industry Data Exchange	<ul style="list-style-type: none"> • IDX establishes unified access to AEMO services across all markets using modern authentication and communication protocols. This initiative will leverage IDAM. • IDAM and IDX feed into each other to enable consolidated management of participant identities and their authentication and access. • IDAM enables IDX.
Forecasting Platform Uplift (Dependent initiative)	<ul style="list-style-type: none"> • The initiative established a converged modelling platform that supports model development, interfaces for forecasting-as-a-service providers and layered blended models across several modelling domains e.g., demand and VRE. • The platform is part of a future state forecasting roadmap where new third party vendors (forecasting a service providers) could submit forecasts. IDAM will support the management of identification and authorisation of these participants.
Consolidated Master Data Repository	<ul style="list-style-type: none"> • As the single source of truth for organisational identity, it is important that the master data repository maps data from the new IDAM framework. • The consolidation of users and user roles from the new IDAM framework will map into Consolidated Master Data Repository, which will act as the single source of truth for organisational identity.
FRC Target State	<ul style="list-style-type: none"> • FRC includes establishing a consolidated Asset and Participant Relationship Management system (APRM) that enables unification of services onto a shared platform, single access to AEMO's Retail systems, and simplification of Participants' and AEMO processes. • As markets and systems are consolidated through FRC, the new IDAM framework is in place to facilitate a cohesive approach to management organisational authorisation and access.
DOE, DER Data Hub and Registry Services, DER Operational Tools	<ul style="list-style-type: none"> • As the DER reforms are implemented and a new cohort of Participants interact with AEMO's systems, it becomes increasingly important that IDAM systems can efficiently manage the anticipated increased volume of interactions and entities.

7.1.7 Delivery Risks

Table 22 IDAM initiative delivery risks

Risk ID	Risk Type	Description	Mitigation
1	Relationships	Increase in project complexity due to multiple dependencies/synergies and overlapping projects in a similar timeline.	Planning and scheduling

7.1.8 Risks to Participants if not delivered with NEM Reform Program reforms

Table 23 IDAM initiative Participant risks

Risk ID	Risk Type	Description	Impact
1	Security	AEMO would be compelled to use legacy IDAM services which do not implement best practices in cyber security controls (e.g. multifactor authentication) and are insufficient to meet new industry obligations introduced under the SOCI Act.	High
2	Scalability	The introduction of new markets and anticipated volume of a new cohort of Participants means that more Participants will be exposed to existing pain points regarding an inconsistent, fragmented and duplicated user experience when accessing AEMO's systems.	Moderate

7.1.9 Next Steps

- AEMO has developed a high-level plan that includes activities, milestones, drivers, triggers, assumptions and other factors to consider. The plan highlights the activities, process and use case development, gap analysis, ongoing industry consultations, target state development.
- As part of the product roadmap AEMO will consult with industry to determine an appropriate transition strategy prior to any funding decision being made.
- Key steps include:
 - Gap analysis, High Level Business Processes and Use Cases (Cal. Q1 2023).
 - Development of conceptual architecture design
 - Industry consultation (Cal. Q1/2 2023).
 - Agreed definition of target state and transition strategy developed (Cal. Q2 2023).
 - Business case development (Cal. Q2 2023)
 - Approval of Business Case through established AEMO and industry governance channels



7.2 Industry Data Exchange

7.2.1 Problem Statement

AEMO's existing data exchange systems have been variously acquired over the last 10-15 years, and use inconsistent standards, protocols and formats. AEMO's markets are also undergoing significant transformation, resulting in new data exchange needs. Existing data exchange mechanisms will not meet needs and will fail to comply with new industry obligations around cyber security such as the SOCI Act. AEMO is introducing new data exchange patterns without a target state and roadmap which is inhibiting participants from modernising their systems and quantifying the benefits of their investments.

7.2.2 Objective

- Develop unified data exchange standards covering (but not limited to) protocols, payloads, connectivity methods, authentication/authorisation.
- Agree on the target state architecture of the data exchange channels and patterns with Participants.
- Develop a roadmap of how the existing interfaces will be transitioned to the target state detailing the transition requirements/solution and sunset timeframes.
- Provide principles, guardrails and foundational data exchange patterns and standards for core reforms such as those related to the DER Marketplace.

7.2.3 Direct Value Benefit for Participants

- Consolidated systems and standards will lower entry barriers for new Participants and reduce overall costs for industry and implementation of future industry reforms as new reforms are implemented directly in target state. These cost benefits realised by Participants will mean that Participants can improve the cost outcomes for their customers.

7.2.4 Indirect Value/Benefit for Participants

- The modernised systems will improve speed to market of changes and support innovation and support for emerging services within the energy industry (e.g. Data Sharing Services). This results in overall cost efficiency in a rapidly changing energy landscape and can provide operational efficiency benefits and value to Participants.
- Linking currently disparate systems will enable new work processes to be implemented within AEMO that improve data security by adoption of modern authentication and data exchange protocols.
- The IDX design phase will define standards, protocols, connectivity methods enabling the efficient implementation of reforms. It will also avoid implementing initiatives in the legacy interfaces which would later require additional effort and costs for Participants to migrate to the unified standards. This also facilitates Participants' ability to manage and plan their roadmaps and investments.

7.2.5 Project Scope/Proposed Solution

- Define the architecture of the target state, including the transition to the target state.

- Define guardrails/standards for protocols, authorisation/authentication patterns and payload formats.
- Deliver high-level technical solution and a roadmap illustrating the path to target state, and sunset periods for transitioning from the legacy to new systems.
- Development of the defined target solution interfaces for NEM Retail and NEM Wholesale (i.e. establish framework). The intention is to progressively implement the target state solution across all retail and wholesale markets, for both fuels but the NEM scope is limited to NEM retail and wholesale.
- Migration of BAU industry interfaces to the new platform.
- Make the new platform available in timeframes to support other NEM Reform Initiatives.
- Support data exchange for use cases for data sharing requirements among Participants,. Use cases include but not limited:
 - Business process outsourcing.
 - Operating agents working on behalf of participants (e.g. and they need to access and submit data for a particular plant).
 - Bi-lateral arrangements between participants (e.g. PPA; exchange data to understand exposure).
- This initiative will employ a phased approach, and the final scope will be subject to the next phase of review.

7.2.6 Key Initiative Relationships

Table 24 Industry Data Exchange initiative relationships

Name	Description
Identity and Access Management	<ul style="list-style-type: none"> • IDAM provides a unified mechanism to authenticate participant users and applications when accessing AEMO services. • IDAM is the vehicle that enables the new IDX. IDAM and IDX feed into each other to enable consolidated management of Participant identities and their authentication and access. • Secure data exchange is intrinsically linked to an authorisation and access framework. As such, IDAM and IDX need to complement each other • Consent management for data sharing agreements
Consolidated Master Data Repository	<ul style="list-style-type: none"> • As the single source of truth for organisational data, the master data repository will need to adopt industry data exchange standards that integrated with the IDX framework. • The consolidation of users and user roles from the new IDAM and IDX framework will map into Consolidated Master Data Repository, which will act as the single source of truth for organisational identity.
FRC Target State	<ul style="list-style-type: none"> • FRC includes establishing a consolidated Asset and Participant Relationship Management system (APRM) that enables unification of services onto a shared platform, single access to AEMO's Retail systems, and simplification of Participants' and AEMO processes. • As markets and systems are consolidated through FRC, the new IDX framework is in place to facilitate a cohesive approach to industry data exchange.
DOE, DER Data Hub and Registry Services, DER Operational Tools	<ul style="list-style-type: none"> • A core element of the DER Marketplace initiatives is data exchange that enables the effective and efficient integration of DER into wholesale markets and supports a local services exchange. This will mean orders of magnitude more data that will need to be absorbed, governed, and exchanged. • It would be inefficient to establish a new DER Marketplace under legacy systems that would need to be retrofit.
Forecasting Platform Uplift (Dependent initiative)	<ul style="list-style-type: none"> • IDX will provide a unified access to AEMO services across all markets using modern authentication and communication protocols. This initiative will leverage Identity and Access Management and could support the data exchange to and from forecasting service suppliers.

Name	Description
All reform initiatives	<ul style="list-style-type: none"> The standards, protocols and architecture will enable the data exchange elements of all NEM Reform Program initiatives. All reforms – particularly those introducing new markets and new cohorts of Participants, will use the new IDAM and IDX frameworks.

7.2.7 Delivery Risks

Table 25 Industry Data Exchange initiative delivery risks

Risk ID	Risk Type	Description	Mitigation
1	Industry Buy-in	Gaining agreement across multiple markets, fuels and jurisdiction for single data exchange.	Extensive industry consultations
2	Relationships	Increase in project complexity due to multiple dependencies/synergies and overlapping projects in a similar timeline.	Planning and scheduling
3	Participant costs	Investments that incumbent Participants (especially large retailers and distributors) have made may not subscribe to the design changes. There would also be capital costs for implementing new gateways.	AEMO to explore options to take out cost from Industry implementation

7.2.8 Risks to Participants if not delivered with NEM Reform Programs

Table 26 Industry Data Exchange initiative Participant risks

Risk ID	Risk Type	Description	Impact
1	Complexity	The current suite of data exchange mechanisms across markets and fuels creates complexities and costs for Participants in managing data exchange requirements and creates a barrier to entry for new Participants.	High
2.	Security	Critical infrastructure and sensitive data continuing to be exchanged over less secure channels. Inability to comply with industry wide requirements under SOCI act.	High

7.2.9 Next Steps

- AEMO has drafted a high level plan that includes activities, milestones, drivers, triggers, assumptions and other factors to consider. This plan highlights the activities, process and use case development, gap analysis, ongoing industry consultations, target state development.
- As part of the forthcoming activities AEMO will consult with industry to review and take feedback on a proposed target state and an appropriate transition strategy and relevant Industry cost
- Key steps include:
 - Gap analysis, High Level Business Processes and Use Cases (Cal. Q1 2023).
 - Industry consultation (Cal. Q1/2 2023).
 - Agreed definition of target state and transition strategy developed (Cal. Q2 2023).
 - Business case developed (Cal. Q2 2023).
 - Approval of Business Case through established AEMO and industry governance channels.

7.3 SCADA Lite

7.3.1 Problem Statement

Market Participants need appropriate communication and/or telemetry systems to support dispatch instructions and auditing of responses. These systems are also needed to provide the increased visibility of resources under the DER reforms work program. Greater visibility of the power system also enables AEMO to support management of grid security. While Supervisory Control and Data Acquisition (SCADA) systems are critical to the operation of the NEM's current scheduling framework, they are a significant entry barrier for smaller participants into central dispatch due to the granularity of data they communicate with AEMO's control rooms.

7.3.2 Objective

- Enable capabilities for providing a service that aggregators or distribution network connected generators/loads can utilise if they cannot access the service through their network.
- This work is part of an operational data exchange strategy that includes cost, resilience and technology considerations for the changing system with higher volume of active DER.

7.3.3 Direct Value/Benefit for Participants

- Reduced entry barriers for smaller generators and demand side resources to provide greater visibility to AEMO and participate in the market with lighter telemetry.

7.3.4 Indirect Value/Benefit for Participants

- Accurate forecasts of active DER shifting load or generation enable AEMO to reflect DER in load forecasts provided to the market and for generation scheduling. This benefits Participants in the NEM, including DNSPs and scheduled and semi-scheduled generators.

7.3.5 Project Scope/Proposed Solution

- Scope is in development but likely to include setting up processes covering application, onboarding network and Energy Management System (EMS) configuration.
- The proposed solution will need to consider the Power and Data Communications Standard review underway and cater for market design and grid architecture.
- The scope does not include changes to NEMDE or receiving bids or dispatch instructions.

7.3.6 Key Initiative Relationships

Table 27 SCADA Lite initiative relationships

Name	Description
Scheduled Lite	<ul style="list-style-type: none">• SCADA Lite will provide a platform for participants, such as VPPs, to communicate with AEMO and provide visibility of their DER device activities.

Name	Description
Integrating Energy Storage Systems	<ul style="list-style-type: none"> SCADA Lite will provide a platform for participants, such as VPPs, to communicate with AEMO and provide visibility of their DER device activities and participate in dispatch with lighter telemetry.
Operational Data Store	<ul style="list-style-type: none"> ODS establishes a capability for storing high volume of operational transactional data at near-real-time. SCADA Lite will provide a low-cost mechanism for secure communications with new actors in the industry as DER integration progresses at scale in the NEM. This initiative provides high reliability and lower cost data communication technology for SCADA quality data. ODS surfaces data – it is a series of layers ('technology behind the scenes') that uses elements from other systems (including SCADA) and brings them together.
DER Data Hub and Registry Services	<ul style="list-style-type: none"> As a low-cost mechanism to support telemetry services SCADA Lite may provide a platform for participants to communicate with AEMO and provide visibility of their DER device activities
DER Operational Tools	
Distribution Local Network Services	

7.3.7 Delivery Risks

Table 28 SCADA Lite initiative delivery risks

Risk ID	Risk Type	Description	Mitigation
1	Relationships	Alignment of implementation in time to support regulatory deadlines of core reform initiatives that this would support.	Planning and scheduling
2	Relationships	Increase in project complexity due to multiple dependencies/synergies and overlapping projects in a similar timeline. The scope also needs to consider external organisation registration processes and needs	Planning and scheduling

7.3.8 Risks to Participants if not delivered with NEM Reform Program

Table 29 SCADA Lite initiative Participant risks

Risk ID	Risk Type	Description	Impact
1	System security	AEMO would face operational challenges in collating SCADA data which may reduce visibility of DER in the market. This creates risks to the effective integration of an anticipated increased in DER and may result in risks to system security.	High

7.3.9 Next Steps

- To be confirmed.

8 AEMO Strategic Initiatives

8.1 Portal Consolidation

8.1.1 Problem Statement

AEMO browser services are exposed over a disparate range of end points and require multiple sets of credentials to consume these services. This results in a suboptimal user experience for AEMO's stakeholders. Further, the requirement to access browser services via private networks creates technical barriers to consuming these services.

8.1.2 Objective

- Implement the framework, and roadmap for transition and implementation, to enable stakeholders with the ability to self-manage their user experience by delivering a new web and mobile user portal that provides personalised, secure, single pane of glass access to data and services.
- Enable users to access a single unified portal that hosts all web applications in scope.
- Provide integration with the enterprise identity management and user authentication solution.

8.1.3 Direct Value/Benefit for Participants

- A consolidated internet-facing portal will enable an enhanced and frictionless user management experience, which would deliver efficiency benefits for stakeholders. An improved and consolidated user interface also reduces user pain points of being required to interact through different access points.
- Data entry validation rules and management processes and controls reduce data breach risk and improved data quality and reliability. This provides data security value to Participants and ensures their data provided to, and held by AEMO, is accurate.

8.1.4 Indirect Value/Benefit for Participants

- A consolidated access portal enhances the ability to flexibly and quickly adapt to market developments which results in overall cost efficiency in a rapidly changing energy landscape. This also supports speed for innovation that can provide operational efficiency benefits and value to Participants.
- Improved operational efficiency in collecting data from Participants reduces the operational and administrative burden on Participants.

8.1.5 Project Scope/Proposed Solution

- The aim of the Portal Consolidation project is to enable a single pane of glass experience for Energy Market Participants and other partners.
- This is to be achieved by:

- A new consolidated internet facing and mobile portal for hosting AEMO browser services for use by both registered and non-registered NEM users that includes a fully featured online user help function personalisation.
- Integration with the new identity and access management platform.
- Establish a roadmap outlining the progressive migration of AEMO’s browser services to the consolidated target state framework.
- Migration of any existing web applications to internet facing determined in scope by the feasibility phase
- The roadmap will be implemented via other business reforms for browser services that fall outside the scope of Portal Consolidation.
- Rollout to NEM Participants to enable them to access the consolidated and access to services.

8.1.6 Key Initiative Relationships

Table 30 Portal Consolidation Framework initiative relationships

Name	Description
Identity and Access Management	<ul style="list-style-type: none"> • The framework for Portal Consolidation will enable integration with IDAM. • The design of the Portal Consolidation framework needs to account for the interactions with the authentication and authorisation patterns in the new IDAM framework to support effective integration.
Industry Data Exchange	<ul style="list-style-type: none"> • Portal Consolidation framework enables the roadmap toward a single pane of glass user experience for participants accessing all AEMO browser-based services. • IDX will need to include a unified data exchange approach and methods which will need to consider work from Portal Consolidation to facilitate integration where needed.
Consolidated Master Data Repository	<ul style="list-style-type: none"> • The Consolidated Master Data Repository initiative will establish an internal master data management platform hosting information about power system asset data (e.g. NMI standing data, DER devices) used by AEMO market systems. • Aligning Portal Consolidation with the master repository facilitates the objective of creating a single source of truth to track organisational identity and their authorised contacts.

8.1.7 Delivery risks

Table 31 Portal Consolidation Framework initiative delivery risks

Risk ID	Risk Type	Description	Mitigation
1	Relationship	Delays to the delivery of IDAM	Planning and scheduling
2	Implementation	Increase in project complexity due to dependencies / synergies and overlapping projects in a similar timeline.	Planning and scheduling

8.1.8 Risks to Participants if not delivered with NEM Reform Program

Table 32 Portal Consolidation Framework initiative Participant risks

Risk ID	Risk Type	Description	Impact
1	Data accessibility reliability	The current fragmented framework means it is more challenging for Participants to consume AEMO browser services.	High



8.1.9 Next Steps

- AEMO has developed a product roadmap that includes activities, milestones, drivers, triggers, assumptions and other factors to consider. This product roadmap highlights the planning activities, process and use case development, gap analysis, ongoing industry consultations, target state development.
- As part of the product roadmap AEMO will consult with industry to determine an appropriate transition strategy prior to any funding decision being made.
- Key steps include:
 - Gap analysis, development of high level conceptual architecture design (Cal. Q1 2023).
 - Industry consultation (Cal. Q1/2 2023).
 - Agreed definition of target state and transition strategy developed (Cal. Q2 2023).
 - Business case developed (Cal. Q2 2023).
 - Approval of Business Case through established AEMO and industry governance channels.



8.2 Consolidated Master Data Repository

Note this initiative is currently subject to review as part of AEMO's ongoing Future State Architecture assessment.

8.2.1 Problem Statement

Master and reference data related to organisational identity is held in siloed applications, often with duplication. This has potentially adverse business implications for Participant experience and efficiency.

8.2.2 Objective

- Simplify the platform used to consolidate disparate data through the Consolidation of Master Data Repository by including stakeholder identity data.
- Provide Master Data as a service (in batch and real time).
- Improve Participant user experience by providing a single source of truth and data quality management.
- Improve ability to maintain external user's roles accurately and thereby minimise the risk of data breaches.

8.2.3 Direct Value/Benefit for Participants

- The consolidated master data repository will improve the Participant user experience by consolidating data contained within multiple applications otherwise storing data in silos. This means Participants will be able to access a single source of truth for all of their data.
- Providing data as a service and easier access to consistent quality data and simplified, unified information to Participants.
- Providing a single source of truth also reduces the need for a Participant active in different process and/or markets to provide organisational data multiple times through different applications. Participants will be able to provide one update that will map across various AEMO applications and remove the need for Participants to engage with multiple AEMO business units.
- This streamlined process will provide Participants with improved service and time efficiencies.

8.2.4 Indirect Value/Benefit for Participants

- Consolidated master data creates operational efficiencies for AEMO by providing a unified view (single source of truth) across data lifecycle stages which Control Room operators can access. This reduces manual processes and creates efficiencies in AEMO's data auditing and reporting capabilities.
- Improved operational efficiency and data quality also deliver value for Participants through enhanced data quality management.

8.2.5 Project Scope/Proposed Solution

- Define the architecture of the target state, including the transition to the target state.

The target state for this initiative is to eliminate data dependencies on alternative sources of truth for NEM Retail and Wholesale data, and to connect those existing sources of truth to the consolidated master data repository, thereby reducing the need for a Participant active in multiple processes and/or markets to provide organisational data multiple times through different applications.

- Provide a high-level technical solution and a roadmap depicting the path to the target state.
- Delivery of outstanding scope not delivered by Phase 1 (which establishes the foundation by building the new master data management platform to load data from an agreed suite of applications and enables loading of operational data).
- Finalise establishment of the new master data management platform.
- Load data from an agreed suite of application to enable loading of operational data.
- Consideration for new technologies such as DER, EVs and battery data collations via aggregators to understand the systems that will be used, and which will require mapping to the consolidated master data repository.
- Data clean-up of source data being ingested by the master repository to the extent it relates to NEM Retail and Wholesale data.
- This initiative will employ a phased approach, and the final scope will be subject to the next phase of review.

8.2.6 Key Initiative Relationships

Table 33 Consolidated Master Data Repository initiative relationships

Name	Description
Operational Security Mechanism	<ul style="list-style-type: none"> • OSM provides a procuring and scheduling process for ESS by producing a least-cost, inter-temporal optimised dispatch schedule. • Given timing, potential benefits for new OSM participants to be mapped into master repository platform.
Operating Reserves	<ul style="list-style-type: none"> • The Operating Reserves reform aims to unbundling reserves from energy to value flexible, responsive resources, through one or more new markets. • Given timing, potential benefits for new OR participants to be mapped into master repository platform.
EV Charging Standing Data Register	<ul style="list-style-type: none"> • EV standing data could potentially be captured in the consolidated master data repository (further scoping needed).
ST PASA replacement (Dependent initiative)	<ul style="list-style-type: none"> • The ST PASA replacement initiative is a review of the Pre-dispatch (PD) and Short Term (ST) PASA methodology and supporting systems and processes. • ST PASA will consume data from the master data repository.
Operational Decision-Making Tools (Dependent initiative)	<ul style="list-style-type: none"> • ODMT established a new enterprise platform for new decision-making tools used by the AEMO control room operators. Multiple disparate user interfaces converged into single user experience platform, capabilities for improved analytics and handling greater volumes of transactional data. • ODMT will consume data from the master data repository.
Forecasting Platform Uplift (Dependent initiative)	<ul style="list-style-type: none"> • The initiative establishes a converged modelling platform that supports model development, interfaces for forecasting-as-a-service providers and layered blended models across a number of modelling domains e.g. demand and VRE. • The platform is part of a future state forecasting roadmap where new third-party vendors (forecasting a service providers) could submit forecasts. The organisational identity management of these participants will need to be mapped to the consolidated master data repository.

8.2.7 Delivery Risks

Table 34 Consolidated Master Data Repository initiative delivery risks

Risk ID	Risk Type	Description	Mitigation
1	Relationships	Alignment of implementation in time to support regulatory deadlines of core reform initiatives that this would support.	Planning and scheduling
2	Relationships	Increase in project complexity due to multiple dependencies/synergies and overlapping projects in a similar timeline.	Planning and scheduling

8.2.8 Risks to Participants if not delivered with NEM Reform Program

Table 35 Consolidated Master Data Repository initiative Participant risks

Risk ID	Risk Type	Description	Impact
1	Data security	Managing data security across multiple access portals for Participants increases the risk of a data privacy incident.	High
2	Communication	Disparate Participant contact databases increases the risk of duplicated communications. This creates inefficiencies for Participants and the risk that communications may be less effective.	High

8.2.9 Next Steps

- Develop and finalise full scope of Phase 2.



8.3 FRC Target State

8.3.1 Problem Statement

AEMO currently maintains multiple applications to manage assets and participant relationships in the Retail Markets. Standing Data from these systems are copied (duplicated) to other downstream systems causing data latency and quality issues. The majority of these systems are bespoke with point-to-point integration and all of the Full Retail Competition (FRC) platforms are at the end of their technical life and require renewal.

There are significant regulatory changes on the horizon that require significant investment to enhance and maintain these systems and new market reforms continue to introduce additional assets and/or additional characteristics of the assets requiring smart investments.

8.3.2 Objective

- Implement a consolidated Asset and Participant Relationship Management system (APRM); that enables unification of services onto a shared platform and simplification of Participants' and AEMO processes.
- Provide single access to AEMO's Retail systems (network, portal, hub, data access and system architecture) for Participants and potentially to non-Participants such as 3rd parties (e.g. under the Consumer Data Right for Energy reforms).
- Accommodate new market assets such as DER, and EV into AEMO grid and market solutions.
- Provide the foundation for unifying the procedure definitions, business processes, data exchange patterns and mechanisms, and AEMO systems across jurisdictions, markets and fuels.
- Implement systems changes to improve delivery of consolidated processes at lower cost to both Market Participants and AEMO.

8.3.3 Direct Value/Benefit for Participants

- Improved operational performance by leveraging unified interface protocol and methodologies removes duplication efforts and costs to Participants across the industry.

8.3.4 Indirect Value/Benefit for Participants

- Easier market changes through reduced dependency on code changes provides value to Participants via reduced costs, time and effort for the implementation of procedure changes and enables third parties to provide system solutions at lower prices.
- A consolidated FRC platform enables visibility of all markets data in one system and utilising the same toolsets. This creates operational efficiencies that will enable AEMO to manage interactions with Participants more efficiently.
- Alignment to AEMO's cyber security standards and minimised data movement across the organisation, will improve data security, quality, latency, and accuracy.



8.3.5 Project Scope/Proposed Solution

- Develop target state and transition state architecture with a roadmap illustrating the functional and technical view and its integration with the market and other internal systems, and the draft implementation sequence.
- Design and implement an Actor and Asset Management platform, including the solution architecture, and its technology stack. The platform needs to enable consolidated procedures, interfaces, security standards, protocols, and support processes across all Retail Markets (the integration for non-NEM retail markets is outside the NEM Reform Program scope).
- Provide single access to AEMO’s retail systems (network, portal, hub, data access and system architecture) for Participants and potentially to non-Participants such as 3rd parties (e.g. NEM Reform Program scope only extends to NEM retail systems and Participants).
- Accommodate new market assets such as DER, and Electric Vehicles (EV) into AEMO NEM grid and market solutions.
- Develop and execute an implementation roadmap - sequencing for the implementation phase(s), including the retirement transition for the legacy applications and the associated regret spend.
- Implement a consolidated FRC platform that provides visibility of all market data, and covers the applications defined in the implementation sequencing plan. The platform will extend to new assets such as DER, EVs and integrating it with the grid and other market systems.
- Key steppingstones to get to the NEM Reform Program target state include:
 - Actor-Asset platform (single view of asset over the entire lifecycle);
 - NEM CATS;
 - NEM wholesale registration process;
 - Bring other processes and applications onto platform (e.g. DER Register); and
 - Bring EV Register onto platform.
- This initiative will employ a phased approach, and the final scope will be subject to the next phase of review.

8.3.6 Key Initiative Relationships

Table 36 FRC Target State initiative relationships

Name	Description
Identity and Access Management	<ul style="list-style-type: none"> • IDAM will establish a unified mechanism to authenticate participant users and applications when accessing AEMO services. • FRC includes establishing a consolidated Asset and Participant Relationship Management system (APRM) that enables unification of services onto a shared platform, single access to AEMO’s Retail systems, and simplification of Participants’ and AEMO processes. • As markets and systems are consolidated through FRC, the new IDAM framework is in place to facilitate a cohesive approach to management organisational authorisation and access.
Industry Data Exchange	<ul style="list-style-type: none"> • IDX will establish a unified access to AEMO services across all markets using modern authentication and communication protocols. This initiative will leverage IDAM. • As markets and systems are consolidated through FRC, the new IDX framework is in place to facilitate a cohesive approach to industry data exchange.

Name	Description
Flexible Trading Arrangements Model 2	<ul style="list-style-type: none"> FTA2 will touch Retail processes, including MSATS (process changes to identify flexible NMIs, reconciliation of network charges) – through an extension of existing embedded network processes. Many of the participants for FTA2 will also be participants in 'traditional' Retail systems.
DOE, DER Data Hub and Registry Services, DER Operational Tools	<ul style="list-style-type: none"> Many participants in a DER Marketplace are likely to be active across other markets, and may include a new cohort of participants (e.g. 'traders/aggregators'). Therefore, the objectives of FRC target state to provide unified services through a shared, single access platform to AEMO's retail systems and processes would support a more efficient experience for a market likely to have a greater number of participants compared to the current Retail market.
Business Rules Engine (Dependent initiative)	<ul style="list-style-type: none"> BRE creates the reference architecture; an internal technology capability within which to define business rules and processes. Core market platforms will leverage this capability as a foundation building block. BRE will capture enterprise-wide business requirements to accommodate process changes efficiently. FRC cannot be completed without BRE. The business rules implemented will enable the development of the FRC consolidated platform.

8.3.7 Delivery Risks

Table 37 FRC Target State initiative delivery risks

Risk ID	Risk Type	Description	Mitigation
1	Relationships	Alignment of implementation in time to support regulatory deadlines of core reform initiatives that this would support.	Planning and scheduling

8.3.8 Risks to Participants if not delivered with NEM Reform Program

Table 38 FRC Target State initiative Participant risks

Risk ID	Risk Type	Description	Impact
1	Cost efficiencies	<p>The platform needs to be replaced. Implementing reforms by building on near end-of-life systems will mean that reform capabilities will need to be integrated into the future state systems not long after the reforms take effect.</p> <p>As new markets are implemented through the reforms, a non-consolidated FRC platform will increase costs to manage a large number of diverse procedures and systems.</p>	High
2	Participant experience	Participants active in various Retail Markets, including new DER Markets, will have a fragmented experience that creates operational inefficiencies for Participants managing FRC processes across markets.	High

8.3.9 Next Steps

- AEMO has published an Expression of Interest (EOI) to scan the Market to determine what platform/product are available as well as to refine the target state architecture.
- Options assessment to be completed to determine if DER related initiatives should be on the platform (as opposed to other available options) and to sequence the changes on the platform.



8.4 Dispatch, Bids/Offers, and Constraints Target State

8.4.1 Problem Statement

AEMO's core market Dispatch and Constraints platform is at the end of its technical life and the technologies which underpin this platform are legacy. There is a rapidly diminishing footprint of resources in the contract market with skills in these technologies available.

8.4.2 Objective

- To modernise the core market dispatch and short-term market systems to align it with modern technologies that are widely supported in AEMO and for which external resources with those skill sets readily exist.

8.4.3 Direct Value/Benefit for Participants

- Ensures the ongoing viability and maintainability of the core market Dispatch and Constraints platforms – which are mission critical to enable secure and optimised participation by actors in various markets in the NEM.

8.4.4 Indirect Value/Benefit for Participants

- Adoption of modern delivery frameworks will improve the ability of AEMO to deliver changes to these platforms which will be increasingly required as the energy transition continues. This will provide cost efficiency benefits and value to Participants through reduced implementation costs.

8.4.5 Project Scope/Proposed Solution

- Tranche 1 (underway) – A tactical incremental solution to transition from end-of-life technology to a supported platform in order to eliminate immediate technology risks and provide an opportunity to apply more readily available technology personnel, thereby enhancing scalability and organisational delivery capability. This solution can be implemented without affecting regulatory reform initiatives related to NEM Reform Program. Once this tactical uplift is completed, the dispatch ecosystem will be fit for purpose as a base solution for implementation of further reforms for the remainder of the NEM Reform Program, subject to defined checkpoints to assess (i) any fundamental changes in the reform requirements (e.g., nodal pricing) and (ii) performance and scalability requirements that may be impacted by forthcoming DER growth and initiatives.
- Ongoing work, subject to the progress of various reform initiatives including, but not limited to, Scheduled Lite and other DER related initiatives, and ST-PASA to define a target state architecture and high-level roadmap depicting the key transitional steps/components with a focus on those that resolve immediate technology risks (e.g. diminishing resource support). This provides the potential for a range of off ramps if project risks materialise.
- This initiative will employ a phased approach subject to various Checkpoints. The final scope of each phase will be subject to review.

8.4.6 Key Initiative Relationships

Table 39 Dispatch, Bids/Offers, and Constraints Target State relationships

Name	Description
Operating Reserve	<ul style="list-style-type: none"> The proposed change to create a new system service to procure energy reserves would have significant interaction with the dispatch and ST Markets systems. It has been proposed that AEMO would procure, on a rolling-basis in every 5-minute dispatch interval, a certain volume of operating reserves with the capability to dispatch it as energy in the dispatch interval 30-minutes ahead.
Operational Security Mechanism	<ul style="list-style-type: none"> The proposed rule change would create a procurement service in operational timeframes to schedule the system services contracted in planning timeframes. The procurement and scheduling process would need to produce an inter-temporal optimised dispatch schedule that considers technical constraints and costs for unit commitment and system security. The target state does not have a relationship to OSM because it is assumed there will be a single optimisation engine run ahead of time that is separate to NEMDE. However, there are potential opportunities to use the same SCED engine for ST PASA and the Dispatch uplift.
Fast Frequency Response	<ul style="list-style-type: none"> The scope of the target state needs to be defined and the needs of FCAS markets considered in that process.
ST PASA replacement (Dependent initiative)	<ul style="list-style-type: none"> A technology uplift of AEMO backend market platform services to replace legacy technology. In the case of bids/offers this will leverage 5MS deliverables. The design of ST PASA could feed into the design, or become, the dispatch target state.

8.4.7 Delivery Risks

Table 40 Dispatch, Bids/Offers, and Constraints Target State delivery risks

Risk ID	Risk Type	Description	Mitigation
1	Relationships	Alignment of implementation in time to support regulatory deadlines of core reform initiatives that this would support such as those DER initiatives identified under the DER Marketplace banner.	Planning and scheduling
2	Relationships	Increase in project complexity due to multiple dependencies/synergies and overlapping projects in a similar timeline.	Planning and scheduling
3	Technical	Dispatch is the most 'mission critical' part of the NEM's market systems. As such, the consequences of complications in the delivery of the platform are significant from a functional and potential loss of value (revenue loss) to the NEM and Market Participants.	Planning and scheduling

8.4.8 Risks to Participants if not delivered with NEM Reform Program

Table 41 Dispatch, Bids/Offers, and Constraints Target State Participant risks

Risk ID	Risk Type	Description	Impact
1	Cost efficiencies	Continuous monitoring and refinement of target state architecture required (including identification of transitional steps / components) as policy / rules, scope and designs of reform initiatives are progressed to ensure platforms / systems are fit for purpose and capable of delivering changes necessary during implementation.	High



8.4.9 Next Steps

Ongoing monitoring and assessment of target state requirements at various 'Checkpoints' including:

- Checkpoint 1 – Review Transmission & Access reform policy to determine whether market evolve from a regional to a nodal basis, Review the design of Schedule Lite/DER and business assumption around scalability (1-5years) which will inform whether Dispatch Target State design is fit for purpose for 5 years' worth of growth.
- Checkpoint 2 - Review ST-PASA new Nodal Security Constrained Economic Dispatch (SCED) engine and evaluate what applications DTS can leverage. Assess WA Wholesale Energy Market (WEM) reform SCED "WEMDE" to inform the detailed design of Dispatch Target State. Evaluate Market Clearing Engine (MCE) (replacing existing clearing engine in the DWGM market).

9 AEMO Dependent Initiatives

The NEM Reform Implementation Roadmap includes several enabling initiatives that are to be delivered by AEMO's Operational Technology Roadmap (OTR) Program or separately as an independent project by AEMO (e.g., ST PASA Replacement). In that respect, they become dependencies for the NEM Reform Program rather than being delivered by the NEM Reform Program itself.

The following table highlights such initiatives.

Name	Description
Operational Decision-Making Tools	<ul style="list-style-type: none">• A refresh of the user interfaces and decision-making tools used by the AEMO control room operators to reflect the increasing demands of managing the grid. Multiple disparate User Interfaces converged into single user experience platform.
Business Rules Engine	<ul style="list-style-type: none">• An internal AEMO technology capability within which business rules and processes are defined. Core market platforms will leverage this capability as a foundation building block.
Operational Data Store	<ul style="list-style-type: none">• Establishing a capability for storing high volume of operational transactional data at near-real-time.
Forecasting Platform Uplift	<ul style="list-style-type: none">• A converged modelling platform that supports model development, interfaces for forecasting-as-a-service providers and layered blended models across several modelling domains e.g. demand and VRE.
ST PASA Replacement	<ul style="list-style-type: none">• Review of the Pre-dispatch (PD) and Short Term (ST) PASA methodology and supporting systems and processes.

Further details on the OTR Program are available via AEMO's website here:

<https://aemo.com.au/initiatives/major-programs/operations-technology-roadmap>

A1. Appendix A – ESB Post-2025 Program

The following table provides a summary of each of the four major reform pathways put forward by the ESB and those reform initiatives (in bold) considered within that will form the basis of the NEM Reform Implementation Roadmap.

Table 42 Summary of the ESB reform pathways

Pathway	Objective	This means	Reform Initiative*
Resource Adequacy Mechanism	<ul style="list-style-type: none"> Establish new market-based arrangements to explicitly value capacity to provide an 'investable' and enduring long-term signal. Establish market arrangements that support efficient allocation of investment risk between participants, jurisdictions, and consumers. Establish tools that provide jurisdictions sufficient confidence that reliability will be maintained in a way that preserves market signals. 	We have investment in the right mix of resources (generation, storage and demand response) in place prior to anticipated plant closures, and that plant exit does not cause significant price or reliability shocks to consumers through the transition.	<ul style="list-style-type: none"> Investment principles for jurisdictional schemes MT PSA Enhancements Jurisdictional Strategic Reserve Ministerial RRO Trigger Capacity Mechanism Ongoing Monitoring
Essential System Services	<ul style="list-style-type: none"> Establish new market-based arrangements to value the services needed to support the changing mix of resources in the NEM (frequency, inertia, system strength, and operating reserves). Establish new market mechanisms to support efficient scheduling and dispatch by AEMO. Deliver a range of supply and demand-based technologies and resources with capabilities to deliver these essential services. 	We have the resources and services when needed to manage the complexity of dispatch and to deliver a secure supply to customers.	<ul style="list-style-type: none"> Fast Frequency Response Frequency Performance Payments (part of PFR Incentive Arrangements rule) Operating Reserve Market System Strength (Planning) Operational Security Mechanism Unbundling system services Integrated ahead market
Integration of DER and Flexible Demand	<ul style="list-style-type: none"> Establish frameworks that enable consumers to be rewarded for their flexible demand and generation, facilitate options for how they want to engage and remain protected by a fit-for-purpose consumer protections framework. Establish wholesale market arrangements that support innovation, the integration of new business models and a more efficient supply and demand balance. Establish networks with the ability to accommodate the continued update of DER, two-way energy flows, and manage the security of the network in a cost-effective way. Provide AEMO with the visibility and tools it needs to continue to operate a safe, secure, and reliable system, including maintaining system security associated with low minimum system load conditions. 	We create new opportunities for consumers about how they receive and use energy and are rewarded for doing so flexibly.	<ul style="list-style-type: none"> Integrating Energy Storage Flexible Trading Arrangements Scheduled Lite Dynamic Operating Envelopes Distribution Local Network Services Turn-up Services DER Data Hub and Registry Services DER Operational Tools
Transmission and Access	<ul style="list-style-type: none"> Establish better signals for generators to locate in areas where there is available generation capacity - namely in the REZs. Reduced uncertainty for investors, through measures that give rise to more predictable future patterns of congestion, and a more orderly and predictable connections process. 	We have a network to meet future needs, renewable energy zones, and a targeted set of investments that can deliver the energy transition at lower cost.	<ul style="list-style-type: none"> Dedicated connection assets and system strength Interim REZ framework Transmission Access Reform (Enhanced Information, Congestion Relief Market & Priority Access Model)

Pathway	Objective	This means	Reform Initiative*
	<ul style="list-style-type: none"> Establish better use of the network, resulting in more efficient dispatch outcomes and lower costs for consumers. Ensure batteries are locating where they are needed most and being paid to operate in ways that benefit the broader system. 		<ul style="list-style-type: none"> Transmission Planning and Investment Review Enhanced congestion information LMP and FTR

A2. Appendix B – References

Workstream	Reform Initiative	Reference (link to rule change, market review, or latest ESB publication)
RAMS	Increase MT-PASA Information	AEMC Rule Determination: https://www.aemc.gov.au/rule-changes/enhancing-information-generator-availability-mt-pasa AEMO Guidelines and Methodology Consultation: https://www.aemo.com.au/consultations/current-and-closed-consultations/2022-reliability-forecasting-guidelines-and-methodology
	Capacity Investment Scheme	Commonwealth Government Announcement: https://www.energy.gov.au/news-media/news/capacity-investment-scheme-power-australian-energy-market-transformation
ESS	Fast Frequency Response	AEMC Rule Change: https://www.aemc.gov.au/rule-changes/fast-frequency-response-market-ancillary-service AEMO MASS and FCAS Verification tool: https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/system-operations/ancillary-services/market-ancillary-services-specification-and-fcas-verification-tool AEMO Constraint Formulation Guideline Consultation: https://aemo.com.au/consultations/current-and-closed-consultations/cfg-and-scvpf
	Frequency Performance Payments (part of PFR Incentive Arrangements rule)	AEMC Rule Change: https://www.aemc.gov.au/rule-changes/primary-frequency-response-incentive-arrangements AEMO FPP Project: https://aemo.com.au/initiatives/major-programs/frequency-performance-payments-project AEMO FCFP Consultation: https://aemo.com.au/consultations/current-and-closed-consultations/frequency-contribution-factors-procedure AEMO PFR Requirements Consultation: https://aemo.com.au/consultations/current-and-closed-consultations/primary-frequency-response-requirements
	Operating Reserves	AEMC Rule Change: https://www.aemc.gov.au/rule-changes/operating-reserve-market
	Operational Security Mechanism	AEMC Rule Change: https://www.aemc.gov.au/rule-changes/operational-security-mechanism
	System Strength (Planning)	AEMC Rule Change: https://www.aemc.gov.au/rule-changes/efficient-management-system-strength-power-system
	TA	Enhanced Information, Congestion Relief Market & Priority Access Model
DER & FD	Integrating Energy Storage Systems	AEMC Rule Change Consultation: https://www.aemc.gov.au/rule-changes/integrating-energy-storage-systems-nem

Workstream	Reform Initiative	Reference (link to rule change, market review, or latest ESB publication)
		<p>AEMC Rule Change Consultation: https://www.aemc.gov.au/rule-changes/implementing-integrated-energy-storage-systems</p> <p>AEMO IESS Project: https://aemo.com.au/initiatives/submissions/integrating-energy-storage-systems-iess-into-the-nem</p>
	Flexible Trading Arrangements (Model 2)	AEMC Rule Change Consultation: https://www.aemc.gov.au/rule-changes/unlocking-CER-benefits-through-flexible-trading
	Scheduled Lite	AEMC Rule Change Consultation: https://www.aemc.gov.au/rule-changes/scheduled-lite-mechanism
	Dynamic Operating Envelops	<p>ESB Final Advice to Ministers: https://esb-post2025-market-design.aemc.gov.au/32572/1619564172-part-b-p2025-march-paper-appendices-esb-final-for-publication-30-april-2021.pdf</p> <p>ESB Interoperability Policy Framework: https://esb-post2025-market-design.aemc.gov.au/integration-of-distributed-energy-resources-der-and-flexible-demand#development-of-interoperability-policy</p> <p>AER Review of regulatory framework for flexible export limit implementation: https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/review-of-regulatory-framework-for-flexible-export-limit-implementation</p>
	Distribution Local Network Services	<p>ESB Final Advice to Ministers: https://esb-post2025-market-design.aemc.gov.au/32572/1619564172-part-b-p2025-march-paper-appendices-esb-final-for-publication-30-april-2021.pdf</p> <p>ESB CER Implementation Plan: https://www.datocms-assets.com/32572/1629954551-esb-final-report-explainer-clean-and-smart-power-der-pathway.pdf</p> <p>AEMO Project Edge: https://aemo.com.au/en/initiatives/major-programs/nem-distributed-energy-resources-der-program/der-demonstrations/project-edge</p>
	DER Data Hub and Registry Services	As above
	DER Operational Tools	As above
Data Strategy	Data Services	<p>ESB Consultation Paper – Data Services: https://www.datocms-assets.com/32572/1671059508-esb-data-services-delivery-model-consultation-paper-december-2022.pdf</p>
	Electric Vehicles Charging Standing Data Register	<p>ESB Consultation Paper – EVSE Standing Data: https://www.datocms-assets.com/32572/1670367035-esb-electric-vehicle-supply-equipment-standing-data-consultation-paper-december-2022.pdf</p> <p>ESB Data Strategy: https://www.datocms-assets.com/32572/1630275857-esb-data-strategy-july-2021.pdf</p>
	Bill Transparency	<p>ESB Data Strategy: https://www.datocms-assets.com/32572/1630275857-esb-data-strategy-july-2021.pdf</p>
	Network Transparency	As above