AUSTRALIAN CONSERVATION FOUNDATION

16 FEBRUARY 2023

Submission to the Inputs, Assumptions and Scenarios Report

Analysing pathways to Australia's fast, cheap and sustainable zero carbon transition

Recommendations:

Recommendation 1: *Apply the following minimum baseline conditions to all scenarios:*

- *Policy alignment to at most a 2 degrees Celsius global warming limit, recognising that the Paris Agreement also commits signatories (including Australia) to pursue efforts to limit the rise to 1.5 degrees Celsius, and that this limit should occur before 2040.*
- *An expectation that the electricity sector reaches zero emissions around 2030.*
- *All existing and announced state and territory commitments on climate and electricity regardless of whether these are policies, plans or law.*
- *Adopt levels of transport electrification at least consistent with Australia's emissions projections 2022,[1] with battery electric to remain the dominant zero emissions transport technology.*
- *Recognise international net zero commitments by China, South Korea, Japan and the United States (under the incoming Biden Administration) as well as the existing commitments of the European Union and United Kingdom.*
- *Exclude carbon capture and storage (CCS) in electricity generation, given the technology is high cost, obsolete, and risky technology. Particularly given the cost of electricity from coal or gas power stations with CCS would be at least six times that from renewable energy sources.*2

Recommendation 2: *Develop at least one more scenario providing a pathway to limit global temperature increase below 1.5oC.*

Recommendation 3: *Update Green Energy Exports scenario to include broader renewable energy exports, low emission technologies including other energy-intensive products such as green steel, supporting stronger domestic economic outcomes, electrification including battery electric vehicles, improved energy performance, and not relying on green gas and offsets.*

Recommendation 4: *Update the modelling assumptions for the Orchestrated Step Change scenario to include expected growth in demand side participation.*

Recommendation 5*: Update the Diverse Step Change scenario to significantly reduce the reliance on biomethane to achieve our targets.*

[1] https://www.dcceew.gov.au/climate-change/publications/australias-emissions-projections-2022
[2] https://www.acf.org.au/reality_check_why_ccs_has_no_role_in_australias_energy_system

Recommendation 6: *Consider removing the Progressive Change scenario.*
Recommendation 7: *Develop a new 1.5oC scenario with modelling assumptions that include staffing, manufacturing, import and supply chain constraints.*
Recommendation 8: *Analyse the risk and impact of underinvestment and consequent delays to transmission build in achieving Australia's decarbonisation targets.*
Recommendation 9: *Include recently announced federal, state and territory renewable energy and emission reduction targets.*
Recommendation 10: *Ensure modelling assumptions only include hydrogen been used for hard to abate sectors.*
Recommendation 11: *Include analysis of leakage and global warming contribution of that leaked hydrogen.*
Recommendation 12: *reduce the amount of assumed hydrogen fuel cells for transport, particularly for light vehicle and buses.*
Recommendation 13: *Complete a strong electrification sensitivity to model the impact of delays in transmission build on the scenarios.*
Recommendation 14: *Include updated EV sales projections form the most recent Australia's emissions projections report,*[3] *or any updates in the soon to be released National Electric Vehicles Strategy.*
Recommendation 15: *Prioritise modelling for solar or renewable powered products and commodities such as green steel, aluminium, refining other metals and advanced manufacturing, to become a renewable export superpower.*
Recommendation 16: *Integrate resilience and climate adaptation across all IASR scenarios beyond temperature to considering all hazards, including forecasts of cost of preparedness and recovery to climate change.*

Introduction

The Australian Conservation Foundation (ACF) welcomes the opportunity to comment on AEMO's draft 2023 Inputs, Assumptions and Scenarios Report, which will be used in AEMO's forecasting and planning publications for the National Electricity Market (NEM).

ACF is Australia's national environment organisation. We are 700,000 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.

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.

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.

[3] https://www.dcceew.gov.au/climate-change/publications/australias-emissions-projections-2022

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 2022 report[4] 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'll likely be closer 32% (but excludes the safeguard mechanism (SGM) and the target of 82% clean energy target). Including these, assuming the SGM excludes coal and gas and offsets, gets us to a 41% reduction by 2030. Other policies that directly impact the electricity system being consulted on but not confirmed, such as the National Electric Vehicle Strategy and the National Reconstruction Fund, 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.

AEMO's Integrated System Plan (ISP) provides a key roadmap to help inform and prioritise necessary investment and ensure a smooth transition to a clean energy system in Australia. ACF is very supportive of AEMO's efforts related to the ISP including forecasting and planning and consulting widely on inputs and assumptions. 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 and achieve our climate ambitions, and to ensure that the Australian energy system is fit for purpose. We do, however, caution against relying heavily on existing gas networks, hydrogen, biomethane and offsets to achieve our climate targets. The inclusion of carbon capture and storage (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.

Scenario Development

Recommendation 1: Apply the following minimum baseline conditions to all scenarios:

- ***Policy alignment to at most a 2 degrees Celsius global warming limit, recognising that the Paris Agreement also commits signatories (including Australia) to pursue efforts to limit the rise to 1.5 degrees Celsius, and that this limit should occur before 2040.***
- ***An expectation that the electricity sector reaches zero emissions around 2030, while protecting nature.***
- ***All existing and announced state and territory commitments on climate and electricity regardless of whether these are policies, plans or law.***

[4] https://www.dcceew.gov.au/climate-change/publications/australias-emissions-projections-2022

- ***Adopt levels of transport electrification to be at least consistent with Australia's emissions projections 2022,[5] with battery electric to remain the dominant zero emissions transport technology.***
- ***Recognise international net zero commitments by China, South Korea, Japan and the United States (under the incoming Biden Administration) as well as the existing commitments of the European Union and United Kingdom.***
- ***Exclude carbon capture and storage (CCS) in electricity generation, given the technology is high cost, obsolete, and risky technology. Particularly given the cost of electricity from coal or gas power stations with CCS would be at least six times that from renewable energy sources.[6]***

Recommendation 2: Develop at least one more scenario providing a pathway to limit global temperature increase below 1.5oC.

ACF believes the current scenario assumptions do not adequately reflect existing, committed, and likely programs and policies, nor a fair and sustainable development path for Australia's energy system. The scenarios are set (in terms of their narrative), but force outcomes that may not reflect the narrative (i.e. they're internally inconsistent), such as cheaper electrification being superseded by hydrogen. As such, the pathway chosen is unlikely to be economically efficient, a stated objective of the scenarios.

The scenarios in the IASR are based on targets that aim to keep average global temperature increases below certain levels (i.e. below 1.5oC, 1.8oC or 2.6oC depending on the scenario), and that these are to be reached by the end of the century. However, under the Paris Agreement, Australia has committed to limiting global temperature rise to 2 degrees Celsius, and pursuing efforts to limit the rise to 1.5 degrees and the IPCC Special Report on Global Warming of 1.5ºC[7] suggests we will reach 1.5 degrees by around 2040. Achieving this by the end of the century would mean exceeding it and returning to this level later in the century, after many climate impacts have been felt.

Despite this, only one scenario reaches 1.5oC and it is not plausible. Having only one 1.5oC scenario misses the opportunities of the scenario process of analysing different 1.5 degree pathways, including social and economic impacts, impacts on social licence and potential policy developments, and the investment pathways required.

[5] https://www.dcceew.gov.au/climate-change/publications/australias-emissions-projections-2022
[6] https://www.acf.org.au/reality_check_why_ccs_has_no_role_in_australias_energy_system
[7] https://www.ipcc.ch/sr15/chapter/spm/

Scenario modelling by ClimateWorks Australia (2020)[8] indicates that this commits Australia to achieving net zero emissions economy-wide by 2035 (1.5 degrees) or 2050 at the latest (2 degrees). It is important to note that achieving net zero emissions economy-wide requires the electricity sector to achieve zero emissions much earlier. For example, scenarios for 2 degrees Celsius by ClimateWorks Australia (2020) indicate that the electricity sector would reach near zero emission by 2035. The scenarios should recognise the global average temperature goals should be reached much earlier than the end of the century. In addition, the CWA 1.5oC scenario relies on CCS. The AEMO 1.5oC scenario should aim to remain below 1.5oC without, i.e. with real reductions.

At a high level, it cannot be assumed that climate action correlates with economic growth as suggested in the 4 scenarios. We can decarbonise and moderate, stop, or reverse growth in sectors we wish to manage. These are all value choices and potential outcomes with or without economic growth. That is, even with economic growth, we need deliberate policies and programs for decarbonisation and improved equity, and not just rely on economic growth.

It is noted that the 2023 IASR scenarios do not include the *Slow Change* scenario found in the previous 2022 ISP as the federal government has since legislated for a 43% emission reduction by 2030. We also note that at least 43% emissions reduction by 2030 is modelled in each scenario. These targets are based on getting Australia to contribute fairly to keeping warming below 2.0oC. As noted, greater ambition is required to keep us below 1.5oC of warming. As such, it is plausible that ambition will be increased between now and 2030, and highly likely after 2030 on our journey to net zero by 2050. As such, while we acknowledge *Slow Change* is no longer relevant, scenario modelling should include higher emission reduction targets.

Green Energy Exports

Recommendation 3: Update Green Energy Exports scenario to include broader renewable energy exports, low emission technologies including other energy-intensive products such as green steel, supporting stronger domestic economic outcomes, electrification including battery electric vehicles, improved energy performance, and not relying on green gas and offsets.

This scenario is the closest to the 2022 ISPs *Hydrogen Export* scenario, and is the only scenario that aims to achieve keeping warming below 1.5°C. It includes high electrification, yet states that many homes and businesses delay the switch to electricity for their heating requirements, relying instead on alternative

[8] https://www.climateworkscentre.org/resource/decarbonisation-futures-solutions-actions-and-benchmarks-for-a-net-zero-emissions-australia/

gases (such as hydrogen and/or biomethane). Twice as much biogas is used in the *Green Energy Exports* scenario (than even *Diverse Step Change*). The pace and scale of electrification in the residential sector is assumed to be similar or less than other scenarios, yet aims to reach 1.5oC. Having both high electrification and fuel switching to hydrogen and biomethane means this scenario will not assist in real world planning for an energy system contributing to our carbon targets, its stated climate outcome of limiting warming to 1.5oC, and is therefore internally inconsistent. The assumptions around hydrogen and biomethane in this scenario are also unlikely to win social license.

The *Green Energy Exports* scenario includes unlimited blending of hydrogen in gas networks, with up to 10% blending of hydrogen in gas networks in all other scenarios. This is unnecessary and implausible for a 1.5oC scenario, where electrification with renewables is more realistic. Renewable hydrogen is needed for hard to abate industries, such as replacing coking coal in steel-making and gas in the making of fertilisers. It may be possible to have a low and high hydrogen scenario.

It seems highly improbable that hydrogen will replace gas in households considering the cost of the fuel itself, and the cost of the infrastructure to transport it and the doubling up of service charges for households. Scenarios are for probable futures, household hydrogen for cooking or heating is not one of them. In relying on hydrogen and biomethane, this scenario fails to model the cost of gas network, plant and other machinery upgrades, which is likely to be extremely expensive. Such a development path would also disadvantage renters and low-income households. These assumptions are inadvisable and inherently implausible. This scenario could include policies to incentivise mid-scale renewable energy developments, that may reduce the need for transmission. It is unclear if this is already the case and assumed to be included in behind the meter installations.

Orchestrated Step Change

The Orchestrated Step Change scenario aims to keep global temperature below 1.8°C. ACF believes this is the mostly likely scenario as the *Green Energy Exports* scenario assumptions are implausible, even though *Green Energy Exports* is the only scenario achieving 1.5oC warming. This tells us greater ambition is needed.

Recommendation 4: Update the modelling assumptions for the Orchestrated Step Change scenario to include expected growth in demand side participation.

This scenario also makes use of land-use sequestration offsets to manage sectors. These should be limited to 5% of emission reductions for specific industries that are harder to decarbonise, meaning low emissions technologies, energy efficiency and demand side participation need to be strengthened to fit the current high electrification narrative. ACF supports the assumed scale of NEM-connected hydrogen production being limited, and would encourage its use by hard to abate sectors as an input.

This scenario could also include policies to incentivise mid-scale renewable energy developments (10kw-30MW), that may reduce the need for transmission. Noting this is assumed to be included in behind the meter installations, it is unclear how much mid-scale renewable energy there is and what distribution.

Diverse Step Change

Recommendation 5: Update the Diverse Step Change scenario to significantly reduce the reliance on biomethane to achieve our targets.

This scenario is about exploring alternatives to electrification and leads to 1.8°C of warming. The scenario includes a 7.5% biomethane blending target for reticulated gas by 2030 and 10% by 2035. It is unclear what the justification is for biomethane having such a strong role to play in this scenario (and across remaining scenarios) without a credible technical path for availability at the scales proposed.

In addition, the scenario relies on subsidies to enable higher production. Such subsidies are unlikely to be implemented with the current and proposed funding sources, such as the National Reconstruction Fund, and is unlikely to receive social license.

While biomethane blending reduces the emissions intensity of molecular energy use, it is unlikely to be sufficient to achieve the decarbonisation needed. The scenario also involves strengthening the role of the gas network during the transition and slowing the pace of electrification investments outside the transport sector. We need to opposite, even to achieve the relatively modest 1.8oC target.

Section 5.22.2 of the National Electricity Rules (NER) furthermore, states that "The purpose of the *Integrated System Plan* is to establish a whole of system plan for the efficient development of the power system *that achieves power system needs* for a planning horizon of at least 20 years for the long term interests of the consumers of electricity", and…"In determining *power system needs*, as it relates to a NEM participating jurisdiction, AEMO may consider a current environmental or energy policy of that participating jurisdiction where that policy has been sufficiently developed to enable AEMO to identify the impacts of it on the power system and at least one of the following is satisfied:

(1) a commitment has been made in an international agreement to implement that policy;
(2) that policy has been enacted in legislation;
(3) there is a regulatory obligation in relation to that policy;
(4) there is material funding allocated to that policy in a budget of the relevant participating jurisdiction; or
(5) the MCE has advised AEMO to incorporate the policy."

As such, it is unlikely that including biomethane satisfies the criteria of section 5.22.3(b) of the NER in determining power system needs, and nor do the scenarios clarify how such a scale of biomethane development will be achieved or what would drive their development.

Progressive Change

Recommendation 6: Consider removing the Progressive Change scenario.

Recommendation 7: Develop a new 1.5oC scenario with modelling assumptions that include staffing, manufacturing, import and supply chain constraints.

The underlying policy settings of *Progressive Change* scenario are inconsistent with existing announced, funded, and legislated policies of state and federal governments. We also need to ensure we are well below the 2.6ºC outcome. Both the EU and US are exerting strong international pressure for Australia to raise it climate ambition, as does the broader Australian community. This scenario does not satisfy the *plausible* criteria for scenario development.

The scenario assumes 0% growth in demand-side participation (DSP), even though there is an ongoing federal National Energy Performance Strategy (NEPS) process that is likely to lead to significant DSP. Many distribution network companies are also looking at including tariffs and demand management options in their network pricing options. While currently too early to be included, we are also expecting the announcement of an electrification package in the May 2023 budget that will enable DSP.

There are also strong indicators that many organisations in the global investor community are moving increasingly away from fossil fuels and toward clean technologies to avoid future climate risks (i.e. risks that have been communicated clearly by Australia's financial regulators). For example, Climate Action 100+,[9] whose signatories include more than 700 investors, managing around $US68 trillion, engaging 166 large companies representing 80% global industrial emissions, are using their financial power to pressure the world's biggest polluting companies to reduce emissions and address climate risk—including in Australia. Their members include Australian institutional investors and some of the largest institutional investors in the world. The increasing flow of finance and investment to clean technologies adds a further reason why slow growth/low decarbonisation appears implausible.

[9] https://www.climateaction100.org/

Missing from the scenarios is a "worst case" scenario under current policy settings, while maintaining some target outcomes, such as staying below 1.5oC of warming. Such a scenario would provide insights regarding the spread of reliability risks in the energy transition, and opportunities for addressing them.

The world is still recovering from COVIDs economic impacts, with many countries also decarbonising at the same time creating competition, and global geo-political events such as Russia's invasion of the Ukraine having impacts on trade. There is, therefore, still value in analysing a 1.5oC scenario with tight supply chains.

Even with state and federal governments announcing new money for manufacturing, it will take time to upscale low emission technology manufacturing and installation, including wind, solar, energy efficiency plant, appliance, and materials. According to many stakeholders, including the IPCC,[10] remaining below 1.5oC is not possible without degrowth (as distinct from collapse). There are also risks of import and manufacturing supply chain constraints for low emission technologies, electric vehicles and no bans on ICE engine sales. Australia may also fail to access trained staff or being outcompeted in terms of accessing staff and investment.[11] New manufacturing needs to embed circular economies, more resilience goods, and reparable manufacturing. There is also a risk that failure to achieve social licence significantly hinders or slows much of the rewiring the nation.

Matters for consultation

Does the draft 2023 IASR scenario collection adequately enable AEMO to sufficiently test the risks of over-and under-investment in the power system in the Integrated System Plan?

Do the scenario names provide improved clarity regarding their drivers and potential use?

Recommendation 8: Analyse the risk and impact of underinvestment and consequent delays to transmission build in achieving Australia's decarbonisation targets.

There is significant risk that underinvestment will occur using the existing IASR scenarios. Poor assumptions in the modelling, including inadequate electrification, heavy reliance on capture and storage and offsets, means AEMO will fail to test real world pathways to achieve 1.5oC limits to warming. Because of the shortcomings of the scenario as presented above, there are existing and significant potential risks that may not be captured, including but not limited to:

[10] https://www.ipcc.ch/report/ar6/wg3/

[11] https://www.pv-magazine-australia.com/press-releases/bidens-clean-energy-arms-race-puts-australian-economy-on-the-back-foot/

- Hydrogen and biogas not playing as significant a role as expected.
- Not earning social licence around community expectations (especially around actual emission reductions and decarbonisation).
- Inaccurate assumptions around state-based energy efficiency and performance programs, including electrification, leaving generation and transmission build cost gaps.

Strong electrification is needed, and this will require significant transmission investment to support increased demand, and the generation that must be connected at scale. Without electrification sensitivity analysis, the IASR and ISP risk significant under investment. It is necessary to model the impact of underinvestment and consequent delays to transmission build in achieving Australia's decarbonisation targets.

Public policy settings

ACF broadly supports the public policy settings included in the IASR and the ISP. There are however a few existing omissions and policies that may be relevant. The federal government's climate ambition has increased and there are a number of policy development processes in train, and it can be expected that this will enable higher climate ambition from some states. It could, for example be assumed that Queensland will increase its own ambition to at least match that of the federal government, or that the National Energy Performance Strategy and the National Reconstruction Fund could be leveraged by states to raise their own ambitions.

Similarly, a number of existing or proposed state and federal programs have not been included in the IASR's base-case policy assumptions. These should be included in all scenarios, and include:

- State based manufacturing funding, such as the Queensland Manufacturing Hubs[12] funding
- The Capacity Investment Scheme, including its $10B underwriting to procure at least 6 GW new renewable resources.[13]
- National Reconstruction Fund
- Powering the Regions Fund

[12] https://www.rdmw.qld.gov.au/regional-development/mhgp
[13] https://www.energy.gov.au/news-media/news/capacity-investment-scheme-power-australian-energy-market-transformation

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Targets

Recommendation 9: Include recently announced federal, state and territory renewable energy and emission reduction targets.

The minimum policy settings applied across all scenarios should recognise that all Australian states and territories have also made public commitments to reach net zero emissions by 2050 (the Australian Capital Territory aims to achieve this in 2045).

Both the federal government and states have existing targets that appear not to have been included in the IASR's base-case policy assumptions. These include:

- The federal governments' 82% renewables by 2030 government target is noted (S3.1), but does not appear to be in the modelling. This is a significant target that underpins and guides federal government funding decisions.
- Victoria's legislated targets for emissions reductions, including the 75-80% target (from 2005 levels) by 2035 across all scenarios.
- NSW's stated target of reducing economy-wide emissions by 70% (from 2005 levels) by 2035.
- South Australia's target for 100% Renewables by 2030, and 500% renewable energy by 2050.

Hydrogen

Recommendation 10: Ensure modelling assumptions only include hydrogen been used for hard to abate sectors.

It is inefficient to blend hydrogen in gas networks, as is updating the existing gas network and appliances to handle the expected blends of hydrogen, requiring large amounts of the gas network to be essentially rebuilt from scratch. Green hydrogen should only be used for harder to abate processes and sectors, and should be renewably produced on-site where possible. Electrification should be encouraged wherever it is practicable.

Recommendation 11: Include analysis of leakage and global warming contribution of that leaked hydrogen.

While having a lower impact than fugitive emissions from methane industry today, the draft IASR neglects to consider the Global Warming Potential (GWP) of hydrogen, nor the fact that hydrogen is a small molecule with high potential to escape or leak into the atmosphere (fugitive emissions). While hydrogen has a short atmospheric lifetime, transition to hydrogen will be rapid at the same time we need rapid decarbonisation, meaning its GWP over a short period is significant. It cannot plausibly limit global temperature increase below 1.5oC.

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Hydrogen Transport

Recommendation 12: reduce the amount of assumed hydrogen fuel cells for transport, particularly for light vehicle and buses.

Section 2.2.1 suggests high numbers of hydrogen fuel cells for transport in the *Green Energy Exports* scenario. However, hydrogen is unlikely to outcompete battery electric technology in transport for most light vehicle and bus applications. The cost, complexity, timeframes and market for hydrogen vehicles makes the role of hydrogen in transport uncertain and unlikely to significantly affect uptake of battery EVs. Battery electric vehicle technologies are likely to dominate, particularly in light vehicles and buses given the existing and increasing uptake, market and cost reductions.

In contrast hydrogen transport faces a number of barriers such as cost, complexity, inefficiency and timeframes involved in the hydrogen supply chain. Hydrogen transport may play a larger role for long haul transport. This view has been backed by analysts including those at BNEF, which concluded that "the bulk of the car, bus and light-truck market look set to adopt [battery electric technology], which are a cheaper solution than fuel cells."[14]

Carbon Sequestration and Offsets

Table 11 and Figure 3 of the draft IASR demonstrate that land-based carbon sequestration is assumed to implemented at unrealistic levels in all scenarios, particularly the only 1.5°C aligned *Green Energy Exports* scenario. This would again represent under investment of what is needed in the real world. In assuming such high levels of offsetting and carbon capture and storage, AEMO is suggesting that large parts of the Australian economy will fail to decarbonise (even by 2050), requiring significant offsets. These are technically unlikely, not to mention that actual emissions sooner is what is required.

Higher global investment or uptake of carbon capture and storage (CCS) in the power sector is implausible.

[14] https://theconversation.com/hydrogen-cars-wont-overtake-electric-vehicles-because-theyre-hampered-by-the-laws-of-science-139899

- Economic analysis of CCS related to the power sector by Associate Professor Bruce Mountain of the Victoria Energy Policy Centre at Victoria University shows clearly why CCS is implausible. The analysis[15] concluded that adding CCS to electricity generation in Australia would:
  - More than double the capital outlay for coal-fired power stations.
  - Cost even more for gas generators than coal generators.
  - Increase the cost of electricity by between $90 and $125 per megawatt hour.
  - Likely cost at least six times as much as wind generation plus storage, with comparable dispatchability.

- CCS for power generation is largely obsolete worldwide despite significant industry and government funding. It is unlikely to ever be cost competitive for power generation, particularly given the strong global uptake and significant cost reductions for renewable energy technologies.

Energy Performance

Energy performance refers to energy efficiency, electrification, fuel switching, and behaviour. That is any demand side participation (DSP) more broadly. The IASR uses the NEM Electricity Statement of Opportunities (ESOO), which uses existing and committed DSP only, representing the current level with adjustments for committed changes to DSP as reported to AEMO through the DSP IP, or through policy targets with supporting legislation implemented.

Electrification

Recommendation 13: Complete a strong electrification sensitivity to model the impact of delays in transmission build on the scenarios.

Strong electrification sensitivity in the 2021 IASR[16] targeted the decarbonisation ambition of the 1.5oC *Hydrogen Superpower Scenario*, demonstrating that early investment is necessary to achieve the tighter carbon budgets of that scenario (and also what climate science demands). At minimum, a "strong electrification" sensitivity should be included in a 1.5oC scenario to consider the planning implications of a future that has a high decarbonisation ambition, and that this should include high energy efficiency (any electrification should include high energy efficiency).

[15] https://www.acf.org.au/coal_or_gas_plus_carbon_capture_costs_six_times_more_than_wind_plus_battery_storage_new_report

[16] https://aemo.com.au/-/media/files/major-publications/isp/2021/2021-inputs-assumptions-and-scenarios-report.pdf

Recommendation 14: Include updated EV sales projections form the most recent Australia's emissions projections report,[17] or any updates in the soon to be released National Electric Vehicles Strategy.

The high level of carbon sequestration currently in the 1.5oC scenario demonstrates the level of electrification required, including higher levels of transport electrification. The most recent *Australia's emissions projections report* (Australian Government 2022)[18] expects electric vehicles to make up 23 per cent of new light duty vehicle sales by 2030 (around 7 per cent of the total vehicle stock), 44% in 2035 (around 14 per cent of the total vehicle stock), (not taking account of potential new policies under the National Electric Vehicle Strategy (NEVS)). We note that the 2022 projections report reports that transport emissions have increased and EV sales projections have decreased since the 2021 projections report, likely from supply chain issues, but also from improved data analysis.[19] These projections should be included across all scenarios, and updated with any projections under the NEVS or improved fuel efficiency if introduced. These concerns also speak to the need for a scenario that includes potential supply chain constraints for EV production and/or import.

Exports

Recommendation 15: Prioritise modelling for solar or renewable powered products and commodities such as green steel, aluminium, refining other metals and advanced manufacturing, to become a renewable export superpower.

The *Green Energy Exports* scenario relies more on biogas and hydrogen than other scenarios, explicitly including fossil hydrogen, than it does on energy efficiency and electrification to stay aligned with a 1.5°C goal. More broadly, it should be noted that there is a wide range of opportunities for Australia to become a renewable export superpower that are deserving of attention. Renewable hydrogen exports – while an enormous opportunity – are not the only option for Australia to become a renewable export superpower. For example, WWF Australia has identified six types of opportunities[20], and has concluded that 'based on the engineering, economics and market sizes of these opportunities, solar or renewable powered products and commodities such as green steel, aluminium, refining other metals and advanced manufacturing represent the biggest renewable export opportunities for Australia.'

[17] https://www.dcceew.gov.au/climate-change/publications/australias-emissions-projections-2022
[18] Ibid.
[19] https://reneweconomy.com.au/labor-isnt-rising-to-the-climate-occasion-their-own-projections-prove-it/
[20] https://www.wwf.org.au/ArticleDocuments/353/WWF_Renewable_policy_final_ver2.pdf.aspx?OverrideExpiry=Y

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Climate Impacts

Recommendation 16: Integrate resilience and climate adaptation across all IASR scenarios beyond temperature to considering all hazards, including forecasts of cost of preparedness and recovery to climate change.

Climate impacts appear to be only considered through the impact of temperature increase, and fails to account for the variety in which climate change will affect the power system, such as floods or fire. Investment decisions taken without considering the impact of climate change runs the risk of being vulnerable to it.

In the same way that not planning for climate mitigation makes for a disorderly transition with consequences for all power system stakeholders, not planning for climate change impacts makes for increased cost in recovery rather than a fraction of the cost in preparedness.

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