2023 Preliminary Scenarios – Webinar Feedback

August 2022

Stakeholder feedback from the 2023 scenarios webinar, held on 13 July 2022

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1 Introduction

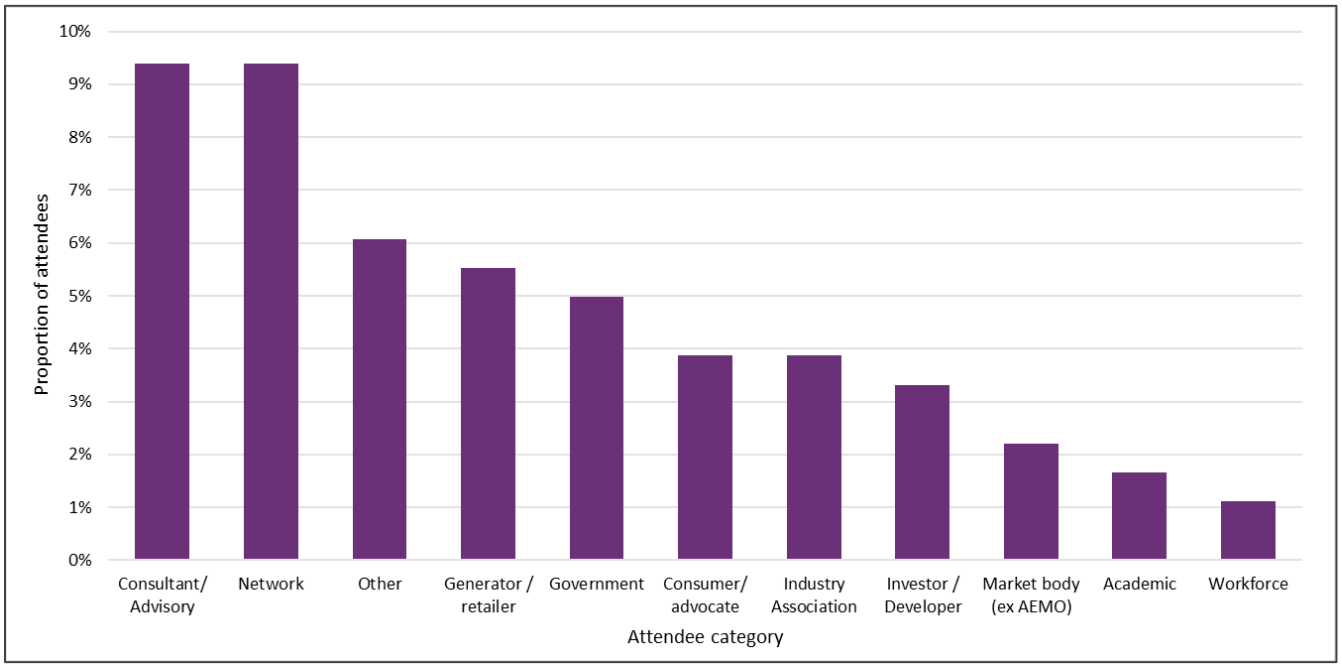
On 13 July 2022, AEMO held a webinar to provide early engagement with stakeholders on scenario development for the 2023 Inputs, Assumptions and Scenario Report (IASR). Once finalised, the scenarios will be used for the 2024 Integrated System Plan (ISP), and the 2023 Electricity and Gas Statements of Opportunities (ESOO and GSOO). During the webinar AEMO presented an overview of the previous scenarios, and proposed a revised set of scenarios for these forecasting and planning activities. Initial changes between the 2021 scenarios and the proposed 2023 scenarios took into account stakeholder feedback during the 2021 IASR and 2022 ISP consultation processes, and considerations within the current energy environment.

The webinar included the opportunity for stakeholders to:

- ask questions to AEMO staff and respond to other stakeholder questions via Slido
- make comments in the Webex chat facility
- respond to poll questions (yes/neutral/no) and include commentary

181 external stakeholders attended the webinar; the actual participation rate may have been higher due to colleagues sharing a connection in a meeting room. The webinar was attended by a wide range of stakeholder groups, with network service providers and consultants having the greatest representation.

Figure 1 Webinar representation



Written material from the webinar is presented in this document, along with some basic analysis of attendees and topics. The verbal comments, questions or responses during the meeting can be accessed via the webinar recording available on AEMO's website[2].

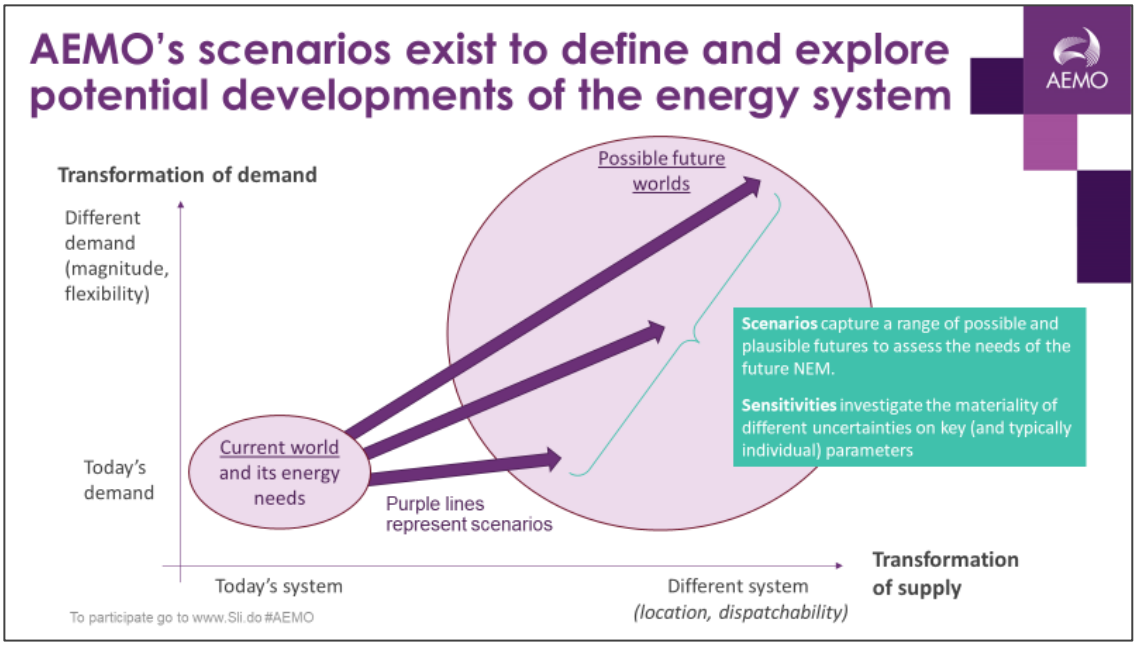
[2] Available at: https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2024-integrated-system-plan-isp

2 Stakeholder feedback

This section details the stakeholder feedback from the webinar, including questions, comments, and poll results. Each sub-section presents relevant slides from the webinar, with relevant feedback listed below the slides. Poll results are also provided.

2.1 Purpose of scenario planning

Figure 2 The purpose of scenario planning



The following table lists stakeholder Q&A from Slido associated with the above slide.

Table 1 Slido questions and responses regarding the purpose of scenario planning

Question Response (note: responses are not from AEMO unless indicated)
Stakeholder A: Integrated Resource Planning normally considers supply side and demand side resources as equivalent approaches to meet customer needs. However, the ISP to date has treated demand side as exogenous inputs and generation & transmission optimised endogenously. Can the 2024 ISP treat both sides equally? Stakeholder B: Treating DER as a resource to be endogenously forecast as part of optimisation is the best approach. AEMO has acknowledged for four years now the need to do this. If it argues it still can't be done, why not? **AEMO verbal response: Optimisation decisions by governments, the market and consumers, through policies and investments are uncertain. The ISP balances this with exogenous inputs for a scenario spread and with sensitivity analysis to determine the impacts of policies and investments.**
Regarding slide 8 (the supply/demand drivers), what have you considered in respect to drivers/restrictions (esp thinking about 1. DSM 2. opposition to grid scale solar in agricultural areas). In view of H2 Superpower slide - AEMO imho really need to up the impact/sensitivity of agricultural land use - and the possibility of mandatory planning requirements for AgriVoltaics as an issue that could have serious impact on the ISP
Stakeholder A: Given significance of DER in the 2022 ISP, can the next ISP (1) Contain a sensitivity analysis for different DER levels and the resultant impacts on other energy supply positions (especially in Step Change scenario) and (2) estimate Distributor network costs to achieve these DER levels Could we look to reimagine scenarios based on tangible outcomes - For instance, the bookends could be Scenario A - electricity decarbonised by 2030 and Scenario B - 80% carbon-free generation by 2050. The variables could be level of electrification in the remainder of the economy. The ISP should go beyond a transmission planning document, and start including costs to distributers and consumers to get to the total cost of getting to net zero by 2050.

AEMO verbal response: The 2022 ISP did, and future ISPs will, include sensitivity analysis on DER uptake.

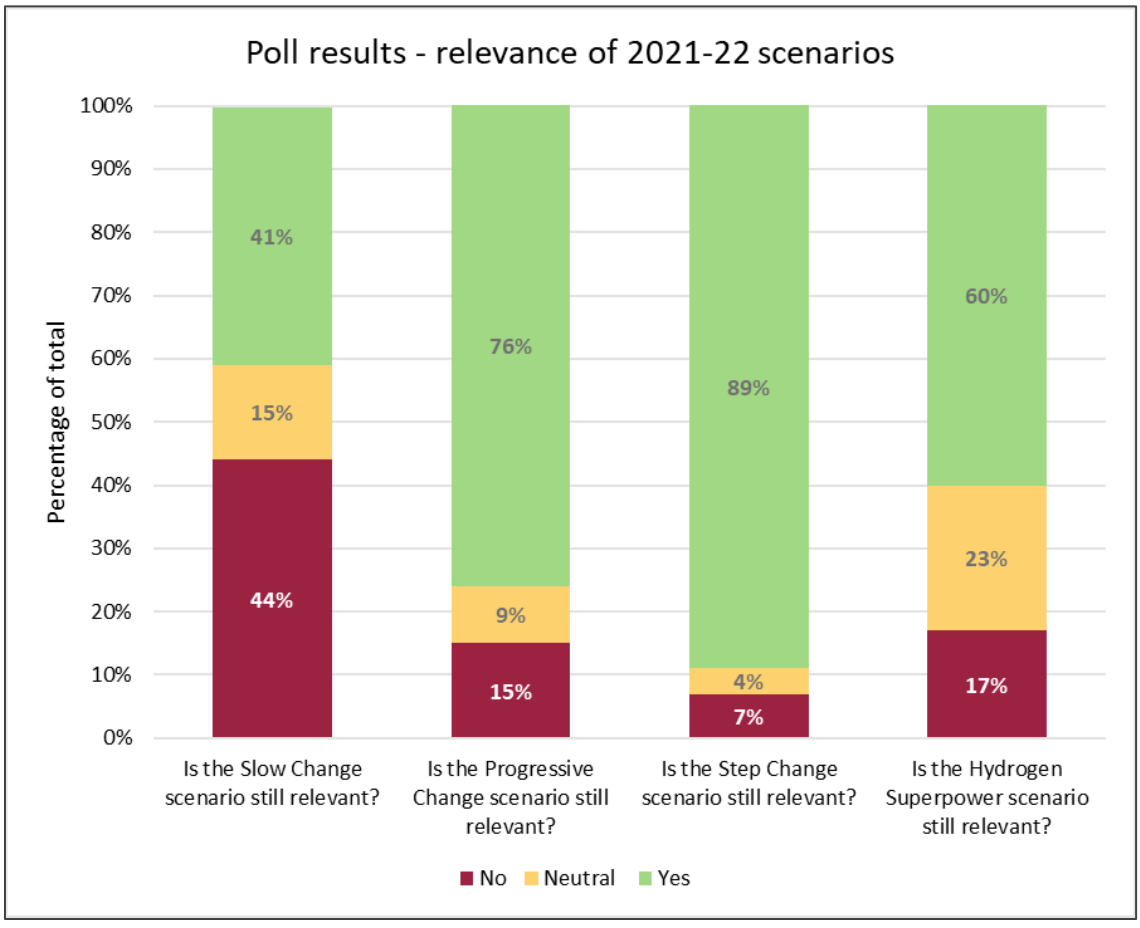
The ISP's purpose is to set up a long-term roadmap for the efficient development of the power system, which can adapt to uncertainty, including consumer choices. The ISP can influence transmission projects, designed to connect and share resources across the system. The ISP can't, nor should it, control how and where consumers should install rooftop PV or batteries. The ISP should aim to enable consumer preferences rather than try to control how and where consumers install DER. Distribution network costs could potentially be estimated when more data on those costs is available[3].

Stakeholder B: On your answer on ISP being transmission focussed, not driving, or being driven by CER/DER: I think you've missed the purpose thrust of question! If Transmission is now primarily about Security & Resiliency then we need to understand FLOWS IN & OUT of Distribution - & TX support of CR

2.2 Scenario Recap

Stakeholders were polled regarding the considered relevance of the four scenarios that have been applied in previous forecasting and planning activities, most notably for the 2022 ISP. The poll results are shown below, demonstrating that most scenarios remain highly relevant for forecasting and planning the NEM.

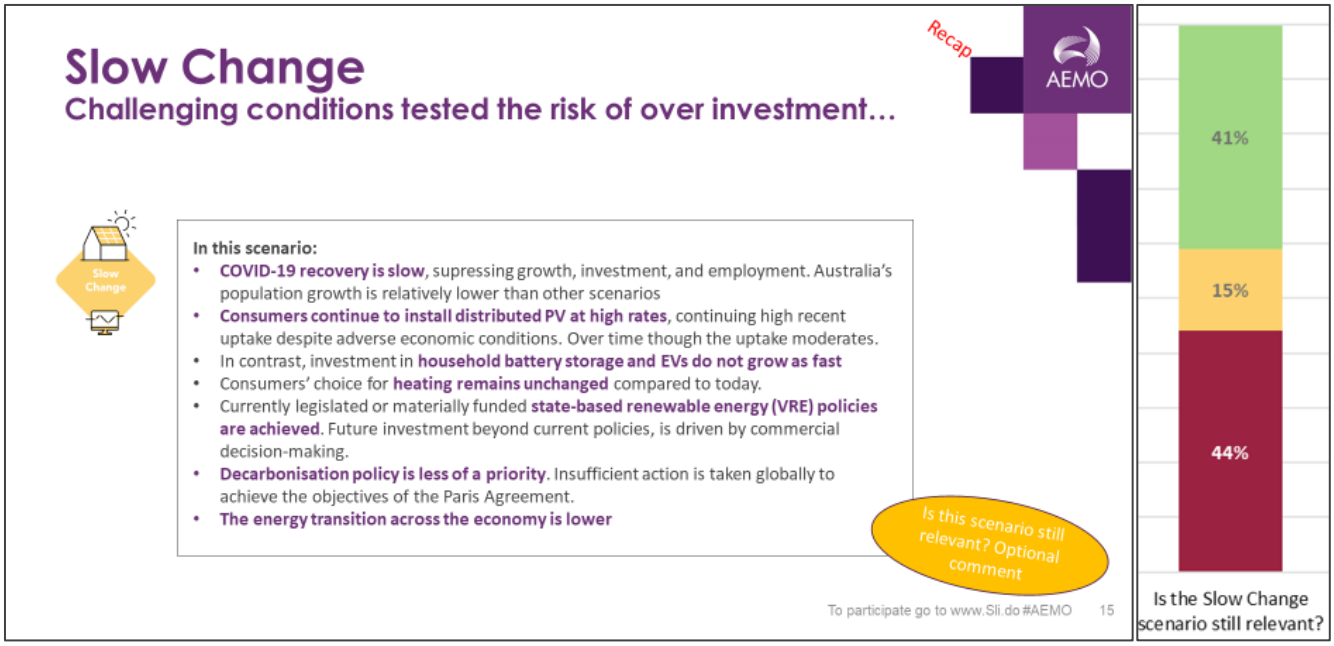
Figure 3 Poll results – Are the previous scenarios still relevant?



[3] See the AER's DER Integration Expenditure guidance note, available at: https://www.aer.gov.au/communication/aer-releases-der-integration-expenditure-guidance-note-and-customer-export-curtailment-value-methodology

2.2.1 Slow Change

Figure 4 ***Slow Change* recap**



The following table lists stakeholder feedback made in the optional comment question associated with the above slide.

Table 2 **Stakeholder comments in response to "Is the *Slow Change* scenario still relevant?"**

Comment
The scenario is still relevant with regards to its fundamentals. Might not necessarily be driven by COVID
Relevant only for sensitivity
Useful more as a benchmark to measure against
Including this scenario ensures the full range of plausible outcomes are considered. It also provides a baseline comparison.
Useful bookend
Without this scenario, this is effectively no 'low' case, which other scenarios are being increasingly driven by policy ambitions, while not necessarily accounting for planning feasibility
It may not be a likely scenario, but it is important to have a good spread to see the impact of different futures. It also avoids the concern of "bias".
Still relevant as a bookend, don't view that likely
Supply chain constraints are the remaining factor keeping this scenario relevant.
Should no longer be used as inconsistent with federal & State Government policies, as well as international pressures
It helps show the delta between moving slow and other scenarios
I think so, but would prefer to see this as delayed transmission build out / delayed storage build out, rather than slow change as such. investors want to build Wind / PV.
State policy settings do not allow this scenario to unfold.
Slow economic growth still relevant. Decarbonization less relevant.
The scenario may still be relevant for representing the uncertainty in economic recovery post pandemic and into the Russian invasion of Ukraine. It represents a de-prioritization of decarbonization and more emphasis on energy security
Decarbonisation not being a priority is not credible (can retain a slow change scenario, but changed as this aspect cannot remain as-is)

With the expected slowdown in world/ National economies this is possible
Necessary to check for regretted investment
Need a slow scenario but parameters need updating.
There needs to be some form of slow scenario, but perhaps not the same one. Main headwinds might relate to supply chain constraints, community concerns etc.
Might see higher than current fuel cost assumptions
It's likely to be worthwhile including one scenario that is relatively "pessimistic" in terms of abatement progress, economic growth, tech costs, etc. in order to get a wide spread of possible scenarios. Scenario planning is not just about what stakeholders want to happen.
Irrelevant with policies in place, but may be worth it if policies fail. Could also be valuable with QLD weak RES-e targets (30% by 2030)
EVs will grow faster and has significant impact.
Growth may be suppressed due to offshore issues, not COVID.
The recent IPCC report shows that clearly a scenario that doesn't reduce emissions will be catastrophic for climate change and unable to meet targets.
As a potential counterfactual. Not a likely vision of the future.
Potentially relevant as it is typically the only scenario that includes the retirement of large industrial loads in the 30 year modelling horizon
Need something for a slower decarbonisation bookend
People are concerned about increased prices and lack of supply. Maybe slow to move forward
We've seen in recent history that policy U-turns can happen completely reversing trends currently underway. A consumer lead scenario in constrained policy settings is required
Just forget about this — to much change to even consider it
World potentially heading into a recession
The shift to renewables globally has slowed with the Ukraine war and global energy crisis

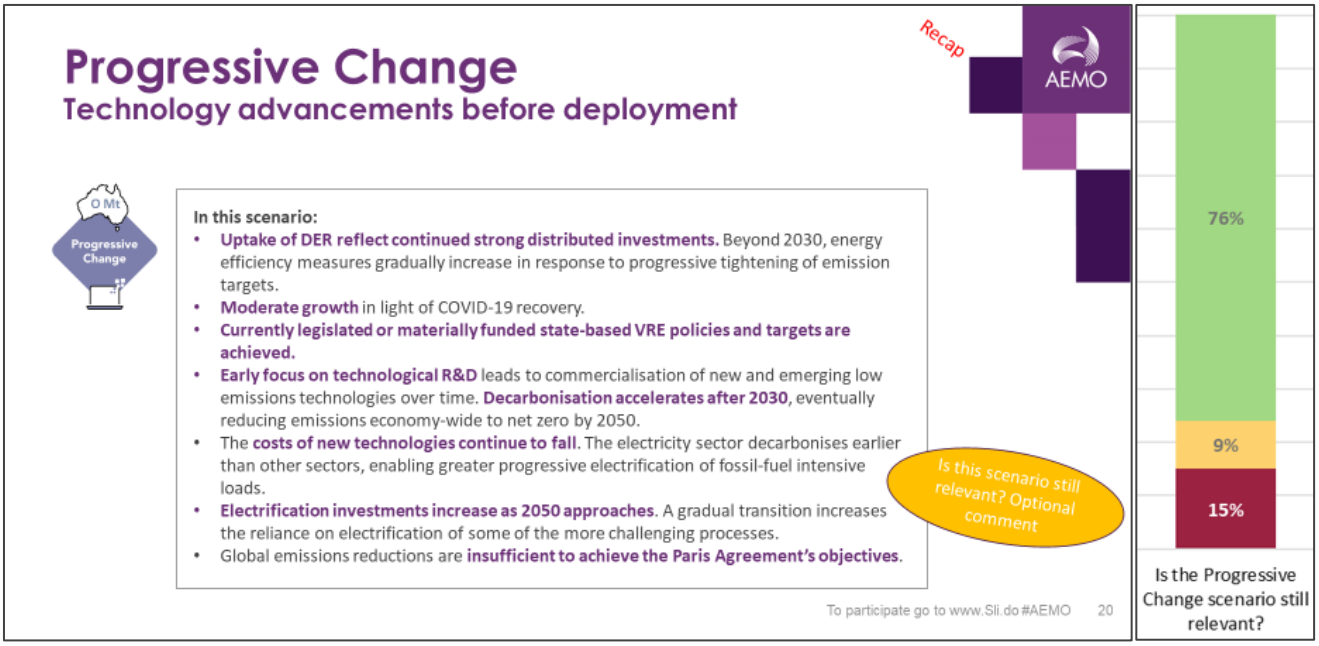
The following table lists stakeholder Q&A from Slido associated with the above slide.

Table 3 Slido questions and responses regarding *Slow Change*

Question Response (note: responses are not from AEMO unless indicated)
Stakeholder A: What about a scenario considering a possible global recession (e.g. supply chain disruption, long war in Ukraine, uncontained inflation) and the impact on ability to invest in NEM over the coming years? Stakeholder B: Is this not a variant/outcome that could drive Slow Change? I would hope that kind of outcome would be covered by that kind of scenario.
Domestic and global demand trends do not necessarily align. They may be differently misaligned for different end uses e.g., Hydrogen may be mainly global, electric vehicles mainly domestic.
Stakeholder A: I didn't see on the AEMO website that a Consumer Panel had been formed for the 2024 ISP scenario planning. Has a new Consumer Panel been constituted for this session? Stakeholder B: Is there pre-registration available? **AEMO verbal response: 2024 ISP Consumer Panel Expressions of Interest will be sent out to the ISP mailing list and through the AEMO communications newsletter.**

2.2.2 Progressive Change

Figure 5 ***Progressive Change*** **recap**



The following table lists stakeholder feedback made in the optional comment question associated with the above slide.

Table 4 **Comments in response to "Is the *Progressive Change* scenario still relevant?"**

Comment
With all the scenarios - are we assuming the same geographic coverage of the NEM?? there is potential for significant expansion of the NEM in QLD. Is this taken into account?
Emissions target for 2030 to be considered so as 82% renewable target...
Yes - but with updated inputs to reflect new Govt targets and initiatives. However, needs greater transparency on the impact of Govt policies.
Given that step and progressive are quite close together in outcomes, one has to go
I would prefer this to be re-framed as a 'most likely' scenario rather than decided at the end through a policy ambition.
I think the progressive change is very relevant as it reflects moderate progress.
This one needs a bit of adjustment. It is not really a likely outcome in my view and now doesn't add a lot of value. *Slow change* is useful as it adds scenario spread, while *Progressive Change,* in its current form, is an unlikely scenario without adding scenario spread.
While it may be still be an option, it is not enough to meet the Paris agreement targets as identified in the scenario. So relevance is low.
The change of mix from gas to electricity is critical. Changing from natural gas to anything else (including hydrogen or blended gas) is very difficult. So, there will be a point in time when gas might become non-viable and lead to a trigger-point for change.
Look at Germany Texas and CA – the experiment has been done
Possibly worth having a hybrid of this and the "slow change" scenario to reflect a more "pessimistic" scenario
Yes - a modified scenario to reflect delays in grid scale investment due to supply chain issues
Bring forward electrification, earlier decarbonisation, be clear Labor's 45% is not science based (and assumes 2 degrees) - maybe look at 1.5. and 2.0
I think need to consider export hydrogen, which is taking place in most of the places.
I feel the speed of network projects should be a consideration in all scenarios. I.e. Progressive change may include a high risk of delay, vs step change.

We need to ensure that technology's data is USED - we made a big mistake with making BTM generation invisible and at the same time makes demand opaque

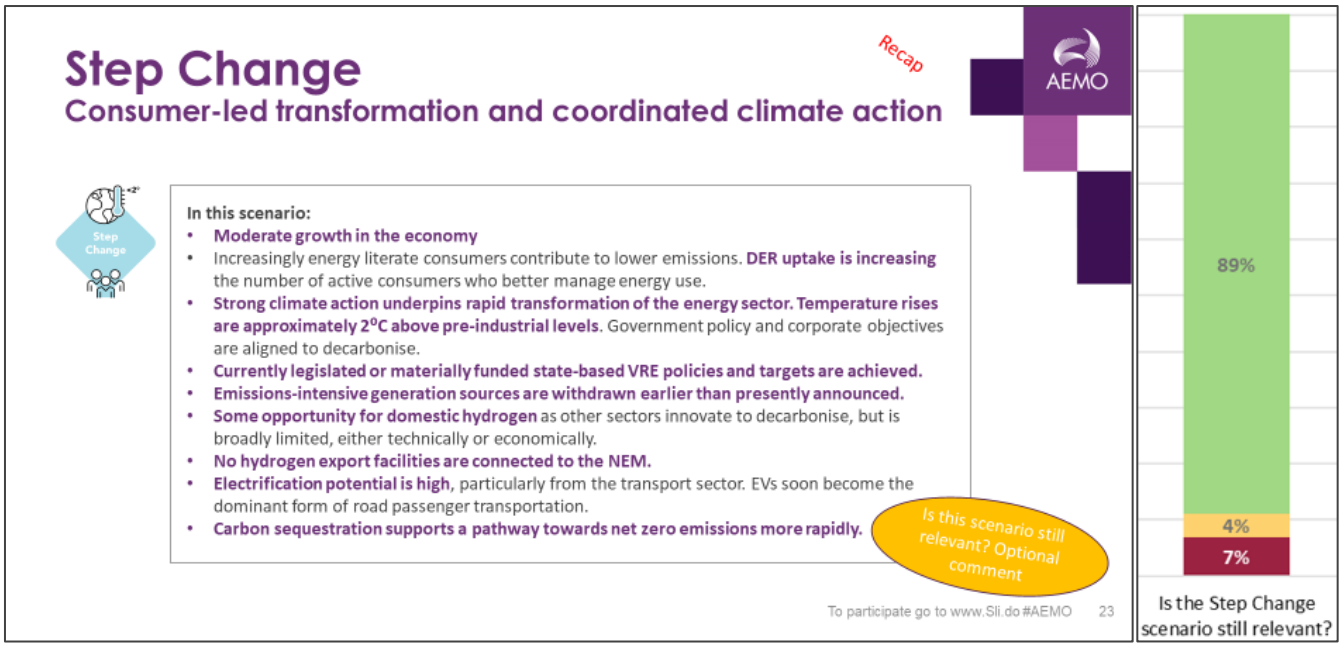
The following table lists stakeholder Q&A from Slido associated with the above slide.

Table 5 Slido questions and responses regarding *Progressive Change*

Question Response (note: responses are not from AEMO unless indicated)
Stakeholder A: It would be very useful if the scenarios could include consideration of the impact on customer electricity/energy bills. For example, if AEMO could provide estimates of the average forecast electricity bills for 2030 for the 2022 ISP scenarios, this would help inform the scenarios for the 2024 ISP. Stakeholder B: Why do you think that is the case, given that: the ISP modelling doesn't deliver wholesale price forecasts (since it is a cost-based model), let alone the rest of the cost stack? Add to that the low price elasticity of electricity demand, and I'm not clear how this exercise would add value? Stakeholder C: You can estimate a wholesale price forecast by using the generation mix and the LCOE to assume that each generator gets paid its LCOE for electricity sold. Retail much harder, but you can forecast transmission cost additions from ISP projects. Assume other costs unchanged. Stakeholder B: I wasn't asserting that it is impossible to construct a price forecast, more questioning how it contributes to the purpose of the ISP, and noting that is a functionally separate exercise, so there may be a question of AEMO resource capacity Stakeholder A: Thanks. The step change scenario implies up to ~$80 billion in capex by 2030. This is non-trivial and perhaps not economically or politically viable. A long term own price elasticity of say -0.2 is not small. If not AEMO, then someone should do it. RACE for 2030 would be happy to assist. Stakeholder C: Thinking from a consumer viewpoint we have three 'systems' they might pay for, i.e. the decarbonised grid, DERs and capacity backup. This begs for coordination in a policy framework which needs development, e.g. do we use more centralised or distributed structures.
Stakeholder A: If the Progressive Change inputs somewhat mirror what was in the 2022 Step Change scenario, would we be better off changing the step change to say Net Zero by 2040, or something different from the Progressive change? Stakeholder B: Good thought. That may well be a better way to handle that change. I voted saying that the old Progressive was probably not useful, but this might be a better proposal on how to handle it. Stakeholder C: Agreed – the parameters for what was called Step Change really are now Progressive Change. Step Change needs to be bolder than the Progressive change and should posit a 60% emissions reduction by 2030. (or 80% by 2040 or both).

2.2.3 Step Change

Figure 6 *Step Change* recap



The following table lists stakeholder feedback made in the optional comment question associated with the above slide.

Table 6 Comments in response to "Is the *Step Change* scenario still relevant?"

Comment
AEMO and stakeholders need to be wary of gravitating towards this as a forecast or best/ desirable estimate, which isn't the point of scenario design
Yes - still most likely
No, replace with updated progressive change and replace with Net Zero by 2040 target.
More so now with Labor's policy. Not a target scenario but a warning (we need 1.5 or less). Also Bowen suggests 45% is science based, but as it is - their target won't allow even 2 degrees or below
This could be re-framed as an aggressive carbon abatement policy ambition, almost a pseudo-high case which could incorporate aggressive hydrogen uptake.
Seems like a valid scenario - but as with all scenarios I would also suggest that maybe hydrogen shouldn't be limited to the H2 Superpower scenario. I think that it is increasingly unlikely that there will be ANY future without at least a few large scale electrolysers.
This is current state scenario not the future state
Key sensitivity is the level of DER development - current level might be too high
This is too close to progressive scenario. Need to look at closely to find out some deviations between these two scenarios. Hydrogen export would be one of the aspect to consider.
Still the most likely
None of the old scenarios are relevant.
Yeah, but think there won't be much spread between this and PC scenario if the PC scenario adopts Fed gov policies...
Should it be renamed?
I'd like to see a lower optimism to DER storage / EV V2G assumptions.
WRT the point "emissions intensive generation withdrawn earlier than presently announced" since the last IASR process, several plants have brought forward closure dates. So does this still apply?
Consumer led reform will likely also include stronger action in energy efficiency, DM, flexible demand, cost reflective price reform, etc
Still most likely scenario - but we need to ensure that CER technology's data is USED - we made a big mistake with making BTM generation invisible and at the same time made load opaque - the need to for disaggregated data will grow
One of the step and prog change needs to stay
Transmission projects should be a factor in these scenarios, would be good to see sensitivity analysis of delayed network projects in the 2024 ISP.
Likely scenario but 2 degrees however still means a "profoundly disrupted climate with fiercer storms, higher seas, animal and plant extinctions, disappearing coral, melting ice and more people dying from heat, smog and infectious disease."
Could I ask why no hydrogen export is assumed?
Yes, but we should aspire to more progressive change.

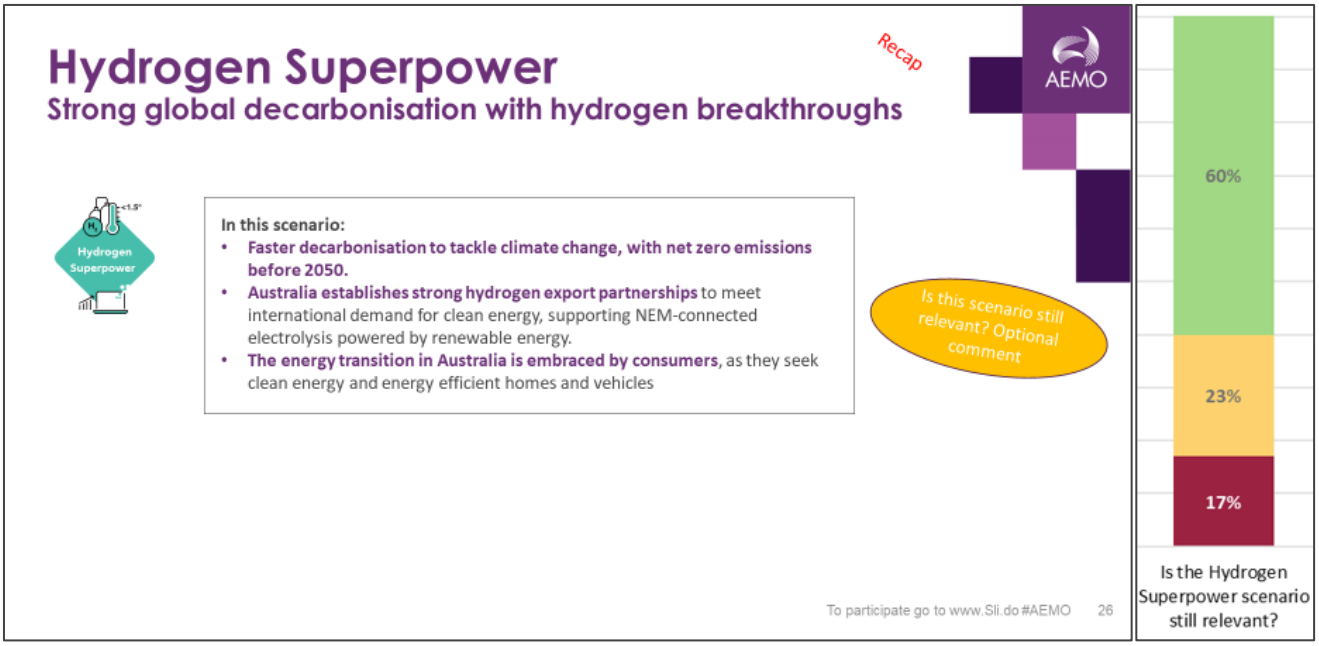
The following table lists stakeholder Q&A from Slido associated with the above slide.

Table 7 Slido questions and responses regarding *Step Change*

Question Response (note: responses are not from AEMO unless indicated)
Stakeholder A: Given the expected role and impact of DER, is there scope to further internalize the drivers of demand in the modelling? Stakeholder B: How can any CER/DER modelling and activation be achieved without DATA? Should AEMO be thinking about a mandatory requirement for disaggregated data from CER/DER sites?

2.2.4 Hydrogen Superpower

Figure 7 ***Hydrogen Superpower*** **recap**



The following table lists stakeholder feedback made in the optional comment question associated with the above slide.

Table 8 **Comments in response to "Is the *Hydrogen Superpower* scenario still relevant?"**

Comment
It is totally unrealistic to believe Australia can be a major global supplier of hydrogen, i.e., a major exporter. Why? Because of the very high costs for transportation and storage versus LNG and we do not have a significant comparative advantage in making hydrogen.
Yes - but with more rational targets regarding what Aust might be able to achieve in H2 taking into account what other countries will do.
Need a scenario to test hydrogen ambitions but also related gas infrastructure impacts
There is a risk that people are voting for their view of likelihood, when here we should only be testing the range of scenarios sufficiently plausible to allocate a non-trivial weighting at the weighting stage
Maybe consider islanded electrolysers but which take away IBR from REZs.
Too much uncertainty - technological and operational
But outcome is too optimistic.
Include nuances around RES-e export embedded in manufacturing (i.e. exported steel, not ore etc)
For scenario spread, we may need to reconsider more ambitious emissions targets under this scenario or a new one
Some uncertainty over grid-connected v non-grid connected electrolysis
It would be more helpful to have a scenario that addresses 1.5 degrees without the externalities of a hydrogen export market.
So many unknowns about this scenario, questioning how it might help
AEMO imho really need to up the impact/sensitivity of agricultural land use - and the possibility of mandatory planning requirements for AgriVoltaics as an issue that could have serious impact on the ISP
Elements of this scenario need to trickle in to step change. It appears unlikely there will be no h2 developments in any scenario. H2 scenario projections will be achieved earlier than this scenario currently assumes.
I think this scenario needs to be paired with the reality of feasibly having that much grid-scale hydrogen added and the supply to support it.
Useful in modelling a spread of scenarios, but the uptake of hydrogen seemed very extreme for 2022 ISP

NEUTRAL - major concern is WHERE will all the VRE come from -it can't use Agricultural land. Developers will think that they can just whack a bit of H2 transfer without considering the impact
Yes - still ambitious but is a potential outcome of decarbonisation
Domestic hydrogen in households is a poor assumption given the state of electrification.
This scenario may take longer than 10 years.
Far too ambitious, especially for Tasmania (multiple GW of hydrogen load)
But name needs to be changed as it doesn't incorporate synthetic green fuels e.g., HIF Global announcement for Tasmania
No. It's based on breaching REZ build limits by adding $0.25m/MW cost.
I would like to see the strong electrification sensitivity which is presented as an alternate approach to H2 superpower become its own scenario
Water use this takes to produce hydrogen has not been factored into the energy plans.
The key issue for Hydrogen superpower isn't necessarily that it won't happen but who pays for it? Domestic energy users shouldn't be subsidising an export industry that they get little benefit from.

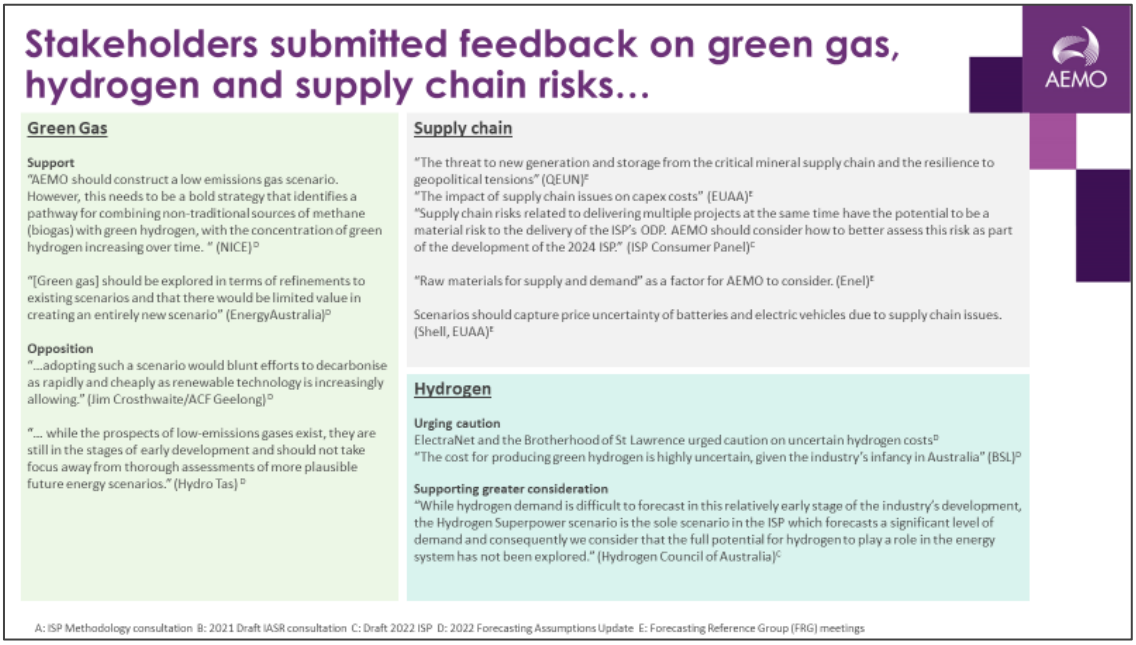
The following table lists stakeholder Q&A from Slido associated with the above slide.

Table 9 Slido questions and responses regarding *Hydrogen Superpower*

Question **Response (note: responses are not from AEMO unless indicated)**
Stakeholder A: The key issue for Hydrogen superpower isn't necessarily that it won't happen but who pays for it? Domestic energy users shouldn't be subsidising an export industry that they get little benefit from. Stakeholder B: I hope the scenario expects that hydrogen export pays for it....like all scenarios it makes assumptions that things in the future are different to the way they are now without knowing why or how. That is the point.
Stakeholder A: Can we change names of scenarios? e.g., Hydrogen superpower. We need to capture the electrolyser load which may not be all for hydrogen. **(AEMO) Stakeholder feedback has included that maintaining scenario names would be helpful, but if the scenarios evolve significantly then name changes may be suitable. We will have to see what evolution occurs first though. (Note: Hydrogen "Superpower" is proposed to change to "Export")**

2.3 2021 scenarios feedback and recent developments

Figure 8 Feedback on green gas, hydrogen and supply chain risks

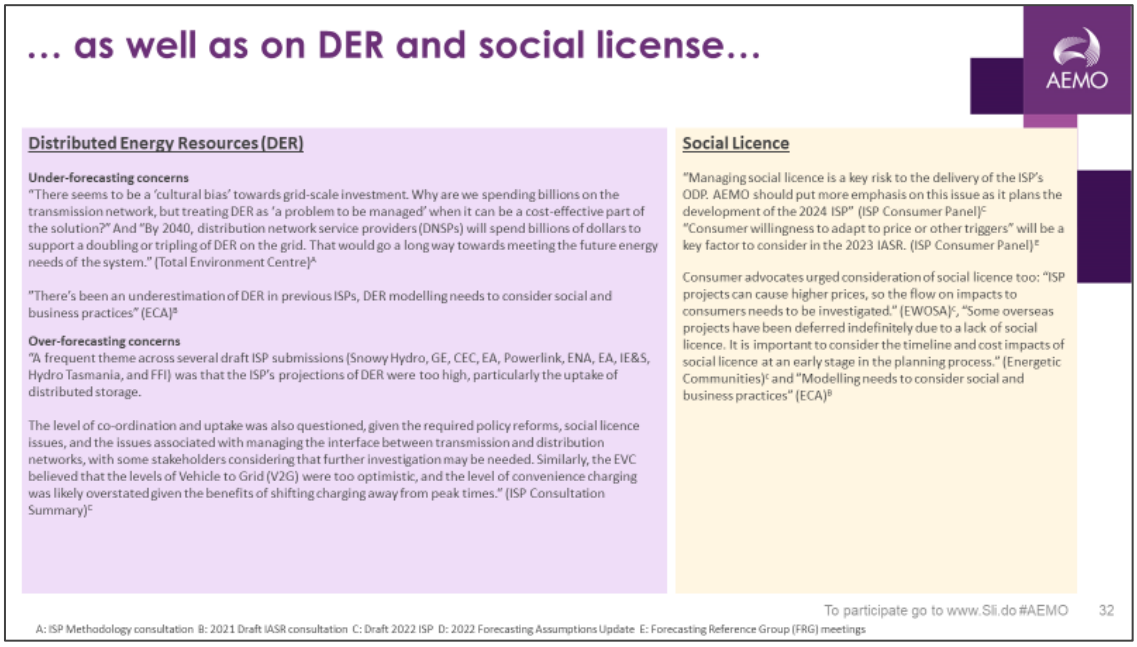


The following table lists stakeholder Q&A from Slido associated with the above slide.

Table 10 Slido questions and responses responding to feedback on green gas, hydrogen and supply chain risks

Question Response (note: responses are not from AEMO unless indicated)
Stakeholder A: Offshore wind costs have been accounted for in sensitivity modelling in the most recent AEMO ISP, and costs continue to fall as shown by recent UK auctions. Given the Vic government has committed to ambitious targets to grow the offshore wind sector, will AEMO account for this in future scenarios? **(AEMO) The method for incorporating government policy is well defined in the ISP Methodology, and I anticipate the next ISP will continue to adopt this. The 2022 ISP outlined why it was incorporated as a sensitivity, and we will monitor policy developments ahead of the ISP modelling.**
Yes – still ambitious but is a potential outcome of decarbonisation
#DSM should not be exogenous - AEMO is biased to "supply" as it can see and control generation (and transmission). The issue imho is that everyone has no visibility of #DSM. Would it help AEMO if we undid the mistake of putting PV BTM. Should there be a mandate to supply #loadflex some data?
There is brief mention of flexible demand (or load shifting) in the step change, but this does not seem to have been quantified as part of the coordinated DER storage forecast. It can achieve the same outcome as storage at lower cost
I hope the scenario expects that hydrogen export pays for it....like all scenarios it makes assumptions that things in the future are different to the way they are now without knowing why or how. That is the point.
There is brief mention of flexible demand (or load shifting) in the step change, but this does not seem to have been quantified as part of the coordinated DER storage forecast. It can achieve the same outcome as storage at lower cost
Will supply chain consider Australian supply channels and local manufacturing of energy assets – battery minerals, PV and battery manufacturing?
Could we look to reimagine scenarios based on tangible outcomes – For instance, the bookends could be Scenario A – electricity decarbonised by 2030 and Scenario B – 80% carbon-free generation by 2050. The variables could be level of electrification in the remainder of the economy.

Figure 9 Feedback on DER and social license



The following table lists stakeholder Q&A from Slido associated with the above slide.

Table 11 Slido questions and responses responding to feedback on DER and social license

Questions
Given importance of Social Licence in terms of implementing the ISP and given significance of electricity bills (affordability) in determining community reaction to the ISP, can the next ISP include estimates of the electricity price impacts (at least for most favoured scenario)?
How are you dealing with emerging policy announcements like the QLD 10 year Energy Plan?
The Vic Govt's Offshore Wind Policy Directions paper makes it clear Vic Govt does not want to be dependent on interstate energy supplies in terms of achieving its net zero position. Should this policy development mean AEMO should downgrade prospect of, or timing of, the Marinus Link? Social licence isn't a variable for scenarios....it is a task to be managed.
There's a big problem with "social license" under the current 2022 ISP - its more about addressing NIMBYISM where I believe that its more important to get the whole community to understand why Transmission CAPACITY is required for Security and Resiliency - and therefore who pays & how they pay
If you factored in 'social licence' would you wind up backing HVDC rather than sticking with AC?

Figure 10 Feedback on recent changes

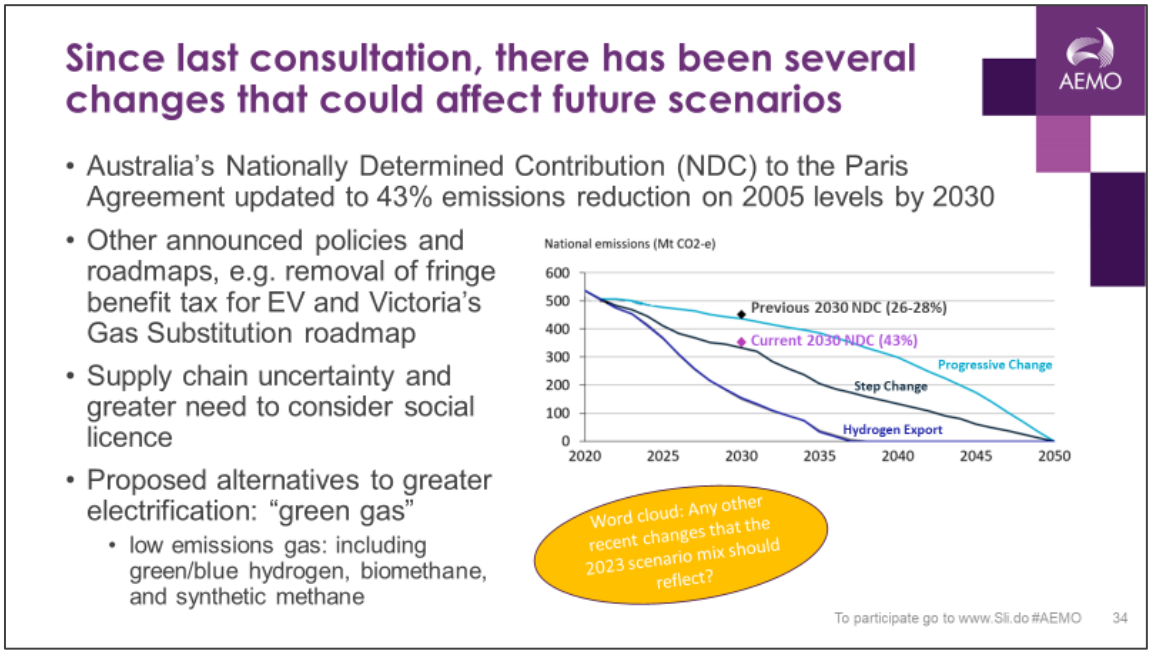
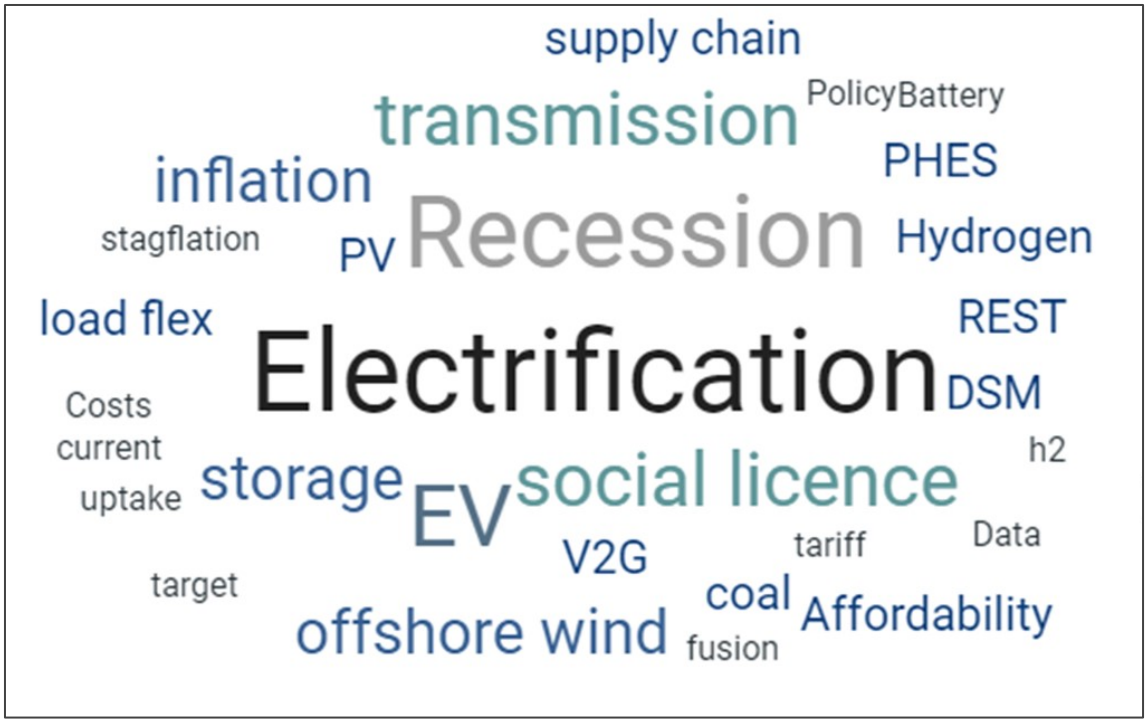


Figure 11 Word cloud results for "Any other recent changes that the 2023 scenario mix should reflect?"



The following table lists stakeholder Q&A from Slido associated with the above slide.

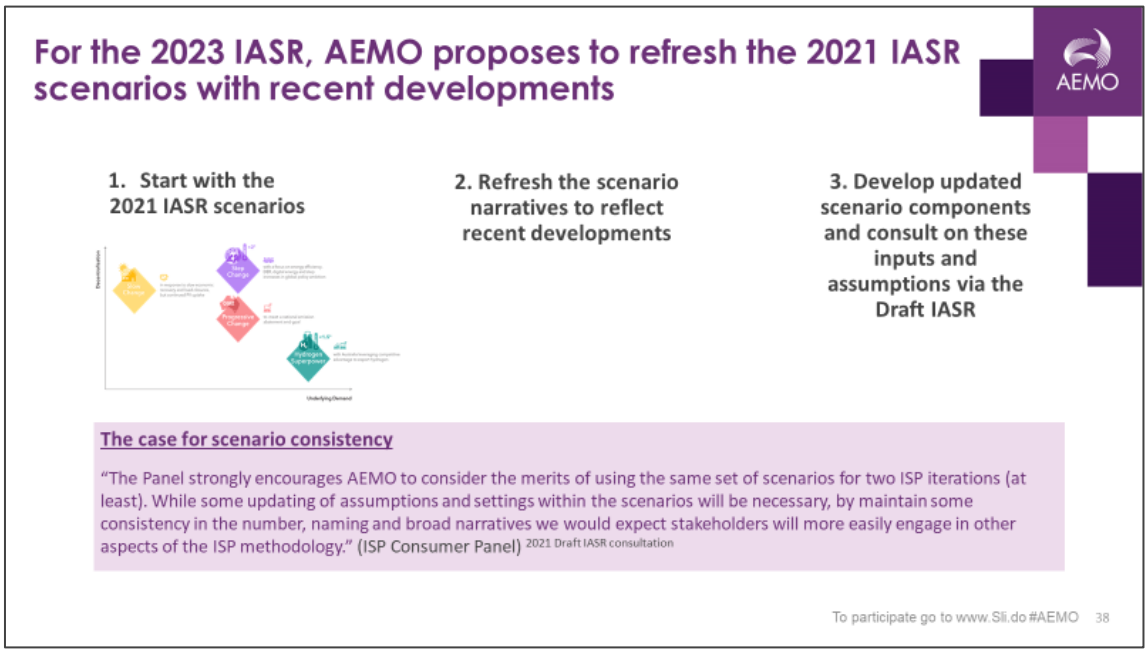
Table 12 Slido questions and responses responding to recent changes

Question Response (note: responses are not from AEMO unless indicated)
Stakeholder A: There is no such thing as “green gas” - it's either green (VRE driven) or not. Stakeholder B: There are biogas options. Stakeholder A: Ok, no Hydrogen colour but green - but trying to make biomethane (as against capture methane) shouldn’t be an option

2.4 Proposed approach for 2023 scenarios

2.4.1 Scenario refresh

Figure 12 Proposal to refresh existing scenarios



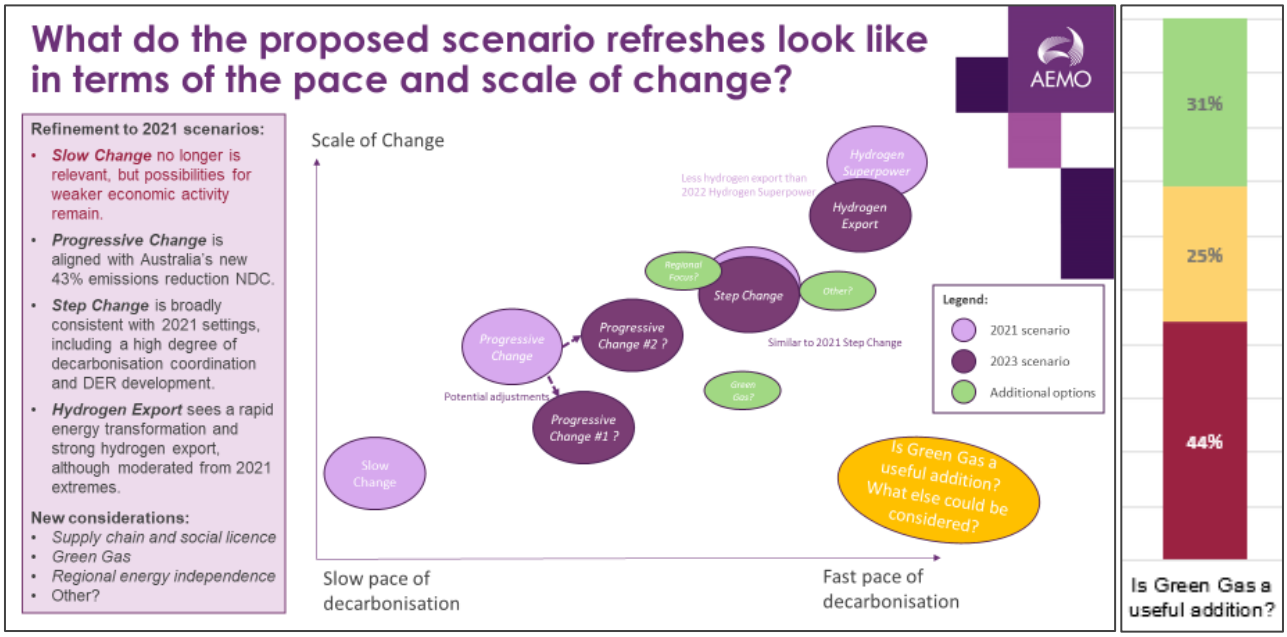
The following table lists stakeholder Q&A from Slido associated with the above slide.

Table 13 Slido questions and responses regarding refreshing existing scenarios

Question Response (note: responses are not from AEMO unless indicated)
Stakeholder A: Noting a desire for scenario consistency, has any thought been given to align scenarios in the WOSP and ISP? **(AEMO) Great question; the WOSP is examining its own appropriate scenarios, and it may be possible for increasing similarity between these for the two publications. Absolute synergy may be challenging, so I'd encourage you to engage with the WOSP directly as well to provide direct feedback there.**
WRT - "Develop updated scenario components and consult on these inputs and assumptions via the Draft IASR“ – Would we be better off having another step first where AEMO sets out and discusses its thoughts before going to the Draft ISAR consultation
If consistency of scenarios over time is valuable, how would you define the circumstances under which they should change?

Proposition: The AEMO interpretation of the role of scenarios over-emphasises the 'likelihood' dimension at the expense of a decent span of 'possible' futures. Why does AEMO persist in this approach, limiting the consideration of the impacts of different technology settings and technology outcomes?
As a consumer advocate, I don't agree with the ISP Consumer Panel view. It was ridiculous that Step Change as the highest DER scenario was considered by 55% of respondents to be the "most likely" scenario yet it was relatively conservative on DER.

Figure 13 Pace and scale of proposed scenario refreshes, with poll result



The following table lists stakeholder feedback made in the optional comment question associated with the above slide.

Table 14 Comments in response to Pace and scale of proposed scenario refreshes

Comment
Maybe rename Step Change to Rapid Change. If we're already on that path, is it still a step change? What happens to the scenario once we've taken said step? A generic title for the hydrogen superpower/export that's less tied to technology might be worth considering. Is the core of this scenario Aus going above and beyond our own domestic decarbonisation and doing some heavy lifting for the rest of the world to reach net zero?
The implications of geopolitical instability and uncertainty
Natural gas should also be considered as a contributor to a gas scenario - even if it forms only a small % in the mix
More Green Gas should be incorporated into Step instead. Strong Government Intervention sensitivity
If I understand this addition correctly, I would think this could just be incorporated into the existing scenarios out in later years to meet carbon abatement ambition goals assuming the technology is developed by then.
Not enough context to what this scenario is
Much greater DER (if renters and low-income access it (Finkle recommendation 6.6)), greater midscale RES-e, more energy efficiency and demand response, alternatives to Capacity Mechanism
Nuclear
What is the definition of green gas?
The hydrogen superpower is definitely a valid scenario
The scenarios need to be grounded in impact on energy bills. "Net Market Benefit" is too abstract.
Electricity super-grids connecting NT and WA
Supply chain issues should be included in modelling of all scenarios. Agree that supply chain should also be considered.

Levels of DER, higher fuel cost - regional focus is interesting but likelihood is somewhat questionable
Gas aint green
Small modular nuclear reactors in place in early 2040s to provide baseload capacity
The green gas scenario provides a useful contrast to other scenarios because it maintains a non-electricity energy vector. It seems at least as plausible as hydrogen superpower at current tech levels/costs.
Hydrogen superpower is basically an impossible version of a 'green gas' scenario already. There's little or no benefit in making a second one. Need to promote and differentiate strong electrification sensitivity instead.
When it comes to gas use, if the end goal in decarbonising gas use potentially requiring huge investment in replacement infrastructure and consumer appliances, wouldn't it be better to potentially solve it through methods that have multiple future uses rather than like for like gas use replacement e.g., electrification. I would like the Strong electrification sensitivity to be explored as a standalone scenario
Demand destruction from high prices
Social license sensitivity - Limit wind resource development to REZ wind build limits rather than add $1.25m/MW to violate
Green gas is electrolyser load. Twiggy first electrolyser is destined for fertiliser production.
The "green gas" name would likely be challenging. But a future with more molecular energy consumption would be a useful sensitivity. I think that doing sensitivities off the "most likely" candidate makes most sense.
storage futures
NO - anything other than green hydrogen - and/or methane capture (landfill etc) shouldn't be a DEVELOPMENT (INVESTMENT) pathway - i.e., no blue/black H2 - also biomass must be genuine waste
Nuclear
Clean coal technology
scenario for storage capacity
Different levels of export demand for Australian aluminium and alumina
If we have an electricity super-grid add geothermal
What do the consumers require with respect to power quality (frequency stability voltage stability), security of supply and price?
Electrification time of day overlays based on different energy load profiles.
Increase in DER and electrification
investment delays due to social licence and supply constraints
Shortcomings of biogas include there not being enough, it being insufficient to reaching net zero, and it being used as a smokescreen for the gas industry to delay real action on climate change. From climate council
No - We have the scenarios we need with just some tweaking

The following table lists stakeholder Q&A from Slido associated with the above slide.

Table 15 Slido questions and responses regarding pace and scale of proposed scenario refreshes

Question Response (note: responses are not from AEMO unless indicated)
The future ISP would benefit from changing its emphasis to a focus on delivered c/kWh energy costs to customers. To do this, costings need to include behind the meter Solar PV and batteries, LV and MV network investments as well as the traditional Generation and Transmission costs.
Stakeholder A: How much should the ISP focus on H2 export given that the volume of energy will require a set of transmission and generation that could be left separate to the "regulated" / "market" driven development of the transmission investment. Stakeholder B: The issue is that anything connected to the grid will still interact and so needs to be considered.
The future ISP needs to demonstrate that has enough generation, transmission and distribution resources to supply the nominated load under worst case conditions.
WRT - "Develop updated scenario components and consult on these inputs and assumptions via the Draft IASR" Would we be better off having another step first where AEMO sets out and discusses its thoughts before going to the Draft ISAR consultation"
Can a slow change with high fuel cost can explore a different driver for change?

The Vic Govt's Offshore Wind Policy Directions paper makes it clear Vic Govt does not want to be dependent on interstate energy supplies in terms of achieving its net zero position. Should this policy development mean AEMO should downgrade prospect of, or timing of, the Marinus Link?
Stakeholder A: By removing slow change because is not in line with the current National Govt ambitions, the same could be argued for removing Hydrogen Export. Slow Change provides a 'worst case' scenario for outcomes that helps create a more reasonable lower bound for decision makers. Stakeholder B: Agreed
Will supply chain consider Australian supply channels and local manufacturing of energy assets - battery minerals, PV and battery manufacturing?
Interesting change of the dimension of the axes from Slide 10 to Slide 21.
Isn't Green Gas just a subset of H2 scenario?

2.4.2 Proposed scenario settings

Figure 14 Proposed scenario settings

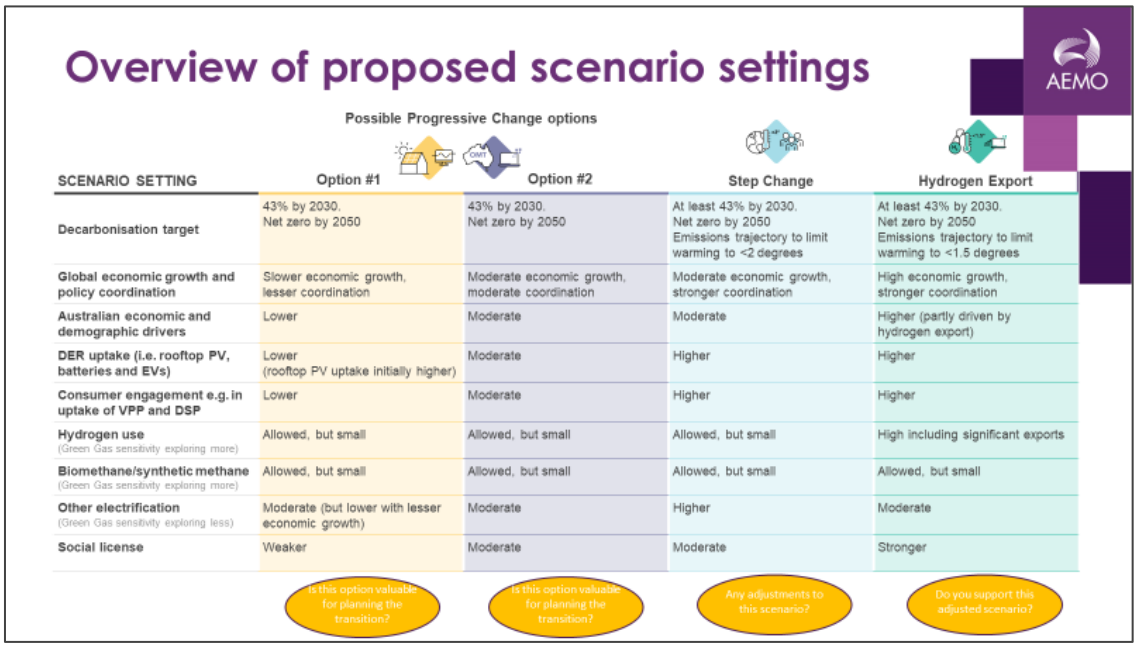
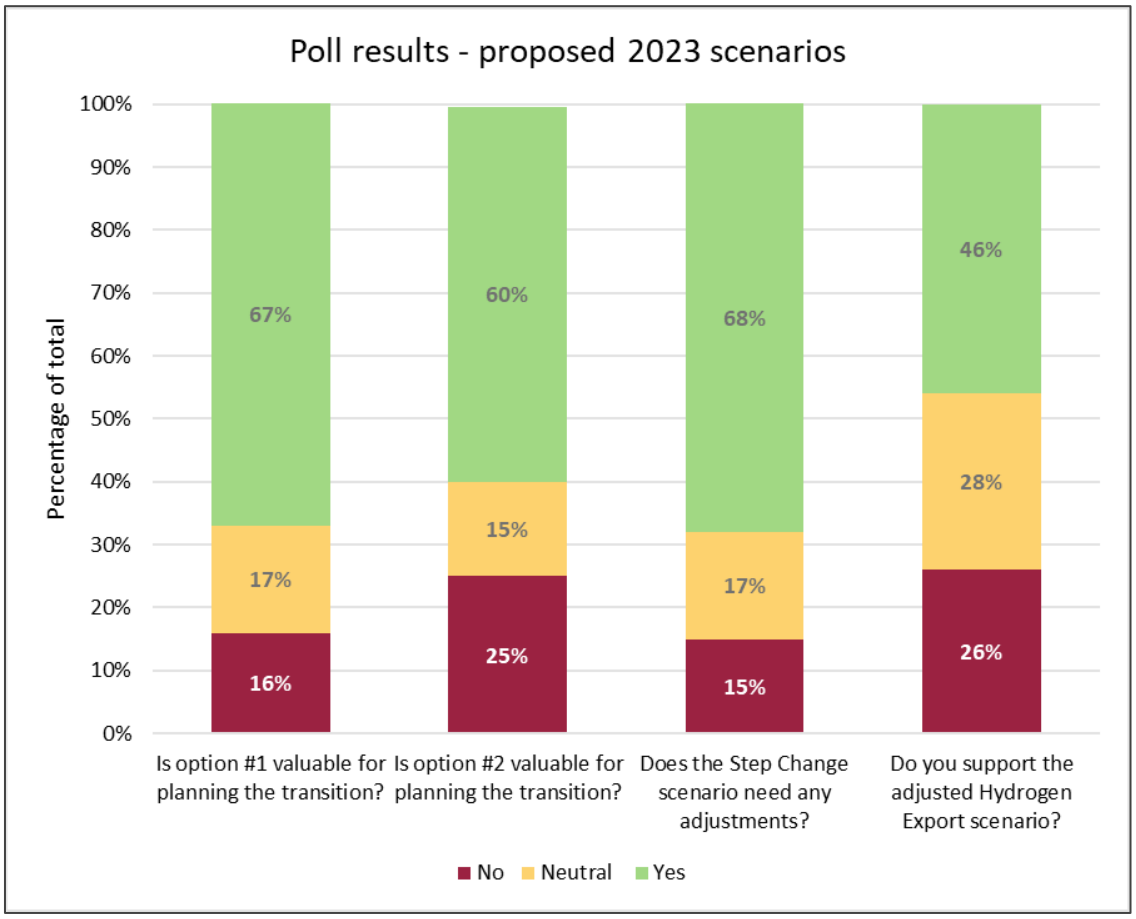


Figure 15 Poll results on the value of each adjusted scenario



The following table lists stakeholder feedback made in the optional comment question associated with "Is option #1 valuable for planning the transition?".

Table 16 Comments in responses to "Is option #1 valuable for planning the transition?"

Comment
This scenario could be used to explore what not hitting net zero looks like i.e. there is yet a concrete policy pathway to hitting this long term target. Also, useful to show consequences of not gaining social licence etc
Yes - but needs a lot more consultation, both informal and formal, in its final development
I'm not sure why the "social licence" aspect is lower only when there is slower economic growth? If anything, you might consider social licence to be a greater challenge in the event that the economy is going well and so factors other than prices have greater weight.
If we are adopting a 43% decarbonisation target for all scenarios, I would prefer to see some constraints put around network and generation investment and timing to reflect some form of 'worst case' outcome, which could then be re-altered as the new slow change.
When it comes to "DER Uptake" and "Consumer Engagement" lines — AEMO and AEMC need to really consider (hopefully now part of the metering (and monitoring) review that is underway) - the need to get much more data from the grid edge - should be part of #DSM
Need option 1 if slow change removed
BESS will be driving factor going ahead as price is going down.
NO - CER/DER and DSM will be increasing more important as VRE grows - need to be able to genuinely engage demand in the balancing the system
Do the questions change between options because the decision has already been made?

Maintaining different assumption sets around DER uptake, EV orchestration and technology costs (e.g., BESS and solar) is highly valuable and provides scenario spreads.
We already have moderate to high DER - why model something we've already surpassed
Surprised by social license 'weaker' setting and the only scenario with the 'weaker' setting. Under slow economic conditions, you may expect society to be more accommodating to infrastructure which may lead to lower energy prices and/or compensation.
I support maintaining scenario spread. I think that this scenario weakens the spread away from Slow Change. There is a lot of feedback on recession and war in Ukraine etc. I think that this is a softening of the spread and I would prefer to go back to a more extreme - but less likely - scenario.
Let's be clear, there needs to be a "failure" scenario so slow change needs to continue. The settings for the 43% emissions reduction really should just be current Step Change scenario - it should have two sub-options that are based on high and low economic growth (demand) scenarios.
But closer to the old Slow Change
Depends on whether slow change is included and with what parameters
AEMO keeps thinking there are land use or international credits available to offset any energy emissions....there aren't.
Forget Land Use and International Credits - the energy system needs to be ZERO not net-zero.
Can a slow change with high fuel cost can explore a different driver for change?

The following table lists stakeholder feedback made in the optional comment question associated with "Is option #2 valuable for planning the transition?".

Table 17 Comments in responses to "Is option #2 valuable for planning the transition?"

Comment
Yes - but needs a lot more consultation, both informal and formal, in its final development
We could amalgamate option#2 and step change, moderating DER uptake to reflect a central outlook.
This just seems to be a mid-point between #1 and #3. I struggle to see a clear role for this scenario. I would prefer more variety for electrification, where across the spread, there is basically none.
82% renewables by 2030 is what Labor says they'll get to, based on their policy initiatives and their modelling
YES - DER and DSM are essential - need to focus on having data from the technology at the grid edge!
Do the questions change between options because the decision has already been made?
Maintaining different assumption sets around DER uptake, EV orchestration and technology costs (e.g., BESS and solar) is highly valuable and provides scenario spreads.
Social licence isn't a variable for scenarios....it is a task to be managed.
This seems like a good way to keep the Progressive Change scenario valid. In essence, maybe it shifts to Step Change from 2021? I do question whether it is valid to have scenarios with low hydrogen uptake though? There is a LOT of reliance on this internationally.

The following table lists stakeholder feedback made in the optional comment question associated with "Does the *Step Change* scenario need any adjustments?".

Table 18 Comments in responses to "Does the *Step Change* scenario need any adjustments?"

Comment
Target net zero by 2040 Sensitivity - low social licence. Sensitivity - lower economic growth
The early years may need to account for equipment supply delays
The tweaks are fine.
We could amalgamate option#2 and step change, moderating DER uptake to reflect a central outlook.
The potential for an Australian hydrogen export market should be acknowledged within the Step Change scenario

It is difficult to understand that social licence is 'moderate' given the large transmission build required
The 43% won't achieve 2 degrees (see climate analytics report). Bowen assumes this is the case, but scenarios should reflect whether it will be achieved and if it is science based.
Roll some "green gas" in
Higher 2030 national decarbonisation target, say 50%. 43% is a minimum target and it can be expected to be beaten. Hydrogen use will be increasing suddenly around 2030 as offshore wind projects came online, so I suggest "Allowed, small to moderate"
Higher 2030 and 2050 target, less gas, more electrification
Needs to allow for Ukraine war, energy crisis, global recession
Step change severely overstates consumer engagement in energy transition. It assumes consumers behave and respond in a similar manner as developers. What incentive do consumers have to participate in VPP, V2G, and investment in expensive BESS? The step change also severely understates the uptake of shallow storage. The AEMO NEM Generation document contains over 10GW of BESS < 4hrs, but current step change only includes 250MW of shallow storage capacity additions through 2050.
Would like to see step change with low/moderate VPP/DSP.
Limit global warming to max 1.5 degrees as required under Paris Accord.
Other electrification should be moderate
YES - focussing the technology and its outputs - especially data
Only change include a higher proportion of hydrogen use and export, but not as significant as Hydrogen superpower.
DER sensitivity is important
A step change now is 60% by 2030. This should be a centre-line economic scenario. Remembering that short term depression/stagflation/inflation scenarios are just that and a long term growth of 3% pa is reasonable.
Other electrification can still be moderate.
On the whole Step Change was good. However, should Step Change be more of a stretch. The fact that it was chosen as most likely maybe means that it wasn't expansive enough. I do question whether it is valid to have scenarios with low hydrogen uptake though?
Do the questions change between options because the decision has already been made?
A step-off sensitivity on green gas could be valuable here.
Respecting build limits for REZs. I can understand why this hydrogen scenario needed to violate it given the volume of renewables required, but I can't understand the rationale in what is, effectively, the central case.

The following table lists stakeholder feedback made in the optional comment question associated with “Do you support the adjusted *Hydrogen Export* scenario?”.

Table 19 Comments in responses to “Do you support the adjusted *Hydrogen Export* scenario?”

Comment
Global and Australian growth can be slow to moderate not high as the world is short of petrol for transport that uses existing cars and existing refuelling infrastructure. All that has been discussed today is green gas not green fuels.
Export hydrogen is more likely to be off grid in the medium to long term
NEUTRAL - Hydrogen Export scenario CANNOT impact on agricultural land use - food security time bomb if productive land is used for export (not unlike the current export of natural gas problem on local prices)
Hydrogen superpower is a stronger theme if we can lead the world in this space.
The H2 Superpower scenario received a 17% vote from the Delphi panel. That is not inconsiderable. It is understood that a lot of people find it hard to believe in, but I would actually say that it is actually too slow. I would strongly recommend that the wider bookends are kept. It should be more about scenarios and plausibility, not perceived likelihood. In fact, I would suggest expanding it given the announcements and developments underway
It should be dropped as it is totally unrealistic - and wastes everyone’s time analysing it.
Do the questions change between options because the decision has already been made?
Decarbonisation national target is a minimum. For this scenario support of export will lead to bigger decarbonisation, say 60%
Level and timing of hydrogen load

Needs more transparency in its core assumptions. See Green Gas as falling within the scenario. Sensitivity - moderate social licence. Sensitivity - 50% of H2 electrolysers developed as standalone electricity consumption not as grid connected
Global and Australian growth can be slow to moderate not high as the world is short of petrol for transport that uses existing cars and existing refuelling infrastructure. All that has been discussed today is green gas not green fuels.
Grid connected hydrogen production for export should be limited to Queensland due to the proximity to Asia Pacific demand markets, and RES resources. Any exports need to be included at a large scale to make the export facilities economical.
Last year's Hydrogen scenario had too much energy production / demand that was unrelated to the NEM.
We need to revisit the assumption around grid-connected hydrogen, and the feasibility of only renewable generation to facilitate this, particularly within the next 10 years. The Strong Electrification sensitivity appeared to be a more reasonable high case.
This needs to remain on the extreme end so the boosters of this scenario remain relevant.
If it 1.5 degree warming is to be achieved, the 43% needs to be 75% (bearing in mind that the energy sector needs to decarbonise faster to allow other sectors to use electrification for decarbonisation). HE and SC scenarios - moderate and higher electrification should be swapped. W.r.t. social licence - clarify or at least reference in the ISP narrative what best practice and next best practice looks like or what should be considered (i.e. not just a $ value).
Needs a name change, greater ambition, greater electrification for domestic.
Do we need to consider stronger demand growth for mining or low carbon manufacturing?
Surprised by the moderate setting for other electrification. Local hydrogen would provide an easier pathway to electrification.
Key question is how far it is AEMO's job to plan for a new export industry given that leads to costs being socialised.
It's fine generally, but the domestic, residential use of hydrogen as a stand-in for gas is implausible, and I'm not aware of anyone who doesn't own (or work for someone who owns) a gas network that thinks it is an option.

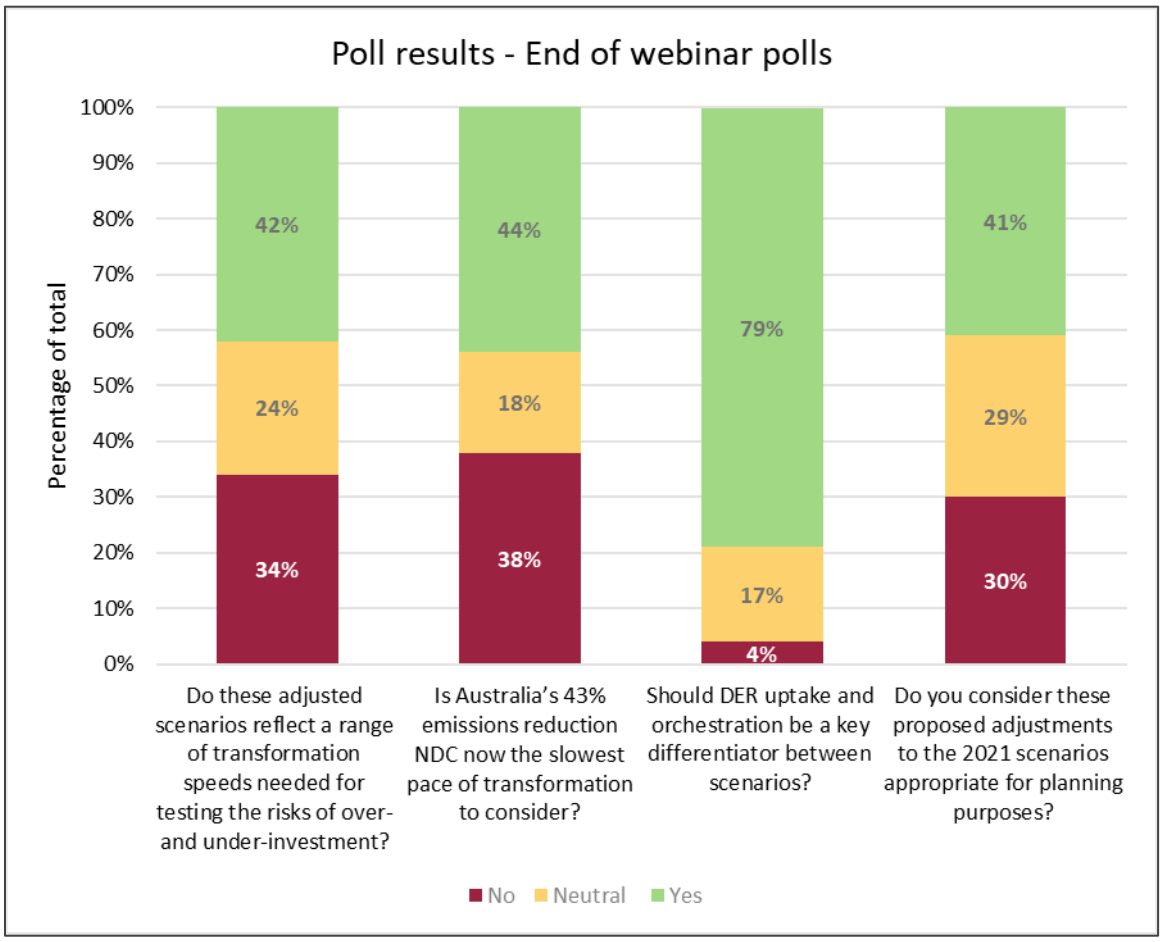
The following table lists stakeholder Q&A from Slido associated with the Proposed scenario settings.

Table 20 Slido and Webex questions and responses regarding the proposed scenario settings

Question Response (note: responses are not from AEMO unless indicated)
AEMO keeps thinking there are land use or international credits available to offset any energy emissions....there aren't.
Stakeholder A: Slides 21 and 22 look like AEMO have already made up their mind on what should happen, so what is the purpose of today? **AEMO verbal response: These scenarios are 'proposed' and the purpose of this webinar is to gather feedback.**
When it comes to "DER Uptake" and "Consumer Engagement" lines — AEMO and AEMC need to really consider (hopefully now part of the metering (and monitoring) review that is underway) - the need to get much more data from the grid edge - should be part of #DSM
Stakeholder A: Forget Land Use and International Credits - the energy system needs to be ZERO not net-zero. Stakeholder B: What do you mean by land use credits?
Stakeholder A: Why is 43% used in the targets? To achieve 43% across the whole economy we need more than 43% for low hanging fruit like NEM transformation Stakeholder B: I suspect that this is just wording. The 2021 ISP scenarios had similar thresholds, but the modelling allowed the economy to choose what to decarbonise - and the electricity sector went first. I would expect the same again. Stakeholder C: I think but can't confirm that 43% means economy wide and acknowledges that industry and agriculture will not be progressing this fast (ALP policy certainly does). Stakeholder D: What do you mean by Land Use credits?
Significant changes in export hydrogen developments were observed in the last two years. Are you expecting to include hydrogen export into these scenarios

2.5 Final polls

Figure 16 Poll results



The following table lists stakeholder feedback made in the optional comment question associated with "Do you consider these proposed adjustments to the 2021 scenarios appropriate for planning purposes?".

Table 21 Comments in responses to "Do you consider these proposed adjustments to the 2021 scenarios appropriate for planning purposes?"

Comment
Can we understand the complementary nature of Hydrogen Export versus Step Change? i.e., in terms of what Tx needs to be built how similar are they?
More consultation needed
I would prefer better scenario names so it is relatable.
Need more consideration of the implications of geopolitical instability and uncertainty
Depends on how you integrate participants comments today and in December
The spread is definitely too narrow. Why narrow the spread? Also, the evidence of a growing hydrogen sector is much stronger.
Not enough info to make this judgment
Some principled adjustments, but more work to be done.
No not enough reform re customer interest, bill impact, CER and Demand side balancing supply side.
Plan grid projects for efficient delivery which will keep costs down, not all at the last minute.

The scenarios need to address the changing geographic coverage of the NEM. The NW of Qld is currently not connected to the NEM and is not considered at all in your planning.

The following table lists stakeholder feedback made in the optional comment question associated with “Do these adjusted scenarios reflect a range of transformation speeds needed for testing the risks of over- and under-investment?

Table 22 ”Comments in responses to “Do these adjusted scenarios reflect a range of transformation speeds needed for testing the risks of over- and under-investment?”

Comment
Neutral, subject to previous comments.
Need to consider Labor’s rewiring the Nation policy and investment. Consideration should be given to are respondents replying to "do we need scenario X" or "does scenario X reflect what it should reflect"
Providing some form of slow change retained. Also consider green gas, noting max 4-5 scenarios. So maybe ditch progressive change?
Scenarios need to be realistic and also should be wide enough to test "no regrets" investment decision making.
There is not enough spread to understand the possible outcomes.
Need the slow change scenario
Neutral - really seems to a lack of understanding and underrating of the CER/DER interaction in the ISP - security and resiliency if/as CER needs more Tx capacity for whole of DNSP support
Uptake of DERs, EVs, PVs and Hydrogen forecasts should be for worst case scenario in order to avoid under investment and last minute upgrades.
Risk of overinvestment is not a consideration for wisely selected grid augmentations
Need scenario with greater ambition
Still feels like there could be a more pessimistic setting on emissions reduction out to 2050 e.g. increasingly harder and more expensive to eke out that last 10% or so.

The following table lists stakeholder feedback made in the optional comment question associated with “Is Australia’s 43% emissions reduction NDC* now the slowest pace of transformation to consider?”.

Table 23 Comments in responses to “Is Australia’s 43% emissions reduction NDC* now the slowest pace of transformation to consider?”

Comment
On the assumption that a major economic downturn invests in the achieving the target
It's a target not a done deal
Scenario is about what might happen not just what "ought" to happen
There is a potential Australia does not meet the target
Deliverability constraints may not allow for this pace to change to be achieved. (noting that 43% is economy wide emissions reduction)
We have to model what policy failure looks like....
No because it distinctly possible that it is not achieved
Several things may cause this to not occur. Whilst unlikely, 1 scenario of lower investment, lower CO2 reduction, etc brings some value.
Need to assess policy failure, or change of government after next 1 or 2 elections
Look at the 50% as a floor.
Need to consider if policy settings don’t support or consumer uptake of new technologies
It’s a target, targets aren't always met
For the purposes of grid planning, yes. The meaningful pending issues are outside the electricity sector, for the most part.
The enthusiasm and competition between developers will ensure a faster pace

Need to consider not meeting the 43%
There is some value in including a scenario that reflects a slightly slower transition, reflecting poor economic performance and other market shocks.
It is possible that we don't achieve it. That shouldn't be a target or a plan, but it is plausible. It is an interesting challenge to manage the difference between producing a plan and understanding a scenario. Not all scenarios need to be likely to be valuable.

The following table lists stakeholder Q&A from Slido and Webex associated with Australia's 43% emissions reduction NDC.

Table 24 Slido and Webex questions and responses to Australia's 43% emissions reduction NDC

Question Response (note: responses are not from AEMO unless indicated)
Social licence isn't a variable for scenarios....it is a task to be managed.
May I know the justification to have 43% decarbonation target by 2030? will carbon price in effect for all the scenarios?
Given importance of Social Licence in terms of implementing the ISP and given significance of electricity bills (affordability) in determining community reaction to the ISP, can the next ISP include estimates of the electricity price impacts (at least for most favoured scenario)?
Why would step change focus only on 43% by 2030 and net zero by 2050 when, there is a strong view electricity sector needs to reduce emissions faster than other sectors and ALP had been talking about 82% renewable energy in electricity by 2030
Agree DER should be a differentiator between scenarios. Agree 43% should be the slowest pace of transformation to consider
My sense is industrial heat only, but also as part of domestic gas phase out. NOT EXPORT.
Stakeholder A: The 43% will be a floor and could end up being higher and the "at least 43%" is economy wide and energy sector will need to go further faster. Stakeholder B: I hope that 43% is a floor, but if electricity bills rise quickly (+recession?), there could be a public/electoral backlash that means Australia falls short of 43% target. (It has happened not long ago!) Stakeholder A: Thanks, although I would have thought rising electricity prices could actually drive greater investment in renewables....i.e. solar sales have increased significantly in last month.
DER sensitivity may influence Government or other investment in DER (i.e. if we decide DER is more efficient, then it may be in Gov interest to further incentives, especially for people who currently can't afford or access DER) and/or networks.
Green gas might be useful IF its focused on exports and large industrial uses, but not for households.
Stakeholder A: What is the difference between *Hydrogen Export* and *Green Gas* scenarios? **AEMO verbal response: *Hydrogen Export* focuses on providing hydrogen to export loads, large users including green steel and other energy-intensive manufacturing, and transportation. *Green Gas* focuses on adding bio-methane to the reticulated gas network. This reduces the scale of electrification required and makes greater continued use of the gas network to complement the electricity network.**

The following table lists stakeholder feedback made in the optional comment question associated with "Should DER uptake and orchestration be a key differentiator between scenarios?".

Table 25 Comments in responses to "Should DER uptake and orchestration be a key differentiator between scenarios?"

Comment
Some of the other matters raised need to be considered
Highest degree of uncertainty in future energy mix. Coal will retire, gas will be needed, wind/solar will be developed, but the level of DER is highly uncertain and will dictate the level of investment in T&D and utility scale capacity additions
I would like to hear from the new Customer Panel
See all my earlier answers and previous submissions - the scenarios need to be properly environmentally spanning. ; It needs to be the differentiator between two varieties of the old step change.
We feel like AEMO has been very optimistic in its assumptions about DER operation.
DER and particularly orchestration is a significant uncertainty. Any increase in orchestration needs to clearly understand the behavioural or social impact.
The possibility of DER in aggregated form being a major player in the future should be significant consideration

Agree with some; disagree with some
Some principled improvements, but more work to be done.; Yes, though no more important than others.
A minor matter
This is essentially modelling the effectiveness of DER orchestration with regard to successful consumer engagement on DER use preferences. We could have grand ideas that it all helps, but is poorly designed and not effective, or we could nail it. Both give very different demand outcomes
Just keep the scenarios from the 2022 ISP
YES - there seems imo to be a misunderstanding the for the interrelationship between transmission and CER/DER - Tx is ow security and resiliency -so it's about flows in/out of Distribution
We need scenario names to be more relevant to the wider community. Not just ISP geeks!
Can't be definitive based on level of information provided.; since is more an input than an output and presumably can have material impact.
Need greater ambition, greater focus on electrification and role of DER; And electrification
A very fair starting point. Thanks for sharing.
Yes, and please include heat-pump hot water (which acts as a solar sponge / battery)

The following table lists stakeholder feedback made in the "Any other comments?" optional comment section.

Table 26 Comments in responses to "Any other comments?"

Comment
Plan grid projects for efficient delivery which will keep costs down, not all at the last minute.
The scenarios need to address the changing geographic coverage of the NEM. The NW of Qld is currently not connected to the NEM and is not considered at all in your planning.
More consultation needed
I would prefer better scenario names so it is relatable.
Depends on how you integrate participants comments today and in December
Can we understand the complementary nature of Hydrogen Export versus Step Change? i.e., in terms of what Tx needs to be built how similar are they?
No not enough reform re customer interest, bill impact, CER and Demand side balancing supply side.
The spread is definitely too narrow. Why narrow the spread? Also, the evidence of a growing hydrogen sector is much stronger.
Not enough info to make this judgment
Some principled adjustments, but more work to be done.
Need more consideration of the implications of geopolitical instability and uncertainty

The following table lists any other stakeholder Q&A from Slido and Webex.

Table 27 Final Slido and Webex questions and responses

Question Response (note: responses are not from AEMO unless indicated)
Are you going to cost your scenarios, on the basis of not only the generator costs but also the transmission, distribution costs plus the necessary firming capacity verses the dispatchable ratings rather than the maximum capacity?
2024 ISP needs to identify storage size and location by REZ and Region, and by scenario, and over time. Else how will investors know where to focus their efforts?
Is there a possibility of a stronger demand from mining and low carbon manufacturing?