



Australia

AUSTRALIA'S ACTION PLAN FOR POWER SECTOR DECARBONISATION

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Department of Climate Change, Energy, the Environment and Water (DCCEEW)

Delivered for the 14th Clean Energy Ministerial (CEM14)

July 2023



ACKNOWLEDGEMENT OF COUNTRY

The Australian Government Department of Climate Change, Energy, the Environment and Water recognises the First Peoples of this nation and their ongoing connection to culture and country. We acknowledge First Nations Peoples as the Traditional Owners, Custodians and Lore Keepers of the world's oldest living culture and pay respects to their Elders past, present and emerging.





BACKGROUND

A collaborative report from the Clean Energy Ministerial (CEM) on [Lessons Learned for Rapid Decarbonization of Power Sectors](#) was delivered to energy ministers and presented at the 13th CEM (CEM13) in the United States in September 2022. In light of these lessons learned and discussed at CEM13, several jurisdictions signaled intent to develop Action Plans for power sector decarbonization, to be released at CEM14 in India in July 2023.

These Action Plans complement, but are differentiated from, other international power sector initiatives such as the Breakthrough Agenda (whose broad purpose is to raise collective ambition) and the Global Power System Transformation (G-PST) Consortium (whose goals are to convene power system operators to accelerate research innovations and foster peer learning). The Action Plans, supported by the [21st Century Power Partnership](#) and other CEM workstreams via direct technical assistance and capacity building, are intended to focus on select implementation actions given each country's existing power sector goals and activities, and are an opportunity for countries to display leadership in power sector decarbonization.

These Action Plans are voluntary, developed by each country individually, not comprehensive of all activities within the jurisdiction, and are living documents that are subject to change.





Australia

I. PLANNING

Action Plan for Rapid Power Sector Decarbonisation

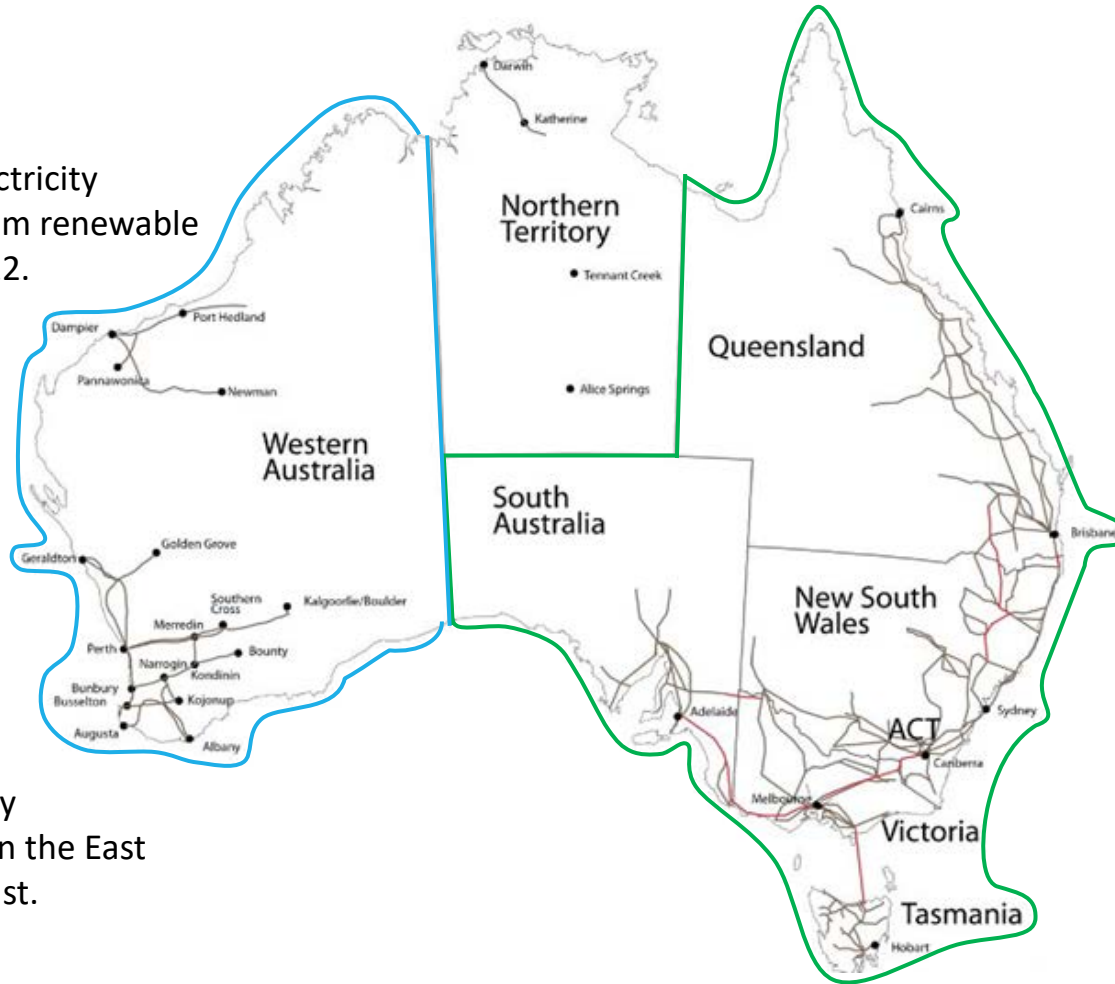


AUSTRALIA'S ENERGY CONTEXT



35.9%

Australia's electricity generation from renewable sources in 2022.



80%

of Australia's electricity consumption occurs on the East and South eastern coast.

Two main electricity markets:

Wholesale Electricity Market (WEM)

- 20 TW/h** of annual electricity generation.
- 6 GW** installed electricity generation capacity.
- 1.5 GW** of solar rooftop PV.

National Electricity Market (NEM)

- 200 TW/h** of annual electricity generation.
- 65 GW** installed electricity generation capacity.
- 15 GW** of solar rooftop PV.

Source: Clean Energy Australia Report (2023)





TACKLING THE CLIMATE CRISIS – CLIMATE TARGETS

Federal Targets and Timeline

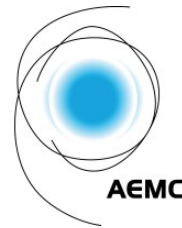
- 2022:** Government legislates emissions reduction targets, including a 43% reduction from 2005 levels by 2030 and net-zero emissions by 2050.
- 2030:** Reach a national renewable energy target of 82% in electricity generation.
- 2050:** Achieve economy-wide net-zero greenhouse gas emissions.

Key Agencies for Achieving Targets:



Australian Government

Department of Climate Change, Energy,
the Environment and Water



Australian
Energy
Market
Commission



AUSTRALIAN
ENERGY
REGULATOR



Economic Regulation Authority

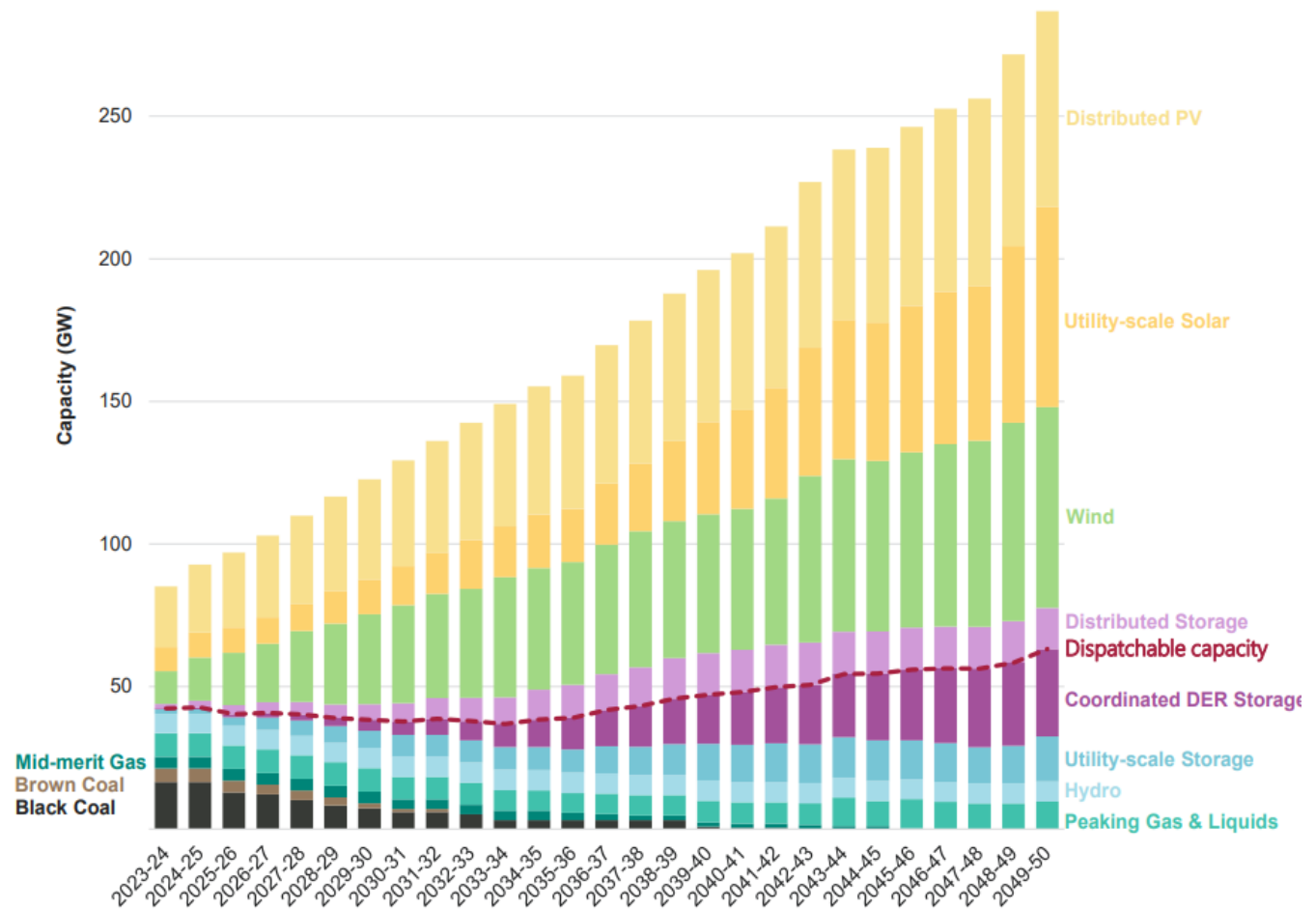
WESTERN AUSTRALIA





A PLAN FOR THE POWER SYSTEM – INTEGRATED SYSTEM PLAN (AEMO)

- The AEMO’s Integrated System Plan (ISP) is a ‘whole of system plan’ for supplying affordable and reliable electricity to homes and businesses in the eastern and south eastern states.
- Identifies where investment is needed to meet the future needs of the National Electricity Market, including:
 - future transmission projects
 - generation and storage projects
 - demand-side developments
- The Government is providing \$20 billion through Rewiring the Nation in low-cost finance (as debt and equity) to expand, upgrade and modernise Australia’s electricity grid.
 - This will support the development of interstate transmission links and infrastructure for Renewable Energy Zones.

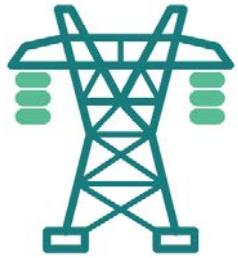


Source: AEMO (2022)





EXPECTED CHANGES TO 2050 (STEP CHANGE SCENARIO) - AEMO



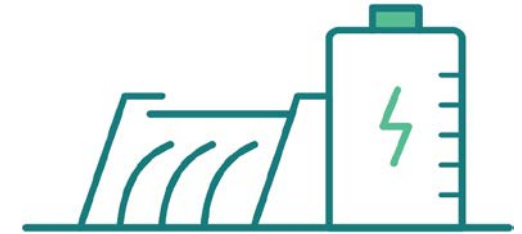
Electricity usage from the grid **to nearly double**



Grid-scale wind and solar **to increase 9-fold**



Distributed solar PV **to increase 5-fold**



Storage capacity **to increase by a factor of 30**

(Batteries, virtual power plants, pumped hydro)





A COORDINATED APPROACH TO POWER SECTOR PLANNING

Powering Australia Plan

- The Powering Australia Plan is focused on accelerating Australia's emissions reductions and delivering reliable and affordable energy.
 - Aims to reduce emissions, create jobs, and cut power bills through boosting renewable energy.
- Focuses on the medium to long term changes necessary to enable the transformation of our economy and electricity grid on the way to net-zero, through:



Decarbonisation



Electrification



Energy efficiency



Technology innovation and development





Australia

II. BUILDING

Action Plan for Rapid Power Sector Decarbonisation

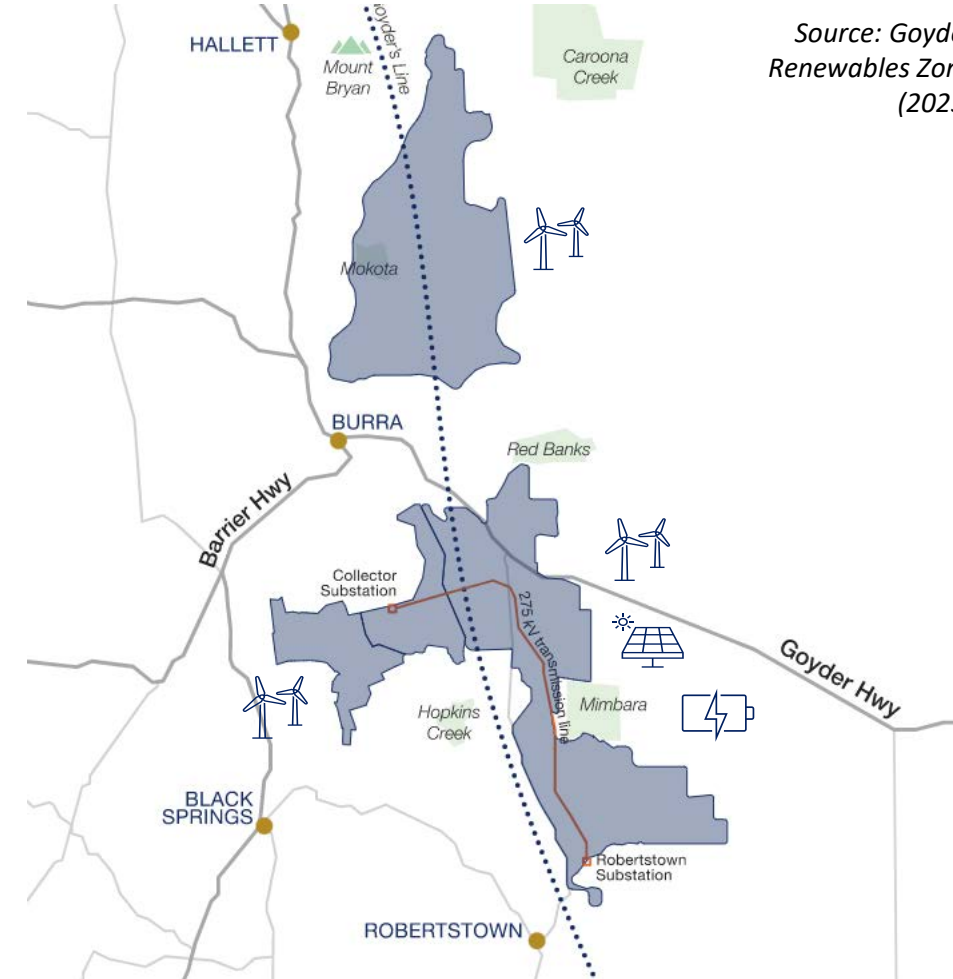


BUILDING THE SYSTEM – RENEWABLE ENERGY ZONES (REZ)

- REZ: high quality resource areas where clusters of large-scale renewable energy projects can be developed using economies of scale.
 - Solar, Wind (land & offshore) and Hydropower
- Coordinated development across the East coast and Southern states.
- REZs connect multiple renewable generators in one location, and are more cost effective and efficient in utilising resources.

Neoen's Goyder South Project – South Australia

- Located near Burra in South Australia's Mid North region
- Land use for farming - wind turbines occupy less than 1% of the land and sheep can graze among solar panels
- Wind turbines (1200 MW), solar (600 MW), and battery storage capacity (900 MW)
- Stage 1 will deliver an additional 412 MW of capacity to South Australia's grid by 2024



Source: Goyder
Renewables Zone
(2023)





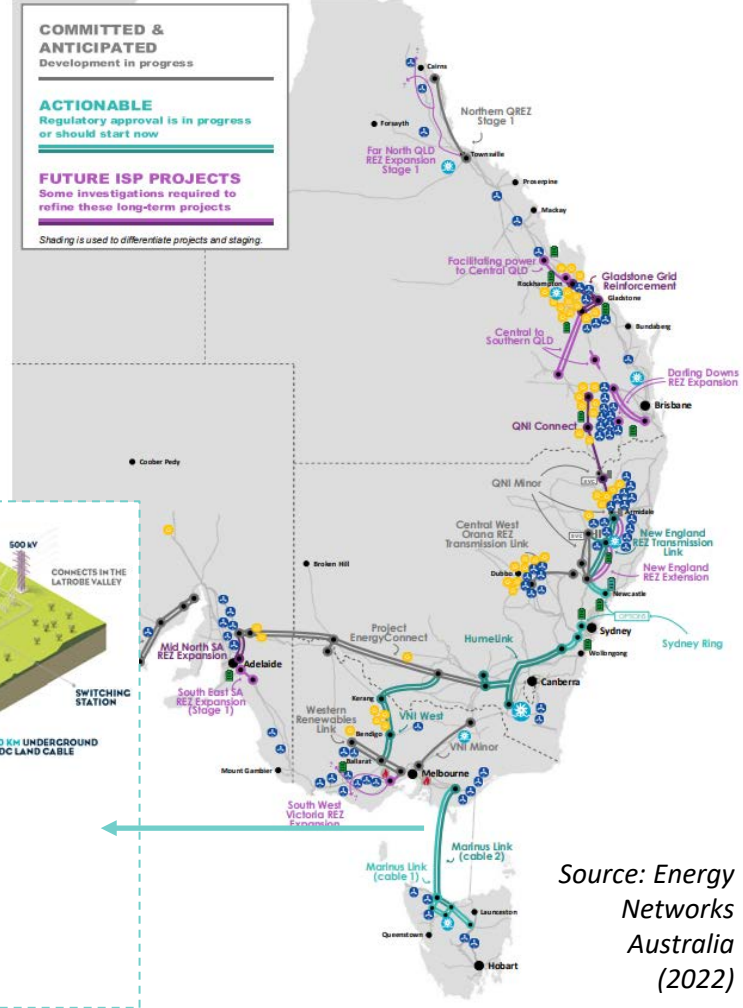
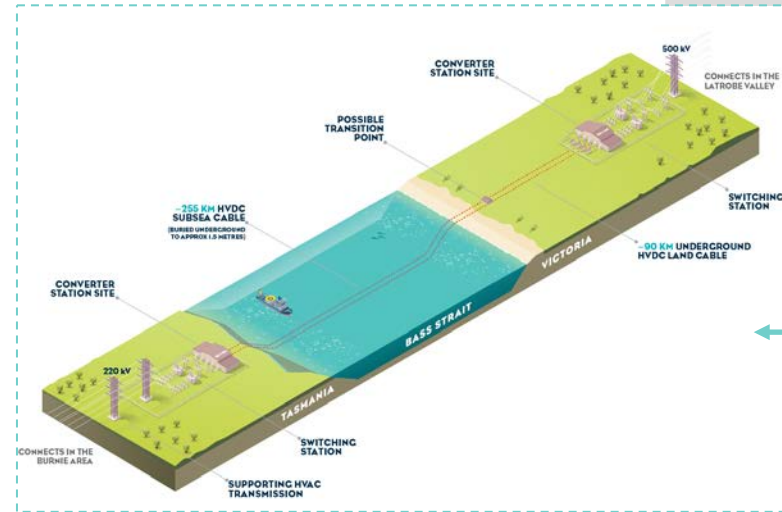
BUILDING THE SYSTEM – TRANSMISSION

Rewiring the Nation (RtN):

- Will invest up to \$20 billion in low-cost finance to expand, upgrade and modernise Australia’s electricity grid, including infrastructure, interstate electricity transmission and renewable energy zones.
- Delivered in partnership by the Rewiring the Nation Office (RtNO) and the Clean Energy Finance Corporation (CEFC).

Marinus Link (VIC-TAS)

- Building under-sea HVDC transmission cables (1500 MW) to connect electricity generated in Tasmania to reach the NEM in Victoria.
- Boost additional power from the Snowy Hydro2.0 power plant and enable NEM access to Tasmania’s hydropower.
- Project will help to reduce emissions by up to 140MT of CO₂ by 2050 and lower electricity prices in the NEM.



Source: Energy Networks Australia (2022)



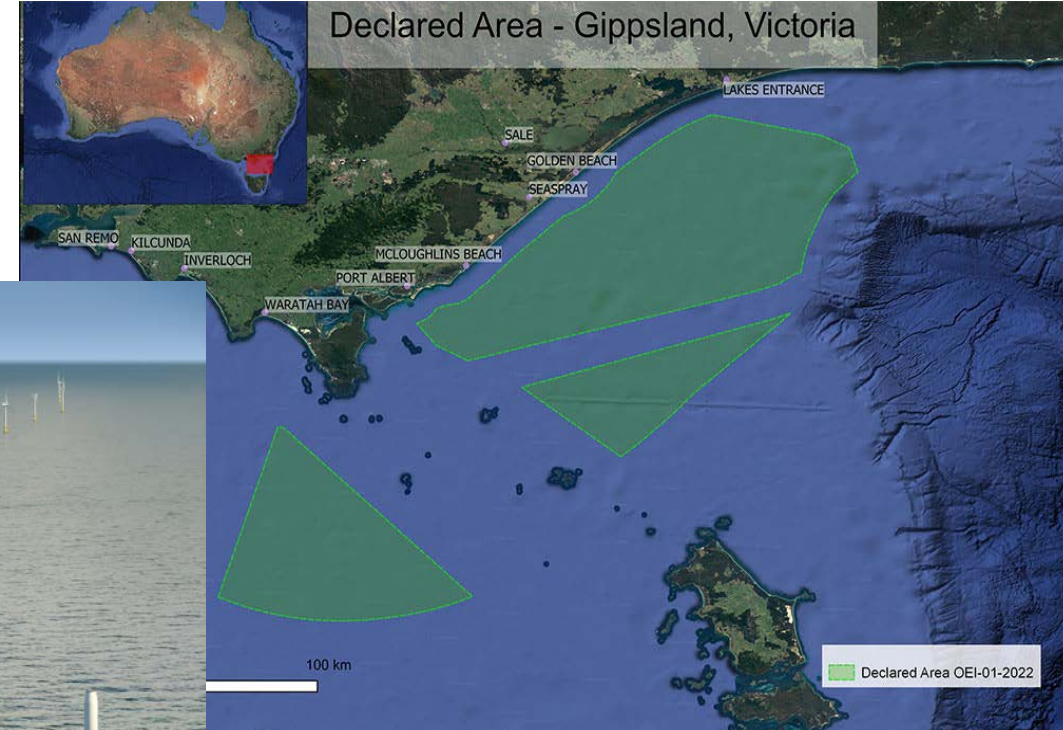
BUILDING THE SYSTEM – OFFSHORE WIND

Offshore Electricity Infrastructure Act 2021

- Unlock offshore RE projects in Commonwealth waters
- Six regions have been proposed with offshore wind potential in NSW, VIC, TAS and WA
- There are now 2 areas declared as suitable for offshore wind under this Act

Gippsland, Victoria offshore wind projects - *Australian first*

- First Offshore Wind Zones declared in December 2022
- Located between 10-50 km off the Gippsland coast
- Multiple projects in the early planning and development stages (some to start construction by 2028)
- Expected to generate 1 – 2.2 GW per project, connecting into existing grids in the Latrobe Valley and/or other onshore renewable energy grids





FINANCING THE TRANSFORMATION – SUPPLY CHAINS

National Reconstruction Fund

- **\$15 billion** committed to establish the National Reconstruction Fund (NRF).
- Investing in clean energy industries and supply chains to support, diversify, and transform Australia's industrial capabilities and manufacturing base.
- Two of the priority investment areas are:



Up to \$3 billion for renewables and low emissions technologies – wind turbines, batteries, solar PV, green metals, etc.



\$1 billion for value adding resources – critical minerals

Powering the Regions Fund

- **\$1.9 billion** committed to establish the Powering the Regions Fund (PRF). The fund will focus on **four key areas**:
 1. Decarbonising existing industries
 2. Developing new clean energy industries
 3. Workforce development
 4. Purchasing carbon credits
- **\$400 million Critical Inputs to Clean Energy Industries Stream** to support primary steel, cement, lime, aluminium and alumina industries.
- **\$400 million Industrial Transformation Program (ARENA)**:
 - Emissions reduction of industrial facilities in regional locations - manufacturing, mining, and agriculture.
 - Trial, demonstration, and small-scale projects.

Source: DCCEEW (2023)





RENEWABLE ENERGY AND STORAGE – SCALING AND INNOVATION

- **Capacity Investment Scheme (CIS)** - to unlock \$10 billion of investment in dispatchable renewable capacity, ensuring reliability in rapidly changing electricity markets.
- \$200 million in grant funding to deliver **Community Batteries for Household Solar** - to help homes lower their power bills and reduce pressure on the electricity grid.
- The **Australian Made Battery Plan** to create jobs and help decarbonize by:
 - Developing Australia's first **National Battery Strategy**, creating an **Australian-made Battery Manufacturing Precinct** and establishing a **Powering Australia Industry Growth Centre**

Source: DCCEEW & DISR (2023)

The **Australian Renewable Energy Agency (ARENA)** provides grant funding to improve affordability and increase the supply of renewable energy in Australia.

- Provided \$3 million to The University of Sydney, in partnership with **SunDrive**. Their project aims to:
 - Commercialise silicon-perovskite tandem solar cell manufacturing technologies in Australia
 - Develop low-cost fabrication technologies for modules with high durability, to improve energy efficiency and drive down costs



Source: ARENA Projects (2022)





Australia

III. OPERATING

Action Plan for Rapid Power Sector Decarbonisation

AEMO's ENGINEERING FRAMEWORK

Engineering Roadmap to 100% Renewables – AEMO's view of the technical, engineering, and operational actions required to prepare and reliably operate the NEM at 100% instantaneous renewable penetration.



- 3 technical preconditions required: **power system security, system operability, and resource adequacy and capability.**
- Over 150 actions and subcomponent actions, over 500 detailed considerations and identified responsible parties, and many existing and emerging challenges associated with achieving each precondition.

Operations Technology Roadmap – Control Room of the Future



- The roadmap identifies the system and market operations capability needs to enable this transformative change while maintaining electricity system reliability, security, and resilience
- Numerous initiatives to uplift the Control Room's operational toolkit
- Key tools will bring
 - Enhanced situational awareness and big data visualisation and modelling
 - Greater system visibility and anticipation capabilities



Source: AEMO (2022)



OPERATING TOOL ROADMAP

Key: New Tool/Process Enhanced Enhanced Existing Tool Existing Process/Project

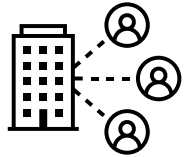
| OT Tool | 2022 | 2025 | Review | 2030+ |
|---|---|--|---|--|
| EMS SCADA and Monitoring | | EMS Upgrade | | |
| Constraints and DSA | ← EMS and WAMS Continuous Development and Integration → | VSA, TSA, FSA suite of tools with look-ahead capability | Constraints and DSA with mitigation actions interoperable with EMMS | Towards automated control actions for constraints |
| Voltage and Reactive Power Management | Resource models, Q limits, contingencies collated, validated | Voltage reactive power management tool with look ahead capability | Voltage constraints with mitigation actions interoperable with EMMS | Towards automated control actions for voltage |
| System Strength and EMT | Hyper-sim model migration. System strength metrics defined. WEM EMT model development | System strength automatically studied in control room RTS | System strength studies incorporate forecasts | Mitigation actions, EMMS Integration |
| Protection, Control, Blackstart, Restoration | | SPS and Protection wide area coordination study tool. Control actions consolidated | Blackstart optimisation using VRE and DER Restoration optimisation using VRE and DER | Machine learning for control optimisation |
| Outage Planning and Reporting | | Automated logging system, integrated with all OT tools. | | Voice activated reporting and data entry |
| Frequency Management Control, Ramping and Inertia | Enduring inertia assessment tool and RTFS enhancement in WEM. UFLS, RoCoF metrics and visualisation | Ramping assessment tool DER and demand control architecture and implementation | | Ramping and inertia constraints interoperable with EEMS |
| EMMS | | ST-PASA and EMMS Uplift for NEW2025 and WEM Market Reforms | | Co-optimised electricity, gas, water markets |
| Compliance Monitoring | ← Continuous dynamic model improvement process → | | Automatic event root cause analysis and decision support tool | |
| Operational Forecasting | | Implementation of Fusion platform for ops forecasting | | Integration of weather forecasts in OT tools |
| Operational Data and Models | AEMO operational and model data flow, process, standards mapping, vision | Modelling and operational metadata governance and management system | | NMM framework and system for ops, markets, planning, connections |

Source: AEMO (2022)





INTEGRATION OF DISTRIBUTED ENERGY RESOURCES



AEMO's Distributed Energy Resources Program seeks to understand and integrate high levels of distributed energy resources (DERs) into the NEM.

- Workstreams: DER Demonstrations, Modelling, Data and Visibility, and Standards Development



Consumer Energy Resources (CER) Implementation Plan seeks to reward consumers, and support innovative business models and system operators to better monitor and operate the system.

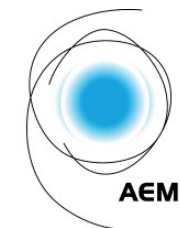


Interoperability Policy – consulting on an Assessment Framework on applying technical standards for inverter-based CER devices.

- AEMO, DISR, and the AEMC will provide direction on technical standards, including mandatory requirements for new inverter-based CER devices and cyber security protection.



Australian Government
**Department of Industry,
Science and Resources**



Australian
Energy
Market
Commission





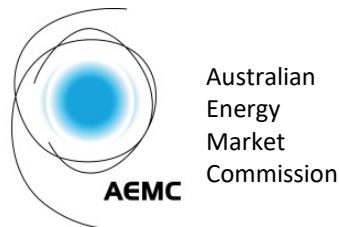
UPDATED OPERATING MODEL – ENERGY ADVISORY PANEL

The National Energy Transformation Partnership (NETP)

- A framework for national alignment and cooperative action by governments to support the transformation of Australia's energy sector.
 - The new operating model is the **Energy Advisory Panel (EAP)**

The Energy Advisory Panel (EAP)

- Under the **NETP**, the **EAP** coordinates market bodies' advice to governments on issues relating to the security, reliability, and affordability of Australia's east coast energy system.
 - Energy Market Bodies represented:



(observer status only)



STAKEHOLDER ENGAGEMENT AND INCLUSION

Community Engagement

- Securing community support and appropriate social licence is vital to timely delivery of NEM infrastructure projects.
 - Occurs through ongoing consultations with local councils, landholders, Traditional Owners, and community members.
- The government is committed to work with and learn from First Nations people to manage the climate crisis and increase adaptation action.
 - Developing a **First Nations Clean Energy Strategy**, co-designed with Indigenous communities.
 - Ensures First Nations people have a say in energy policies and programs in the transition to net zero.



Australian Government

Australian Energy Infrastructure Commissioner

- Independent commissioner receiving and referring complaints from concerned community residents about renewable energy projects and new major transmission projects.
 - Promotes information transparency and best practices for industry and government.



Australian Government

Department of Climate Change, Energy, the Environment and Water

Network Regulators

The Energy Advisory Panel (EAP)



Supporting agencies



National Energy Performance Strategy

- The Government is developing this **Strategy** to accelerate demand-side action to improve energy performance, affordability, and reduce emissions.





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