SALLY McMAHON | AEMC COMMISSIONER

Australian Energy Market Commission

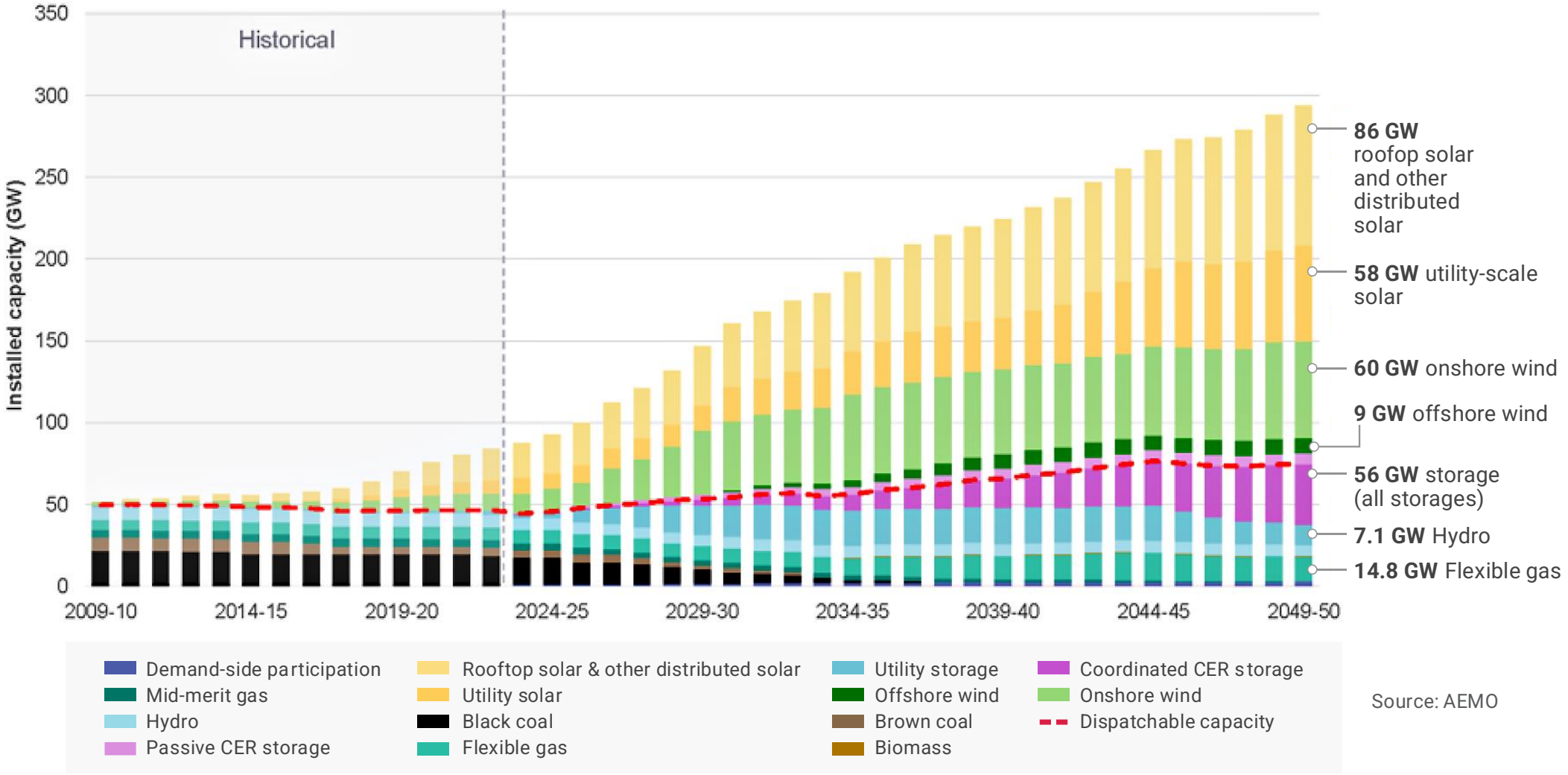
CHALLENGES IN TRANSMISSION AND NEW ENERGY SOURCES

Electricity Security Advisory Board, High Level Meeting, IEA

Paris, September 2025

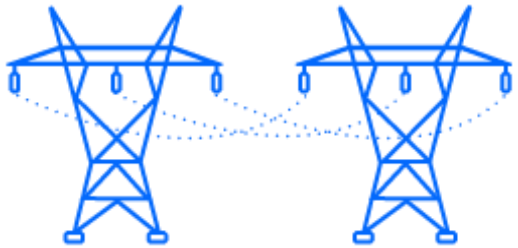
The scale of investment

Six times today's utility-scale wind and solar, five times today's consumer energy resources by 2050

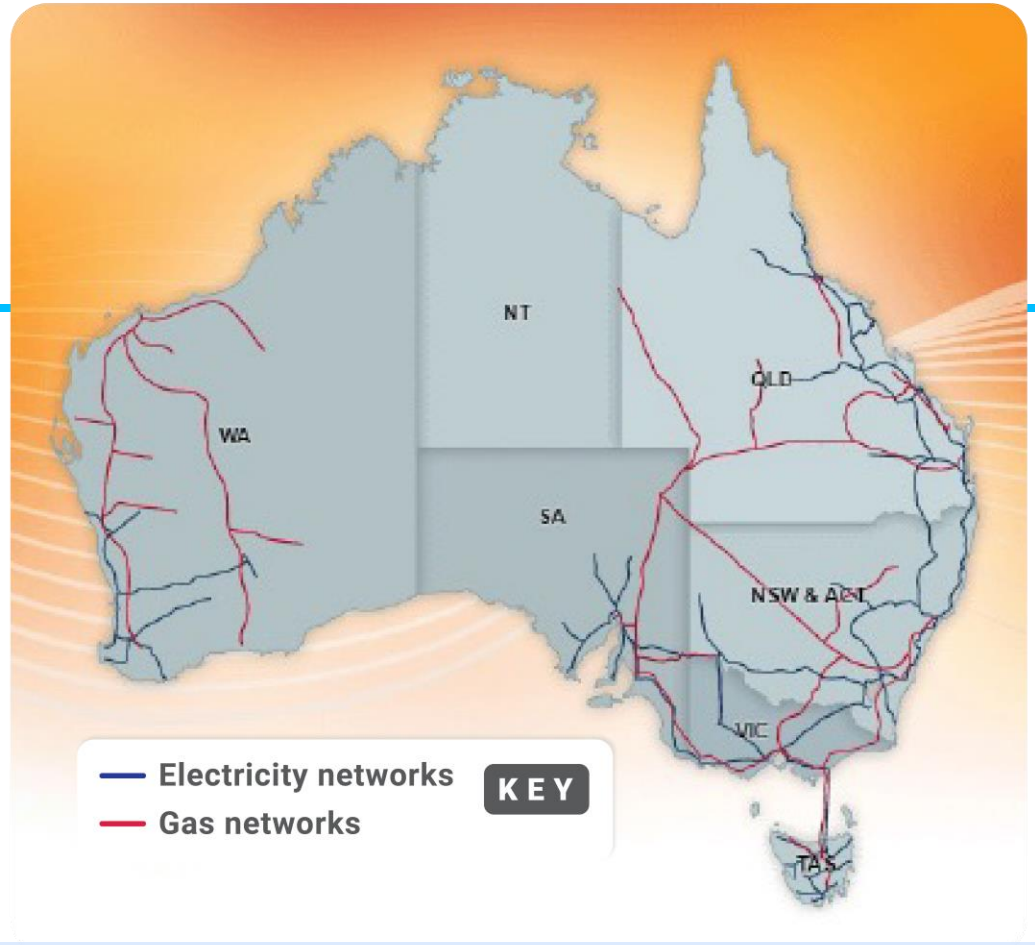


Source: AEMO

Australia’s energy networks



764,000 km
of distribution lines,
and **44,000 km**
of transmission



Regulatory asset base:

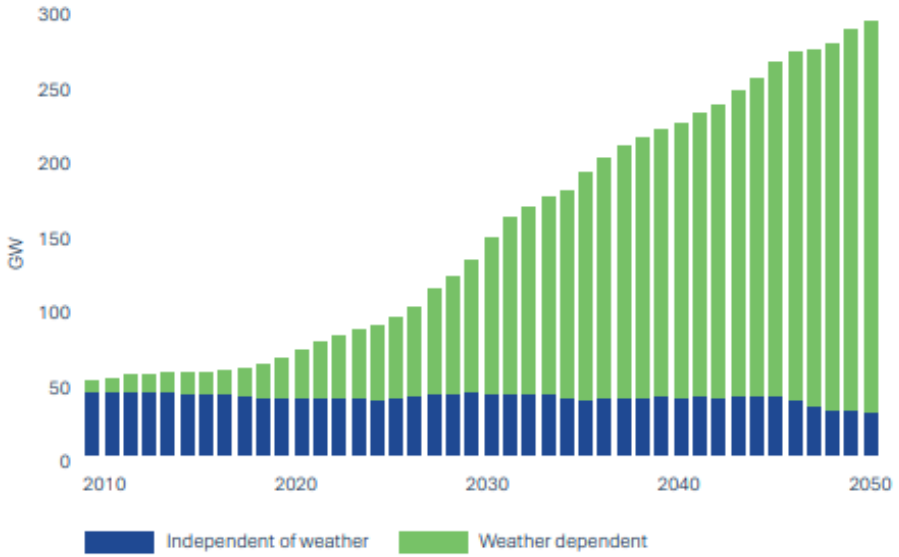
- Total **$123.2 bn**
- RAB per customer cost **$11,160 AUD** (€6250)

Source: AER, State of Energy Market, 2025

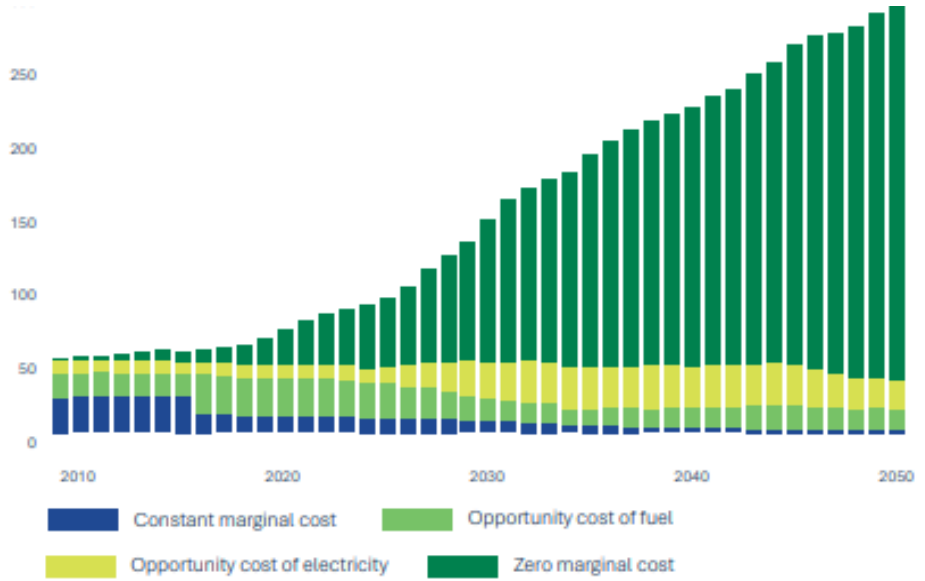
90% of our 27 million people live within 50km of the coast

Technology challenges for new generation

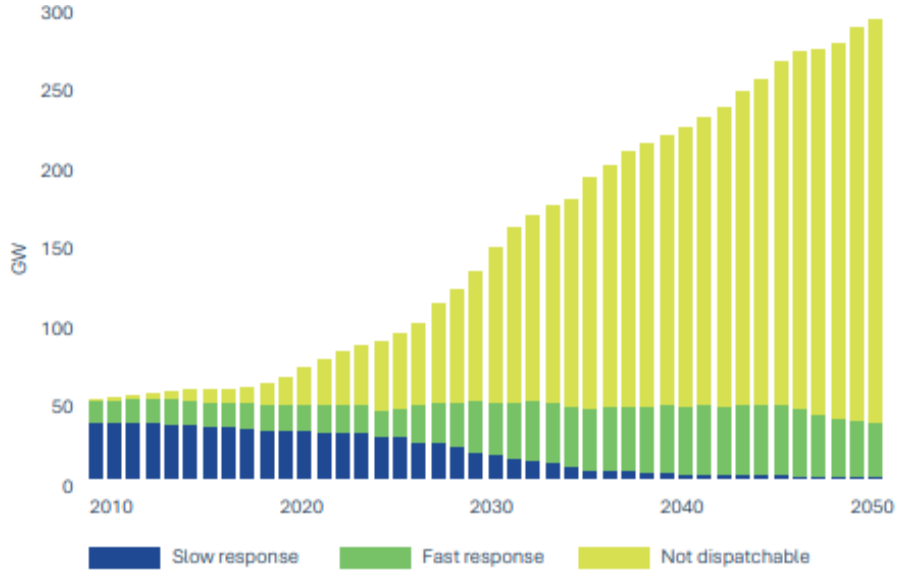
Increasingly weather dependent



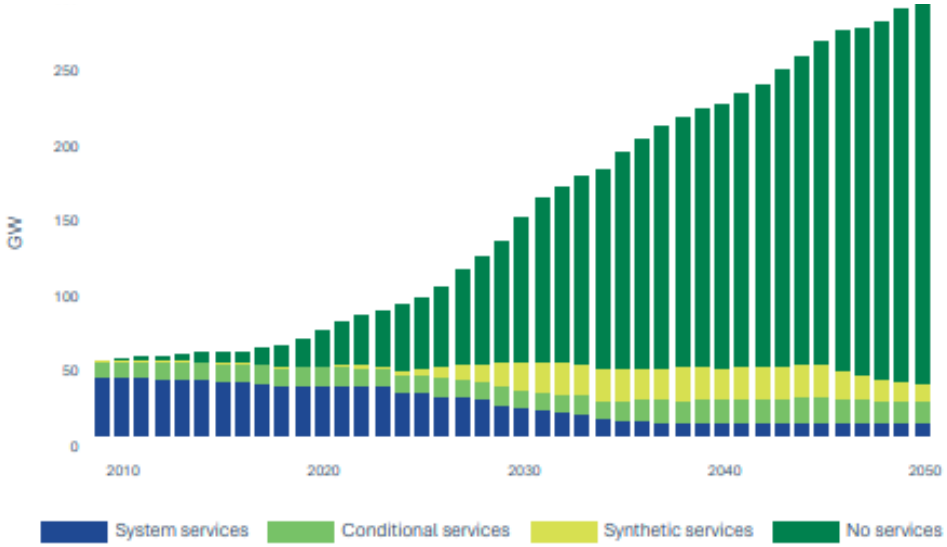
Increasingly more zero marginal cost



Increasingly less dispatchable



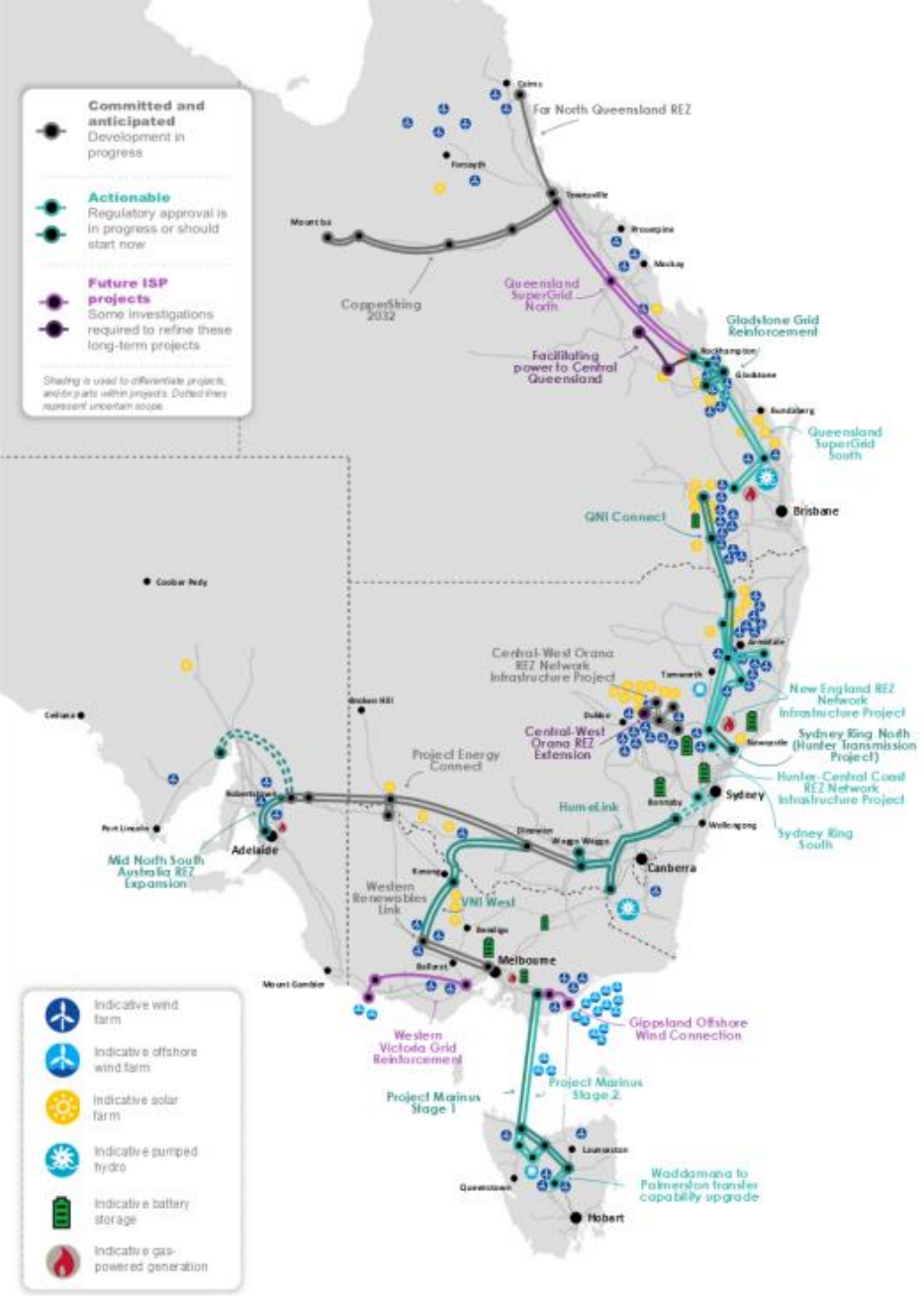
Increasingly less able to provide system services



Source: Expert Panel, NEM Wholesale Market Settings Review, Draft Report August 2025

Projects in the optimal development path in the Integrated System Plan

Committed, to be actioned and future



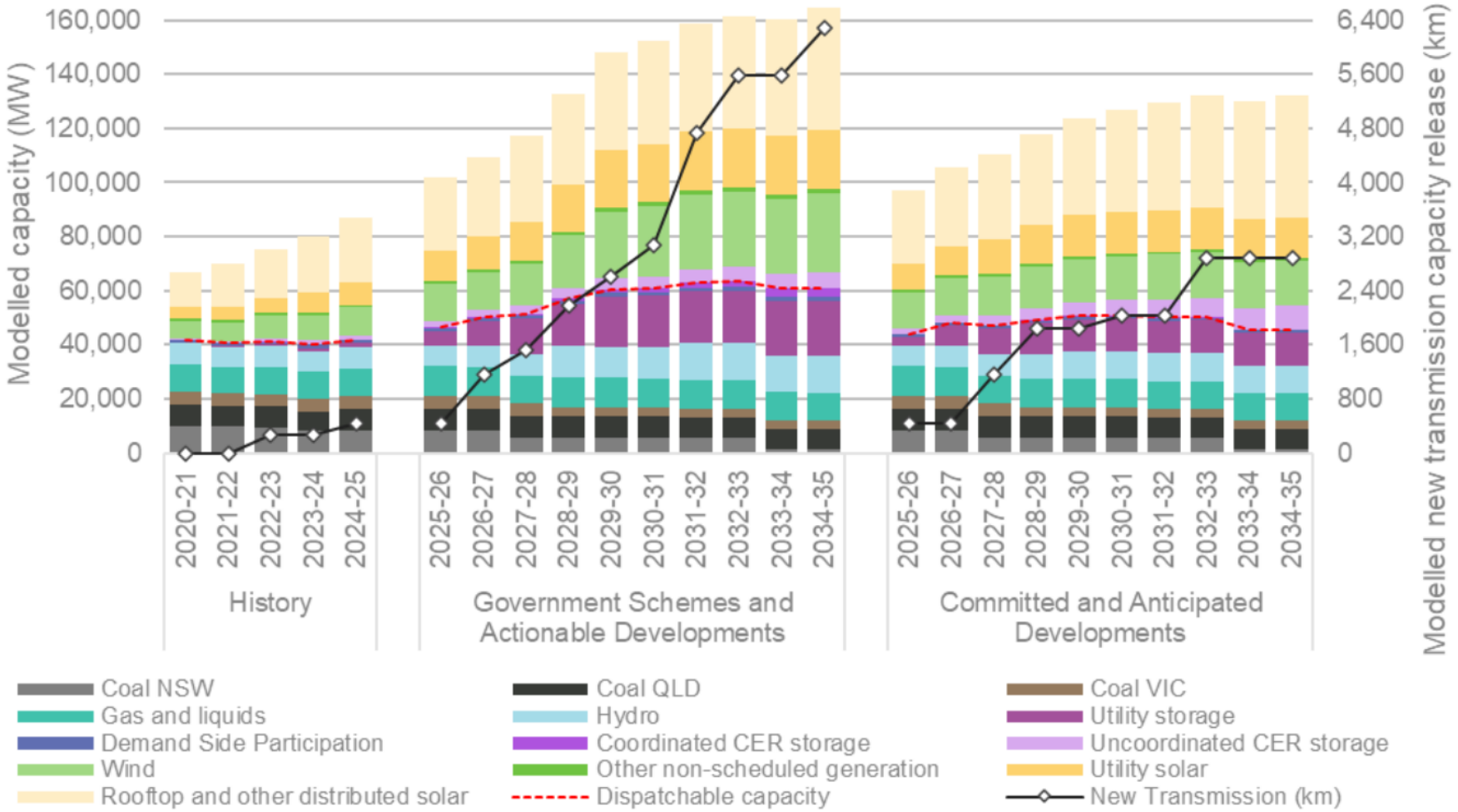
The Integrated System Plan (ISP) is a plan for investment in the NEM to ensure a reliable and secure power system through Australia's transition to a net zero economy.

- Guides $142 billion in investment including $16 billion in transmission.
- Reduces costs for consumers by delivering transmission that would repay its investment cost and save consumers a further $18.5 billion in avoided costs.
- Deliver emissions reductions valued at a further $3.3 billion.

Source: AEMO 2024 Integrated System Plan

10 Year Generation and Transmission Development Outlook

With and without government supported developments compared to history



The electricity statement of opportunities (ESOO) considers the investment needs to replace retiring assets and to meet demand growth to maintain a reliable supply of electricity.

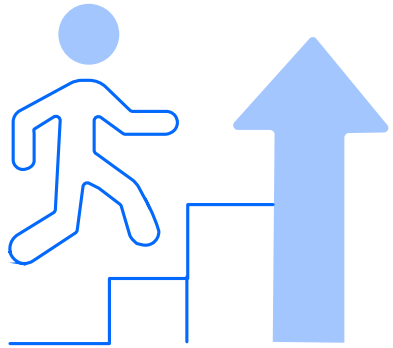
Government support is provided to most new significant transmission investments:

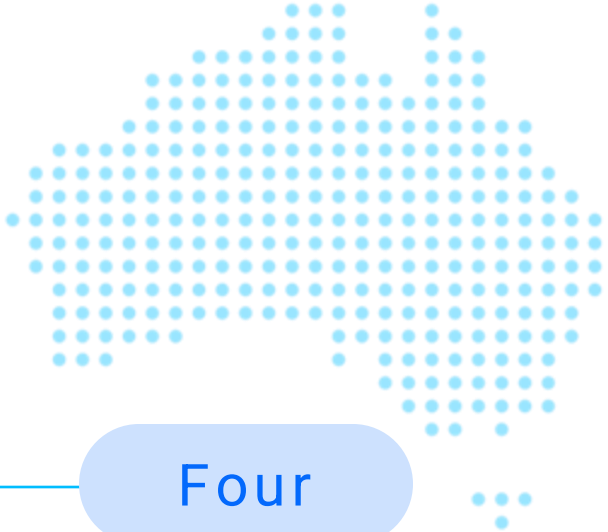
- **Project EnergyConnect**
- **Central West Orana Renewable Energy Zone**
- **VNI West**
- **Humelink**
- **Marinus link**

Source: AEMO 2025 Electricity Statement of Opportunities

Key lessons

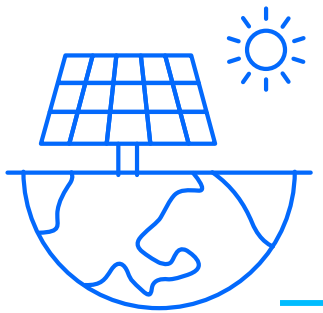
Some things we are learning in our national electricity market in transition





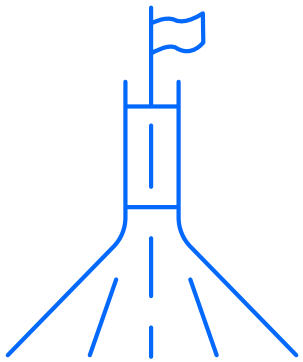
One

The mix of market design and regulation will differ by market, but the need to adapt is universal.



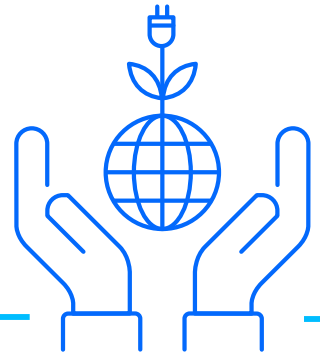
Two

Government support is needed to bridge the gap but should not be enduring



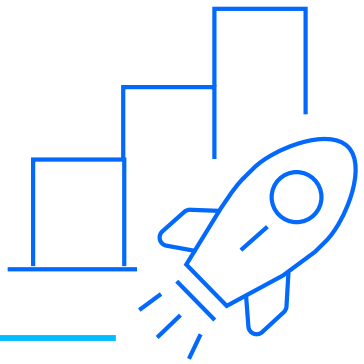
Three

Utilising all our resources is important to deliver overall lower cost and resilience



Four

Time matters. Delay costs.



AEMC

Australian Energy Market Commission

Keep in touch

At the Australian Energy Market Commission we are always keen to keep in touch with our international colleagues. You can learn more about who we are and what we do via our website, or email, sally.mcmahon@aemc.gov.au

www.aemc.gov.au

Appendix

National energy market governance

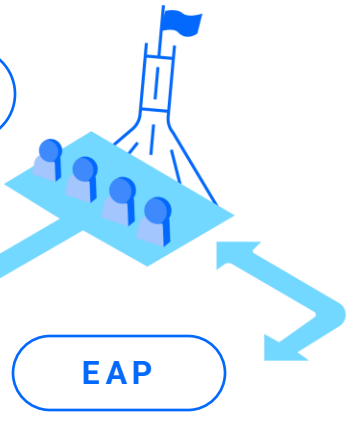
Australian electricity market is vertically unbundled – networks are separated from retail and generation

- Networks are regulated under incentive-based regulation with financial incentives for the company to 'beat' the expenditure allowances and maintain and improve service quality.

ENERGY MINISTERS

Federal, state and territory energy ministers work together through ministerial forums on priority issues of national significance and key reforms in the energy sector

National Electricity Gas and Energy Retail Law and Regulation



EAP

Energy Advisory Panel

Coordinates market bodies' advice to governments under the National Energy Transformation Partnerships, on issues relating to the security, reliability, and affordability of Australia's east coast system

AEMC

Australian Energy Market Commission

Rule maker, market developer and expert adviser to governments

AEMO

Australian Energy Market Operator

Gas and electricity systems market operator

AER

Australian Energy Regulator

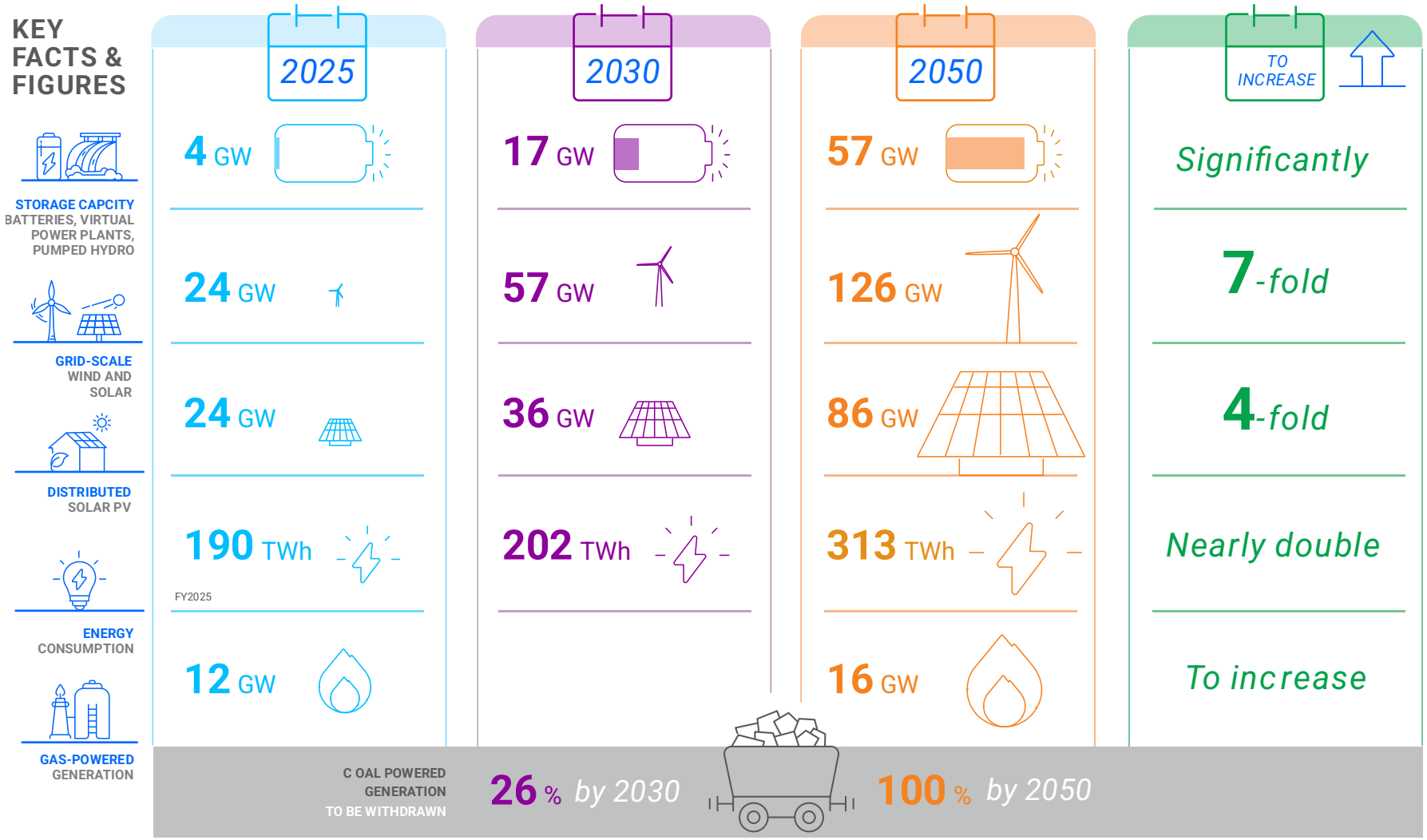
Gas and electricity systems market operator

Energy only wholesale market

Regulated networks

Competition retail sector

A once-in-a-century transformation in the way electricity is generated and consumed



Source: AEMO

Australia is facing unique power system security challenges

A big focus in Australia has been on the challenge of ***maintaining power system security*** – which is ensuring the power system is operating within the acceptable range of technical limits – for example, voltage and frequency.

While the energy transition is giving rise to power system security challenges worldwide, ***it has been especially challenging in Australia because:***

Change in generator types

Australia is seeing a *comparatively large shift from retiring synchronous generation to inverter-based plant.* ***The Integrated System Plan*** forecasts a tripling of the grid-scale variable renewables by 2030 and a six-fold increase by 2050.

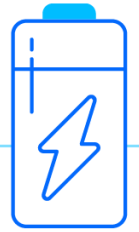
Transmission grid shape

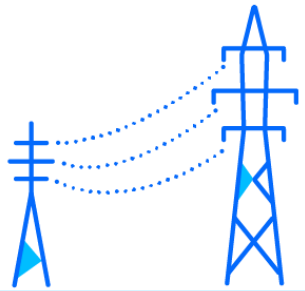
Our *transmission grid is an exceptionally long and thin structure with limited interconnection* – this exacerbates the challenges with system security arising from high penetration of inverter-based plant.

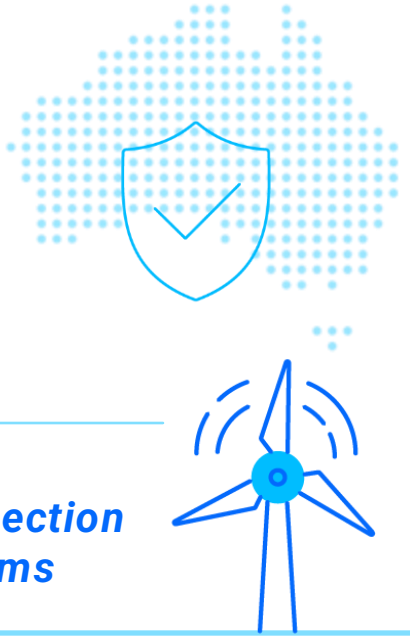
Uptake of PV rooftop solar

The massive uptake of PV rooftop solar further contributes to power system security issues – especially where we have excess solar and minimum demand creating voltage challenges that could make the system insecure.

Power system security reforms are a key focus







Earlier reforms focused on frequency control

- Earlier reforms created frameworks for different types of frequency response.

A framework for 'system strength' was developed

- An Australian term meaning voltage current issues.
- Includes a planning standard requiring transmission companies to procure adequate system strength services.

Now we have a new framework for procuring 'transitional services'

- Procurement of services is less easy to define.
- This framework enables the trialling of new approaches for the delivery of security services.

Connection reforms

- Updating system security access standards for connecting inverter-based generators and storage.
- Improving the connections process to enable the large amount of connecting plant.

AEMC rule changes and reviews to efficiently integrate CER and demand side response

Accelerating smart meter deployment

Enabling data to be captured to maximise CER deployment and innovation opportunities.

Integrating price-responsive resources into the NEM

Providing more flexibility and incentives to capture orchestration.

CER technical standards review

Supporting integration.

Electricity pricing for a consumer-driven future

Looking ahead to what products and services will be popular, and how pricing and tariffs can incentivize adoption.

Unlocking CER benefits through flexible trading

Implementing simple, low-cost reforms to support coordination of price responsive load, separate from static load.

Wholesale demand response mechanism review

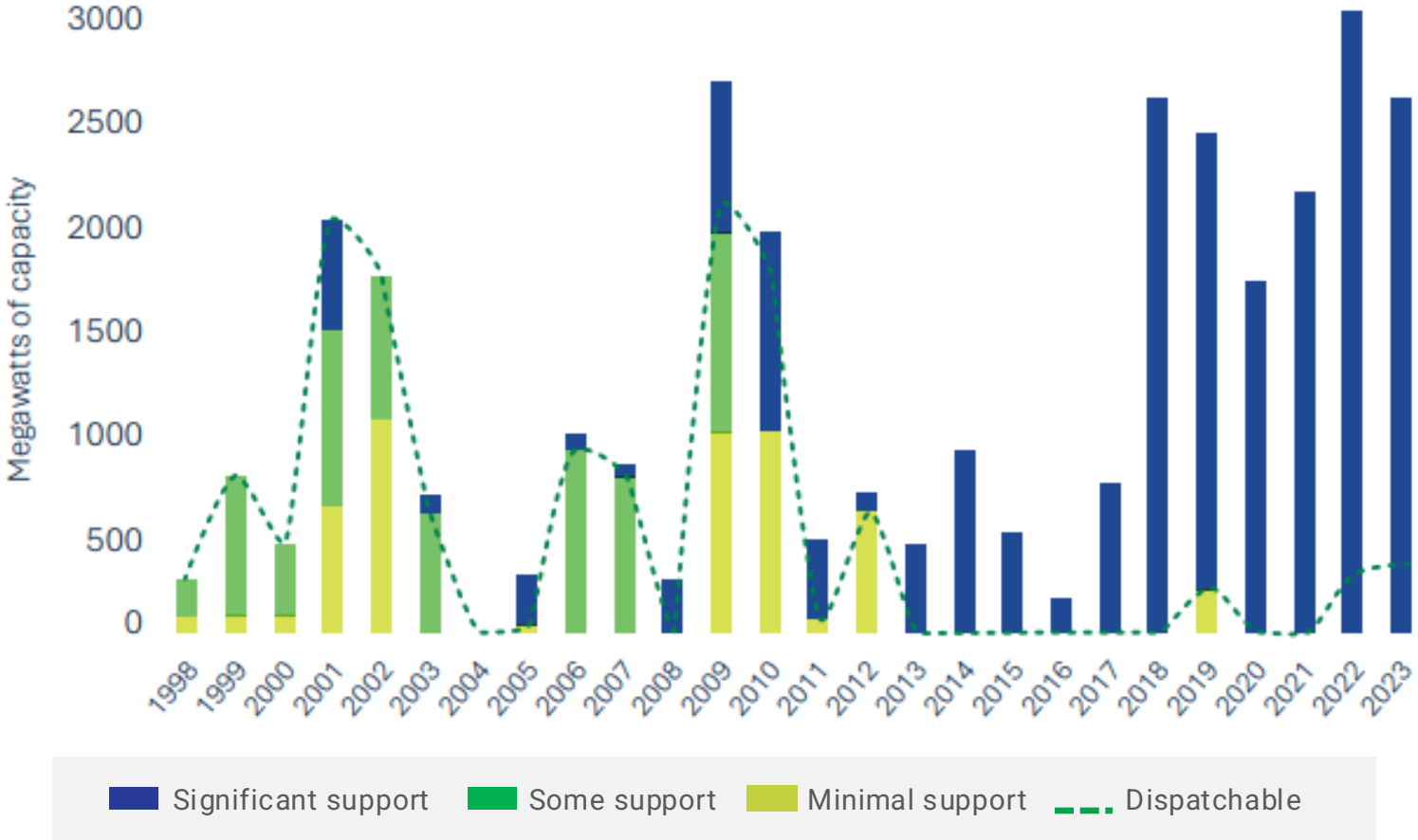
Enabling consumers to sell demand side response.

Real-time data for consumers

Giving customers better access to, ownership of and control over their data, and who else can use that data.

Government support for electricity infrastructure

Generation build by non-market support, 1998 –2023



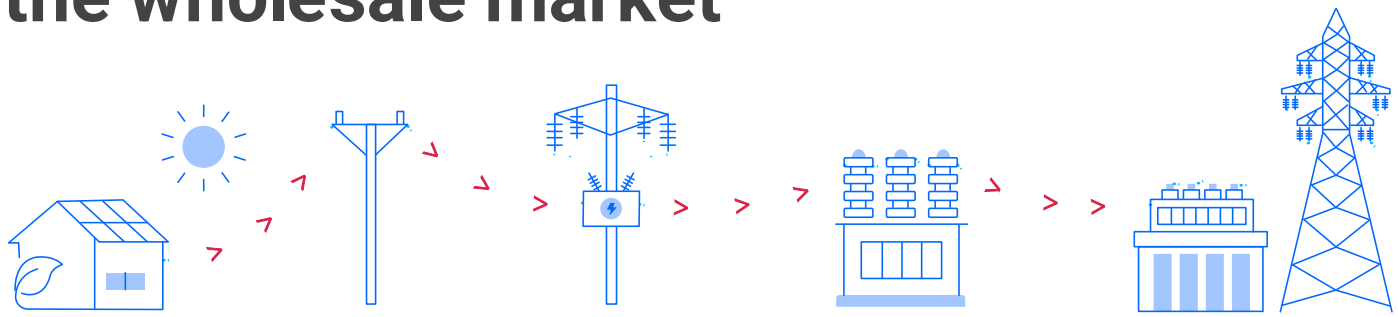
Source: Expert Panel, NEM Wholesale Market Settings Review, Draft Report August 2025

Government support schemes

- **Capacity investment scheme (CIS):** Program to deliver 40 GW of capacity by 2030 through contracts for difference (CfD) to support Australia's 82% renewables target by 2030.
- **Clean Energy Finance Corporation (CEFC):** Commonwealth agency providing discounted finance Corporation invests over $32 billion to support Australia's net zero by 2050 target.
- **Rewiring the Nation:** A $19 billion fund is managed by the CEFC to support investment in grid and transmission infrastructure.
- **New South Wales Long-Term Energy Service Agreements (NSW LTESAs):** These agreements provide revenue certainty for renewable energy generation, firming and long-duration storage, particularly for projects within renewable energy zones (REZs).

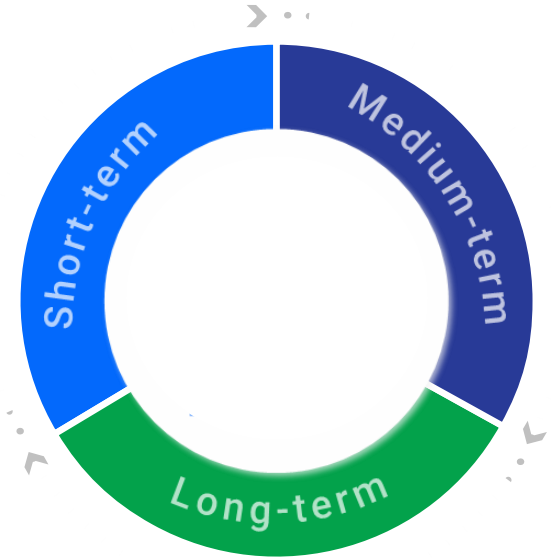
Addressing emerging trends in the wholesale market

An exit strategy for government support for new generation



Emerging trends in the short, medium, and long-term markets

Emerging pressures in the sport market



Liquidity and access challenges in the contract market

Structural barriers to long-term investment

Source: Expert Panel, NEM Wholesale Market Settings Review, Draft Report August 2025

Core recommendations

Short-term spot market — 1 – 5

Retain the current energy-only market. Energy ministers should require a broader range of price-responsive resources to be visible or dispatchable to participate in price formation.

Medium-term derivatives market — 6 – 7

Establish a process to allow industry (buyers and sellers) to define core derivative contracts for bulk energy, shaping and firming – these core products will be the subject of a market making obligation.

Long-term investment market — 8 – 9

Energy ministers should establish an Electricity Services Entry Mechanism (ESEM) within the NEL to facilitate investment in the NEM.

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