

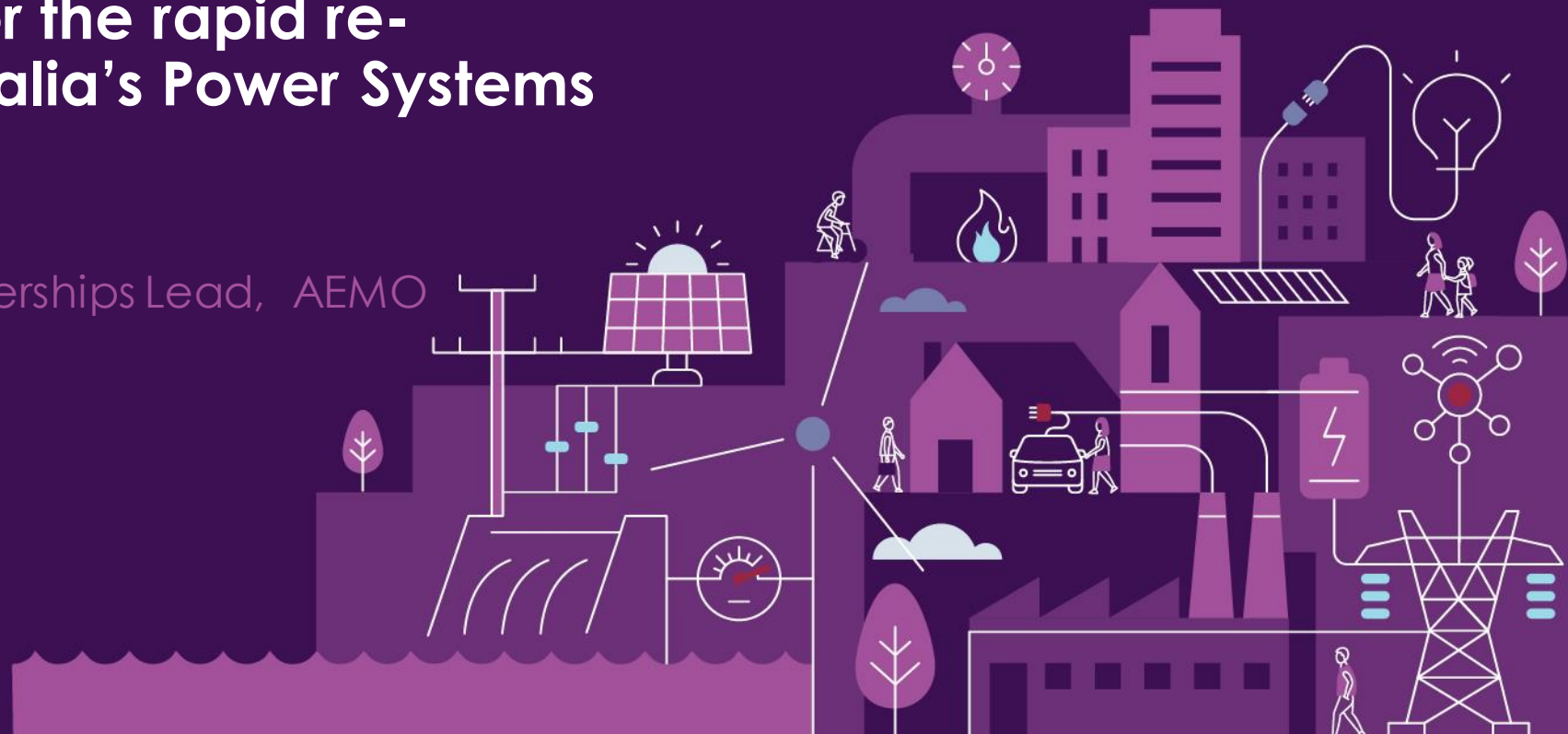


State of Energy Research Conference

Research Priorities for the rapid re-
engineering of Australia's Power Systems

14-16 February 2024

Kevin Cryan, Research Partnerships Lead, AEMO



We acknowledge the Traditional Owners of country
the Whadjuck Nyoongar and recognise their
continuing connection to land, waters and culture.

We pay respect to Elders past and present.

Big Issues Affecting the Future



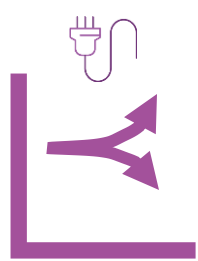
Emissions must reduce



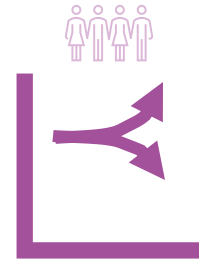
Coal is retiring



Distributed energy will increase



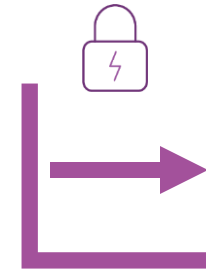
Demand is uncertain



Social licence is unclear



Rising cost of living pressures



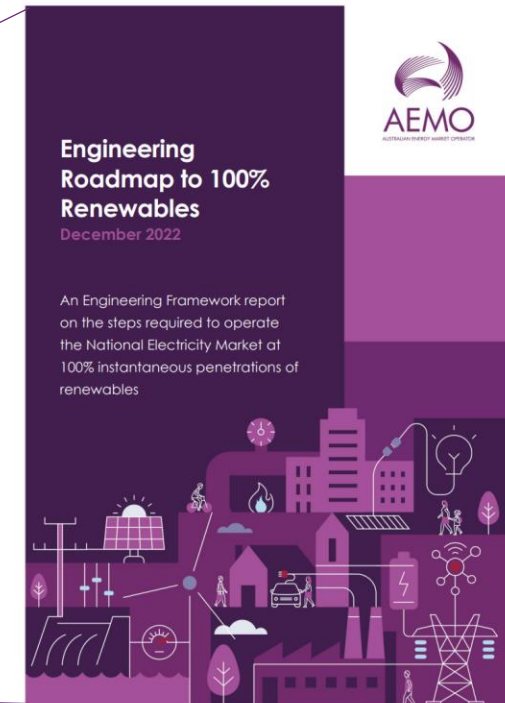
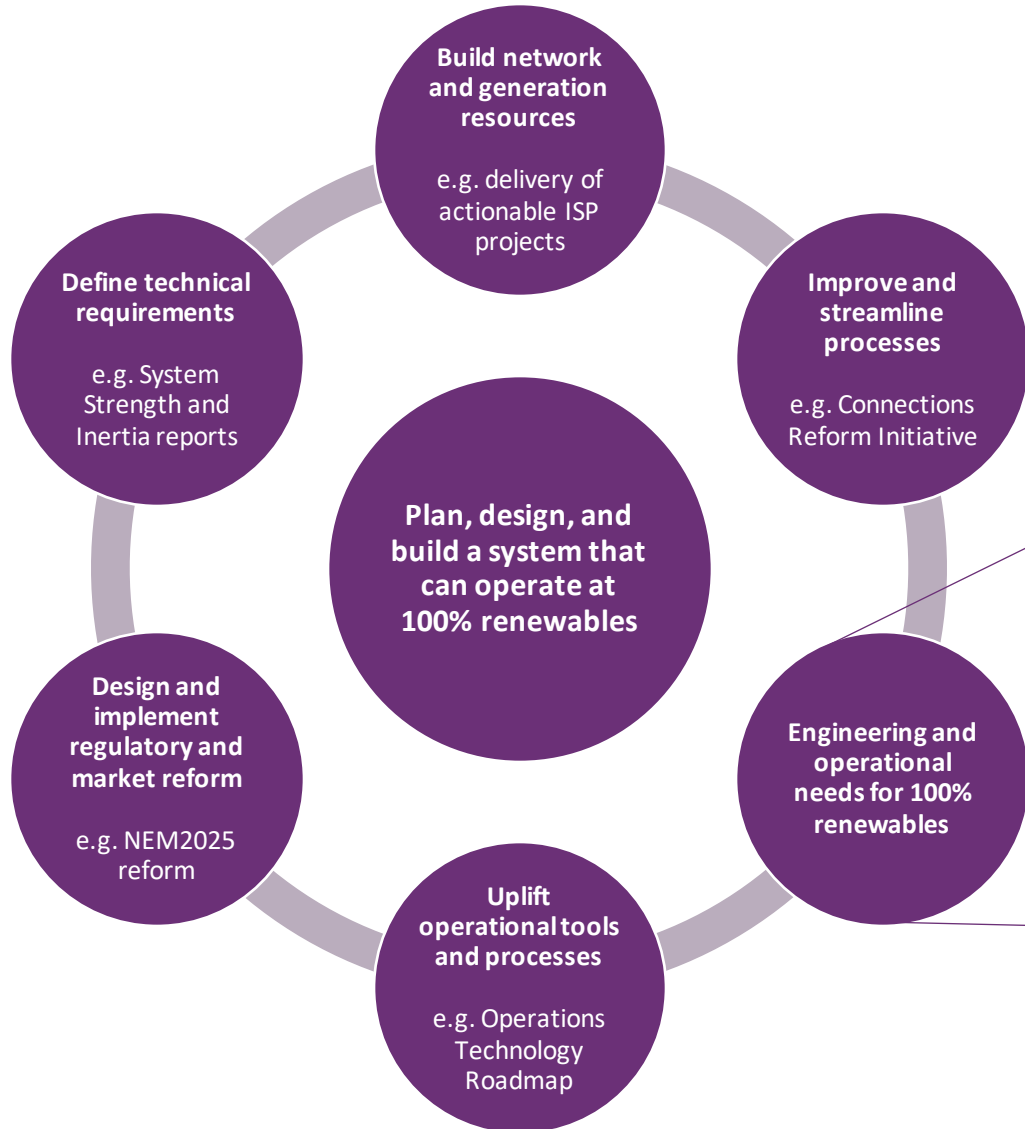
Reliability must be maintained

The ISP balances these issues to find the most appropriate mix of energy infrastructure investment to provide safe, reliable, affordable and sustainable energy for consumers.



Diverse new renewable generation ... interconnected with more transmission.... firmed by storage... and backed up with gas generation.

Preparing for 100% renewables



Engineering Roadmap structure

Power system security

- Frequency & inertia
- Transient & oscillatory stability
- System strength & converter driven stability
- Voltage control
- System restoration

System operability

- Monitoring & situational awareness
- Operational processes
- Power system modelling

Resource adequacy & capability

- Utility-scale variable renewable energy (VRE)
- Distributed energy resources (DER)
- Structural demand shifts
- Transmission
- Distribution
- Firming

AEMO Research Areas of Interest

Theme 1 – Power Systems Security



Methodologies for planning for future requirements and services

Resilience and risk profile of future system operations



Performance of new technologies

Investigating the performance of inverter-based resources



AEMO Research Areas of Interest

Theme 2 – System Operability



Optimisation models and tools



System studies to assess the stability and dynamics of the future system



Screening tools and methods to identify the range of potential instabilities that might emerge

AEMO Research Areas of Interest

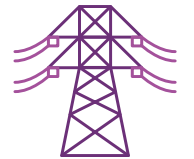


Theme 3 – Resource Adequacy and Capability



Influence of climate change and weather variability

Building and integrating new network and generation assets



Decision-making frameworks for investment planning under uncertainty

Resilient and robust communication architectures



The Role of the Research Partnerships Lead

Supporting AEMO Business Units

Developing research priorities to share with the research community and securing engagements of interns, secondments, PhDs

Relationship Management Research Funders

Collaborating with research funders such as DCCEE, ARENA, CSIRO, Race for 2030, State Government and to provide the financial support our research partners require to deliver value to AEMO

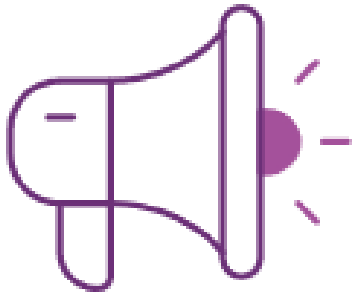
Relationship Management Research Providers

Mapping the inventory of Australian research to AEMO's nominated areas and collaborating to bring research projects to life

Establish policies and governance processes that streamline:

- AEMO initiated requests for applied research
- AEMO input to 3rd party research funding requests and proposals
- AEMO agreements with research and funding organisations
- Postgraduate and undergraduate Internship programs within AEMO

AEMO Engineering Roadmap FY2024



AEMO's Engineering Roadmap FY2024 Priority Actions Report, outlines the activities AEMO planned to undertake in the 2023–24 financial year (FY2024) to help prepare the National Electricity Market for operation at times of 100 percent instantaneous renewables. Link to report can be found here [Engineering Roadmap FY2024 Priority Actions Report](#)

[engineering-roadmap-to-100-per-cent-renewables.pdf \(aemo.com.au\)](#)

AEMO's Engineering Roadmap FY2025 is expected to be released in July.

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For more information visit

aemo.com.au

AEMO Research Areas of Interest

Theme 1 – Resource Adequacy and Capability

This theme relates to research that supports building and integrating energy resources and network capability to enable future renewable potential, and the flexible capacity to balance variability in generation and demand.

- Projecting the influence of climate change and weather variability, including tail-end risks relating to renewable generation performance and consumer demand.
- Consideration of the social licence aspects of building and integrating new network and generation assets at all scales, including the consumer acceptance and engagement relating to active and managed participation of distributed energy resources.
- Decision-making frameworks for investment planning under uncertainty, which reflect the range of risks that can impact project delivery and benefit, such as: forecast uncertainty, supply chain risks, development and planning approvals.
- Scalable tools, models and processes to accurately estimate the locational and aggregate MW contribution of DER for system balancing and characterise the dynamic performance of devices during disturbances.
- Information models, protocols and processes to assist DNSPs to manage increasingly complex interactions within their networks and effectively coordinate with TNSPs and AEMO, and to eventually serve as a platform for system-level flexibility.
- Resilient and robust communication architectures, fall back mechanisms and processes, to support increasing criticality and importance of services and energy provision.

AEMO Research Areas of Interest

Theme 2 – Power Systems Security

This theme centres on research that could inform methodologies and decision-making to maintain the secure technical operating envelope of the power system under increasing renewable penetrations.

- Methodologies for planning for future requirements and services needed to provide system strength, inertia, system restoration, and other technical attributes.
- The underlying resilience and risk profile of future system operations, appropriate metrics, and indicators that can be used as the basis for operational risk management practices, control room alarms, and design of control schemes and other mitigation measures.
- The performance of new technologies, such as grid-forming inverters, and their ability to contribute to maintaining a stable power system.
- Investigating the performance of inverter-based resources to initiate or support the restart process, including building an understanding of the impact and opportunity of DER devices during restoration.

AEMO Research Areas of Interest

Theme 3 – System Operability

This theme considers how research could inform and build AEMO's ability to securely and reliably operate the power system and transition through increasingly complex operating conditions.

- Optimisation models and tools for the assessment and scheduling of energy and capacity over operational timeframes, extending upon reserve management current practice based on assessment of capacity adequacy across different timescales.
- Methods and techniques to help transition from deterministic to probabilistic and consensus-based quantification of forecast variability and uncertainty, allowing for risk-based operational look ahead and dynamic security assessment.
- System studies to assess the stability and dynamics of the future system, guided by simulation across different dispatch scenarios reflecting the transition in and out of high renewable (both high VRE and high DER) periods.
- Screening tools and methods to identify the range of potential instabilities that might emerge in high IBR power system.
- Targeted studies applying to assess different system needs and scarcities to prompt more detailed investigation and to guide 'no regrets,' risk-based decision making in the planning timeframe.