

# ACF Submission to the AEMO Draft 2024 ISP

## Summary of Recommendations

**Recommendation 1:** AEMO to emphasise the Optimal Development Path for Green Energy Exports Scenario, and develop other 1.5 aligned scenarios in future ISPs.

**Recommendation 2:** AEMO should communicate that “most likely” makes it clear this is only an indication of where we are heading, that only achieving the Step Change is inadequate and ambition should be increased, and that Australia needs to plan for the Green Energy Exports 1.5 degree-aligned scenario.

**Recommendation 3:** For future ISPs, AEMO should consider broader and more relevant information to match stakeholder needs:

- Contingencies and plans to reduce risks around social licence, supply chains and workforce planning.
- Prioritising 1.5 aligned scenarios.
- To model or report on opportunities around distribution network level optimisation.

**Recommendation 4:** In the review of the ISP, AEMO should consider expanding the focus of the ISP to include analysis, internally or externally, on how best (and at lowest cost) to optimise distribution level options to reduce the need for new generation capacity and transmission.

**Recommendation 5:** AEMO work with the federal government to prioritise the National Energy Performance Strategy (NEPS) and use it to inform the current and future ISPs and identify improvements for Federal, State and Territorial energy performance programs.

**Recommendation 6:** AEMO provide simple comparisons of the ODP for each scenario in a table in the main report.

**Recommendation 7:** AEMO to emphasise the Green Energy Exports Optimal Development Path in Part B of the ISP.

**Recommendation 8:** AEMO work with the Federal, State and Territorial Governments and other stakeholders to ensure barriers to implementation due to identified risks are identified and planned for.

**Recommendation 9:** AEMO work with Federal, State and Territorial Governments and other stakeholders to emphasise the net market benefits in accessible language to the broader Australian community.

**Recommendation 10:** AEMO to communicate more strongly that the Delphi panel only indicates the most likely scenario, emphasise the need for improvements to overcome risks to achieving the Step Change, and that Australia needs to achieve a 1.5 degree aligned pathway, such as the current Green Exports Scenario.

**Recommendation 11:** AEMO collaborate with all stakeholders to improve community acceptance and understanding for the need for the transition.

**Recommendation 12:** AEMO collaborate with all stakeholders to improve literacy and social licence for orchestration of CER.

**Recommendation 13:** AEMO to ensure scenarios include early planned closure timelines.

**Recommendation 14:** AEMO include greater clarity on how energy resilience at the system, household and business levels will be developed in future ISPs.

**Recommendation 15:** AEMO complete at least one additional 1.5 degree aligned scenario in future ISPs.

**Recommendation 16:** AEMO to collaborate with jurisdictional and local governments and stakeholders to take learnings from existing local processes strategies for planning coal retirement across the NEM.

**Recommendation 17:** AEMO to include analysis of the contribution that the electrification of households and industry, including demand response and storage, has to reduce the need for flexible gas.

**Recommendation 18:** AEMO to include analysis of how much of a contribution CER can make to reducing the need for mid- and large-scale generation and transmission.

**Recommendation 19:** AEMO to collaborate with Jurisdictional governments and stakeholders to include orchestration in literacy and engagement programs program.

**Recommendation 20:** AEMO to include stronger analysis of energy performance opportunities to reduce the size of the build, the need for transmission and therefore the environmental, social and economic costs of the transition.

## Introduction

The Australian Conservation Foundation (ACF) welcomes the opportunity to comment on AEMO's Draft 2024 Integrated System Plan (ISP). ACF congratulates AEMO in bringing together the Draft 2024 ISP, a key roadmap to help inform and prioritise necessary investment and ensure a smooth transition to a clean energy system in Australia. ACF is supportive of AEMO's efforts related to the ISP including forecasting and planning and consulting widely on inputs and assumptions, and congratulates AEMO on its wide and open engagement.

After a decade of inaction, ACF is aware the energy sector is faced with a significant task to build the system to be run on 100% renewable energy (not to mention renewable energy exports) and achieve our climate ambitions, and to ensure that the Australian energy system is fit for purpose.

ACF believes Australia and the world face an unprecedented climate and mass extinction crisis caused first and foremost by digging up and burning fossil fuels like coal, oil, and gas. ACF is Australia's national environment organisation.

We are over 500,000 people who speak out for the air we breathe, the water we drink, and the places and wildlife we love. We are proudly independent, non-partisan and funded by donations from our community.

We are delighted to see that the AEMO predicts that we will be out of coal by 2038, but notes more work needs to be done to bring this date forward to ensure we stay below 1.5 degrees of warming.

Transitioning Australia's electricity sector to a clean, renewable energy-based system is a critical element of Australia's transition to net zero emissions and economy-wide action on climate change. The Australia's emissions projections 2023 report<sup>1</sup> found that currently Australia will not achieve its target of a 43% reduction in emissions by the year 2030 (based on 2005 levels), but that it will be

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<sup>1</sup> <https://www.dcceew.gov.au/climate-change/publications/australias-emissions-projections-2023>

closer 36% (but excludes the 82% clean energy target). Including these gets us to a 42% reduction by 2030. Other policies that directly impact the electricity system being consulted on but not confirmed, such as some measures under the National Electric Vehicle Strategy (principally a fuel efficiency standard for light Vehicles) and the expansion of the Capacity Investment Scheme to support 32 GW of capacity and renewable generation will be central to delivering the 82% target, are yet to be included in the annual projections. These must however be robust and effective to ensure we remain below 1.5 degrees of warming, including no new coal and gas.

Australia needs a national approach to reduce climate emissions in line with the science-based temperature goals that Australia committed to under the Paris Agreement. This includes strong emission reduction and renewable energy targets and strong plans to get there. This means the scenarios we need to evaluate against need to align with remaining below 1.5 degrees of warming and to assess and plan for any risks of not achieving the renewable energy and transmission needed. Of the three scenarios in the ISP, only Green Energy Exports is aligned to this goal. The ISP needs to assess more 1.5 degree aligned scenarios to be relevant to the task needed.

ACF is delighted to see carbon capture and storage (CCS) is given little thrift, maintaining our view that CCS in the power sector is completely implausible and should be excluded from all scenarios. This technology is obsolete worldwide, due to its problem-plagued technology, high costs, high risks, and associated emissions.

Achieving our climate targets can only be achieved through actual reductions, and needs to ensure social equity and affordability for all consumers.

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High Level Context

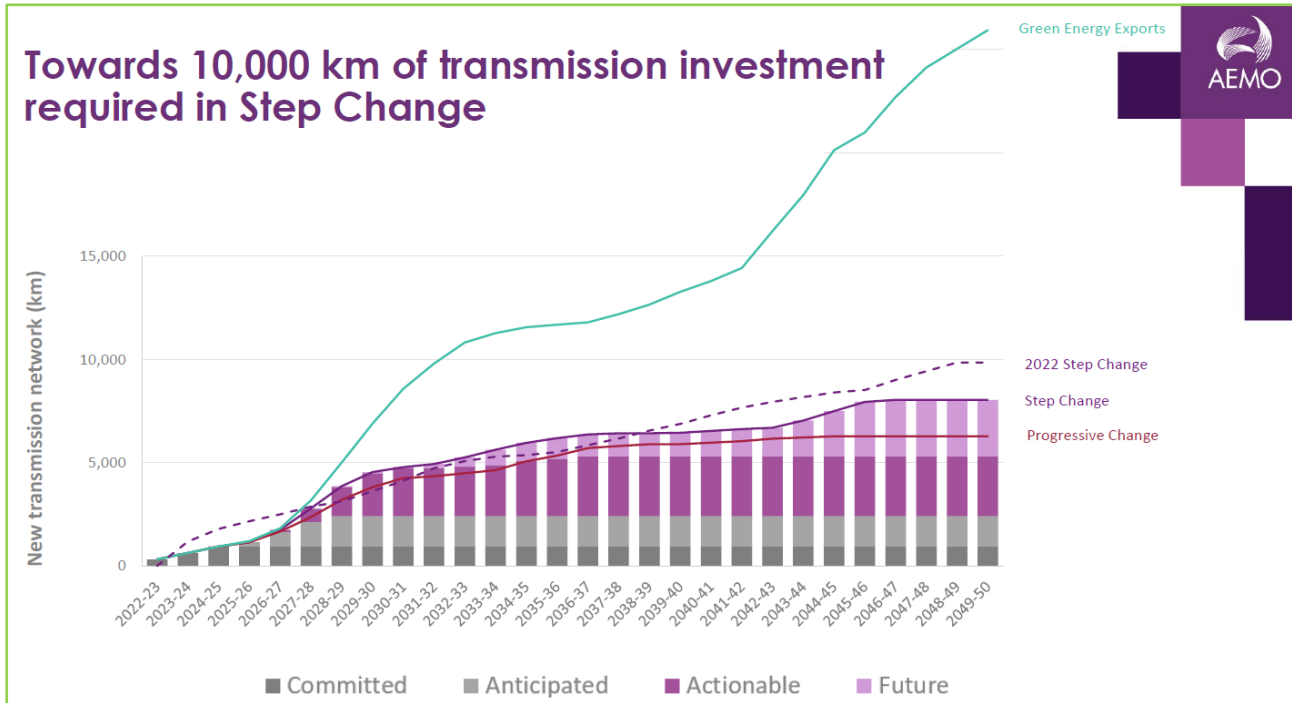


Figure 1: Transmission needs for each scenario.



Figure 2: Wholesale price impact of unreliable coal remaining on the system.

Page	Issue/Question	Comments and Considerations	Recommendation or options
	The ISP lacks the ambition we need to stay below 1.5 degrees of warming.	<ul style="list-style-type: none"> <li>• The ISP in its current form lacks ambition.</li> <li>• The Step Change scenario is considered ‘most likely’ and is the only scenario where the Optimal Development Path is reported in the main ISP report (Part B),</li> <li>• Progressive change is 42% likely and Green Energy Exports at just 15% likely.</li> <li>• “Most Likely” is only an indicator of where we are currently heading.</li> <li>• Step Change, however, only aligns to keeping warming below 2°C and is only compatible with 1.5°C outcomes if actions taken across other sectors.</li> <li>• We are nonetheless already seeing risks playing out in terms of delayed projects and expensive supply chains, including around 30% increases for transmission projects, social licence, and workforce (as acknowledged by the ISP).</li> </ul>	<p>AEMO should emphasise the Optimal Development Path for Green Energy Exports Scenario, and develop other 1.5 aligned scenarios in future ISPs.</p> <p>AEMO should communicate that “most likely” makes it clear this is only an indication of where we are heading, that only achieving the Step Change</p>

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		<ul style="list-style-type: none"> <li>As such, planning for the Step Change will not allow Australia to make a fair contribution to a safe climate, a strong economy and ameliorating the risks to achieving the rate and magnitude transition needed.</li> <li>Australia needs to plan for the Green Energy Exports scenario (or other 1.5 aligned scenario).</li> <li>We need to plan for the 1.5 degree-aligned scenario and ensure all jurisdictions have policies to support that outcome, including powering our exports.</li> <li>AEMO has a role to play in communicating effectively around where we need to go, not just what is likely under current policy settings.</li> </ul>	is inadequate and ambition should be increased, and that Australia needs to plan for the Green Energy Exports 1.5 degree-aligned scenario.
18	Significant Increase renewable energy capacity in the Step Change Scenario, but is less than other scenarios	<ul style="list-style-type: none"> <li>ISP suggests more than 6 GW of new capacity is needed each year until 2030 (currently around 4 GW), but still much less than other scenarios, like Net-Zero Australia, or suggestions from stakeholder like Tim Buckley who suggests wind of 3GW annually and solar alone should be 5-15GW.<sup>2</sup></li> </ul>	
		<ul style="list-style-type: none"> <li>AEMO has removed weaker scenario in previous ISP's as irrelevant.</li> </ul>	
<b>Purpose</b>			
	Being a 20-year plan.	<ul style="list-style-type: none"> <li>ISP is a 20-year draft roadmap to manage the decarbonisation of the main grid. <ul style="list-style-type: none"> <li>The ISP however does not work in isolation – planning for CER, consumer access, social licence, community benefit sharing all need to come in behind it.</li> <li>The ISP only refers to the NEM (so not NT and WA).</li> </ul> </li> <li>ISP aims to provide detailed information for policymakers, makers, investors, investors, consumers, and consumers, communities, researchers, and other stakeholders</li> </ul>	
	Future role of the ISP	<ul style="list-style-type: none"> <li>The ISP serves the regulatory purpose of justifying actionable and future new transmission.</li> </ul>	For future ISPs, AEMO should consider broader and more

<sup>2</sup> <https://www.linkedin.com/feed/update/urn:li:activity:7163038003253178369/>

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		<ul style="list-style-type: none"> <li>● However, as we are increasingly clear on what the transmission needs are, including state based plans and the divergence in projects from the ISP, there may be less value of the ISP in its current form, as <ul style="list-style-type: none"> <li>○ the ISP limits itself to identifying projects;</li> <li>○ decisions are being made by states, e.g., QNI, QEJP; and</li> <li>○ the value to investors risks being outplayed by state plans and policies.</li> </ul> </li> <li>● ISP needs to provide broader and more relevant information to match stakeholder needs.</li> </ul>	<p>relevant information to match stakeholder needs:</p> <ul style="list-style-type: none"> <li>● Contingencies and plans to reduce risks around social licence, supply chains and workforce planning.</li> <li>● Prioritising 1.5 aligned scenarios.</li> <li>● To model or report on opportunities around distribution network level optimisation.</li> </ul>
	<p>Analysis and planning needed beyond transmission.</p>	<ul style="list-style-type: none"> <li>● The ISP is currently focused on the transmission and generation capacity needed under the three scenarios to achieve Australia’s climate and renewable energy targets, taking distribution network level solutions only as inputs.</li> <li>● It is therefore technically not a whole of system plan.</li> <li>● The ISP states: <i>“With coal retiring, renewable energy connected with transmission, firmed with storage and backed up by gas-powered generation is the lowest cost way to supply electricity to homes and businesses throughout Australia’s transition to a net zero economy.”</i></li> <li>● To identify further cost reductions and what is the cheapest option, however, the ISP needs to move beyond being a transmission plan, analysing options to optimise distribution level outcomes to reduce the need for transmission and new mid- to large-scale generation.</li> <li>● This should include modelling and policy options for distribution level generation and CER, energy efficiency and demand response, rather than including them only as inputs/factors to be analysed.</li> <li>● We note AEMO may be restricted by the energy rules, but the analysis needs doing before the above statement on <i>“the lowest cost way to supply electricity to homes and businesses throughout Australia’s transition to a net zero economy “</i> can be made with confidence.</li> </ul>	<p>In the review of the ISP, AEMO should consider expanding the focus of the ISP to include analyse, internally or externally, on how best (and at lowest cost) to optimise distribution level options to reduce the need for new generation capacity and transmission.</p>

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		<ul style="list-style-type: none"> <li>● We also acknowledge this may be too late for the 2024 ISP, but should be considered in the review of the ISP.</li> </ul>	
P37	ISP considers affordability as part of its purpose	<ul style="list-style-type: none"> <li>● “to serve ‘the long-term interests of electricity consumers’, taking into account the ‘price, quality, safety, reliability and security’ of supply”. <ul style="list-style-type: none"> <li>○ Section 3.2 – states the ISP considers “price and quality (affordability)”.</li> <li>○ This differs slightly and is an improvement on the NEO, in that the NEO talks about price but not cost (affordability) to consumers.</li> </ul> </li> <li>● Measured as the ‘net market benefits’ that a development path may bring.</li> <li>● Affordability is an increasing issue for most Australians, especially the most at risk, such as renters, low-income households, and many small businesses.</li> <li>● Consumers need to be empowered to take action in the transition, such as through CER and improved energy performance, to realise the affordability outcomes.</li> <li>● Much of this is discussed as part of the National Energy Performance Strategy (NEPS) consultation, but stakeholders are still waiting for outcomes of that process, that could inform stronger pathways to increased affordability as part of the ISP.</li> </ul>	AEMO work with the federal government to prioritise the National Energy Performance Strategy (NEPS) and use it to inform the current and future ISPs and identify improvements for Federal, State and Territorial energy performance programs.
<b>Optimal Development Path (ODP)</b>			
	Optimal Development Path (ODP) for reaching net zero by 2050	<ul style="list-style-type: none"> <li>● The ODP aims to find lowest cost to get where we need to get to.</li> <li>● AEMO stated (at its stakeholder webinars) that: <ul style="list-style-type: none"> <li>● <i>“Renewable energy connected with transmission, firmed with storage and backed up by gas-powered generation is the lowest cost way to supply is the lowest cost way to supply electricity to homes and businesses throughout Australia’s transition to a net-zero economy”.</i></li> </ul> </li> <li>● ODP relies on policy and market settings that promote competition and innovation, to deliver the efficient, reliable, lower emission electricity services contemplated by the National Electricity Objective.</li> </ul>	
7 (Appendix 2)	Comparisons ODP for each scenario	<ul style="list-style-type: none"> <li>● An ODP is made for each scenario, but presented in a disaggregated manner.</li> <li>● It is difficult to compare the differences of the ODP for each scenario in the main ISP report.</li> </ul>	AEMO provide simple comparisons of the ODP for each scenario in a table in the main report.



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	Green Energy Exports	<ul style="list-style-type: none"> <li>● Part B of the ISP refers to the ODP of the Step Change Scenario.</li> <li>● As the only 1.5 degree aligned scenario and significant renewable energy exports, the Green Energy Exports ODP needs to be emphasised if Australia is to achieve its commitments to the Paris Agreement and to achieve Science Based Targets.</li> <li>● It would make more sense to ACF that energy stakeholders understand the ODP of the Green Energy Exports scenario (or other 1.5 degree aligned scenario).</li> <li>● Having the greater detail of the Green Energy Exports ODP only in an Appendix (A2) devalues the importance of 1.5 degree aligned scenarios.</li> </ul>	AEMO to emphasise the Green Energy Exports Optimal Development Path in Part B of the ISP.
	Project Status	<p>There are three project classifications:</p> <ul style="list-style-type: none"> <li>● <b>committed and anticipated</b> transmission projects already underway</li> <li>● <b>actionable projects</b>, for which work should continue and/or commence urgently, and</li> <li>● <b>future ISP projects</b>, which may include the need for the transmission network service providers (TNSPs) to undertake preparatory activities.</li> <li>● These are intended pathways – i.e. that Future ISP Projects become Actionable become committed and anticipated.</li> </ul>	
<b>Targets</b>			
	ISP needs to support a number of policy objectives and targets	<ul style="list-style-type: none"> <li>● Powering Australia Plan's 82% renewable energy by 2030</li> <li>● 43% emission reduction by 2030</li> <li>● Safeguard Mechanism</li> <li>● initial Capacity Investment Scheme target</li> </ul>	
77	Achieving the Federal target of 82% renewable energy by 2030.	<ul style="list-style-type: none"> <li>● All ISP scenarios aim to represent Australia reaching its 82% renewable energy by 2030 target.</li> <li>● While Australia can reach the Federal target of 82% renewable energy by 2030, there are a number of risks of slowing down, including not achieving social licence, delays in supply chains and workforce shortages.</li> <li>● Sensitivity Analysis in the ISP suggests that these risks mean we only reach 63% renewable energy by 2030 (see risks below)</li> </ul>	AEMO work with the Federal, State and Territorial Governments and other stakeholders to ensure barriers to implementation due to identified risks are identified and planned for.

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	State Targets and objectives	<ul style="list-style-type: none"> <li>Decisions on when, where and how to implement projects are being made by states, with some state-based decisions been different to that in the ISP.</li> <li>Queensland, for example has proposed new renewable energy targets (with the Bill currently going through Queensland Parliament), has projects such as Borumba Pumped Hydro, CopperString 2032, and transmission options from the Queensland Energy &amp; Jobs Plan.</li> <li>We now have a clear idea of what transmission is needed, and it is unlikely to change significantly</li> </ul>	
	•	•	
<b>Demand</b>			
	NEM Demand (Step Change)	<ul style="list-style-type: none"> <li>Future energy consumption from the NEM will rise by approximately 108% by 2050. <ul style="list-style-type: none"> <li>Most of this is from business and industry.</li> </ul> </li> <li>Households will meet most of their own needs.</li> <li>Electricity consumption across the NEM (operational consumption) is forecast to continue rising from 180 TWh to over 420 TWh in 2049-50</li> </ul>	
	Household Consumption (Step Change)	<ul style="list-style-type: none"> <li>household electricity consumption will increase nearly four-fold to 150 terawatt hours a year by 2050 (underlying consumption).</li> <li>consumption from the grid however, will remain at around 40 TWh a year, little changed from today (operational consumption).</li> <li>uptake of energy efficient buildings, appliances and behaviour will offset this increase, resulting in underlying consumption of 110 TWh.</li> </ul>	
	Business and industry (Step Change)	<ul style="list-style-type: none"> <li>Business and industry total consumption is forecast to more than double from today's 145 TWh to almost 345 TWh in 2050</li> </ul>	
<b>Coal Closure</b>			
	Coal closure is forecast to happen faster than previous versions	<ul style="list-style-type: none"> <li>Coal mostly gone from the grid by 2038 in Step Change scenario.</li> <li>Draft ISP notes "<i>Coal retirements may occur even faster than these forecasts. Ownership has become less attractive, with higher operating costs, reduced fuel security, high maintenance costs and greater competition from renewable energy in the wholesale market.</i>"</li> </ul>	
<b>Transmission</b>			

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	Slightly less than 10,000 km required	<ul style="list-style-type: none"> <li>● Figure 1 shows the km of transmission needed.</li> <li>● Slightly less than 10,000 km required for Step Change and Progressive Change, which slightly less than the 2022 ISP.</li> <li>● Early years (2022-2028) are lower than 2022 ISP as projects have been completed and removed from ISP.</li> <li>● Some Queensland projects have 500kV – so higher capacity of projects with less km transmission</li> </ul>	
	Green Energy Exports	<ul style="list-style-type: none"> <li>● Over twice as much transmission would be needed.</li> <li>● Therefore, a stronger need for the ISP to identify energy performance opportunities.</li> <li>● Reaffirms that emphasis needs to be given to the Green Energy Exports scenario, and the need for other 1.5 degree aligned scenarios.</li> <li>● A much larger investment would be needed.</li> </ul>	
19	Net market Benefits	<ul style="list-style-type: none"> <li>● Net Market benefits have reduced by 30% since the last ISP because of a range of factors including increased transmission, generator and storage costs, lower gas costs.</li> <li>● They are nonetheless at \$17B (i.e. what consumers would otherwise be paying for without the extra transmission).</li> <li>● Just benefits are not that clear for the broader community, which would assist in the social licence and broader understanding of the need for the transition.</li> </ul>	AEMO work with Federal, State and Territorial Governments and other stakeholders to emphasise the net market benefits in accessible language to the broader Australian community.
<b>Delphi Panel</b>			
	Delphi Panel membership	<ul style="list-style-type: none"> <li>● Delphi Panel Process <ul style="list-style-type: none"> <li>● Expert stakeholders who collect and test (through informed, anonymous debate), their view of the relative likelihood of each scenario.</li> <li>● more than 30 participants, including industry experts, government representatives, network service provider representatives, generators and retailers, researchers, academics, and consumer advocates</li> </ul> </li> </ul>	
		<ul style="list-style-type: none"> <li>● The Delphi Panel has confirmed Step Change Step Change as the 'most likely' (43% Likely), and Progressive Change not far behind (42%).</li> <li>● What is “most likely” is less relevant than clearly identifying an appropriate 1.5 degree aligned scenario, and planning to achieve that outcome.</li> </ul>	AEMO to communicate more strongly that the Delphi panel only indicates the most likely scenario, emphasise the need for improvements to overcome

Page	Issue/Question	Comments and Considerations	Recommendation or options
		<ul style="list-style-type: none"> <li>• The Delphi Panel tells us where we are likely heading, not where we need to head.</li> <li>• We need to get to Green Energy Exports or an alternative 1.5 degree aligned scenario.</li> <li>• The higher likelihood of only achieving the Step Change or Progressive Change scenarios (noting the risks to achieving them as described elsewhere in the ISP, e.g. poor social licence and supply chains) indicate Australia is failing in achieving the transition we need to return to a safe climate and support communities in both understanding the need for the transition and the benefits for communities and nature.</li> </ul>	risks to achieving the Step Change, and that Australia needs to achieve a 1.5 degree aligned pathway, such as the current Green Exports Scenario.
<b>Risks</b>			
74	There are significant risks to the transition.	<ul style="list-style-type: none"> <li>• There are significant risk facing the success of the transition required, including investment uncertainty, supply chains, worker shortages and social licence.</li> </ul>	
74, 76	Social licence	<ul style="list-style-type: none"> <li>• The success of the transition relies on consumers and communities being engaged and empowered as part of the energy transition.</li> <li>• The responsibility for this lies with both jurisdictional governments and project proponents.</li> <li>• The ISP identifies three areas where community acceptance or social licence is needed: <ul style="list-style-type: none"> <li>• local community acceptance of new infrastructure development,</li> <li>• owner acceptance for the 'orchestration' of their consumer energy resources, and</li> <li>• broad social acceptance of the energy transition itself.</li> </ul> </li> <li>• Orchestration also carries risk if it takes away from CER owners' control where visibility by the system operator may be all that's needed.</li> </ul>	<p>AEMO collaborate with all stakeholders to improve community acceptance, understanding for the need for the transition.</p> <p>AEMO collaborate with all stakeholders to improve literacy and social licence for orchestration of CER.</p>
74	Coal Replacement	<ul style="list-style-type: none"> <li>• The possibility of replacement generation not being available when coal plants retire is real and growing.</li> <li>• Unplanned generator outages are increasing (and the sooner firmed renewables are connected, the more secure the transition will be)</li> <li>• Main risks include: <ul style="list-style-type: none"> <li>• uncertainty for infrastructure investment,</li> </ul> </li> </ul>	AEMO to ensure scenarios include early planned closure timelines.

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75		<ul style="list-style-type: none"> <li>● early retirements of coal-fired generation plants <ul style="list-style-type: none"> <li>○ Coal generators are required to give three and a half years' notice of a closure, with industry claiming this leaves the NEM little time to respond, and that such closures can cause price shocks and reliability issues.</li> <li>○ Despite this, the draft ISP notes to reach targets, coal closure must happen sooner.</li> <li>○ In addition, broad coal closure cannot be delayed, especially if it leaves unreliable and highly polluting older plants online.</li> <li>○ We saw the impact of this this week (13/2/2024) with significant number of households and businesses without power and elevated prices after the failure of Loy Yang (Figure 2).</li> <li>○ While the causes of this particular outage are still being investigated at the time of writing, it is likely that it was caused by tripping after extreme weather taking out the transmission towers,<sup>3</sup> and such events can only be expected to increase with increased heat events.</li> </ul> </li> <li>● consumer energy resources are not yet adequately integrated into grid operations. <ul style="list-style-type: none"> <li>○ Consumer-owned assets offer significant system benefits and offset the need for grid-scale investment.</li> <li>○ CER can provide significant net market benefits if shared both by their owners and by energy consumers across the NEM, such as through virtual power plants (VPPs)</li> </ul> </li> <li>● Remaining below 1.5 degrees of warming requires rapid coal closures. There is no room for unnecessarily allowing the coal industry to delay coal closures.</li> </ul>	

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<sup>3</sup> <https://www.theguardian.com/australia-news/2024/feb/13/victorias-electricity-spot-prices-soar-as-states-largest-coal-generator-suffers-outage>

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		<ul style="list-style-type: none"> <li>● AEMO is asking for market reforms that will expedite investment and effectively balance timely investment with assessment rigour across all forms of infrastructure.</li> </ul>	
	Investment uncertainty	<ul style="list-style-type: none"> <li>● Expansion of the Capacity Investment Scheme gives additional support for the development of 32 GW of new capacity nationally, including 23 GW of renewable energy and 9 GW of clean dispatchable capacity</li> </ul>	
	Critical energy assets and workforce	<ul style="list-style-type: none"> <li>● This refers to grid-scale generators and batteries, high voltage transmission lines and cables, synchronous condensers and transformers – and the people needed to instal and operate them.</li> <li>● Australia may not be able to access reliable and cost-effective supply of these assets over the next 15 years.</li> <li>● Countries competing for the same resources.</li> <li>● Actionable ISP projects have already experienced schedule delays.</li> <li>● These factors support the need for greater workforce planning.</li> </ul>	
	Energy Resilience	<ul style="list-style-type: none"> <li>● Resilience – it is unclear how energy resilience is being considered though alternative options. <ul style="list-style-type: none"> <li>○ Planning for shocks such as occurred in Victoria this week, where storms took down transmission towers that may have lead to Loy Yang tripping.</li> <li>○ Such events are expected to increase in occurrence due to climate change.</li> <li>○ At the household and business level, air conditioning load is expected to increase, especially for poorest quality housing.</li> </ul> </li> </ul>	AEMO include greater clarity on how energy resilience at the system, household and business levels will be developed in in future ISPs.

### Scenarios

Page	Issue/Question	Comments and Considerations	Recommendation or options
	3 main scenarios	<ul style="list-style-type: none"> <li>● Step Change – 2 degree aligned, with strong CER uptake (only 1.5 degree aligned if several extra measures are taken in other sectors)</li> <li>● Progressive – 2 degree aligned, more challenging economic conditions and supply chain constraints, reduced investment in utility-scale assets and CER</li> <li>● Green Energy Exports – the only 1.5 degree aligned scenario, with significant electrification and clean energy exports</li> </ul>	

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	Scenario Alignment	<ul style="list-style-type: none"> <li>There is only one 1.5 degree aligned scenario.</li> <li>Industry and stakeholders need to understand what the energy system needs to look like to achieve staying below 1.5 degrees of warming and the ISP needs to model and clarify what this might look like under differing scenarios.</li> </ul>	AEMO complete at least one additional 1.5 degree aligned scenario in future ISPs.
	Electricity Demand (2050)	<ul style="list-style-type: none"> <li>Step Change – 121 TWh</li> <li>Progressive – 82 TWh</li> <li>Green Energy Exports – 142 TWh</li> </ul>	
		<ul style="list-style-type: none"> <li>Slow change scenario has been dropped as it fails to achieve necessary policy objectives.</li> </ul>	
		<ul style="list-style-type: none"> <li>All scenarios meet the Federal Governments emission target of 43% and 82% renewables by 2030.</li> </ul>	
<b>Step Change</b>			
10	Optimal Development Path (ODP)	<ul style="list-style-type: none"> <li>Triples grid-scale variable renewable energy by 2030, and increase it seven-fold by 2050.</li> <li>Consistent with 2022 ISP, but with more ambition regarding consumer uptake (large scale wind and solar about the same)</li> <li>6 GW of new renewable energy per year (4 GW in the 2022 ISP) <ul style="list-style-type: none"> <li>Current installation rate is already almost 4 GW annually</li> </ul> </li> </ul>	
10 11		<ul style="list-style-type: none"> <li>Wind would dominate installations through to 2030.</li> <li>By 2050 grid-scale solar capacity would be 55 GW and wind 70 GW.</li> <li>Almost quadruple the firming capacity from sources alternative to coal, including 50 GW / 654 gigawatt hours (GWh) of dispatchable storage, as well as 16 GW of flexible gas.</li> </ul>	
	CER	<ul style="list-style-type: none"> <li>Consumer energy resources provide a strong contribution to the transition.</li> <li>Supports a four-fold increase in rooftop solar capacity - 72 GW by 2050</li> <li>Will facilitate CER batteries and VPPs to deliver 27 GW of flexible demand response for the NEM.</li> <li>Still a third of households unlikely to access CER, especially low-income and rental households.</li> <li>There are some state-based programs and the Home Energy Upgrades Fund (HEUF), but these programs are inadequate for private rentals in particular without legislative change.</li> </ul>	AEMO work with jurisdictional governments and stakeholders to include supports for at risk households to participate in the transition.

Page	Issue/Question	Comments and Considerations	Recommendation or options
		<ul style="list-style-type: none"> <li>● VPPs can assist in these and we're yet to see the impact of solar gardens and solar banks.</li> </ul>	
	2.0 Degree - aligned	<ul style="list-style-type: none"> <li>● This scenario is only 2.0 degree aligned.</li> <li>● The scenario can only contribute to a 1.5 degree pathway if there is decarbonisation across other sectors.</li> <li>● Other sectors, however, will be relying on energy decarbonisation to decarbonise themselves.</li> <li>● electricity sector should reach zero emissions around 2030.</li> <li>● This is particularly true due to electrification.</li> <li>● This scenario represents a failure of Australian energy policy and climate action.</li> </ul>	
<b>Progressive Change</b>			
	Optimal Development Path (ODP)	<ul style="list-style-type: none"> <li>● Represents more challenging conditions resulting in the transition speed focusing on Australia's current policies and global commitments to decarbonisation.</li> </ul>	
		<ul style="list-style-type: none"> <li>● Still sees net zero, but much more difficult development path</li> </ul>	
		<ul style="list-style-type: none"> <li>● Only 4 GW coal by 2033/34</li> </ul>	
		<ul style="list-style-type: none"> <li>● This scenario represents a failure of Australian energy policy and climate action.</li> </ul>	
<b>Green Energy Exports (previously Hydrogen Superpower)</b>			
	Optimal Development Path (ODP)	<ul style="list-style-type: none"> <li>● approximately 100 GW would need to be in place by the end of the 2030 (40 GW more than that in Step Change)</li> <li>● 360 GW of utility-scale VRE by 2050</li> <li>● strong hydrogen production for export and domestic use</li> <li>● green steel production assumed in the scenario.</li> <li>● 135 GW of electrolyser capacity is needed to meet both export and domestic hydrogen demand.</li> </ul>	

## Technologies



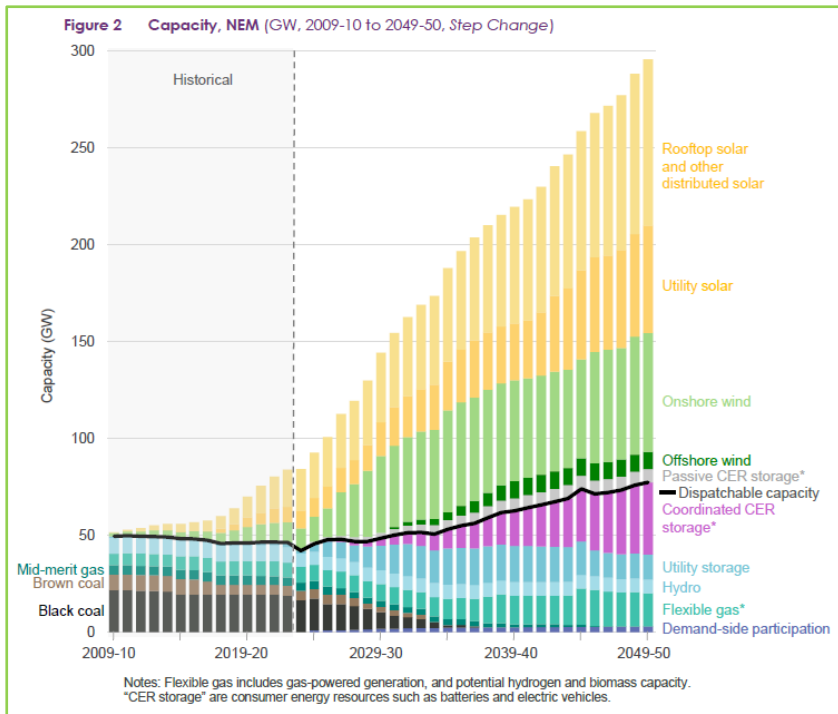


Figure 3: Capacity times lines of various technologies under Step Change scenario (Figure 2 in ISP)

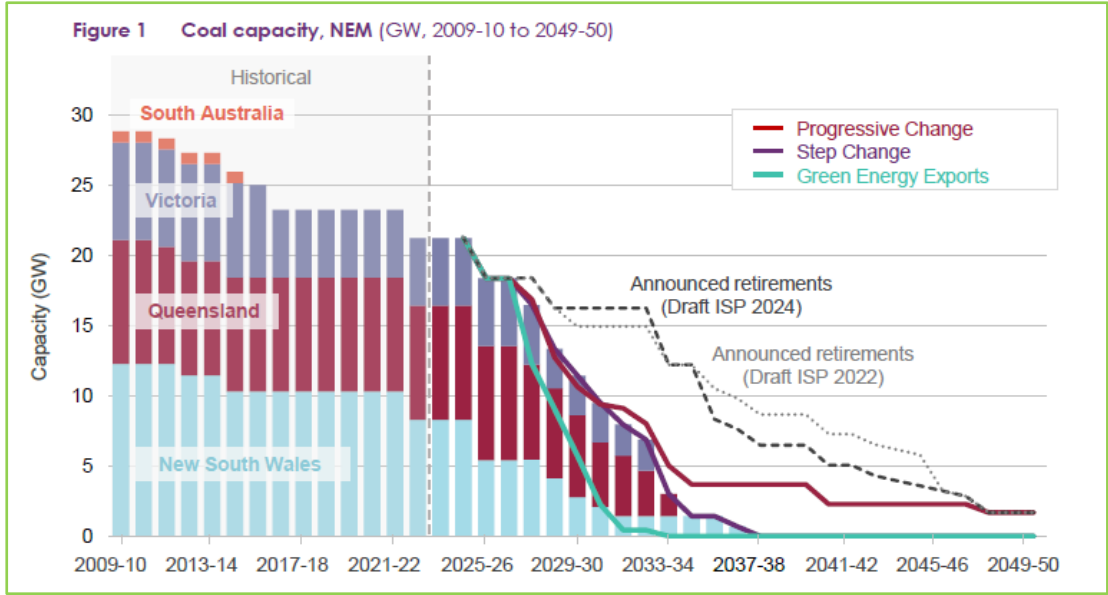


Figure 4: Coal Retirement Pathway (Figure 1 in ISP)

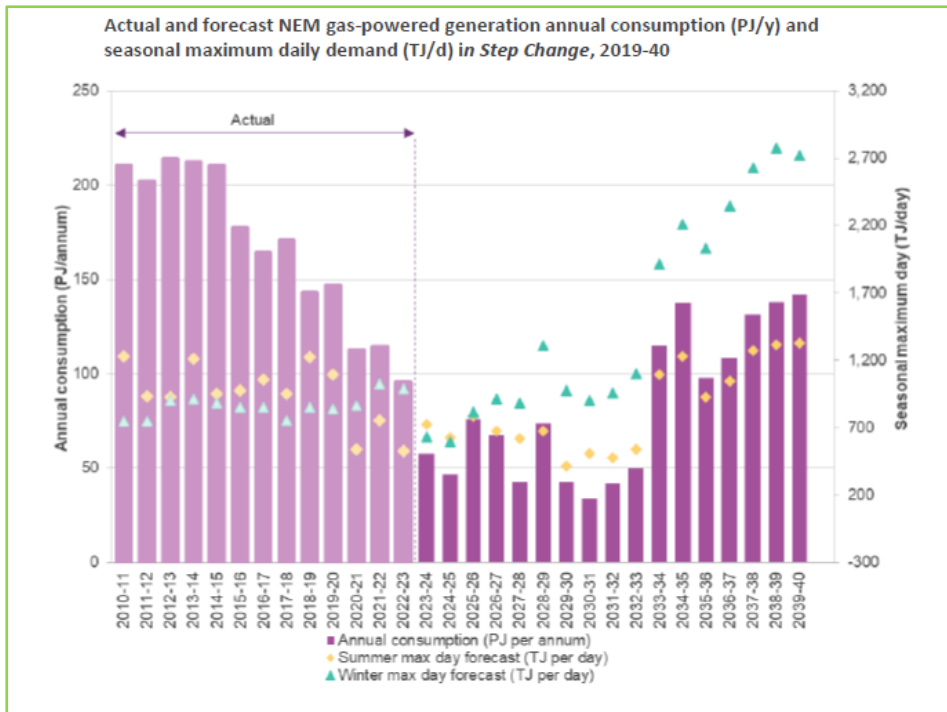


Figure 5: Gas Powered Generation (GPG) trending down, but expected to rise again after 2031.

Page	Issue/Question	Comments and Considerations	Recommendation or options
<b>Grid Scale Wind and Solar</b>			
44		<ul style="list-style-type: none"> <li>Grid scale wind and solar needs to triple by 2030 and times 7 by 2050 from 19GW today to 126 GW. <ul style="list-style-type: none"> <li>70 GW Wind by 2050</li> <li>55GW large scale solar</li> </ul> </li> </ul>	
		<ul style="list-style-type: none"> <li>New colour added to figures for offshore wind (OSW)</li> </ul>	

Page	Issue/Question	Comments and Considerations	Recommendation or options
	Dominance of wind	<ul style="list-style-type: none"> <li>● ISP suggest the need for wind to dominate installations of large-scale renewables through to 2030 to offset the already substantial amounts of utility scale coal and the growing amount of rooftop PV.</li> </ul>	
<b>Pumped Hydropower</b>			
		<ul style="list-style-type: none"> <li>● ISP includes Borumba Dam, assumes it will go ahead as it is beneficial to consumers (and includes gladstone grid upgrade).</li> </ul>	
<b>Storage - General</b>			
		<ul style="list-style-type: none"> <li>● Need a range of depth of storage.</li> <li>● Will be required for intra-day and seasonal demand response.</li> <li>● Go from 3GW storage now, to 19GW in 2030, and 57 by 2050 - almost 80% storage capacity from CER plus depth from utility side.</li> </ul>	
<b>Utility Scale Storage</b>			
		<ul style="list-style-type: none"> <li>● The wedge (Figure 3) narrows when they reach technical life of 20 years as the sector will need to make replacement decisions by then.</li> <li>● The forecast need for medium-depth storage has reduced by 5 GW due to increased wind generation and increased storage capacity from consumer energy resources. <ul style="list-style-type: none"> <li>○ Noting there is still capacity for a lot more CER on the distribution network, along with improved energy performance, this indicates there is likely more to be gained from CER and energy performance to further reduce the amount of storage needed.</li> </ul> </li> </ul>	
<b>Coal</b>			
	Coal retirement	<ul style="list-style-type: none"> <li>● Currently 21 GW</li> <li>● Coal retiring 2-3 times faster than anticipated – as early as 2033/34 in QLD and Vic, and 2038 across the NEM (Figure 4), or 5 years earlier than the previous 2022 ISP.</li> <li>● Coal is they are becoming less reliable, more difficult to maintain and less able to compete with the growing share of renewables.</li> <li>● Only the Green Energy Exports scenario, however, will allow us to achieve science-based targets and decarbonise the energy sector by 2035.</li> </ul>	
		<ul style="list-style-type: none"> <li>● ISP states that market and policy settings do not yet address the risks of coal retirement.</li> </ul>	AEMO to collaborate with jurisdictional and local

Page	Issue/Question	Comments and Considerations	Recommendation or options
		<ul style="list-style-type: none"> <li>State governments and some communities including Gladstone, Hunter Vally and Latrobe Valley have developed models of strong community engagement and planning for coal retirement.</li> </ul>	governments and stakeholders to take learnings from existing local processes strategies for planning coal retirement across the NEM.
<b>Gas</b>			
	Gas generation will decline but more gas generation capacity required	<ul style="list-style-type: none"> <li>This is a planning issue that can be addressed through improved demand response, especially in the residential sector, which hits above it weight regarding potential to reduce peaks (in both gas and electricity)</li> <li>AEMO expects declining trend of gas for electricity generation to continue.</li> <li>Expected to decline to &lt;1TWh of supply in 2025 compared to over 15TWh in 2011.</li> <li>However, more gas generation capacity will be required for shorter periods of renewable energy shortfalls from current capacity of 11GW to 16GW (was 9GW in previous ISP).</li> <li>Most of this new capacity (8 GW) will replace power stations that are scheduled to retire.</li> </ul>	
	"Flexible" gas	<ul style="list-style-type: none"> <li>Outlook for "flexible gas" is higher - but lower utilisation - suggesting we need more peaking gas than we have now - but we will use less of it - and might not be natural gas.</li> <li>Reinforces the importance of getting households off gas and electrified, with demand response.</li> </ul>	AEMO to include analysis of the contribution that the electrification of households and industry, including demand response and storage, has to reduce the need for flexible gas.
	Jurisdictions	<ul style="list-style-type: none"> <li>Some states have introduced phased bans on new gas connections</li> </ul>	
<b>Carbon Capture and Storage (CCS)</b>			
71	ISP does not support CCS.	<ul style="list-style-type: none"> <li>The ISP included analysis of CCS as an alternative to the ODP, but found that while the ODP provides for the gas generation that is needed, the ISP states that renewables are far cheaper for any additional need.</li> </ul>	
<b>Consumer Energy Resources (CER)</b>			
47		By 2050: <ul style="list-style-type: none"> <li>Progressive – 42 GW</li> </ul>	

Page	Issue/Question	Comments and Considerations	Recommendation or options
		<ul style="list-style-type: none"> <li>● Step Change – 86 GW <ul style="list-style-type: none"> <li>○ Rooftop solar 77 GW</li> </ul> </li> <li>● Green Energy Exports – 99 GW</li> </ul>	
30	CER can play a significant role in getting Australian off fossil fuels	<ul style="list-style-type: none"> <li>● Growth in CER reduces the need for utility-scale solutions.</li> <li>● Capable of meeting 48 per cent of underlying energy demand across the NEM in the middle of a sunny day</li> <li>● Previously considered a hindrance to grid stability, AEMO now recognises CER and necessary.</li> <li>● Growth in CER means that even with electrification (including EVs, heat pumps, electric cooktops), households will still consume about the same amount of energy from the grid.</li> <li>● It is best that CER is coordinated or ‘orchestrated’ to complement and support the grid most efficiently.</li> <li>● It is expected that smart energy controls will help manage this.</li> <li>● The energy literacy and social license needed for this may still need improving. CER will reduce the need for utility-scale solutions, particularly if the assets can be coordinated or ‘orchestrated’.</li> </ul>	AEMO to include analysis of how much of a contribution CER can make to reducing the need for mid- and large-scale generation and transmission.
	Consumer Demand	<ul style="list-style-type: none"> <li>● Consumers are clearly driving the uptake of CER and should be encouraged to do so.</li> <li>● This uptake includes electrification of households.</li> <li>● CER needs to be supported with energy performance.</li> <li>● Many at risk households are missing out, including renters, low-income households, and some First Nations communities.</li> </ul>	
44	Rooftop Solar and Consumer Energy on the roofs of households will play a more important role in the transition	<ul style="list-style-type: none"> <li>● Rooftop solar expect increase 4-fold 36 by 2030 86 by 2050.</li> <li>● By 2050 79% of households will have rooftop solar (vs 65% forecast in 2022), providing 86 GW capacity.</li> <li>● AEMO describes CER as both an opportunity and a risk, highlighting that the system benefits of CER would be foregone if those resources are not grouped together into properly integrated Virtual Power Plants (VPP)s.</li> <li>● Doesn’t have to be in VPPs - other options such as orchestration, especially has many consumer do not understand or trust VPPs.</li> </ul>	
CER Solar			

Page	Issue/Question	Comments and Considerations	Recommendation or options
		<ul style="list-style-type: none"> <li>● Today – 1 GW</li> <li>● 2050 <ul style="list-style-type: none"> <li>○ Progressive – 42 GW</li> <li>○ Step Change – 86 GW</li> <li>○ Green Energy Exports – 99 GW</li> </ul> </li> </ul>	
	CER plays a major role meeting the grid's storage and demand flexibility needs	<ul style="list-style-type: none"> <li>● Coordinated consumer-owned storage is forecast to rise from today's 0.4 GW to 37 GW in 2049-50 (Green Energy Exports) – making up 65% of the NEM's total energy storage capacity.</li> <li>● significant reform and work are needed so that consumers can “see the benefits of orchestration, overcoming both technical complexity and a lack of perceived value, then trust the energy sector to deliver those benefits</li> </ul>	
	Lack of community support for CER orchestration	<ul style="list-style-type: none"> <li>● There will be four-fold consumption in 2050 - increasing to 150 TWh, but households will still be drawing comparable electricity from the grid to today. <ul style="list-style-type: none"> <li>○ uptake of energy efficient buildings, appliances and behaviour will need to offset this increase, resulting in underlying consumption of 110 TWh.</li> </ul> </li> <li>● Rooftop solar further reduces reliance on the grid to only 40 TWh across the year by 2050 (i.e. close to today's)</li> </ul>	AEMO to collaborate with Jurisdictional governments and stakeholders to include orchestration in literacy and engagement programs program.
		<ul style="list-style-type: none"> <li>● CER will need to be fully utilised optimised for grid to be optimised</li> </ul>	
<b>CER Storage</b>			
47		<ul style="list-style-type: none"> <li>● Today – 1 GW</li> <li>● 2050 <ul style="list-style-type: none"> <li>○ Progressive – 5 GW</li> <li>○ Step Change – 34 GW</li> <li>○ Green Energy Exports – 37 GW</li> </ul> </li> </ul>	
	Most storage is CER storage	<ul style="list-style-type: none"> <li>● Higher proportion being coordinated - AEMO test this and look at reliability in Energy Statement of Opportunities (ESOO) – but they don't make assumptions unless they see real projects.</li> <li>● Co-ordinated CER Storage from ~2040 is higher than 2022 ISP.</li> <li>● Around 80% of storage will be CER storage.</li> </ul>	
	Rate of adoption	<ul style="list-style-type: none"> <li>● adoption forecast to grow strongly in the late 2020s and early 2030s.</li> <li>● This needs to be incentivised to occur earlier to reduce the need for mid to large scale generation and transmission.</li> </ul>	

## Energy Performance

Section	Issue/Question	Comments and Considerations	Recommendation or options
	Energy performance is still seen mostly as an input by the ISP.	<ul style="list-style-type: none"> <li>• While the ISP acknowledges that energy performance (and demand response in particular) is key to reducing the amount of renewable energy and transmission needed, it is still only seen as an input into the ISP, predominately based on jurisdictional policies.</li> <li>• The ISP has a role in improving energy efficiency outcomes.</li> <li>• The ISP in its current form fails to acknowledge spare capacity in distribution networks that could be utilised, as well as opportunities for improved energy performance and potentially microgrids.               <ul style="list-style-type: none"> <li>○ Opportunities for energy performance to contribute energy resilience benefits w.r.t. transmission are not being fully analysed – diversity is needed, such as microgrids, storage and demand response.</li> <li>○ Transmission is relatively locked in – with other options batteries etc not really been utilised to the best of their opportunity.</li> </ul> </li> </ul>	AEMO to include stronger analysis of energy performance opportunities to reduce the size of the build, the need for transmission and therefore the environmental, social, and economic costs of the transition.
		<ul style="list-style-type: none"> <li>• ISP accommodates more energy consumption with less emissions - reflecting policy commitments to faster rate of change.</li> <li>• Nonetheless, there're are slower investments than ISP 2022 in commercial energy efficiency measures and on-site generation site generation options (small non-scheduled generators).</li> </ul>	
	Market Benefits	<ul style="list-style-type: none"> <li>• Without transmission, the transition is expected to cost more.</li> <li>• More gas generation and storage would be required.</li> <li>• Transmission in the ISP saves \$17billion through more efficient investment.</li> <li>• This could be improved further with energy performance.</li> <li>• Key planning and decisions on this may be outside of transmission</li> </ul>	
	National Energy Performance Strategy (NEPS)	<ul style="list-style-type: none"> <li>• While not the role of AEMO, there has been little communication regarding the NEPS.</li> <li>• The NEPS is an important process and Australia is well behind other OECD countries with respect to energy performance.</li> </ul>	



Section	Issue/Question	Comments and Considerations	Recommendation or options
		<ul style="list-style-type: none"> <li>Greater transparency of the NEPS would improve stakeholders understanding of the relationship of energy performance to the ISP, and potentially how the ISP could be used to inform and improve the energy performance policies of all jurisdictions.</li> </ul>	