Draft 2021 Inputs, Assumptions and Scenarios Consultation Feedback

AEMO Planning and Forecasting

3 March 2021

We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and culture.
We pay our respects to their Elders past, present and emerging.

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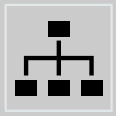
Objectives of the day

To provide a summary of the submissions received



To outline proposed changes to the set of scenarios in response to stakeholder feedback, and to provide the opportunity for stakeholders to provide further feedback ahead of a two-week written consultation period

To detail common areas of feedback in the submissions and to provide an indication of AEMO's current intentions and considerations

To seek feedback on AEMO's reflections on the IASR submissions

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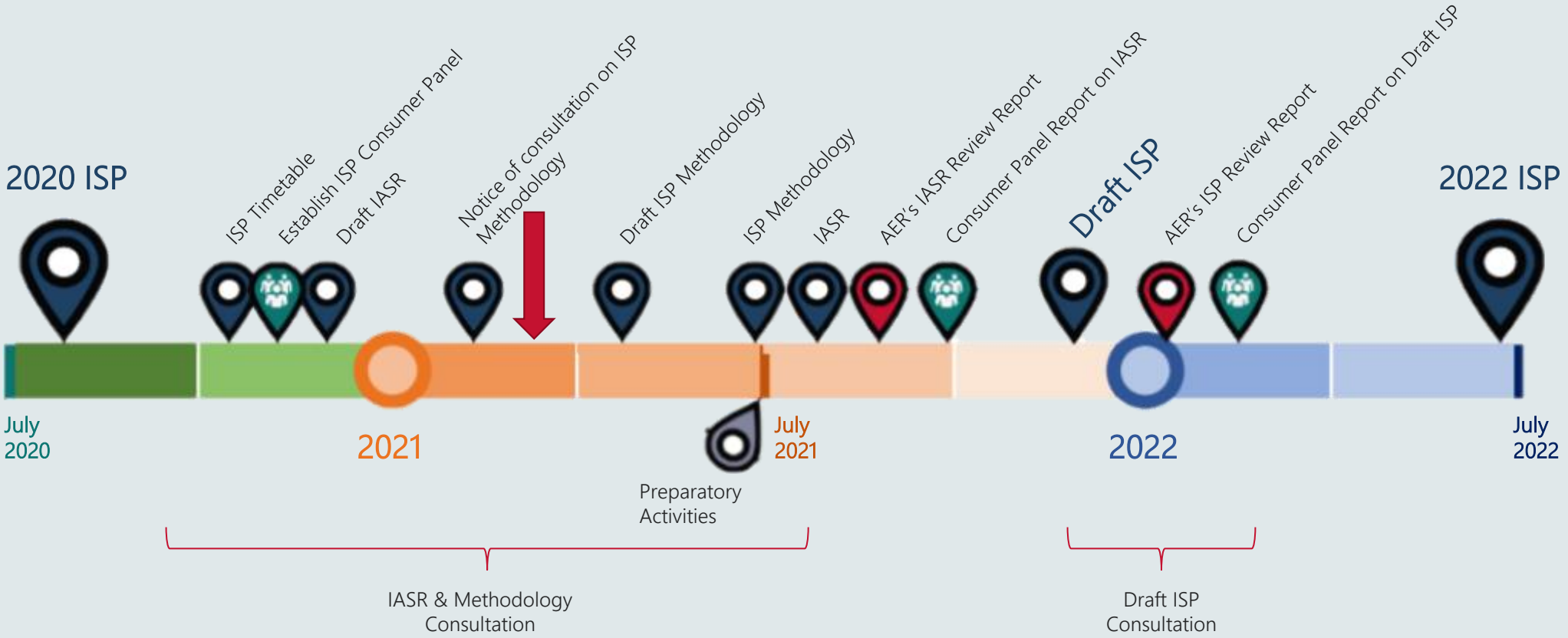
2022 ISP Timeline



2022 ISP consultation milestones (up to December 2021)

Publication	Timing	Responsibility
ISP Timetable	30 October 2020	AEMO
Establish ISP Consumer Panel	By 30 November 2020	AEMO & ISP Consumer Panel
Draft IASR	**11 December 2020**	**AEMO**
Notice of Consultation on ISP Methodology	1 February 2021	AEMO
Draft ISP Methodology	21 April 2021	AEMO
ISP Methodology	30 June 0221	AEMO
Preparatory Activity Reports	By 30 June 2021	TNSPs
IASR	**30 July 2021**	**AEMO**
AER's IASR Review Report	By 30 August 2021	AER
Consumer Panel Report on IASR	By 30 September 2021	ISP Consumer Panel

Draft ISP to be published December 2021

AEMO received nearly 50 submissions

Advisory

Consumer Advocacy

ISP Consumer Panel

Environment

Electricity & Gas Network

Generation/ Retail

Developer

Government

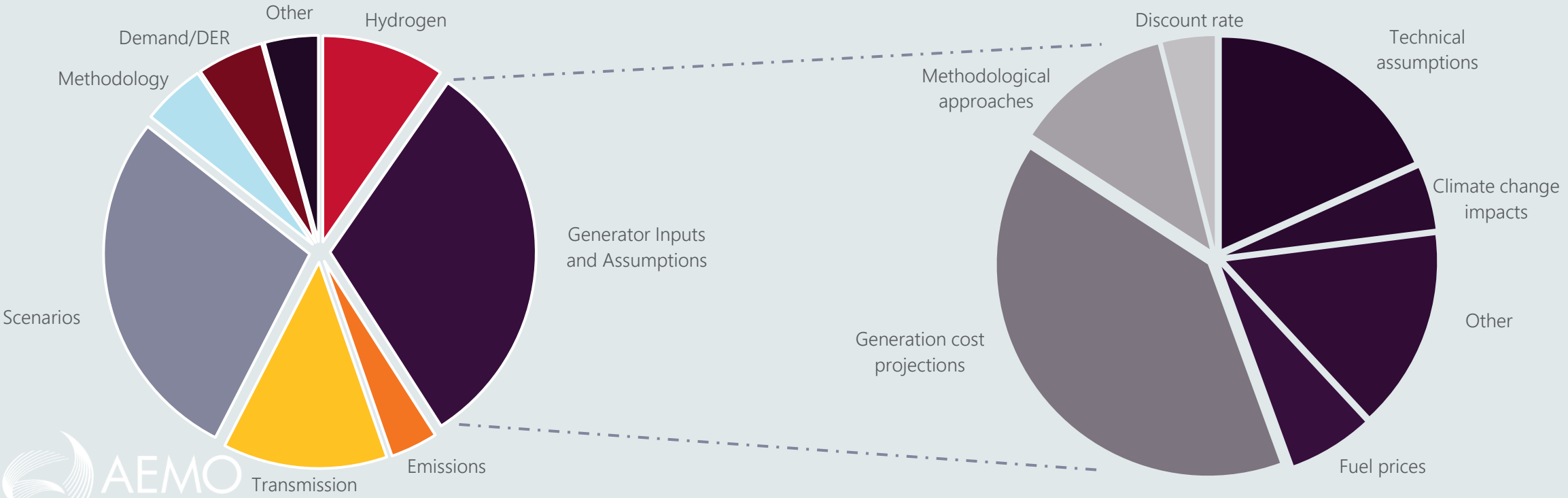
Senator Gerard Rennick

Other

Oscar Archer

Summary of feedback

- Submissions have been categorised into high-level topics
- Several key themes raised by stakeholders
- The topic that received the most feedback was the Scenarios



Scenarios proposed in the Draft IASR

Central	Based around current state and federal government and environmental policies (currently funded and/or legislated policies and commitments), and best estimates of all key drivers. Assumed a progression towards net zero emissions in the second half of the century.
Slow Growth	Lowest levels of growth, increased risks of industrial load closures, and decarbonisation ambitions, though with strong PV uptake in the near term. Over time distributed PV uptake moderates.
Diversified Technology	This scenario combined assumptions on low gas prices with cost reductions in CCS (given global ambitions to limit temperature increases to 2 degrees). This scenario aimed to understand the implication of low gas prices and CCS reductions, reflecting Federal Government policy overtures on the role of gas and technology.
Sustainable Growth	2 degree decarbonisation in the context of rapidly falling costs for VRE/batteries, with high economic growth and DER uptake. No NEM-connected hydrogen generation.
Export Superpower	This scenario had the highest level of decarbonisation ambition in the draft IASR (1.5 degrees) combined with high economic growth/population assumptions, as well as the development of a significant hydrogen industry aimed at both export and domestic consumption.

Reflections on the Central scenario

Feedback on the Central scenario

Governments

- Central remains limited in scope, suggesting the creation of a separate scenario representing a direction for net zero emissions by 2050

Government of South Australia

- AEMO to consider impact of achieving net-zero emissions across the entire economy. Request for AEMO to also include a scenario that reflects NSW economy-wide net zero emissions objective

NSW GOVERNMENT

Consumer Advocates

- Central scenario should reflect clearly stated intentions by governments

Major Energy Users Inc.

- Supports incorporation of a stronger set of assumptions around the decarbonisation of the economy in the Central Scenario

ENERGY CONSUMERS AUSTRALIA

- It is not clear that the issue of decarbonisation is appropriately dealt with in the Central Scenario. Recommend further engagement on this issue

ISP Consumer Panel

- Central scenario should include net-zero emission target by 2050 ( ) as well as target RCP2.6

Market Participants/Developers

- Central scenario to be more progressive ( ) and does not represent a credible baseline view of the future

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- Legislated state-level interim emissions reduction targets should be integrated once announced, and we underscore the need to continue to update the modelling with legislated and defined measures as they are confirmed throughout 2021.

EnergyAustralia

Networks

- Central scenario should reflect Victoria's Climate Change Act (net zero emissions by 2050)

AusNet services

- More appropriate for the Central scenario to reflect a net-zero by 2050 ambition

Energy Networks Australia

Climate/Industry Bodies

- Central scenario should reflect the state-based emissions targets of net-zero by no later than 2050 adopted by every Australian state and territory

Australian Gas Infrastructure Group

- Central scenario should target net zero by 2050 ( ) and be be consistent with emission trajectory of RCP2.6 (<2 degrees)

AUSTRALIAN CONSERVATION FOUNDATION

Nature Conservation Council

AUSTRALIAN CONSERVATION FOUNDATION

- Central scenario should be more similar to Sustainable Growth

TOTAL ENVIRONMENT CENTRE

AEMO's response to feedback on Central

There is a clear desire across stakeholders to consider a commitment to net zero by 2050, either in the Central scenario or in addition to the Central.

There remains currently no legislated national commitment to a net zero target, although all states and territories have some form of net zero target/plan.

The Federal Government has also emphasised a goal "to reach net zero emissions as soon as possible, and preferably by 2050" *, but that the timing "will depend on the advances made in science and technology".

Proposed approach is to replace the Central scenario with two different outlooks:

- A **Current Trajectory** scenario which does not extend policy beyond existing commitments (particularly 26-28% by 2030), with technology and economic trends informing long term.
- A **2050 Net Zero** scenario which transitions from the 2030 commitment to net zero emissions in 2050.

PM Scott Morrison, National Press Club address, 1 February 2021

Shared assumptions: Current Trajectory and 2050 Net Zero

Central outlook for economic and population growth

Central outlook for distributed PV and residential storage

26-28% emissions reduction on 2005 levels by 2030

Continuation of all legislated policies (state-based VRE targets, Victoria and ACT net zero targets, etc.)

All inputs and assumptions are consistent up to 2030

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Assumption differences: Current Trajectory and 2050 Net Zero

Current Trajectory

- **Beyond 2030, no explicit decarbonisation objective nationally.**
- Consumer-driven developments continue based on economics and consumer preferences.
- Electricity sector decarbonisation through coal retirements, economics of new generation and influence of state-based policies and targets.
- More limited impacts of decarbonisation from other sectors, driven by gradual changes in technology and science.

2050 Net Zero

- **Beyond 2030, Australian emissions transition linearly towards net zero by 2050*.**
- Likely impacts:
  - Greater levels of electrification and energy efficiency as a means of decarbonisation from other sectors, although rate of sectoral decarbonisation will vary with technology and science developments.
  - Increased speed of emissions reduction in the electricity sector after 2030.

* Net zero could be reached between 2040 and 2060 depending on technological improvements and break-throughs, but the scenario nominally targets 2050 for this assessment.

So what is AEMO's "most likely" scenario?

Section 3.2.2 of the AER's Cost Benefit Analysis (CBA) guidelines require AEMO to identify a "most likely" scenario, for the purposes of clause 5.22.5(e)(3) of the NER. Previously this has been the Central scenario

Scenario weightings will be developed through further consultation in Q3 and Q4 2021 prior to the release of the Draft ISP

The proposed approach maintains the flexibility to understand how the relative likelihood of the scenarios evolves over the coming months

Consideration of emissions in the scenarios

Feedback on the importance of decarbonisation

Summary of feedback

- Extent and pace of decarbonisation a major focus across many submissions.
- Reflects the view that this represents the greatest source of sectoral uncertainty.
- Feedback also suggested scenarios should have a more ambitious upper bound/reflect more rapid change in policy.

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ISP Consumer Panel

public interest advocacy centre ltd

AUSTRALIAN CONSERVATION FOUNDATION

Energy Networks Australia

HAVYATT ASSOCIATES

AEMO proposal

- Given the greater degree of sectoral interactions due to decarbonisation, we propose that the purposes of the scenarios more deeply explore this key source of sectoral uncertainty.
- Our scenarios will also be informed by multi-sectoral modelling to ascertain these impacts.

Updated consideration of decarbonisation in scenarios

Sustainable Growth

- Keep the level of economic and population growth consistent with a Central outlook.
- Retain a focus on DER uptake and early decarbonisation which may be consistent with the Paris Agreement objective of keeping temperature rise to below 2 degrees.

Purpose:

- Understand the impact of stronger decarbonisation on the electricity sector.

Rapid Decarbonisation (sensitivity)

- New sensitivity that uses similar settings to the Export Superpower but assumes limited uptake of domestic hydrogen consumption within the NEM.

Purpose:

- Explores the challenges in the NEM of more rapid decarbonisation without widespread hydrogen consumption.

Export Superpower

- No change to the scenario settings (early decarbonisation activities which may be consistent with achieving a 1.5 degree objective), but improved inputs and approach informed from stakeholder feedback.

Purpose:

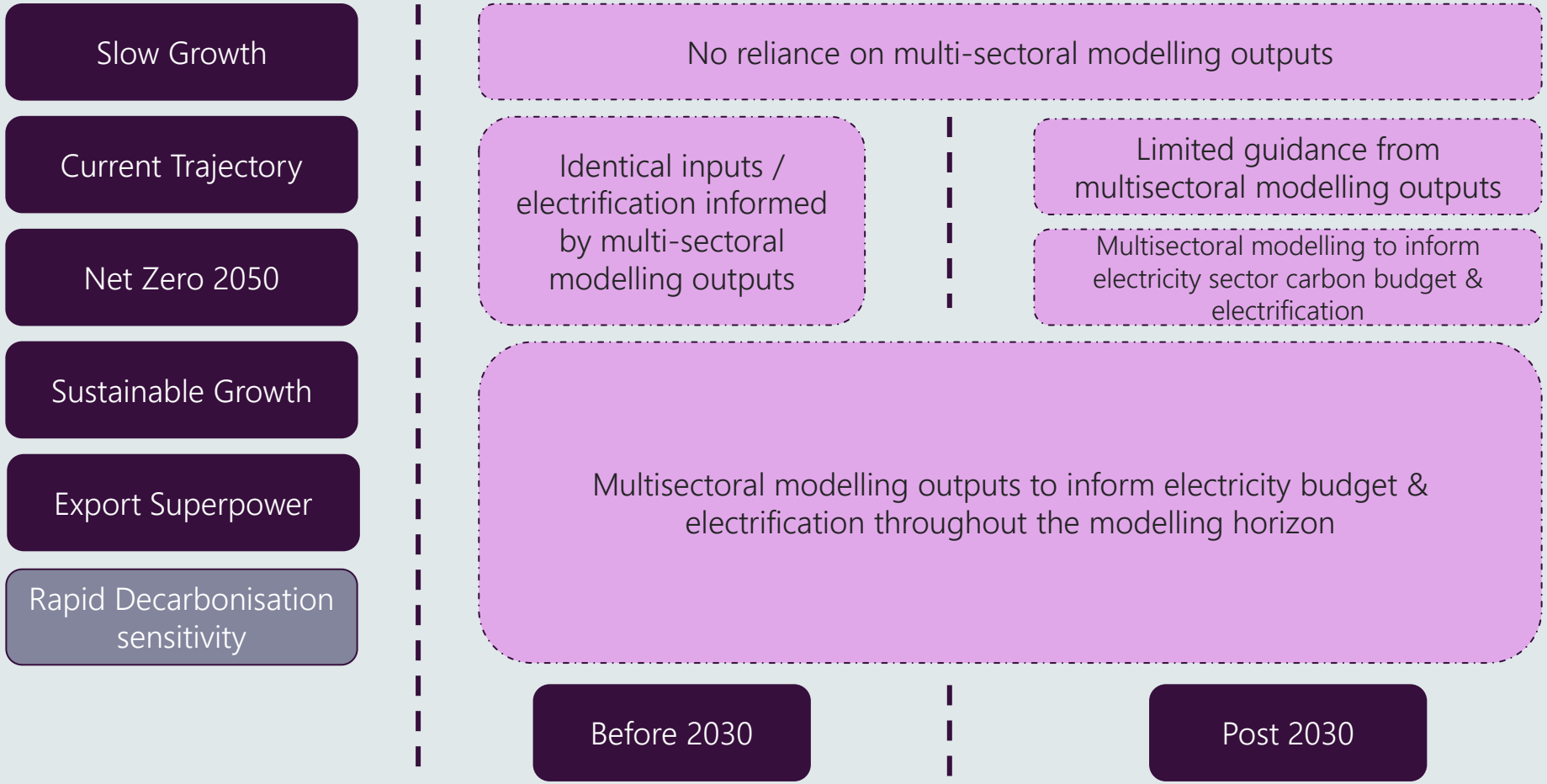
- To explore the impact of significant hydrogen production in the NEM, including:
  - The impact of much higher NEM demand.
  - The role of electrolysers in helping manage the transition towards deep emissions reduction.

Approach to modelling decarbonisation assumptions

A multi-sectoral emission modelling approach

- Stakeholder feedback reiterates that lower emission budgets and net zero targets require informed and careful considerations of linkages between sectors across the economy, and the potential pitfalls of considering the electricity sector in relative isolation.
- AEMO is commissioning multi-sectoral modelling of our scenarios, to inform sector-level emission trajectories, and the scale of electrification from decarbonising the broader economy.
- This will provide us with insights in the activities needed across other sectors (transport, buildings, etc.) to meet economy-wide targets, and the influence on electricity demand.

How the decarbonisation assumptions will be applied across scenarios



Summary of proposed scenario set

Feedback on the Diversified Technology scenario

Market participants

- Unclear if this scenario is internally consistent and plausible enough, given inputs and assumptions
- A gas-led recovery is very unlikely. A gas price fall would accelerate coal retirements
- As designed, the scenario should be reconsidered, and could simply be included as a risk scenario

Consumer Advocates

- Scenario should be excluded as it does not meet AEMO's principles for inclusion, and is a risk to AEMO's credibility
- Scenario is not consistent with the IEA SDS in any way – needs to be reclassified as STEPS and consistent with RCP4.5
- Scenario should be removed and increased gas production / lower DER should be examined separately
- Scenario should be retained

Environment

- The assumptions that underpin this scenario are implausible and it should therefore be deleted
- Scenario name should be changed back to Gas-led recovery, as name may mislead stakeholders
- An appropriate mechanism to reduce gas prices should be explicitly disclosed
- RCP target should not reference RCP2.6 but RCP4.5 – Australia will not be able to free-ride on other countries decarbonisation

AEMO's proposed approach: Converting the Diversified Technology scenario into a low gas price sensitivity.

Other stakeholder proposed scenarios / sensitivities

Higher transmission cost sensitivity	Delta electricity; ISP Consumer Panel
A delayed Snowy 2.0 sensitivity	Hydro Tasmania
A delayed transmission investments coinciding with coal-fired generation retirements sensitivity	Hydro Tasmania
Decentralised future, driven by reduced DER costs and new policies	ISP Consumer Panel
Offshore wind sensitivities	Climate Council
A low growth and high decarbonisation scenario	Australian Conservation Foundation
Load closures sensitivity	EnergyAustralia

Current proposed scenarios/sensitivities

Core scenarios

- Slow Growth
- Current Trajectory
- 2050 Net Zero
- Sustainable Growth
- Export Superpower

Event-driven scenarios

- 2050 Net Zero with Marinus Link funding arrangements not resolved
- 2050 Net Zero with CopperString included

Sensitivities

- Rapid Decarbonisation
- Low gas price
- Sensitivities of higher and/or lower DER uptake on one or more scenarios.

Adjustments to Draft IASR

Converted Central into:

- Current Trajectory
- 2050 Net Zero

Converted Diversified Technology into a sensitivity

Removed scenarios related to early closures

Other risks to be tested:

- Transmission Costs
- Discount rates

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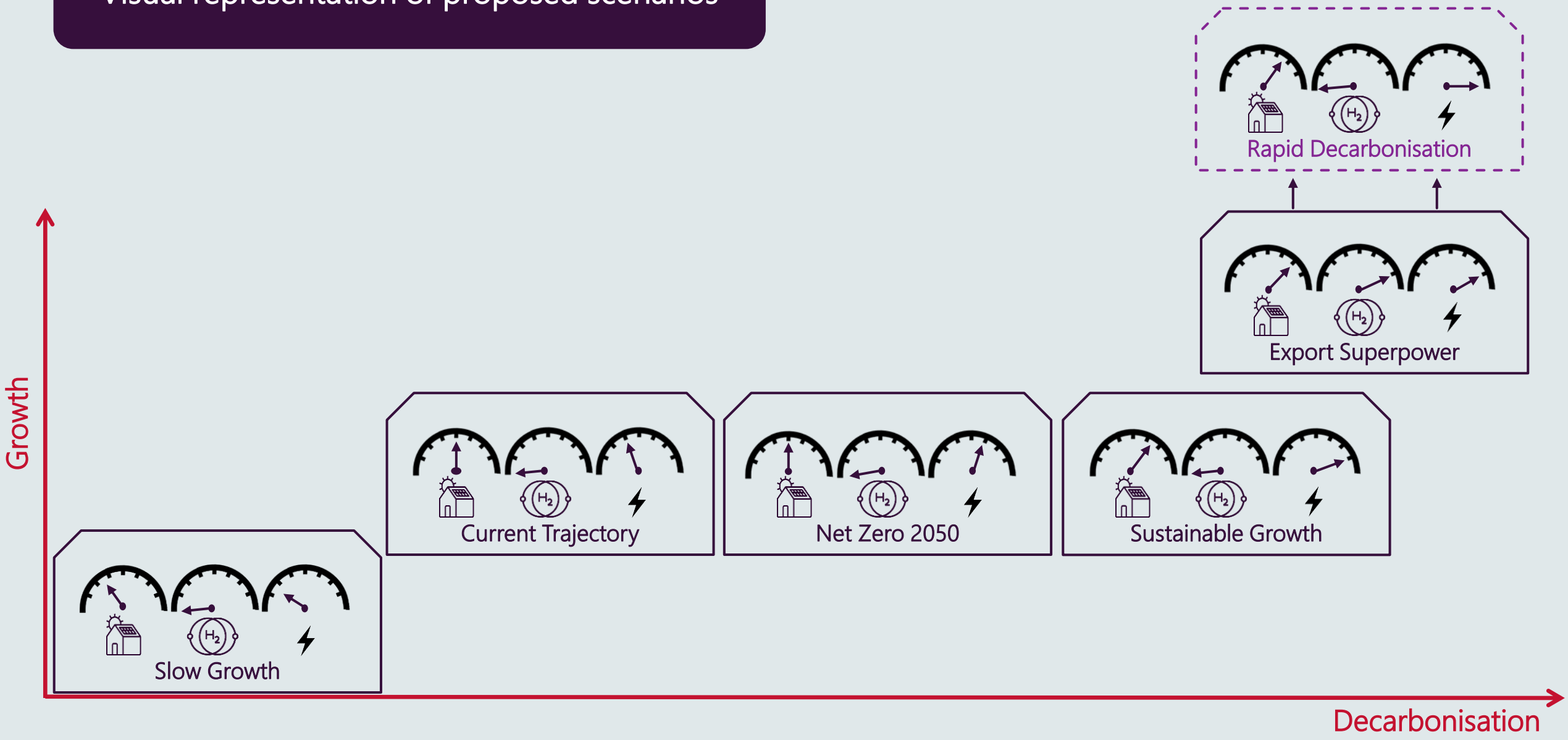
Visual representation of proposed scenarios



Further action

Given the significant changes in the design of scenarios, AEMO is keen to seek further written feedback on the scenarios and their settings

Stakeholders are welcome to provide written submissions before 17 March 2021 via email to ISP@aemo.com.au

These submissions, and feedback received today, will be considered as a second round of consultation on Scenarios, before finalisation

IASR Feedback: Main themes

Theme 1: NEM emissions

Issues

Pro-rata allocation of economy-wide emissions was not considered appropriate by some stakeholders, given views that the electricity sector will have to reduce emissions at a greater pace than other sectors

Some stakeholders also considered it unreasonable to use the Land Use, Land Use Change and Forestry (LULUCF) sector to balance leftover emissions in the energy sector.

Our current consideration

We are engaging with experts to consider how best to design a NEM budget drawing from a multisectoral approach, instead of relying on sector-level assumptions of emission reductions

The multisectoral modelling approach will consider assumed technology and science developments that will be required to achieve whole-of-economy ambition, where possible

Given how LULUCF is a sector in the National Greenhouse Gas Inventory (in line with the United Nations Framework Convention on Climate Change) we believe it appropriate to consider it when targeting net zero emissions

Theme 2: Climate Change Impacts

Issues

Recommendation for AEMO to review firmness assumptions for inverter connected equipment and performance of underlying wind resources during extreme temperatures EnergyAustralia

Recommendation for AEMO to increase focus on climate change impacts for each scenario (i.e. implication of climate change on electricity sector)

Suggestion for AEMO to develop synthetic weather traces to better reflect extreme weather events, which will inform generator assumptions and transmission builds TasNetworks

Request for AEMO to increase the transparency and accessibility of information regarding the effects of climate change on the energy system

Our current consideration

FRG scheduled for May which will present on updates to assumptions of climate change impacts including temperature and hydro inflow factors.

Further information is also provided on the ESCI website.

Consideration of some extreme weather case studies in 2022 ISP to compare resilience of short-listed candidate development paths.

AEMO is continuing to explore better ways to sample weather/climate uncertainty through the use of synthetic traces.

AEMO has implemented improvements to better capture the impact of extreme temperature on wind generation.

Theme 3: Fuel Prices

Issue	Comments about the transparency of LGA report on forecasted gas prices ISP Consumer Panel EnergyAustralia
	Suggestion for AEMO to reassess coal prices and to consider volume constraints in assumptions EnergyAustralia
	Suggestion for AEMO to review assumed coal and gas prices in the high decarbonisation scenarios CLIMATE COUNCIL
Our current consideration	Further engagement on the gas prices and the treatment of gas pricing in the ISP will be held in April. More information on this will be forthcoming. AEMO does consider that the current relativity of the coal/gas prices between scenarios is appropriate based on the narrative of international decarbonisation resulting in lower demand for emissions intensive commodities.

Theme 4: Discount rates

Issues

The ISP Consumer Panel were concerned that AEMO has over-relied on external determinations of discount rates, rather than calculate a commercial private sector rate. ISP Consumer Panel

More analysis is needed regarding the assumption of a lower discount rate for Slow Growth. Why not a higher one for Export Superpower and Sustainable Growth? ISP Consumer Panel

The Consumer Panel also argued that AEMO's proposal to lower the WACC for NSW Roadmap projects by 2% needs further explanation. ISP Consumer Panel

Other stakeholders argued for AEMO to consider alternative discount rates in NSW (EnergyAustralia) or argued against lower WACCS for generation projects within REZs (Energy Networks Australia)

Our current consideration

We are looking to engage expert advice to refine the assumptions for the discount rate used for WACC and for calculating the net present value of costs and benefits, as well as considering the appropriateness of any adjustments between scenarios, and for any generation constructed under state-based policies.

Theme 5: Transmission costs (incl REZ)

Issue	Requests for clarity/updates on transmission costs following recent projects e.g. Project EnergyConnect, Western VIC augmentation  
	Concerns about source of transmission costs 
	More info on network costing/system strength requested    ISP Consumer Panel
Our current consideration	AEMO is undertaking a cost update process which aims to significantly improve our cost estimates and treatment of risk in the ISP. The outcomes of this process will be incorporated into the final IASR and ISP methodology. REZ costing is included in this. See https://www.aemo.com.au/-/media/files/major-publications/isp/2022/tcd-webinar-presentation-slides.pdf?la=en&hash=778E08562DBF0302B0B35F2B555232B8

Theme 6: Social Licence

Issue	Social licence needs to be considered for future infrastructure builds
Our current consideration	We have introduced the "REZ resource limit violation penalty factor" which notionally includes social license considerations. We are considering submissions and views and will continue to engage on this matter.

Theme 7: REZ definitions

Issue	General support for Banana REZ (CQP energy estate) and Hunter REZ additions (energy estate). Suggest we align with renewable industrial precincts energy estate Disagreement on removing Southern Tablelands (N4) EnergyAustralia
Our current consideration	We are considering submissions and views and may engage further to explore these issues. We are also working to ensure that the REZs identified by the New South Wales government are included.

Theme 8: Hydrogen Scenario/Investment

Issues

Non-hydrogen exports should be considered under the Export Superpower scenario to holistically capture Australia's export opportunities

AUSTRALIAN CONSERVATION FOUNDATION

Walcha Energy

The term "electrification" and what it means needs clarification, as hydrogen use results in gas infrastructure continued to be used, despite increased electricity to manufacture hydrogen.

Energy Networks Australia

Risk of high investment costs passed onto consumers

ENERGY CONSUMERS AUSTRALIA

ElectraNet

A number of scenario assumptions are underpinned by little supporting evidence, including but not limited to the potential cost competitiveness of hydrogen, or water availability

ISP Consumer Panel

QEUN

origin

Energy Networks Australia

energy estate

Our current consideration

We are considering submissions and views and will explore these issues further.

The scale and location of hydrogen production is highly uncertain, and is therefore proposed to be assessed across various scenarios. The Export Superpower scenario will explore the impacts of an export industry within the NEM, while domestic consumption may be present in other scenarios. Without hydrogen development, increased electrification may be required to decarbonise other sectors, and AEMO will consider this within the multi-sectoral modelling purpose.

The presence of flexible hydrogen production may lower the infrastructure costs and needs, and may increase the scale of load that costs are spread across.

Given the relative uncertainty of this scenario, it will provide useful insights and depth of assessment for the ISP's ODP, however it is unlikely to be the driver of investments in its own right.

Other Feedback

Topics/Issues	Engagement Opportunity
Approach to coal retirements	ISP Methodology consultation
DER uptake	Forecasting Reference Group (March)
Improvement in transmission losses	ISP Methodology consultation
Off-shore wind assumptions	Currently under review
Hydrogen operation aspects (e.g. flexibility, water consumption and port suitability)	Currently under review
Pumped hydro cost assumptions	Relevant parties to be engaged by AEMO
Regional cost factors	Currently under review
Relative competitiveness of EV options (FCEV vs BEV)	Currently under review
Energy efficiency assumptions	Energy Efficiency workshop (March), Forecasting Reference Group (April)
Sub-regional modelling	Currently under review
Value of Customer Reliability assumptions	Currently under review

The Final IASR will document how feedback has been considered across all submissions

Next Steps

Next Steps

Scenario Consultation open until 17th March 2021. Feedback provided today will be considered within those submissions.

Submissions will be considered before scenarios are finalised.

FRG and other topic-specific workshops are opportunities for further engagement.

Final IASR to be released in July 2021.

Engagement opportunities to help finalise the IASR

Workshops/Discussions	Date
Additional scenario Consultation (submissions close)	17 March
Energy efficiency workshop	24 March
ISP Methodology – Stage 1 workshop	*30 March*
March FRG – DER and connections	31 March
Transmission costs – webinar	15 April
Gas price workshop	April – TBC
April FRG – Energy efficiency, DER, electrification	28 April
May FRG – DSP, climate change impacts	26 May
Transmission costs – final workshop	Late May
ISP Methodology – Stage 2 workshop	*Early June*
June FRG – Forced outage rates	30 June

Appendix

Preliminary scenario settings, including changes from Draft IASR settings

Scenario settings

Scenario	Slow Growth	Current Trajectory	Net Zero	Sustainable Growth	Export Superpower
Economic growth and population outlook*	Low	Moderate	Moderate	~~High~~ Moderate	High
Energy efficiency improvement	~~Moderate~~ Low	Moderate	Moderate	High	High
DSP growth	Low	Moderate	Moderate	High	High
Distributed PV	Moderate, but elevated in the short term	Moderate	Moderate	High	High
Battery storage installed capacity	Low	Moderate	Moderate	High	High
Battery storage aggregation / VPP deployment	Low	Moderate	Moderate	High	High
Battery Electric Vehicle (BEV) uptake	Low	Moderate	Moderate	High	Moderate/High
BEV charging time switch to coordinated dynamic charging	Low	Moderate	Moderate	High	Moderate/High
Electrification of other sectors (expected outcome)	Low	Low/Moderate	Moderate	Moderate/High	Moderate/High
Hydrogen consumption	Minimal	Minimal	Potential for domestic consumption	Potential for domestic consumption	Large NEM-connected export and domestic consumption

Scenario	Slow Growth	Current Trajectory	Net Zero	Sustainable Growth	Export Superpower
Shared Socioeconomic Pathway (SSP)[2]	SSP3	SSP2	SSP2	SSP1	SSP1
International Energy Agency (IEA) 2020 World Energy Outlook (WEO) scenario	Delayed Recovery Scenario (DRS)	Stated Policy Scenario (STEPS)	Stated Policy Scenario (STEPS)	Sustainable Development Scenario (SDS)	Net Zero Emissions by 2050 case (NZE2050)
Climate change impacts based on assumed Representative Concentration Pathway (RCP) (mean temperature rise by 2100) *	RCP7.0 (~4°C)	RCP4.5 (~2.6°C)	RCP4.5 (~2.6°C)	RCP2.6 (~1.8°C)	RCP1.9 (<1.5°C)
Decarbonisation target	No explicit decarbonisation target.	26-28% reduction by 2030. Further decarbonisation influenced by technology and economic improvements	26-28% reduction by 2030 Economy-wide net zero target by 2050.	Economy-wide net zero before 2050, exceeding 26-28% reduction by 2030 Pace of decarbonisation consistent with limiting temperature rise to 2 degrees, in line with global activities.	Economy-wide net zero by early 2040s, exceeding 26-28% reduction by 2030 Pace of decarbonisation consistent with limiting temperature rise to 2 degrees, in line with global activities.
Generator and storage build costs	CSIRO GenCost Central	CSIRO GenCost Central	CSIRO GenCost Central	CSIRO GenCost High VRE	CSIRO GenCost High VRE
Generator retirements	In line with expected closure years, or earlier if economic to do so.	In line with expected closure years, or earlier if economic.	In line with expected closure years, or earlier if economic or driven by decarbonisation objectives beyond 2030.	In line with expected closure year, or earlier if economic or driven by decarbonisation objectives	In line with expected closure year, or earlier if economic or driven by decarbonisation objectives
Relative project finance costs	Lower than Central, reflecting lower rates of return with lower economic growth	In line with current long-term financing costs appropriate for a private enterprise	In line with current long-term financing costs appropriate for a private enterprise	As per Central	As per Central

***** The modelling will not target a specific global temperature objective, but in applying more rapid decarbonisation activities, it is assumed that a lower RCP is more relevant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