MUA Submission: 2020-21

Planning and Forecasting Consultation

on Inputs, Assumptions and Scenarios

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Australian Energy Market Operator

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Introduction

This submission has been prepared by Maritime Union of Australia (MUA). The MUA is a Division of the 120,000-member Construction, Forestry, Maritime, Mining and Energy Union and an affiliate of the 20-million-member International Transport Workers' Federation (ITF).

The MUA represents approximately 13,000 workers in the shipping, offshore oil and gas, stevedoring, port services and commercial diving sectors of the Australian maritime industry. MUA members work in coal export ports and we are part of the Offshore Alliance representing workers working on offshore oil and gas facilities. MUA members currently handle wind turbines and solar panels in ports across Australia, and would be part of building and maintaining future offshore renewable energy projects.

MUA members are also energy consumers who have an interest in a secure, efficient and affordable energy system. In 2020, MUA members worked on the vessels that rescued people from bushfires in Mallacoota, sheltered a large numbers of people fleeing bushfires on commercial tugs in Eden, and a number of MUA members lost their homes to bushfires.

Summary

The MUA strongly supports the development of the Integrated System Plan (ISP) for the future of the electricity system in Australia. A strong and transparent plan is essential to taking the climate action we need, and to ensuring that we do not increase inequality and social dislocation as a result.

There are three key aspects of the draft Inputs, Assumptions and Scenarios for the Integrated System Plan outlined in the current consultation that we would like to see improved:

1. **Include offshore wind.** AEMO must urgently update the available renewable energy resources used to map Renewable Energy Zones to include offshore renewable resources. The ISP process should no longer rely on the 2018 report by consultants DNV-GL that did not consider any offshore renewable resources, including offshore wind, ocean wave and tidal-current energy generation. Without considering all the available renewable resources, we cannot be sure that the ISP's recommendations are the best possible plan. Offshore wind can make a significant contribution to peak energy demand that could reduce the need for energy storage. Much of the existing transmission grid and most population and industrial centres in the NEM are close to the coast. Before significant investment takes place, AEMO must properly test whether building offshore renewables could reduce the need for expensive transmission and storage, and reduce the climate risk in our energy system.

2. **Reflect transition costs in system modelling.** AEMO has so far undertaken modelling limited to the energy system, and not the broader social context it is embedded in. The modelling seeks to reduce costs yet its limited scope means it does not include the externalised social costs of the transition, particularly where renewable energy generation is proposed to be built at a distance from the coal fired power it will eventually be replacing. In the short term, we propose that energy system modelling should include a 'transition cost' for Renewable Energy Zones located more than 50km from an existing coal fired power station.

   The 'transition cost' should be determined in consultation with affected workers and communities, and should include the social costs of avoiding unemployment of the coal-fired power workforce, relocation and/or training of a new workforce, and the construction of new infrastructure and development of new supply chains to facilitate large-scale energy being built in new areas. In the medium term, AEMO should undertake more integrated modelling that includes employment, education, and health to better understand the challenges and opportunities of the energy transition being modelled (an example of such an integrated model is IRENA E3ME model).

   Ultimately, however, we think such costs should be avoided through holistic location planning, job guarantees, and just transition measures. In any case, these costs must not be ignored.

3. **Include just transition measures in high decarbonisation scenarios.** The Sustainable Growth and Export Superpower scenarios must include explicit efforts to reduce inequality and ensure a just transition for workers and communities, determined in consultation with affected workers and communities. It is not realistic to assume that we can achieve the social and economic changes required for a 1.5°C or 2°C scenario based on 'increased awareness' or 'consumer action'. Much more profound social measures will be needed to address the impacts and overcome the social and economic challenges of the transition. Measures to address inequality in order to facilitate climate action are already integrated into the Shared Socioeconomic Pathway (SSP1) model that AEMO is proposing to link to those two scenarios.

The MUA is working hard to prepare our membership and industries for the necessary transition to a zero-net emissions economy and society. We recognise the need to urgently reduce emissions globally and in Australia to prevent global heating from exceeding 1.5°C, but this will have a very significant impact on the jobs held by many of our members. Our ability to provide climate leadership in these industries depends on the ability of the Australian government and of our union to deliver a just transition to our members working in fossil fuel industries, and their communities. If we cannot provide such a transition, we risk significant reductions to workers' living standards, deepening inequality, and a very significant political backlash which could stall the transition we need.

We believe that a just transition will require very significant public investment and ownership in energy systems, as well as many other sectors of the economy. It will require Commonwealth, state and regional Transition Authorities with the resources to make investments in affected communities and deliver job guarantees to ensure that workers in fossil fuel industries can make a direct transition to work in low-carbon industries.

Offshore Wind in Australia

The development of offshore wind in Australia is progressing rapidly. The government carried out a consultation on the regulatory framework for offshore renewable energy in early 2020, and says that 'legislative settings and framework aim to be in place and operational by mid-2021', well before the 2022 ISP is issued. $4.8 million in funding was provided to finish developing the new framework and deal with initial licence applications in the 2020 Commonwealth budget.[1]

At least five offshore wind projects are at various stages of development in Australia. The projects are:

1. **Star of the South** off Gippsland, Victoria. 2.2 GW, back by global offshore wind leaders Copenhangen Infrastructure Partners. Exploration licence was approved in March 2019 which has allowed the project to undertake detailed observations and planning. EPBC Act referral is underway.[2]
2. **NSW offshore wind.** Starting with a multi-gigawatt project off Newcastle, then potentially expanding with further locations off Wollongong, Ulladulla and Eden up to 6 GW in total. The developer is Oceanex, which is led by two of the co-founders of the Star of the South offshore wind farm, Andy Evans and Peter Sgardelis, with international investment partners. The project will use floating offshore wind technology.
3. **Newcastle Offshore Wind**. A separate multi-gigawatt Newcastle project, which applied for a licence from DISER in January 2020.
4. **The Cliff Head Wind and Solar Project** south of Geraldton in WA, being developed by Pilot Energy in a joint venture with Triangle Energy. Up to 1.1 GW in size.[3] Although this project is not in the NEM if it goes ahead it will contribute to the economies of scale for other projects.
5. **Bass Offshore Wind Energy** off Burnie, being developed by Brookvale Energy. Initially 360 MW, with an expansion to up to 2GW linked to the development of Marinus Link.[4]

Offshore wind in the Draft ISP

We are pleased to see that AEMO is including greater consideration of offshore wind in the Inputs, Assumptions and Scenarios it will be using in the modelling for the 2022 ISP. However, we are disappointed to see that AEMO plans to continue to rely on the 2018

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[1] The bill will be the Offshore Renewable Energy Infrastructure Bill (changed from the 'Offshore Clean Energy Infrastructure Bill'). Department of Industry, Science, Energy and Resources (DISER), Offshore clean energy infrastructure - proposed framework, 4 December 2020. DISER, Offshore renewable energy, 21 January 2021.

[2] Star of the South

[3] Pilot Energy, Pilot to sell majority interest in offshore Perth Basin Permit and form Wind and Solar Joint Venture with Triangle, ASX Announcement 9 November 2020; Pilot Energy, Pilot to pursue development of offshore wind project, ASX announcement 4 September 2020.

[4] Brookvale Energy

assessment[5] of renewable energy resources and identification of Renewable Energy Zones that does not include offshore wind (p.108 of the Draft IASR Report).

As we previously raised in a letter to AEMO,[6] the DNV report only looked at onshore renewable energy resources, and did not contain a justification of why. This may have been a reasonable (although short-sighted) approach in 2018, however, it now creates a risk that the 2022 ISP will be out of date and out of step with projects being planned and built in the NEM. A map of the renewable energy resources considered as part of the ISP is given in Figure 1. This should be compared with Figure 2, which shows the available wind resources in NSW (to give one example), including offshore wind.

We support AEMO's inclusion of offshore wind in the Gippsland REZ.[7] However this is the only offshore wind location that has been included for the NEM (p.92). There is good reason for including offshore wind in Gippsland, but it is quite arbitrary to exclude the rest of the potential Australian coastal areas, and this seems out of step with the systematic way that the rest of the ISP is developed.

It is good to see that AEMO (and the CSIRO through Gencost) have made efforts to better include offshore wind in other parts of the model. However, because offshore wind has not been included as part of the available renewable energy resources or identification of the REZs, its deployment is artificially limited in scope as there is only one location in the ISP where it is possible to build it. These problems are particularly acute for the modelling of the Export Superpower scenario, where it appears that AEMO is contemplating expanding REZs beyond their resource limits and building extra transmission hundreds of kilometers inland without assessing the substantial renewable energy resource that exist adjacent to the proposed hydrogen export ports, at sea.

If the 2022 ISP does not properly include offshore renewable energy in its assessment of Australia's renewable energy resources, it will be seriously out of step with the Australian legislative framework for renewable energy and projects currently being developed. Offshore wind and ocean wave and tidal-current energy should be included in a reassessment of renewable resources and REZ locations.[8] This is particularly important as AEMO identifies that 'diversity of resources' within REZs and between REZs is a critical aspect of selecting REZs.[9]

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[5] Renewable energy resources and renewable energy zones were identified in the document *Multi-Criteria Scoring for the Identification of Renewable Energy Zones*, prepared by DNV-GL for AEMO in April 2018. This is further discussed in Australian Energy Market Operator, 2020 ISP Appendix 5, p. 8-12.

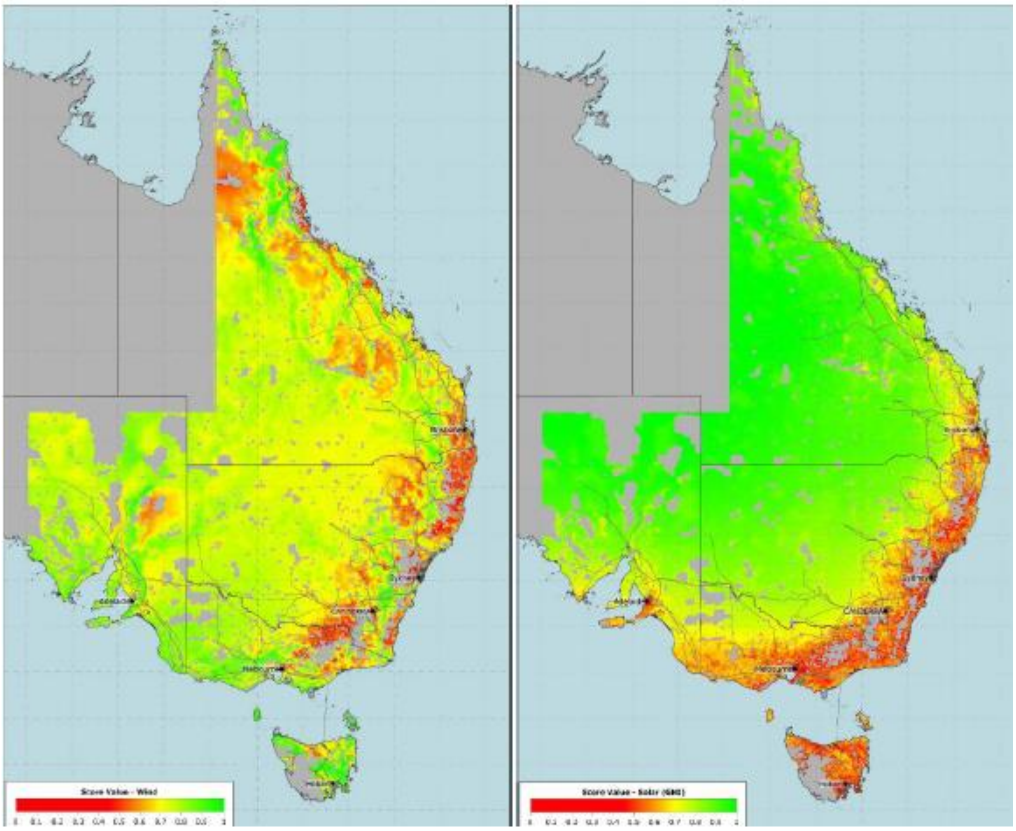
[6] Maritime Union of Australia to the Australian Electricity Market Operator, 21 February 2020, consultation on the Draft 2020 ISP.

[7] 4GW of the potential 6GW of renewable energy AEMO has assessed as available in the REZ is offshore wind. Australian Energy Market Operator, 2020 ISP Appendix 5, p.128

[8] Offshore wind because of the number of grid-connected projects in progress. Tidal current generation costs have also declined significantly. Wave and tidal-current energy would substantially add to the diversity of renewable resources. Costs are outlined in Gencost 2019-20, CSIRO, p.20-21. Arenawire, Full steam ahead for King Island wave power trial, 4 October 2019.

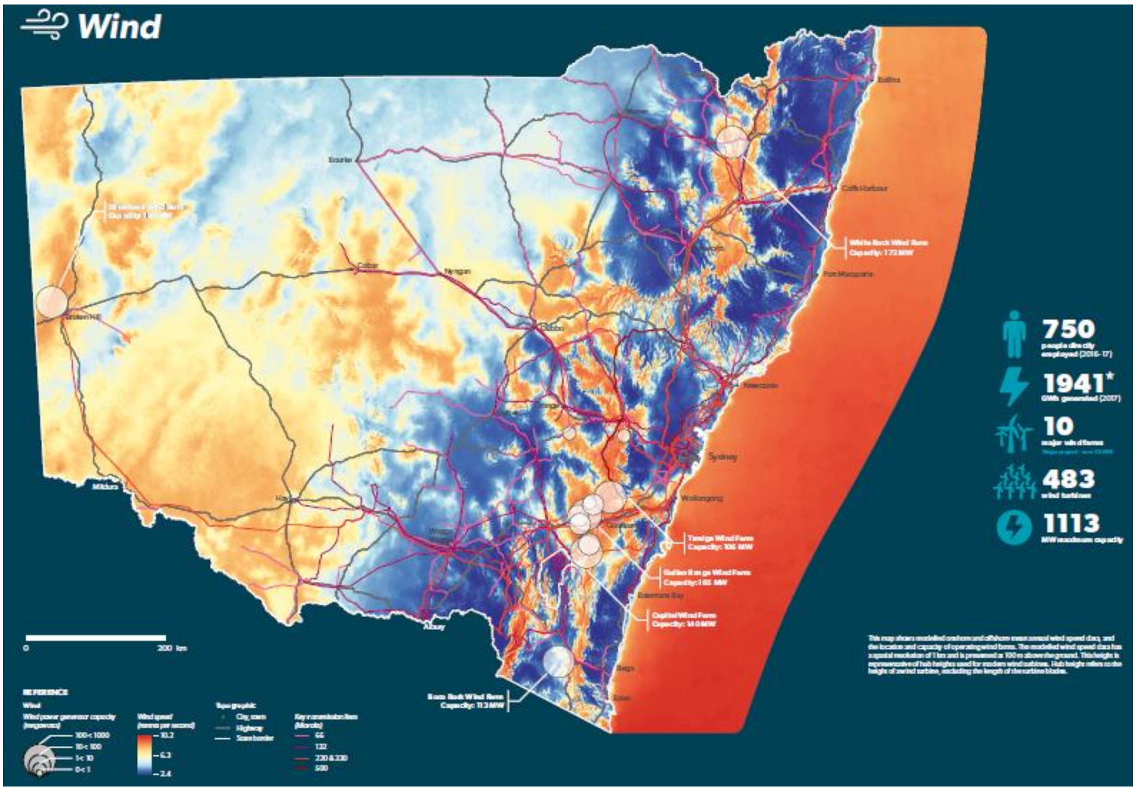
[9] Australian Energy Market Operator, 2020 ISP Appendix 5, p.11-12.

Figure 1: Renewable energy resources used to evaluate Renewable Energy Zones in the 2020 Integrated System Plan, and proposed to be used in the 2022 ISP. The left map is wind and the right is solar. Green indicates the best resources, weighted with other factors outlined in the ISP.



Source: Australian Energy Market Operator, 2020 ISP Appendix 5, p.9.

Figure 2: NSW wind speed. Red indicates highest mean annual wind speed, and blue is lowest.



Source: Carter P.J & Gammidge L.C. (compilers) 2019. Renewable energy map of new South Wales (3rd Edition). Geological Survey of New South Wales, Maitland. ©State of New South Wales through NSW Department of Planning and Environment 2018.

Without considering all the available renewable resources, we cannot be sure that the ISP's recommendations are the best possible plan. More consistent wind offshore with a high peak-demand contribution factor and high capacity factor could reduce the need for storage. Offshore wind has been described by the International Energy Agency (IEA) as having a 'value proposition potentially comparable to that of baseload technologies such as nuclear power and coal-fired generators.' The reliability and consistency of offshore wind 'reduces the need for investment in other dispatchable capacity, including investment in combined-cycle gas turbines (CCGTs).[10]

Much of the existing transmission grid and most population and industrial centres in the NEM are close to the coast. Building renewable energy offshore virtually eliminates the climate risks of high temperature and bushfires.[11] Many of the REZs are proposed to be built in areas with a high bushfire and temperature risk. Before significant investment takes place, AEMO must update the renewable energy resources used to develop the 2022 ISP to properly test whether building offshore renewables could reduce the need for expensive transmission and storage, and reduce the climate hazards the energy system is exposed to.

Recommendation: that AEMO must urgently update the available renewable energy resources used to map Renewable Energy Zones to include offshore renewable resources. The 2022 ISP process should no longer rely on the 2018 report by consultants DNV-GL that did not consider any offshore renewable resources, including offshore wind, ocean wave and tidal-current energy generation. The prioritisation and identification of Renewable Energy Zones for the 2022 ISP must be revised on the basis of the new analysis that includes offshore resources, and properly identifies their different capacities.

Another approach would be to include a sensitivity for a higher level of development of offshore wind. This could be a useful interim approach while a full analysis based on offshore renewable resources take place. However, it appears to us that the model used to develop the ISP only looks at renewable resources that are in identified REZs.[12] Any sensitivity must be run without such constraints to ensure it offers meaningful data.

Workforce and system transition – addressing externalised costs

AEMO's modelling in previous ISPs has made clear that Australia's electricity system will be undergoing a complete transformation in the upcoming decades.

While AEMO's modelling maps out a least-cost path, we believe that the calculation of costs has been done on too narrow a basis. There will be a significant social cost to the transformation of the energy system and this should be understood and included in policy considerations and modelling to ensure the real costs are properly considered and shared

[10] International Energy Agency, *Offshore Wind Outlook 2019*, p.12, 21, 44.
[11] The Star of the South offshore wind project is proposing to bury the transmission cable landing site and the short length of onshore transmission needed underground.
[12] Based on the details outlined in AEMO, Market Modelling Methodologies, July 2020, p.40-41.

across society. Small groups of workers and communities should not be left to bear the brunt of changes on their own.

One output from the 2020 ISP was that for many locations in the NEM, there is a significant distance between the sites of coal-fired power stations scheduled for closure, and the sites of REZs that have been identified for development. Looking at the REZs proposed for NSW, the bulk of new generation is proposed to be built 280km-400km from current coal fired power stations, as follows:

Armidale (REZ N2) to Liddell Power Station 285km
Armidale (REZ N2) to Vales Point Power Station 376km
Dubbo (REZ N3) to Liddell Power Station 283km
Armidale (REZ N3) to Vales Point Power Station 398km

Other NSW renewable energy zones are proposed to be located even further west, north, and south (p.110 Draft IASR Report). Shifting the location of the bulk of a state's electricity generation does not simply involve building new transmission lines. There are significant social costs of such an enormous shift of the state's essential infrastructure, and the policy discussion should be had about whether this is a desirable outcome.

Concerns have been raised about energy models that rely 'on cost optimization formulations,' which can 'produce transition scenarios that can significantly distort the options to address the transition'.[13] The lack of a coherent energy policy in Australia means that the ISP and associated processes have effectively become our energy transition plan – but they are fundamentally technocratic in nature and lack the broader social considerations that are needed to win the public acceptance and support that the necessary reduction in greenhouse gases needs if it is to proceed without significant public backlash.

The energy transition presents us with many opportunities – but if poorly planned it could result in thousands of workers losing their jobs, communities losing long-standing industries, and potentially significant geographical shifts in where energy is generated and jobs are located. This transition also looks likely to be taking place during one of the worst economic crises that Australia has ever experienced.

Achieving social license and confidence in these measures requires meaningful consultation with the workers, unions and communities who are affected by and have an interest in these decisions, as well as the broader public. Consultation must include workers and unions who work in the current system, including in the generators scheduled to close, and workers who will be building new infrastructure.

Recommendation: That AEMO's energy system modelling include a 'transition cost' for Renewable Energy Zones located more than 50km from an existing coal fired power station. The 'transition cost' should be determined in consultation with affected workers and communities, and should reflect the social costs of avoiding unemployment of the coal-fired power workforce, relocation and/or training of a new workforce, and the construction of

[13] Xavier Garcia-Casals, Rabia Ferroukhi, Bishal Parajuli. Measuring the socio-economic footprint of the energy transition. *Energy Transitions* (2019) 3: 105.

new infrastructure and development of new supply chains to facilitate large-scale energy being built in new areas.

Costs to be modelled for this 'transition cost' include those listed below, but a proper consultation should take place with affected workers and communities to determine this:

- Training the workforce for the construction and maintenance of new generation and transmission infrastructure, including new training and education facilities.
- Costs associated with avoiding unemployment of the previous workforce and loss of jobs in those communities. We believe job guarantees, training, and a direct transition should be made available to all affected workers, and support should be provided to communities.
- Infrastructure costs – capacity of roads and bridges will likely need upgrading to deal with the transportation of turbines, towers, solar panels, and other equipment.
- International and local supply chains will need to be established.

Weight should be given to building renewable energy close to current power stations.

Recommendation: In the medium term, AEMO should undertake more integrated modelling that includes employment, education, and health to better understand the challenges and opportunities of the energy transition being modelled.

One example of such an integrated model is IRENA E3ME model, which recognises that 'the energy system is embedded into the wider economy, which in turn is embedded into the social system, and the Earth system. Standalone energy or energy-economy transitions do not exist.'[14] The outcomes of this model show that:

> Overall, the energy transition will generate more jobs in renewable energy and energy efficiency than will be lost in the fossil fuel sector. However, the geographic distribution of jobs gained and lost may not be in alignment. Similarly, new job creation may not occur within the same time scale as jobs losses, and training misalignments can also be expected, requiring additional adjustment measures. Moreover, other economic sectors than the energy sector can experience transition-related employment impacts, calling for a holistic labour policy that applies just transition considerations across all the economy.
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> It is against this backdrop—diverging transition outcomes as well as spatial and temporal adjustments needs—that policies for economic restructuring are needed to spread the benefits of the transition widely and to minimize the burdens and costs. Such policies are essential not only as a matter of fundamental fairness but also to limit the likelihood that those negatively impacted will continue to oppose policies required to render the world's economies climate-safe.[15]

[14] Xavier Garcia-Casals, Rabia Ferroukhi, Bishal Parajuli. Measuring the socio-economic footprint of the energy transition. *Energy Transitions* (2019) 3: 107.
[15] Xavier Garcia-Casals, Rabia Ferroukhi, Bishal Parajuli. Measuring the socio-economic footprint of the energy transition. *Energy Transitions* (2019) 3: 115-116.

Just transition and scenario modelling

The scenarios with high emissions reduction should also include measures to more explicitly reduce inequality and ensure a just transition, as is the case in global climate scenario modelling and climate agreements. The Paris Agreement describes "the imperatives of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities.”[16]

The Draft 2021 IASR associates each of the proposed Australian scenarios with a particular scenario used in global climate modelling (the Shared Socio-Economic Pathways).[17] This is a good step to assist in the clarity and transparency of assumptions used in modelling. Both the proposed ‘Sustainable Growth’ and the ‘Export Superpower’ scenarios proposed for Australia are proposed to be linked to SSP1. We support this link but we believe an important aspect of the SSP1 scenario has been overlooked and should be introduced into both scenarios.

The draft report describe SSP1 as involving ‘more inclusive development’ such that ‘inequality falls both within and between countries’ (Table 11, p.49 Draft IASR Report). In the SSP1 narrative, this is described as requiring a ‘sustained effort,’ with elements including ‘a reduction of inequality (globally and within economies) alongside ‘rapid technology development, and a high level of awareness regarding environmental degradation’.[18] The rationale for this is elaborated further in a later article by modellers, which describes the ‘main requirement’ for achieving the rapid shift that decarbonisation requires as being ‘further growth of societal support for such a strategy combined with an actual change in investment patterns.’[19]

The challenge of decarbonisation is not simply a question of achieving the best technology at the lowest cost – it is fundamentally a social question, which will be challenging and will be opposed, as the SSP modellers explain:

> It is clear that the SSP1 scenario world will not emerge automatically. It will require a consistent effort of moving in a certain direction. Important risks of the SSP1 world include non-performance of technology, rebound impact of efficiency, possible

[16] UNFCC, Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 13 December 2015, p.21, In Australia, the creation of the LaTrobe Valley Authority following the closure of the Hazelwood coal-fired power plant and the Worker Transfer Scheme is one significant effort to establish a just transition in in Australia. The Queensland Government has also established a Just Transition Group, which will be developing a transition plan for the state.
[17] International Institute for Applied Systems Analysis, SSP Public Database. See UNFCCC reference, International Committee on New Integrated Scenarios for the Assessment of Climate Change, The Shared Socio-Economic Pathways (SSPs): An Overview.
[18] International Institute for Applied Systems Analysis, Supplementary note for the SSP data sets, 2012.
[19] Detlef P. van Vuuren, Elke Stehfest, David E.H.J. Gernaat, Jonathan C. Doelman, Maarten van den Berg, Mathijs Harmsen, Harmen Sytze de Boer, Lex F. Bouwman, Vassilis Daioglou, Oreane Y. Edelenbosch, Bastien Girod, Tom Kram, Luis Lassaletta, Paul L. Lucas, Hans van Meijl, Christoph Müller, Bas J. van Ruijven, Sietske van der Sluis, Andrzej Tabeau,
Energy, land-use and greenhouse gas emissions trajectories under a green growth paradigm, Global Environmental Change, Volume 42, 2017, p. 241.

> tensions associated with free-rider behaviour, and a potential push-back from actors whose interests are not ensured in this storyline.
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> This requires that societal change moves beyond the first-movers and also society-at-large implements the SSP1-related changes. Therefore, interpreting the SSP1 storyline as an easy way to achieve climate policy goals is therefore not necessarily correct.[20]

The modelers conclude that 'more-and-more, it is emphasized in international climate policy that many countries will only accept costly climate policies if these align with achieving other societal goals.'[21] This is certainly the case in Australia, where widespread social support will be necessary to implement the necessary decarbonisation.

The narratives for the 'Sustainable Growth' and the 'Export Superpower' scenarios make no mention of wider social goals or efforts to build widespread acceptance, such as measures to address inequality or ensure workers and communities are not negatively impacted. Instead, the only social aspects mentioned include 'higher levels of awareness', 'energy literate consumers' and 'individual consumer action' (p.23), and 'strong political pressure' (p.29 Draft IASR Report). Social equity measures will be required not only to achieve the social consensus to reduce emissions, but also to achieve other aspects of the scenarios such as high growth in household solar and batteries, and high take up of electric vehicles, household energy efficiency, and switching of household appliances. All of these measures are presently out of reach for a large portion of the Australian population.

Unfortunately, the history in Australia is that industrial transitions have increased inequality, with only one half to one third of displaced workers finding equivalent employment.[22] After the energy battles of the past decades, and the considerable social impact caused by closing just one coal-fired power station, we believe it is completely unrealistic to project that Australia will be able to decarbonise on the scale required by the 1.5°C and 2°C scenarios without comprehensive social programs to ensure that communities and workers can look forward to good secure jobs and improved livelihoods.

Recommendation: The 'Sustainable Growth' and the 'Export Superpower' scenarios must include measures to address inequality and ensure a just transition of affected workers and communities in order to achieve the widespread social support that these rapid decarbonisation scenarios will require. These should be developed in consultation with relevant workers, unions, and communities. Social equity measures will also be needed to achieve the high growth in household solar and batteries, and the high take up of electric vehicles, household energy efficiency, and fuel-switching for household appliances in those scenarios.

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[20] Van Vuuren et al. Energy, land-use and greenhouse gas emissions trajectories under a green growth paradigm, Global Environmental Change, Volume 42, 2017, p. 249.
[21] Van Vuuren et al. Energy, land-use and greenhouse gas emissions trajectories under a green growth paradigm, Global Environmental Change, Volume 42, 2017, p. 249.
[22] ACTU, 2016, *Sharing the challenges and opportunities of a clean energy economy: A Just Transition for coal-fired electricity sector workers and communities.* https://www.actu.org.au/our-work/policy-issues/actu-policy-discussion-paper-a-just-transition-for-coal-fired-electricity-sector-workers-and-communities.

Specific elements of a 'just transition' scenario that could be included are:

- Giving weight to locating future energy generation near existing generation to allow for a workforce and community transition.
- Requirements for jobs created in REZs to be quality jobs, at industry rates of pay and with good job security. The Australian Council of Trade Unions has released landmark reports in 2020 on how to secure good jobs in renewable energy and on achieving a just transition.[23]
- Prioritising the use of existing transmission assets to allow for a workforce transition
- Prioritising renewable energy and other zero-emissions developments in areas impacted by coal station closures
- Prioritising procurement and development of supply chain in areas impacted by coal station closures
- Examining power supply for large industrial loads, and seeking to ensure they are supplied with lowest risk and minimal demand response (see later section in the submission). This is critical to ensuring jobs in all sectors of the economy are maintained, and that workers have confidence they will be maintained. Industrial legislation will need to ensure their rights are maintained and they are properly compensated during demand-response periods.
- Job guarantees, direct transition and re-training for affected workers, and support for communities.

Delivering a just transition will require whole-of-government planning, support and resources.[24]

[23] Australian Council of Trade Unions, *Sharing the benefits with workers: A decent jobs agenda for the renewable energy industry,* November 2020 *and* ACTU, Securing a Just Transition Guidance to assist investors and asset managers support a just transition, December 2020.

[24] Resources on implementing a just transition include: MUA and others, Putting the Justice in Just Transition: Tackling inequality in the new renewable economy, November 2019. Australian Congress of Trade Unions, 2016, Sharing the challenges and opportunities of a clean energy economy: A Just Transition for coal-fired electricity sector workers and communities. Peter Sheldon, Raja Junankar, Anthony De Rosa Ponello. The Ruhr or Appalachia? Deciding the future of Australia's coal power workers and communities, October 2018. IRRC Report for CFMMEU Mining and Energy Division. IndustriALL, Just Transition – An idea whose time has come, 16 May 2019. Commission on Growth, Structural Change and Employment (Germany), Final Report, January 2019.

Response to AEMO questions

Sections are numbered as per the sections in the Draft IASR report.

2.2 The scenario development process

Are there other scenarios, not currently proposed, that could lead to under- or over-investment, and are sufficiently distinct to warrant inclusion? What would be the scenario narrative for such a scenario, and how would it help inform energy sector decision-making?

As outlined above, higher decarbonisation scenarios require just transition elements to ensure that the necessary social support for rapid decarbonisation is in place. This is already a part of the SSP1 scenario that the AEMO 'Sustainable Growth' and the 'Export Superpower' scenarios are linked to. This should be further developed for an Australian context. At a minimum this involves giving weight to locating future energy generation near existing generation to allow for a workforce and community transition.

The name of the 'Diversified Technology' scenario is confusing as it has the same name as a different scenario used in the GenCost process which also feeds into the ISP. This also makes it potentially misleading. As the scenario appears to revolve around a low gas price, it would be more transparent to reflect this in the name. It also seems to be a very different scenario from the SSP1 scenario that AEMO suggests it is linked to (p.50). We cannot see how such a scenario would have the same emissions outcome as the 'Sustainable Growth' scenario (less than 2°C).

4.4.4 Distributed energy resources

Are the proposed mappings of DER trajectories to scenarios reasonable?

We note that there are social and financial limits to household, battery, and electric vehicle uptake. A substantial portion of the Australian population does not own their own home and/or has a low income that precludes these substantial investments. The 'High' uptake of all three in the Sustainable Growth scenario would require significant social equity measures to support this uptake. We also note that in many cases large scale renewable energy and public transport are more efficient, safe, and effective ways of meeting transport and energy needs.

4.4.6 Large industrial loads

This consultation appears mainly to focus on whether large industrial loads will be open or closed in the various future scenarios.

We would like to see question of large industrial loads considered in a different way. The future of the electricity grid should be explicitly designed to ensure a reliable supply for large industrial loads. This is necessary not only to secure the future of those industries and the hundreds or thousands of jobs they support, but also to reduce community anxiety around that the future of that supply in the context of the scheduled closures of coal-fired power stations. In the absence of a clear plan that secures jobs, community anxiety can rapidly translate to an opposition to decarbonisation and emissions reduction goals.

In many cases, large industrial loads have deliberately been built close to coal-fired power stations. To give one example, the Tomago Aluminium Smelter has a constant use of 950MW or 10% of NSW's total electricity supply.[25] It currently has direct transmission lines to both the Bayswater and Eraring coal fired power stations to ensure continuity of supply.[26] As it stands, the ISP seems to contemplate shutting down those power stations and replacing them with renewable energy generation located 300-400km away.[27]

Recommendation: Specific planning should be undertaken to ensure that the future grid provides secure supply for large industrial loads. This should be explicitly addressed in future ISPs to reduce community anxiety and preserve jobs. The Sustainable Growth and Export Superpower scenarios also need to include policy to support those industrial loads.

4.4.7-9 Households, energy efficiency, and appliance uptake and fuel switching

We note that there are social and financial limits to household energy efficiency initiatives and take up of new appliances. A substantial portion of the Australian population does not own their own home and/or has a low income that precludes these substantial investments. There is no incentive for landlords to make these improvements to homes they will not live in. The 'High' uptake of these measures in the Sustainable Growth and Export Superpower scenarios will require significant social equity measures to achieve.

4.4.11 Demand-side participation

Are the levels of DSP targeted across the proposed scenarios appropriate for the scenario narrative?

Demand-side participation means the shut-down of electrical loads at periods of high electricity demand. Large electricity loads are often also large workplaces, so the social and industrial consequences of higher demand-side participation need to be carefully considered. Implemented poorly, increased demand-side response could result in workers being abruptly stood down without pay, working more unpredictable hours, and on increased split shifts or other rostering arrangements that will increase fatigue. Outcomes like this would reduce social support for decarbonisation and emissions reduction initiatives.

The 'High' uptake of demand-side participation in the Sustainable Growth and Export Superpower scenarios will require new industrial legislation to ensure that workers' rights

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[25] Tomago aluminium, Tomago keeps the lights on across the state, 2020. Tomago can reduce this demand to 350MW in minutes when necessary, but this interrupts the function of the smelter.

[26] Bayswater Power Station is approximately 104km from Tomago and generates 2.665 GW across four units and is scheduled to close in 2035. Eraring Power Station is 54km from Tomago and generates 2.88 GW across four units and is scheduled to close in 2032.

[27] The distance from the Tomago Aluminium Smelter to Armidale (REZ N2) is 318km and to Dubbo (REZ N3) to is 369km.

are maintained and that workers are properly compensated during demand-response periods. Without such legislation, the burden of demand-response is shifted to individual workers which could provoke a significant social backlash that would risk the emissions reduction objectives of those scenarios. It effectively externalises a cost that should be properly considered in modelling.

Recommendation: The grid should be designed to minimise the amount of demand-response required. New industrial legislation will be required to ensure workers are properly compensated in demand-response periods.

New entrant generator assumptions

Is AEMO's proposed list of candidate technologies reasonable? If not, what should be included/excluded?

We support the inclusion of offshore wind in the candidate technologies in Table 23 (p.91-2). However the table specifies that only offshore wind off the Gippsland REZ is included. As outlined earlier, offshore wind must be included more systematically into the renewable energy resources used to develop the ISP.

We support the exclusion of nuclear generation.

4.6.3 Technology build costs

Capital costs

We believe the costs for offshore wind used by Gencost and the ISP are too high. There are certainly challenges with establishing the industry in Australia but with a growing number of projects in development, issues of scale can be addressed. Gencost and the Aurecon report it relies on[28] is converting an international cost figure based on US dollars. With the low Australian dollar, cost savings are potentially available through local manufacturing of offshore wind towers (towers are the most likely component that could be manufactured in Australia). A substantial workforce is also available locally that has been trained in the offshore oil and gas industry.

We suggest AEMO further engage the developing offshore wind industry in Australia in revising its cost figures. It would also be useful to look at the costs in the USA where the industry is at a similar stage of development.[29]

Gencost

We are pleased to see that offshore wind is now included in the Gencost modelling alongside other technologies.

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[28] Aurecon 2020, Costs and technical parameters review, December 2020.
[29] US Department of Energy, 2018 Offshore Wind Technologies Market Report.

It appears that the Gencost new STABLE model does not include offshore renewable resources in its underlying resources, as it uses the same input as the 2020 ISP.

Locational costs

The modelling of locational costs must be revised to include a lower figure for offshore wind where no road transport is needed, land is not privately owned, and fuel is cheaper. The 2018 report GHD report[30] that is proposed to underpin the locational costs for the 2022 ISP must be revised to incorporate lower locational costs factors for offshore wind. Using the equivalent onshore costs for offshore construction is not accurate.

Transporting components to site by road is a major cost that is completely avoided in offshore wind projects, where large components are manufactured on the port site or imported by ship and then staged in the port for construction.

The availability of a workforce is much less of an issue for offshore projects as Australia has a very significant maritime and offshore workforce trained in the construction of offshore oil and gas facilities and used to travelling interstate to work. The construction of recent projects in offshore West Australia, the Northern Territory, and in the Port of Gladstone used workers from all over Australia.

For offshore wind projects near established industrial ports (for example Newcastle, Port Kembla, Sydney, Melbourne, Geelong, Burnie, Brisbane, Gladstone, Townsville, Perth, Geraldton, Adelaide) a large and highly skilled maritime and construction workforce is available locally. For other projects constructed at a greater distance to an established industrial port (for example in Gippsland), a maritime workforce is also readily available as their normal employment (often in the offshore oil and gas industry) is already structured around work periods of 3-4 weeks on a ship. Accommodation is provided on the offshore construction vessels. Large numbers of seafarers living in Victoria travel to work in West Australia. The time and cost of travelling to Gippsland would be significantly less and would be very attractive to those seafarers, particularly with the recent state border closures. There is also an existing offshore oil and gas workforce and infrastructure around the Barry Beach Marine Terminal in Gippsland.

The land and development costs are significantly lower for offshore wind where the land is not privately owned. This applies to both the locational cost and the 'technology cost breakdown ratios' given in Table 26 where the cost of land and development is put at 3% for both onshore and offshore wind.

Most fuel in Australia is imported through port terminals, so fuel is available more cheaply in ports than elsewhere.

The costs of environmental approvals should be reviewed to ensure it is up to date.

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[30] GHD. 2018-19 Costs and Technical Parameters review.

Recommendation: The locational cost inputs for the 2022 ISP must be revised to incorporate lower locational costs factors for offshore wind.

4.7.2 Renewable resources

The draft report says that renewable resources were updated in 2020, however, looking at the background documents,[31] it appears that renewable resources are only examined in Renewable Energy Zones. This is problematic insofar as renewable energy zones have been selected without including a consideration of offshore wind.

The selection of renewable energy zones must be revised on a basis that includes offshore wind.

Renewable Energy Zones

There is an urgent need to include offshore renewable resources in the assessment, scoring, and selection of Renewable Energy Zones undertaken in the 2018 DNV-GL report used by AEMO in subsequent ISPs.[32] Please see our earlier comments. It makes no sense to proceed with a plan when this has not even been considered.

Once offshore resources are included, the scoring system used to identify and rank Renewable Energy Zones needs to be overhauled to properly consider offshore renewable resources. Renewable Energy Zone scoring should be clearly distinguish between onshore and offshore sectors so the merits of each can be given proper consideration in the modelling.

The REZ scoring criteria used in the 2020 ISP did not reflect the differences and respective benefits of maritime and onshore REZs. Criteria such as the estimate of average property size, land cover, road access, terrain complexity, population density, and protected areas must be adjusted to provide an accurate comparison of strengths and weakness of onshore and offshore projects.[33]

The only REZ in the 2020 ISP with a maritime component (V5 - Gippsland) included both onshore and offshore resources, but the ISP only used did not differentiate between the scores for demand correlation, temperature risk, or bushfire risk for the onshore and offshore portions of the REZ. IT appears that only the onshore scores were used in the modelling, despite 4 GW of the potential 6GW resource being offshore.

The offshore wind project proposed for the Gippsland REZ is located 20-25km off the coast, where the daily and seasonal profile of wind, generation output, temperature and bushfire risk will be significantly different to onshore areas.[34] Perhaps as a consequence, the Gippsland REZ is ranked quite low for development. Instead the ISP ranks much more highly

[31] For example AEMO, Market Modelling Methodologies, July 2020, p.40-41 and DNV-GL, *Multi-Criteria Scoring for the Identification of Renewable Energy Zones*, April 2018.
[32] DNV-GL, *Multi-Criteria Scoring for the Identification of Renewable Energy Zones*, April 2018.
[33] Australian Energy Market Operator, 2020 ISP Appendix 5, p. 8-12.
[34] Australian Energy Market Operator, 2020 ISP Appendix 5, p.128.

a potential $3 billion investment in the VNI West transmission proposal.[35] This conclusion is particularly odd given the Gippsland offshore wind project has no grid constraints and does not need any additional grid investment once the project is connected - the ISP says there is 2GW of capacity available, and a loss robustness factor of 'A' (best possible).[36]

Including offshore renewable resources will also bolster the resources available for the new 'Hunter-Central Coast' and 'Illawarra' Renewable Energy Zones designated by the NSW government.

We oppose removing the previously designated N4 REZ in the NSW tablelands. This REZ could be shifted to include the adjacent Illawarra and offshore areas, where the issues with planning approvals and community opposition would be significantly less.

If it is not possible to re-evaluate the Renewable Energy Zones, a sensitivity analysis for the scenarios should be undertaken that tests for the effect of offshore wind being built. This must be done in such a way that the lack of offshore REZs does not constrain the development of offshore wind in the model.

REZ definitions for the Export Superpower scenario

The Export Superpower scenario will require more generation capacity to be built near ports, as ports will be used for hydrogen exports. This increases the importance of properly incorporating offshore wind into the assessment of renewable energy zones, as advocated earlier in this submission.

REZ resource limits

The Draft Report notes that increases to the resource limits in REZs may be needed, particularly in the Renewable Energy Superpower Scenario, but that 'land use reviews indicate that the expansion of REZs are likely to become constrained by social licence factors, as opposed to purely on land availability' (p.112 Draft Report).

This further increases the rationale for including offshore renewable resources in a re-assessment of renewable energy zones, as we have been advocating. It makes no sense for the ISP to be contemplating potentially problematic expansion of onshore REZs when it has not even considered the renewable energy resources located directly adjacent to the potential hydrogen export ports.

We support the proposal to add a 'land use penalty factor' if REZ resource limits are allowed to increase.

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[35] Proposed decisions rules say the project should not proceed if it costs more than $2.6 billion. Cost projects range from $1.2 - $3.1 depending on route and other factors Australian Energy Market Operator, 2020 Integrated System Plan, p. 76-80, 89.

[36] Australian Energy Market Operator, 2020 ISP Appendix 5, p.129.

Figure 33 gives a misleading picture of the potential for offshore wind development in the NEM, as it includes only 4 GW. In reality, many more projects are in development and the capacity is far greater than is indicated.

REZ transmission limits and expansion costs for the Export Superpower scenario

The Draft Report notes that REZs may need to be expanded to power hydrogen manufacture in ports under the Export Superpower Scenario, and proposes that the cost of building transmission from inland REZs to ports be modelled at $1,500 MW/km.

This is further rationale for offshore renewable energy resources to be properly incorporated into the ISP, as advocated above. It does not make sense to spend significant sums of money upgrading transmission lines to REZs located hundreds of kilometers inland, when many ports are located directly adjacent to high-quality renewable energy resources which are not currently considered in the ISP.

4.10 Climate change factors and effect on network modelling

The temperature and bushfire risk for onshore and offshore portions of REZs must be modelled separately. There are much lower temperatures and zero bushfire risk at sea, particularly when offshore wind developers are burying the onshore transmission cables associated with offshore development underground (as is proposed in Gippsland).

In the 2020 ISP the Gippsland REZ was given a bushfire risk of 'D' (on a scale from A-E),[37] which means that more than half the days of the year are projected to have a high fire danger and there is a probability of between one and four large fire every twenty years. As only 2GW of the 6GW of the resource of the Gippsland REZ is located onshore, this scoring should not be applied to the offshore area, or to the REZ as a whole.

In NSW, there are acute differences in these risks to consider. The N2 and N3 REZs are the closest REZs in the ISP to the major urban areas of NSW, and they also have the highest bushfire risk (E on a scale from A-E), and a medium temperature risk (C on a scale from A-E). A bushfire risk of E means that more than half the days of the year are projected to have a high fire danger and there is a probability of one large fire every three years.[38] This is a risky basis on which to build the bulk of NSW's electricity supply.

Building offshore wind avoid a very significant portion of climate risk, and this should be modelled as part of the ISP.

Recommendation: The different climate risk profiles of onshore and offshore REZ areas must be accurately reflected and incorporated into ISP modelling.

[37] Australian Energy Market Operator, 2020 ISP Appendix 5, p.128.
[38] Australian Energy Market Operator, 2020 ISP Appendix 5, p. 42, 48 and 52.

4.11.11 Transmission line failure rates

It is important to include increasing bushfire risk for transmission lines. AEMO must also ensure that bushfire risk is not applied to underwater or underground cables.

4.14 Hydrogen modelling

We strongly support the new inclusion of hydrogen modelling in the ISP.

For transportation demand, we note that ships and smaller vessels can be powered by hydrogen. A hydrogen-powered ferry is expected to go into use in Queensland in 2021.

4.14.3 Hydrogen infrastructure needs

We note that AEMO is mainly modelling a hydrogen production model where electricity is transported to the production site located in a port (Pathway 2 in Figure 51 of the Draft Report, p.177). AEMO indicates that in the future it will consider pathway 3, where a pipeline could transport hydrogen to a port.

We urge AEMO to consider pathway 4 (p.177) where electricity is generated near the hydrogen production facilities in a port. Developing offshore wind can facilitate this option as there are excellent offshore wind resources located near many major Australian export ports.

Electrolyser location and hydrogen export ports

We support the selection of the 10 candidate hydrogen export ports. However, we note that almost all these ports are adjacent to excellent offshore wind resources that have not been considered in the modelling. We urge AEMO to revisit its REZs and to include offshore wind in their modelling and assessment of potential REZs.

Workbook

The feedback below relates to the tabs of the IASR workbook provided with the consultation.

Capacity Factors

Under the tab for 'capacity factors', they are listed for each REZ. The Gippsland REZ is listed with a capacity factor of 31-35%, with no distinction between onshore and offshore capacity factors.

The capacity factor for offshore wind in Gippsland should be much higher than 35% – in the region of 45%-55%. The 2020 ISP projected the size of the resource to be 2GW onshore and 4GW offshore, so if only one capacity factor can be modelled then the offshore capacity factor should be used, as this is where the bulk of the resource is.

Alternately the onshore and offshore sections should be treated as separate REZs.

Recommendation: Capacity factors used for REZs in the ISP should reflect the differences between onshore and offshore wind.

Initial build limits

In the workbook tab for 'Initial build limits' for REZs in the NEM, the column for 'offshore' only includes 4,000 MW in Gippsland. This is not an accurate reflection of the potential for offshore wind in the NEM, but is a consequence of not properly assessing the contribution that offshore resources could make to the NEM.

Regional cost factor

Under the tab for 'regional cost factor', the column for offshore wind should reflect access to ports and the available space in ports. We have pasted below the information given in this column (Table 1).

We suggest this information be reviewed. We cannot see why there should be a higher cost to ports such as Newcastle and Port Kembla (NSW Low) than Geelong and Westernport (Vic Low). Newcastle is a large commercial port with significant available space and should be a low cost place for operations.

Table 1: IASR Workbook costs for offshore wind.

	Wind – Offshore
VIC Low	1.00
VIC Medium	1.03
VIC High	1.05
QLD Low	1.03
QLD Medium	1.11
QLD High	1.20
NSW Low	1.05
NSW Medium	1.12
NSW High	1.19
SA Low	1.01
SA Medium	1.08
SA High	1.16
TAS Low	1.02
TAS Medium	1.09
TAS High	1.15

Firm capacity

Under the tab 'firm capacity', the IASR workbook lists the 'peak contribution factor' for wind in different states (pasted below in Table 2). The workbook notes that 'Peak contribution factor refers to the percentage of total capacity expected to be available at the time of peak demand, as used to measure the available generation reserves in the capacity outlook model'.[39] It is notable that the numbers given for the contribution of wind to peak energy demand is quite low (7.5-13.8% for mainland Australia, except for 21.1% in Queensland), and solar is estimated at zero.

Table 2: IASR Workbook 'Peak Contribution factors' for renewable energy.

Wind and solar peak contribution factor[1,4]		
Generator	Summer[5]	Winter[6]
NSW wind, existing[2]	12.84%	12.71%
NSW wind, new entrant[2]	12.02%	13.06%
VIC wind, existing[2]	10.22%	7.80%
VIC wind, new entrant[2]	11.01%	10.31%
SA wind, existing[2]	14.10%	5.25%
SA wind, new entrant[2]	13.81%	7.49%
QLD wind[2,3]	12.51%	21.11%
TAS wind[2,3]	15.06%	12.72%
Solar[4]	0.00%	0.00%

Source: AEMO, IASR Workbook, 'Firm capacity' tab.

Offshore wind can be expected to make a significantly higher contribution to peak energy demand, and its peak contribution factor should be modelled separately and included in the ISP. The International Energy Agency say that the 'high capacity factors and seasonality of offshore wind means that 30% or more of its capacity can be counted towards reliability requirements, which is a higher percentage than for onshore wind and solar PV...This reduces the need for investment in other dispatchable capacity'.[40] These are exactly the whole-of system benefits that the ISP should be designed to identify.

Recommendation: The peak contribution factor for offshore wind should be modelled separately and included in the ISP.

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[39] It is further noted in the Workbook that it is calculated as the 85th percentile contribution of expected wind generation across seasonal peak periods, averaged over all reference years. Refer to AEMO's Market Modelling Methodology report for more information. For QLD and TAS, AEMO applies the New Entrant contribution to peak.

[40] International Energy Agency, *Offshore Wind Outlook 2019*, p.44.