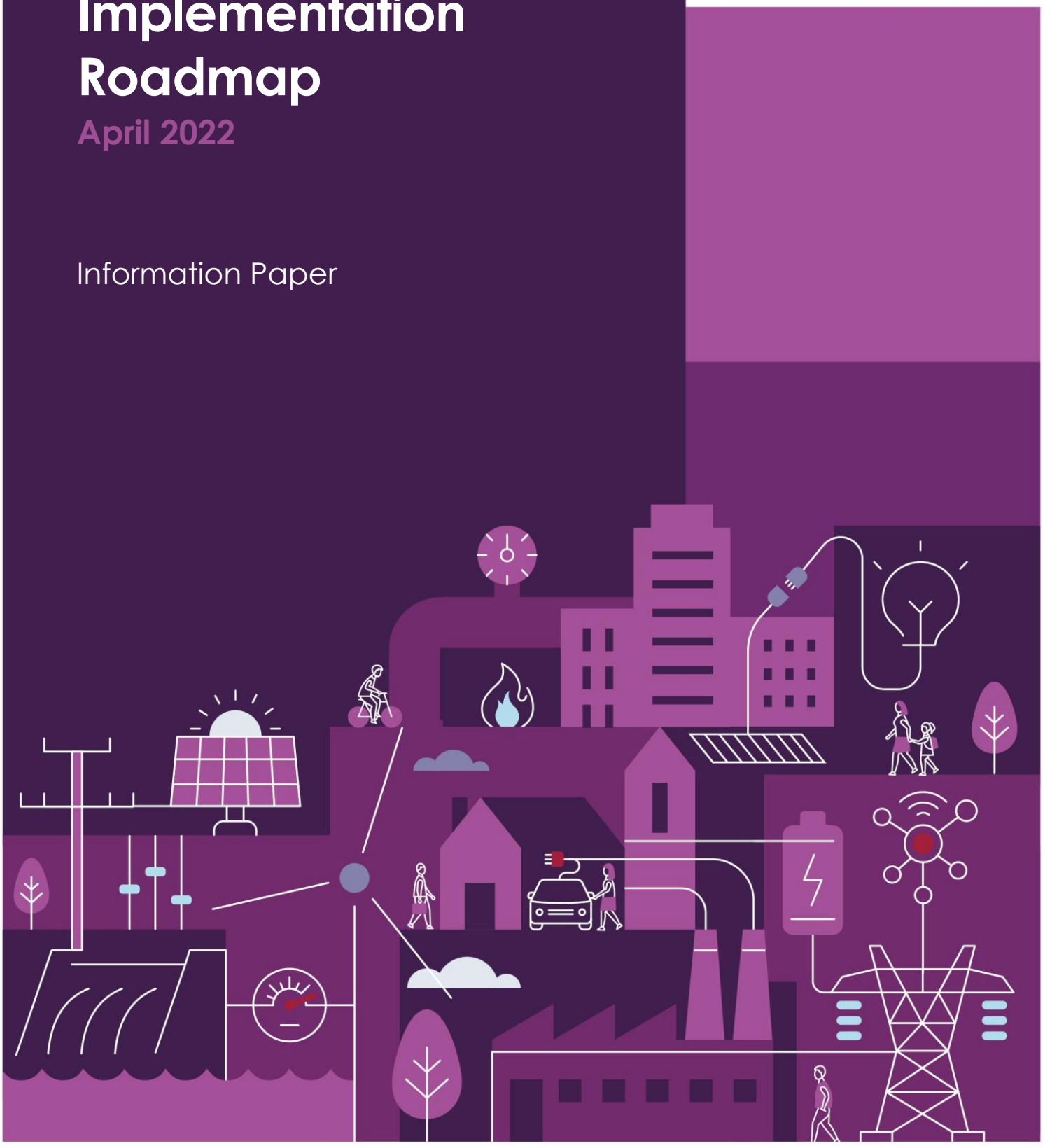
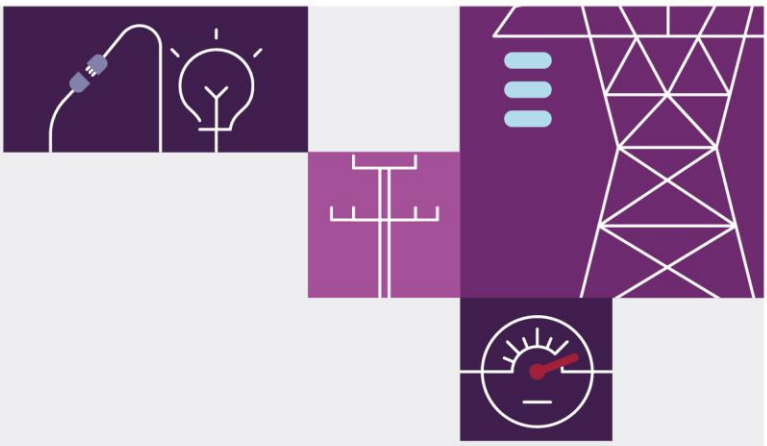
NEM2025 Implementation Roadmap

April 2022

Information Paper





Important notice

Purpose

The purpose of this publication is to outline the process undertaken to develop the NEM2025 Implementation Roadmap.

Disclaimer

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Version control

Version	Release date	Changes
1	21/04/2022	Initial publication

Overview

One of the main enablers for 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 NEM2025 Implementation Roadmap (the Roadmap) available to view in Appendix A1 or alternatively at the RDC section of AEMO's website[1].

The purpose of the NEM2025 Implementation Roadmap is to establish a basis upon which to navigate the breadth of ESB reforms over the coming few years, de-risking delivery and informing implementation timing. Version 1 of the Roadmap provides for two alternative pathways – Regulatory Led and Strategic – representing opposing ends of a spectrum of options.

AEMO and the RDC have prepared this Information Paper to outline the process undertaken in developing the Roadmap, as well as provide additional information in relation to the Post-2025 reform initiatives and those AEMO strategic or foundational initiatives identified and deemed to be potential prerequisites to implementing the Post-2025 reforms.

AEMO welcomes stakeholder feedback and the opportunity to discuss the NEM2025 Implementation Roadmap. AEMO are particularly interested in responses to the following questions:

- Do stakeholders agree with the grouping, sequencing and prioritisation of the Post-2025 reform and AEMO strategic and foundational initiatives?
- Do stakeholders support pursuing a Strategic pathway to implementing the Post-2025 reform initiatives as is the preference of AEMO and the RDC?

Submissions in response to this Information Paper may be sent to stakeholderrelations@aemo.com.au by 5.00 pm (Australian Eastern Standard Time [AEST]) on 20 May 2022 or alternatively a meeting to discuss feedback either on an individual basis or in a round table setting with individual stakeholder groups could be facilitated should this be preferred.

AEMO plans to hold a stakeholder forum on the Regulatory Implementation Roadmap (version 7) and NEM2025 Implementation Roadmap on **11 May 2022** from 10.30 am to 12.00 pm AEST. Please register your interest to attend here by 6 May 2022.

The remainder of this Information Paper is structured as follows:

- Section 1 provides background on the ESB's Post-2025 market design advice, including recommended reform pathways.
- Section 2 describes the role and purpose of the Reform Delivery Committee.

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

- Section 3 outlines the NEM2025 Implementation Roadmap, which is the subject of this Information Paper.
- Section 4 outlines next steps in the NEM2025 Implementation Roadmap development process.

Contents

Overview		3
1	Post-2025 electricity market design	6
2	Reform Delivery Committee	8
3	NEM2025 Implementation Roadmap	9
3.1	Roadmap overview	9
3.2	Roadmap objectives and principles	11
3.3	Scope, assumptions and relationships	11
3.4	Implementation pathways	17
4	Next steps	21
A1.	NEM2025 Implementation Roadmap	22
A1.1	Regulatory Led pathway	22
A1.2	Strategic pathway	24

Tables

Table 1	ESB Post-2025 reform pathways	7
Table 2	ESB Post-2025 reform initiatives	12
Table 3	AEMO strategic and foundational initiatives	14
Table 4	Implementation pathways – trade-offs	18

Figures

Figure 1	NEM2025 Implementation Roadmap (snapshot only – Strategic pathway)	10
Figure 2	Spectrum of implementation pathways	17

1 Post-2025 electricity market design

The Post-2025 electricity market design addresses essential change in a world of expanding consumer choices, new technologies, and large-scale capital replacement as old thermal power stations leave the market[2].

The Energy Security Board (ESB) was tasked by the former Council of Australian Governments Energy Council (COAG EC), to advise on design changes required in the National Electricity Market (NEM) as it transitions from a fleet of largely coal-fired generation to more variable renewable generation.

The ESB provided its final advice to the Energy National Cabinet Reform Committee (National Cabinet) on 27 July 2021 in a manner that set out a pathway of reforms and a timetable for their implementation, towards the year 2025 and beyond. National Cabinet approved the Post-2025 reform recommendations on 29 October 2021.

In presenting its final advice, the ESB divided the work into four interrelated reform pathways:

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

The four pathways are complemented by a Data Strategy for the National Electricity Market (NEM), developed by the ESB, which recognises that digitalisation and data are critical to enabling each of the reform pathways. Specifically, the Data Strategy seeks to provide direction needed to manage changing data needs in the energy transition as well as optimise the long-term interests of energy consumers in a digitalised economy.

Table 1 provides an overview of the four reform pathways and Data Strategy.

One of the main enablers for the 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 Ministers. 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 NEM regulatory and IT systems implementation.

AEMO, in partnership with the Reform Delivery Committee (RDC, or the Committee), has since compiled the NEM2025 Implementation Roadmap (the Roadmap).

[2] See https://esb-post2025-market-design.aemc.gov.au/. Accessed 13 April 2022.

Table 1 ESB Post-2025 reform pathways

Pathways	Objectives	This means
Resource Adequacy Mechanisms	• 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.	Investment in the right mix of resources (generation, storage and demand response) is in place prior to anticipated plant closures, and plant exit does not cause significant price or reliability shocks to consumers through the transition.
Essential System Services	• 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.	Resources and services are available when needed to manage the complexity of dispatch and to deliver a secure supply to customers.
Transmission & Access	• Establish better signals for generators to locate in areas where there is available generation capacity – namely in the renewable energy zones (REZs). • Reduce uncertainty for investors, through measures that give rise to more predictable future patterns of congestion, and a more orderly and predictable connections process. • 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.	The network is capable of meeting the future demands of the power system, including providing for appropriate investment signals to support investment that can deliver the energy transition at lower cost.
Integrating DER & Flexible Demand	• Establish frameworks that enable consumers to be rewarded for their flexible demand and generation, facilitate options for how they want to engage, and protect them with 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 and 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.	New opportunities are created for consumers about how they receive and use energy and are rewarded for doing so flexibly.
Data Strategy	• Establish framework with new guiding policy principles and regulatory reforms to remove existing barriers to better consumer outcomes, support safer data management, and ensure frameworks are fit for purpose in a future energy market. • Build capability: build leadership, coordination and capability across agencies and stakeholders, to better manage data growth, grow value from analytics and support the data services the market needs. • Address priority data gaps: fill gaps in current data sets, critical to support the needs today of better planning, evolving services and robust consumer protections. • Forward planning and adaptability: introduce regular proactive review and planning to meet needs tomorrow, timely standards and flexibility in data arrangements, and facilitate early needs for research and innovation.	Ongoing support is provided for changing data needs over time, with coordination of proactive reviews to identify and address emerging and future priority data gaps and capabilities – all guided by a new framework which sets clear principles and safe but flexible requirements.

2 Reform Delivery Committee

The purpose of the RDC is to facilitate deep and effective collaboration across the industry in development of the NEM2025 Implementation Roadmap.

AEMO established the RDC with the support of the Australian Energy Market Commission (AEMC) and the Australian Energy Regulator (AER).

The Committee's purpose is to facilitate deep and effective collaboration across the industry to develop a NEM2025 Implementation Roadmap that appropriately sequences and seeks to achieve the lowest whole-of-system cost for implementation of reforms and supports the overall delivery of the reform portfolio.

It consists of nominees from market participants, consumer representatives, and representatives of the renewable energy, demand management and energy efficiency industry sectors.

In developing the Roadmap, the RDC has sought to:

- Seek industry and consumer feedback on the prioritisation, interdependencies and sequencing of market reforms and their implementation, for consideration by the market bodies and input to the Regulatory Implementation Roadmap (the Regulatory Implementation Roadmap is discussed in Section 4.4.3).
- Provide early input on the scope, options and interdependencies of uplifts required to AEMO and industry business process, system and technology to implement proposed and mandated reforms.
- Share information on technology costs associated with implementation options for mandated reforms.
- Identify risks and share emerging issues that may impact on the implementation of reforms and require amendments to the Regulatory Implementation Roadmap.
- Discuss and provide feedback on other potential strategic initiatives to make changes to market systems that will reduce costs for participants and consumers.

The Committee has met monthly since its inaugural meeting in November 2021 and has held four additional workshops covering various aspects of the NEM2025 Implementation Roadmap including format and scope, critical relationships/dependencies, alternative implementation pathways, and how initiatives are sequenced, prioritised and grouped.

Further details on the RDC, including presentation and workshop materials, are available at AEMO's website[3].

[3] At https://aemo.com.au/consultations/industry-forums-and-working-groups/list-of-industry-forums-and-working-groups/reform-delivery-committee.

3 NEM2025 Implementation Roadmap

The purpose of the NEM2025 Implementation Roadmap is to establish a basis upon which to navigate the breadth of ESB reforms over the coming few years, de-risking delivery and informing implementation timing.

3.1 Roadmap overview

The NEM2025 Implementation Roadmap is available in full to view in Appendix A1 or alternatively at the RDC section of AEMO's website[4].

Figure 1 provides a snapshot of the NEM2025 Implementation Roadmap. The Roadmap sets out – for each individual initiative – an assessment of the critical steps and estimated timeframes required to complete them across a standard implementation process covering:

- Policy development and design.
- Rules development.
- Project initiation (once rules are defined) including high-level pre-execution design activities.
- Detailed pre-execution design activities.
- Procedure and guideline development.
- Technology delivery.
- Industry testing and trials.
- Effective date (committed, proposed or estimated).

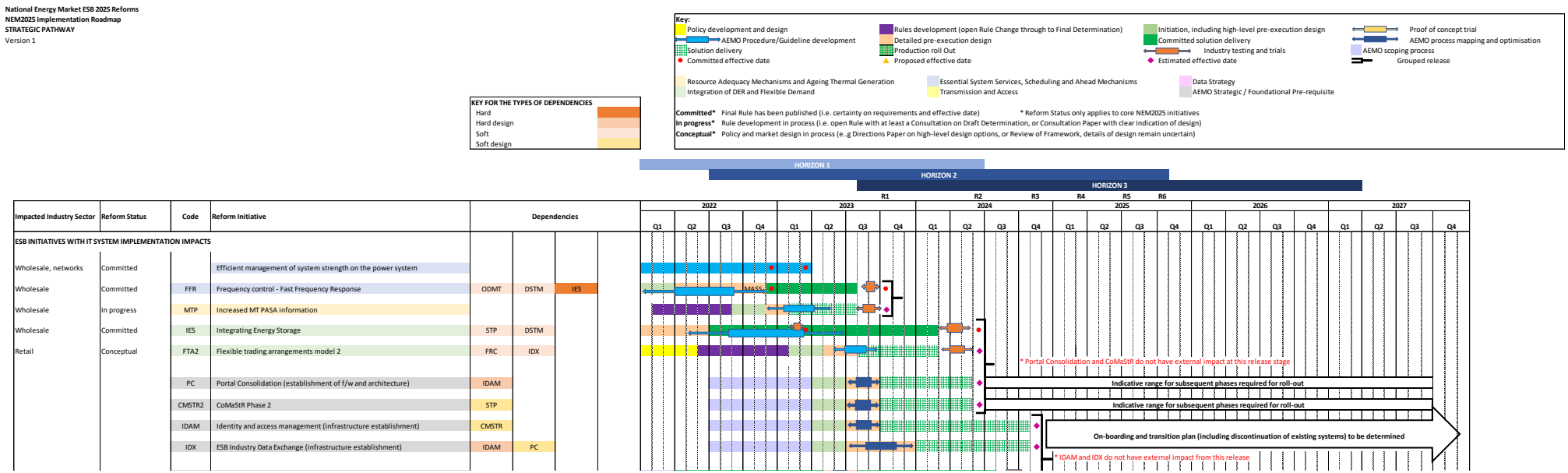
In addition to these standard implementation processes, the Roadmap captures related processes (where appropriate) that may vary across initiatives, including:

- Proof of concept trials.
- AEMO internal scoping processes (for pre-requisite initiatives prior to initiation).
- AEMO internal process mapping and optimisation (for pre-requisite initiatives).

Estimated timeframes for each step within the process have been assessed based on the overall level of complexity associated with implementation of individual initiatives. The Roadmap captures documented assumptions around complexities and estimated timeframes.

[4] At https://aemo.com.au/consultations/industry-forums-and-working-groups/list-of-industry-forums-and-working-groups/reform-delivery-committee

Figure 1 NEM2025 Implementation Roadmap (snapshot only – Strategic pathway)



3.2 Roadmap objectives and principles

The objectives of the NEM2025 Implementation Roadmap are to:

- Facilitate the implementation of the reforms in a timely and efficient manner and at least whole-of-system cost.
- Coordinate industry-wide regulatory and IT change.
- Provide transparency to stakeholders on reform implementation.

In developing the NEM2025 Implementation Roadmap, AEMO and the RDC considered the following factors:

- Reform benefits and priorities.
- Opportunities for bundling and sequencing initiatives to improve implementation efficiency.
- Industry pain points and strategic opportunities to improve operations; for example, lowering transaction costs, reducing barriers to entry and further achievement of the National Energy Objective (NEO).
- Implementation risks.
- Minimising duplicate processes.
- Allocation of implementation responsibilities taking account of efficiency, capability to deliver and management of implementation risks.
- Adaptability to respond to changes.
- Strategic opportunities to invest or make changes to market systems that will reduce the overall cost of implementing NEM2025 reforms.

3.3 Scope, assumptions and relationships

3.3.1 Scope

Each of the Post-2025 reform initiatives that make up the ESB's final recommendations are at varying stages of development or implementation. These stages range from initiatives having been implemented or completed (such as acceptance by jurisdictions on a non-binding basis of investment principles for jurisdictional schemes), to initiatives progressing through the AEMC's rule change process, to initiatives still at a concept/trial phase where further work is required to better understand scope and potential system and process impacts.

The RDC therefore methodically considered all the ESB's reform initiatives and from this list identified 18 reform initiatives to be included in Version 1 of the Roadmap, as shown in Table 2. The initiatives selected for inclusion:

- Are generally anticipated to have impacts on AEMO's and/or market participants' systems and processes, and
- Have a scope of work that can be reasonably well defined, in order to estimate the potential size of the project, the time required to implement it, and its relationships or dependencies with other reform initiatives and/or existing strategic or foundational AEMO or market participant initiatives.

The RDC agreed that initiatives such as a Capacity Mechanism and Congestion Management Model, which are still progressing through high level design at an ESB working group level, should be included in subsequent versions of the Roadmap once further information is available regarding their potential scope.

For reform initiatives under the Integrating DER and Flexible Demand pathway, AEMO and the RDC have sought to align the Roadmap with the ESB's DER Implementation Plan. The RDC noted the significant interlinkages across initiatives under this pathway, including the development of policy, standards, and completion of trails. For these reasons the RDC proposes the inclusion of all these initiatives in Version 1 of the Roadmap, despite these also being at varying stages of development from final rule determination (such as Integrating Energy Storage) to concept/trials (such as Distribution Local Network Services).

Table 2 ESB Post-2025 reform initiatives

Pathway	Reform Initiative	Objective
Resource Adequacy Mechanisms	• Increased Medium Term Projected Assessment of System Adequacy (MT PASA) Information	• Establishing the reporting of a unit's status through reason codes via MT PASA in accordance with IEEE Standard 762-2006 definitions for use in reporting electric generating unit reliability, availability and productivity, and tailored to a domestic context or equivalent. • Establishing the reporting of recall times via MT PASA when triggered through a reason code
Essential System Services	• Fast Frequency Response	• Establish two new market ancillary services – very fast raise and very fast lower – to operate alongside the existing contingency FCAS markets
	• Mandatory Primary Frequency Response	• Continuation of mandatory PFR requirements beyond the June 2023 sunset date, i.e. going forward all scheduled and semi-scheduled generators will be required to provide PFR. • To design a new cost allocation system for Regulation FCAS, known as 'Causer Pays' based on, and which supports, tight dead-band MPFR
	• Operating Reserve Market	• Unbundling 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
	• System Strength (Planning)	• 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.
	• Operational Security Mechanism	• Provide a procuring and scheduling process for ESS by producing a least-cost, inter-temporal optimised dispatch schedule which considers attendant technical constraints and costs for unit commitment and system security.
Transmission & Access	N/A at this time	
Integrating DER & Flexible Demand	• Integrating Energy Storage	• New rule change for integrating energy storage systems (IESS) into the NEM to better integrate and utilise energy storage and hybrid systems (i.e. batteries).
	• Flexible Trading Arrangements (Model 2)	• 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 establishes a specific category of connection arrangement, a Private Metering Arrangement (PMA), enabling a NMI to be established within a customer's electrical installation.

Pathway	Reform Initiative	Objective
	• Scheduled Lite	• 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 either: – provide greater visibility to the market operator about intentions in the market, or – to participate in dispatch of energy and ancillary services
	• Dynamic Operating Envelopes	• 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.
	• Distribution Local Network Services	• 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
	• Turn-up Services	• Increase the capability and capacity of load to respond to low or negative price signals during times of abundant variable renewable energy, which is correlated to periods of minimum system load
	• DER Data Hub & Registry Services	• 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.
	• DER Operational Tools	• 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
Data Strategy	• Data Services	• To define and deliver data services models that enable greater access to, and derived value from, existing data via innovative data services and analytics capabilities.
	• EV Charging Standing Data Register	• Uptake and behaviour of emerging EV technologies is well understood, supporting efficient and responsive forecasting, planning, and operational management. • Data on 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 Electric Vehicle Supply Equipment (EVSE) data are streamlined with wider reforms supporting EVs, including any new requirements for EVSE standards, installations or connection agreements, DERR and jurisdictional transport data. • EV research and program data is coordinated and accessible, providing data on EV behaviour and uptake
	• Bill Transparency	• Resolve current duplication of retail reporting arrangements, reducing retail market costs. • Provide a statistically robust, accessible source of data on what consumers are actually paying, linking their retail arrangements and usage to understand both billing arrangements and associated market outcomes. • Track consumer outcomes on an ongoing, rather than in-frequent, manner and this information should be readily accessible by market regulators. • Be able to link analysis to a range of factors, such as regional demographics and DER services, hardship programs, and jurisdictional subsidies. • This measure will reduce the existing burden on retailers, and the retail consumer base, thus encouraging innovation and increasing consumer choice.

Pathway	Reform Initiative	Objective
	• Network Transparency	• 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.

In addition to the Post-2025 reform initiatives, AEMO has identified a subset of initiatives deemed to be potential prerequisites to implementing the reform initiatives. Each of the initiatives listed in Table 3 represents either a foundational investment in an AEMO legacy system that is, for example, nearing the end of its technical life, or a more strategic investment as part of AEMO's wider digital program of work aimed at ensuring AEMO's IT systems are fit for purpose to meet the need of the transition and beyond. Unlike the reform initiatives, where timeframes may be dictated by a regulatory deadline, sequencing of the strategic or foundational initiatives can prove to be more complex.

A brief description on each of the Post-2025 reform initiatives and AEMO strategic or foundational initiatives, including problem statement, objective, scope, high-level assessment of AEMO and participant impacts, key relationships and estimated timeline is available to view at the RDC section of AEMO's website[5].

Table 3 AEMO strategic and foundational initiatives

Pathway	Reform Initiative	Objective
Foundational – Foundational dependency work to deliver an uplift to base capability on which reforms are dependent	Identity Access Management	• Integrate the design, testing and implementation of the legacy authentication interface with the B2C platform. • Seamless integration capabilities with AEMO downstream systems to ensure authorised users/systems retain access to their applications / services. • Ability to store validated credentials in AEMO's external identity provider. • Reporting of success and exceptions encountered during this process so that external parties can be serviced should errors occur.
	Industry Data exchange	• 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 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.
	Operational Decision-Making Tools	• Design and build a new enterprise platform for new tools that will be developed and deliver a customisable NEM common graphical user interface (GUI) for NEM operations, including a model to manage data access and storage for Operations. • Develop: – Decision-making tools that are highly adaptable to changing requirements. – Operational dashboards that enable faster and lower cost updates in future. – Analytics to convert raw data into targeted information, based on user-workflow. – Capabilities to handle greater volumes of data from a much wider variety of sources.
	Business Rules Engine	• Develop a rules engine framework and decision automation platform for AEMO to make optimised, data and situation-aware decisions. • Efficiently model, analyse and deploy operational decisions via business rules implementation.

[5] At https://aemo.com.au/consultations/industry-forums-and-working-groups/list-of-industry-forums-and-working-groups/reform-delivery-committee

Pathway	Reform Initiative	Objective
		• Enable AEMO to implement business rules and analytics across various workflows, business processes and data to deliver business values despite facing frequent changes. • Improve effectiveness and efficiency of operational decisions influenced by frequent changes in data, process, and regulatory market rules. • Manage and model the business decisions and their relationships over the outcomes of the business rules.
	Operational Data Store	• An Enterprise Data Platform (EDP) that offers a portfolio of data services across multiple use cases (across the enterprise), including analytical and use cases related to core/critical systems (market and energy systems).
	Forecasting Platform Uplift	• 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.
	Short Term Projected Assessment of System Adequacy (ST PASA) Replacement	• Complete a holistic review of the PD and ST PASA methodology and develop a system that is flexible enough to serve the market now and into the future. • Re-develop lack of reserve indicators and procedures based on the new more granular schedules. • Test, select, procure and deploy a commercial SCED/SCUC market clearing engine subsystem. • Design and build overall system. • Design and develop business driven data management processes to enable stable long-lived integration
	SCADA Lite	• 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.
Strategic – Strategic dependency work to effectively futureproof capabilities and scalability of systems thereby avoiding investment in systems that will become end-of-life shortly after the reforms take effect	Portal Consolidation	• 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. • Provide integration with the enterprise identity management and user authentication solution. • Deliver a User Access Management application (SAM) for use by external administration to support the management of application users and permissions
	CoMaStR	• 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.
	Dispatch Target State	• 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
	Bids / Offers Target State	
	Constraints Target State	
	FRC Target State	• 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.

Pathway	Reform Initiative	Objective
		• 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 Electric Vehicles (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.

3.3.2 Assumptions

In developing the NEM2025 Implementation Roadmap, the RDC has made several assumptions including:

- **Complexity and timing** – given each the initiatives (Post-2025 or AEMO) are at varying stages of development and firm deadlines have not been set for their implementation, the RDC has been required to make several assumptions regarding the complexity of, and timeline associated with, implementing each initiative. Specifically, initiatives have been assigned a small, medium and large rating based on an assessment of their complexity to implemented. The related timelines for implementation for each size project are shown in worksheet 'Process' of the Roadmap.
- **Contingency** – while each of the implementation pathways are possible to achieve, they assume certain pre-conditions and underlying assumptions are met, including but not limited to completion of rule change processes, project start and end (effective) times, availability of AEMO and market participant resources, and completion of policy and detailed design work. There is no explicit contingency overlay accounting for these pre-conditions and underlying assumptions built into the Roadmap. Instead, contingency has been implicitly accounted for in determining an initiative's size and complexity and the necessary steps to implement it.
- **Other reviews** – AEMO has several other reviews or roadmaps in development, including a review of its Future State Architecture and the development of its Engineering Framework and Operational Technology Roadmap. The outcomes for each of these could have implications for the Roadmap. Where appropriate, AEMO has provided feedback about these potential implications into the development of the Roadmap, ensuring consistency across the group.
- **Business case** – work has commenced on a business case assessing the costs and benefits of the alternative implementation pathways. The outcomes of this work, to be completed by June 2022, will help inform the preferred implementation pathway.

3.3.3 Relationships

In addition to making assumptions about initiatives' complexity and timeline to implement, the RDC has sought to identify and map key relationships among reform initiatives and the subset of AEMO initiatives. Specifically, the Roadmap requires an understanding of the key technology solutions and functional relationships to accurately group, prioritise and sequence the implementation of initiatives. Each of these relationships provides for an understanding of:

- **Technology solution** – design or implementation dependencies and investments required in those enabling technology solutions

- **Functional** – whether an initiative will touch on the same system or process, if there are deadlines that overlap with the delivery of another, and the potential impacts of ongoing policy or trials.

Understanding each of these relationships will improve the overall efficiency of implementation across the wider reform program. A summary assessment of the relationships including type identified across all initiatives is available to view at the RDC section of AEMO's website[6] (see Workshop 2 Round 1 presentation).

3.4 Implementation pathways

The transformational nature of the reforms presents an opportunity to lay the foundations of future capabilities that will be needed as the system and market evolve and mature over time. However, uncertainties – regarding, for example, policy, market design, trials, effective dates and current life cycle of systems – will challenge the formation of the Roadmap and the individual pathways considered.

The RDC has considered those alternative pathways across a spectrum, as shown in Figure 2. It is likely the Roadmap will be a hybrid of both approaches. For example, there are some initiatives that have progressed to a final determination and have a firm implementation date to be met, while others are yet to reach this stage and may allow for broader strategic consideration in the approach to their implementation.

Figure 2 Spectrum of implementation pathways

How this process defines the threshold for earlier incorporation of technology investments that set up long-term capabilities and efficiencies, and addresses industry pain points, in the delivery of the reforms has the potential to impact the timeliness and overall efficiency, including costs, of the NEM2025 reform program.

As a result, Version 1 of the Roadmap provides for two alternative pathways – Regulatory Led and Strategic – representing each end of the spectrum of options.

Each pathway comes with several trade-offs to be considered that are discussed further below.

Under a **Regulatory Led** approach, the Roadmap provides for implementation of all the reform initiatives in sequence without considering shared system impacts and future state technology investment efficiencies. This pathway largely removes delivery of foundational and strategic technology investment initiatives from the Roadmap, except those without which a reform could not be delivered – 'true' hard dependencies.

Under a **Strategic** approach, the Roadmap places emphasis on strategic/foundational initiatives that enable the reforms under a future state that facilitates scalability and limits the number of investments that may be required in future as the market continues to transform and mature. The bundling approach in this pathway seeks to minimise the number of times the same systems are changed, to create implementation efficiencies.

Each pathway is documented in full in Appendix A1. Alternatively, stakeholders may view the Roadmap at the RDC section of AEMO's website[7].

[6] At https://aemo.com.au/consultations/industry-forums-and-working-groups/list-of-industry-forums-and-working-groups/reform-delivery-committee

[7] At https://aemo.com.au/consultations/industry-forums-and-working-groups/list-of-industry-forums-and-working-groups/reform-delivery-committee

3.4.1 Trade-offs

The choice of implementation pathway(s) requires consideration of various trade-offs affecting overall program delivery and efficiency, as shown in Table 4.

Table 4 Implementation pathways – trade-offs

Trade-off	Description	Assessment[8]
Program optimisation	Coordination of regulatory and IT change in a timely and efficient manner, and consideration of shared system impacts to bundle reforms to minimise the number of system releases. *Example: Collectively adopted pathways provide for optimal grouping, sequencing and prioritisation of AEMO, participant and NEM2025 initiatives.*	A Strategic approach scores higher as it gives consideration to shared system impacts and bundling of initiatives to minimise the number of system releases however will impact on participants' ability to deliver BAU initiatives.
Regulatory timelines	Capacity to meet regulatory timeframes. *Example: A strategic/foundational pathway could necessitate delay to the implementation of reform initiative in order to establish new foundational systems/processes.*	A Regulatory Led approach scores higher as it delivers the benefits identified from reforms according to intended or assumed timeframe minimising any delays.
Overall cost efficiency	Implementation of reforms in a timely and efficient manner and at least whole-of-system cost, *Example: A short term focus may require building upon legacy systems that are nearing their end-of-life and need to be replaced. This may still require transition to a target state at a later date adding costs.*	A Strategic approach scores higher as efficiency gains achieved through aligning the delivery of reforms with establishment of frameworks for future state systems. A Regulatory Led approach scores lower despite potentially being cheaper in the short term as it will require transition to target state after reforms are delivered adding costs in the long term.
Risks	Minimises overall implementation risks. *Example: Delay of an individual initiatives over time may create different delivery risks in the future such as the challenges of managing a larger bundle of reforms including resourcing and variations in scope.*	A Regulatory Led approach scores higher overall as total number and scope of initiatives to be implemented is reduced, minimising risk. A Strategic approach also lowers risk by reducing the scale of scope for some strategic initiatives and potentially delaying the implementation of some reforms.
Scalability	Flexibility to adapt to future changes. *Example: The extent to which a pathway delivers target state reforms / initiatives with capabilities beyond those required for 'Day 1'.*	A Strategic approach scores higher as delivery of reforms to leverage the frameworks for future state systems.
Participant investment and operations	Considers impact on participant investments (timing and scale) required for each delivery pathway as well as impacts on participants day-to-day operations and administration. *Example: A regulatory led pathway would maintain existing systems (and pain points) but would require further participant investment to transition to strategic systems over time.*	Both a Regulatory Led and a Strategic approach score equally. A Regulatory Led approach minimises total number and scope of initiatives initially, allowing focus on internal BAU initiatives, but will require more releases over the duration of the roadmap. A Strategic approach is potentially more impactful in the short term but with few releases over the duration of the roadmap.

3.4.2 Alternative approaches

The total volume of work to deliver the Post-2025 reforms (including foundational technology architecture and frameworks) may necessitate alternative ways of working for:

- The reforms to be delivered in a timely and efficient manner, and
- Market participants to benefit from individual reform initiatives sooner rather than later.

[8] Individual trade-off scores ranging from 1-3 were assigned to each approach with a higher number indicating a better score with respect to meeting the overall benefits of the particular trade-off.

For example, AEMO has outlined one such approach – an integrated design – below. This approach would provide for an alternate pathway to those presented in Version 1 of the Roadmap.

Specifically, an integrated design approach could be appropriate for initiatives with key relationships or dependencies, such as Operational Security Mechanism, Ramping/Operating Reserves and Capacity Mechanism (subject to policy decisions).

An integrated up-front design process could enable a single development process to be undertaken accounting for all these initiatives, improving efficiency and reducing risk. Under this approach, the production of rules, procedures, and systems could leverage the up-front design and could be made in parallel while also allowing for a phased implementation of initiatives rather than single integrated release. This approach could avoid re-working linkages between initiatives at each stage of the implementation process.

However, for this approach to work, the following would be required:

- Integrated approach to policy and design development.
- Integrated teams across design, rules and solution/systems development.
- Key elements of policy/rules work to potentially be brought forward/expedited (subject to initiatives in question).
- Agreement among market bodies on critical assumptions/design elements.

AEMO has commenced discussion with the market bodies to determine whether practical opportunities exist for an integrated design approach across initiatives.

3.4.3 Regulatory Implementation Roadmap v7

In addition to the NEM2025 reform initiatives, there are several other reforms currently underway that may similarly impact on implementation overall program. These reforms are captured as part of AEMO's regular publication of the Regulatory Implementation Roadmap[9].

To provide stakeholders with an understanding of the full suite of reforms, AEMO is seeking to update the Regulatory Implementation Roadmap (now Version 7) as part of this process. It is AEMO's intention to integrate the Regulatory Implementation Roadmap and NEM2025 Implementation Roadmap into a single roadmap in mid-2022.

AEMO will host a forum seeking stakeholder feedback on both roadmaps on 11 May 2022.

3.4.4 Preferred pathway

Based on the work performed to date, the RDC has released both pathways, Regulatory Led and Strategic, as Version 1 of the NEM2025 Implementation Roadmap for stakeholder consideration and feedback.

Currently, AEMO's preference is to recommend the Strategic pathway, given:

- The opportunities it presents for overall program optimisation.
- The ability to meet regulatory timelines, although with known potential risks to be managed.
- The opportunities it presents to deliver overall cost efficiency across the wider NEM2025 program.

[9] At https://aemo.com.au/en/initiatives/major-programs/regulatory-implementation-roadmap.

- That while challenging, opportunities exist to mitigate overall risk of implementing the NEM2025 program provided sufficient upfront planning and collaboration among market bodies and participants.
- The ability to leverage the technology architecture and frameworks of future state systems to drive scalability.
- Its potential reduced the overall impact to participant investments and operations over the longer term.

The RDC has similarly endorsed this preference at this time based on overall program optimisation and potential ability to drive cost efficiencies. This endorsement is subject to several caveats including the completion of the business case assessing each pathway option and an assessment of the combined impacts of both the Regulatory Implementation Roadmap (Version 7) and NEM2025 Implementation Roadmap.

4 Next steps

Stakeholder feedback

AEMO welcomes stakeholder feedback and the opportunity to discuss the NEM2025 Implementation Roadmap.

AEMO plans to hold a stakeholder forum on the Regulatory Implementation Roadmap (version 7) and NEM2025 Implementation Roadmap on **11 May 2022** from 10.30 am to 12.00 pm (Australian Eastern Standard Time [AEST]). Please register your interest to attend here by 6 May 2022.

AEMO are particularly interested in responses to the following questions:

- Do stakeholders agree with the grouping, sequencing and prioritisation of the NEM2025 reform and AEMO strategic and foundational initiatives?
- Do stakeholders support pursuing a Strategic pathway to implementing the NEM2025 reform initiatives as is the preference of AEMO and the RDC?

Submissions in response to this Information Paper may be sent to stakeholderrelations@aemo.com.au by 5.00 pm (Australian Eastern Standard Time [AEST]) on 20 May 2022 or alternatively a meeting to discuss feedback either on an individual basis or in a round table setting with individual stakeholder groups could be facilitated should this be preferred.

AEMO and the RDC will review and incorporate stakeholder feedback into the next iteration of the roadmap. This feedback along with the business case will help to inform the preferred implementation pathway as well as how initiatives are grouped, prioritised and sequenced.

RDC

The Committee will continue to meet monthly to discuss the development of the next iteration of the Roadmap, feedback received via this process, and any further changes in initiative scopes or participant impact assessments and opportunities to derive efficiencies or cost savings.

Business case assessment

Over the coming months AEMO will develop a business case considering the alternative pathway options, integrating the NEM2025 Implementation Roadmap and Regulatory Implementation Roadmap and incorporating stakeholder feedback.

AEMO has begun work on this business case. The outcomes of this work, to be completed by June 2022, will be shared with the RDC and will help inform the preferred implementation pathway.

Roadmap integration

As noted above, it is AEMO's intention to integrate the NEM2025 Implementation Roadmap and Regulatory Implementation Roadmap in time for the next publication date, currently scheduled for mid-2022. Work will commence on this process shortly to meet the current schedule.

A1. NEM2025 Implementation Roadmap

A1.1 Regulatory Led pathway

National Energy Market ESB 2025 Reforms
NEM2025 Implementation Roadmap
REGULATORY-LED PATHWAY
Version 1

Key:
- Policy development and design
- AEMO Procedure/Guideline development
- Solution delivery
- Committed effective date
- Rules development (open Rule Change through to Final Determination)
- Detailed pre-execution design
- Production roll Out
- Proposed effective date
- Initiation, including high-level pre-execution design
- Committed solution delivery
- Industry testing and trials
- Estimated effective date
- Proof of concept trial
- AEMO process mapping and optimisation
- AEMO scoping process
- Grouped release
- Resource Adequacy Mechanisms and Ageing Thermal Generation
- Integration of DER and Flexible Demand
- Essential System Services, Scheduling and Ahead Mechanisms
- Transmission and Access
- Data Strategy
- AEMO Strategic / Foundational Pre-requisite

Committed* Final Rule has been published (i.e. certainty on requirements and effective date) * Reform Status only applies to core NEM2025 initiatives
In progress* Rule development in process (i.e. open Rule with at least a Consultation on Draft Determination, or Consultation Paper with clear indication of design)
Conceptual* Policy and market design in process (e.g. Directions Paper on high-level design options, or Review of Framework, details of design remain uncertain)

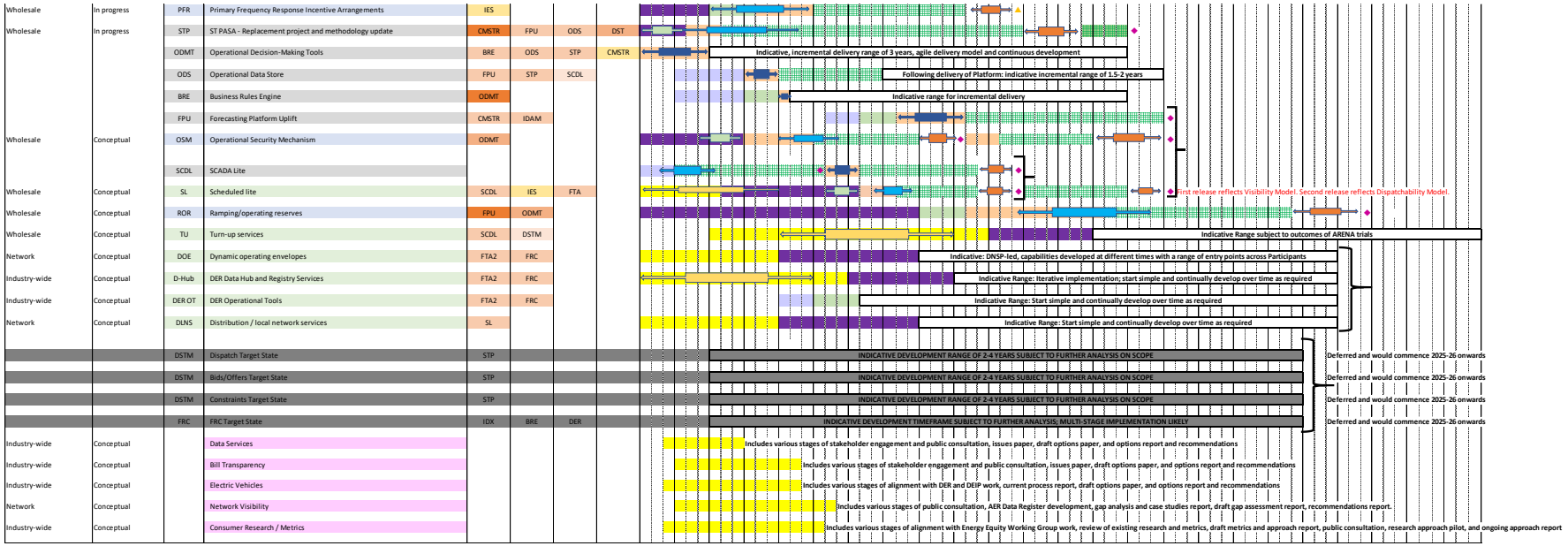
KEY FOR THE TYPES OF DEPENDENCIES
Hard
Hard design
Soft
Soft design

HORIZON 1
HORIZON 2
HORIZON 3
R1 R2 R3 R4 R5 R6 R7
2022 2023 2024 2025 2026 2027
Q1 Q2 Q3 Q4

Impacted Industry Sector	Reform Status	Code	Reform Initiative	Dependencies		
ESB INITIATIVES WITH IT SYSTEM IMPLEMENTATION IMPACTS						
Wholesale, networks	Committed		Efficient management of system strength on the power system			
Wholesale	Committed	FFR	Frequency control - Fast Frequency Response	ODMT	DSTM	IES
Wholesale	In progress	MTP	Increased MT PASA information			
Wholesale	Committed	IES	Integrating Energy Storage	STP	DSTM	
Retail	Conceptual	FTA2	Flexible trading arrangements model 2	FRC	IDX	
		PC	Portal Consolidation (establishment of f/w and architecture)	IDAM		
		CMSTR2	CoMaSTR Phase 2	STP		
		IDAM	Identity and access management (infrastructure establishment)			
		IDX	ESB Industry Data Exchange (infrastructure establishment)	IDAM	PC	

MASS
Deferred and would commence 2025-26 onwards
Deferred and would commence 2025-26 onwards
Deferred and would commence 2025-26 onwards
Deferred and would commence 2025-26 onwards

Appendix A1. NEM2025 Implementation Roadmap



A1.2 Strategic pathway

National Energy Market ESB 2025 Reforms
NEM2025 Implementation Roadmap
STRATEGIC PATHWAY
Version 1

Key:
- Policy development and design
- AEMO Procedure/Guideline development
- Solution delivery
- Committed effective date
- Rules development (open Rule Change through to Final Determination)
- Detailed pre-execution design
- Production roll Out
- Proposed effective date
- Initiation, including high-level pre-execution design
- Committed solution delivery
- Industry testing and trials
- Estimated effective date
- Proof of concept trial
- AEMO process mapping and optimisation
- AEMO scoping process
- Grouped release
- Resource Adequacy Mechanisms and Ageing Thermal Generation
- Integration of DER and Flexible Demand
- Essential System Services, Scheduling and Ahead Mechanisms
- Transmission and Access
- Data Strategy
- AEMO Strategic / Foundational Pre-requisite

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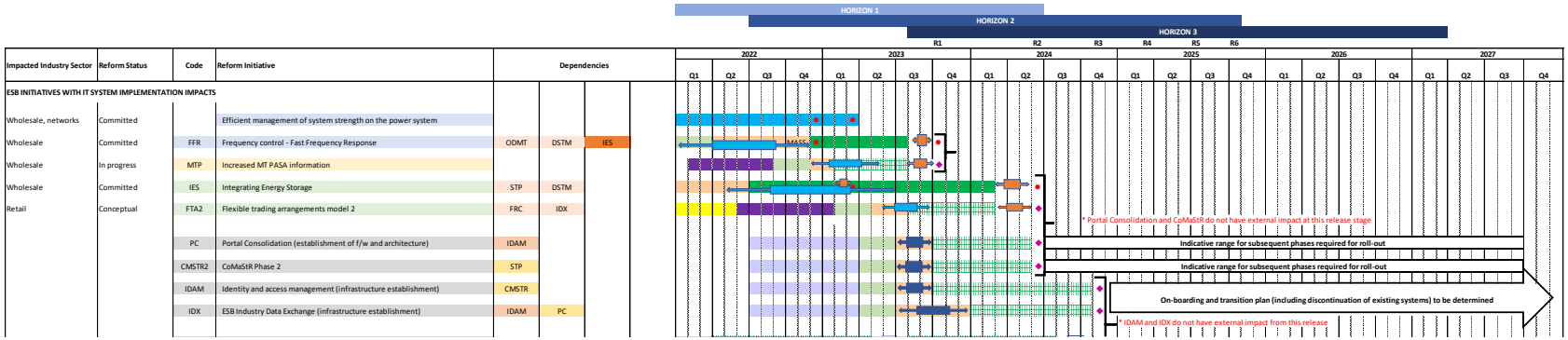
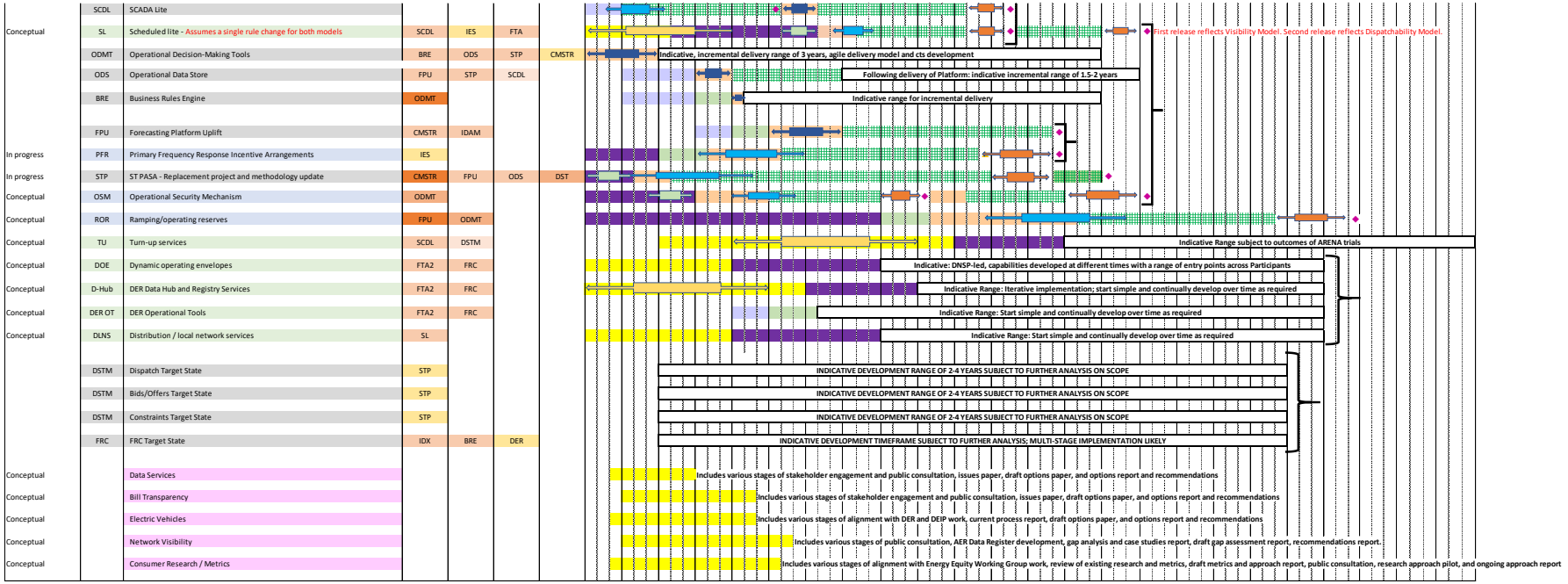
KEY FOR THE TYPES OF DEPENDENCIES
- Hard
- Hard design
- Soft
- Soft design



Appendix A1. NEM2025 Implementation Roadmap