



# Implementing the WA Government's Distributed Energy Resources Roadmap

AEMO Stakeholder Forum - 27 August 2020

# Agenda

1. Background: a changing WEM

## **DER Roadmap projects**

2. Technology Integration workstream (including DER Register)

3. DER Participation workstream

4. DER Orchestration Pilot

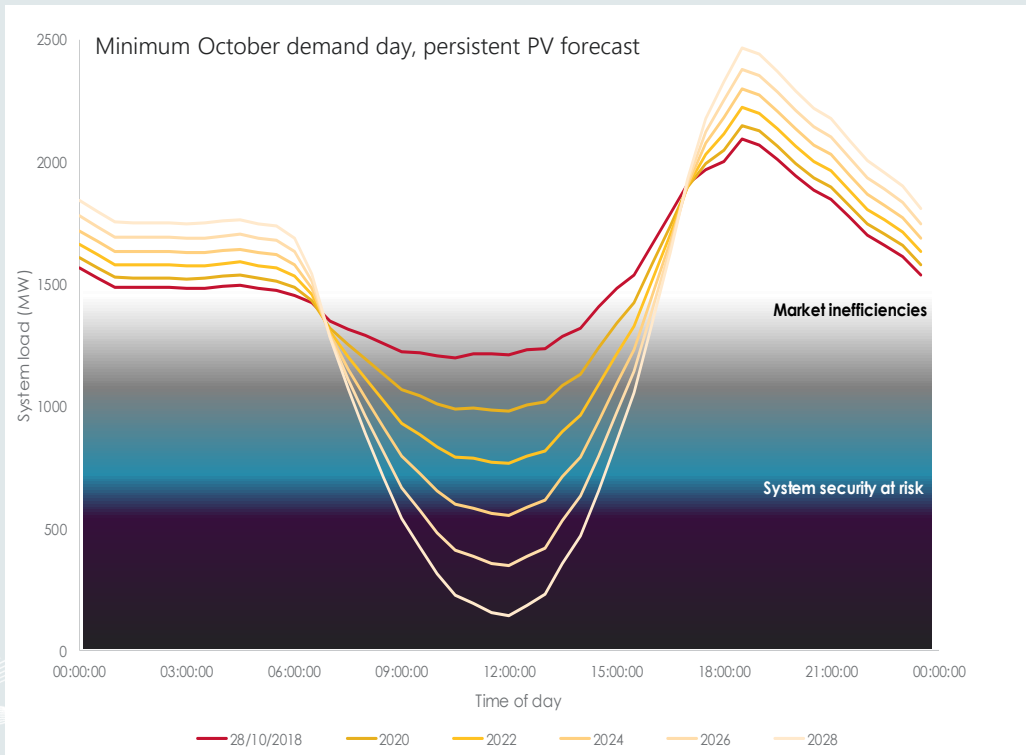
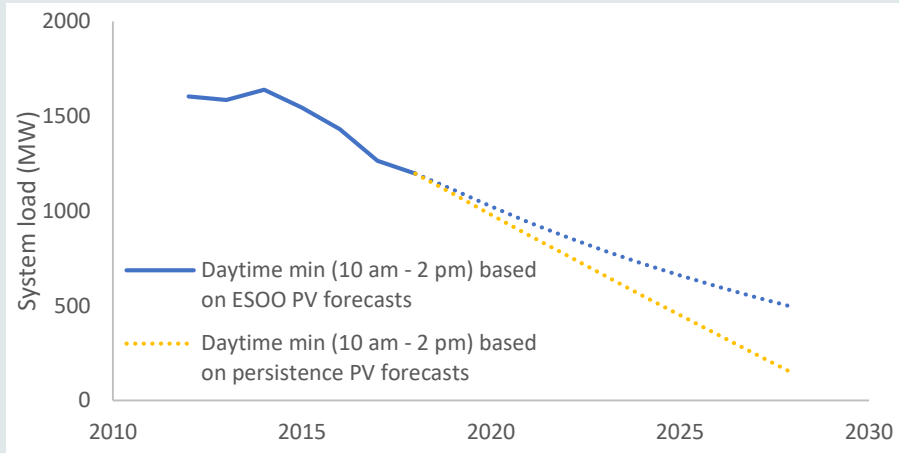
5. Leveraging AEMO capability

6. Expenditure forecast summary

7. Next steps

# 1. Background

The WEM and SWIS will continue to change as DER grows



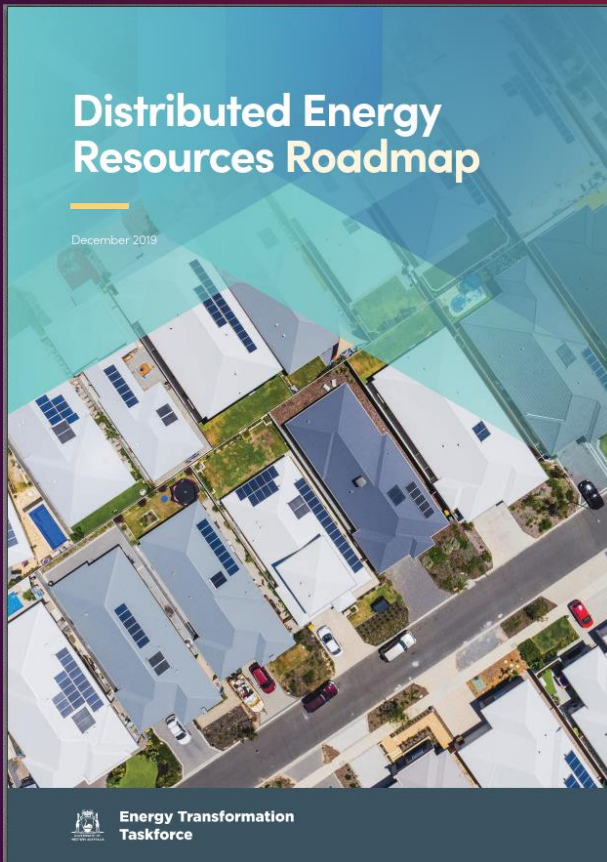
## Declining minimum system demand

- The SWIS is at an inflection point of being able to manage the changing dynamics of system demand level, generation mix and volatility
- This is shown by
  - The persistent deterioration in midday load
  - Increasing cost of Ancillary Services (Essential System Services)
  - Increasing incidence of negative wholesale market prices
  - Increasing penetration of large-scale renewables and DER resulting in dispatch volatility in synchronous generation (likely impact of increased maintenance, reduced reliability) and lower synchronous generation (which presently provide majority of Ancillary Services) dispatch in general
  - Reversing distribution network power flows as rooftop solar PV increases at ~200 MW per year

The WEM and AEMO must adapt to manage DER

# 1. Background

- The WA Government published the *Distributed Energy Resources (DER) Roadmap* in April 2020.
- The DER Roadmap (as part of the Government's overall *Energy Transformation Strategy*) is a key pathway to optimise the security and reliability of the SWIS and transition the State to a decentralised, democratised and highly data driven power system for the benefit of all consumers.
- The DER Roadmap is a *five-year plan* outlining *36 actions* that will be taken to evolve the SWIS and WEM to better manage DER.



*“The reliability and security of the power system is central”*

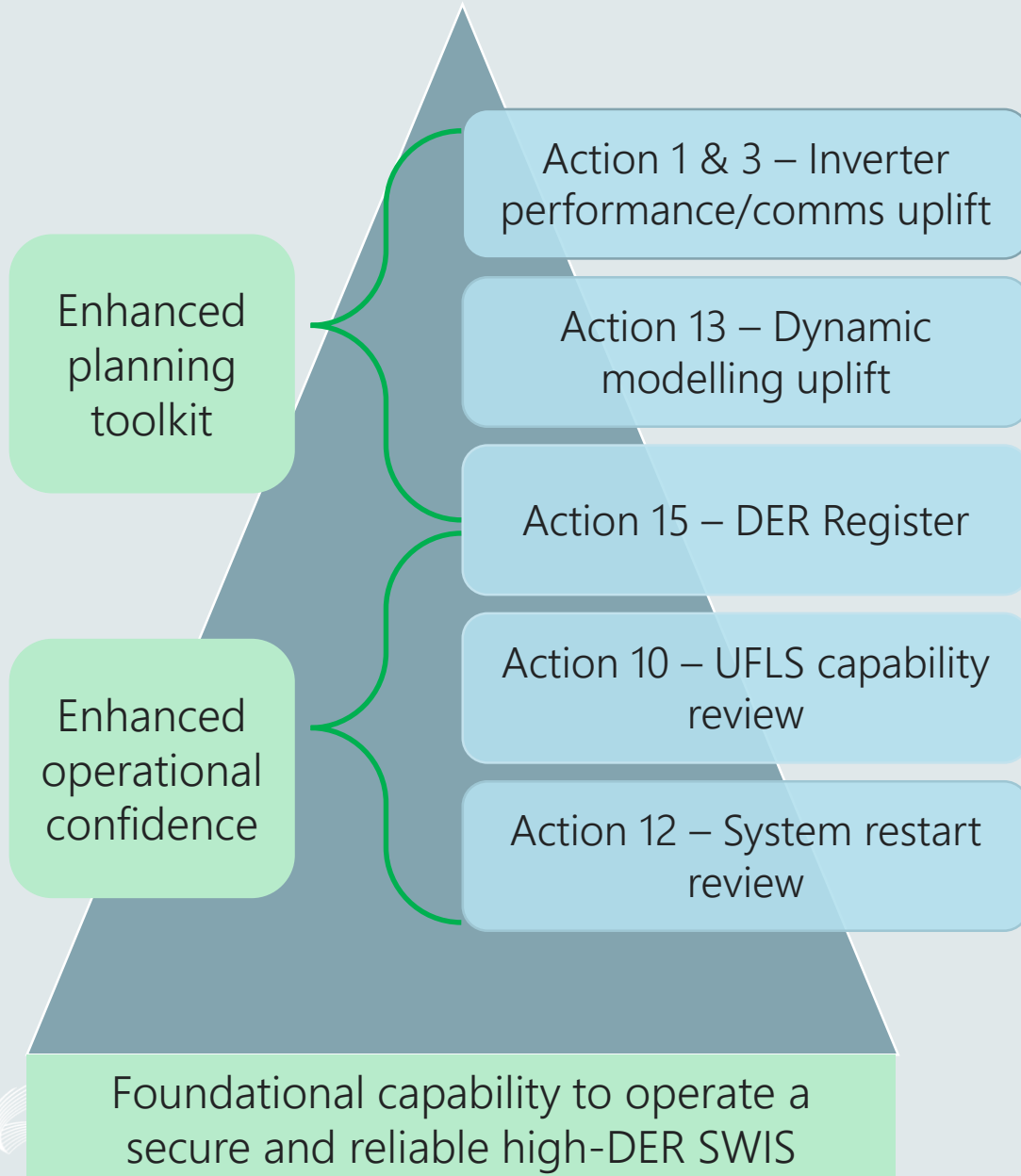
*“Integration of DER into the wholesale market and across electricity supply chain to facilitate value capture, maintain system security and reliability and reduce total costs.”*

# 1. AEMO Expenditure forecast drivers

- The DER Roadmap was not contemplated in the AR5 submission, and does not fall within the scope of the reform activities considered as part of the ERA's 2019 determination.
- Under the Wholesale Electricity Market Rules, AEMO will be applying to the *Economic Regulation Authority* for an adjustment to its approved budget to reflect the costs incurred in respect of these activities.
- The Minister for Energy has now provided the endorsement of the DER Roadmap activities to be undertaken by AEMO, including in relation to:
  - "Planning for establishment of a DER Register for the SWIS" (and establishing the register under Rule 3.24 gazetted in July)
  - "Activities to facilitate the integration of DER technologies into the South West Interconnected System (SWIS) to enhance management of power system security and reliability"
  - "Activities to facilitate the participation of DER in electricity service markets to deliver more efficient market outcomes"
  - "Participation in a DER orchestration pilot (as described in the DER Roadmap) in collaboration with Synergy and Western Power, to develop and test the capability of DER orchestration in the SWIS, apply learnings to the planning and implementation of the DMO capability in the WEM, and integrate systems and processes with the DSO."
- Related actions in the roadmap define AEMO's scope of work.

# 2.1 Technology Integration

Aligned DER Roadmap Actions in AEMO's scope



The **Technology Integration Workstream** will uplift foundational capabilities to forecast, plan and operate a secure and reliable high-DER SWIS.

This workstream includes:

- developing and applying tools to better understand DER behaviour,
- Establishing arrangements to collect and use DER data
- applying outcomes from this work to uplift system security parameters such as under-frequency load shedding and system restart,
- ongoing DER performance monitoring and uplift enablement, and
- Leveraging learnings, insights of and tools to understand DER behaviour from AEMO's work in the NEM.

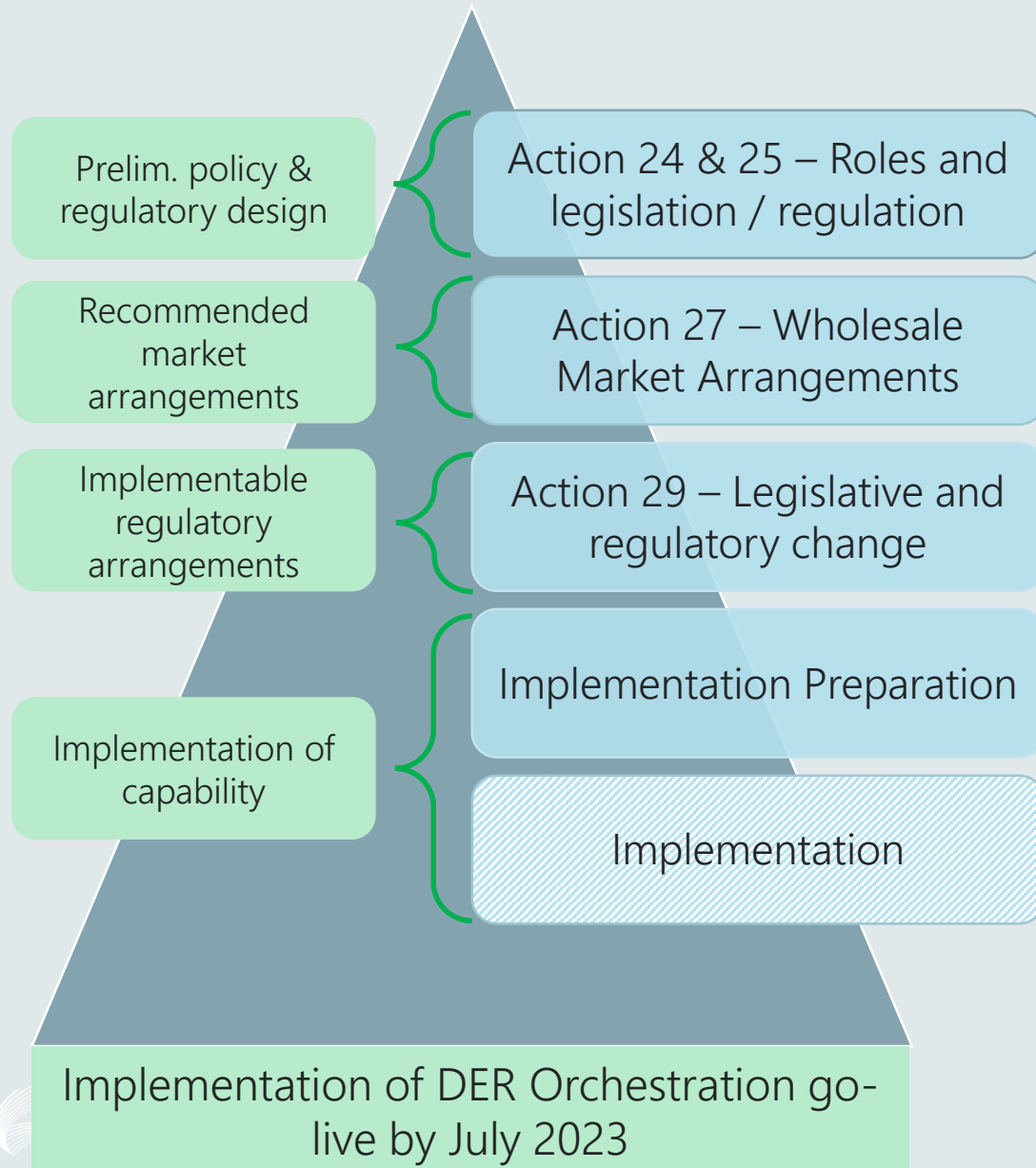
# 2.2 Technology Integration – Scope

Functional overview: Staged based on capability uplift to support the secure and reliable system operation

2020						2021						2022						Outcomes / Benefits						
Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun
<p><b>Action 1: Inverter autonomous performance requirements and monitoring</b></p> <ul style="list-style-type: none"> <li>• Updates to AS4777 for WA region</li> <li>• DER performance monitoring and (via Project Symphony) and analysis</li> <li>• Fleet performance analysis</li> <li>• Ongoing review / recommendations</li> </ul>																								<ul style="list-style-type: none"> <li>• Appropriate baseline inverter performance (via AS4777), and ongoing monitoring / uplift as required.</li> <li>• Define active DER performance monitoring for market participation / network services.</li> </ul>
<p><b>Action 3: Interoperability and cyber requirements</b></p> <ul style="list-style-type: none"> <li>• Test and demonstrate specification performance for Project Symphony</li> <li>• Stakeholder engagement to refine specifications (via standards workstream)</li> <li>• Guidelines applicable for SWIS, aligned to national standards</li> </ul>																								<ul style="list-style-type: none"> <li>• Demonstrated interoperability and cyber security requirements for WEM/SWIS.</li> <li>• Local requirements implemented with lead time for OEM preparation ahead of July 2023, for secure DER Orchestration model.</li> </ul>
<p><b>Action 13: Uplift AEMO dynamic, DER and load modelling capability</b></p> <ul style="list-style-type: none"> <li>• Uplift modelling capability to enable dynamic modelling of DER</li> <li>• Develop, implement and test DER and Load models for the WEM/SWIS</li> <li>• Reporting on outcomes of model development</li> </ul>																								<ul style="list-style-type: none"> <li>• AEMO capability uplifted to enable modelling of system performance, incorporating DER.</li> <li>• Knowledge sharing of outcomes with key stakeholders.</li> </ul>
<p><b>Action 11: Under Frequency Load Shedding revision</b></p> <ul style="list-style-type: none"> <li>• Modelling and analysis undertaken in partnership with Western Power</li> <li>• Review and update of UFLS scheme considering DER behaviour</li> <li>• Frequency risk analysis / reporting</li> </ul>																								<ul style="list-style-type: none"> <li>• Confidence in UFLS scheme design and efficacy.</li> <li>• Analysis of frequency risk in response to system change / DER uptake.</li> </ul>
<p><b>Action 12: System Restart review</b></p> <ul style="list-style-type: none"> <li>• Modelling and analysis undertaken in partnership with Western Power</li> <li>• Review and update of System Restart procedures considering DER behaviour</li> <li>• Ongoing frequency risk analysis and review to consider restart plans</li> </ul>																								<ul style="list-style-type: none"> <li>• Confidence in restart scheme design and efficacy.</li> </ul>
<p><b>Action 15: WEM DER Register</b></p> <ul style="list-style-type: none"> <li>• Extend existing system to WA Systems</li> <li>• Defined WEM Information Procedures</li> <li>• Public reporting arrangements</li> </ul>																								<ul style="list-style-type: none"> <li>• Enhanced visibility of DER to refine forecasting and operational decisions</li> <li>• DER fleet performance analysis</li> <li>• Ongoing standards compliance for DER, and aligned active DER participation/registration requirements</li> </ul>

# 3.1 DER Participation

Aligned DER Roadmap Actions in AEMO's scope



- Led by ETIU with AEMO contribution at key stages, the **DER Participation Workstream** tackles the regulatory and market development requirements to enable DER to participate in the WEM and to provide network support services to Western Power.
- AEMO's goal with respect to these actions is to **support the development of a more efficient and sustainable WEM** through the participation of DER, in line with anticipated increases in DER contribution to the energy system.
- Through **an iterative process to consider, define and test market arrangements** the DER Participation workstream will design the operational arrangements to permit DER to provide a broad range of market and network services.

Note: AR6



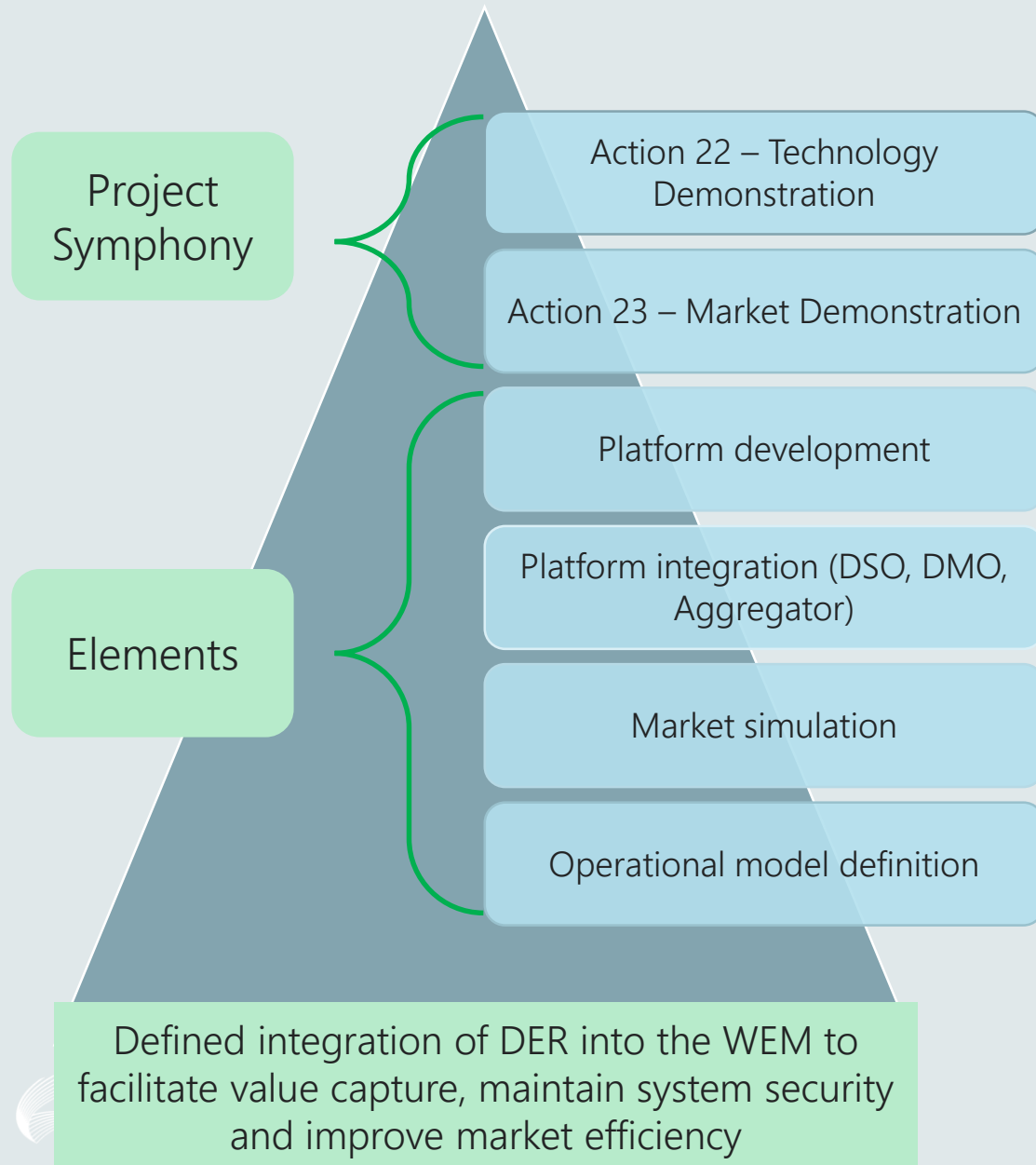
# 3.2 DER Participation – Scope

Functional overview: Staged based on collaboration and demonstration (ETIU lead)

2020						2021						2022						Outcomes / Benefits						
Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		Jan	Feb	Mar	Apr	May	Jun
<b>Action 24 &amp; 25: Preliminary roles and market design</b> <ul style="list-style-type: none"> <li>Preliminary market design</li> <li>Stakeholder feedback on preliminary design</li> <li>Government lead implementation planning (Gov)</li> </ul>																		<ul style="list-style-type: none"> <li>Preliminary market design visible</li> <li>Stakeholder views incorporated</li> <li>Implementation plan established</li> <li>Post-SCED market considered</li> </ul>						
						<b>Action 27: Detailed market design</b> <ul style="list-style-type: none"> <li>Detailed market design and participation arrangements</li> <li>Stakeholder feedback on detailed design</li> <li>Design and implementation plan development (considering WEM Reform)</li> </ul>												<ul style="list-style-type: none"> <li>Post-SCED market design considered.</li> <li>Stakeholder input and feedback further inform designs for DER participation</li> </ul>						
												<b>Action 29: Design and enact regulatory change</b> <ul style="list-style-type: none"> <li>Engagement in detailed design and implementation of changes required (ETIU-led)</li> </ul>						<ul style="list-style-type: none"> <li>Clarified regulatory and legislative framework for DER Orchestration</li> </ul>						
<b>Alignment to Project Symphony (Actions 22 &amp; 23)</b> <ul style="list-style-type: none"> <li>Demonstrate DER capability, market design and technical participation arrangements</li> <li>Confirm implementation planning and participation arrangements</li> </ul>																								<ul style="list-style-type: none"> <li>Test designs and confirm DER capability, or identify capability gap to inform change, implemented model</li> <li>Confirm implementation plan for market. participation, and further development post July 2023</li> </ul>
												<b>AEMO Implementation planning</b> <ul style="list-style-type: none"> <li>Preliminary operational design (considering Project Symphony, SCED, DER Platform)</li> <li>Detailed design and implementation plans, preparation for execution in AR6</li> </ul>						<ul style="list-style-type: none"> <li>Initial and detailed plans for implementation in post-SCED WEM Systems</li> <li>Detailed design and implementation planning</li> </ul>						

# 4.1 DER Orchestration Pilot

Aligned DER Roadmap Actions in AEMO's scope

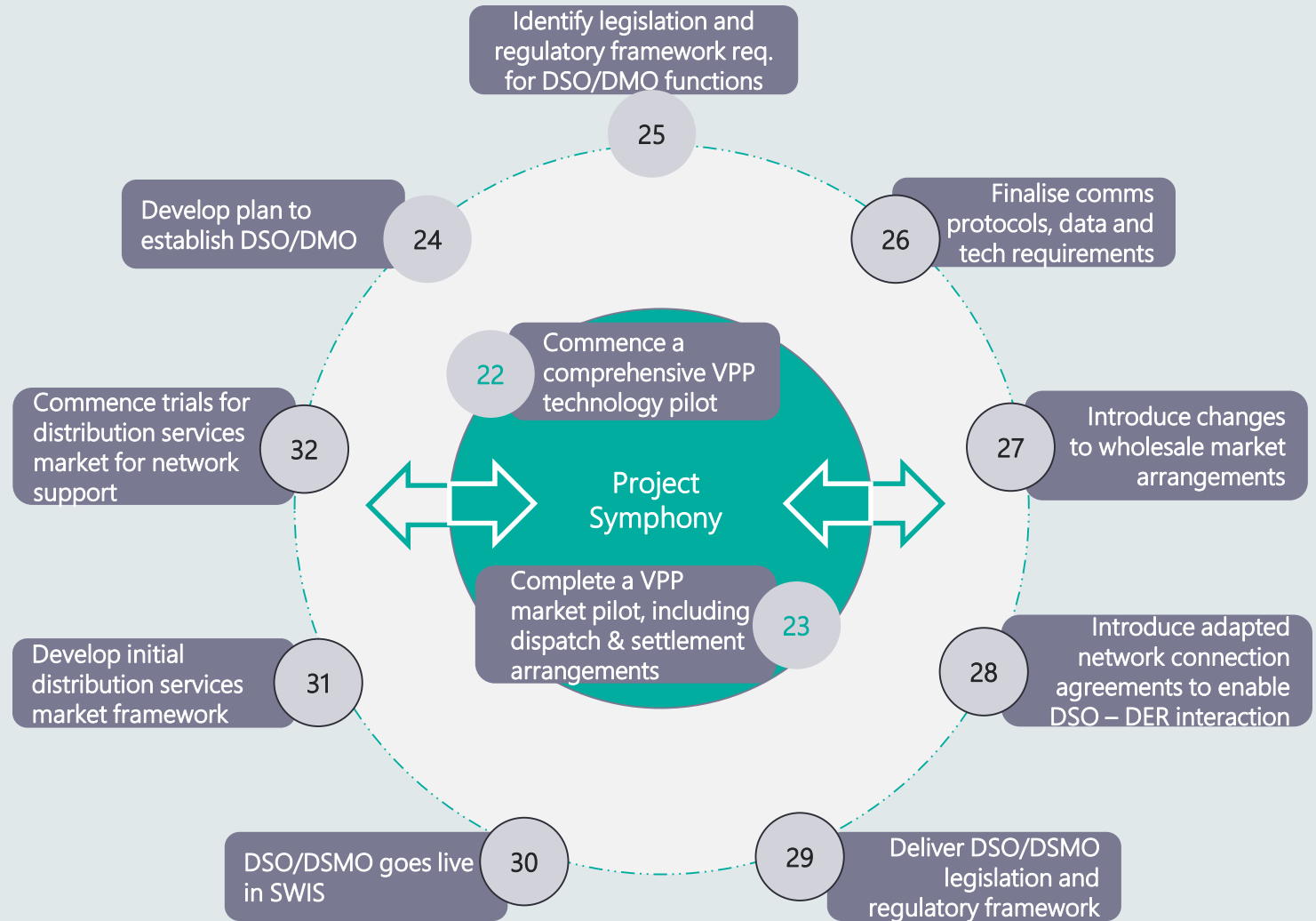
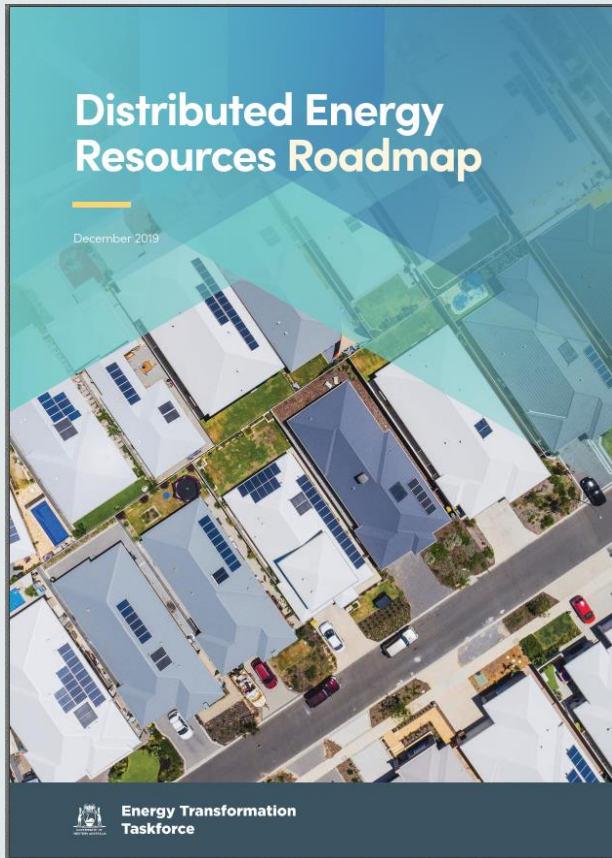


The DER Orchestration Pilot (AKA Project Symphony) will provide key learnings to the development of the DER Orchestration model in the WEM, and nationally:

- **Demonstrate** roles for AEMO, DSO and Aggregator.
- **Build and pilot integration** components between actors and simulated market systems, including demonstrating **dispatch of DER**.
- Demonstrate **capability of DER** to participate in WEM markets (post WEM Reform), in parallel with providing network support services (NSS).
- Provide **key learnings and definition** of the DER Orchestration model and market participation model implemented in the WEM from July 2023 (including cost-benefit assessment of implementation).
- Develop **stakeholder understanding of expectations** for DER orchestration in the WEM/SWIS.
- Investments to be reused in achieving operational model by July 2023.

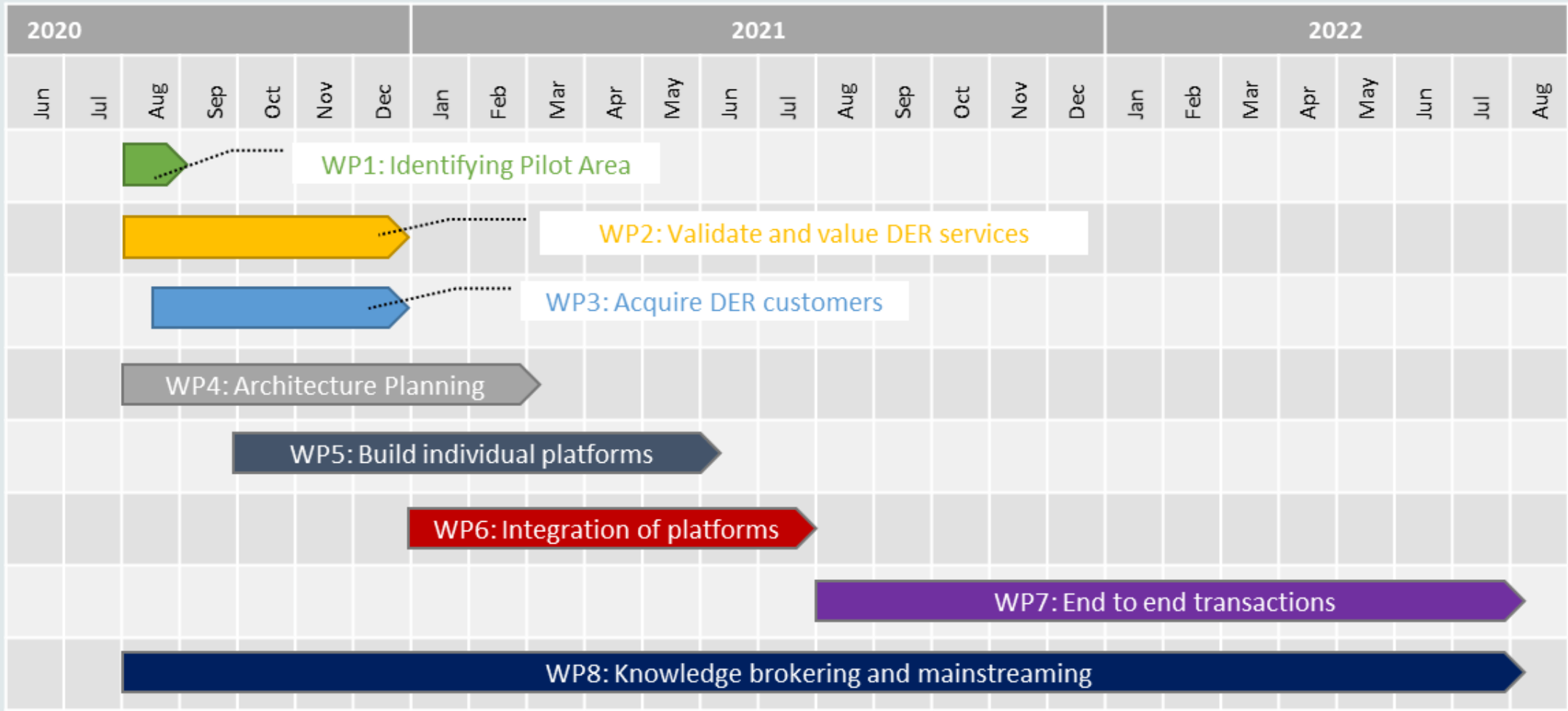
# 4.2 DER Orchestration Pilot

Integration with DER roadmap



# 4.3 DER Orchestration Pilot

Delivery: Work package overview



## 4. Leveraging AEMO capability

There are a number of synergies that will be shared and leveraged between related projects, including:

- Shared utilisation of the DER Register system across WEM and NEM;
- NEM and National standards development;
- NEM operational changes to manage a high DER environment, including modelling approaches, tools and methodologies;
- System security performance assessments, such as frequency risk analysis in the NEM;
- Demonstration projects in Victoria, South Australia and NEM, and;
- Alignment to key elements of the WEM Reform implementation (in AR6).

# AR5 Expenditure Forecast

## CAPEX overview (draft)

	<b>FY20</b>	<b>FY21</b>	<b>FY22</b>	<b>AR5</b>
	<b>\$m</b>	<b>\$m</b>	<b>\$m</b>	<b>\$m</b>
Technology Integration	0.1	1.5	2.3	3.8
DER Participation	0.0	0.9	1.6	2.6
DER Register	0.1	1.3	0.1	1.5
Project Symphony	0.2	7.7	3.1	11.0
<b>Total</b>	<b>0.4</b>	<b>11.4</b>	<b>7.1</b>	<b>18.9</b>

- This forecast is the outcome of:
  - Detailed planning and project design which has refined scope and planned to harness synergies between projects for delivery in line with the DER Roadmap's aggressive timelines;
  - Sense checking costs against similar projects, and;
  - Building detailed design work including co-design between project teams to secure synergies / cost efficiencies between projects and stakeholders.

# AR5 Expenditure Forecast

## Market fees overview (draft)

	<b>AR5 Estimate FY21</b>	<b>AR5 Estimate FY22</b>	<b>AR6 Estimate FY23</b>	<b>AR6 Estimate FY24</b>	<b>AR6 Estimate FY25</b>
Forecast WEM Fees (\$/MWh)*	0.894	0.928	0.964	0.995	1.026
Forecast WA DER Roadmap Expenditure (\$/MWh)	0.00	0.01	0.04	0.08	0.08
Impact on forecast fees	0.2%	0.7%	4.6%	8.4%	8.2%

\* Based on the published 2020-21 AEMO Budget and Fees document.

- Impact on fees are expected to come through starting FY21 (AR5) whereby we will see a 0.2% increase on forecast fees for that year. This is would gradually increase to approx. 8% impact on forecast fees by FY24. Fee impacts from depreciation of investments are forecast to remain steady to and cease by FY30.
- Note: OPEX expenses for these projects will contribute less than 0.5% to fees and will therefore be managed within the existing AR5 OPEX overspend allowance. The ERA will not be asked to approve AR5 OPEX for these activities. Requirements for OPEX in AR6 and beyond as these projects are completed is uncertain at this time.
- Key assumptions
  - Capital depreciation commencement dates are aligned to the completion of WA DER roadmap actions with majority of the depreciation only starting in Jan'23 (AR6) - with the exception of WA DER Register which is estimated to be completed in Q3 FY21.
  - Useful life of 7 years is assumed based on the blend of technology and procedural assets to be established.

## 5. Next steps

1. Consolidate feedback
2. Refine forecasts
3. AEMO Board to consider in September
4. Engage with ERA ahead of submission
5. AEMO submission to ERA during September
6. Continue to refine activities and meet early DER Roadmap milestones in the interim

Contact us via: [WADERProgram@aemo.com.au](mailto:WADERProgram@aemo.com.au)



# Questions and Feedback