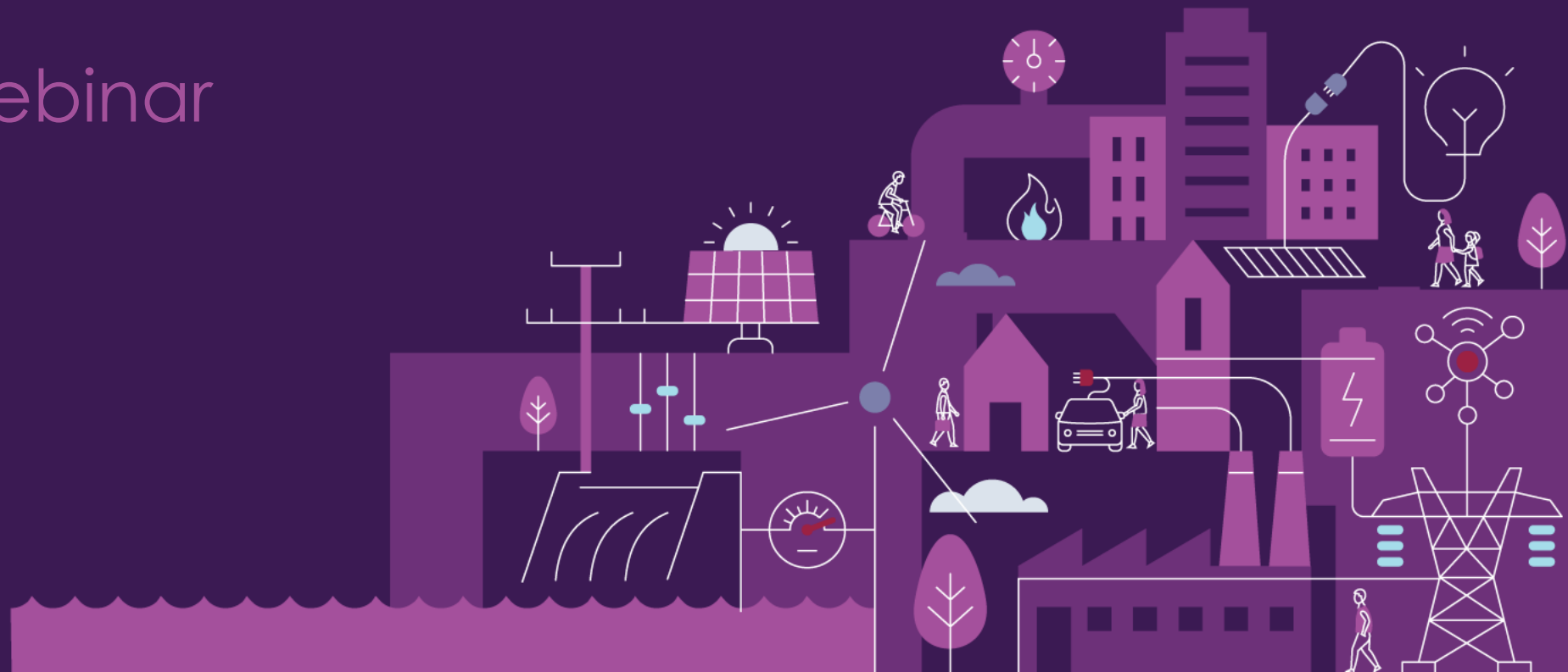


Engineering Roadmap and Transitional Services Guideline

NEM public webinar

22 August 2024





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.

'Journey of unity: AEMO's Reconciliation Path' by Lani Balzan

AEMO Group is proud to have delivered its first Reconciliation Action Plan in May 2024. *'Journey of unity: AEMO's Reconciliation Path'* was created by Wiradjuri artist Lani Balzan to visually narrate 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.

Read our
RAP 



NEM Engineering Roadmap

Public webinar

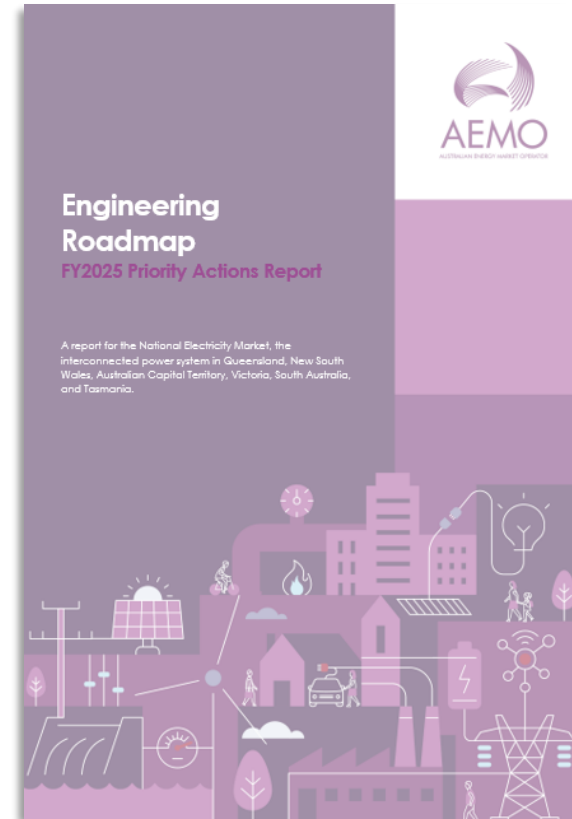
22 August 2024



Objectives

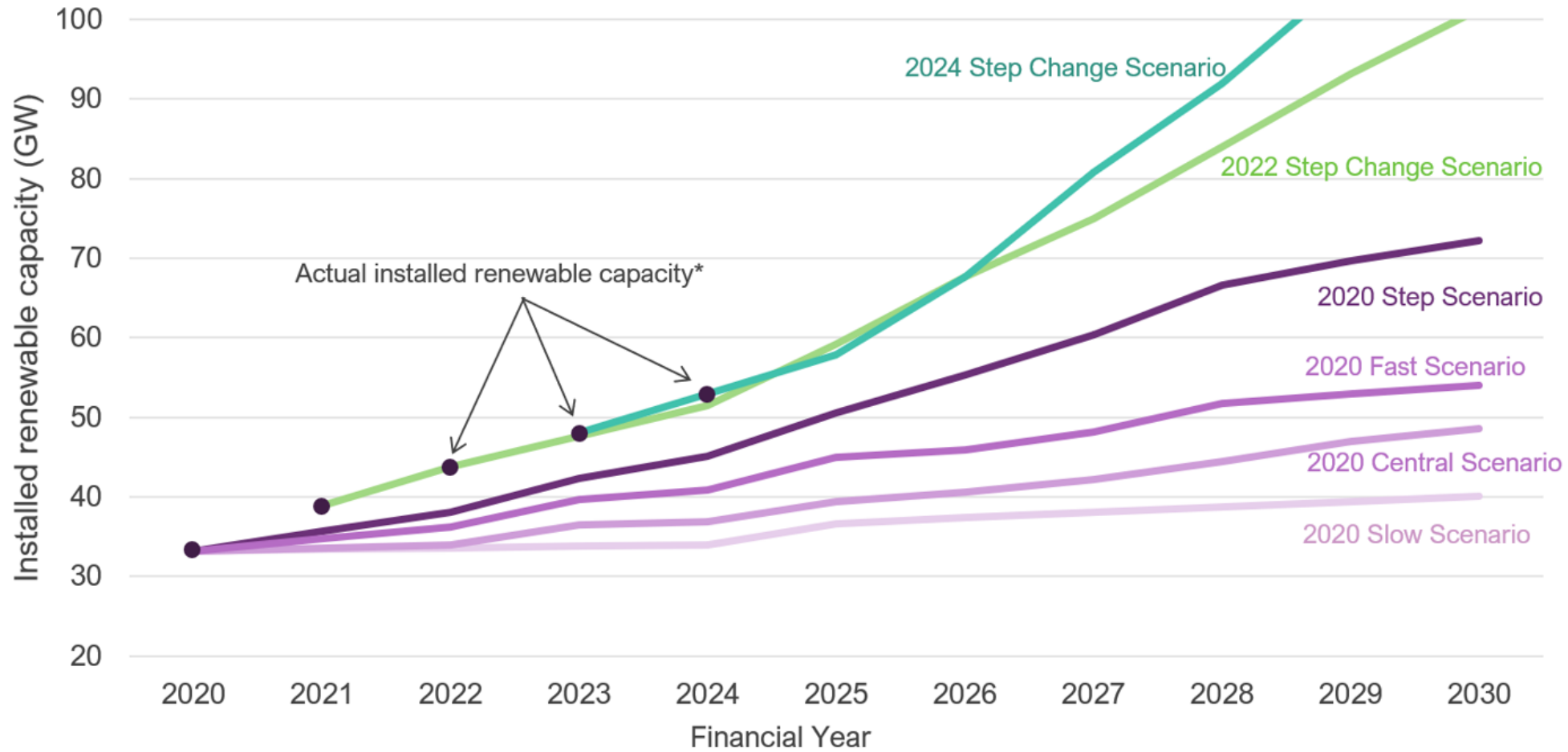


- Scene setting – reflect on the state of the energy transition
- Present an overview of the NEM Engineering Roadmap FY25 Priority Actions Report
- Introduce the Transition Plan for System Security



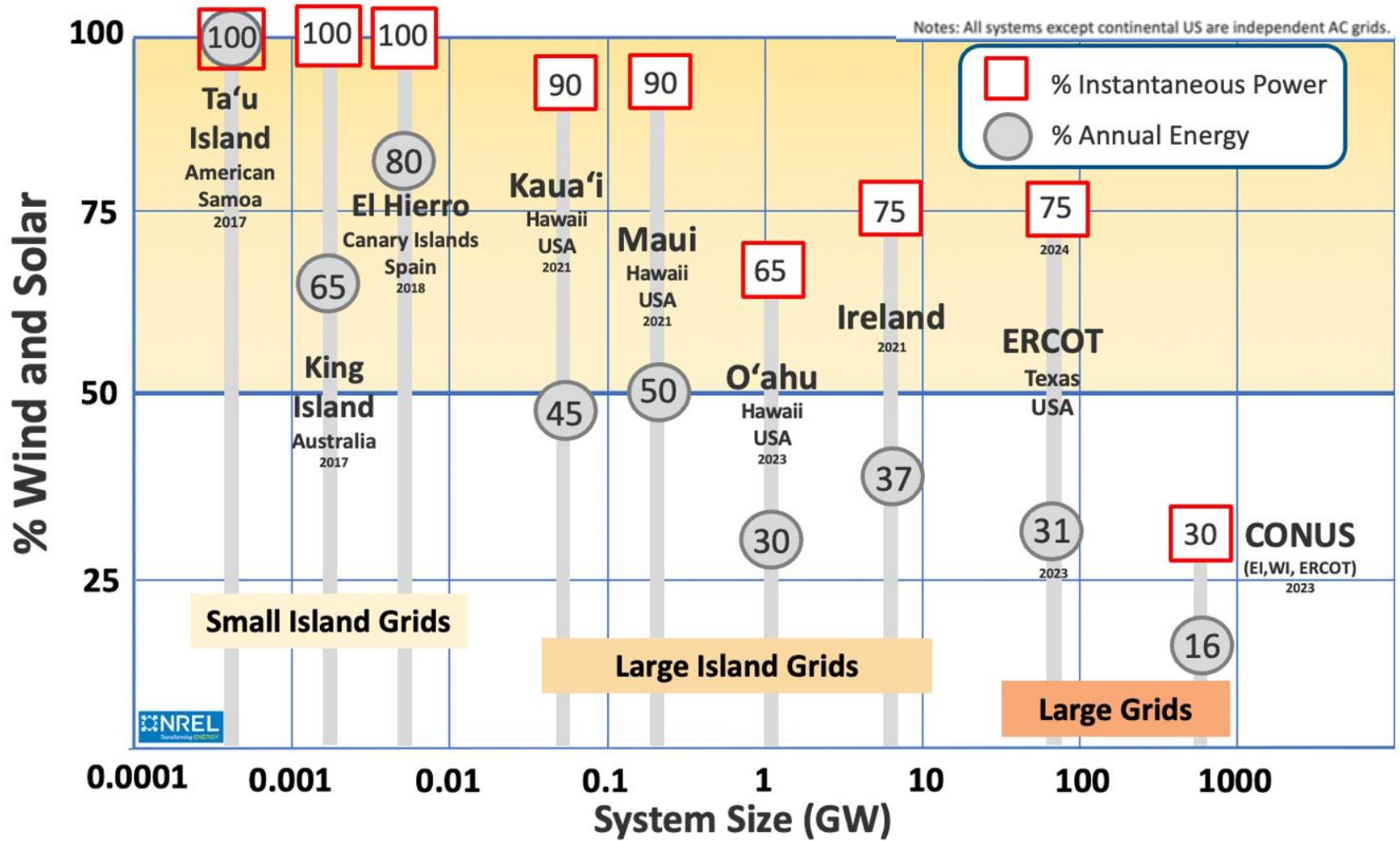
Read the [report and associated material](#)

State of the transition

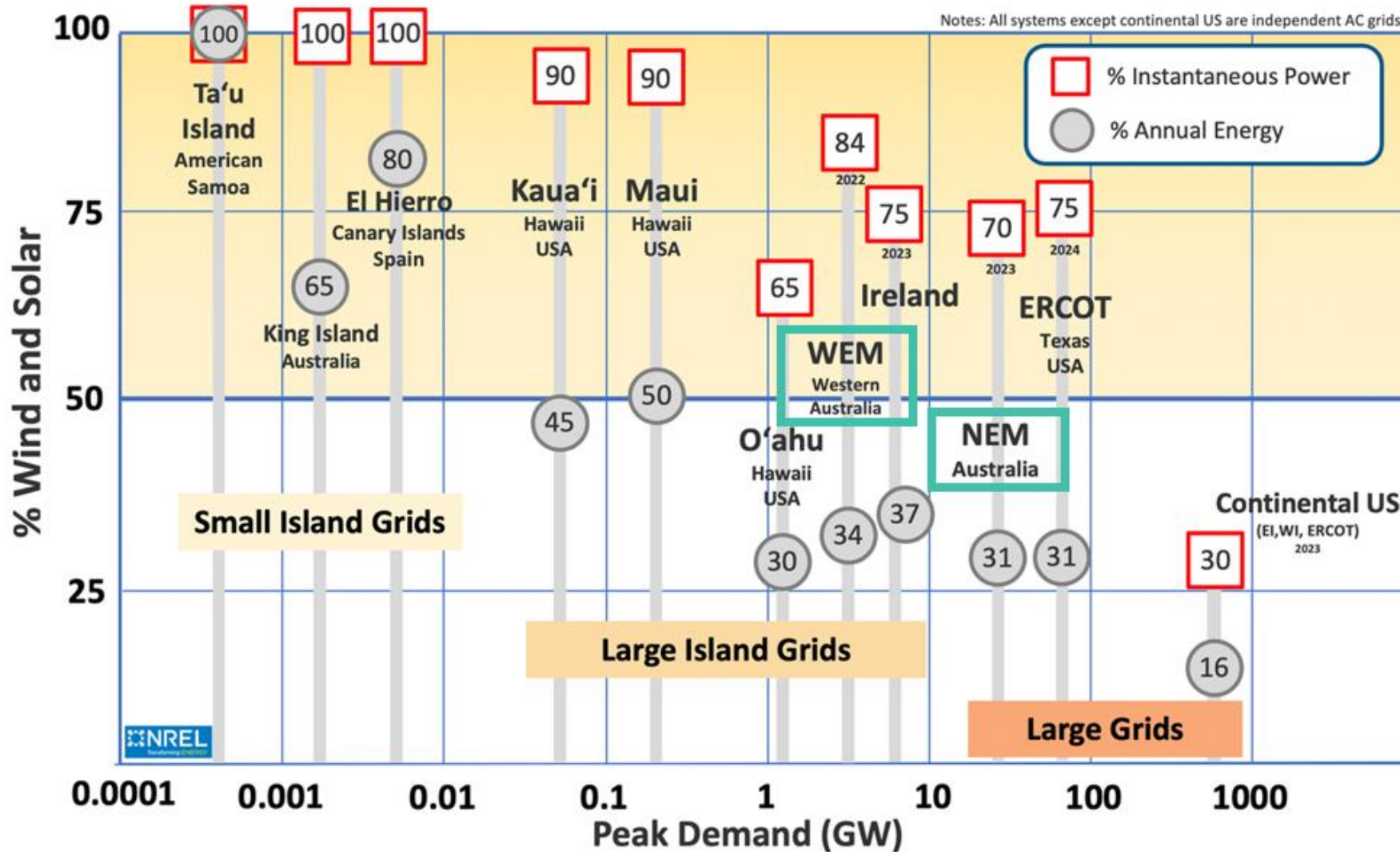


*Renewable capacity includes the following technology types: hydro, utility storage, coordinated consumer energy resources (CER) storage, passive CER storage, offshore wind, onshore wind, utility solar, rooftop solar and other distributed solar.

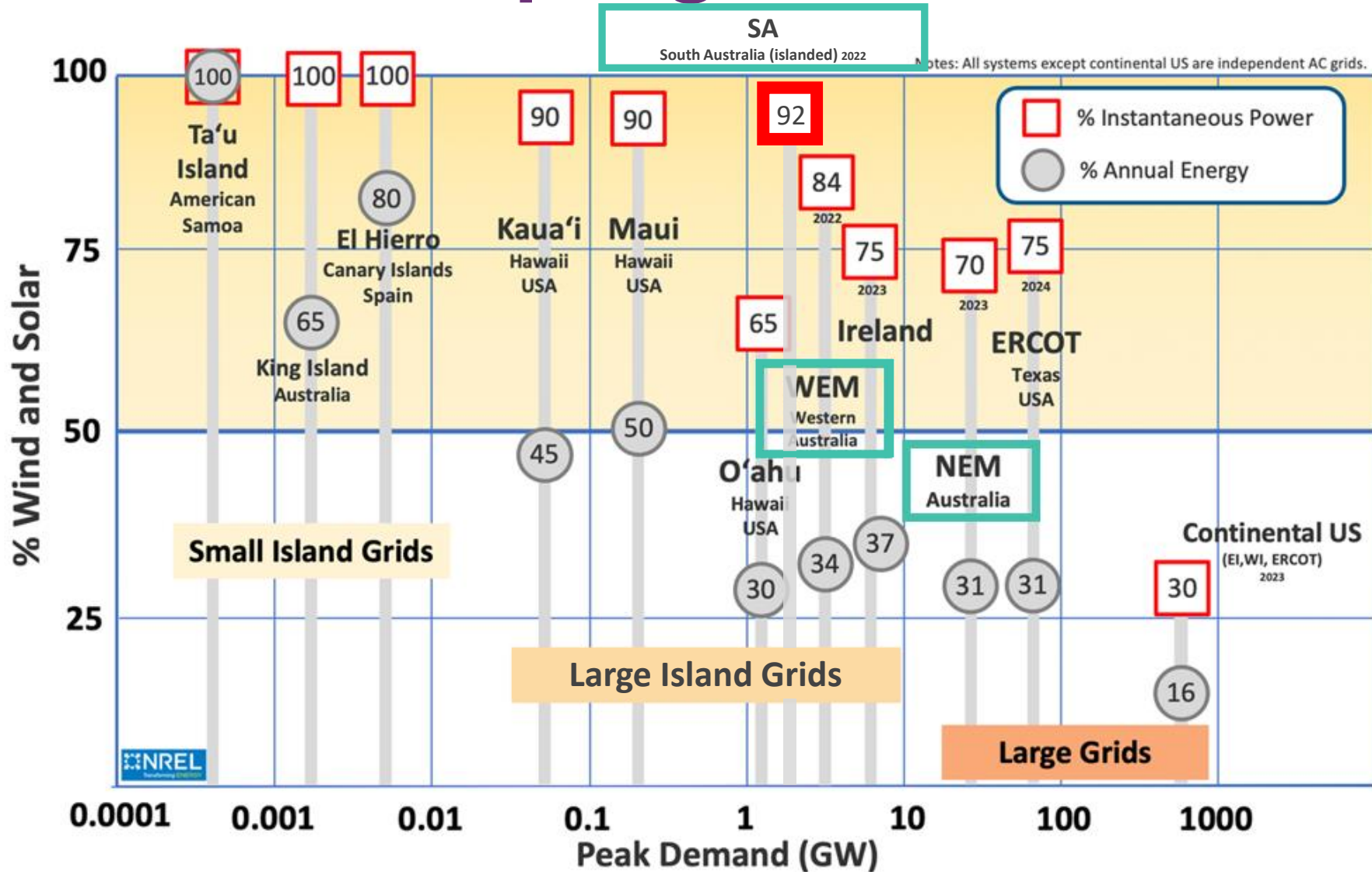
International progress



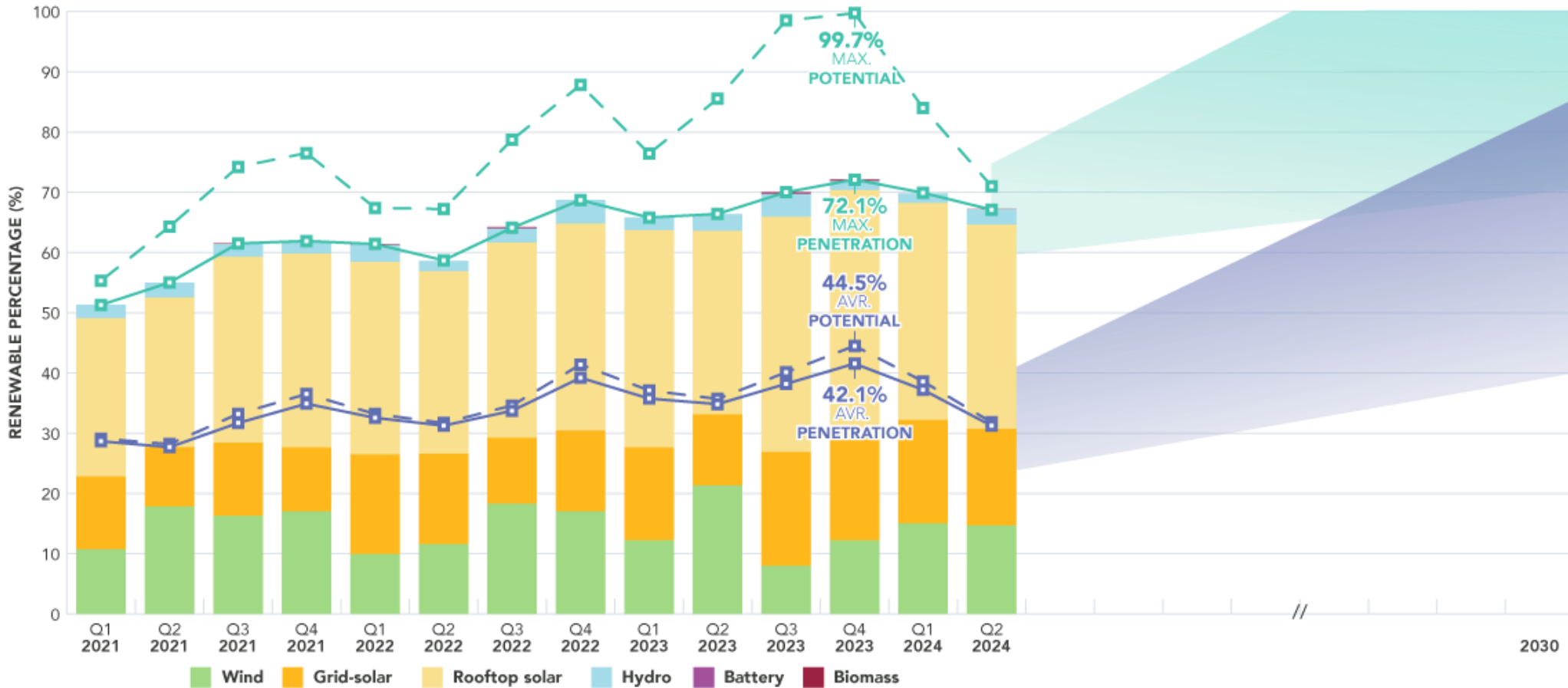
International progress



International progress



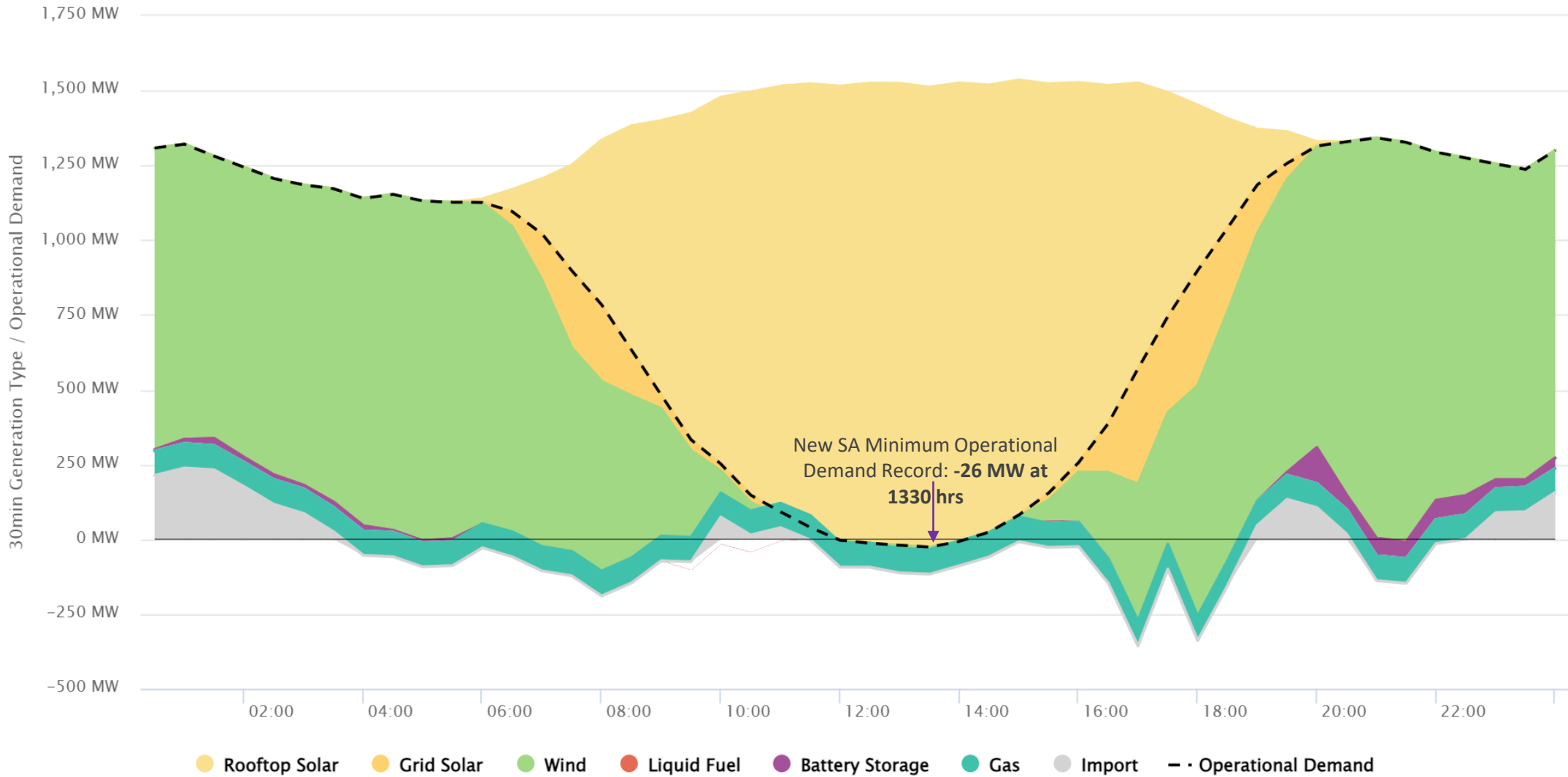
Renewable contributions are increasing rapidly



Potential: available renewable generation given weather conditions for a 30-minute window – regardless of whether available generators are running

Penetration: generation actually produced by renewables over 30 minutes

Rooftop solar hits 100% in SA



SA Generation Mix for 31 December 2023

NEM Engineering Roadmap journey

March 2021

July 2021

December 2021

June 2022

December 2022

June 2023

August 2024

Engineering Framework

Engineering Roadmap

Stocktake of work in progress across industry



Defining future operational conditions

- 1 Fewer synchronous generators online
- 2 Ubiquitous rooftop solar
- 3 Extensive grid-scale VRE
- 4 Structural demand shifts
- 5 Responsive demand
- 6 Widespread energy storage

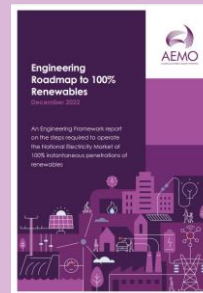
Comprehensive gap analysis

300+ individual potential gaps

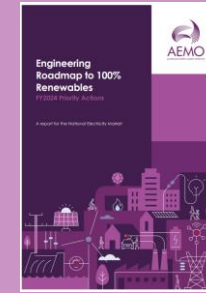
FY23 priority actions



Engineering Roadmap to 100% Renewables



FY24 priority actions

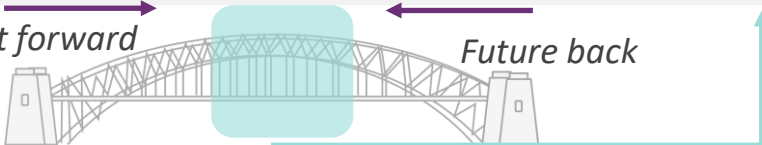


FY25 priority actions

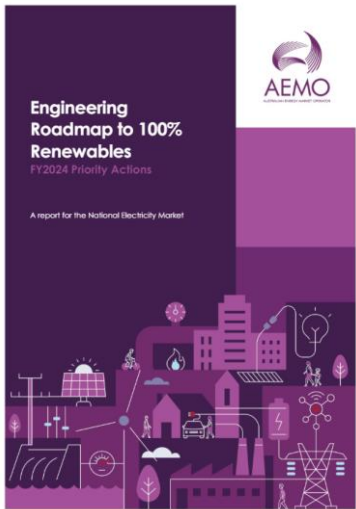


Present forward

Future back



Progress over past 12 months



Implementation of [FY24 priority actions](#) (17/18 completed, 1 in progress)

FY2024 Progress

Enabling high penetrations of distributed energy resources (DER)

Ensuring DER technologies are integrated in a way that maintains secure and reliable power system operation, and that enables a two-way power system.

- Improved compliance with AS/NZS4777
- Input into draft CER Roadmap
- Promoted device coordination and aggregation requirements
- Technical requirements for <5MW connections with DNSPs
- Backstop design requirements defined and communicated
- Functional requirements defined and gaps assessed with DNSPs
- Engaged with government and bodies on DER cyber security

Conducting future power system studies

Understanding the power system requirements of a future with uncharted operating conditions and new phenomena to determine secure operating envelopes.

- Power system analysis studies on system strength, inertia and voltage control
- Role and need for inertia report published
- System restart process updated for near-term conditions
- Assessment of high DPV system security issues, with updated procedures for VIC and SA
- Q4 2023 Frequency Report details frequency performance

Enabling new solutions to address system needs

Accelerating the development and understanding of new technologies in a timely manner, while ensuring their performance is appropriate and can be relied upon to maintain a secure and resilient power system.

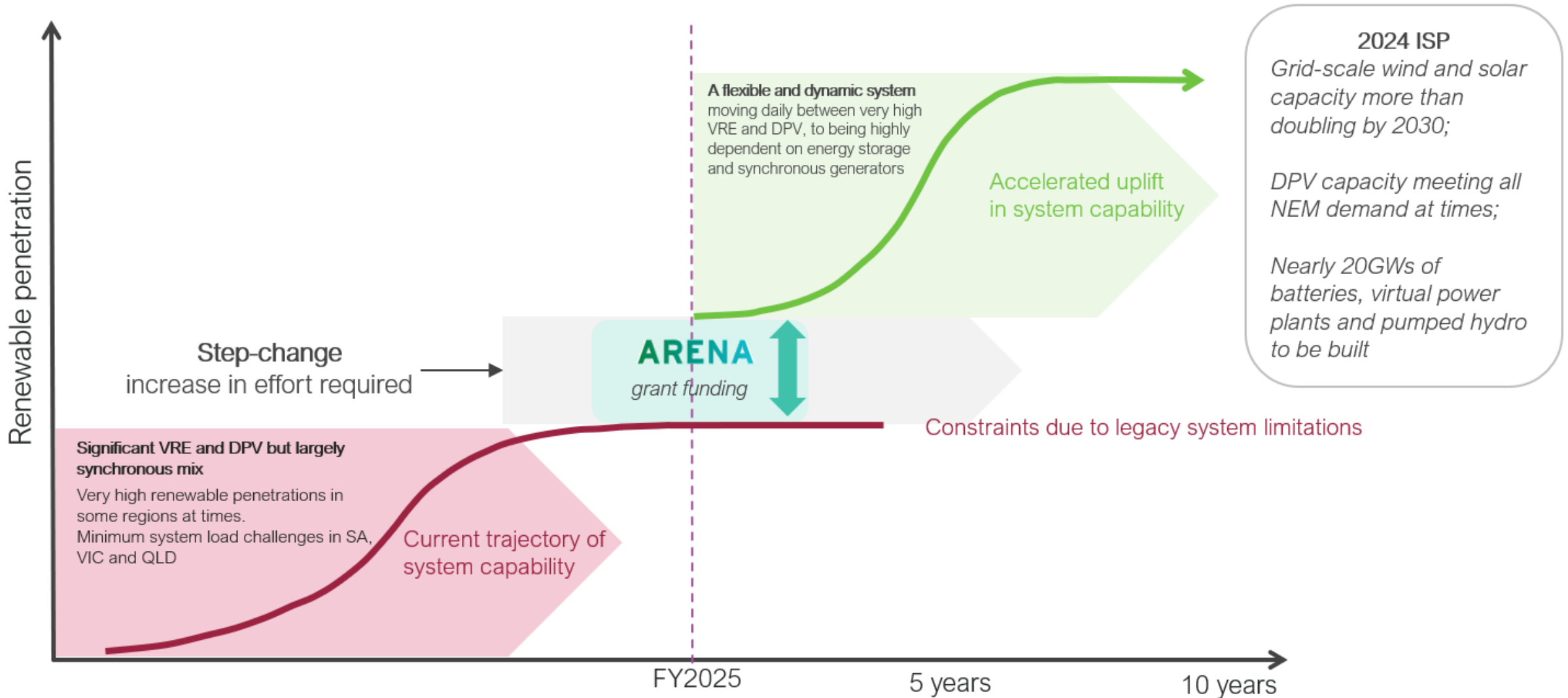
- Grid-forming (GFM) inverter core requirements test specifications published
- Consensus on system support capabilities for GFM inverter technologies established across all project phases
- Improving security frameworks rule change

Building operational readiness

Successfully navigate previously untested and uncharted operating territory, keeping within operational risk tolerances and aligning with societal expectations for secure and reliable supply.

- Established Operational Transition Planning governance and processes
- 100% Inverter Based Resource Study – Tasmania Region
- Weather data quality assessment for operational readiness

2025 step-change uplift



FY2025 Priority Actions

- Committed to 37 actions in FY2025 across six workstreams

Priority focus areas

Delivering foundational transition enablers



Providing long-range investment visibility



Progressing operational readiness



Workstreams

DER Governance

Operational DER integration

Future power system phenomena

New technology capabilities

Operational transition planning

RTO and operations support

Actions

16 actions

11 actions

10 actions


Focus Area 1: Delivering foundational transition enablers


What: Collaborating closely with stakeholders to establish critical foundations for the future power system, including defining roles and responsibilities for new technical matters, and establishing effective processes for future system operation.


Why: *Many foundational requirements have long lead times and will require early mobilisation to enable a timely and efficient transition.*

Example Actions: supporting world-leading DPV uptake

Target outcome: Sufficient volumes of new DPV are compliant with current performance standards and reliably respond to emergency signals to enable secure operation at high DPV penetration.

 *Enabling participation pathways for DER and load flexibility in the daytime*
(FY25_5, FY25_6)

 *Emergency backstop for DPV across NEM mainland regions*
(FY25_3)

 *Governance frameworks for DER compliance with AS/NZS4777 & backstop*
(FY25_4)

Workstreams

 **DER Governance**

 **Operational DER integration**

Focus Area 2: Providing long-range investment visibility

What: Identifying future power system needs that may require investment from one or more parties and providing clarity on the capability of different technologies to meet these needs.

Why: *Investors require timely signals and clear regulations and standards to deliver investments ahead of real-time needs.*

Example Actions: grid-forming (GFM) inverters

Target outcome: Clarity for investors on the expectations of GFM inverters and how services from these devices will be valued.



Investigate synthetic inertial response (FY25_23)



Knowledge Sharing Report on the performance of GFM-battery energy storage system (BESS) (FY25_27)



Initial Synthetic Inertia Specification

Workstreams



Future power system phenomena



New technology capabilities

Focus Area 3: Progressing operational readiness

What: Maintaining power system security in real-time operations (RTO) under unprecedented penetration of variable, inverter-based, and distributed resources.

Why: *Early preparation for key operational transition milestones is critical to a timely transition and to avoid unnecessary interventions that increase costs borne by consumers.*

Example Actions: navigating operational transition points

Target outcome: The proactive management of power system requirements with minimum synchronous units ahead of time, avoiding costly delays to the transition



Operational transition planning and procedures in each region (FY25_35, FY25_36)



Governance process for operational transition points (FY25_34)



Initial Transition Plan for System Security

Workstreams



RTO and operations support



Operational transition planning

Transition Plan for System Security

Transition plan for system security

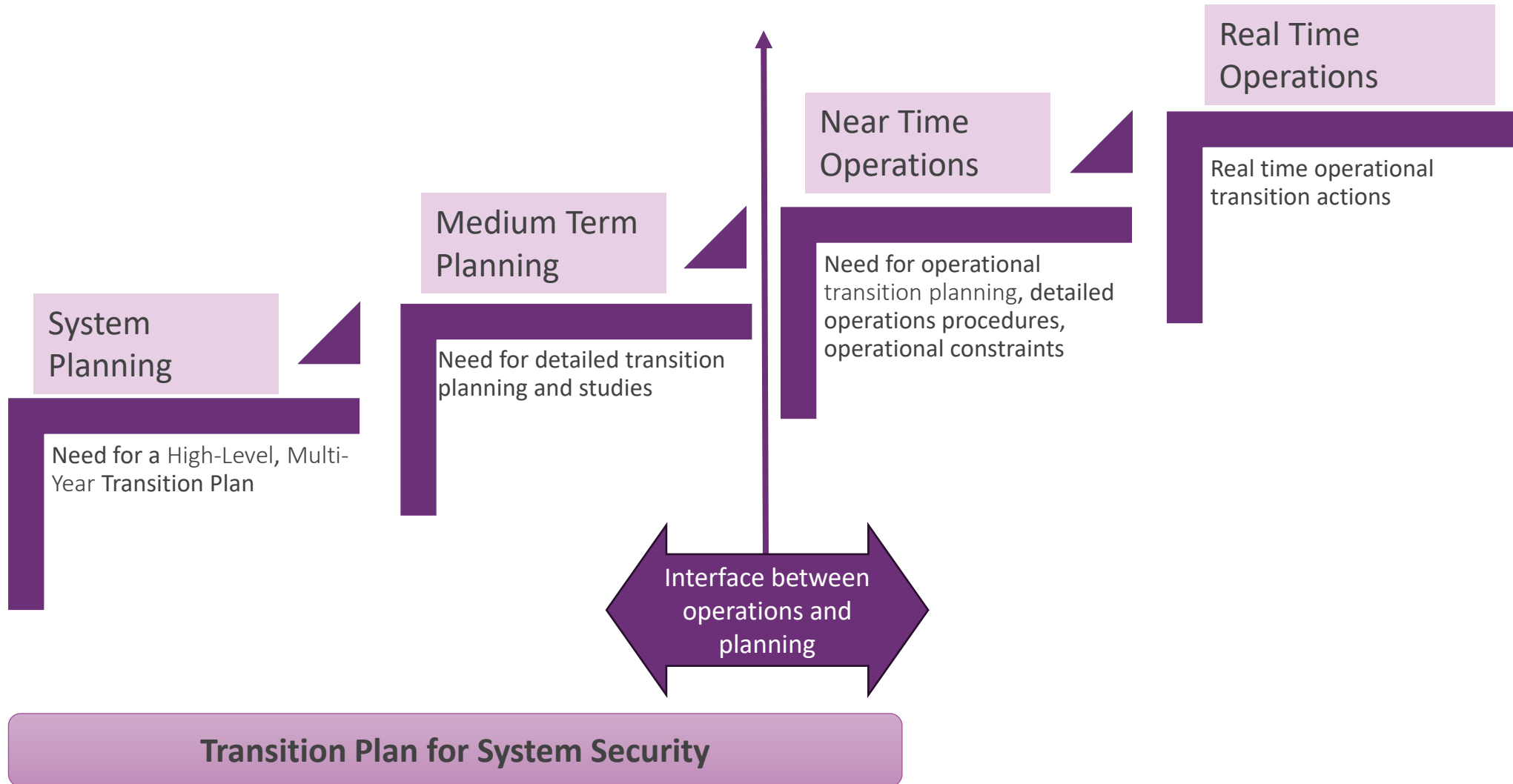
NER 5.20.8 Publication of the Transition Plan for System Security

(a) AEMO must publish annually by 1 December the Transition Plan for System Security on its website.

(b) The purpose of the Transition Plan for System Security is to make available to Market Participants and other interested persons an analysis of:

- (1) how AEMO is planning to maintain power system security through the transition to a low- or zero-emissions power system;
and
- (2) AEMO's current technical understanding of what is needed to achieve power system security in a low- or zero-emissions power system and the work AEMO is undertaking to improve this understanding and to specify the range of services that will be required in a low- or zero-emissions power system.

Operational transition planning



Transition plan for system security



Horizon 1
Now – 2 years

Identification of near-term 'operational transition points' and progressing their coordinated navigation.

Horizon 2
2 – 5 years

Identification of upcoming operational transition points, and screening studies to prioritise emerging system needs and regional requirements.

Horizon 3
5 years+

Identification of emerging power system requirements, future-back preparation for 100% renewables, targeted research outcomes.



TRANSITION PLAN FOR SYSTEM SECURITY

Stakeholder input

Questions

- What information should AEMO include in *The Transition Plan for System Security* to help stakeholders navigate upcoming Operational Transition Points as renewable penetration continues to increase?
- Where is additional coordinated effort required for the system to maintain security while transitioning to higher penetration of renewables?
- What actions are required to accelerate renewable penetration towards 100%?
- How would you like to be engaged with for the development and publication of the *Transition Plan for System Security*?

Interested parties are encouraged to submit feedback to these questions to futureenergy@aemo.com.au by **5 September 2024**.

Next steps

- Implementation of FY2025 Engineering Roadmap Priority Actions
- Stakeholder feedback on Transition Plan for System Security
- Publication of Transition Plan for System Security by 1 December
- Contact Future Energy Systems team on:
futureenergy@aemo.com.au



AEMO

AUSTRALIAN ENERGY MARKET OPERATOR