

SWIS Engineering Roadmap

Industry Forum

22 August 2024

Disclaimer: Please note that this meeting will be recorded by AEMO and published on our website. By continuing, you consent to AEMO recording the call and using the recording for this purpose. If you do not consent, you may exit the meeting. No other recording of the meeting is permitted.





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.

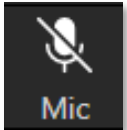
'Journey of unity: AEMO's Reconciliation Path' by Lani Balzan

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.

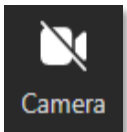
Read our
RAP



Online housekeeping



- Please mute your microphone during the presentation.



- Please leave your camera off as well, but we'd love to see you during Q&A.



- We have a Q&A session at the end of today's session. You're also welcome to enter your questions in the chat.



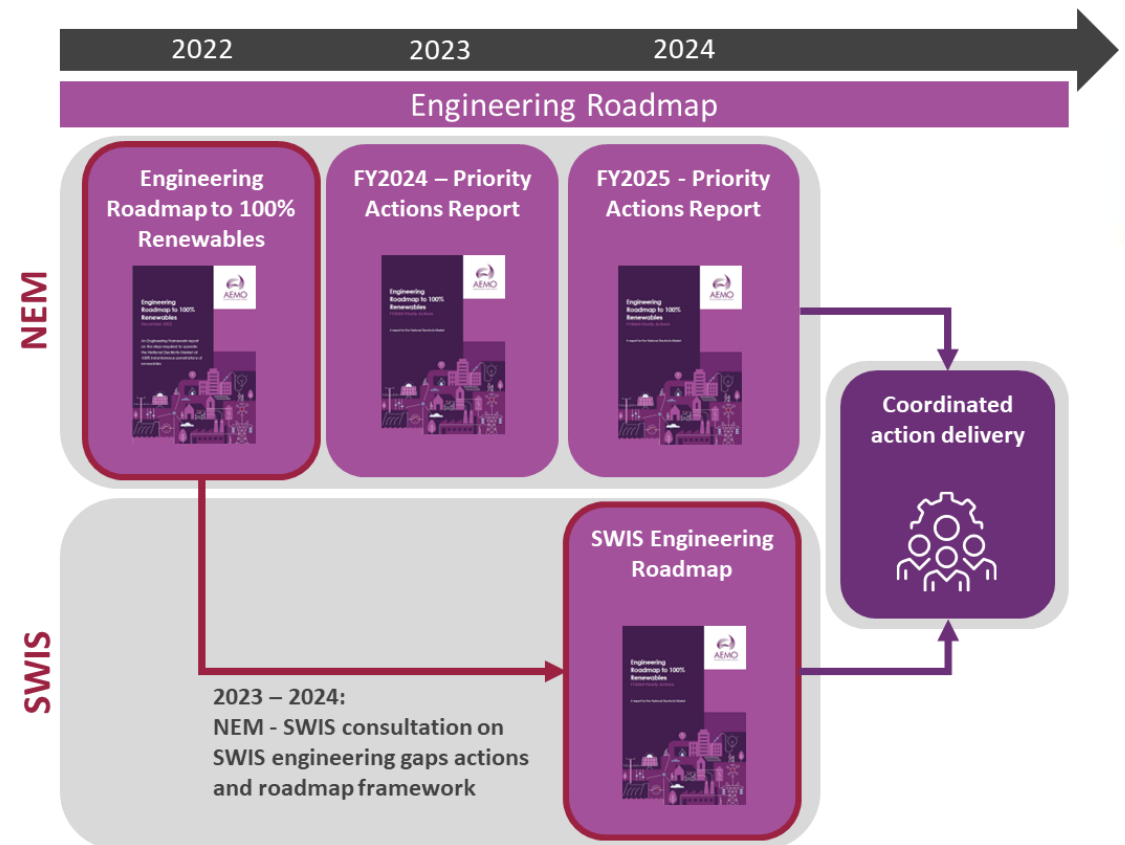
- A recording of the forum and copy of the presentation will be published on our web page:

[AEMO | Engineering Roadmaps.](#)

- We welcome feedback via: wa.futuresystemdesign@aemo.com.au

Significant progress toward managing the energy transition

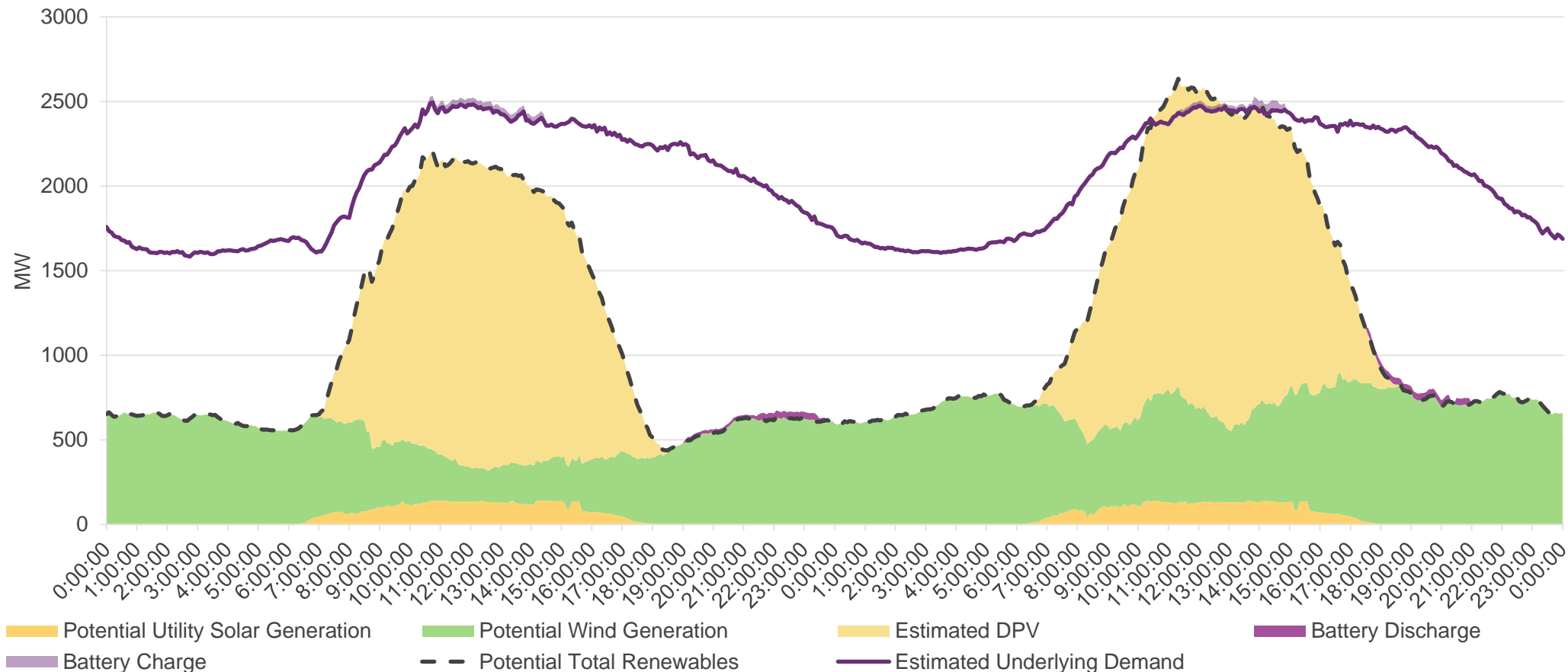
- The SWIS Engineering Roadmap follows significant work in WA to progress the Energy Transformation Strategy.
- AEMO’s 2019 and 2021 Reports on Renewable Energy Integration highlighted key needs of the power system through the energy transition.
- The SWIS Engineering Roadmap consolidates engineering activities to enable the power system to evolve to meet Federal and State net zero targets.
- The SWIS Engineering Roadmap leverages the framing and ongoing work program from the NEM Engineering Roadmap.



Link to reports: [AEMO | Engineering Roadmaps](#)

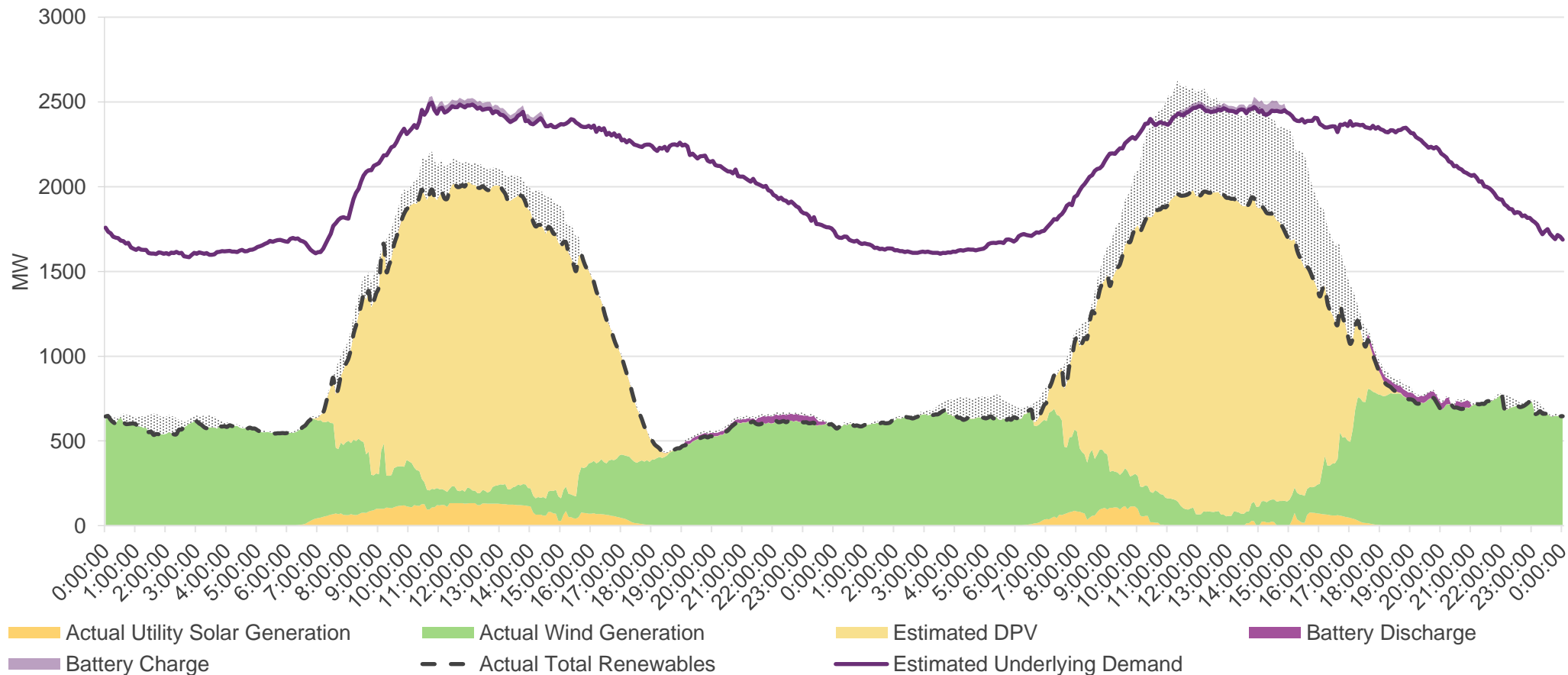
WA has had more than 100% renewables potential, but..

The system is not yet able to harness the full potential of this renewable energy.



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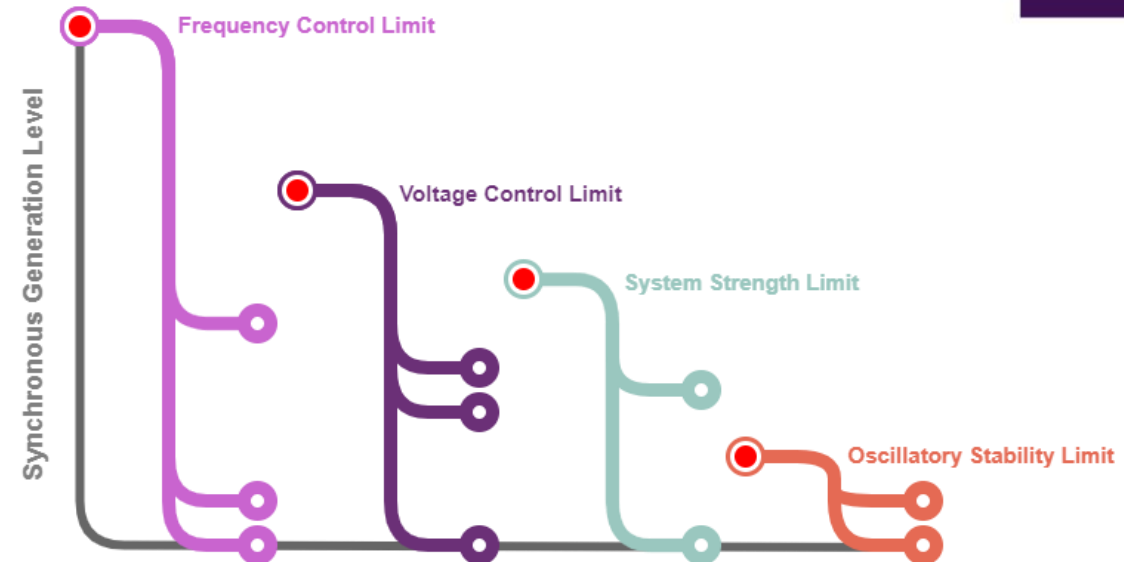
Critical capabilities are needed to securely operate the future power system

The transition to renewables is more than simply a ‘straight swap’ of generation assets. Limits to instantaneous renewables contribution can be assessed for each technical need of the system and progressively unlocked by new operational processes, investments and services, including:

- Frequency and RoCoF control services
- Voltage control: providing the capability for adequate voltage control at all nodes in the SWIS
- System strength: ensuring that there is sufficient system strength at all nodes in the SWIS to allow IBR generation to operate stably and for protection systems to operate correctly
- Oscillatory stability: to prevent adverse and potentially unstable interactions between generation facilities

These technical needs must be managed in conjunction with resource adequacy needs such as:

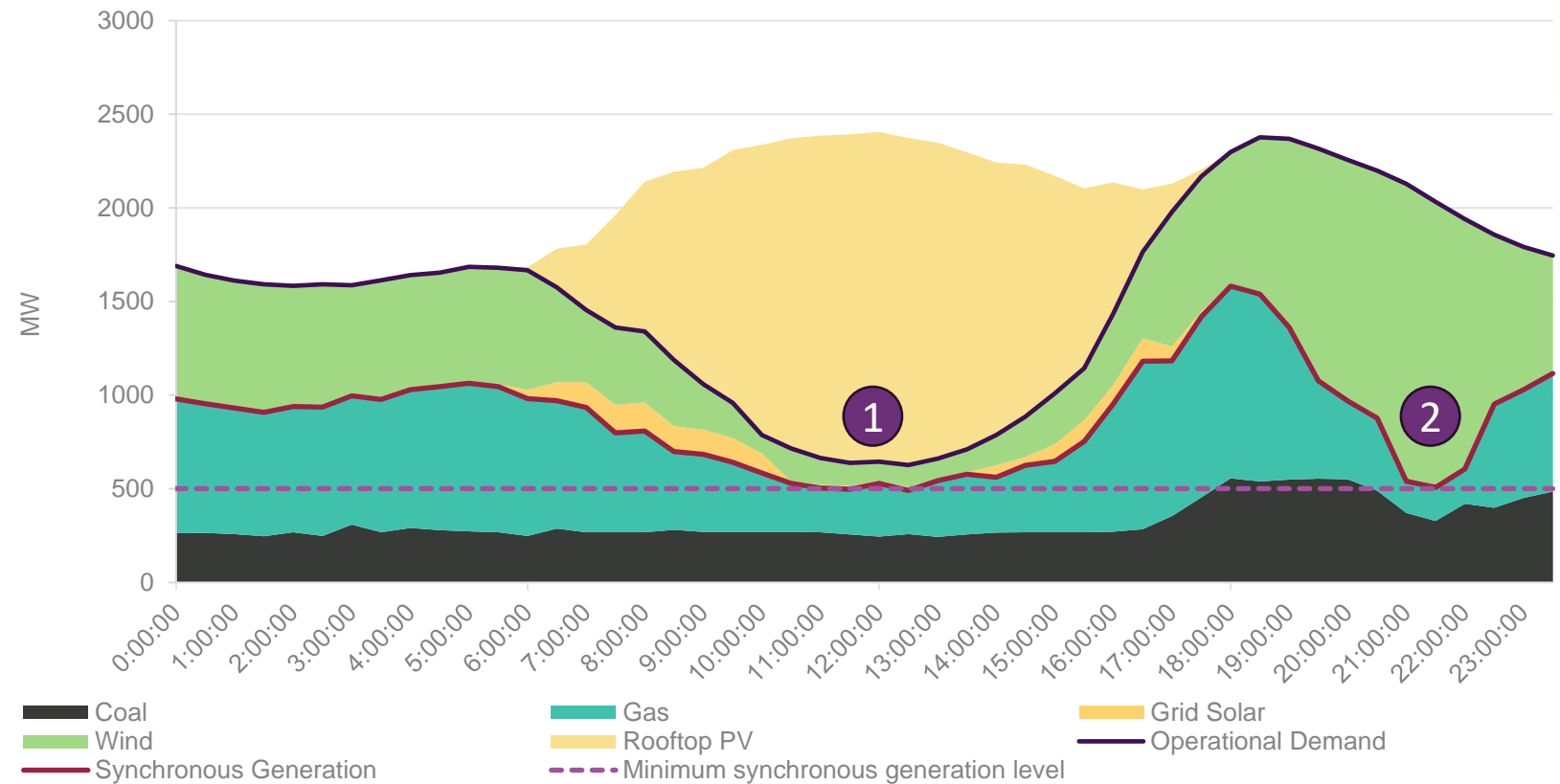
- Ramping: managing load uncertainty and generation variability across relevant time horizons
- Management of duration-limited resources and renewable energy droughts: ensuring sufficient firming and backup generation to manage shortages in wind and/or solar generation over various timeframes



Illustrative only

Minimum synchronous generation level

- The Roadmap frames the limits to renewables penetration in terms of minimum synchronous generation levels, an evolution of the Minimum Demand Threshold (MDT) concept used operationally.
- This framing is critical as grid-scale renewables contribute increasingly to meeting demand.
- Example shows equivalent levels of synchronous generation at very different demand levels.



The SWIS needs an Engineering Roadmap to:



Enable the efficient delivery of the transition to help achieve net zero



Remove engineering barriers to operating with higher penetrations of renewables and lower levels of synchronous generation



Inform timely investment decisions by market participants and Western Power



Inform the technical requirements of future regulatory changes, to ensure solutions are delivered most efficiently



Pre-emptively manage emerging power system risks

In the future, AEMO expects...



Coal generation and other aging fossil-fuelled generators to retire from the SWIS.



Electricity demand to significantly increase due to electrification and new industry development.

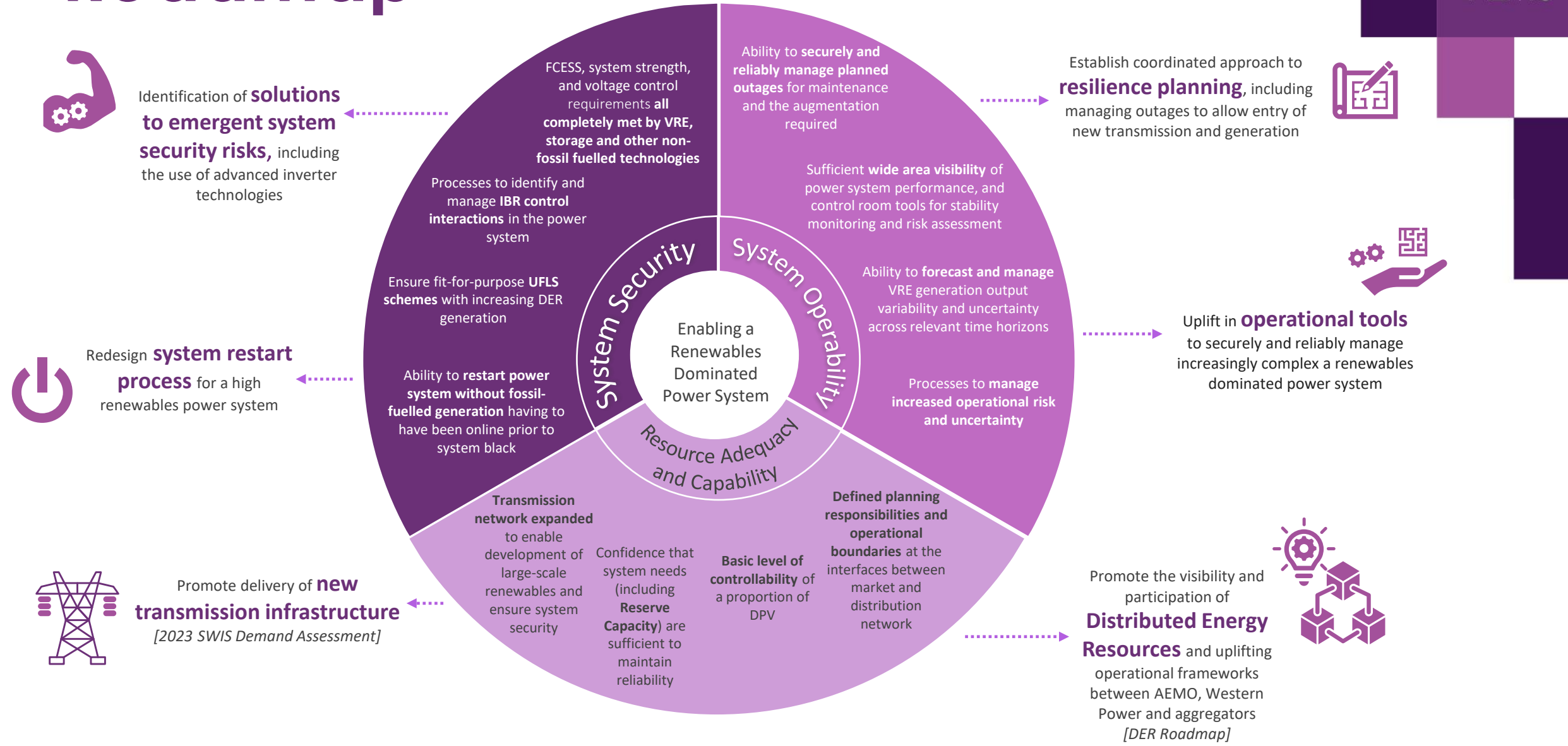


The majority of energy demand to be directly served by inverter-based renewable energy sources – in particular rooftop solar during daylight times – firmed by storage and backed up by gas generation.



Distributed Energy Resources (DER) will increasingly be aggregated and operated as virtual power plants.




Roadmap







Action Roadmap

Preconditions	In-progress	Future Actions
<p>Ability to keep system frequency within defined limits following credible and non-credible events, including RoCoF containment and effective emergency frequency control arrangements</p>		<p>Review the RoCoF Safe Limit based on an assessment of RoCoF Ride-Through Capability and availability of RoCoF Control Service</p> <p>Establish understanding and specification of 'synthetic' inertial response from IBRs, and equivalence to synchronous machines, and potential plant level constraints on the capability to provide synthetic inertia</p> <p>Specify accreditation requirements for RoCoF Control Service from synthetic inertia providers</p> <p>Identify and progress opportunities (where economic) for common solutions to address inertia requirements in conjunction with identified system strength needs, such as adding flywheels to synchronous condenser installations</p> <p>AEMO and Western Power to review UFLS adequacy with increasing aggregate DPV uptake, including assessing the possible need for an UFLS redesign</p> <p>Use phasor measurement units (to be installed by Western Power) to provide increased accuracy of system inertia estimation in real time</p> <p>AEMO and Western Power remediate or redesign Over Frequency Generation Shedding (OFGS) arrangements for effective operation</p>
<p>Frequency Co-optimised Essential System Services (FCESS) reserve requirements completely met by VRE, storage and demand response.</p>		<p>Forecast the efficacy of FCESS (Regulation, Contingency Reserve, RoCoF Control Service) under high renewables penetration scenarios</p>







Significant progress toward managing the energy transition

	Recommendation	Relevant initiative	Solution
	Technical standards, services, and mechanisms		
1	Enable Fast Frequency Response service	Energy Transformation Strategy (ETS) Stage 1 – WEM reforms (commenced 1 October 2023)	
2	Dynamic monitoring, and medium-term and long-term solutions for Under-Frequency Load Shedding (UFLS)	Distributed Energy Resources (DER) Roadmap – Technology integration (in progress)	 <i>Partial</i>
3	Enable ramping service	ETS Stage 1 – Non-Co-optimised Essential System Service (NCESS) Framework (procurement mechanism rules commenced) ETS Stage 2 – Reserve Capacity Mechanism (RCM) Review (introduction of a flexibility capacity product)	

Significant progress toward managing the energy transition

	Recommendation	Relevant initiative	Solution
	Distribution system related		
4	Ongoing inverter monitoring and compliance	DER Roadmap – Technology integration (in progress) ETS Stage 2 – Energy and Governance Legislation Reform (Project EAGLE) (in progress)	
5	Management of Distributed PV systems - PRIORITY	DER Roadmap – Emergency Solar Management (commenced February 2022) ETS Stage 1 – NCESS procurements for Minimum Demand Service (2023 and 2024-2025 Capacity Years)	 <i>Partial</i>
6	Market and incentive frameworks for DER participation	ETS Stage 2 – Project Eagle (in progress) DER Roadmap – DER Participation (in progress) ETS Stage 1 – NCESS procurements for Peak Demand Service (2024-2025 and 2025-2026 Capacity Years)	 <i>In progress</i>
7	Develop visibility of, and incentives for, flexible loads	DER Roadmap – DER Participation (Visibility Framework developed) ETS Stage 2 – Demand Side Participation Review (in progress)	 <i>In progress</i>

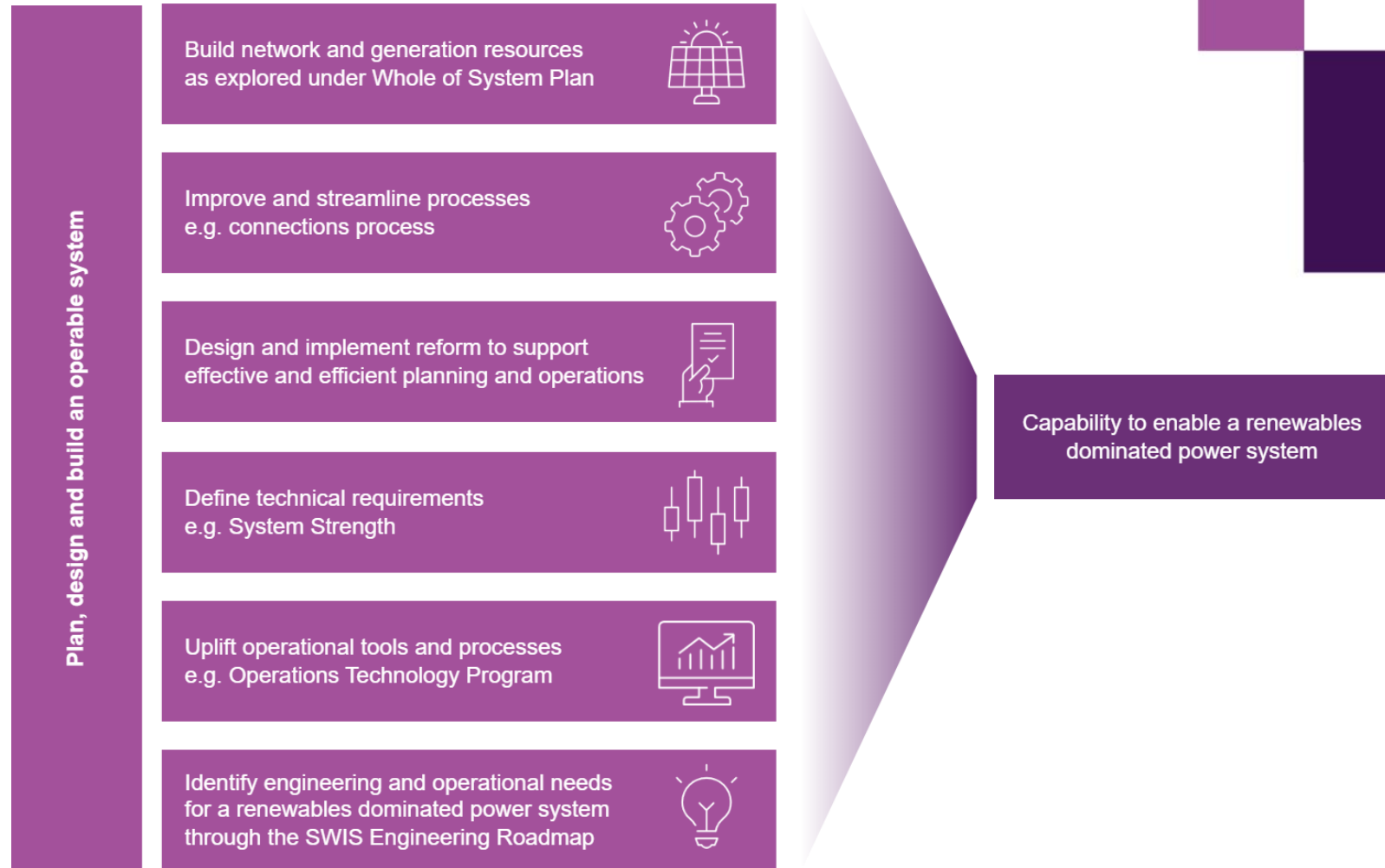
Significant progress toward managing the energy transition

	Recommendation	Relevant initiative	Solution
Wholesale market related			
8	Changing the approach to hybrid facilities	ETS Stage 2 – Demand Side Participation Review (in progress)	 <i>In Progress</i>
9	Improving market incentives to address system variability	ETS Stage 2 – Cost Allocation Review (in progress)	 <i>In Progress</i>
Regulatory architecture and functionality			
10	Centralised SWIS reliability standard and supporting frameworks	ETS Stage 2 – Project Eagle (in progress) DER Roadmap (in progress)	 <i>In Progress</i>
11	Framework for contingency planning and management to support power system resilience	ETS Stage 2 – Project Eagle (in progress)	 <i>Yet to be determined</i>
12	Build on the utility of the inaugural Whole of System Plan (WOSP)	ETS Stage 1 – Electricity Networks Access Code (ENAC) and WEM Rules amendments commenced), SWIS Demand Assessment	
13	Embed requirements for interoperability and cybersecurity	DER Roadmap – Technology integration (in progress)	 <i>In Progress</i>

Interdependencies

- The SWIS Roadmap includes engineering actions that need to be undertaken as part of the broader energy transition.
- The SWIS Roadmap does not assign these actions to specific parties, in recognition that:

“No one organisation can undertake all required actions underpinning the energy transition. The transition will require a coordinated effort between AEMO, governments, industry, market bodies and communities.”
- AEMO will work with key stakeholders to finalise prioritisation, roles and responsibilities and integrate into the broader program of work.
- Actions which fall outside AEMO’s scope (e.g. delivering transmission, building out renewables) are included for both completeness and to further support the efforts across industry.



Next Steps

- Seeking feedback, on how you'd like to be engaged, whether you see gaps in the presented actions and which actions you see needing to be progressed as a priority.
- Welcome feedback by email to wa.futuresystemdesign@aemo.com.au by 30 September 2024.
- AEMO is developing a set of priority actions for industry consultation.

Q&A



Contact us at: wa.futuresystemdesign@aemo.com.au



For more information visit

aemo.com.au