Public

AEMO Power System Modelling Strategy (DRAFT)

November 2026

Draft Strategy and Five-Year Roadmap



Public



We acknowledge the Traditional Custodians of the land, seas and waters across Australia. We honour the wisdom of Aboriginal and Torres Strait Islander Elders past and present and embrace future generations.

We acknowledge that, wherever we work, we do so on Aboriginal and Torres Strait Islander lands. We pay respect to the world's oldest continuing culture and First Nations peoples' deep and continuing connection to Country; and hope that our work can benefit both people and Country.

AEMO is proud to have launched its Innovate Reconciliation Action Plan (RAP) in June 2026. Pictured left and featuring on the cover of the Innovate RAP is Wiradjuri artist Lani Balzan's 'Journey of unity: AEMO's Reconciliation Path', a visual representation of our ongoing journey towards reconciliation – a collaborative endeavour that honours First Nations cultures, fosters mutual understanding, and paves the way for a brighter, more inclusive future.

Important notice

Purpose

This draft publication has been prepared by the Australian Energy Market Operator (AEMO) for consultation on the proposed Power System Modelling Strategy and its supporting indicative five-year implementation roadmap, to support the development of a fit-for-purpose, future-ready power system modelling capability for the National Electricity Market (NEM) and Wholesale Electricity Market (WEM). The Strategy is intended to guide AEMO's capability development, investment prioritisation, governance arrangements and stakeholder engagement relating to power system modelling over the next five years.

Disclaimer

This publication is a draft strategic planning and consultation document. The proposed initiatives, options, sequencing, timeframes and implementation pathways described in it are indicative only and do not represent final decisions or commitments by AEMO.

AEMO has made reasonable efforts to ensure the quality of the information in this publication but cannot guarantee that the information, forecasts, assumptions, options, recommendations and implementation pathways contained in this publication are accurate, complete or appropriate for your circumstances.

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Acknowledgement

AEMO acknowledges the support, co-operation and contribution of participants and original equipment manufacturers in providing data and information used in this publication. The Strategy was developed with support from Electric Power Research Institute (EPRI) and through engagement with stakeholders across the Australian energy sector.

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Executive summary

Purpose and development of the Strategy

Power system models underpin the secure and reliable operation of the Australian National Electricity Market (NEM) and the Wholesale Electricity Market (WEM). The proposed Power System Modelling Strategy (the Strategy) is intended to support AEMO's capability development, investment prioritisation, aligned with operational and stakeholder needs, through developing industry consensus on the future direction of power system modelling capabilities, governance and engagement.

AEMO plays a key role in managing and curating models provided by participants and, in turn, making them available for use by industry. The Strategy aims to address needs and expectations of stakeholders while adequately considering stakeholder impacts and trade-offs in future states. Growth in inverter-based resources (IBR), distributed and consumer energy resources (DER and CER) and large new loads is increasing the scale and complexity of power system models and studies across the NEM and WEM. Operational decisions also increasingly rely on models and data being available within operational timeframes, with connection assessments of new generation and load facilities placing significant time and volume demands on modelling tools and existing data systems. If current practices continue, these pressures are expected to create increasing challenges for modelling capability across AEMO and industry.

The Strategy identifies where existing capabilities may not sufficiently address future needs, defines a future vision and proposes the capability uplift required over the next five years. This uplift is presented as strategic options, each assessed for its potential benefits in mitigating system planning and operational risks, the potential challenges in addressing stakeholder concerns, and its relative cost. The Strategy is underpinned by requirements in the National Electricity Rules (NER) and associated instruments, including the Power System Model Guidelines (PSMG). While the PSMG sets formal model quality, information and submission requirements, the Strategy sets the direction and priorities that inform them.

AEMO engaged the Electric Power Research Institute (EPRI) to assess power system modelling capabilities and develop the Strategy in close collaboration with a dedicated AEMO internal project team covering the NEM and WEM, with reference to international best practice and emerging capabilities and practices.

AEMO published the Power System Modelling Strategy Approach Paper on 16 September 2026, opening a four-week consultation period through to 16 October 2026. The Approach Paper outlined AEMO’s proposed approach to developing the Strategy and sought stakeholder feedback on its scope, priority modelling challenges, stakeholder impacts and development of the roadmap. AEMO received 12 submissions, and this draft Strategy has been informed by that feedback. The Draft Power System Modelling Consultation Paper that accompanies the draft Strategy summarises the feedback received and how it has been considered in developing the draft Strategy.

Vision for power system modelling

A trusted, future-ready and integrated power system modelling capability enabling a reliable, affordable, and sustainable energy future (the Vision)

The proposed Vision is supported by the consistent development, refinement, validation, and application of interconnection customer (IC) and power system models with verified data that both meet the user’s needs, enabling credible and repeatable outputs to be produced efficiently across modelling platforms and simulation domains (for example,

time-domain and frequency-domain) that are fit for purpose to study the respective phenomena of concern. The Strategy aims to achieve the Vision by building capabilities that enable implementation of focused automation, governance, usability, and training.

Successful delivery of the strategy should:

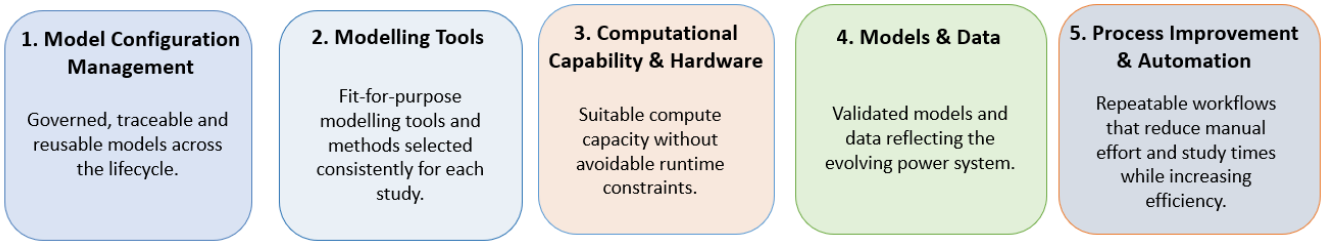
- reduce time required to prepare and maintain power system models,
- improve model currency and alignment with the physical power system, reducing operational risk,
- reduce turnaround times for connection and operational studies,
- increase reuse and compatibility of models across modelling platforms,
- improve stakeholder access to modelling information, and
- enable operational use of modelling capabilities within decision-making timeframes.

Roadmap from current state to future state

The Strategy is supported by an indicative five-year implementation roadmap comprising the executive overview in **Figure 2** and the more detailed focus-area roadmaps in Section 3 (the Roadmap).

The Roadmap builds on previous work[1,2,3], sets out how identified gaps may be addressed over five years to achieve the future states that support the Vision. It proposes prioritisation and sequencing of AEMO's capability development and investment decisions, and gives industry greater clarity on the options for future direction of industry modelling capability, governance and engagement. Based on the gap analysis, the Strategy identifies five key modelling focus areas, each with a defined future state, as shown in **Figure 1**.

Figure 1 Power system modelling capability future states



The sequence and timing of the proposed capabilities and investments outlined below in **Figure 2** are indicative and are yet to be confirmed. AEMO is seeking industry feedback on the sequence and timeline.

[1] See https://www.aemo.com.au/initiatives/major-programs/operations-technology-program/operations-technology-roadmap

[2] See https://www.aemo.com.au/-/media/files/initiatives/engineering-framework/2022/engineering-roadmap-to-100-per-cent-renewables.pdf?rev=fce632fe896a4ecb8a46e0178b38aa91&sc_lang=en

[3] See power-system-analysis-tools--future-requirements---independent-review.pdf

Roadmap implementation

The roadmap provides an indicative five-year pathway from AEMO's current modelling capability towards the proposed future states. It sequences capability development and investment across the five focus areas, recognising the dependencies between improvements in modelling tools, model management, computational capability, models and data, and process automation.

Near-term initiatives establish foundations for improved model management, fit-for-purpose study methods, model validation and more efficient modelling processes, while later initiatives build towards greater integration, automation, model customisation, and operational application of modelling capability. Strategic choices identified along the roadmap will influence the scope, sequencing and level of investment required.

The decision to progress individual initiatives on the roadmap will be subject to further assessment, prioritisation, funding, resources and deliverability. It will evolve as implementation progresses and new information becomes available, with greater certainty in near-term initiatives and increasing uncertainty over the mid-term horizon. System changes and market reforms, including those relating to renewable energy zones, data centres, Consumer Energy Resource (CER) integration and Distribution System Operator (DSO) responsibilities may also shape the strategy as it progresses.

AEMO intends to continue working with industry, including through relevant existing forums to deliver the Strategy. This may include leveraging existing forums or establishing new industry forums to facilitate stakeholder engagement including original equipment manufacturer (OEM), software vendor and Participant engagement.

Consultation feedback sought

AEMO is seeking stakeholder feedback on the proposed strategic direction, priorities and sequencing set out in this draft Strategy and supporting five-year roadmap.

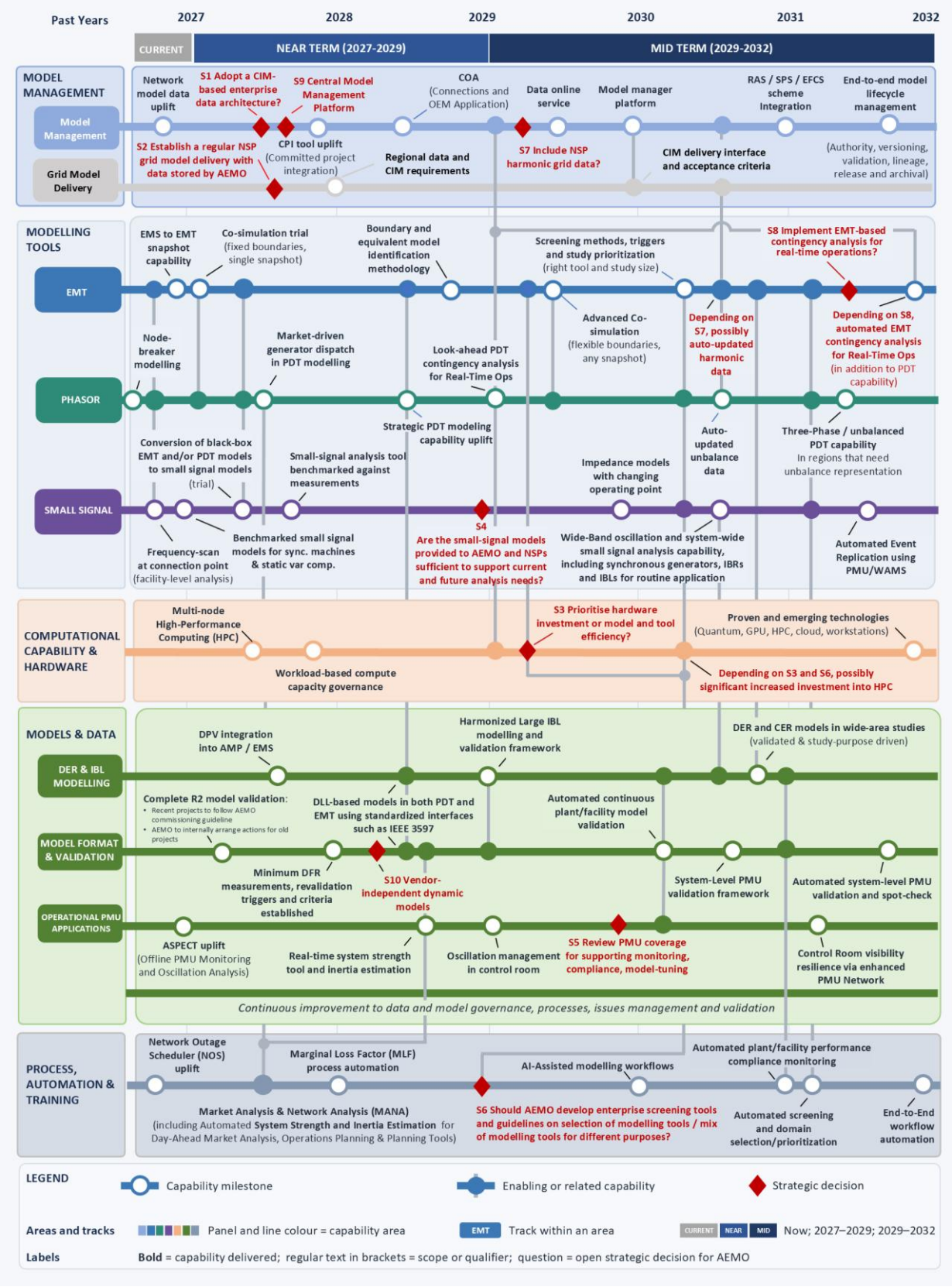
The accompanying Draft Power System Modelling Strategy Consultation Paper[4] sets out the specific areas and questions on which AEMO is seeking feedback.

Written submissions are invited by 7 December 2026 and should be provided in PDF format to modelling@aemo.com.au.

Stakeholder feedback will inform finalisation of the Strategy and supporting roadmap.

[4] At https://www.aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2026/power-system-modelling-strategy/aemo-modelling-strategy-consultation.pdf?rev=fbb8b1332e8a43ff873c3e12322125c4&sc_lang=en.

Figure 2 Indicative five-year roadmap: executive overview



Note: for additional definitions, see abbreviations list on pages 8-9.

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Abbreviations

Abbreviation	Term
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AI	artificial intelligence
AMP	AEMO Modelling Platform
ASPECT	AEMO Synchrophasor Engineering & Computation Tool
CER	consumer energy resources
CIM	Common Information Model
COA	Connections and OEM Application
CPI	committed project integration
DER	distributed energy resources
DFR	digital fault recorder
DLL	dynamic-link library
DPV	distributed photovoltaics
DSA	dynamic security assessment
DSO	Distribution System Operator
EFCS	emergency frequency control scheme
EMS	energy management system
EMT	electromagnetic transient
EPRI	Electric Power Research Institute
ESM Rules	Energy System and Market Rules
GPU	graphics processing unit
HIL	hardware-in-the-loop
HPC	high-performance computing
IBL	inverter-based load
IBR	inverter-based resource
IC	interconnection customer
IEEE	Institute of Electrical and Electronics Engineers
MANA	Market Analysis & Network Analysis
MLF	marginal loss factor
NEM	National Electricity Market
NER	National Electricity Rules
NOS	Network Outage Scheduler
NSP	network service provider
OEM	original equipment manufacturer
PDT	phasor-domain transient
PMU	phasor measurement unit
PSMG	Power System Model Guidelines

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Abbreviation	Term
RAS	remedial action scheme
RDMA	remote direct memory access
SPS	special protection scheme
TNSP	transmission network service provider
WAMPAC	wide-area monitoring, protection and control
WAMS	wide-area monitoring system
WEM	Wholesale Electricity Market

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1 Current state of power system modelling and identified gaps

1.1 Role of power system models and AEMO's current capability

AEMO, network service providers (NSPs) and market participants use power system models to determine operating limits, assess real-time security, develop constraints, plan networks and assess new and existing connections. As these models directly inform security, connection and investment decisions, they need to remain adequate and accurate as the power system evolves. AEMO already maintains extensive power system modelling capabilities supporting operational security, planning, connections and market functions across the NEM and WEM. These capabilities continue to evolve through current initiatives such as development of electromagnetic transient (EMT) snapshot capability, automated development of phasor-domain transient (PDT) models from market modelling tools, and application of dedicated high-performance computing. The Strategy builds upon this strong foundation, focusing on areas where increasing system complexity and stakeholder expectations are creating capability gaps.

1.2 Drivers of change in modelling requirements

Table 1 summarises two categories of drivers that are increasing the demands placed on power system models: changes in the power system itself, and the expanded use of models, measurement data and computational capability to support monitoring and control decisions within operational timeframes.

Table 1 Drivers of change and their effect on modelling

Driver	Effect on modelling
Increased inverter-based resources	Models are more detailed and vendor-specific, and supplied as compiled code in some software platforms. Control interactions, including oscillations in weaker parts of the network, require more EMT analysis, modal analysis, frequency-domain analysis and systems to manage these models.
Growth in DER and CER	Rooftop solar and other distributed resources at times supply a large share of demand. Representing their response to disturbances requires detailed data from distribution networks.
New types of large load	Data centres and other large inverter-based loads behave differently from conventional load, and accepted models and requirements are still emerging.
Larger, more complex studies	Integrating IBR, DER and large-load models into the wide-area model increases run times and the potential for error, increasing the time required to assess necessary conditions that can be studied.
Timely monitoring and control decisions in operational timeframes	Operators require models validated against measurements, phasor measurement unit (PMU) data providing visibility of oscillations and system strength, and computational capability that returns results quickly enough to inform monitoring and control decisions. Modelling, computational capability and operational visibility therefore need to develop together.
Rising volumes and expectations, including open model data	Connection volumes and requests for model information are increasing, including proposals for more open access to NEM model data. Specialist modelling skills remain in high demand.

1.3 Capability gaps by focus area

Capability gaps have been grouped based upon associated risk and opportunities identified through the assessment into key focus areas, each describing the intended direction for that area. AEMO already operates an established modelling environment and improvements are underway; the gaps below are those that remain between that current state and the proposed Vision. **Table 2** summarises the identified gaps in each focus area and the impacts likely if current practices were to continue.

Table 2 Summary of modelling capability gaps and consequences of inaction by key focus areas

Focus area	Principal gaps	Likely impact if current practices continue
1. Model configuration management	• **Managing model data:** held across several platforms with partially non-standardised input/output interfaces, system data management and version control limitations, creating challenges in maintaining alignment of power system models with the physical power system. • **Modelling protection and control schemes:** represented inconsistently between planning and operational models. • **Moving models from planning to operations, and vice versa:** largely manual.	Model volumes and versions are expected to keep growing without a single governed source or a limited number of sources with standardised input/output interfaces and coherent data governance. As a result: • Studies may rely on inconsistent or out-dated models. • Requests for current or historical model data would take longer to address. • Engineering effort would continue to go into reconciling and transcribing models. • Operational and planning decisions may require increasingly conservative assumptions, potentially affecting efficient utilisation of the power system. • Discrepancies between power system models and the physical system can undermine AEMO's ability to identify security risks and determine appropriate operating limits, increasing risks to Top Enterprise Risk 1 – AEMO does not maintain secure and reliable operation of the energy system and markets.
2. Modelling tools	• **Choosing the right study method:** while there are some principles and guidelines which define the use of different study tools (or the mix of study tools), this tends to be specific to particular studies and not generalised in a way that can be adopted across the industry. • **Running large EMT studies:** wide-area run times are approaching practical limits, and methods to reduce them are not yet established or validated. • **Reproducing oscillation events:** suitable models and assessment methods are not routinely available. • **Studying unbalanced conditions:** not routinely possible using PDT tools. • **R2 validation testing:** completion of R2 validation remains in progress for a number of existing plant in the NEM, alongside implementation of the staged validation process for newer projects.	Reliance on full wide-area EMT studies is expected to grow faster than available compute and specialist staff can support. As a result: • Long run times and study scoping would extend connection and planning timeframes. • Additional compute capabilities would be needed to absorb the growth. • Wide-area contingency studies may not meet timeframe for operational decision making. • Reduced confidence in the assessment of plant performance, new connections and system security limits. • Oscillation and insufficient damping/stability risks in areas with high IBR penetration would become harder to predict or reproduce.
3. Computational capability and hardware	• **Matching compute to workloads:** models are becoming increasingly computationally intensive, creating a need for a more integrated long-term strategy for computational requirements.	Demand for computation is expected to require a more coordinated and forward-looking approach to computational investment. The absence of this may lead to: • Model development timelines may increase resulting in delayed model updates. • Increasing pressure on connection-study timeframes.. • Operational-timeframe studies may not be completed in timeframes required to inform monitoring and control decisions. • Operational decisions may lean more towards conservative outcomes.

Focus area	Principal gaps	Likely impact if current practices continue
4. Models and data	• **Lack of model interoperability:** models do not use standardised interfaces or wrappers. • **Providing study cases including committed plant:** is available on request but not consistently provided to participants. Dedicated resource and funding not allocated. • **Validating system models against measurements:** currently undertaken offline for selected events, with opportunities to expand routine validation within operational timeframes and establish consistent model-quality metrics. • **Modelling large loads:** being defined by AEMO with the Australian Energy Market Commission (AEMC), including accepted models and submission requirements for large inverter-based loads, including potential to leverage hardware-in-the-loop (HIL) testing, but a commonly accepted NEM-wide framework is not yet in place. • **Representing DER:** aggregated PDT models are in place, but EMT representations are not yet consistent across tools, and a governed approach to selecting and maintaining DER representations is still needed. • **Using PMU data:** no automated benchmarking utilising PMU data.	Without model interoperability, risks increase related to • dependence on specific software platforms, • restriction of model portability, and • inability to utilise wide-area models that are equivalent across multiple simulation software tools. Growth in DER, large loads and firmware changes of power electronic controls is expected to outpace data collection and validation. As a result: • Confidence in models could decrease, and DER and large-load behaviour during disturbances may be misrepresented. • Large-load connections and post-event analysis would remain case by case. • More conservative constraints or operating margins may be applied to manage uncertainty.

2 Strategic decisions

The roadmap identifies 10 strategic decisions (S1 to S10). Strategic decisions involve a choice between two options and determine the scope and pace of other parts of the roadmap. Each is marked by a dark red diamond (♦) in **Figure 2**, with a label giving its identifier, timing and description. These decisions are for AEMO to take, informed by stakeholder feedback. Where provided, EPRI's recommendation is noted.

Table 3 Key strategic decisions and options

Decision	Option A	Option B	What the decision influences on the roadmap
S1 · Year 1 **CIM based enterprise data architecture** **Should AEMO adopt the Common Information Model (CIM) as the common architecture for model management?**	**EPRI Recommendation:** Uplift existing energy management system (EMS) and AEMO Modelling Platform (AMP) environments to leverage standard data formats interfacing between each other and with modelling applications.	Continue using existing or proprietary data structures or data exchange interfaces.	Whether core model management operates on a common architecture by Year 3, which NSP model exchange and automation at scale depend on.
S2 · Year 1 **NSP grid model delivery** **Establish a regular NSP grid model delivery with data stored by AEMO or distributed at NSPs?**	**EPRI Recommendation:** NSPs regularly deliver grid data to AEMO at an agreed frequency and following significant updates as provided for under the NER and Energy System and Market Rules (ESM Rules) for the NEM and WEM respectively. AEMO maintains controlled, versioned copies of the data, with incoming updates validated before being made available to downstream applications. NSPs remain authoritative for their source model data.	AEMO accesses grid model data maintained by NSPs on demand through secure, standardised interfaces, without maintaining regularly synchronised local copies. Data availability, currency, and consistency depend on NSP-hosted systems and agreed data exchange arrangements.	Sets the data management foundation for the model manager platform and end-to-end model lifecycle management. Determines how NSP model data is accessed, retained, validated, and version-controlled by AEMO. This influences the consistency, reliability, and reproducibility of network models used by downstream capabilities.
S3 · Beginning of Year 3 **HPC investment** **Prioritise hardware investment or model and tool efficacy?**	**EPRI Recommendation:** Continue high-performance computing (HPC) investment and leverage co-simulation capabilities.	Make significant additional HPC investment and run multiple setups in an appropriate architecture that is based on representative EMT, frequency-domain, co-simulation and automated-study workloads. Anticipate future improvements in HPC performance to meet business requirements.	Whether large-scale EMT capacity grows mainly through co-simulation and better use of existing and already planned HPC, or through a step increase in hardware. A step increase would make EMT studies less dependent on network equivalencing succeeding.
S4 · End of Year 2 **Small-signal models** **Are the small-signal models provided to AEMO and NSPs sufficient to support current and future analysis needs?**	**EPRI Recommendation:** Consult on changes to the PSMG to strengthen requirements to obtain linearised state-space models of new or modified connections.	Utilise EMT models to derive small-signal representation where linearised state-space models are unavailable.	Whether linearised state-space models enable detailed small-signal assessments or reliance on high-volume EMT studies continues.
S5 · End of Year 3 **PMU coverage** **What should future PMU types and network coverage be for supporting monitoring, compliance assessments, model-tuning, and other use cases?**	Specify PMU types, design requirements and coverage requirements for future applications.	Continue current PMU deployment practice that may not support future applications in the longer term.	Whether PMUs installed within the five-year horizon meet the requirements of the future needs such as OSL, SCADA failover etc.

Decision	Option A	Option B	What the decision influences on the roadmap
S6 · End of Year 2 Enterprise screening tools **Should AEMO develop enterprise screening tools and guidelines on selection of modelling tools / mix of modelling tools for different purposes?**	**EPRI Recommendation:** Establish enterprise-wide (and where appropriate, industry-wide) screening methods, triggers and study prioritisation criteria along with guidelines on selection of modelling tools/mix of modelling tools for different purposes. Implement Change management program to support the above.	Continue to rely on computational extensive EMT time-domain studies and increase the investment in HPC as needed.	Option B would require increased investment into HPC.
S7 · Year 3 NSP harmonic grid data **Should AEMO include NSP harmonic grid data in its regularly maintained model data?**	**EPRI Recommendation:** Keep harmonic data outside AEMO's regular model data. Detailed harmonic data stays with network and asset owners, who remain responsible for power quality studies. AEMO retrieves the data only on an as-needed basis, when a specific study or concern requires it. Reassess on an ongoing basis to consider if costs/benefits change in time.	AEMO maintains a central harmonic grid model on behalf of NSPs to support harmonic studies, including harmonic load-flow and EMT time-domain simulations. As harmonics are managed largely at a local or regional level, this may extend beyond AEMO's current system responsibility.	Option B would add harmonic grid data to model management and make auto-updated harmonic data a committed EMT capability.
S8 · Year 5 Real-time operations capability to evaluate EMT phenomena **Implement capability to assess EMT related phenomena in real-time?**	**EPRI Recommendation:** Continue developing fast EMT capability while monitoring and assessing emerging approaches that could provide alternative or complementary means of real-time system security assessment.	Continue to rely on Phasor Domain tools for assessment of system security in real-time.	Option B would not uplift capability to assess emerging EMT-related and IBR stability phenomena within operational timeframes.
S9 · Year 2 Central model management platform **Implement a central model management platform?**	Implement a central model management platform, upstream of the EMS.	Continue to utilise EMS as the central source of truth for network data, and utilise model configuration management through AMP to connect dynamic models, with other changes and customisations implemented by end-users.	Option B would likely require a greater level of manual effort and constrain opportunities for further automation and standardisation of modelling-data quality controls.
S10 · Year 2 Vendor-independent dynamic models **Should AEMO update model requirements to enable users' greater flexibility in using the software tool of their choice?**	• Specify vendor-independent PDT, and/or • Specify vendor-independent EMT models, and/or • Specify vendor-independent models that work in both PDT and EMT domains.	• Retain current model formats and software tools. • Where feasible, explore model conversion tools, development of parametrised models, and wrapper-based software integration approaches.	Influences cost of model development and assessment, model usability (including computational performance) and user flexibility in their choice of modelling tool(s).

3 Roadmap for each modelling focus area

The following detailed area roadmaps, which support **Figure 2**, provide a deeper insight into the initiatives within each capability area and their contribution to AEMO's future modelling capabilities.

For each initiative, the roadmaps outline the key stakeholders, current state capabilities and challenges, outline the required technology, process and workforce uplifts needed to achieve the desired future state. Capability milestones across the next five years illustrate the progression from foundational activities through to advanced capabilities, highlighting key dependencies and strategic decision points.

The sequence and timing of the proposed capabilities and investments outlined in these detailed area roadmaps are indicative and are yet to be validated with AEMO, NSP and industry subject matter experts.

Legend for Figures 3 to 7

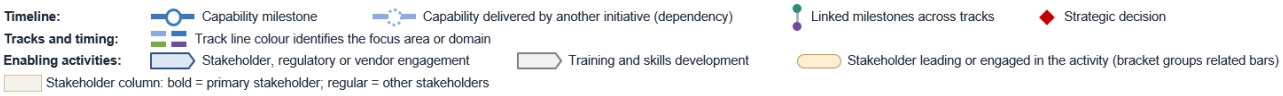


Figure 3 Model configuration management

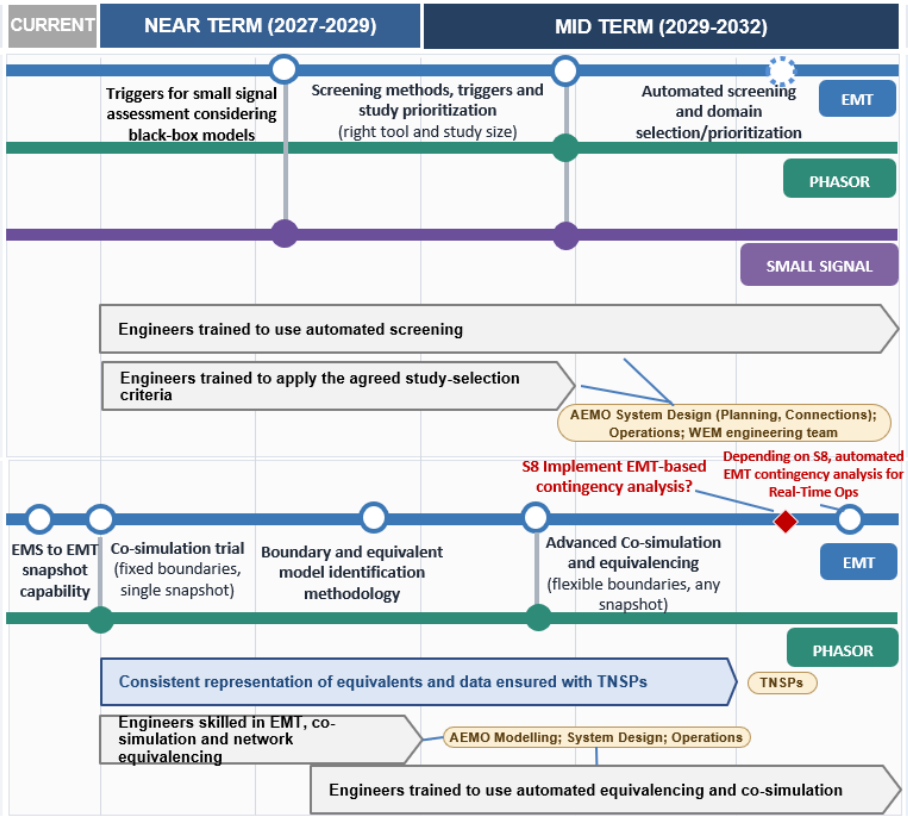
Area future state: *AEMO has consistent guidelines, procedures and systems for managing power system models throughout their lifecycle, from creation and validation to use, revision and retirement. A consistent source of truth makes models trusted, traceable and readily transferable across planning, connections and operations in the NEM and WEM.*

Initiative	Stakeholder	AEMO current state	CURRENT / NEAR TERM (2027-2029) / MID TERM (2029-2032)	Initiative future state
Source-of-Truth Governance	**AEMO Data Governance** AEMO model-management business product owner — to be designated AEMO Digital / platform teams AEMO System Design, Operations, Connections, and Modelling teams NSPs, proponents, Generator Owners, and OEMs AEMO Information Management, Legal, and Cyber Security AEMO WEM team AEMO Enterprise Architecture and CIM/standards leads AEMO Commercial / Procurement and Finance Network model manager vendors and system integrators	Model Management Core model management capabilities exist but remain platform- and team-specific. The energy management system (EMS) provides operational model management and publication, and AMP provides planning-side PDT history, mappings, case preparation and shared capability. These platforms do not yet operate under one consistently governed framework spanning planning and operations. Authority, persistent identity, lifecycle and validation status, lineage, reproducible case assembly, controlled stakeholder contribution, access and service management are not applied consistently across model domains, the NEM and the WEM.	Network model data uplift S9 Central Model Management Platform S7 Include NSP harmonic grid data? Data online service End-to-end model lifecycle management S1 Adopt a CIM-based enterprise data architecture? (Common Information Model) CPI tool uplift (Committed project integration) COA (Connections and OEM Application) Model manager platform (Authority, versioning, validation, lineage, release and archival) Grid Model Delivery Regional data and CIM requirements S2 Establish a regular NSP grid model delivery with data stored by AEMO CIM delivery interface and acceptance criteria NSPs TNSPs deliver validated regional network and EMT data through a standard CIM interface Governed network-model exchange piloted with selected TNSPs on the shadow run	*AEMO operates a governed enterprise Grid Model Management (GMM) service, defined by agreed functional requirements, across planning, connections and operations in the NEM and WEM. Named model authorities govern approved components, identities, versions, effective dates, validation status and lineage, supporting reproducible case assembly. The EMS, AMP and specialist applications have defined roles in the selected architecture; versioned, standards-based interfaces preserve the detail required by each modelling tool and support data portability. Controlled self-service enables authorised stakeholders to contribute information, receive validation feedback and access approved model data under defined quality, confidentiality, intellectual-property and cyber-security controls. Named business and Digital owners sustain service levels, support and recovery.*
RAS / SPS / EFCS Scheme Integration	**AEMO Operations** AEMO Modelling and scheme engineering teams TNSPs and Generator Owners, and relevant OEMs EFCS Stream project team Operations Simulator teams PSMG custodian	Scheme information and representations are managed through multiple processes and bespoke implementations. Visibility of ownership, approved versions, modelling coverage, validation evidence, lifecycle status, risk and backlog is incomplete. Planning and operational representations are not consistently traceable, backlog prioritisation is not uniformly risk-based, and boundaries with related remediation and operator-simulation work require confirmation.	Scheme portfolio and risk-based work prioritization (Active schemes, owners, model coverage and backlog ranked by operational risk)) Model Manager Platform RAS / SPS / EFCS scheme Integration Authoritative scheme records and lifecycle (Approved logic, settings, versions and equipment mappings, managed from registration to retirement)	*In-scope remedial action schemes (RAS), system protection schemes (SPS) and emergency frequency control schemes (EFCS) are managed through an end-to-end lifecycle from registration and modelling through validation, approval, change, periodic review and retirement. Authoritative records link ownership, approved logic and settings, versions, equipment mappings, validation evidence and available records of actual scheme operation. Validated, fit-for-purpose planning and operational representations are traceable to these records and integrated with approved modelling tools through governed interfaces. Risk-based prioritisation, escalation and sustained ownership and resourcing reduce high-risk modelling backlog and maintain visibility of coverage, limitations and outstanding work. Real-time scheme-status displays and operator decision support remain with the relevant operational capabilities.*

Figure 4 Area 1: Modelling tools, page 1 of 2

Area future state: *AEMO and industry have access to the right modelling tools at the right time and apply a consistent, risk-based approach to selecting the appropriate modelling domain, model and analytical method for each study question and intended decision. This enables NEM and WEM modelling teams to undertake the required range of studies efficiently and without compromising scale, speed or fidelity.*

Initiative	Stakeholder	AEMO current state	Initiative future state
Screening and Study Selection Framework	**AEMO System Design - System Planning Department** **AEMO Operations** AEMO System Design - Connections AEMO Modelling Steering Group AEMO WEM engineering team NSPs	Whilst there are some principles and guidelines which define the use of different study tools (or the mix of study tools), this tends to be specific to particular studies and not generalised in a way that can be adopted across the industry. Similarly, the thresholds for choosing a particular study tool also tend to be specific to the individual study. Frequency scans of EMT models are mainly for post-incident analysis (as needed), and are only starting to be used in planning and connections. A commercially available small-signal tool is being introduced, but its use is limited by the need for OEMs and NSPs to provide and benchmark models.	*An agreed, documented, cross-team set of study-selection criteria across the staged screening flow, which provides: automated screening embedded in study workflows; early identification of weak grid areas, system strength issues, resource characteristics, and emerging risks; clear guidance on when (and to what extent) PDT, EMT, co-simulation or small-signal studies are required; and broader operating-condition assessment with fewer unnecessary detailed studies. The criteria are supported by a standing procedure to verify appropriateness of thresholds after new events and by an efficient, targeted use of EMT studies.*
Co-Simulation and Wide-Area Equivalencing	**AEMO Modelling team** **TNSPs (Victoria as initial partner; all NEM TNSPs at embedding)** AEMO System Design AEMO Operations PSMG custodian	Case preparation (including boundary identification, network reduction and equivalencing) for wide-area EMT studies is a manual and study-specific process, relying on SMEs – these are not generalized in a way that can be adopted across teams and industry. Co-simulation is at proof-of-concept stage through a trial, and full-system EMT run times range one to two hours or more.	*A methodology identifies network boundaries and creates equivalent networks from a detailed system model in a streamlined, largely automated way, with equivalents derived for the relevant operating conditions and representative of the dynamic behavior of the portion of the system being represented. Both equivalencing and co-simulation are validated and benchmarked against full detailed models, applied consistently across TNSPs, anchored to the single source of model truth.*



Area 1: Modelling tools, page 2 of 2

Area future state: *AEMO and industry have access to the right modelling tools at the right time and apply a consistent, risk-based approach to selecting the appropriate modelling domain, model and analytical method for each study question and intended decision. This enables NEM and WEM modelling teams to undertake the required range of studies efficiently and without compromising scale, speed or fidelity.*

Initiative	Stakeholder	AEMO current state	CURRENT / NEAR TERM (2027-2029) / MID TERM (2029-2032)	Initiative future state
State-Space and Impedance Intake Protocol	**OEMs / Vendors** AEMO Connections team AEMO Modelling team (SSAT, impedance) PSMG custodian AEMC / Rule-makers	Small-signal and impedance assessment is utilized for focused studies. OEMs supply EMT models as compiled libraries, so the representation of these devices in wide-area small-signal stability studies is challenging, in some cases generic models or proxies using other approaches are utilized. Open-box models have been developed for major synchronous plants and SVCs. Across industry, the use of frequency scanning methods across operating points and their ability to replicate oscillations events is still emerging.	Frequency-scan at connection point (facility-level analysis) Benchmarked small signal models for sync. machines & static var comp. S4 Are the small-signal models provided to AEMO and NSPs sufficient to support current and future analysis needs? Impedance models with changing operating point Automated Event Replication using PMU/WAMS Conversion of black-box EMT and/or PDT models to small signal models for system-wide analysis (e.g., oscillations) - trial Small-signal analysis tool benchmarked against measurements Wide-Band oscillation and system-wide small signal analysis capability, including synchronous generators, IBRs and IBLs for routine application (Standardized approach) AEMO position on mandatory OEM model requirements prepared (supports implementation of S1 Option A) — AEMC / Rule-makers; PSMG custodian OEMs trained to deliver standards-aligned impedance and linearised models — OEMs / Vendors AEMO engineers skilled in small-signal, frequency-scan and impedance methods — AEMO Modelling team; Connections team Priority OEM topics agreed, including impedance-model supply with IP protection — OEMs OEMs trained to deliver standards-aligned impedance and linearised models	*Using blackbox models, AEMO can assess IBR small-signal stability across the system for every new operating point. This comprises: routine small-signal stability assessment across the NEM as a standard part of planning and operational study workflows, rather than a proxied or one-off exercise; clear application of state-space and impedance techniques, with a defined understanding of where each method is most effective and how they can be used together; better representation of IBR technologies, supported by benchmarking state-space and impedance models for selected IBR; improved coordination of oscillation damping controls, informed by identifying the devices and controls participating in sub-synchronous and inter-area oscillations; and frequency-domain scans prepared in advance as a screening layer, with a monitoring linkage that helps identify oscillations and confirm whether they can be replicated.*
Phasor domain: Three-Phase / Unbalanced RMS Capability	**TNSPs (Victoria as initial partner; all regional TNSPs at embedding)** AEMO System Design AEMO Modelling team Tool vendor PSMG custodian	Positive-sequence tools are capable of representing unbalance through sequence impedances in fault studies and have the capability to extract network sequence impedances during dynamic simulations, but steady-state power flow remains positive-sequence. Some information regarding unbalance exists in AEMO, but may not be automatically updated and reflected in the phasor models.	Market-driven generator dispatch in PDT modelling Look-ahead PDT contingency analysis for Real-Time Ops Strategic PDT modeling capability uplift: • 64-bit architecture and user-model migration • Extensible RAWX/model-data architecture • Enterprise model-governance • Future-proof dynamic-model submission standards • New dynamic models (REGCC advanced IBR model, REGFM models, PERC1 IBL model) • New modules (e.g., time series power flow, harmonics, critical clearing time, gridcode) Model manager platform Auto-updated unbalance data Three-Phase / unbalanced PDT capability In regions that need unbalance representation TNSPs — TNSP negative/zero sequence and network data delivered and updated through a standard CIM interface TNSPs trained to prepare sequence in a standard format	*The regions in which unbalanced conditions are material are identified. For these regions, verified sequence components are maintained; sequence quantities are calculated automatically to reflect the current network state; power flow, fault and dynamic simulations account for unbalanced voltages; and sequence information is carried through the single source of model truth.*

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Figure 5 Area 3: Computational capability and hardware

Area future state: *AEMO has access to the appropriate computational capability when and where it is needed, enabling modelling teams across the NEM and WEM to undertake required studies without unnecessary constraints on scale, speed or fidelity.*

Initiative	Stakeholder	AEMO current state	CURRENT	NEAR TERM (2027-2029)	MID TERM (2029-2032)	Initiative future state
Enterprise Compute Strategy	**AEMO IT and Digital** AEMO Modelling team AEMO System Design AEMO Operations AEMO Cyber and Information Security	AEMO is building heavy-compute capability, including GPU work and in-house tooling for parallelising PDT simulations. These compute choices and investment are currently governed through individual teams and projects. Models are becoming increasingly computationally intensive, with no clear strategy for long term compute requirements, at times the queue times for studies can become long.		Workload-based compute capacity governance **Multi-node High-Performance Computing (HPC)**	Depending on S3 and S6, possibly significant increased investment into HPC **S3 Prioritise hardware investment or model and tool efficiency?** **Proven and Emerging technologies** (Quantum, GPU, HPC, cloud, workstations)	*AEMO uses an enterprise compute strategy that matches each modelling workload, including time-critical operational studies, to fit-for-purpose HPC, cloud, GPU or workstation infrastructure. The required simulation software is supported on each environment, and capacity and investment are governed in a coordinated way. This enables modelling teams to undertake required studies without unnecessary constraints on scale, speed or fidelity.*

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Figure 6 Area 4: Models and data, page 1 of 2

Area future state: *AEMO maintains a coordinated, end-to-end model and data ecosystem covering generation, networks, distributed energy resources (DER), consumer energy resources (CER), composite load representations, and standalone large loads across the NEM and WEM. Models and data are supported by appropriate monitoring, validation and continuous improvement, with associated uplift, where needed.*

Initiative	Stakeholder	AEMO current state	CURRENT / NEAR TERM (2027-2029) / MID TERM (2029-2032)	Initiative future state
DER Aggregated Dynamic Representation	**AEMO System Design** **AEMO Modelling team** AEMO Operations PSMG custodian	Aggregated DER/CMLD models can be built in AMP for PSS/E, and PSCAD DER/CMLD models also exist. However, PSCAD representations are not yet integrated consistently into wide-area EMT models, and DER representation, aggregation level or study boundary may be selected depending on the study. Current models principally represent DER shake-off behaviour, and representations, substation data, parameters, validation evidence and maintenance are not connected through one governed approach.	**DPV Integration into AMP / EMS** **Standard model interfaces and real-code PDT and EMT models** (e.g., IEEE P3597, building on CIGRE B4.82) **DER and CER models in wide-area studies** (validated & study-purpose driven)	*AEMO uses validated, study-purpose-driven DER and CER dynamic representations across PDT and EMT workflows. Screening criteria determine where detailed or aggregated representation is required and at what geographic and electrical level. Representations are governed from consistent source data and assumptions, calibrated against available measurements, and capable of representing the phenomena relevant to each study, including DER/CMLD shake-off and, where evidence supports the need, higher-frequency interactions. The approach reduces the computational burden of wide-area EMT studies while maintaining defined accuracy, numerical robustness and traceability.*
Large IBL Modelling Framework	**Large-Load Proponents (data centers)** OEMs supplying IBL equipment AEMO Connections team AEMO Modelling team PSMG custodian	Large inverter-based loads are growing rapidly, but common modelling representations, model libraries, submission requirements and acceptance processes are not yet consistently established. AEMO is developing guidance and individual TNSPs have their own approaches. Model availability varies across proponents and OEMs, and grid-side and facility-side responsibilities require clarification, so large-load behaviour may be handled case by case and represented inconsistently in connection, planning and operational studies.	**Harmonized Large IBL modelling and validation framework** **Interconnection requirements and conformity checks for large loads defined** Large-Load Proponents; Connections team	*AEMO assesses the connection, planning and operational impacts of large inverter-based loads, starting with data centres and electrolysers, through a consistent modelling framework embedded in the PSMG and Connections process. The framework assigns grid-side and facility-side responsibilities, distinguishes facility-level from equipment-level models, and defines data requirements, acceptance criteria and governed model libraries. This includes time-domain behaviour for rapidly varying loads, such as AI training facilities, and the treatment of co-located generation. Models are validated against measurements, revalidated at regular intervals and after material equipment or control changes, and tested for sensitivity to parameter variation.*

Area 4: Models and data, page 2 of 2

Area future state: *AEMO maintains a coordinated, end-to-end model and data ecosystem covering generation, networks, distributed energy resources (DER), consumer energy resources (CER), composite load representations, and standalone large loads across the NEM and WEM. Models and data are supported by appropriate monitoring, validation and continuous improvement, with associated uplift, where needed.*

Initiative	Stakeholder	AEMO current state	CURRENT / NEAR TERM (2027-2029) / MID TERM (2029-2032)	Initiative future state
Generator-Owner Continuous Plant Validation and Model Format	**Generation Owners** OEMs / Vendors AEMO Modelling team PSMG custodian AEMO Connections team TNSP Protection team	Generator model validation is tied mainly to commissioning. Study cases including committed plant are available on request but not consistently provided to participants, and dedicated resources/funding are not allocated to prioritize this. Where a later alteration, including a firmware update, meets the NER clause 5.3.9 or S5.2.2 criteria, the Generator must submit updated models per NER clause S5.2.4(d). Other changes are managed through compliance programs, which must be consistent with the 2026 Template for Compliance Programs by February 2027. Post-firmware drift is a growing risk in regions with high IBR penetration, and plant non-compliance is typically identified reactively.	**Complete R2 model validation:** • Recent projects to follow AEMO commissioning guideline • AEMO to internally arrange actions for old projects Minimum DFR measurements, revalidation triggers and criteria established Automated continuous plant/facility model validation Generator-owner continuous plant validation S10 Vendor-independent dynamic models: Should AEMO update model requirements to enable users' greater flexibility in using the software tool of their choice? Regulatory pathway for mandatory revalidation prepared → Generation Owners; PSMG custodian Firmware-change notification and model-quality priorities agreed with OEMs OEMs trained to deliver standards-aligned plant models and evidence → OEMs / Vendors	*AEMO continuously validates registered plant models against measurements across the plant lifetime. Digital fault recorder (DFR) and PMU data are used routinely to validate and spot-check generator models, with automated data retrieval and compliance monitoring under human review. Models are revalidated after changes such as firmware updates or operational tuning, building on the information already provided through the NER clause 5.3.9 alteration process. This provides defensible audit evidence and a clear confidence status for each registered model.*
AEMO System-Level PMU Validation and Spot-Check	**AEMO Operations** **AEMO System Design / Planning** AEMO Modelling team Generation Owners TNSPs	Dynamic models are tuned manually and combined with an operational snapshot in the dynamic security assessment (DSA) processor to create a snapshot dynamic case, which informs transfer levels, alarms and dispatch limits. System-level validation is offline and can take days or weeks to collect data and replicate an event.	System-Level PMU validation framework Automated system-level PMU validation and spot-check	*AEMO builds operational-timeframe dynamic models from EMS snapshots enriched with dynamic data, validates them against PMU measurements using accuracy indices, and tunes them with progressively less manual effort closer to real time. Validated models and measurements are exchanged between planning and operations through network model management.*
PMU Deployment and Control Room Application	**AEMO Operations** **TNSPs** AEMO Modelling team ASPECT and WEM-WAMS teams AER	PMUs are already used operationally for oscillation detection and source location, event alarming, and wide-area visualisation (more than 300 NEM PMUs), with mode monitoring and WEM wide-area monitoring in progress. A prioritised use-case set and defined end state, consolidated control-room delivery, systematic model validation, real-time system strength metrics, state estimation, distribution-level PMU coverage and closed-loop control are not yet in place.	ASPECT uplift (Offline PMU Monitoring and Oscillation Analysis) Real-time system strength tool and inertia estimation Oscillation management in control room S5 Review PMU coverage for supporting monitoring, compliance, model-tuning? Control Room visibility resilience via enhanced PMU Network Operators trained for wide-area monitoring and control → AEMO Operations Additional PMU deployment coordination → TNSPs	*A prioritised, use-case-driven synchrophasor capability in which each use case is matched to the PMU count, measurements and placement it needs; AEMO coordinates with TNSPs to close deployment gaps; existing operational functions are consolidated and extended in the control room across the NEM and WEM.*

Figure 7 Area 5: Process improvement, automation and efficiency

Area future state: *AEMO's modelling processes are efficient, repeatable and appropriately automated, enabling consistent practices across the NEM and WEM. Automation and emerging technologies, including artificial intelligence where appropriate, reduce repetitive manual effort and allow modelling specialists to focus on higher-value engineering analysis and decision-making.*

Initiative	Stakeholder	AEMO current state	CURRENT / NEAR TERM (2027-2029) / MID TERM (2029-2032)	Initiative future state
AI / ML-Assisted Workflows	**AEMO Modelling team** AEMO System Design AEMO Operations AEMO Data Governance PSMG custodian	Narrow, single-task AI automation is in use today, and EMT model creation and basic study automation have been demonstrated. However, adoption remains exploratory. Cyber-approved access to AI tools that can be used with sensitive network information has not yet been resolved, and there is no framework for evaluating AI outputs or retaining engineering skills.	**Secure AI access, platform onboarded** **AI-Assisted modelling workflows** (Agents and evaluation layer in place) **OEMs trained to deliver standards-aligned plant models and evidence** **AEMO Modelling; System Design; Operations**	*AI supports AEMO's engineering workflows rather than replacing them. A small, highly skilled team routinely operates retrieval-augmented, agent-driven workflows built for specific AEMO processes, automating model validation, study set-up, screening and case generation. These workflows are built on strong data foundations, including a centralised data engineering framework. The level of automation also depends on consistent OEM EMT model structures. A trusted evaluation layer checks AI outputs, and engineers retain manual competency. This reduces repetitive manual effort and lets modelling specialists focus on higher-value engineering analysis.*
End-to-End Workflow Automation	**AEMO Modelling Engineers** **AEMO Connections team** Modelling Tools project team Operations Simulator 2.0 project team AEMO Operations	Case building and study preparation depend on substantial manual engineering effort, local scripts, templates and practitioner knowledge. Activities, effort and differences between connection, planning, operational, historical-validation, PDT and EMT workflows are not consistently baselined, and workflow lineage, validation gates, exception handling and results processing are not standardised end to end.	**Network Outage Scheduler (NOS) uplift** **Marginal Loss Factor (MLF) Process Automation** **AI-Assisted modelling workflows** **Automated plant/facility performance compliance monitoring** **End-to-End workflow automation** **Market Analysis & Network Analysis (MANA)** (including Automated **System Strength and Inertia Estimation** for Day-Ahead Market Analysis, Operations Planning & Planning Tools) **S6 Should AEMO develop enterprise screening tools and guidelines on selection of modelling tools / mix of modelling tools for different purposes?** **Automated screening and domain selection/prioritization**	*AEMO uses governed, modular and reusable automation pipelines to build cases and execute selected study workflows from approved model components and assumptions. Each workflow records its inputs, transformations, validation results, exceptions, execution settings, outputs and approvals, enabling reproducible studies across historical, current, connection, operational and future-planning use cases. Engineers retain accountable control at defined decision points and focus manual effort on modelling judgement, exception resolution and interpretation.*