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Australia Needs 1.5°C Aligned National Energy Pathways

Lack of a comprehensive energy transition strategy creates confusion among stakeholders

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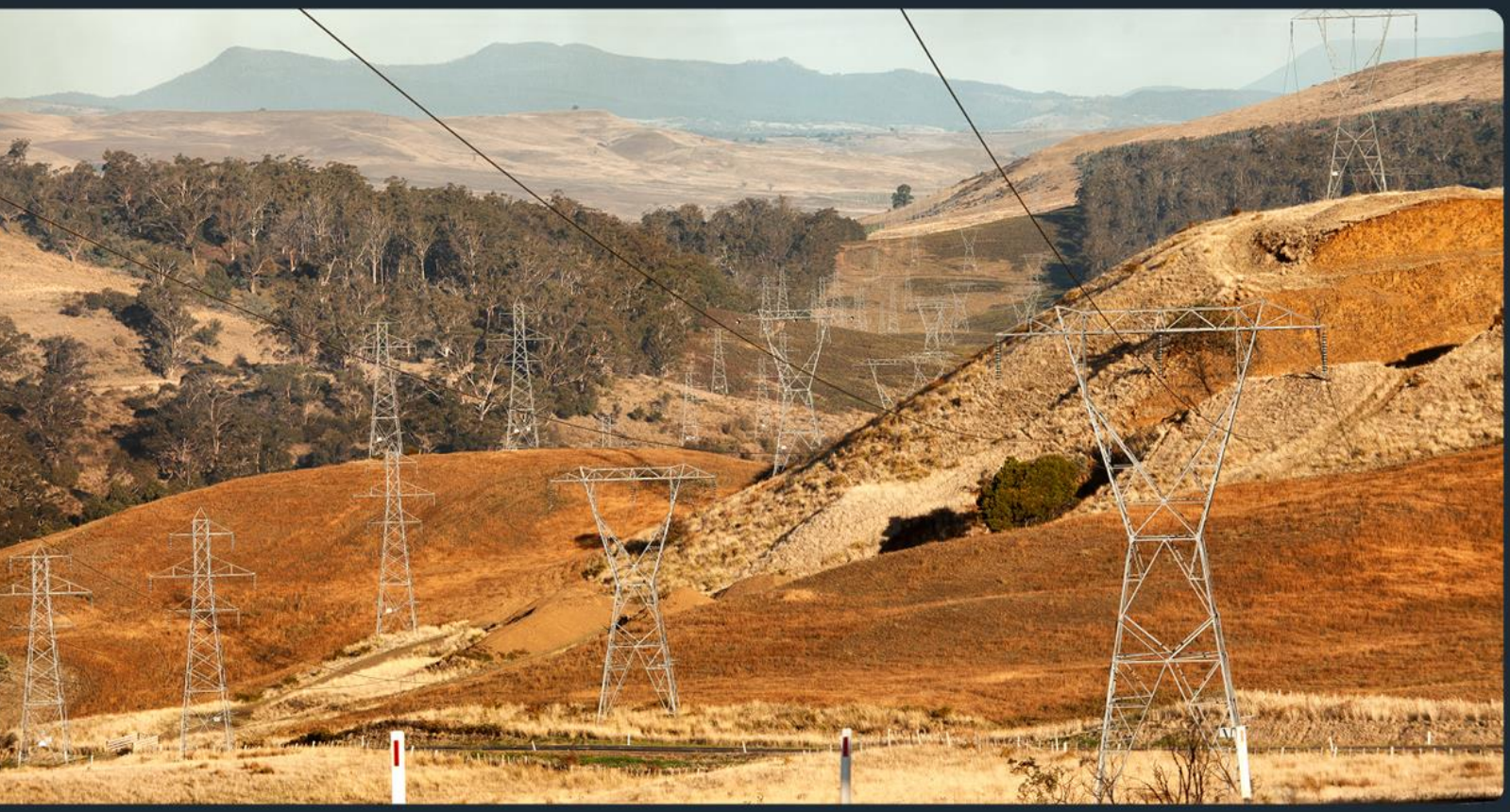

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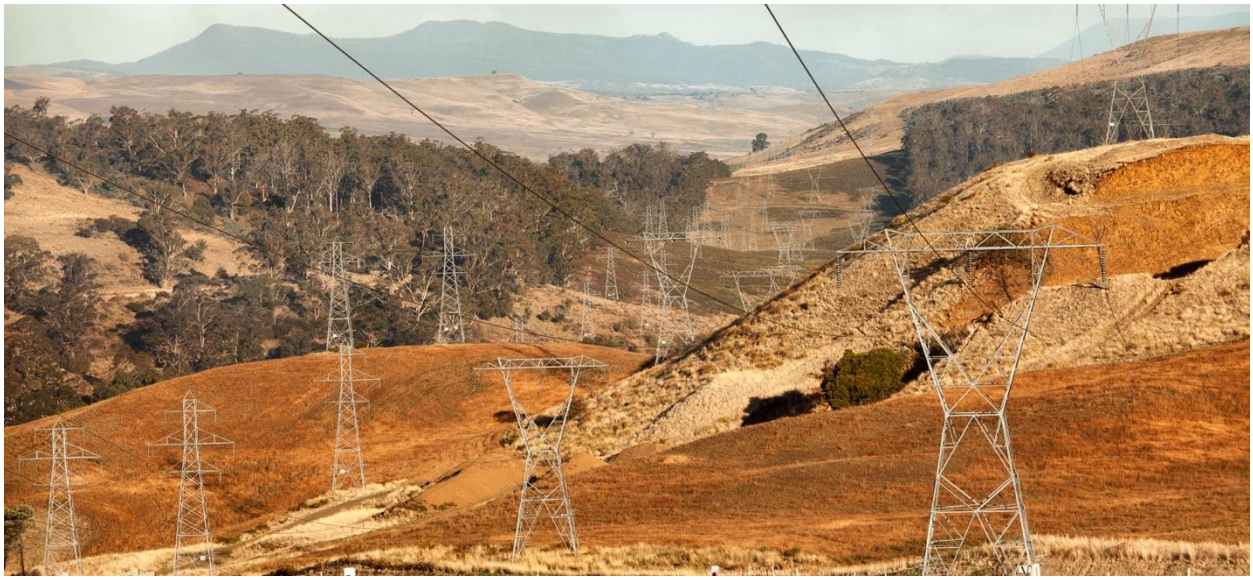
Key Findings

The Australian government has objectives that contradict each other, and lacks a comprehensive plan for how it will achieve its emissions reduction goals.

AEMO's scenarios are used as a de facto plan, but do not meet several of the government's objectives and state targets, and make questionable assumptions and choices.

Australia needs 1.5°C national energy pathways that look at the energy transition in an integrated way across fuel types, sectors and solutions.

In the absence of shared national energy pathways, the left hand of the government doesn't know what the right hand is doing.

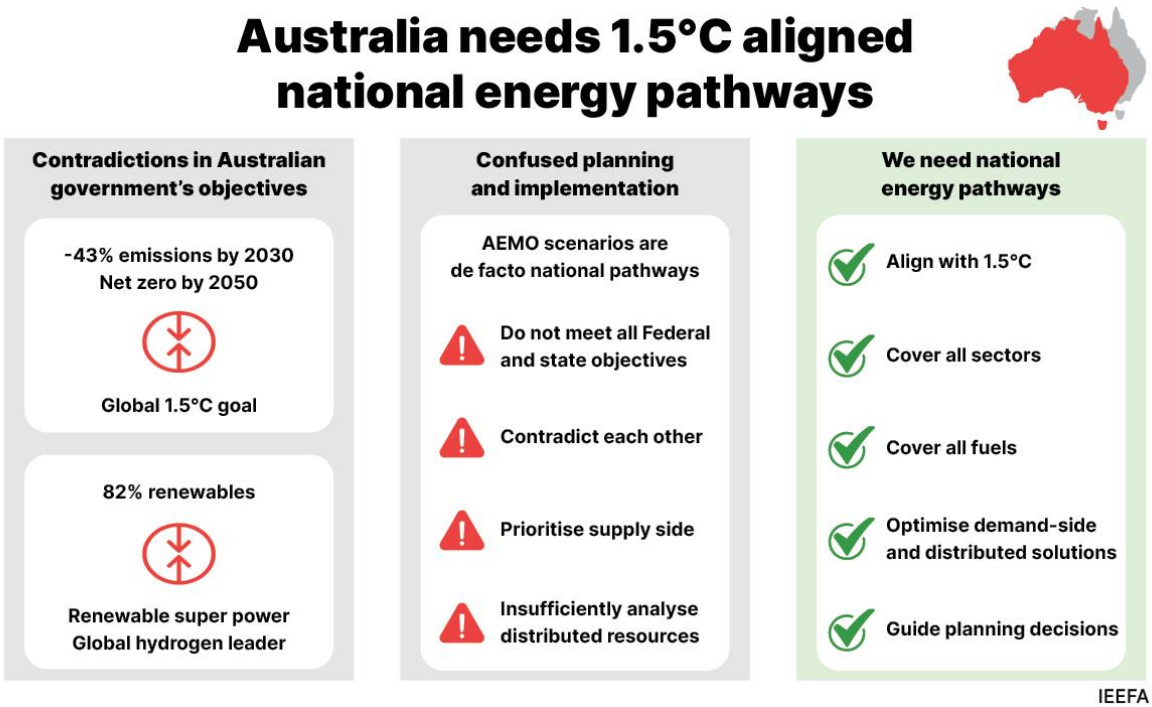


Executive Summary

The Australian government has made a clear commitment to the global goal of limiting global warming below 1.5°C. To support this objective, Australia has set emissions reduction and renewable electricity generation targets. However, it has no comprehensive plan for how it will achieve those targets, and some internal inconsistencies between different government objectives are creating confusion when it comes to implementation.

In the absence of a comprehensive plan, the Australian Energy Market Operator's (AEMO) scenarios are used by many to support planning and investment decisions. However, the scenario presented as most likely only meets some but not all of the government's objectives and doesn't meet Victoria's emissions reduction targets. Its electricity and gas scenarios also materially contradict each other, and AEMO's choice of assumptions has been questioned by clean energy investors. The current piecemeal approach appears to prioritise supply-side solutions over demand-side solutions, and does not sufficiently analyse the potential impact and value of distributed resources.

Australia needs 1.5°C national energy pathways that look at the energy transition in an integrated way across fuel types, sectors and solutions. The pathways should investigate a wide range of possible outcomes – clearly identifying where solutions are preferable, and exploring alternatives where large amounts of uncertainty exist. The pathways should support planning decisions, and make recommendations on which new supply projects are essential, on timelines for phasing out key infrastructure assets, and on priority usage for scarce resources. This should include both domestic energy requirements as well as export-focused projects.



Internally inconsistent objectives, and some big areas of uncertainty

A clear commitment to 1.5°C by the Australian government

Australia is a party to the Paris Agreement,[1] a legally binding international treaty on climate change that came into force in November 2016. The objective of the agreement is to "[hold] the increase in the global average temperature to well below 2°C above pre-industrial levels and [pursue] efforts to limit the temperature increase to 1.5°C above pre-industrial levels".[2]

Since then, the UN's Intergovernmental Panel on Climate Change (IPCC) has stressed the importance of the 1.5°C goal, given that "every increment of global warming will intensify multiple and concurrent hazards".[3] In response, G20 leaders, including Australia, recognised the importance of the 1.5°C goal, and committed to accelerating their actions to achieve global net zero emissions by around 2050 in line with this objective.[4] The Australian government also describes the goal of the Paris agreement as limiting global warming to 1.5°C in its 2022 Climate Change Statement.[5]

Emissions reduction targets incompatible with the 1.5°C goal

Australia has now legislated both a net zero emissions target by 2050 and a target to reduce emissions by 43% on 2005 levels by 2030.[6] These targets are inconsistent with the 1.5°C goal.

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The International Energy Agency (IEA) developed a Net Zero Emissions by 2050 scenario, which shows how the global energy sector can achieve an orderly transition to net zero CO2 emissions. It gives a 50% probability of achieving the global goal of 1.5°C with no or low overshoot.[7] This

[1] Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW). International climate action.
[2] United Nations Framework Convention on Climate Change (UNFCCC). The Paris Agreement.
[3] Intergovernmental Panel on Climate Change (IPCC). AR6 Synthesis Report – Headline statements. 2023.
[4] G20. Rome leaders' declaration. October 2021. Page 8.
[5] DCCEEW. Annual Climate Change Statement 2022. 2022. Page 13.
[6] Ibid. Page 14.
[7] International Energy Agency (IEA). Net Zero Emissions by 2050 Scenario (NZE). 2022.

scenario shows that to achieve this goal, global CO2 emissions need to decrease by about 35% by 2030 compared with 2010 and reach net zero by 2050.[8] However, developed economies need to exceed the global average in emissions reductions: reducing by about 60% by 2030 compared with 2010 and reaching net zero by about 2045.[9] For Australia, this would also mean a 60% emissions reduction by 2030 compared with 2005.[10]

The federal government has not published advice on how its climate targets align to particular temperature outcomes. However, multiple studies looking at an Australia-specific 1.5°C carbon budget and trajectory found that Australian emissions would need to decrease emissions by 67-74% by 2030 compared with 2005 and reach net zero emissions by about 2035 to 2038 in order to be aligned with the global 1.5°C goal.[11,12]

Australia's hydrogen ambitions seem misaligned with its electricity sector targets

The Australian government committed to an 82% national renewable electricity target by 2030. Despite not setting a specific target related to hydrogen production, the government has recently restated an ambition to "be a global hydrogen leader by 2030 on both an export basis and for the decarbonization of Australian industries".[13] While the potential for direct hydrogen exports has been questioned due to its physical properties,[14] recent analysis confirms that Australia has a high potential for hydrogen-based exports such as green iron.[15] The government also provided A$2 billion in the 2023-24 budget for the new Hydrogen Headstart program, to accelerate the development of Australia's hydrogen industry in line with its vision of being a Renewable Energy Superpower.[16]

The Australian Energy Market Operator's (AEMO) scenarios suggest that those objectives are at odds with each other. AEMO modelled four future scenarios for the National Energy Market (NEM) as part of its 2022 Integrated System Plan (ISP). The scenario it presents as most likely is *Step Change*.[17] That scenario achieves the government's 82% renewable electricity target by 2030-31.[18]

[8] IEA. Net Zero Emissions by 2050 Scenario (NZE). Figures and data by Chapter – Chapter 2. Figure 2.2. 2022.
[9] Ibid.
[10] IEEFA calculations based on: DCCEEW. Australia's National Greenhouse Accounts. Emissions inventories. Paris Agreement inventory.
[11] Climateworks Australia. Decarbonisation Futures: Solutions, actions and benchmarks for a net zero emissions Australia. March 2020. Pages 13-14.
[12] Climate Resource. Updated assessment of Australia's emission reduction targets and 1.5°C pathways. June 2023. Page 4..
[13] DCCEEW. Australia's National Hydrogen Strategy .
[14] BloombergNEF. Liebreich: The Unbearable Lightness of Hydrogen. December 2022.
[15] EY. Seizing Australia's energy superpower opportunities. April 2023. Page 8.
[16] DCCEEW. Powering Australia.
[17] Australian Energy Market Operator. 2022 Integrated System Plan (ISP). 2022. Page 33.
[18] Ibid. Page 45.

However, it only includes a limited amount of hydrogen produced for domestic decarbonisation purposes, and no hydrogen to support renewable exports.[19] The *Hydrogen Superpower* scenario, the only in which high levels of hydrogen production are targeted at exports (directly or indirectly via green steel production) requires a higher share of renewable electricity by 2030.[20]

Most importantly, AEMO's scenarios show that not only the share of renewables matters, but also their volume. Indeed, the *Hydrogen Superpower* scenario has nearly twice as much large-scale wind and solar capacity by 2030 and four times as much by 2050 as the *Step Change* scenario.[21] Leaving such a vast level of ambiguity on the volume of renewables build-out required to achieve the government's ambitions could create issues when it comes to planning supply chain and other requirements.

Many remaining areas of uncertainty

The government hasn't articulated how it will achieve the 43% emissions reduction target by 2030: what contribution is expected from different sectors and levers, and how it all adds up to a consistent national pathway.[22]

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The only other sector-specific target adopted by the government is the declining cap on Australia's largest industrial emitters leading to net zero, which was recently added to the Safeguard Mechanism.[23]

The government has expressed its interest in a number of areas without adopting specific targets:

- The country's hydrogen ambition is not accompanied by any target of domestic hydrogen production;

[19] Ibid. Page 31.
[20] Australian Energy Market Operator. 2022 Integrated System Plan (ISP). 2022. Page 45. Figure 16.
[21] IEEFA calculations based on: Australian Energy Market Operator. 2022 Integrated System Plan (ISP). Generation Outlook. 2022.
[22] DCCEEW. Australia's energy strategies and frameworks. National Energy Performance Strategy. 2023.
[23] DCCEEW. Safeguard Mechanism Reforms factsheet. May 2023. Page 2.

- Australia joined the Global Methane Pledge, which aims to reduce global methane emissions by at least 30% below 2020 levels by 2030,[24] but did not specify its domestic methane reduction target;
- The government developed a National Electric Vehicle Strategy but has not set any targets for electric vehicle adoption.[25] It remains to be seen how much clarity the Fuel Efficiency Standard under development will provide on likely electric vehicle uptake;[26]
- The government is developing a National Energy Performance Strategy, which will provide a "national plan to accelerate demand-side action, including energy efficiency and electrification".[27] It is unclear at this stage whether the plan will include targets.[28]

The above programs are piecemeal, and do not provide a coherent unified plan. In the absence of an overarching plan, this creates significant levels of uncertainty for the future trajectory of Australia's energy transition.

A confused and deficient implementation approach

Due to these inconsistencies and areas of uncertainty, Australia does not have a shared national view of how the transition will occur. This is leading to confusion and discrepancies in the advice and decisions of government departments and agencies. To put it simply, the left hand of the government does not know what the right hand is doing.

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AEMO's central scenarios are contradictory and 'not credible'

In the absence of shared national pathways, AEMO scenarios are often referred to by public and private stakeholders as "reference pathways" for planning and investment decisions. Examples include the Australian Energy Regulator (AER), which relies heavily on AEMO's Gas Statement of Opportunities (GSOO) forecasts to set gas network revenue and tariffs (as in Victoria recently

[24] DCCEEW. Australia joins Global Methane Pledge. 23 October 2022.
[25] DCCEEW. The National Electric Vehicle Strategy. 2023. Page 34.
[26] DCCEEW. Reducing transport emissions.
[27] DCCEEW. National Energy Performance Strategy.
[28] DCCEEW. National Energy Performance Strategy – Consultation paper. November 2022. Page 7.

for AusNet,[29] Multinet[30] and AGN[31]), state governments, which often seek to align their own energy planning to AEMO's scenarios (with examples from New South Wales,[32] Victoria[33] and Queensland[34]), and national energy planning initiatives such as CSIRO's Renewable Energy Storage Roadmap.[35]

The primary purpose of AEMO's forecasts is to support their ESOO and GSOO publications for short-term decision making in electricity and gas markets, alongside the long-term ISP. The ISP was established as a planning tool for the national transmission grid under the National Electricity Law.[36] However, today it is being applied much more broadly, "informing market participants, investors, policy decision makers and consumers".[37] AEMO presents these forecasts as the "most comprehensive and robust analysis of the future electricity needs of the NEM".[38] Yet, rather than being guided by the government, the likelihood of scenarios is rated by a panel of energy industry stakeholders.[39]

In its 2023 GSOO, AEMO presents a scenario (*Orchestrated Step Change*) aligned with 1.8°C, and misaligned with the government's hydrogen ambitions as most likely in its electricity and gas forecasts.[40] This most likely gas scenario also does not meet Victoria's legislated emissions reduction targets from 2035.[41] This is particularly problematic for projections in the buildings sector, given that Victoria represents more than 60% of Australia's gas use in buildings.[42] Despite this inconsistency,

[29] AER. Final Decision: AusNet Gas Services Gas distribution access arrangement 1 July 2023 to 30 June 2028. Attachment 12 - Demand. June 2023. Page 7.
[30] AER. Final Decision: Multinet Gas Networks Gas distribution access arrangement 1 July 2023 to 30 June 2028. Attachment 12 - Demand. June 2023. Page 7.
[31] AER. Final Decision: Australian Gas Networks (Victoria & Albury) Gas distribution access arrangement 1 July 2023 to 30 June 2028. Attachment 12 - Demand. June 2023. Page 6.
[32] NSW Office of Energy and Climate Change. NSW Electricity Infrastructure Roadmap benefits modelling report. June 2023. Page 17.
[33] Victorian government, Department of Environment, Land, Water and Planning. Victorian electricity sector renewable energy transition: Energy market modelling report. October 2022. Page 6.
[34] Queensland government, Queensland Energy and Jobs Plan. Queensland SuperGrid Infrastructure Blueprint: Optimal energy infrastructure pathway for the Queensland Energy and Jobs Plan. September 2022. Page 8.
[35] CSIRO. Renewable Energy Storage Roadmap. Page viii. March 2023.
[36] South Australian government. National Electricity (South Australia) Act 1996. Page 110.
[37] AEMO. 2022 Integrated System Plan (ISP) website. 2022.
[38] AEMO. 2022 Integrated System Plan (ISP). 2022. Page 21.
[39] South Australian government. National Electricity (South Australia) Act 1996. Page 33.
[40] AEMO. 2023 Gas Statement of Opportunities (GSOO). 2023. Page 18.
[41] AEMO. Draft 2023 Inputs, Assumptions and Scenarios Report. December 2022. Page 28.
[42] IEEFA calculations based on: DCCEEW. Australian Energy Update 2022. Table F. September 2022.

these forecasts have recently been used by the AER to forecast revenues and set consumer tariffs for Victoria's gas distribution networks for the next five years (AusNet,[43] Multinet[44] and AGN[45]).

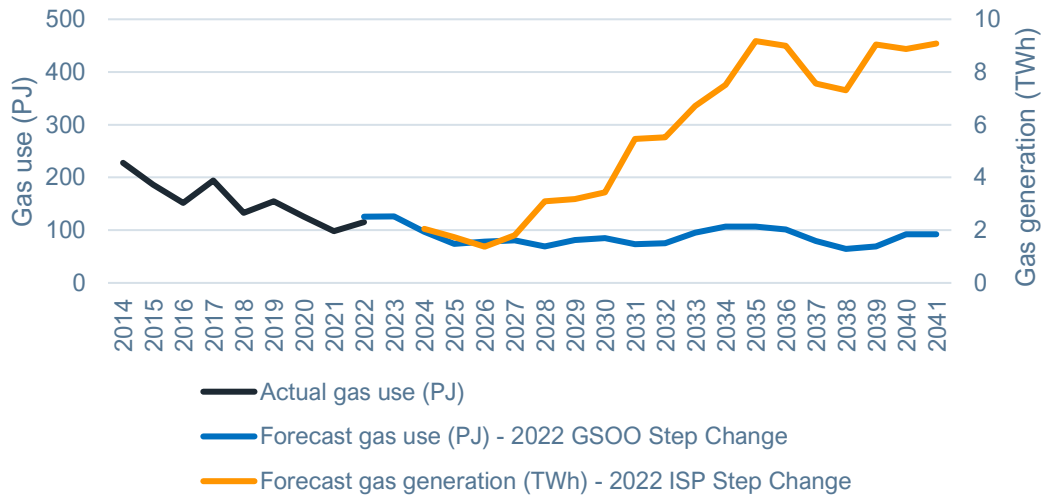
Clean energy investors have questioned the assumption choices behind the only 1.5°C aligned scenario modelling by AEMO, and have developed an alternative scenario that they consider to be more "practical and commercially credible".[46]

> **AEMO's GSOO presents widely different forecasts for gas use in electricity generation than its electricity roadmap.**

In addition, AEMO's GSOO presents widely different forecasts for gas use in electricity generation in the most likely scenario than its ISP. The former decreases significantly to 2050 while the other increases materially (Figure 1). The GSOO is meant to guide decisions about future gas supply needs.[47] However, the government seems to be referring to the ISP's forecast of increasing gas generation to inform its decisions regarding gas developments. Federal Climate Change and Energy Minister Chris Bowen said that as the share of renewables sources shifts towards the government's 82% target by 2030, the remaining 18 per cent of power "will increasingly be focused on gas".[48]

[43] AER. Final Decision: AusNet Gas Services Gas distribution access arrangement 1 July 2023 to 30 June 2028. Attachment 12 - Demand. June 2023. Page 11.
[44] AER. Final Decision: Multinet Gas Networks Gas distribution access arrangement 1 July 2023 to 30 June 2028. Attachment 12 - Demand. June 2023. Page 10.
[45] AER. Final Decision: Australian Gas Networks (Victoria & Albury) Gas distribution access arrangement 1 July 2023 to 30 June 2028. Attachment 12 - Demand. June 2023. Page 10.
[46] Clean Energy Investor Group (CEIG) and Baringa Partners. Decarbonising Australia: Accelerating our energy transition with a credible 1.5°C scenario. April 2023. Page 4.
[47] AEMO. Gas Statement of Opportunities.
[48] Australian Financial Review. Bowen defends need for future gas supply as Labor pushes Greens. 13 March 2023.

Figure 1: Comparison of GSOO's gas use for electricity generation forecast with ISP's gas generation forecast



Sources: AEMO 2023 Gas Statement of Opportunities and 2022 Integrated System Plan

An unjustified focus on supply-side solutions

Several agencies consider a few demand scenarios, and then look at how the supply can meet the gap, rather than looking at what would be an optimum approach to manage both the supply and demand sides of the equation. In the 2023 GSOO, AEMO concluded that all future scenarios "forecast the long-term need for additional supply".[49] In its review of the supply-demand outlook, the Australian Competition and Consumer Commission (ACCC) accepts AEMO's GSOO's central scenario's demand forecast, and therefore uniquely looks at supply-side solutions to fill the gas supply gap.[50]

IEEFA's submission to AEMO on updates to the ISP methodology[51] emphasised the need for better optimisation of demand-side and supply-side solutions in its electricity scenarios. Our recent gas supply gap analysis also showed that faster and stronger demand-side action could fill the gas supply gap and avoid the need to develop new costly and emissions intensive gas fields. It showed that making small adjustments to the demand-side actions included in AEMO's 2023 GSOO *Green Energy Exports (1.5°C)* scenario could eradicate the gas supply gap for the next two decades. "Accelerating action to improve energy efficiency and electrification in buildings could eradicate the

[49] AEMO. 2023 Gas statement of opportunities for central and eastern Australia. March 2023. Page 4.
[50] ACCC. Gas inquiry 2017-2030. Interim update on east coast gas supply-demand outlook for 2023. March 2023. Page 3.
[51] IEEFA. Response to AEMO consultation on updates to the ISP Methodology. May 2023

gas supply gaps for the next decade while also alleviating the cost of living crisis for households. […] The rest of the gas supply gap could be filled by a small increase in industrial gas demand reduction, well within the identified technological and economic potential." [52]

Both the IEA and the IPCC state that new developments in oil and gas are incompatible with the global goal of 1.5°C with no/low overshoot.[53,54] Limiting new gas developments as much as possible by prioritising demand-side action is therefore crucial to achieving the global climate goals.

Investments in energy efficiency in particular deliver multiple benefits. For consumers, these include cost reductions[55] as well as improved health outcomes.[56] Demand-side activities also typically create more jobs than supply-side activities.[57]

More emphasis should be put on demand-side solutions before concluding for the need for more supply. In its recent review of Australia's energy policy, the IEA highlighted that recent improvements in energy efficiency slowed down to about 1.9% per year, and that they should be increased to 4.2% a year until 2030 to align with the global IEA Net Zero roadmap.[58]

More work needed on distributed solutions

The potential impact and value of Distributed Energy Resources (DER) is also underanalysed in AEMO's ISP.

Our recent analysis of the potential impact of saturation DER shows that it could dramatically change the shape of electricity markets and networks. It also shows that not only does the uptake of DER matter for the outcome, but also the associated regulatory settings. For example, the outcome is wildly different whether battery trading was allowed or not.[59]

> **Our recent analysis of the potential impact of saturation DER shows that it could dramatically change the shape of electricity markets and networks.**

The analysis recommends that "we need energy system and market planning to better understand

[52] IEEFA. Australia can and should eradicate its gas supply gap – but not with more gas. April 2023.
[53] IPCC. AR6 Synthesis Report – Longer Report. 2023. Page 24.
[54] IEA. Net Zero by 2050: A Roadmap for the Global Energy Sector. May 2021. Page 21.
[55] IEA. Energy Efficiency 2022. Page 76.
[56] IEA. Capturing the multiple benefits of energy efficiency. 2014. Pages 21-22.
[57] H. Garrett-Peltier. Green versus brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input-output model. February 2017.
[58] IEA. Australia 2023 - Energy policy review. April 2023. Page 12.
[59] IEEFA. Household solar and storage will dramatically change the shape of electricity markets and networks. April 2023.

the implications of high levels of DER on the need for large-scale generation and storage."[60] In particular, the ISP scenarios should consider an equivalent range of divergence in DER settings as they do for large-scale renewables.

It would be valuable to test the impact of different DER uptake settings while holding other parameters constant. This would help understand the specific impact of DER solutions.

AEMO recently shared its intention to test more DER sensitivities around its most likely scenario, but those seem to be focused on under-investment or reduced orchestration rather than looking at how DER could most effectively support the transition.[61]

The need for 1.5°C aligned national energy pathways

There is a need for 1.5°C-aligned national energy pathways to guide government policy and planning across organisations and departments, and inform private investment decisions.

What good national energy pathways would do

Based on what was discussed in the previous section, some key characteristics of national energy pathways should be that they:

- align with the government's objective to keep global warming below 1.5°C;
- meet all federal and state government targets;
- are internally consistent;
- reflect a reasonable contribution of energy emissions towards the economy-wide objective;
- consider electricity and fuels transitions in an integrated way;
- consider both demand and supply side solutions, and;
- consider both large scale and distributed solutions.

The pathways should investigate a wide range of possible outcomes, and clearly identify where solutions are preferable in terms of economic, consumer, environmental and feasibility criteria. They should also explore alternative scenarios where large amounts of uncertainty exist.

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[60] IEEFA. Household solar and storage will dramatically change the shape of electricity markets and networks. April 2023.
[61] AEMO. Inputs, Assumptions and Scenarios webinar. 18 June 2023.

The pathways need to support planning decisions by public and private actors. As such they should provide recommendations on:

- what new supply is essential to meet domestic energy needs, and what new supply could or should be avoided through demand-side measures;
- timelines for phasing out key infrastructure assets such as gas networks and large thermal generation plants;
- what would be the priority usage of scarce resources such as green hydrogen, talent and parts for renewable electricity generation, storage and transmission and distribution assets, and;
- what is needed to ensure any new export markets (e.g. renewable electricity, green hydrogen, green iron) does not impede the domestic energy transition.

The pathways should include an outlook for Australia's energy exports

The pathways should also develop a shared view on the international energy transition and the implications for the future demand for our energy and mineral exports. This would help develop recommendations on what export-focused projects are likely to be unnecessary.

IEEFA's Global LNG Outlook 2023-2027 shows that a tidal wave of new LNG projects will come online globally starting mid-2025. As a result, "liquefaction projects targeting in-service after 2026 may be entering a much smaller demand pool than bullish market forecasts anticipate".[62] Demand for many of those projects is uncertain, with large, uncontracted volumes expected from Qatar.[63]

Avoiding the development of unnecessary coal and gas fields in Australia will help avoid large volumes of emissions,[64] improving our chances to meet the objectives of the Paris Agreement and lowering the emissions reduction pressure on other domestic industries.[65]

> **Avoiding the development of unnecessary coal and gas fields in Australia will help avoid large volumes of emissions**

[62] IEEFA. Global LNG Outlook 2023-2027. Page 5.
[63] Columbia Center on Global Energy Policy. Qatar's Contract Quandary. 26 April 2023.
[64] The Australia Institute. Emissions from the 116 proposed coal and gas projects would swamp the reductions from the safeguard mechanism. March 2023.
[65] DCCEEW. Safeguard Mechanism Reforms factsheet. May 2023. Page 2.

Other countries have successfully implemented national energy pathways and strategies

Germany is an example of a country that embarked early on an integrated and long-term strategy for its energy system. "In late 2010, Germany initiated the Energiewende, a major plan for making its energy system more efficient, supplied mainly by renewable energy sources. The country has adopted a strategy for an energy pathway to 2050, which includes an accelerated phase-out of nuclear power by 2022."[66] Their plan also includes medium- and long-term targets in all sectors of the economy.[67]

China's latest five-year plan on Renewable Energy Development (2021-2025) "emphasizes the link between China's climate commitments, energy transition, and energy supply security; establishes detailed targets for primary energy mix, power generation rate, electrification rate, and more".[68]

France has a Multiannual Energy Plan (MEP) which is a "comprehensive strategy which covers all aspects of energy policy and all forms of energy. Citizens, local authorities, consumers and companies operating in the transport and energy sectors have all been closely involved in the drafting of this plan ... This MEP is consistent with the national low-carbon strategy adopted in October 2015, and is a vital tool for the implementation of the Paris Climate Agreement."[69] It sets out the country's energy objectives and targets for various sectors, including electricity, heating and transportation.[70]

Conclusion

There are too many inconsistencies and gaps in the current government's climate and energy plan. This leads to confusion when it comes to planning and implementation.

Australia needs 1.5°C national energy pathways that look at the energy transition in an integrated way across fuel types, sectors and solutions. The pathways should investigate a wide range of possible outcomes – clearly identifying where solutions are preferable, and exploring alternatives where large amounts of uncertainty exist. The pathways should support planning decisions, and make recommendations on which new supply projects are essential, on timelines for phasing out key infrastructure assets, and on priority usage for scarce resources. This should include both domestic energy requirements as well as export-focused projects. We can learn from other countries' experience when it comes to developing and implementing effective national energy pathways.

[66] IEA. Germany.
[67] Agora Energiewende. Q1 What is the German Energiewende? September 2022.
[68] Energy Foundation China. China's 14th Five-Year Plans on Renewable Energy Development and Modern Energy System. September 2022.
[69] Ministere de la Transition Ecologique et Solidaire. The Multiannual Energy Plan. Page 1.
[70] Ibid. Page 2.

About IEEFA

The Institute for Energy Economics and Financial Analysis (IEEFA) examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. www.ieefa.org

About the Authors

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Amandine is a recognised expert in net zero emissions transitions across the economy. She led the development of the first domestic net zero emissions pathway for Australia and subsequent updates, which are considered to be the reference for Paris-aligned pathways and used by business, finance and government organisations. She has worked with and advised many organisations on the strategy, investment and risk implications of the energy transition.

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Jay Gordon is a Research Analyst at IEEFA focusing on the Australian electricity sector. He brings experience in modelling Australia's energy system transition, including investigating the role of the electricity sector in helping the broader economy transition towards a net zero future.

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