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21 February 2024

To: Australian Energy Market Operator

RE: Draft 2024 ISP Consultation

Thank you for the opportunity for the Institute for Energy Economics and Financial Analysis (IEEFA) to provide input into AEMO's Draft 2024 ISP Consultation. IEEFA is an independent energy finance think tank that examines issues related to energy markets, trends, and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy.

IEEFA thanks AEMO for the large amount of work it has put into the 2024 Integrated System Plan (ISP) process so far. The process involves multiple energy industry and consumer stakeholders and is an important process to help align stakeholders on the planning of the National Electricity Market (NEM).

IEEFA has reviewed the Draft 2024 ISP in detail and finds that there are a range of actions AEMO could take to strengthen the ISP to provide more certainty and confidence on the optimal path for the NEM. These changes would help ensure the ISP is better aligned with the government's target of 82% renewables by 2030 and 43% emissions reduction by 2030. In summary, IEEFA recommends that AEMO:

- More comprehensively discuss the impacts of 1.5°C-aligned climate targets with a focus on the *Rapid Decarbonisation* sensitivity.
- Provide further discussion to qualify gas power generation (GPG) outcomes in the 'optimal development path' (ODP), as the change in balance of GPG and storage capacity compared with previous ISPs is not explained.
- Reassess central gas price assumptions and model a 'High Gas Price' sensitivity – as it is not clear that current assumptions reflect the costs of overcoming near-term supply constraints, or that the current ODP would be resilient if future price shocks were to occur.
- Explain changes in the mapping of *GenCost* scenarios to ISP scenarios, which have led to material increases in storage cost forecasts.
- Revise distributed solar PV forecasts as they appear to be conservative and not up-to-date with the most recent Green Energy Markets projections.
- Makes the assumptions used by CSIRO and Green Energy Markets around the uptake of dynamic operating envelopes transparent.
- Update the electric vehicle (EV) forecasts to use the most recent CSIRO modelling and reconsider EV vehicle to grid forecasts.
- Model and report on the demand side in more detail: consider a broader range of demand side interventions and co-optimise between demand and supply where possible.
- Provide a higher distributed energy resources (DERs) scenario or sensitivity to inform planning and policymaking.
- Include integrated planning with distribution network service providers in the ISP process.
- Provide higher data granularity in generation results, to inform the industry.
- Explore the faster renewables and storage capacity build and coal exit forecast in the *Rapid Decarbonisation* sensitivity in the final ISP report in more detail.

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- Provide more clarity around the drivers of coal exits: emissions, revenue adequacy or both, to inform planning and policymaking.
- Undertake a balanced social licence analysis, not only exploring social license for renewables and transmission but also for new gas and coal developments.
- Revise coal price assumptions, which appear to be materially lower than actual coal prices.

Please see IEEFA's detailed response exploring each of these areas in the following pages.

Regards,

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1. Does the proposed optimal development path help to deliver reliable, secure and affordable electricity through the NEM, and reduce Australia's greenhouse gas emissions? If yes, what gives you that confidence? If not, what should be considered further, and why?

The draft ISP provides a pathway showing how to decarbonise the NEM

AEMO's recent Quarterly Energy Dynamics report for Q4 2023 highlights the accelerating pace of change that is underway as the NEM transitions towards a greater share of renewable energy. Even more change is anticipated as Australia moves towards its target of 82% renewables by 2030. The role of credible and rigorous modelling is critical to guide the NEM towards these targets.

AEMO's draft release of the 2024 ISP once again is centred on *Step Change,* a scenario aligned to Australia's 82% renewable energy target and net zero emissions target.

The following response outlines several key areas where IEEFA believes the 2024 ISP could be strengthened further, to provide more certainty and confidence on the optimal path for the NEM.

IEEFA supports AEMO's inclusion of a new 1.5°C-aligned sensitivity, but recommends its outcomes are discussed in greater detail

IEEFA's previous response to consultation on updates to the ISP methodology outlined the case for a "[…] more central, balanced 1.5°C scenario" as an alternative to the *1.5°C Green Energy Exports* scenario, which features a disproportionate reliance on hydrogen to achieve emissions targets." We suggested that this scenario should present an alternative technology pathway to *1.5°C Green Energy Exports*.[1] Clean energy investors have previously questioned the over-reliance of hydrogen in this scenario.[2]

We acknowledge that AEMO has included a new 1.5°C-aligned sensitivity on the *Step Change* scenario, called *Rapid Decarbonisation*.

In IEEFA's view, this is a particularly important sensitivity as it is the only one modelled that embeds Australia's binding commitments under the Paris Agreement under a relatively technology-neutral approach.

The objective of the Paris Agreement is to "[hold] the increase in the global average temperature to well below 2°C above pre-industrial levels and [pursue] efforts to limit the temperature increase to 1.5°C above pre-industrial levels".[3] The Australian government also describes the goal of the Paris agreement as limiting global warming to 1.5°C in its 2022 Climate Change Statement.[4]

AEMO notes that it has chosen to apply the amended National Electricity Objective (NEO) in the 2024 ISP, which requires it to use scenarios that comply with Australian governments' emissions reduction policies.[5]

[1] IEEFA. IEEFA response on AEMO consultation on the updates to the ISP Methodology. 1 May 2023.
[2] Clean Energy Investor Group (CEIG) and Baringa Partners. Decarbonising Australia: Accelerating our energy transition with a credible 1.5°C scenario. April 2023. Page 4.
[3] United Nations Framework Convention on Climate Change (UNFCCC). The Paris Agreement.
[4] DCCEEW. Annual Climate Change Statement 2022. 2022. Page 13.
[5] AEMO. Draft 2024 Integrated System Plan. December 2023.

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IEEFA therefore suggests that findings from the *Rapid Decarbonisation* sensitivity are of equal or greater importance than the *Green Energy Exports* scenario, and that these findings should be discussed in detail in the final 2024 ISP report.

As one example, AEMO notes that it tests how the candidate development paths perform against the sensitivities, and that "The analysis showed that the benefits changed materially with levels of deep storage assets and energy efficiency."[6] The draft results for the ODP show significantly divergent deep storage capacity outcomes for *Step Change* versus the *Rapid Decarbonisation* sensitivity (5.5 gigawatts (GW) and 9.9GW by 2052 respectively). This implies that a pathway aligned to a 1.5°C objective may be materially different to the ODP in *Step Change*, which warrants further discussion.

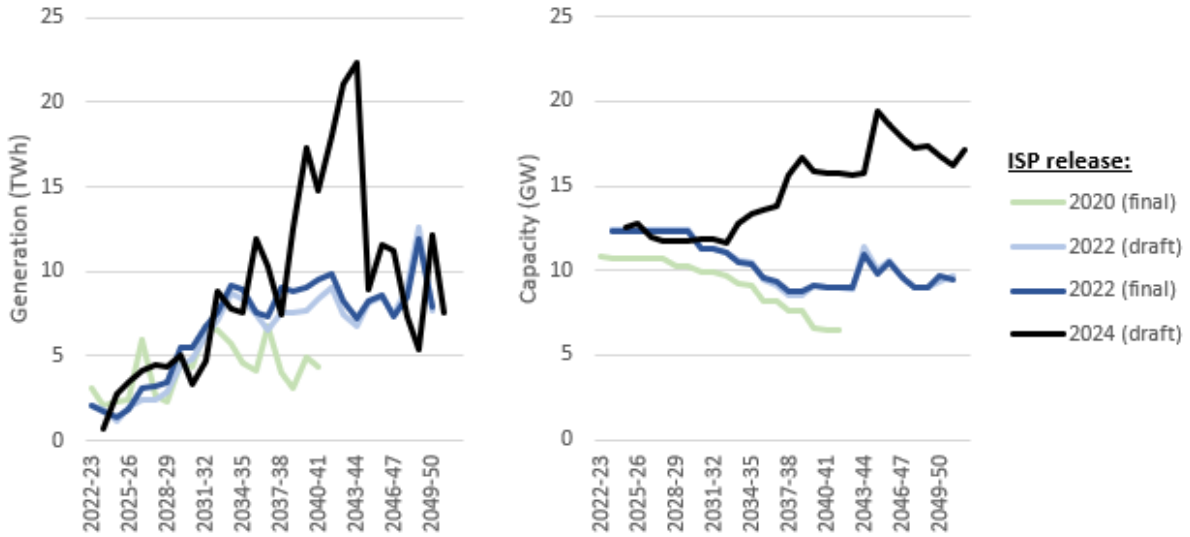
Provide further discussion to qualify gas power generation (GPG) outcomes in the ODP

The draft ISP reports that gas power generation (GPG) will be needed in additional to firmed storage to support future high penetration of renewables in the NEM.[7] However, more interpretation is needed to explain the level of divergence in several GPG outcomes compared with the 2022 Final ISP.

The long-term capacity outlook for GPG has been significantly elevated in the 2024 draft ISP *Step Change* scenario compared with previous iterations of *Step Change*. This increase in capacity is largely supporting a significant surge in GPG between approximately 2038 and 2045. Following this surge, utilisation rates fall well below previous ISP forecasts (Figure 1).

Given the divergence between previous modelling outcomes, recent GPG trends, and the materiality of these outcomes, they warrant further analysis.

Figure 1: Gas power generation (top left), capacity (top right) and average utilisation (bottom) forecasts, compared across recent draft and final ISPs (Step Change)



[6] AEMO. Draft 2024 Integrated System Plan. December 2023. Page 71.
[7] Ibid. Page 65.

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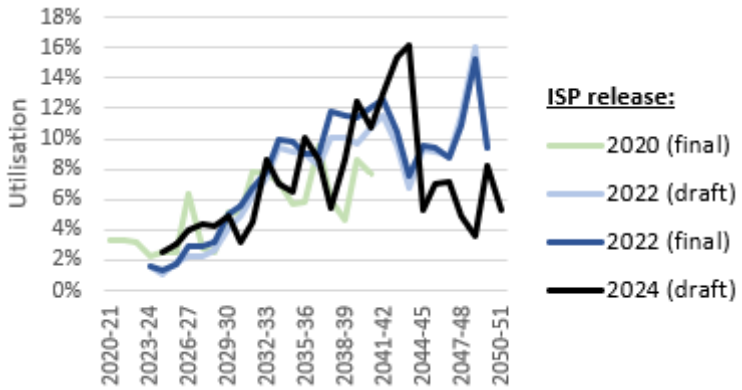
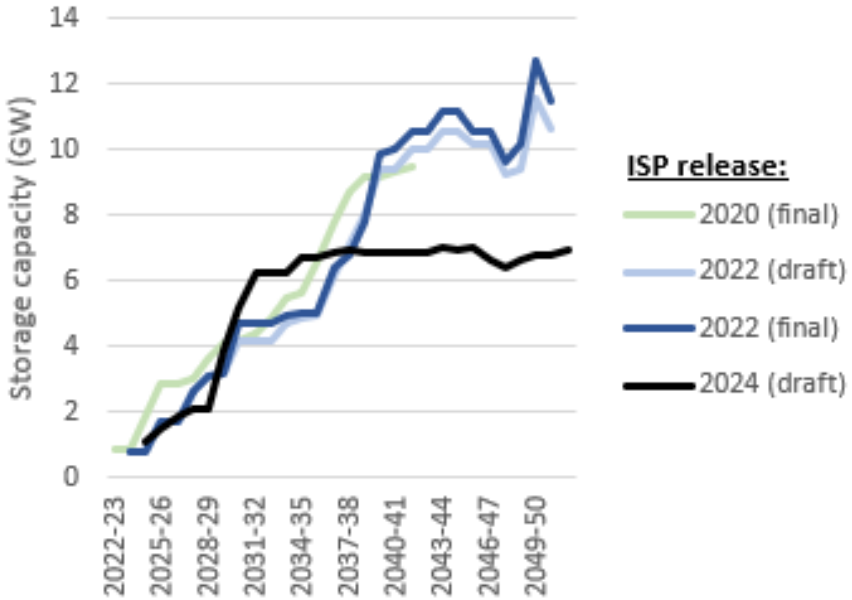


Source: IEEFA analysis of AEMO generation and storage outlook data for the draft 2024 ISP, final 2022 ISP, draft 2022 ISP and final 2020 ISP.

The increase in GPG capacity relative to the 2022 Final ISP appears to correlate with a significant downgrade in deep and medium utility-scale storage capacity forecasts (excluding Snowy 2.0). *Step Change* in the draft 2024 ISP sees deep and medium storage capacity exceed 6GW by 2032, after which it does not grow substantially over the rest of the modelling horizon. This significantly contrasts with results from the 2022 final ISP, which saw continued growth, exceeding 12GW at its highest point (Figure 2).

Figure 2: Combined deep and medium utility-scale storage capacity forecasts, compared across recent draft and final ISPs (Step Change)



Source: IEEFA analysis of AEMO generation and storage outlook data for the draft 2024 ISP, final 2022 ISP, draft 2022 ISP and final 2020 ISP. Note: Excludes Snowy 2.0 but includes Borumba.

These draft 2024 results imply that by the 2030s, the least-cost pathway for the NEM is to halt investment in medium and deep utility-scale storage but invest significantly new GPG capacity with low future utilisation rates. This contrasts significantly with the final 2022 ISP and 2020 ISP which come to a different conclusion.

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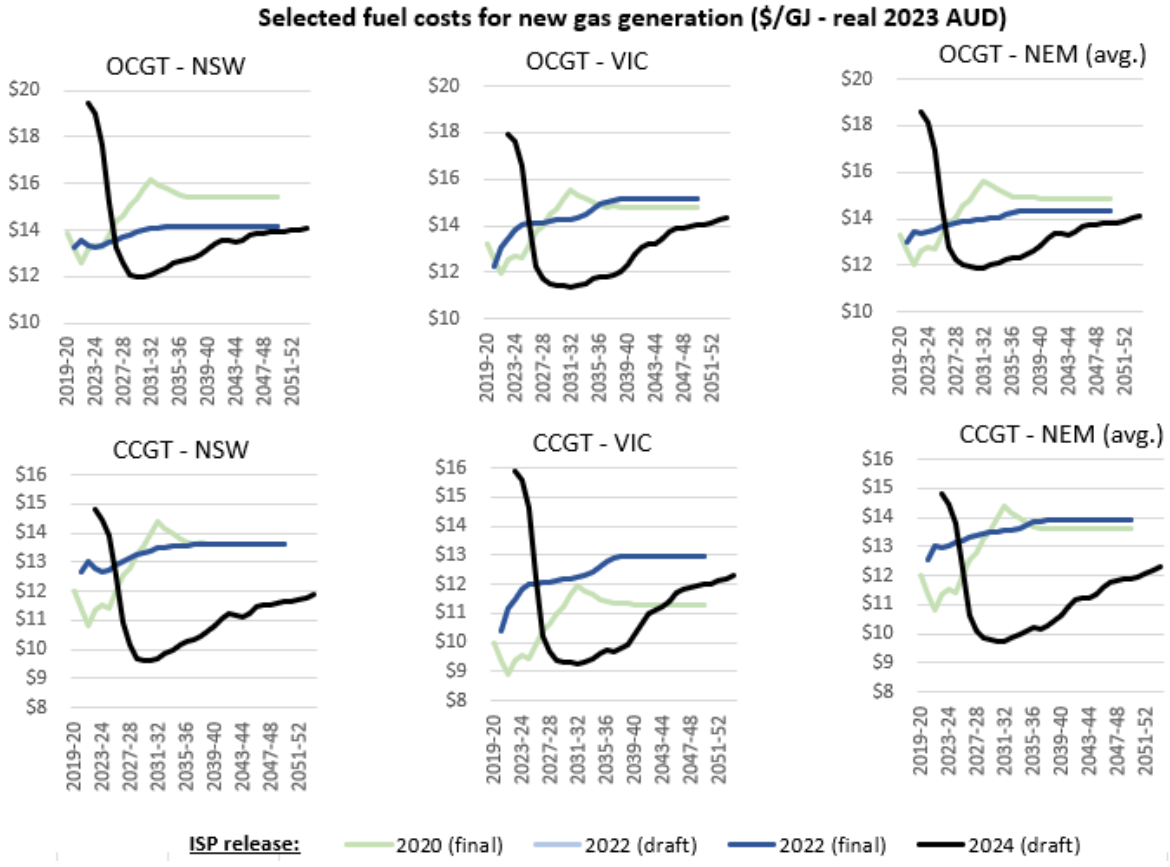
We recommend AEMO extends its commentary on GPG outcomes to clarify why this outcome is considered optimal by the model compared with the previous ISP.

Reassess central gas price assumptions and model a 'high gas price' sensitivity

Figure 3 shows that GPG fuel price assumptions in the 2024 ISP have materially changed compared to the final 2022 ISP. While there has been an adjustment to reflect actual raised prices in 2022-23, for most new generators, fuel prices are expected to fall much lower than previously forecast, when adjusted for inflation.

Figure 3: Fuel cost assumptions for new open cycle gas turbine (OCGT) and combined cycle gas turbine (CCGT) generation in NSW, Victoria and averaged across the NEM, compared across recent ISP releases (Step Change)



Source: IEEFA analysis of AEMO generation and storage outlook data for the draft 2024 ISP, final 2022 ISP, draft 2022 ISP and final 2020 ISP. Note: All costs adjusted from original AEMO values to 2023 AUD, based on end-year inflation of 0.7%, 3.5%, 7.8% and 4.1% for CY 2020, 2021, 2022 and 2023 respectively.

These changes may materially impact the long-term perceived profitability of GPG. IEEFA recommends AEMO provide more information explaining the cause and implications of this significant change in input assumptions.

Lowered gas prices in the late 2020s are surprising given that AEMO's 2023 Gas Statement of Opportunities (GSOO) forecast annual gas supply shortfalls in southern regions from 2027, based on scenario assumptions broadly consistent with the 2024 ISP's *Step Change* scenario.[8]

[8] AEMO. Gas Statement of Opportunities. March 2023. Page 14.

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Mitigating these gas supply constraints without reductions in gas demand beyond the *Step Change* forecasts is likely to require new infrastructure such as liquified natural gas (LNG) import terminals or new long-distance transmission pipelines. These would incur costs that are likely to passed through to gas users.

Gas price input assumptions are derived from modelling by ACIL Allen, which considers costs for specific projects assumed in AEMO's GSOO.[9] However, it is not clear whether costs for new projects that would be required to supply future gas for GPG in southern states are included.

This implies a likelihood that the fuel price forecasts underestimate the actual cost to deliver gas to these generators. IEEFA recommends AEMO assess whether the Acil Allen forecasts are feasible in the context of supply gaps forecast in the 2023 GSOO and update them if necessary. Additionally, recent years have highlighted the sensitivity of Australia's domestic gas market to major global price shocks. These shocks are difficult to forecast, though if they occur, their impacts on the NEM are now known to be material.

There is a strong case for AEMO to include a 'High Gas Price' sensitivity in the final 2024 ISP. This should be accompanied by an appropriately detailed discussion in the main report at explains the impacts of the sensitivity on GPG and other results in the modelling. This would help improve transparency of how fuel price assumptions impact the final modelling results.

Explain changes in the mapping of *GenCost* scenarios to ISP scenarios, which have led to material changes in storage cost forecasts

While investigating potential drivers behind the divergent GPG outcomes between the draft 2024 and final 2022 ISP, IEEFA found that there have been very significant increases in assumed capex for new utility-scale battery storage, in parallel with modest reductions in capex for new OCGT and CCGT capacity.

These increases are so significant that there is a lag of more than 28 years between when the $1,000 per kilowatt (kw) threshold is crossed for a four-hour battery in the 2022 *Step Change* scenario, compared with in the draft 2024 *Step Change* scenario (Figure 4).

Capital cost forecasts for the final 2022 ISP and draft 2024 ISP are derived from CSIRO's 2020-21 and 2022-23 *GenCost* publications respectively. Between these publications, CSIRO has revised the *GenCost* scenarios to reflect developments such as a greater need for a range of emission reduction scenarios.[10]

In the final 2022 ISP, the *Step Change* scenario drew capex assumptions from the *GenCost High VRE* scenario. This scenario has since been renamed to *Global NZE by 2050*.[11] However, rather than mapping the new *Global NZE by 2050* scenario to *Step Change*, the draft 2024 ISP changes the *Step Change* mapping to instead draw on the new *Global NZE post 2050* scenario from *GenCost,* which CSIRO consider to be a "middle-ground" scenario.[12]

The remapping has significantly elevated the cost of utility-scale storage, particularly for four- and eight-hour batteries. Figure 4 compares utility-scale battery capex forecasts for the following *GenCost* scenarios:

[9] ACIL Allen. Natural gas price forecasts for the Final 2023 IASR and for the 2024 GSOO. Page 17.
[10] CSIRO. GenCost 2021-22. July 2022. Page 21.
[11] Ibid.
[12] Ibid.

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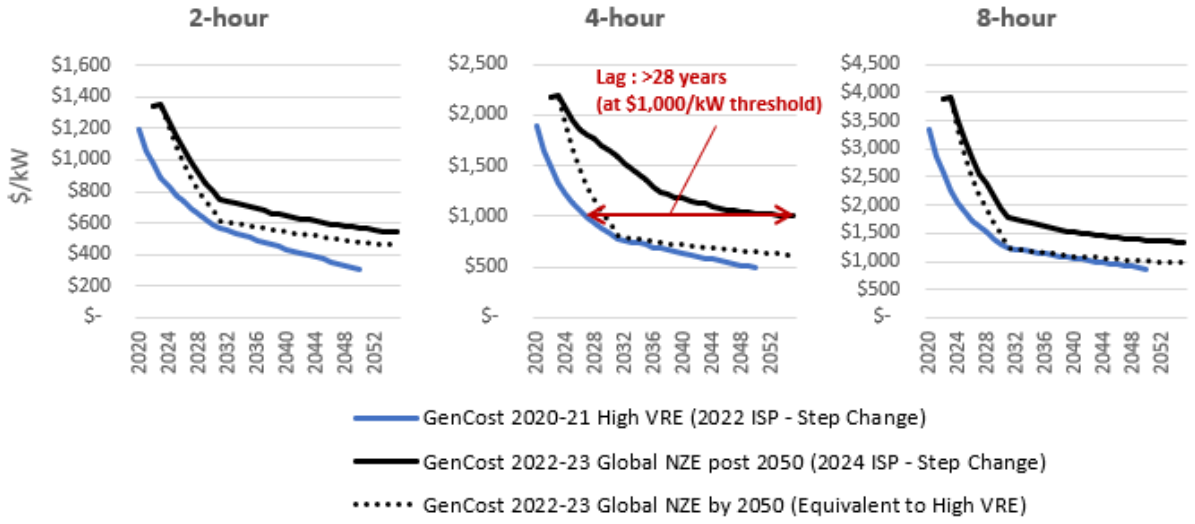
- 2020-21 *High VRE* (Mapped to *Step Change* in the final 2022 ISP).
- 2022-23 *Global NZE post 2050* (Mapped to *Step Change* in the draft 2024 ISP).
- 2022-23 *Global NZE by 2050* (The updated equivalent of the 2020-21 *High VRE* scenario).

Figure 4: Comparison of 2-hour, 4-hour and 8-hour battery build costs, converted to real 2023 AUD per kW, from selected GenCost scenarios.



Note: In order to illustrate the magnitude of the change in assumptions, a maximum lag of >28 years between the four-hour battery cost trajectories used in 2022 versus 2024 Step Change is highlighted.

IEEFA acknowledges that it may be appropriate to remap assumptions as scenarios evolve between ISP iterations. However, this particular change has resulted in a substantial downgrade in the long-term expectations for utility-scale storage cost reductions, which is not adequately explained in the Draft ISP report.

We therefore recommend the implications of this change, and particularly its impacts on the GPG outcomes discussed in Section 6 of the draft ISP, are explained in more detail.

We also note AEMO has included a *Rapid Decarbonisation* sensitivity on the *Step Change* scenario that reflects an increased emission reduction effort consistent to limiting global temperature rise to less than 1.5°C.[13] We recommend AEMO clarifies whether this sensitivity will therefore use capex assumptions aligned to *Global NZE by 2050*.

Revise distributed solar PV forecasts as they appear to be conservative and not up-to-date with the most recent modelling

The distributed solar forecasts in the ISP *Step Change* scenario (Candidate Development Path 11) show around 2.5GW on average being installed in the NEM each year out to 2050.[14] However, the trends of increasing solar photovoltaic (PV) system size and reducing capital costs indicate the ISP's distributed solar PV forecasts are likely to be conservative.

IEEFA expects rooftop solar to grow faster than AEMO has accounted for in the draft 2024 ISP, primarily due to larger future PV system sizes than is currently assumed in the draft ISP. AEMO

[13] AEMO. 2023 Inputs, Assumptions and Scenarios Report. July 2023. Page 23.
[14] AEMO. Draft 2024 ISP Consultation, Generation and storage outlook excel files. 15 December 2023.

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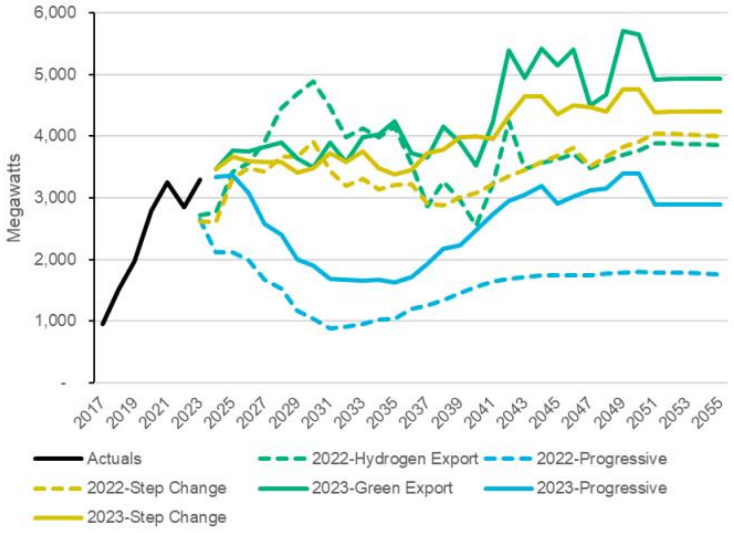
has used both Green Energy Markets (GEM) and CSIRO 2022 projections to determine the ISP distributed solar PV projections.[15][16] However, GEM updated its distributed solar projections in December 2023 for AEMO's 2024 Forecasting Assumptions Update.[17] The 2023 GEM rooftop solar capacity additions per year are now higher than the 2022 GEM projections (used for the ISP) as seen in Figure 5 below. GEM has attributed their higher solar forecasts largely to growth in solar PV system size.[18]

Figure 5: National megawatts of solar additions to stock 2022 vs 2023 projections



Source: Green Energy Markets[19]

GEM's old 2022 projections see residential rooftop PV system sizes remain stable around the approximately 8kW mark from 2028 onwards as shown in Figure 6 below. In the new December 2023 projections system size grows from a current level of 8kW to around 12kW by 2054. This is a significantly higher endpoint than the old projections. If AEMO incorporated these new projections the rooftop PV forecast would be significantly higher.

Even the new GEM rooftop PV forecasts may not be fully accounting for the potential growth in solar PV system sizes: they still do not come close to following the historical trajectory seen (Figure 6).

[15] AEMO. 2023 - 24 inputs, assumptions and scenarios. Accessed 20 February 2023.
[16] Green Energy Markets. Final Projections for distributed energy resources – solar PV and stationary energy battery systems. December 2022.
[17] AEMO. 2024 Forecasting Assumptions Update Consultation. Accessed 20 February 2023.
[18] Green Energy Markets. Projections for distributed energy resources – solar PV and stationary energy battery systems. December 2023.
[19] Green Energy Markets. Projections for distributed energy resources – solar PV and stationary energy battery systems. December 2023. Page 17.

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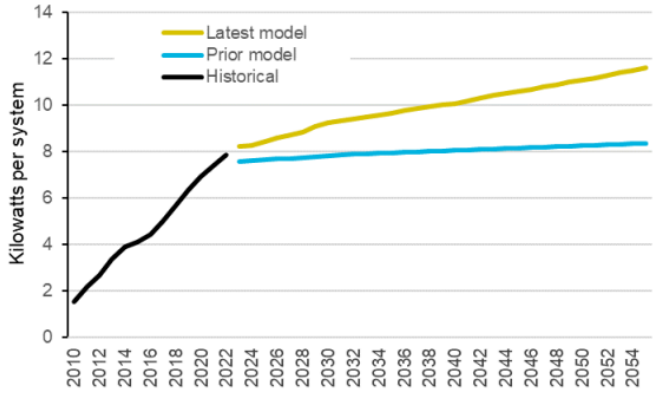
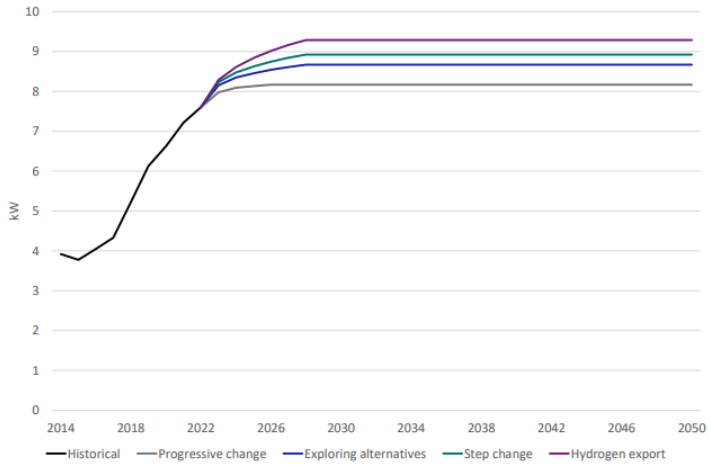
Figure 6: Average size of a new residential solar system by installation year – 2022 vs 2023 projections



Source: Green Energy Markets.[20]

CSIRO's 2022 projections for AEMO, which also helped form the draft 2024 ISP distributed solar forecast, have significantly lower solar PV system size than GEM's new projections.[21] CSIRO's *Step Change* scenario modelling of residential solar PV system size reaches only around 9kW in ~2028 and no growth from then out to 2050, while GEM's new projections reach around 11kW in 2050 and almost 12kW in 2054.

Figure 7: Historical and assumed future size of new residential solar systems



Source: CSIRO[22]

AEMO should at least use the more recent 2023 GEM forecasts for the final ISP modelling to get to a more accurate and up-to-date rooftop PV forecast, rather than using out-of-date GEM and CSIRO 2022 forecasts.

Lower solar PV capital costs than what is currently expected could also mean the ISP's distributed solar PV forecasts are underestimated. ARENA has flagged that "ARENA has a 30-30-

[20] Green Energy Markets. Projections for distributed energy resources – solar PV and stationary energy battery systems. December 2023. Page 18.
[21] CSIRO. Small-scale solar PV and battery projections 2022. December 2022.
[22] CSIRO. Small-scale solar PV and battery projections 2022. December 2022. Page 33.

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30 vision for ultra low-cost solar in Australia. This represents 30 per cent solar module efficiency and an *installed cost* of 30 cents per watt by 2030."[23]

ARENA estimates we are currently at 22-23 per cent solar module efficiency and $1.2 per watt for utility scale solar.[24,25] ARENA's goal of moving from around $1.2 per watt to 30 cents per watt means a cost reduction of around 75%. If these goals are achieved in the utility-scale solar market, it would have a significant flow-on effect on the distributed solar market.

ARENA says, "To achieve [the vision of 30 cents per watt], we are targeting an LCOE of <$20/MWh with a primary focus on utility-scale solar."[26] Professor Martin Green, UNSW solar pioneer, has estimated that solar PV could even reach an LCOE of $15/MWh by 2030 – similar to ARENA's aim.[27]

GEM estimates that current residential and commercial solar PV costs are approximately $1.5 per watt.[28] The GEM and CSIRO forecasts (used to form the draft ISP) find solar PV capital costs in 2030 to be around $1 per watt in 2030.

- **GEM 2022 projections, *Step Change*:** around $1 per watt in 2030 for residential PV systems and 90 cents per watt for commercial in 2030.[29]
- **CSIRO's 2022 projections, *Step Change*:** around $1 per watt for residential and small-scale installations in 2030.[30,31]

The GEM and CSIRO forecasts are therefore estimating roughly a 30% capital cost reduction from now until 2030 for residential solar PV. However, if the residential solar PV market followed the same 75% cost reduction trajectory as ARENA and Martin Green's estimates for the utility-scale market, residential solar PV systems would cost significantly less. While distributed solar might not follow the same trajectory as utility-scale solar, and such strong capital cost reductions could be considered ambitious, it is an indicator of what could be possible and the breadth of scenarios that we should be planning for in the NEM.

It would be worthwhile for AEMO to explore a higher rooftop solar uptake level in the ISP to reflect a situation in which stronger rooftop PV cost reductions and higher system size growth comes to pass. The scenarios in the ISP should reflect a broad range of possible outcomes in the NEM.

AEMO should explore higher rooftop PV forecast scenarios to reflect the rapidly changing market. At the very least, AEMO should use the latest GEM projections (completed for AEMO in December 2023) in the final ISP, to help reflect the likelihood of higher solar PV system size than previously assumed.

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[23] ARENA. The Incredible ULCS. July 2023.
[24] ARENA. The Incredible ULCS. July 2023.
[25] ARENA. Watch this space: Ultra Low Cost Solar. 27 October 2022. Note: ARENA CEO Darren Miller states: "Large scale solar today costs around $1.2 million per Megawatt, or $1.20 per Watt, to install in the field. Breaking it down, at this installed capital cost of $1.20 per Watt, the effective cost of solar energy (or levelised cost) works out at around $50-60/MWh."
[26] ARENA. Strategic priorities: optimise the transition to renewable electricity. 12 September 2023.
[27] AFR. You could get ultra-cheap solar far sooner than you think. 1 December 2021.
[28] Green Energy Markets. Final Projections for distributed energy resources – solar PV and stationary energy battery systems. December 2022. Note this *excludes* discounts from-government support measures e.g. STCs and *includes* GST.
[29] Green Energy Markets. Final Projections for distributed energy resources – solar PV and stationary energy battery systems. December 2022.
[30] CSIRO. Small-scale solar PV and battery projections 2022. December 2022.
[31] Note that all figures have been determined by reading from the chart so are not fully accurate.

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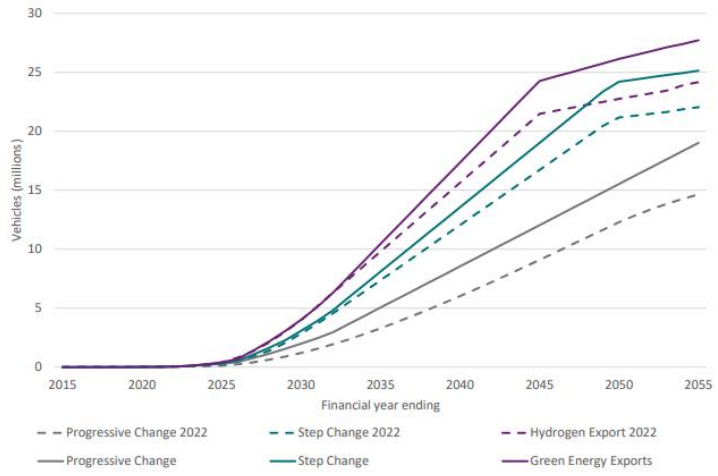
Make DOE assumptions transparent

IEEFA understands both GEM and CSIRO make assumptions about the uptake of dynamic operating envelopes and the extent to which they will constrain and free up rooftop solar but these assumptions are not stated. IEEFA recommends these assumptions are made transparent so they can be tested, especially with distribution networks.

Update the EV forecasts and reconsider EV V2G forecasts

AEMO's EV forecasts also appear conservative as the current draft 2024 ISP is using CSIRO's old EV projections rather than the more up-to-date ones. CSIRO's 2022 projections show around 22 million EVs in the NEM by 2050, whereas CSIRO's 2023 projections show around 24 million EVs by 2050 in the *Step Change* scenario (see Figure 8 and Figure 9 below). The new CSIRO projections show a slight increase in EV numbers so should be incorporated into the ISP for accuracy. There are also other updates in the new CSIRO projections that should be incorporated into AEMO's model.

Figure 8: Projected number of EVs in the NEM – 2023 projections



Source: CSIRO[32]

[32] CSIRO. Electric vehicle projections 2023: update to the 2022 projections report. December 2023. Page 30.

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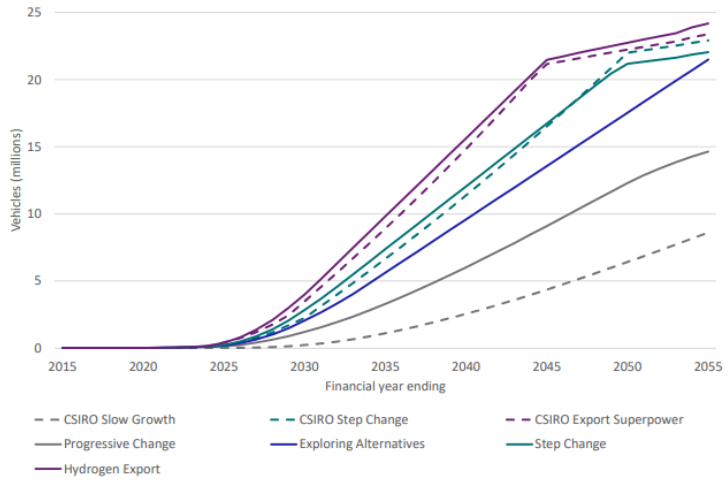
Figure 9: Projected number of EVs in the NEM – 2022 projections compared with 2021 scenarios



Source: CSIRO[33]

IEEFA has also identified that AEMO's V2G forecasts assume quite a slow start to EV uptake. While sales of EVs are currently slow, these can be expected to accelerate due to international trends, government support and the growing availability of lower cost EVs. In addition, there are range of EVs coming with bidirectional charging (V2X encompasses Vehicle to Load (V2L), Vehicle to Home (V2H) and Vehicle to Grid (V2G)).[34]

The second issue is that AEMO's V2G capacity appears underestimated. AEMO's V2G forecasts show 10,634MW and 52,540MWh vehicle to grid capacity which can be called on by a retailer or aggregator to supply back to the grid. This data is used within the Plexos model and is based on the 2022 CSIRO trajectories developed for AEMO.[35] However, enX has modelled the EV fleet capacity to 2050 and found 2340GWh of available EV storage capacity by 2050. The 52GWh of AEMO EV V2G capacity represents only 2% of the available EV storage capacity than enX has forecast. This indicates a potential underestimation of EV V2G capacity. While not all vehicles will be used for vehicle-to-grid, it would seem likely that a greater proportion of the storage available in vehicles would be used by the electricity system to make the most of this valuable asset. CSIRO appears to be cautious and conservative through its projections, but in doing so, is risking the over-build of large-scale generation and storage and reduced focus on EVs, which could increase the cost of the transition.

[33] CSIRO. Electric vehicle projections 2022. November 2022. Page 53.
[34] enX. V2X.au Summary Report – Opportunities and Challenges for Bidirectional Charging in Australia. June 2023.
[35] AEMO. 2023 IASR Assumptions Workbook version 5.2. 5 September 2023.

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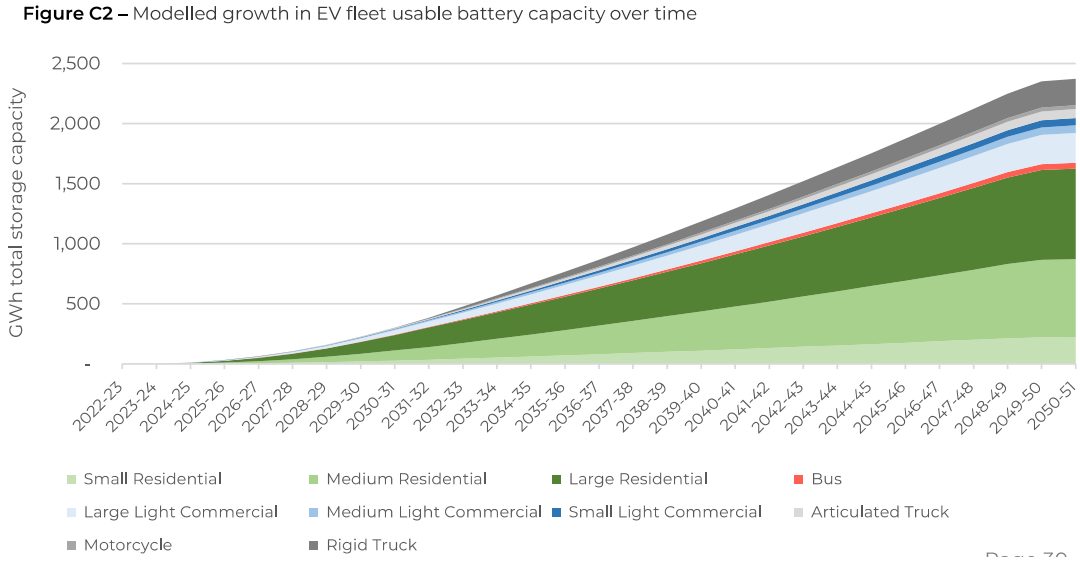
Figure 10: Projected EV fleet battery capacity to 2050



Source: enX[36]

Model and report on the demand side in more detail

The ISP is heavily focused on supply-side and transmission planning. In IEEFA's view the ISP should be a full whole-of-system plan, determining how various components of the system work together and optimise costs. It should identify the lowest-cost solution for the NEM, making the right tradeoffs between storage, transmission, generation and demand-side actions – large, medium and small in scale. As many demand-side considerations are treated as an input to the ISP process, the ISP does not fully optimise for the whole of the system.

Ideally, the ISP would co-optimise between the demand side and supply side, and small-scale resources and large-scale resources. If it is not possible to do this for the 2024 ISP, then iterations in modelling could be performed to optimise between supply and demand, and various scenarios or sensitivity analyses could be undertaken. IEEFA recommends that more attention be placed on the demand side in the 2024 ISP modelling and reporting.

Upon reading the ISP it is unclear how various flexible demand-side opportunities have been incorporated into AEMO's forecast and the size of various demand-side opportunities. AEMO's ISP report does not explicitly explore the following flexible demand opportunities:

- Household and business electrification resulting in flexible demand e.g. hot water systems, industrial heat pumps.
- Household and business flexible demand through new and replacement electric appliances e.g. air conditioning.
- Household and business flexible demand participating in retail programs (e.g. Origin Spike).
- Changes to hot water load control by distribution network service providers (DNSPs).

[36] enX. V2X.au Summary Report – Opportunities and Challenges for Bidirectional Charging in Australia. June 2023.

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The lack of focus on and transparency around flexible demand, including through electrification, makes energy planning and policymaking more challenging.

To rectify this, IEEFA recommends that AEMO models and reports on the potential contribution of these (and other) various forms of flexible demand, and that it works on co-optimising between demand and supply in the ISP process.

Develop a high DER scenario or sensitivity in the ISP

IEEFA recommends that AEMO include a higher DER scenario or at the very least, a high DER sensitivity in the ISP, an upside equivalent to the hydrogen export scenario for the large scale. While each scenario in the ISP does include different levels of DER uptake, it is difficult to isolate the impact of DER from the various other inputs across each scenario. There would be value in developing a high DER scenario or sensitivity and comparing that to the other scenarios or sensitivities.

With a greater range information on DER, there is the opportunity to have the public policy discussion about the value (or not) of higher DER uptake and what would be needed for that to be made reality. Recent IEEFA research demonstrated that DER has potential economic benefits of $19 billion out to 2040, drawing on NERA, Energy Synapse and Baringa modelling.[37] The ISP could provide a helpful indication of the system cost and benefits from higher DER penetration.

Include integrated planning with DNSPs in the ISP process

In addition, the ISP does not appear to fully reflect the detailed plans and responsibilities of distribution businesses to incorporate more DER into the distribution networks. The appendices and main report of the draft 2024 ISP do not explore distribution networks in detail. IEEFA recommends AEMO work with distribution network companies, industry and consumers to develop a process to incorporate distribution inputs into its planning. Such a process needs to be open and transparent and well documented.

Provide higher data granularity in generation results

IEEFA requests that half-hourly generation results (by technology; by state if possible; and for all future years or for as many time periods as possible) be released in the 2024 ISP process. This would be a great way to increase stakeholder understanding of the NEM's requirements on shorter timeframes and would help stakeholders understand the financial viability of various forms of generation into the future. It would enable stakeholders to do their own analysis using the ISP data, ensuring higher stakeholder alignment regarding the requirements of the future NEM.

[37] IEEFA. DER could provide $19 billion economic boost by 2040. 15 February 2024.

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2. Do you think that the proposed timing and treatment of actionable projects in the Draft 2024 ISP will support a reliable, secure and affordable NEM? If yes, what gives you that confidence? If not, what should be considered further, and why?

The final ISP report should explore the faster renewables and storage capacity build needed in the *Rapid Decarbonisation* sensitivity

The Draft 2024 ISP forecasts that coal power stations will exit two to three times faster than their announced dates, which would be in line with a 1.8°C trajectory.[38]

To keep in line with 1.5°C would require even faster coal exits and replacement capacity build, as shown in the coal capacity forecast for *Green Energy Exports*.

Green Energy Exports also sees a far more rapid increase in renewable energy capacity compared with *Step Change*, and nearly 3.5 times the length of new transmission by 2050 compared with *Step Change*.[39] However, the report notes that much of this capacity is focused on areas useful for exports such as ports. *Green Energy Exports* assumes Australia will directly export 13 million tonnes of hydrogen per year by 2052, despite growing recognition that direct exports of hydrogen do not make financial sense.[40]

It is therefore not possible to use the current *Green Energy Exports* results to understand the minimum level of investment needed to maintain a reliable, secure and affordable NEM under 1.5°C-aligned climate targets in the absence of a large-scale hydrogen export industry. Rather, it would be far more appropriate to discuss the outcomes of the *Rapid Decarbonisation* sensitivity in the final ISP report.

IEEFA recommends that the final ISP report explores the faster renewable and storage capacity build needed in *Rapid Decarbonisation*, or the further demand-side interventions that would help stay on a least-cost 1.5°C-aligned pathway.

IEEFA also recommends a 'High CER' sensitivity or scenario is run to explore how CER could help reduce demand and fill energy supply gaps in the case that large-scale renewables and storage build and transmission experience further delays.

AEMO should provide more clarity around the drivers of coal exits

AEMO wrote in the addendum to the 2022 ISP: "AEMO applied two alternative approaches to forecast coal retirements, as explained in this section and in the ISP Methodology. These approaches considered the profitability of generators and/or the impact of emissions reduction objectives in identifying closure timings. As outlined in this section, the revenue adequacy modelling was not a significant driver for generator closure timings."[41]

IEEFA requests further information be published on the impact of revenue adequacy modelling on generator timings in the final ISP. This is important to inform discussions around coal exits, including the Orderly Exit Management Framework proposal. It should be clear what the driver

[38] AEMO. Draft 2024 Integrated System Plan. December 2023.
[39] AEMO. Draft 2024 Integrated System Plan. December 2023. Page 55.
[40] IEEFA. Submission to the Review of the National Hydrogen Strategy. 23 August 2023. Page 4.
[41] AEMO. Addendum to the draft 2022 ISP. Page 6.

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for coal exits are – emissions budgets, revenue adequacy modelling, or both – and data should be published on each.

3. Does the Draft 2024 ISP accurately reflect consumers' risk preferences? If yes, how so? If not, how else could consumers' risk preferences be included and what risks do you think are important to consider?

DER investments could be higher than AEMO's current forecast – as explored in the previous sections – and it would be valuable to explore a scenario with higher DER uptake. Consumer risk preferences could be explored through various scenarios and sensitivities and through more detailed modelling and reporting on demand-side opportunities.

4. Do you have advice about how social licence can be further considered in the ISP, or advice on how to quantify the potential impact of social licence through social licence sensitivity analysis?

Social licence analysis should be balanced

AEMO has indicated that the 2024 final ISP will include a more robust consideration of social licence issues that impact the timing and feasibility of new large-scale renewables and transmission projects, which is important. However, such analysis must also consider the social licence issues that impact alternative technologies.

For example, non-renewable projects that have faced significant social licence setbacks in recent years include:

- New upstream gas developments.
- Gas infrastructure developments.
- Coal mine expansions.
- Coal power plant life extensions.

Another way to consider social licence issues is to give greater attention to Distributed Energy Resources (DER) which don't share the same social licence issues as large-scale generation and transmission.

5. Do you have any feedback on the Addendum to the 2023 Inputs Assumptions and Scenarios Report?

Coal price assumptions appear to be materially lower than actual prices, so should be revised

IEEFA notes that there are material differences between coal prices assumed in the current inputs and assumptions workbook, and actual prices reported publicly by generators.

For example, in its 2023 annual report, AGL reported an average fuel cost of $22.80 per megawatt-hour (MWh) across their generation fleet.[42]

[42] AGL. AGL Energy Limited 2023 Annual Report. 10 August 2023. Page 18.

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A cross-comparison with AEMO fuel cost assumptions for Bayswater, Loy Yang A and Liddell reveals a weighted average fuel cost of $15.02/MWh, 34% lower than AGL's figure. This indicates a potential difference between assumed and actual coal prices and/or heat rates.

Table 1: Comparison of AEMO coal generator assumptions with actual data from AGL

	AEMO assumptions					AGL 2023 annual report	
	Coal price ($/GJ)		Heat rate (GJ/MWh HHV)		Fuel cost ($/MWh)	FY23 Generation (MWh)	Fuel cost ($/MWh)
Bayswater	$2.54	x	9.4	=	$23.97	12,916	
Loy Yang A	$0.76	x	12.16	=	$9.24	12,418	
*Liddell**	*$1.95*	x	*10.14*	=	*$17.92*	5,020	
Weighted average					**$15.02**		**$22.80**

**Liddell is included to accurately compare with AGL's FY23 data. Liddell assumptions are taken from the 2022 ISP inputs and assumptions and adjusted for inflation. All other AEMO assumptions are from the 2024 inputs and assumptions workbook. All costs are in 2023 AUD.*

Although IEEFA acknowledges that emissions constraints may be a more significant driver of coal plant retirements in the ISP compared with profitability, the scale of these cost differences may be material to other outcomes including the total system cost between scenarios.

IEEFA recommends that AEMO review coal generation fuel cost inputs and revise them if this review reveals inconsistencies with actual company data.