

The Roadmap to Renewable Energy in WA

State of Energy Research Conference

Perth, February 2024 Dean Sharafi



About AEMO

- AEMO is a member-based, not-for-profit • organisation.
- We are the independent energy market and ٠ system operator and system planner for the National Electricity Market (NEM) and the WA Wholesale Electricity Market (WEM).
- We also operate retail and wholesale gas ٠ markets across south-eastern Australia and Victoria's gas pipeline grid.



AEMO Services is an independent subsidiary of AEMO, established in 2021 to enable the transparent provision of advisory and energy services to National Electricity





On the way to Renewable Energy, why do we need to collaborate?





Australian power systems are continuously integrating high levels of renewable energy to reach the stated goal of Net Zero.



We are moving away from synchronous fossil fuel generators to cleaner alternatives, and this has created challenges for the power system.



We increasingly need to work with research institutions and academia to resolve these challenges



How energy transition future unfolds?



Low-cost renewable energy, taking advantage of the abundant wind and solar resources.



Firming technology like batteries, and gas generation, to smooth out the peaks and fill in the gaps.



New transmission & modernised distribution networks to connect lowcost renewable sources. A power system capable of running, at times, entirely on renewable energy.

How energy transition future unfolds?

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Low-cost renewable energy, taking advantage of the abundant wind and solar resources. A power system capable of running, ter ba at times, entirely on gas to renewable energy. AEMC



Energy transition is well underway Close to 100% renewables in 2022

Potential Renewable Generation vs Underlying Demand on 16/10/2022





Energy transition is well underway Potential for 100% renewables at times in 2023



Estimated Underlaying Demand

Potential Total Renewables

7

AEMO's Roadmap to Renewable Energy



Relevant acronyms

DPV: Distributed photovoltaics; EF: Engineering Framework; FCAS: Frequency control ancillary service; VRE: Variable Renewable Energy

storage and other non-fossil fuelled technologies

ite **emergency frequency** I **arrangements** in place manage non-credible contingency events

lity to **restart** system without ssil-fuelled ation having to een online prior system black

Transmission

Preconditions

security

System

Resource Adequad and Capability

system performance, and control room tools for stability monitoring and risk assessment

> Ability to **forecast and active manage** plausible VRE generation output variabilit and uncertainty

> > Processes to manage increased operational r and uncertainty during in operation in uncharter operational condition

Defined planning

operabilix



Relevant acronyms

Managing the power system | June 2023



Available Generation (MW) = Total Scheduled Generation – Scheduled Generation Outages + Wind Generation + Grid Scale Solar Generation – Network Constraints (110 MW).



Daunkelflaute





SWIS Roadmap to Renewable Energy

Areas of potential collaboration with universities



Frequency related knowledge objectives



Preconditions for first 100% periods	ln progress	Commence First 100 soon perio	%More regulards100% operation
Ability to keep system frequency within defined limits following credible and non-credible events, including RoCoF containment and effective emergency frequency control arrangements	Identify and p identified sys AEMO and We increasing agg possible need	Review the RoCoF Safe Limit based on an assessment of RoCoF Ride-Through Capability and availability of RoCoF Control Service 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 Specify accreditation requirements for RoCoF Control Service from synthetic inertia providers or orgress opportunities (where economic) opportunities for common solutions to address inertia requirements in conjunction with tem strength needs, such as adding flywheels to synchronous condenser installations AEMO and Western Power remediate or redesign UFLS arrangements for effective operation during high DPV conditions Use phasor measurement units (to be installed by Western Power) to provide increased accuracy of system inertia estimation in real time	
Frequency Co-optimised Essential System Services (FCESS) reserve requirements completely met by VRE, storage, demand response and other non-fossil fuel technologies	Review the eff penetration s AEMO to aug responsive be	fficacy of FCESS (Regulation, Contingency Reserve, RoCoF Control Service) under high renewables cenarios ment methodology for FCESS service quantity to ensure impacts of uncertainty relating to increasing price chaviour of non-scheduled facilities and DER is reflected in service quantities	
Legend	Roadmap actic	n Newly identified WA action Collaboration	

Frequency related knowledge objectives



Frequency related knowledge objectives



Legend Roadmap action

action

AEMC

Frequency Management Transient & oscillatory stability System strength and converter driven stability Voltage control system restoration Monitoring & situational awareness Power system modelling

We are already engaging













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