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14 May 2024

To: Climate Change Authority
RE: Targets, Pathways and Progress consultation

Thank you for the opportunity for the Institute for Energy Economics and Financial Analysis (IEEFA) to provide input on the *Targets, pathways and progress* discussion paper. IEEFA is an energy finance think tank that examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy.

In IEEFA's view:

- It will be critical for the authority to comprehensively assess all opportunities to reduce emissions in Australia, and appropriately estimate their net economic cost/benefit beyond energy considerations. Our research finds that many opportunities are underestimated in government planning, and so are the relative economic benefits of renewable-based solutions compared with fossil-based solutions.
- Distributed energy resources, energy efficiency and electrification present particularly large untapped opportunities. They could support the renewable electricity transition, eradicate the looming excess gas demand in Australia's southern states and reduce energy costs for consumers.
- The Authority should pay close attention to the net economic cost/benefit of new and expanded fossil-fuel projects (extraction, transport, use). Our research suggests that many proposed projects would not deliver financial returns based on increasing costs and decreasing revenue, and present significant environmental and economic risks for Australia.
- Assumptions regarding the methane emissions from coalmining and gas extraction and transport, and the potential for carbon capture and storage and carbon credits to reduce emissions should be based on most recent evidence to reduce risks of inadequate emissions reduction plans.
- Government needs to establish the right conditions for a shift in investments. This will require targeted interventions and policies, as well as broader changes such as a review of energy market governance and network revenue regulation.

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1. How should the Authority take account of climate science and Australia's international obligations in considering possible emissions reductions targets for 2035?

It is in Australia's economic interest to adopt a target in line with climate science and Australia's international obligations.

The economic costs of not acting in line with climate science and Australia's international obligations are likely to materially outweigh the costs of doing so.

In its AR6 synthesis report, the Intergovernmental Panel on Climate Change (IPCC) stated: *"Risks and projected adverse impacts and related losses and damages from climate change escalate with every increment of global warming (very high confidence)."*

The report also states: *"Deep, rapid, and sustained mitigation and accelerated implementation of adaptation actions in this decade would reduce projected losses and damages for humans and ecosystems (very high confidence), and deliver many co-benefits, especially for air quality and health (high confidence). Delayed mitigation and adaptation action would lock in high-emissions infrastructure, raise risks of stranded assets and cost-escalation, reduce feasibility, and increase losses and damages (high confidence)."*

Australia is very exposed to those losses and damages, as explained in a previous IEEFA submission to the Authority: *"The recently published Intergenerational Report 2023 looked at a range of economic implications from climate change impacts, all highly significant for Australia. For example, it estimated that just the impact of increased temperatures on productivity could cost the economy between A$135 and A$423 billion in today's dollars to 2063. A global study also showed that the economic benefits of reducing air pollution could outweigh the cost of mitigation actions."*

2. How should the Authority weight the goals of ambition and achievability in considering possible emissions reductions targets for 2035?

The Authority should ensure it has properly assessed all emissions reduction opportunities.

Our research shows many areas where government agencies have underestimated the potential for emissions reductions.

- **Distributed energy resources (DER):** A recent IEEFA report found *"that AEMO's projections for rooftop solar and V2G* [vehicle to grid] *are conservative, and that the draft 2024 ISP* [Integrated System Plan] *does not fully examine the opportunities offered by flexible demand. IEEFA recommends more detailed exploration of flexible demand opportunities in the short term, and co-optimisation between demand and supply in the*

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ISP process in the longer term. IEEFA also recommends that AEMO include a stronger DER scenario in the 2026 ISP, and a stronger DER sensitivity in the 2024 ISP."

- **Gas demand reduction:** An IEEFA report found that, "*Untapped, cost-effective interventions to improve gas efficiency and expedite electrification could slash gas demand by more than 40% by 2030 in Australia's southern states' residential buildings and industry. These reductions could more than eradicate the anticipated gas supply gap, while also bringing energy bills down, alleviating Australia's cost-of-living crisis. Increasing gas supply will instead come at a high cost that would have to be recovered through energy bills, while also undermining governments' emissions reduction efforts."*
- **Electricity demand reduction:** Recent IEEFA analysis found that, *"technologies have advanced to the point where modern electric appliances are widely available that use a fraction of the energy of either gas appliances or resistive electric appliances. [...] Australians could save a further $2.2 billion for each year that new resistive appliances are switched to efficient alternatives instead.*" The savings achieved from switching from resistive electric appliances to heat-pump-based appliances could more than offset the additional electricity use required to switch from gas appliances to heat-pump-based appliances. However, this opportunity was not included in the recently released National Energy Performance Strategy.
- **Avoid expansions in coalmine production:** IEEFA analysis suggests that, "*recent earnings results and the Resources and Energy Quarterly forecasts point to worsening market conditions, which raise questions about the economic case for multiple mine expansions in progress. [...] Swapping out the unit cost assumptions made by the proposed Baralaba South proponents with typical industry cost increases experienced, would recast Baralaba South as loss making. Meaning there could be no royalty payments or taxes paid."* Given that these mines would create material methane emissions and make the government's emissions reduction targets harder to achieve, it is important to closely consider their net economic benefit in government plans.
- **Avoid expansions in LNG production:** IEEFA analysis finds that, *"The International Energy Agency (IEA) recently predicted that global gas demand will start declining this decade even in its most conservative scenario, aligned with about 2.4°C global warming. Japan and South Korea are already seeing declines in liquified natural gas (LNG) imports, and various barriers are expected to constrain future demand from emerging Asia. At the same time, global supply is increasing at a rapid pace, which is expected to lead to an LNG supply glut in the second half of this decade. Australia is a relatively high-cost gas producer compared with other countries such as Qatar and the US, which dominate the forecasts for upcoming capacity increases. Under those global conditions, it is likely that Australian gas companies are entering a declining market for their LNG."* Given the high emissions intensity of LNG production, and the low performance of Carbon Capture and Storage (CCS) projects, it will be important to also closely consider the net economic benefits of new LNG projects in government plans.

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The Authority should ensure it has properly assessed the relative economic cost-benefits of proposed emissions reduction actions.

It will be important that the Authority includes a broader scope than energy and emissions to assess the benefits of emissions reduction actions. As stated in a previous submission: *"While it is not reasonable to expect that all benefits can be assessed, the authority should ensure it includes all elements that are material. In particular, it will be critical that the authority captures (within the economic modelling or through side analyses):*

- *Cost savings from reduced energy bills and subsequent economic benefits.*
- *Jobs created in green industries, in particular in renewables and energy efficiency sectors that have a high job intensity.*
- *Additional benefits of increasing electrification include reducing Australia's energy security risks from dependency on fossil fuel supply chains.*
- *The observed trends of decreasing costs in deployment of renewable energy and battery storage.*
- *The opportunity costs of resources (labour, water, transport) required for fossil fuel projects, both proposed greenfield and brownfield projects and existing projects.*
- *Opportunity costs of capital require to fund fossil fuel infrastructure investments.*
- *Avoided cost of mitigating the emissions from new or existing fossil fuel production.*
- *Higher competitiveness of domestic industries in a low-carbon world.*
- *Health and productivity benefits from reduced use of fossil fuels and improved thermal insulation.*
- *Economic benefits from reduced impacts of climate change."*

A Sustainability Victoria "randomised controlled trial designed to measure the impact of an energy efficiency and thermal comfort home upgrade", for example, found that "for every $1 saved in energy, more than $10 is saved in health".

A recent IEEFA analysis of the water impacts of coalmining activities found that coalmining is the second-largest water user in Australia, behind agriculture. About 80% of the water it uses is freshwater. *"It is responsible for almost all (~90%) of regulated water discharges to the environment from mining activity in Australia. Over the past 10 years, there have been at least 60 cases of illegal contaminated water discharges where legal action was taken or financial penalties issued to companies in Australia's coal industry."* As a result, reduced coal production is likely to have significant economic benefits through reduced water use, which can be used for other activities, and reduced water contamination.

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3. How can Australia further support other countries to decarbonise and develop sustainably?

Australia should ensure that it doesn't contribute to an oversupply of fossil fuels, which will slow decarbonisation in other countries.

IEEFA's Global LNG Outlook 2024-28 found that, *"nameplate LNG liquefaction capacity from projects that have already begun construction, or that are approved by financially capable backers, could add 193 million metric tons per year (MTPA) of new supply capacity from 2024 through 2028 – a 40% increase in five years. By the end of 2028, the world's total nameplate liquefaction capacity could reach 666.5MTPA. For perspective, the International Energy Agency (IEA) projects total LNG trade in 2050 to reach 482MTPA under its stated policies scenario. In other words, LNG liquefaction capacity coming online through 2028 exceeds IEA long-term demand scenarios."*

S&P Global Commodity Insights anticipates that prices will fall, and this could increase LNG demand.

At the same time, Portfolio players, Chinese suppliers and Japanese traders are trying to stimulate demand by moving further downstream, developing LNG regasification infrastructure and extending credit lines to buyers in developing countries.

The Australian Government has indicated it plans to provide financial support for the Middle Arm Sustainable Development Precinct. As previously noted by IEEFA: *"At the centre of the strategy is the creation of an abundant supply of natural gas from the Barossa and Beetaloo fields that can be competitively sold on the LNG export market and used locally in industrial processes for businesses that would be drawn to the area.*" Any increase in Australian LNG exports will contribute to the LNG glut, which could drive greater LNG demand in our region, and crowd out investment in renewables. Government support for the Middle Arm Precinct creates risks for taxpayers, given "the robust market for LNG exports anticipated in the plan is unlikely to materialise". and could draw investment to infrastructure that faces risks of underutilisation and stranding.

Australia has the potential to supply green iron to other countries, and accelerate global steel decarbonisation.

Green iron – made with the direct reduced iron (DRI) process and exported as hot briquetted iron (HBI) – is being considered for import by major global steelmakers instead of importing iron ore and green hydrogen, as part of decarbonisation plans for an industry based on the import of iron ore and metallurgical coal.

Australia has numerous advantages that present it with an opportunity to lead the global steel sector into a low-carbon future, including abundant iron ore and renewable energy resources, established infrastructure, and political and regulatory stability providing a strong investment environment.

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Although Australia leads the world in iron ore exports, other nations and regions have the opportunity to combine their higher-grade iron ore and renewable energy resources to produce green iron for export in response to future demand growth. Australia risks losing ground to other nations and regions (including Brazil, Africa and the Middle East) in the accelerating global shift towards green iron and low-carbon steel if research and development projects are not prioritised.

Australia also has an opportunity to increase its production of high-grade iron ore to meet the increasing demand from global DRI assets.

There are many mutually beneficial opportunities for collaboration with India.

IEEFA highlighted several potential benefits of decarbonisation collaboration with India: *"Australia can help India meet its climate goals by providing investments and finance, expertise in the extraction of critical minerals and technology to decarbonise hard-to-abate sectors like steel. [...] India can offer Australia an alternate source for solar photovoltaic modules, while its companies, which are already investing heavily in green hydrogen projects locally, are also looking at Australia to set up manufacturing units."*

Australia can export professional services in low-emissions technologies

Australia can play an important role in supporting other countries' decarbonisation efforts through exporting professional services in clean energy technology and services related to decarbonising mining processes, deploying renewable energy and effective emissions reduction technologies.

Australia is recognised as a global leader in mining services exports, and the value of professional and scientific services exports exceeds the economic contribution of Australia's mining industry. The importance of Australia's services exports often gets overlooked largely due to the complexities involved in collecting and reporting on services export data. Australia's professional, scientific and technical services generated more value added to the Australian economy (15% of total value added) than the Mining industry in 2020-21. Regional consultations in Southeast Asia have highlighted the substantial interest in Australia's expertise and capabilities in emerging low-emissions technologies

4. Which technologies are important for each sector's pathway to net zero and why?

Electricity

Supply-side technologies

In the electricity sector, the key supply-side technologies to enable net zero will be wind, solar and storage, as evidenced in CSIRO's Gencost Consultation draft and AEMO's Draft 2024 ISP.

Nuclear is not a solution for Australia due to its high cost and the long lead times for planning, designing and constructing new projects. Nuclear small modular reactors (SMRs) in Australia would have a significantly higher cost than wind and solar farms, according to CSIRO's Gencost Consultation draft.

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It's expected that getting a nuclear SMR up and running in Australia would take about 15 years. So this option would not help Australia quickly replace retiring coal-fired power stations, which AEMO forecasts will all retire over the next 15 years or so. AEMO's Draft 2024 ISP Step Change scenario anticipates that 90% of coal power capacity will exit by 2034-35, and the entire coal fleet will retire by 2038.

Key demand-side technologies will be DER, including rooftop solar, household storage and electric vehicles, demand flexibility (particularly within newly electrified loads such as hot water) and energy efficiency, as detailed in a recent IEEFA report.

Demand-side technologies

The demand-side and distributed energy resources should not be underestimated, as together they form a significant portion of the energy system, and can provide significant services to the National Electricity Market (NEM) as a whole.

A recent IEEFA report states: *"The small stuff adds up – distributed energy resources (DER) in homes and businesses will likely be the largest component of generation capacity, storage and flexible load in the National Electricity Market (NEM) by 2050, according to the Australian Energy Market Operator (AEMO) in its draft 2024 Integrated System Plan (ISP)."*

A meta analysis of various studies by IEEFA has shown that enabling flexible DER to provide services to the grid could deliver $19 billion of economic benefits in Australia to 2040.

Our report found: *"Distributed energy resources (DER) can reduce the amount of large-scale renewable generation needed, reduce the amount of transmission and distribution network build, provide Frequency Control Ancillary Services (FCAS), emergency power supplies (individually and through the Reliability and Emergency Reserve Trader (RERT) scheme), as well as flexible demand, including demand response. Offering such an array of possibilities, DER can be seen as the Swiss Army knife of the electricity system."*

"This meta analysis finds that, based on the results of studies by Baringa Partners and NERA Economic Consulting, DER integration could deliver a ***combined net present value (NPV) of more than $19 billion by 2040.*** *The Baringa study found $11 billion in distribution and transmission network avoided costs and benefits of DER integration. Meanwhile, the NERA study found $8 billion in generation and storage cost reductions resulting from high levels of DER with high flexibility.* ***In addition, there is $10 billion in wholesale market super profit reductions which would benefit consumers****, according to the NERA study."*

"The Baringa and NERA studies had no overlap in their modelled value streams. Summing two separate studies like this is not without risk, especially as the Baringa study is based on 2020 forecasts and does not include flexible demand more broadly or from electrification. Nonetheless, ***the $19 billion figure gives a sense of the magnitude of the economic benefits that could be unlocked if the energy transformation supports DER investment and integration.****"*

"Our meta analysis concludes that we need significant, courageous action on DER integration as soon as possible if we want to underpin Australia's future economic prosperity with lower electricity and transport costs, and electrification to eliminate dependency on gas. DER must not

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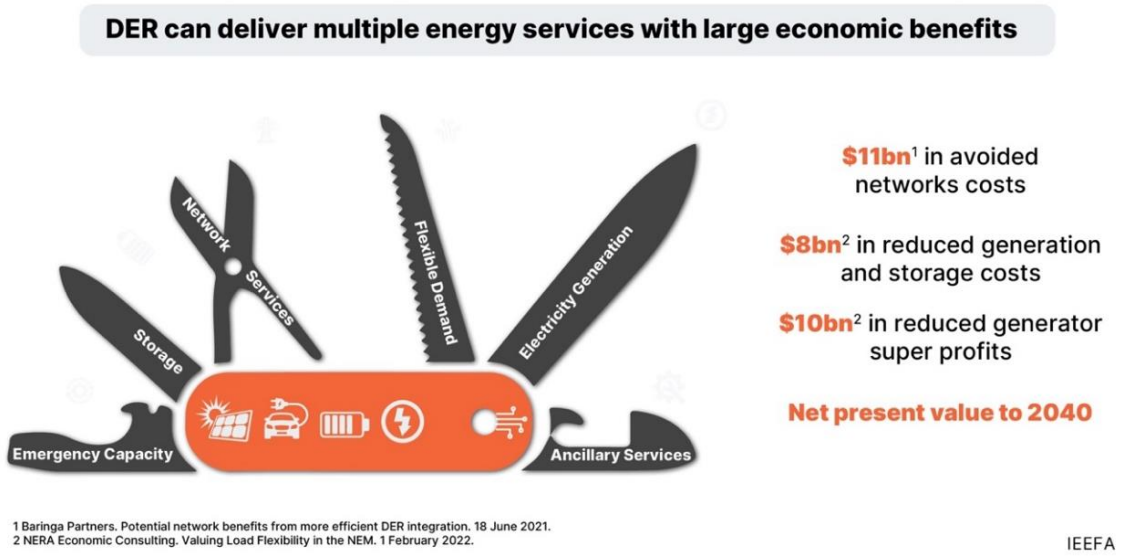
come second in policy, planning and regulation to transmission and large-scale generation. DER must be considered on equal terms, with more thoughtful recognition of the multiple benefits outlined in this report."

Figure: DER – the Swiss Army knife of the electricity system



Source: IEEFA

Maximising existing assets

In the context of construction delays for new large-scale assets, it will be important to investigate the opportunities to maximise the use of existing assets. For example, a recent IEEFA report looked at the opportunities to optimise Tasmania's assets and found that, *"it seems that Tasmania has substantial unutilised water storage capacity. [...] Improving the energy productivity of its buildings and expanding renewable generation would help Tasmania to 'hoard water' in existing dams, freeing up hydro generation for higher-value uses."* Also, mainland battery storage used as "virtual transmission" capacity could help increase Basslink utilisation. *"It would allow Hydro Tasmania to increase undersea cable utilisation for imports and exports by charging the mainland battery when mainland prices or demand are relatively low, then feed it to Tasmania when cable capacity is available or into the mainland grid when prices are high."*

Built environment

Upgrading household appliances could lead to a step-change increase in energy efficiency

The size of the opportunity for upgrading households to energy-efficient appliances is significant. IEEFA analysis has found: *"The continued installation of gas and resistive electric appliances is locking Australian consumers into $3.4 billion in unnecessary costs each year. [...] technologies have advanced to the point where modern electric appliances are widely available that use a fraction of the energy of either gas appliances or resistive electric appliances."*

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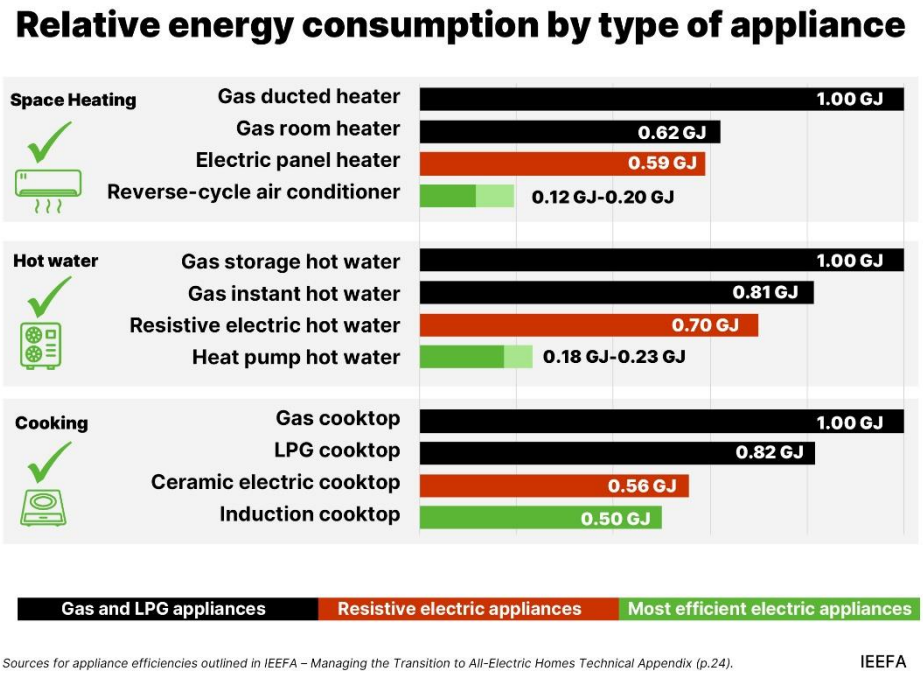
In particular – upgrading from inefficient gas or electric appliances to heat-pump-based appliances for space and water heating leads to a step change in energy efficiency improvements (see figure below).

Figure: Efficient electric appliances vs inefficient appliances



Thermal efficiency could deliver higher benefits if focused on higher users

IEEFA analysis found that: *"Households are not uniform in energy consumption.* [Sustainability Victoria] *SV found that 5% of the houses they sampled rated at less than 0.5 stars, and another 8% rated between 0.5 and 1 stars. A 0.5-star house has a thermal load 60% bigger than an average existing house. A large-scale survey of households conducted by Frontier Economics for the Australian Energy Regulator (AER) found a significant spread of gas consumption in Victoria. Over the winter months, assuming that the state average equates to the average for two- and three-people households, then we can see that a material share of households have a consumption higher than twice the average, and some outliers have consumptions that are several multiples of the average."* Therefore, strategically targeting large energy users could help achieve faster emissions reductions.

Industry & Waste

Steel

Global steelmakers will increasingly shift from blast furnaces to recycling steel in electric arc furnaces (EAFs) (secondary steelmaking) and DRI-based processes that can switch from natural gas to green hydrogen (primary steelmaking). Carbon capture utilisation and storage (CCUS) looks unlikely to play a major role in decarbonising the global steel sector. CCUS technology has been around for nearly 50 years, and has accumulated a history of significant underperformance.

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CCUS is also susceptible to significant financial, technological and environmental risks, made worse by uncertainty over the long-term effectiveness of geological CO_2 storage. The investment trend in low-emission steel projects worldwide validates the transition towards DRI-based steelmaking, with almost no commercial-scale projects focusing on CCUS at present.

Green hydrogen is set to transform the steel industry. However, the hydrogen economy faces constraints such as limited electrolyser manufacturing capacity, and entails significant electricity consumption, posing challenges for renewable energy supply. With all challenges facing green hydrogen production, it is crucial to prioritise the available capacities for sectors that can yield a substantial reduction in carbon emissions, such as the steel industry.

In the race towards green steel production via DRI-EAF, the utilisation of gas is merely an intermediate measure, and should not perpetuate reliance on fossil fuels in steelmaking due to its significant carbon emissions.

Aluminium

It would be worthwhile for the Authority to consider the potential benefits aluminium smelters upgrades could deliver to the energy system through increased demand response. An IEEFA report found that: "*Some successful smelters generate considerable revenue from supplying energy or energy services, the so-called demand-side response. In this respect, it is worth reimagining a smelter as a giant virtual battery, one that also produces aluminium. Tomago CEO Matt Howell has acknowledged this key change in thinking in comments supporting the continuation of the Australian Energy Market Operator's Reliability and Emergency Reserve Trader (RETR) scheme: 'We've got a very large load that can come off in a very short space of time to avoid large-scale rolling blackouts, and that has value.' He refers to 600MW of capacity that can be switched off in minutes. Most smelters can provide a very periodic reserve system of demand response, notably the ability to occasionally reduce electricity demand for up to 3 hours at a time. But without a technology upgrade, this capacity does present significant risk to the integrity of smelter potlines. An unplanned 5½ hour outage at Portland in Victoria in 2016 reduced smelting capacity to 27% for many months.*"

Ammonia

IEEFA's recent research shows that a shift to green hydrogen-based ammonia is achievable by 2030, at least for explosives manufacturing: "*Adoption of green hydrogen in ammonia production is currently slow, but a proposed ammonia plant expansion in Western Australia, while currently gas-based, presents a timely opportunity to demonstrate large-scale integration of renewables and green hydrogen. Miners consume about half of Australia's ammonia through explosives; they could shift to green explosives for a minimal increase in operating costs, with the right incentives.*"

IEEFA's research suggests that blue hydrogen (steam methane reforming with CCUS) is unlikely to be an attractive solution. It shows that the emissions intensity of blue hydrogen is likely to be much higher than commonly assumed once you take into account the full lifecycle analysis of all emissions from the process, including the fugitive methane emissions associated with the production of gas and realistic capture rates for CCUS.

As noted by the IEA, "*oil, gas and coal mining operations release large amounts of methane, a potent greenhouse gas, either by accident or design*."

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Resources

It is critical that the authority considers the inaccuracy of current methods used by coal mines in Australia to report methane emissions.

Existing research has found significant underreporting of methane emissions from coalmining operations in Australia and overseas. According to previous analysis by Ember, "*independent satellite measurements have uncovered underreporting of methane emissions from Australian coal mines – twice as high as official estimates*". The majority of Australian coal production reports methane emissions by multiplying coal production (run-of-mine [ROM] coal) by a fixed emissions factor.

The issue of underreporting methane emissions is of most concern in open-cut mines, a recent IEEFA study found. According to Global Energy Monitor's methane tracker data, open-cut mines in Australia are responsible for 52% of the methane emissions in Australian coalmining, and up to 60% when including the operations that combine open-cut and underground mining.

Methane emission estimates from Australian coalmining reported by the IEA suggests open-cut mine emissions could be 3.5 times higher than reported by coalmining companies, and subsequently the Australian government (assuming that all under-reported coalmining emissions are associated with open-cut mines). The IEA estimates are conservative, with other sources, such as the Global Energy Monitor and Carbon Majors, reporting that Australian open-cut mine methane emissions may be 10 times higher than reported.

IEEFA's previous analysis found there is a widening divide in Australia between the growth of open-cut coalmines and reduced production at underground mines. The largest six mines in NSW are open-cut mines, and are expanding at a rapid rate (see Table). They now make up more than 40% of production and the top six underground share of production has fallen to just 10%.

Table: NSW top six mines, year-on-year production change by type

Open-cut mines	Year-on-year to Nov 2023	Underground mines	Year-on-year to Nov 2023
Bengalla	16%	Appin	-17%
HVO	47%	Dendrobium	-27%
Moolarben OC	39%	Integra	-4%
Mt Arthur Coal	41%	Metropolitan	20%
Mt Thorley Warkworth	41%	Moolarben UG	-23%
Wilpinjong	3%	Narrabri	-35%
Top six open-cut	**31%**	**Top six underground**	**-21%**

Source: NSW Coal Services, IEEFA. Saleable Production Year-on-Year (YoY) Calendar Year 2023 vs Calendar Year 2022.

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Production reduction is the only way to fully eliminate emissions from oil, coal and gas.

Addressing climate change will require addressing methane emissions from both coal, oil and gas. The IEA has outlined a range of measures that could help to reduce methane emissions, including mandated "*leak detection and repair requirements, technology standards and bans on non-emergency flaring and venting. Still further reductions can be achieved with the help of more accurate and reliable data on emissions and abatement opportunities – but this will require robust measurement and reporting mechanisms. If all countries that have already committed to reducing methane emissions were to adopt these policies, we estimate methane emissions from global fossil fuel operations could be cut by nearly 15%.*"

While targeted measures can eliminate most methane emissions, the only effective measure to fully eliminate emissions is to reduce oil, coal and gas demand to avoid the need to develop new coal, oil and gas reserves. The IEA further notes: "*When it comes to coal, the most effective way to lower emissions is to focus on lowering demand. But encouraging better management of methane leaks in existing and abandoned mines is also important.*"

Carbon capture and storage is not a reliable solution to reduce emissions

In a previous submission to the Authority, IEEFA stated that: *"Last year, IEEFA conducted a review of 13 flagship Carbon Capture and Storage (CCS) projects globally comprising about 55% of the total nominal capture capacity operating worldwide. It found that failed or underperforming projects considerably outnumbered successful experiences."*

Figure: Performance of Flagship CCS Projects Globally

Carbon Capture and Storage (CCS) projects' poor report card

Project	Capacity (MtCO2 p.a.)	Performance
Natural Gas processing		
1986 Shute Creek	7	Lifetime under-performance of 36%
1996 Sleipner	0.9	Performing close to the capture capacity
2004 In Salah	1.1	Failed after 7 years of operation
2007 Snøhvit	0.7	Performing close to the capture capacity
2019 Gorgon	4	Lifetime under-performance of ~50%
Industrial sector		
2000 Great Plains	3	Lifetime under-performance of 20–30%
2013 Coffeyville	0.9	No public data was found on the lifetime performance.
2015 Quest	1.1	Performing close to the capture capacity
2016 Abu Dhabi	0.8	No public data was found on the lifetime performance.
2017 Illinois Industrial (IL-CCS)	1	Lifetime under-performance of 45–50%
Power sector		
2014 Kemper	3	Failed to be started
2014 Boundary Dam	1	Lifetime under-performance of ~50%
2017 Petra Nova	1.4	Failed after 4 years of operation

Source: IEEFA. The Carbon Capture Crux: Lessons learned. September 2022.

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"A more recent IEEFA analysis of Norway's Sleipner and Snohvit projects, two of the three successful CCS experiences in the review, demonstrated that carbon capture and storage is not without material ongoing risks that may ultimately negate some or all the benefits it seeks to create"

"The troubled track record of CCS and the high risk that storage of CO2 won't be permanent mean Australia should not rely on it to reduce emissions from new and existing gas projects."

IEEFA finds there is no economic case for public funds to be allocated for such speculative projects. Government incentives would likely achieve greater emissions reduction goals flowing into fast-growing, efficient and clean renewable energy technologies, and the battery and storage sectors, as IEEFA reported. Renewables, efficiency, electrification and reducing fugitive methane emissions can address more than 80% of the world's decarbonisation needs by 2030, according to the IEA and the Intergovernmental Panel on Climate Change (IPCC).

Transport

Electric vehicles can offer valuable services to our decarbonising electricity grids

The role of electric vehicles (EVs) in decarbonising Australia's transport sector is mostly well understood, and has been recognised through the development of New Vehicle Efficiency Standards (NVES).

However, IEEFA's submission to the NVES consultation highlighted that the NVES cost-benefit analysis excluded "*a very significant category of benefits that electric vehicles (EVs) can provide via services to the electricity grid.*" We observed that, "*EVs are likely to present the most significant source of future flexible electricity demand and storage, providing energy market and network services that are increasingly valuable as Australia's electricity systems transition to high shares of renewable energy.*

"*In the UK, EVs are already competing with gas generation to provide grid-firming services. It is estimated that under current levels of EV uptake (2.8% of the total fleet), the theoretical firming capacity of the fleet is already greater than the capacity of gas-peaking plants.*"

Opportunities exist to integrate one-way (unidirectionally) charged EVs into the grid. However, IEEFA found, "*there is a significant additional category of benefits that can be enabled via two-way (bidirectional) charging*", opportunities described as "V2X".

V2X can offer new revenue streams for consumers, who are compensated for providing services to the grid. Analysis of the full potential varies significantly in the literature, however, "*IEEFA expects revenue within a reasonable potential range of $1,000-$3,700/year.*"

We anticipate that grid integration of EVs will gain increasing attention as international case studies demonstrate its potential, and as federal and state energy ministers progress the development of a National Consumer Energy Resources Roadmap.

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5. How can governments use mandates, rules and standards to accelerate Australia's decarbonisation? Is more planning by governments needed? If so, how should this be co-ordinated and how can this be done while making the transition inclusive, adaptive and innovative?

There is an urgent opportunity to upgrade appliance standards.

IEEFA's research has shown there is a significant economic opportunity for upgrading gas and resistive electric household appliances to efficient electric alternatives.

The National Energy Performance Strategy drew attention towards improving Australia's existing appliance standards legislation, the Greenhouse and Energy Minimum Standards (GEMS) Act. It identified a priority to, "*Streamline, expand and modernise the Greenhouse and Energy Minimum Standards (GEMS) framework*".

There is a compelling case for the federal government to update the GEMS framework to support a shift towards efficient electric appliances. Improved appliance standards could enable both a shift away from gas appliances and inefficient electric appliances. Our analysis found that, "*Nationally, ensuring appliances are efficient and electric through improved energy performance standards would result in a net reduction in annual electricity demand.*"

We observed that, "*With the right policy supports, improved appliance energy performance standards can also present an equitable approach for renters"* and*, "Supplementary solutions exist that could address*" challenges, including the upfront cost burden, hard to upgrade homes and impacts on gas distribution networks.

Appliance standards are not the only policy change that could or should encourage the shift to lower-cost, lower-emissions appliances. However, the benefits can augment other policies, including those that enable upgrades to the thermal efficiency of homes, ensure new hot water systems have demand flexibility functions, and encourage further uptake of DER.

Acting quickly could help alleviate the upcoming tightness in the gas market.

Australia needs technical standards for DER

As DER becomes an increasing contributor in the energy system, we need to be sure we are properly integrating DER with the grid and getting the most out of DER assets. This includes assets such as rooftop solar, EVs, flexible demand, and household energy storage solutions. IEEFA's research found that there is little focus on, and co-ordination of, DER technical standards:

"There is currently no way for DER technical standards to be set consistently across the NEM, let alone have compliance of the DER and their installation against those standards enforced. The lack of governance arrangements for DER technical standards is a critical issue for the integration of DER into networks and markets."

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There is a need for greater focus on DER technical standards, and an independent body set up to progress DER technical standards. In a previous report, IEEFA recommended that:

*"**Energy Ministers create a new DER Authority (an independent technical body)** through a change to the NEL* [National Electricity Laws]*or, more simply, through Commonwealth legislation. The body would: set a vision for DER technical standards; develop a technical standards work program; monitor, review and set DER technical standards; consider issues related to compliance and enforcement of standards in their development; advise on standards to other government and energy market bodies; and undertake related reviews."*\

More co-ordinated planning needed to co-optimise demand side and supply side

Energy system planning in Australia has conventionally considered demand projections as an external, uncontrolled input, and hence focuses on optimising the mix of supply-side solutions to meet that demand.

Increasingly, this model is no longer fit for purpose. It does not recognise the valuable contribution that DER, electrification and energy efficiency can make towards reducing the costs of the energy transition.

For example, with respect to AEMO's Integrated System Plan (ISP), IEEFA observed in a recent submission:

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

We further noted: "*The current one-way linkage between these steps leads to a risk that the demand side and supply side are not fully cost-optimised. [...] This can lead to a bias where the ISP focuses disproportionately on supply-side measures to reduce system costs.*"

Recent delays in generation and transmission projects as well as increasing social licence concerns over large-scale infrastructure projects demonstrate that this supply-side bias carries material risks.

In their response to the federal Department of Climate Change, Energy, Environment and Water's recent review of the ISP, energy ministers acknowledged that better integration of demand and supply side modelling was needed. However, they recommended that, "*The System Planning Working Group will report to the Energy and Climate Change Ministerial Council (ECMC) on progress made in implementing this approach **following the 2026 ISP.***"

This delay is concerning given the pace of Australia's energy transition, and the material likelihood that major supply-side investment decisions in the coming years could be locked in without a full understanding of whether they are required under a true least-cost pathway for consumers.

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Equitable phase-down of gas distribution networks requires urgent planning

Consumers could benefit significantly from a transition to efficient electric homes. However, the transition has material implications for gas distribution networks, which typically recover 80% of their costs from residential customers (up to 93% in Victoria, according to a recent IEEFA submission.

The federal government has recognised this in its discussion paper for the Electricity and Energy Sector Plan, observing:

- "*Regulatory settings will need to be considered as electrification accelerates and use of gas networks declines. It is important to ensure that the gas regulatory framework is fit for purpose into the future as demand for, and use of, gas changes*" and;
- "*Governments, regulators, and pipeline owners will need to work together to ensure current and future investments in gas pipelines reflect an appropriate and considered allocation of these risks.*"

These issues are material, and as IEEFA observed in its submission, "*A managed phase-down of residential gas networks is essential.*"

"*Forecasts increasingly agree that a long-term decline in Australian residential gas consumption is likely. This assertion is underpinned by a fundamental shift to the underlying of economics of gas versus electricity in homes, and government policies to support efficient electrification.*"

"*Specifically, there is a risk that gas network assets are left stranded as customers leave the network. This raises urgent questions around the most economical and equitable way to allocate gas networks' stranded asset risks.*"

Material decisions on the future of gas pipeline assets, and risk allocation between consumers and networks, are being made by the Australian Energy Regulator (AER) on a case-by-case basis at the beginning of five-year regulatory windows.

As IEEFA's submission stated: "*The AER has made interim decisions that reallocate some risks from networks to consumers in Victoria, but it has signalled that it does not view these as long-term decisions.*"

It is challenging to expect the AER to make these decisions without any form of overarching guidance on what an equitable phase-down of gas distribution networks looks like. There is an urgent need for federal and state governments to agree on a plan to manage this phase-down.

Rules on new assets could avoid locking in unnecessary gas-based infrastructure

Several new gas-based assets are planned. Avoiding unnecessary investment in gas infrastructure will be key to keeping the cost of the transition down.

For example, IEEFA recently identified that: *"Current proposals for a gas-based expansion of CSBP's ammonia plant in Kwinana, Western Australia, would add about 0.5MtCO2e* [500,000 tonnes of CO2 equivalent] *to Australia's emissions each year. However, instead of proceeding as planned, the expansion offers an opportunity to demonstrate large-scale integration of renewables and green hydrogen in the domestic ammonia supply chain. It could create demand*

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for about 53,000 tonnes of green hydrogen – 18% of the green hydrogen production currently proposed across Australia for domestic use, and more than twice the planned capacity in Western Australia."

IEEFA's review of the business plan for the Middle-Arm Gas and Petrochemicals Hub found that it is flawed: "*The ambitious plan relies on too many unproven assumptions, including the viability of carbon capture and storage; a robust market for liquefied natural gas; partners who will agree to develop resources in the isolated region and significant infusions of public dollars over a long period that could upset Australia's fiscal balances. Given the obstacles to the development of the Middle Arm Gas and Petrochemicals Hub, it is highly likely that a significant burden of the project's costs will fall on those least able to afford it – Australian taxpayers.*"

6. How can governments stimulate private finance needed for the net zero transition – are there innovative instruments that could be deployed or new business models that governments could support? Is there a bigger role for governments to play in coordinating the investment needed to transition the economy?

In a recent submission, IEEFA identified a number of instruments that could be used to attract private capital:

"The Australian government could consider expanding the role and capabilities of the Clean Energy Finance Corporation (CEFC) to go beyond its current strategy of debt and equity co-investments. The CEFC could implement a comprehensive suite of catalytic financial instruments like credit enhancement mechanisms (loan guarantees, loan loss reserves, subordinated debt) in line with the tools used by green banks in other countries to address financial uncertainties pertaining to clean energy infrastructure debt:

- *Mitigate financing risks and uncertainties for large-scale clean energy infrastructure projects, which currently face challenges attracting debt financing at scale, for example due to perceived higher risks given for early-stage technologies.*
- *Increase the loan-to-project value ratios from the current level of 50%-60% to around 70% by absorbing some of the debt risks through credit enhancement tools.*

"By deploying such catalytic capital instruments, the CEFC may be able to unlock higher private investment, especially from large sources like Australia's $3.5 trillion superannuation funds, which is crucial for financing Australia's net zero transition. More importantly, it can alleviate some of the financial uncertainties hampering investment from institutional investors like super funds by ensuring appropriate risk adjusted return."

"The government could consider broadening the mandate of Australia's $270 billion Future Fund, the nation's sovereign wealth fund, to include a specific focus on investing in clean energy infrastructure within Australia, alongside its existing risk-return objectives. Assigning 10%-15% of the Fund's investments to clean energy infrastructure could yield significant catalytic effects, instilling investor confidence and encouraging further investment in the energy transition sector.

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This would involve making patient, strategic equity investments in Australian critical minerals, grid infrastructure and established renewable energy firms. By leveraging the Future Fund's meticulous due diligence processes, approvals could be expedited, attracting additional capital from other investors. Furthermore, the fund could create an early-stage risk capital pool to invest in early-stage domestic clean-tech companies. Such a strategic investment approach would aim to bolster domestic capabilities and achieve scale in pivotal energy transition sectors, while maintaining majority Australian ownership and maximising tax benefits."

7. How can governments better support markets, including carbon markets, to deliver emissions reduction outcomes?

Ensuring the success of the Capacity Investment Scheme

The Capacity Investment Scheme will be key to reaching the 82% renewables targets. However, there are adjustments to the scheme that could help ensure its success.

The scheme is set to support 23GW of renewables, however about 36GW of renewables will be needed to 2030 to reach the 82% target. Therefore, IEEFA has recommended that the federal government consider expanding the CIS or ensuring that NSW's commitments to install 12GW of new variable renewable energy (VRE) capacity is counted as additional to the federal government's 23GW.

Further, we need to ensure the CIS is structured to minimise the risks of projects that never go ahead, and reward bidders that have commercially viable projects they can deliver on a rapid timeframe. Five proposals to do so include the following:

1. *"Create a race through oversubscribing tender rounds relative to a megawatt target **and make contracts contingent on getting to construction commitment** ahead of the target being reached. The aim is to keep the pressure on tender winners to reach construction commitment as fast as possible and weed out projects which are slow to progress."*
2. *"Provide an **exceptional value standing offer** underwriting contract that projects can access outside of the tender process once they reach construction commitment. There will be cases of developers who might score poorly in a tender evaluation but who manage to surprise us with their ability to progress a project to construction commitment, if they were able to lock-in underwriting support. This could also help smaller projects which might be excluded from the tender process but could be a very good way to get around the transmission capacity constraints. […] After the first auction, once DCCEEW has gained some understanding of the bid prices of participants, it could provide a standing offer at a declared floor and ceiling price for each state which it considers to represent good value to taxpayers. This standing offer underwriting agreement would be available to any renewable energy project (other than those contracted under the tender) which managed to reach construction commitment within 18 months of the first tender round closing."*
3. *"Make it a condition of tender eligibility that **projects must already have necessary government planning and environmental approvals**. Planning approvals in some states can take years, so awarding contracts to projects without approvals increases the*

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risk the CIS will end up with projects that don't get built within the required short time frames."

4. ***"Keep tenders to a national basis**, don't pre-allocate capacity to individual states. This will put the pressure on states to compete against one another with fast approvals and supporting infrastructure to create a pool of competitive projects."*
5. ***"Drop selection criteria relating to community engagement and social licence** and leave this to the planning approval process. Don't try to get a tender process to do what is best dealt with through planning policy."*

Encouraging demand for renewable-based products like green explosives

Lack of demand is a key barrier to the development of renewable-based products. Government can play a key role in encouraging/creating demand for those products. For example, IEEFA's report examining ammonia and explosives found that, *"Government support will be crucial to drive and complement action by miners, by addressing data transparency challenges and reducing investment risk. Adapting existing schemes such as Renewable Energy Certificates could drive investment in explosives inputs. The creation of a similar market-based mechanism offers the opportunity of recognition for miners' action, and financial incentives and competitive advantages for ammonia producers. Other emerging initiatives such as a hydrogen Guarantee of Origin (GO) scheme could also provide a consistent, accurate approach to tracking emissions from production of hydrogen and derivative products such as ammonia. Investment support can cover shortfalls in miners' commitments, while regulatory measures can mandate full decarbonisation of explosives production. Other measures such as legislating Scope 3 emissions reductions or placing limits on the use of offsets would also accelerate action across the ammonia supply chain."*

Consider the limitations and evidence of carbon credits in achieving emissions reductions by evaluating latest evidence.

The importance and prevalence of carbon credits or offsets being used in decarbonisation strategies in different industries and by businesses must be understood better. If carbon credits and offsets do not actually result in reducing carbon emissions, then there is no feasible way that they can be used as a decarbonisation strategy. There are a multitude of studies that have found significant failures in carbon offset accreditation, making carbon credits bought from these certifiers essentially useless. A global investigation into the effectiveness of REDD+ carbon credits certified by Verra, found that 90% had no positive impact on the climate. A separate study into the effectiveness of 40 REDD+ projects certified by Verra conducted by the University of Cambridge found no evidence of reductions in deforestation and degradation over an eight to 10-year period. Additionally, researchers from the University of Berkeley's Goldman School of Public Policy assessed 300 carbon offset projects and found significant problems that allowed businesses to be credited for operating as usual rather than improving or reducing emissions. Research from Australia examining Australian Carbon Credit Units (ACCU)s under Human-Induced Regeneration (HIR) found that, "*the vast majority of HIR projects that have been credited to date have resulted in very little (and often negative) tree cover change*".

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Additionally, using carbon credits to offset methane emissions is inappropriate, given the significant differences in the nature of how methane and CO_2 interact in the atmosphere and their contribution to global warming. **Methane emissions need to be measured, monitored separately to** CO_2 **emissions rather than being converted into** CO_2 **equivalent**, with complementary but separate strategies on methane emissions reductions and CO_2 emissions reductions.

8. What further actions can be taken by governments (e.g. through public funding), the private sector and households to accelerate emissions reductions, including in relation to the deployment of technologies and access to new opportunities in the transition to net zero? What barriers stand in the way and how could they be overcome?

Need to review energy governance

More co-ordination is needed between governments to ensure the energy market bodies and energy industry as a whole can move quickly enough to reach decarbonisation goals. As IEEFA explored in its report, Growing the Sharing Energy Economy:

"While energy market governance has been reviewed several times since the NEM was created, its fitness for purpose to meet Australia's decarbonisation goal of 43% by 2030 and 82% renewables by 2030 has never been evaluated."

It recommended that energy ministers should, "*Commission an independent review of energy market governance and its fitness for purpose for integrating DER and for the energy transition to be completed within six months. While previous reviews have considered the governance of the energy market intuitions, none have done so when there was the current level of urgency of renewable energy, storage and flexible demand deployment.*"

Need to review electricity distribution network economic regulation

DER can now provide distribution network services that have traditionally only been provided by network infrastructure. Standalone power systems (usually made up of solar with storage and potentially a back-up diesel generator) can provide power for remote homes and businesses in place of the network or without the need to extend the network to a new development. Rooftop solar, storage, EVs and flexible demand can also support existing distribution networks by providing feeding into, or importing from, the grid to alleviate network constraints, for example, due to high voltages. In this new world, we need to reconsider who can provide network services, how they are paid and what is the nature of the procurement. To grapple with these significant questions, a review of the economic regulation of distribution networks is required, as IEEFA recommended:

"Network revenue regulation was designed to reward distribution businesses for delivering one-way flows of electricity, including the construction of assets to meet peak network flows.

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Networks now need to enable two-way flows and DER integration to support decarbonisation. A review of distribution network revenue regulation is needed to enable DER to provide network services on a level playing field with expenditure on network assets, and to make sure that in a DER-rich future, networks are used efficiently and that distribution network costs can be reduced for consumers."

12. How can Australian governments support the wellbeing of workers, communities and regions as the nation decarbonises, including in relation to cost of living, workforce and industry transition and access to low emissions technologies and services?

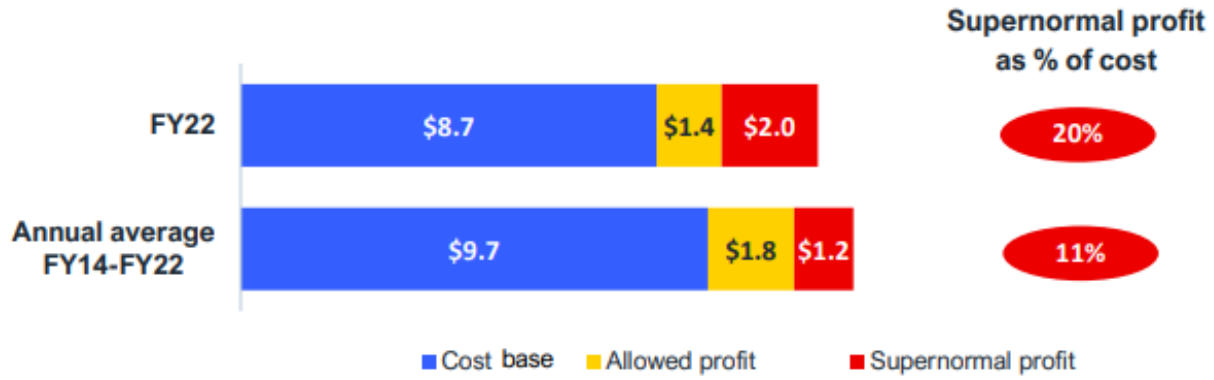
Electricity network supernormal profits must be addressed to ensure the transition is cost-effective

IEEFA analysis has shown how electricity networks have been obtaining supernormal profits that have been extracted due to weaknesses in the regulatory system.

"An analysis of this data shows that supernormal profits have been recorded every year since 2014, and that these were excessive in eight of the past nine years. Estimated sector-wide supernormal profits were persistent, averaging about $1.2 billion a year over FY14-FY22 or 11% of total cost (including allowed profits). In FY2022, the combined actual profits were $3.4 billion, 2.5 times the risk-adjusted, allowed profit of $1.4 billion – a supernormal profit of $2 billion."

The estimated supernormal profits over the periods analysed are summarised in the figure below.

Figure: Annual network cost and profit outcomes ($ billion real)



Source: IEEFA. Note that supernormal profit as % of cost is calculated as the supernormal profit divided by the cost base plus allowed profit.

The AER has responded to the IEEFA report, finding a similar figure, although referring to it as "outperformance" rather than "supernormal profit". The AER stated:

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"We derive a similar outcome to IEEFA with a return on equity of $9.7 billion out of total revenue of $122 billion ($2022, real). The difference is that our estimate uses the actual leverage of the networks businesses as opposed to average gearing across networks used by IEEFA."

IEEFA responded to the AER's comments, stating:

"This is the first time that AER has acknowledged the size of the dollar figure gap between allowed and actual network profits."

"The AER has so far not provided any new evidence to support its assertion that about $10 billion of additional network profits – on top of about $16 billion of allowed profit – is consistent with incentive regulation and has no impact on consumer bills."

"Whether referred to as 'supernormal profits' or 'outperformance', it is clear from both the IEEFA analysis and the AER's response that networks are receiving significant additional profits of $10-$11 billion above the allowed level, which is around $16 billion. The IEEFA analysis acknowledges that some level of supernormal profit could be reasonable, but objects to such an excessive level of supernormal profits."

Measures should be taken to bring this down to a reasonable level of profit to prevent adverse impacts on consumers and the electricity system as a whole.

IEEFA recommended: *"NEM Ministers should obtain independent expert advice to test the IEEFA analysis and identify suitable remedies to bring network profits to reasonable levels. Potential remedies include changes to the laws and rules governing the economic regulation of monopoly networks, alongside the introduction of greater transparency and independent monitoring of network profits by the Australian government. […] Without these changes, excessive supernormal network profits and less affordable power bills will likely continue for the foreseeable future.*

"Substantial new regulated network investment is required to support the energy transformation to allow the timely replacement of high-emissions power stations with renewable energy and storage. Excessive network profits are inefficiently raising consumer bills and impeding this transformation."

Ensure consumers don't pay unnecessarily for gas networks stranding

As discussed above, the transition to all-electric homes is likely to significantly disrupt the business model of gas distribution networks.

Gas distribution costs do not linearly decrease if networks serve fewer customers or lower volumes of gas. IEEFA's modelling for Victoria demonstrated there is a risk of a "death spiral" occurring where costs are increasingly and inequitably shared across a diminishing consumer base.

There is also the longer-term risk that networks simply become financially unviable, and that billions of dollars in network assets become stranded.

Fully regulated gas networks in Australia are subject to a "weighted average price cap" form of regulation, which exposes them to risk where actual gas demand differs from forecasts. However,

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as gas demand begins to decline and the likelihood of downside risks increases, networks are likely to try to shield themselves from these risks.

To do so, networks could request allowances for accelerated depreciation, or request to move to a form of regulation that reallocates some risk exposure to consumers (including a "revenue cap" or "hybrid price-revenue cap").

Most fully regulated gas networks have experienced exceptionally high returns on equity, that would generally reflect a business exposed to significant risk.

Higher rates of return generally come at the expense of consumers. As consumers have not materially benefited from the existing risk exposure allocation, there is no strong case for consumers to bear additional stranded asset risks on behalf of networks, including additional charges for accelerated depreciation. The aforementioned plan to phase down gas distribution networks equitably will need to consider this, and provide guidance on how stranded asset risks should equitably be shared in future.

An onus may need to be placed on networks to explain why their allocation of risks is inequitable with respect to the National Gas Laws (NGL) or National Gas Rules (NGR) before any further accelerated depreciation, or changes to form of regulation, are approved.

Furthermore, in its response to the AER's 2023 gas networks tariff review, IEEFA stated: "*It is worth noting that under the National Gas Rules (NGR), gas networks are not guaranteed the ability to fully recover all of their costs. Provisions exist in the NGR for capital redundancy – that enable the AER to make decisions around assets that cease to contribute to service delivery, and how such costs should be shared between networks and users.*"