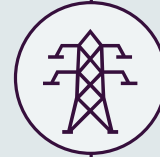


# AEMO integrated system plan

Benefits, opportunities, and critics

October 2021

# About AEMO



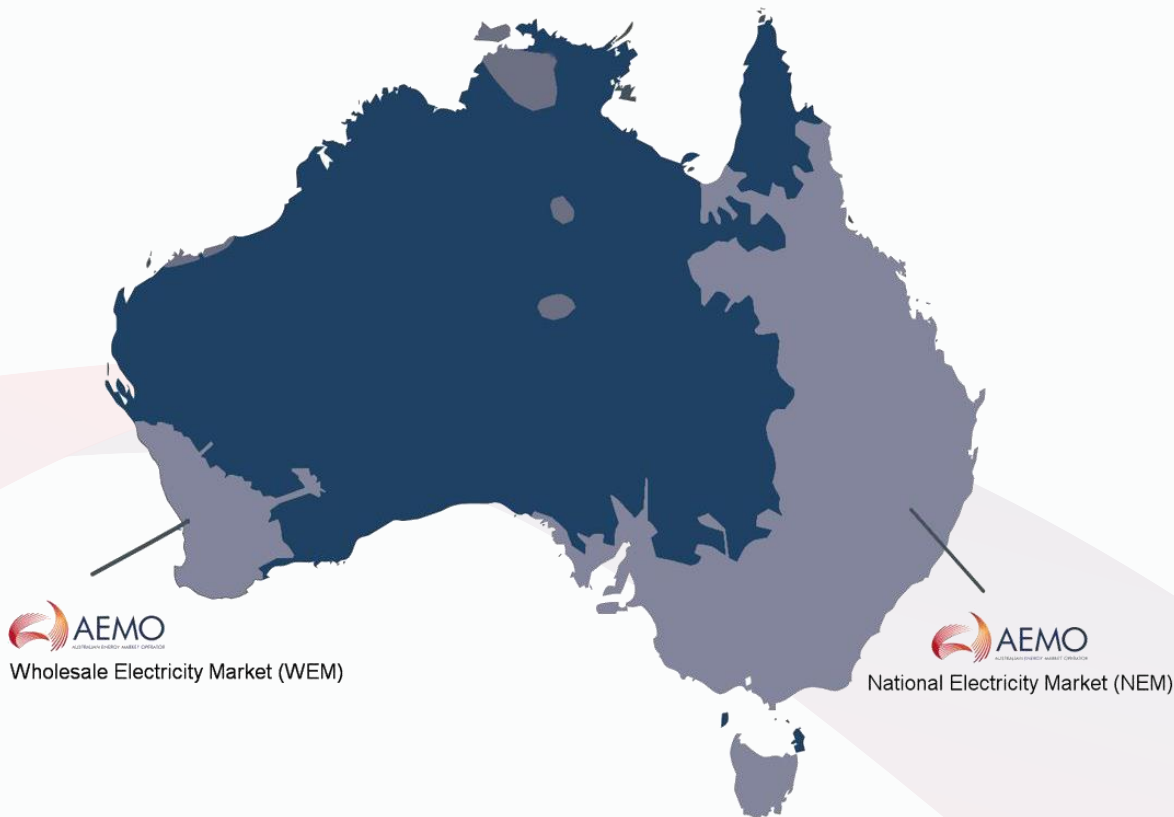
AEMO is a member-based, not-for-profit organisation.



We are the independent energy market and 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 markets across south-eastern Australia and Victoria's gas pipeline grid.



# Our corporate priorities at a glance



1. Operating today's  
systems and markets



2. Navigating the  
energy future



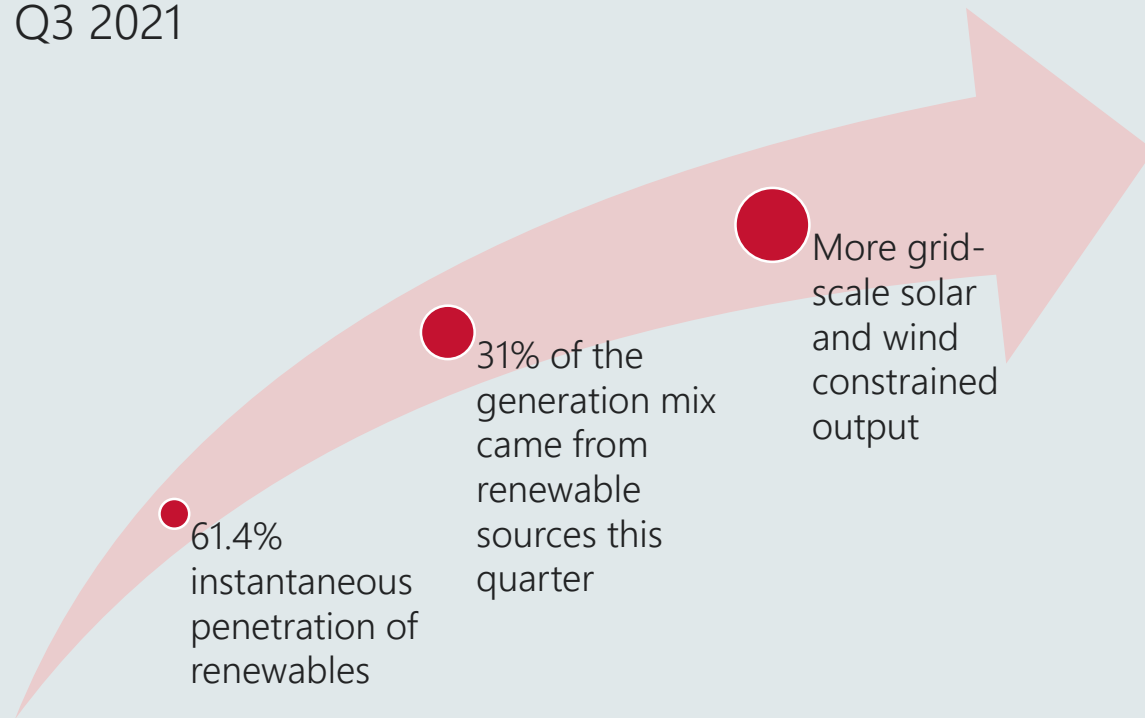
3. Engaging our  
stakeholders



4. Evolving the way  
we work

# The NEM in transition continues to break records: July – Sept 2021

## Quarterly Energy Dynamics, Q3 2021



Record levels of negative prices: 16% of trading intervals with price  $\leq$  \$0/MWh

Pressure on viability of coal-fired generators and lower gas generation

In Victoria, average spot prices were just \$0.01/MWh during Aug and Sept

Three major coal-fired power stations have brought forward expected closure in past year

By lowering emission intensity of the NEM, other sectors can decarbonise through electrification

# Meeting the long-term interests of consumers during such a transition requires a 'whole-of-system plan'



- The ISP describes Australia's future least cost energy transition
- Looks ahead to 2050
- Utilises the opportunities provided from existing technologies and anticipated innovations
- Aims to inform policy makers, investors, consumers, researchers and other energy stakeholders

# 2022 ISP scenarios influenced by extensive stakeholder consultation, research and analysis

- Five scenarios cover a plausible range of energy futures. These scenarios assume different futures, depending on questions like:
  - **How much does the population and economy grow, and how much will we rely on electricity** for our energy needs?
  - **How much will energy supply keep decentralising**, as homes and businesses invest in their own rooftop PV and storage systems?
  - What will be the impact of increasing digitalisation, changes in technology, and the **emergence and growth of new technologies such as electric vehicles**?
  - **How quickly will sectors, businesses and households seek to decarbonise**, and how much will they switch from other fuels to electricity as electrical power comes more from renewables and less from fossil fuels?
  - **Will we see the rise of alternative fuels like biofuels and hydrogen?**

In 20 years, what do the different scenarios look like for how people live and work in the NEM?

## SNAPSHOT OF 2040 COMPARED TO TODAY



**2020** – 35% of industry and manufacturing processes is powered by gas  
**2040** – natural gas use in industry ranges across scenarios. In Net Zero 2050 it is 7% higher than in 2020, but it has reduced by 18% in Step Change and 56% in Hydrogen Superpower, with some earlier gas-fuelled processes now using hydrogen.



**2020** – only 0.1% of our cars are electric vehicles  
**2040** – strong growth in electric vehicles in all scenarios except Slow Change, from one-third of all vehicles being electric (Steady Progress), to around half (Net Zero 2050 and Step Change), to 75% (Hydrogen Superpower)

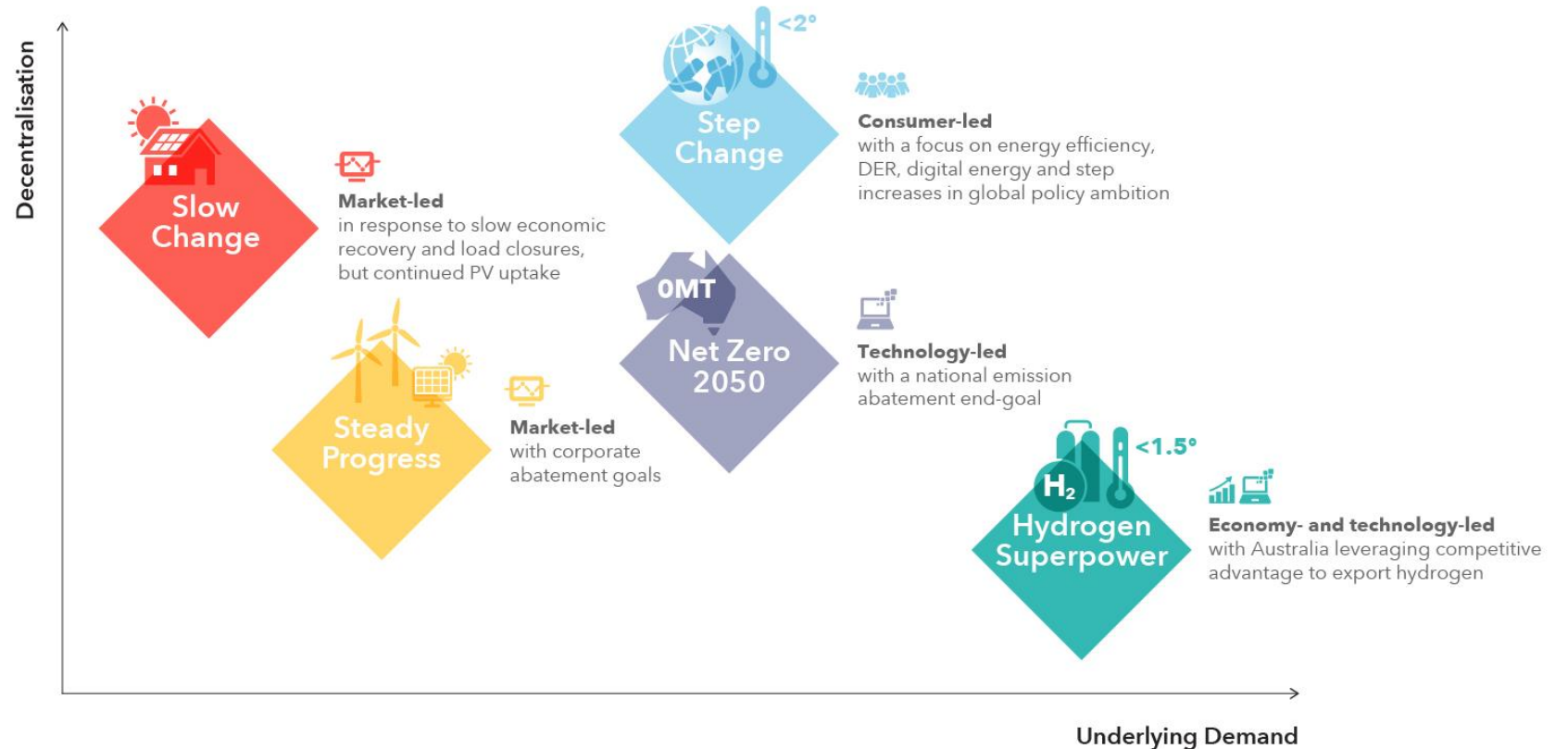
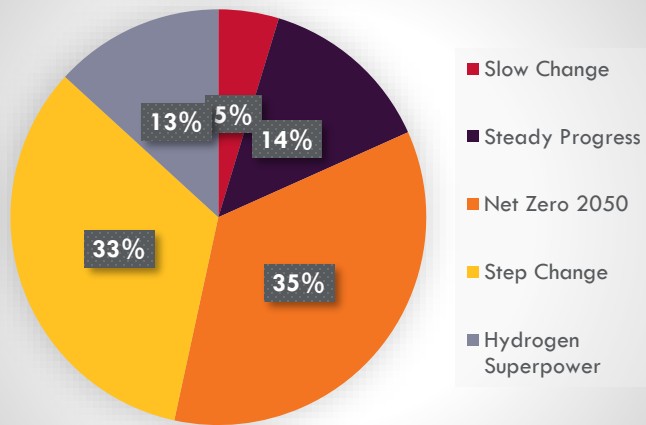


**2020** – consumers own 8 GW of capacity in their rooftop solar and batteries (about 14% of all the capacity in the NEM). 5 million homes heated by gas  
**2040** – consumer-owned generation capacity could have tripled (Steady Progress and Slow Change), quadrupled (Net Zero 2050 and Step Change), or be approaching five times 2020 capacity (Hydrogen Superpower). Gas use in homes has reduced by about 15% (Steady Progress), 55% (Net Zero 2050), 85% (Step Change) or 90% (Hydrogen Superpower), as consumers have switched to electric heating options or clean fuel alternatives to save cost and reduce emissions

# Scenarios are characterised by **pace of decarbonisation** and **level of decentralisation**












































































This year's Integrated System Plan (ISP) extends to consider potential **broad economy electrification** as a method for decarbonisation.

## Relative likelihoods





# The possible futures of the NEM in 2040

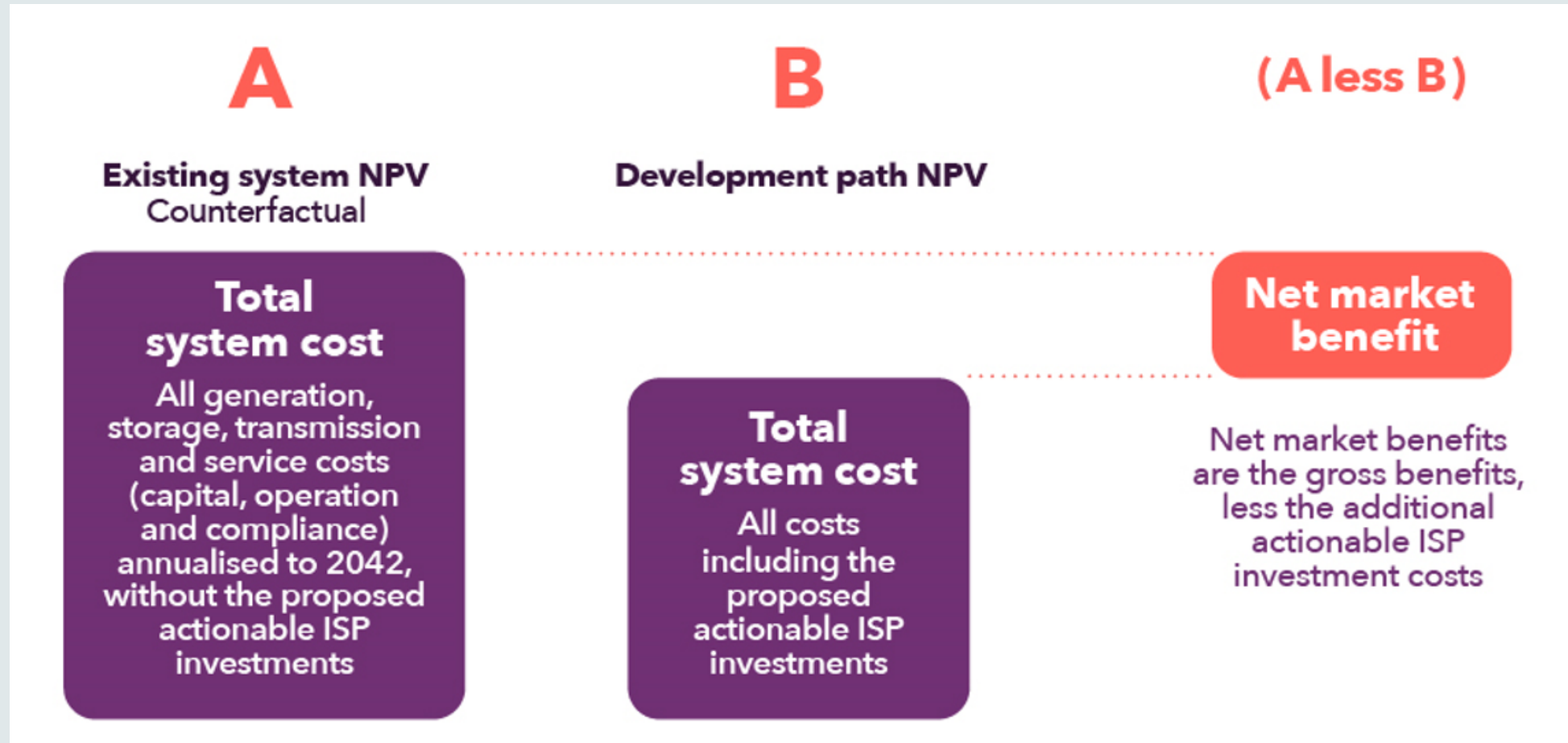
	 Slow Change	 Steady Progress	 Net Zero 2050	 Step Change	 Hydrogen Superpower
<b>DEMAND</b>					
<b>Electrification</b>					
- % of road transport that is EV by 2040	 22%	 44%	 52%	 58%	 76%
- % of residential EVs still relying on convenience charging by 2040	 68%	 61%	 57%	 47%	 40%
- Industrial electrification by 2040	 -25 TWh	 8 TWh	 32 TWh	 45 TWh	 66 TWh
- Residential electrification by 2040	 0 TWh	 0 TWh	 6 TWh	 9 TWh	 10 TWh
Energy efficiency savings by 2040	 16 TWh	 25 TWh	 30 TWh	 44 TWh	 44 TWh
<b>Underlying Consumption</b>					
- NEM underlying consumption by 2040	 184 TWh	 245 TWh	 276 TWh	 279 TWh	 329 TWh
- H2 consumption (domestic), 2040	 0 TWh	 0 TWh	 2 TWh	 15 TWh	 64 TWh
- H2 consumption (export), including green steel, 2040	 0 TWh	 0 TWh	 0 TWh	 0 TWh	 221 TWh
- Total underlying consumption by 2040	 184 TWh	 245 TWh	 278 TWh	 294 TWh	 614 TWh
<b>SUPPLY</b>					
Distributed PV Generation	 47 TWh	 51 TWh	 61 TWh	 66 TWh	 83 TWh
% of household daily consumption potential stored in batteries	 4%	 12%	 17%	 32%	 35%
% of underlying consumption met by DER by 2040	 26%	 21%	 22%	 22%	 13%
Estimate of % coal in generation mix by 2040 *	 50%	 20-25%	 15-20%	 5%	 0%
Estimate of NEM emissions production by 2040 (MT CO <sub>2</sub> -e) *	 TBD	 TBD	 55 (~40% of 2020 NEM emissions)	 10 (~7% of 2020 NEM emissions)	 1 (~1% of 2020 NEM emissions)

 Level of change

\* Estimates will be refined through ISP modelling



# Calculating benefits to consumers



# Transition requires targeted investment in grid infrastructure

2020 ISP Example



Classification	Project	Indicative timing
 <b>Committed</b>	SA System Strength Remediation	2021-22
	QNI Minor	2021-22
	Western Victoria Transmission Network Project	2025-26
 <b>Actionable<sup>1</sup></b>	VNI Minor	2022-23
	Project EnergyConnect	2024-25
	HumeLink	2025-26
	Central-West Orana REZ Transmission Link	Mid-2020s
	VNI West <sup>2</sup>	2027-28
 <b>Preparatory Activities Required</b>	Marinus Link <sup>2</sup> - Cable 1 - Cable 2	2028-29 to 2031-32 2031-32 to 2035-36
	QNI Medium & Large	2030s
	Central to Southern QLD	Early-2030s
	Reinforcing Sydney, Newcastle and Wollongong Supply	2026-27 to 2032-33
	Gladstone Grid Reinforcement	2030s
	New England REZ Network Expansion <sup>3</sup>	2030s
	North West NSW Network Expansion <sup>4</sup>	2030s
 <b>Future ISP Projects</b>	Far North QLD REZ	2030s
	South East SA REZ	2030s
	Mid North SA REZ	2030s

<sup>1</sup> Estimated practical completion including any subsequent testing - projects may be delivered earlier  
<sup>2</sup> Decision rules may affect timing  
<sup>3</sup> May be accelerated by government initiatives  
<sup>4</sup> Not shown on map. AEMO requires that preliminary engineering designs be completed by 30 June 2021

2020

2040

# Making decisions in best interest of consumers...

...requires good engagement

- Aim to strike the balance between not spending too much too soon, or too little too late
  - Use scenario and sensitivity analysis to ensure the plan is robust to a range of possible futures
- Guided by the AER's best practice forecasting guidelines and cost benefit analysis guidelines
  - Principles include accountability, openness, transparency, accuracy
- Established the ISP Consumer Panel as part of the oversight framework to:
  - Promote the consumer interest
  - Help us better understand how we can engage effectively with consumers so that they know what it means for them
  - Develop an ISP that electricity consumers can have confidence in

*" in order to maximise the benefits of this energy transition for the whole of society, all of us need to play our role and work collaboratively, together, and learn from one another",*

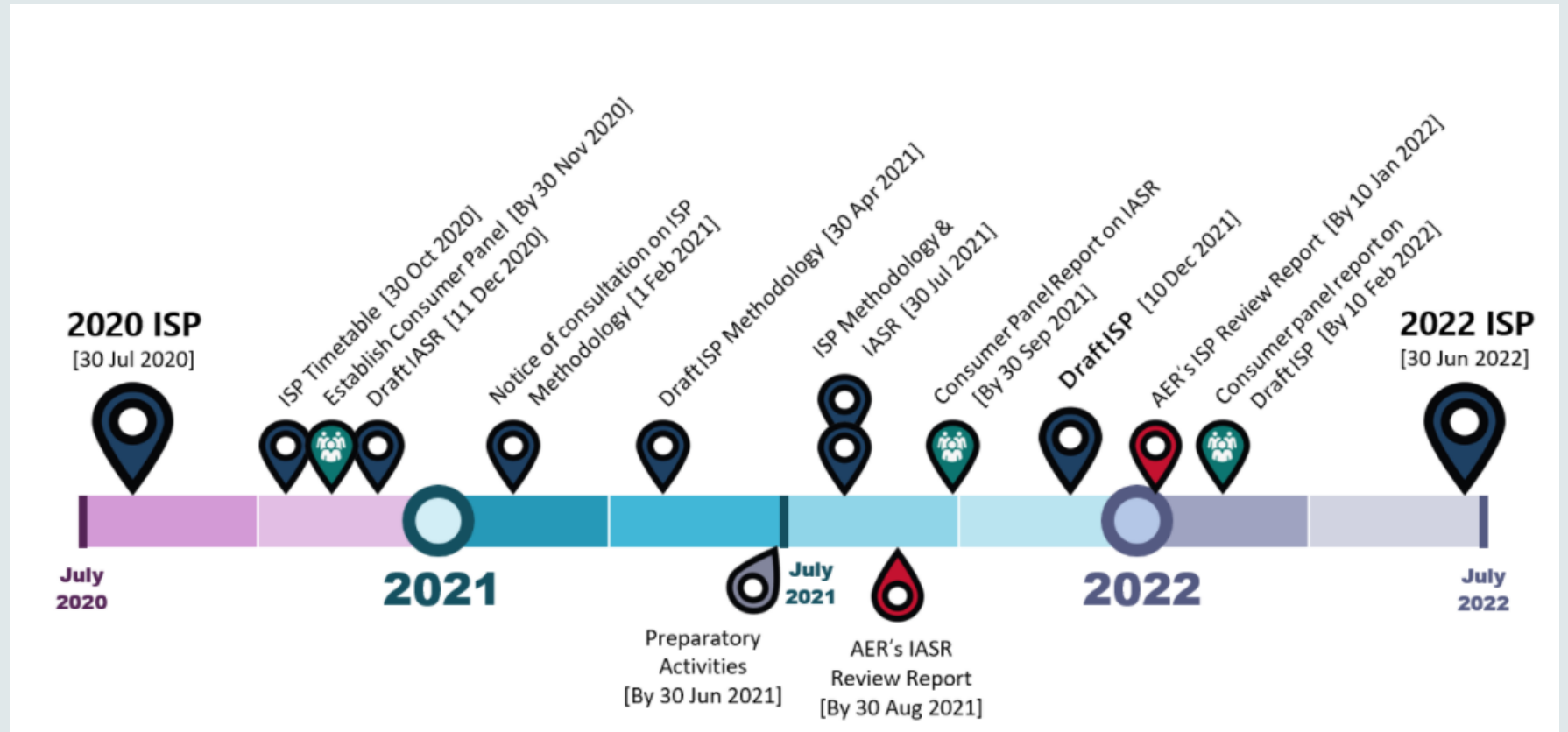
*Daniel Westerman, AEMO CEO*

# How to get involved

Draft 2022 ISP will be published 10 December for consultation.

Consultation to focus on:

- How **uncertainty** is managed (Consumer Panel recommendation)
- Whether the ISP reflects consumers' level of risk neutrality or **risk aversion**



<https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp/get-involved>