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31 July 2026

To: NSW Net Zero Commission
Re: Call for Evidence: Decarbonisation Pathways for NSW

Thank you for the opportunity for the Institute for Energy Economics and Financial Analysis (IEEFA) to provide input to the NSW Net Zero Commission (NZC) Call for Evidence to inform the development of NSW Decarbonisation Pathways.

IEEFA is an independent 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.

IEEFA has significant experience across many of the relevant sectors being modelled by the Net Zero Commission, and has applied this experience in the comments below. The submission includes an Executive Summary as well as detailed commentaries on the relevant issues.

We would be happy to discuss any of the issues raised in this submission if that would be of benefit to the process.

Kind regards,

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Electricity and energy opportunities, barriers and timelines

Deployment of renewable energy generation assets and transmission infrastructure build-out, including Renewable Energy Zone delivery

NSW's renewable build-out is progressing but the key challenge is installing renewables and transmission fast enough to reach renewables and emissions targets and replace coal generators as they age. IEEFA recommends the NSW NZC include (in specific pathways) the potential for alternative technologies to unlock new renewables capacity and network capacity to supplement large-scale renewables and transmission build. This includes commercial and industrial (C&I) solar and storage, transmission support batteries (such as the Waratah super battery) and renewables connected to the distribution network.

Adoption of Consumer Energy Resources, including rooftop solar, household batteries and vehicle-to-grid, as well as other distributed solutions such as community batteries

IEEFA research has found:

- **Household energy upgrades can lower energy bills and reduce peak demand.** IEEFA's modelling found a cost-effective sequence of upgrades for a typical home in Sydney could reduce its energy bills by 94%. Households with solar and a 10 kilowatt hour (kWh) battery can substantially reduce their contribution to peak demand during a typical summer and winter day in Sydney. This potential is amplified when battery owners export excess power in the evening peak period. This modelling was based on a 10kWh battery. Typical installed battery sizes now exceed 20kWh, and these households will likely have a larger capacity to export energy to the grid in the evening.

- **The C&I solar and storage sector has significant potential but is being held back by a number of barriers**. Just 5.6 gigawatts (GW) of C&I solar is installed nationally against forecast 2050 capacity of 17–31GW. Technical solar rooftop potential is as high as 86GW across commercial, industrial and rural zones. NSW's decision to include C&I storage in the Peak Demand Reduction Scheme (PDRS) may drive higher uptake of C&I storage in NSW. However, more work needs to be done to remove network-related barriers such as slow grid connection processes and complex, inconsistent network tariffs, which hinder C&I solar and storage uptake.

- **Phasing out inefficient electric appliances in NSW households could reduce annual residential electricity demand** by 5.8 terawatt hours (TWh), which could lead to a net 20% reduction in residential electricity demand, even if gas appliances were electrified.

- **Distributed energy resources (DER such as rooftop solar, batteries and flexible demand, could deliver at least $19 billion in economic benefits to Australia** by 2040, from avoided network, large-scale generation and storage costs.

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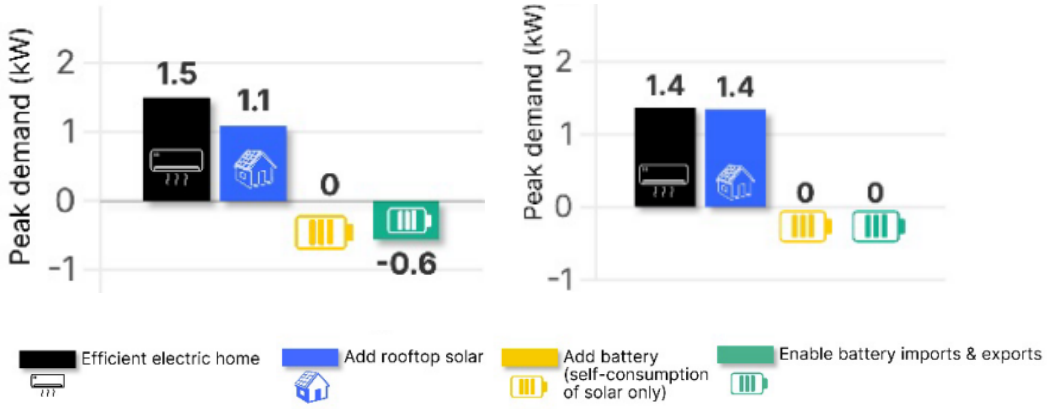
Figure 1: Impact of rooftop solar and batteries on average-day January (left) and July (right) peak demand for a Sydney household



Source: IEEFA

Electricity demand, including new sources such as data centres, industrial demand management, load shifting and battery deployment, and their market impacts

- **Large-scale batteries are reshaping electricity market supply and price patterns** as seen in AEMO's recent Quarterly Energy Dynamics Report. In particular, reductions in wholesale spot prices during evening peaks have been evident.

- **Significant opportunities exist in industrial demand management.** New Zealand began using demand response in 2007, and now meets more than 16% of peak demand through demand response programs. In some US states, it is used to meet more than 10% of peak demand for electricity. It would be of value for the NSW NZC to gauge the industrial demand management opportunity and include high levels of demand response in the fast-track scenario.

- **NSW needs to adequately plan for data centres**. NSW has 85 active data centre projects – 46 operating and 39 in the pipeline, according to RenewMap, with Sydney a dominant hub. AEMO's ISP forecast data centres could consume almost 10% of underlying demand in 2050 – five times today's share and the equivalent of 20% of today's total demand. To prevent strain on the grid from added data centre loads, NSW and the broader NEM needs to install enough generation supply. The NSW NZC should consider various data centre development pathways in the sectoral pathways work, and how to prevent electricity system cost shifts from data centre operators onto other NSW consumers. NSW NZC could also consider the potential for C&I solar and storage projects, either installed at data centres or at multiple nearby sites, to help serve new data centre loads.

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Equity in the electricity transition, including strengthening community engagement in infrastructure deployment and benefit-sharing

- Rental properties comprise more than 30% of households, however renters face significant barriers to accessing efficient electric homes, rooftop solar and batteries. A recent IEEFA report outlined the case for minimum energy efficiency standards to address this.

- We have found that minimum energy efficiency standards for rental properties could save NSW renters $35 billion by 2050. Well-implemented standards could ensure renters could be better off from day one. Furthermore, upgrading rental properties could benefit all energy consumers via reducing peak electricity demand.

- Specific implementation considerations for NSW are outlined in IEEFA's submission to the state government's consultation on minimum energy efficiency standards for rental properties.

- A NSW government change to the PDRS to include storage in apartments could help drive additional update of storage, and improve equity outcomes.

- Broader signalling from the AEMC of a direction towards fixed network tariffs could lead to inequitable outcomes, as lower energy consumers could pay more with higher fixed charges. Further higher fixed charges could slow the uptake of DER, and may be a relevant dynamic to consider for NSW's decarbonisation scenarios.

Infrastructure, market, policy and demand-side conditions needed to support the orderly closure of coal-fired generation assets in NSW

NSW and Australia more broadly should consider a comprehensive, long-term framework to manage coal exit that provides more certainty on coal closure dates, and therefore certainty for investors in replacement capacity. NSW (and the NEM more broadly) has an Orderly Exit Management Framework (OEMF), however it only applies to generators that bring forward their exit date, and does not provide a full exit schedule for all generators. A Clean Energy Investor Group survey found coal closure certainty was the second-highest regulatory or policy measure that would unlock greater renewables investment in Australia (after an expedited transmission rollout).

As coal generators get closer to typical retirement age, their availability levels can decline. They can experience increased outages. The NSW NZC or other relevant agencies should ideally develop various contingency plans in the event coal generators have major technical issues. Detailed financial and technical audits of NSW's coal generators would be a helpful input to planning processes such as the decarbonisation pathways.

Any other issues

There are opportunities to increase the utilisation of the distribution network and connect new renewables (or unlock curtailed renewables) in the distribution network. Some examples of this

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are NEARA's digital twin modelling (which identified spare capacity in Essential Energy's network) and AEMO's recent identification of distribution Renewable Energy Zones (REZs) in NSW and voltage optimisation opportunities that could unlock clean energy exports.

Transport opportunities, barriers and timelines

Transitioning to electric vehicles, considering passenger and heavy vehicles, and autonomous/shared ownership models, including rollout of charging infrastructure

The rollout of EVs will require planning to ensure they are effectively integrated with the grid in a way that minimises overall system costs. This should address issues such as time of charging, integration of EV chargers with electricity network planning, integration of public EV chargers with solar and storage assets, and bidirectional charging.

Transitioning and mode shifting for freight and the infrastructure and fuel supply needed, including for road freight, shipping and aviation

IEEFA's recent briefing note, Managing Australia's diesel squeeze, identifies road transport as the largest diesel consumer nationally at 53% of use, dominated by light commercial vehicles and trucks. The top 10% of drivers by distance travelled are responsible for up to 40% of all kilometres driven. This means targeted electrification of heavy road users (a cohort disproportionately represented in NSW's freight corridors along the Hume and Pacific highways) could deliver outsized diesel-import reductions relatively quickly. IEEFA believes electrification of road freight should be considered in the balanced scenario, with a delayed take-up informing the delayed case.

IEEFA notes there is frequent advocacy for the role of rail freight in reducing transport emissions. While modal shift would reduce emissions in the immediate term, as road transport converts to EVs, over time this would erode rail's emissions advantage relative to road, and even potentially reverse it should rail not transition to battery electric locomotives in the relevant timeframe. IEEFA would therefore recommend care in modelling emissions reductions from modal shift, and ensure that the conversion of trucking fleets to EVs should be the baseline. Any conversion should be included in the Fast Tracked scenario only if modal shift delivers a lower emissions profile based on the introduction of battery electric locomotives in the modelling timeframe.

Adoption of renewable and low emission fuels, including hydrogen

Battery-electric solutions are likely to be the most prominent for the large majority of NSW's light, medium and urban-freight task in the short to medium term. Hydrogen or renewable diesel/sustainable aviation fuel is more likely to be required by genuinely hard-to-electrify long-haul, heavy and aviation applications where alternatives remain immature.

Increasing public transport, cycling and walking

As IEEFA explored in a prior submission to the NZC, "The most effective approaches to accelerate rapid decarbonisation across passenger transport within NSW include developing

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better infrastructure to enable passengers to travel via low-emissions options such as public transport, cycling and electric mobility including EVs and E-scooters."

Industry opportunities, barriers and timelines

Electrification of smaller industrial facilities and low to medium temperature process heat, including supply chain considerations

IEEFA research has found that industrial heat pumps could reduce the energy use of food and beverage manufacturers by 80% or more. This could not only help reduce industrial energy costs and emissions, but also alleviate gas market tightness in eastern Australia. However, adoption remains extremely slow.

A separate IEEFA report found, "Growing evidence highlights large, untapped opportunities to reduce energy use in industrial facilities, including several past programs in NSW… If done in parallel to industrial electrification, energy efficiency could also offset the additional electricity use, reducing the investment required in the electricity system. A program targeting industrial heat electrification could also cover other opportunities such as energy efficiency and a shift to renewable fuels, as done in New Zealand."

Key interactions and synergies between industries, facilities and regional hubs, such as electricity, clean fuel, waste or supply chain infrastructure, including embodied emissions of infrastructure and power generation

As IEEFA stated in a previous submission to the NZC: "One of the heavy industry facilities in NSW is Orica's ammonia plant at Kooragang Island. A shift from gas to green hydrogen feedstock is the most prospective opportunity to decarbonise ammonia production. However, green hydrogen deployment has been slow in Australia, which is delaying cost reductions gained through learning rates and economies of scale. A lack of demand at scale is a key barrier, with government support insufficient to eradicate the cost premium compared with existing technologies."

"IEEFA has identified one opportunity to create demand at scale through the introduction of mandatory offtake requirements for green hydrogen-based explosives. Ammonia production is an ideal first adopter of green hydrogen in Australia for a range of reasons, and half of Australia's ammonia production is used to make explosives for the local mining industry." IEEFA calculated, "switching to 20% green ammonia for explosives production by 2025 would increase mining operating costs by less than 0.1%. This could be done by blending green hydrogen and existing gas-based hydrogen with minimal asset upgrades. A full switch to 100% green ammonia for explosives production by 2030 would increase mining operating costs by up to 0.4%."

Steel technology transition

Following the blast furnace reline at the Port Kembla steelworks, it looks unlikely there will be any major capital investment in coal-based ironmaking in Australia again. A plan to transition the Whyalla steelworks in South Australia from blast furnace to direct reduced iron (DRI)-based

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steelmaking is in place. Proposed projects for new low-carbon ironmaking capacity in Australia are based on DRI technology.

DRI is a mature technology used at commercial scale around the world, based on gas. As the global steel sector targets emissions reductions, the industry is expected to progressively shift away from coal-based steelmaking towards DRI. The major providers of DRI technology – Midrex and Energiron – have made clear their technology is hydrogen-ready.

Globally, it is clear steelmakers seeking to make investments to reduce their emissions are turning to DRI technology rather than carbon capture and storage (CCS) for existing blast furnaces. There still no commercial-scale CCS plants for coal-based steelmaking anywhere in the world – DRI is leaving it far behind.

CCS has a poor track record across all sectors in which it has been attempted. For steelmaking, successful CCS implementation is complicated by the fact CO_2 is emitted at various stages of the steelmaking process. The issues faced by CCS in the steel sector mirror the difficulties and risks encountered in other sectors. These include inadequate carbon capture rates, high cost of CO_2 transportation and doubts over both the availability of CO_2 storage sites and their long-term security. The International Energy Agency (IEA) has continued to downgrade the role it expects CCS will play in addressing emissions. In its latest World Energy Outlook, the IEA projects CCS will contribute less than 5% to emissions offsetting by 2050. The IEA regularly downgrades its estimates for CCS as alternatives, such as renewable energy, electrification and alternative industrial processes, become cheaper.

In addition to coal-based steelmaking, the future of CCS for DRI-based steelmaking looks very limited. There is only one commercial-scale CCS project for DRI-based steelmaking anywhere in the world (the Al Reyadah project), and it captures only around 25% of the plant's total emissions. In addition, the captured carbon is used for enhanced oil recovery (EoR), leading to the consumption of more fossil fuels and production of more carbon emissions. It is unlikely this CCS plant in the United Arab Emirates would have gone ahead if it weren't for the EoR element. No other commercial-scale CCS project for DRI has been built since Al Reyadah was commissioned 10 years ago.

DRI technology provider Midrex does not see a major role for CCS, stating, "CCS remains a niche technology for steel and is likely to work only in very specific locations and under particular circumstances".

Green hydrogen is the more likely alternative to CCS in reducing the emissions of gas-based DRI. Although green hydrogen development has slowed in many sectors, its role in the steel sector is firming. Day one green hydrogen use in DRI projects has become the global benchmark for low-carbon iron and steelmaking.

Stegra is building a DRI-based steel plant in Sweden that will run on 100% green hydrogen. German steelmaker Salzgitter intends to use some green hydrogen in the reduction mix at its DRI project from day one, sourcing the green hydrogen both internally and externally. French steel start-up GravitHy has recently recommitted to hydrogen, stating, "Our strategy is to start with

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hydrogen from day one." In Oman, Meranti Green Steel expects to make a final investment decision on its planned DRI plant in the second half of 2026. The plant will use 10%–15% green hydrogen from day one. In China, giant steelmaker Baosteel already has a commercial-scale DRI plant in operation, and is developing its own green hydrogen project to supply it.

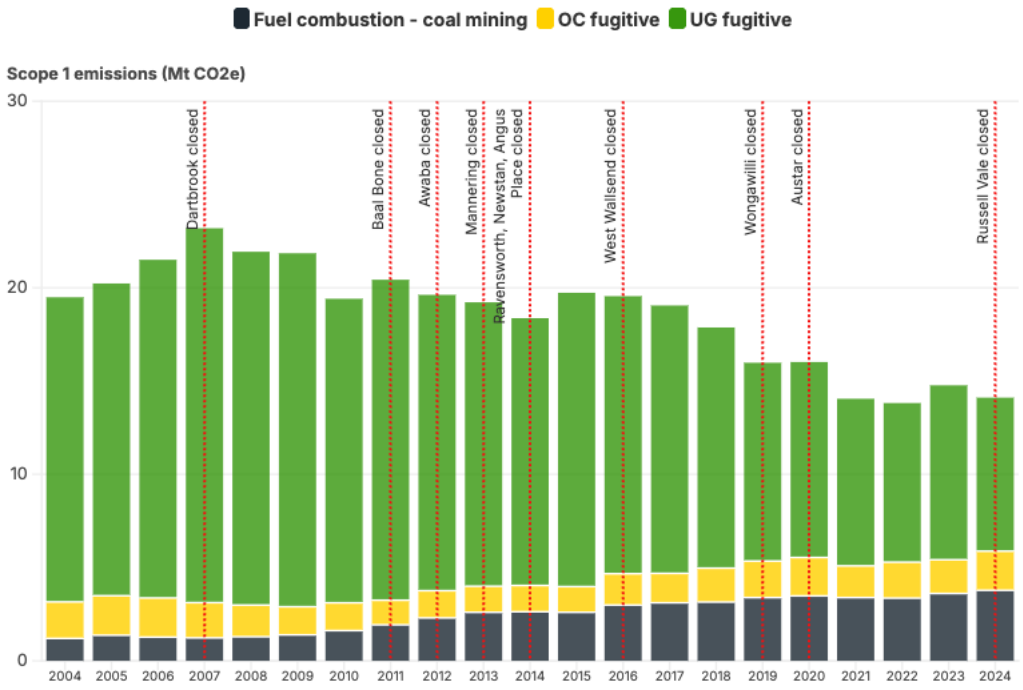
Global developments clearly indicate the technology pathway for the Port Kembla steelworks. A shift from coal-based steelmaking towards DRI with early green hydrogen use is the benchmark to which Port Kembla will be compared.

Resources opportunities, barriers and timelines

Review of NSW coal sector emissions trends

The coal sector in NSW has achieved significant Scope 1 emissions reductions, falling 28% between 2004 and 2024 to a level of 14.1MtCO_2e in 2024 (Figure 2). Deeper analysis suggests this is driven more by mine closures than abatement strategies, which informs the development of future sector emissions pathways.

Figure 2: NSW coalmining emissions trend, including underground mine closures



Source: National Greenhouse Accounts, filtered for NSW Coal.

Figure 2 demonstrates significant falls in emissions from the closure of underground coalmining, the most emissions-intensive form of mining, halving between 2004 and 2024, from 16.33MtCO_2e to 8.23MtCO_2e.

Sector emissions reductions from mine closures (not abatement strategies) are consistent with the NSW government's NSW Coal Industry 2026–50 report where coal industry contributions to

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emissions reductions are based on mine closures rather than any apparent emission abatement strategy.

The 2050 framework has effectively banned greenfield developments but allows emissions and extensions subject to approval under the rigorous assessment framework. The NZC Spotlight report suggests any approval would be inconsistent with legislated emissions targets. How the NZC finding will be incorporated into the assessment process will be highlighted by the HVO Continuation project application, which is before the NSW Independent Planning Commission.

Onsite emissions abatement

Scope 1 emissions at mines are largely driven by fugitive emissions and emissions associated with diesel use for production machinery. The strategies to abate onsite emissions vary according to the source.

Fugitive Emissions

Fugitive emissions (of methane) remain an ongoing source of Australia's emissions, with policy settings not creating sufficiently strong incentives for onsite abatement.

In part, the lack of action by gas and coal operators to reduce methane emissions reflects continued undermeasurement and reporting, with a growing body of evidence suggesting material underreporting.

Underreporting can, in turn, affect the efficacy of the Safeguard Mechanism in driving abatement, due to insufficient facility coverage and inappropriate baselines and decline curves. It can also affect the financial case for abatement if companies are unable to accurately forecast how much methane will be captured (and therefore revenue from methane sales) following implementation of abatement technologies and techniques.

Importantly, commercially available technologies can materially reduce methane emissions in both coalmining and gas extraction and transportation. The International Energy Agency, for instance, estimates available technologies can reduce fossil fuel methane emissions by two-thirds.

In NSW, this is likely to be most relevant to coal production, and gas transmission and distribution networks.

For the former, fugitive emissions can be captured and utilised for electricity generation projects (or flaring/oxidation), and these savings have been eligible for credits most recently via the ACCU Coal Mine Waste Gas (CMWG) method.

The CMWG method expired in March 2025. The federal government announced in April it would not return, citing "declining marginal value". This is expected to put downward pressure on future voluntary emissions abatement projects. IEEFA has reflected these outcomes in its recommendations where onsite abatement is only incorporated into the optimistic Fast Track Pathway.

Diesel combustion emissions

Figure 2 indicates that coalmining diesel combustion emissions have been trending upward, rising by a factor of more than three to 3.78MtCO_2e in 2024. This increase is driven by a growth in open-cut coalmine production, rising strip ratios and a resulting increase in diesel intensity.

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NSW coalmining has no active mitigation of diesel emissions. Given the applications pending to extend and expand coalmines do not incorporate strategies to electrify the mining fleet, this lack of mitigation will continue, and emissions will be offset by ACCU purchases.

This discrepancy drives the economic decision not to mitigate diesel emissions, and the reliance on Safeguard offsets to manage the emission exposures, as highlighted in IEEFA's recommendations for the pathway modelling.

Note the offsets used by the coal industry for emissions created in NSW are not limited to creation in NSW. This will affect the relevant pathway modelling as discussed below.

Hunter Valley Operations Continuation Project

The Hunter Valley Operations (HVO) coalmine is seeking both an extension, to 2045, and an expansion of production, to 26MTPA, which is under consideration by the IPC. It has released communications highlighting questions raised by stakeholders about the consistency of the NSW government's NSW Coal Industry 2026–50 with the NZC's findings that expansions and extensions are not consistent with legislated targets.

IEEFA notes that the NZC has agreed to meet with the IPC in respect of HVO, the transcript for which is not yet public. We further note that the outcome of the IPC's consideration of the HVO application is uncertain, and will have a significant bearing on the potential pathways the NZC might consider.

If the HVO application is approved, this effectively locks in an emissions profile to 2045 above that required to meet NSW's legislated targets, with no abatement strategies in place and entirely reliant on the use of offsets to manage the 60% exceedance of forecast Safeguard liabilities. It should be noted that the commitments to offsets have not been constrained to NSW, so a natural assumption is that they are purchased from outside NSW. As stated by the NZC in the webinar supporting this process, only offsets created within NSW borders are eligible for inclusion in the modelling. Therefore, the use of offsets to manage emissions can be a key consideration in the modelling.

IEEFA assumes emissions associated with coal transport by rail from the mine to the Port of Newcastle are likely reported within the Transport sector. However, it would be more accurate to include them with mining emissions as they are explicitly linked with mining activity. This would ensure they are appropriately varied with the relevant modelling scenario being considered.

These issues inform the pathway recommendations provided below.

Pathway recommendations

IEEFA recommends the following approaches for the modelling of coalmining emissions:

- All emissions scenarios should include emissions associated with the haulage of coal to the Port of Newcastle (or other demand centres) to ensure these coal haulage emissions are treated consistently with the relevant mining scenario adopted.
- The ***Delayed Scenario*** should reflect the approach outlined in the NSW Coal Industry 2026–2050 report, based on:

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- Extension and expansion applications of existing mines approved.
- No onsite abatement technologies being adopted, ensuring no reduction in emissions intensity is achieved.
- Safeguard exceedances are managed through the purchase of offsets not linked to NSW and therefore not included in the modelling.
- Coal sector contributions to the reduction of emissions are therefore being met by the closure of coalmines, with the cost of implementing emission reductions to meet NSW legislated targets falling upon other industries.
- IEEFA notes that this scenario is not consistent with the findings of the NZC Spotlight report.

- The **Balanced scenario** should reflect the findings of the NZC Spotlight report in respect of extensions and expansions but continue the approach to the use of offsets to meet Safeguard exceedances:
  - No extension or expansion application is approved as per the NZC Spotlight report's key findings.
  - No onsite abatement technologies being adopted, ensuring no reduction in emissions intensity is achieved.
  - Safeguard exceedances are managed through the purchase of offsets not linked to NSW and therefore not included in the modelling.
  - Coal sector contributions to the reduction of emissions are therefore being met through an acceleration of mine closures.
  - IEEFA notes that this scenario is not consistent with the findings of the NZC Spotlight report in respect of the application of onsite abatement strategies.

- The **Fast Tracked scenario** should be considered an optimistic case, consistent with the key findings of the Spotlight report, but acknowledging that the economics of investing in abatement technologies is explicitly linked to the remaining life of the mine:
  - No extension or expansion applications are approved.
  - For mines with a remaining life of 2040 or beyond, mine site operations are decarbonised, removing emissions associated with the mining fleet, and fugitive emissions are captured for onsite power generation (to power the truck fleet).
    - The remaining emissions for these mines, including for rail haulage, are offset through purchases linked to NSW.
  - For mines with a remaining life earlier than 2040, such that the investment life is not sufficient to support investment in abatement strategies, all emissions are offset through purchases linked to NSW.

New and critical minerals production

Emissions associated with the development of new mines should be assumed to be abated from the commencement of operations. That is, investment in a decarbonised mine should form part of the original final investment decision and recovered over the proposed life of the mine.

Any remaining emissions profile, including in respect of the transport of the mine's production, should be assumed to be offset through the purchases of offsets linked to NSW.

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IEEFA notes that critical minerals are essential to the net zero transition. Given the above assumes these new mines can be developed on a decarbonised basis, the scenarios assessed can reflect the pace and the extent to which the opportunities are developed, which are beyond the scope of IEEFA's submission.

An alternative would be to apply the following assumptions for offsets:

- Delayed Case – all offsets are purchased outside NSW.
- Balanced Case – 50% of offsets are purchased outside NSW.
- Fast Tracked – all offsets are purchased within NSW.

Natural gas production

IEEFA notes that NSW has no operating gas extraction facilities, with the Narrabri Gas Project the only new project being proposed. This has been approved for development but awaits a final investment decision from Santos.

IEEFA further notes that the need and timing for new gas supply sources is a function of complex modelling and assumptions related to gas demand and alternative gas supply (which in turn is influenced by development approvals and government policy). In particular, with the Australian government still designing a Domestic Gas Reservation scheme, there remains considerable uncertainty about future gas supply from Queensland, and therefore the need for additional gas extraction within NSW.

This may explain Santos's decision to "deprioritise Narrabri", stating it will not be "spending any capital or exerting any effort" on the project as it prioritises gas extraction in the NT's Beetaloo Basin, and "if the Beetaloo works, it changes what we might want to do" with some of its Australian gas projects, including Narrabri.

Given Narrabri has not reached final investment decision and ongoing uncertainty about Santos's intentions to develop the field, and in light of uncertainties associated with the gas market in NSW, IEEFA would support the exclusion of the Narrabri gas project from all modelled pathways.

Built environment opportunities, barriers and timelines

Electrification of residential and commercial buildings, including demand-side measures

NSW should require newly built homes to be all-electric

A large number of new dwellings in NSW continue to be connected to the gas distribution network. This presents a significant risk to consumers, given the likelihood gas network assets may become stranded. Preventing new dwellings from connecting to the gas network would shield consumers from this risk, while encouraging the use of efficient electric appliances that have far lower running costs than gas appliances.

Several local governments in NSW have already taken proactive steps to require new buildings to be all-electric. However, a more consistent approach could involve the state government

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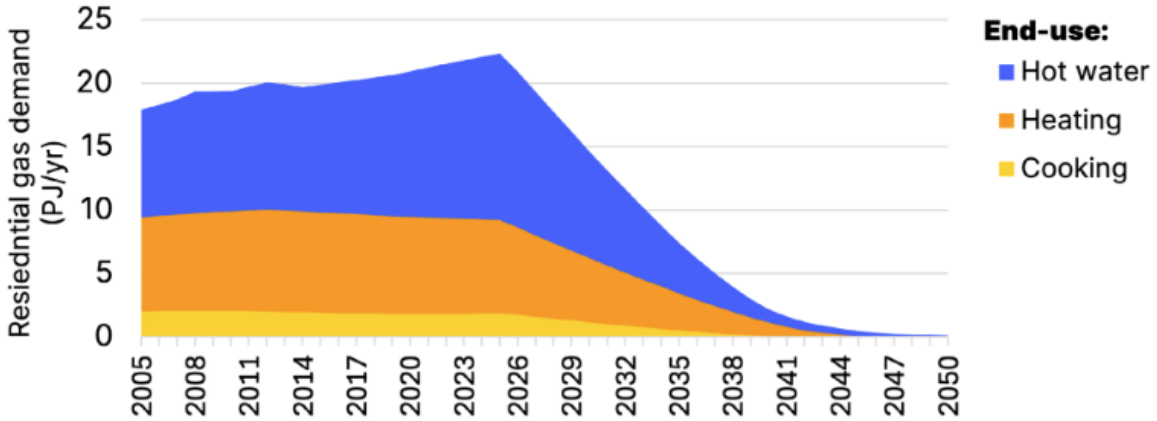
amending planning regulations or the BASIX scheme to ensure new developments are all-electric.

NSW should require gas appliances to be replaced with efficient electric appliances at end of life

Similarly, new gas appliances are still being installed in existing NSW homes. This keeps households exposed to gas network stranded-asset risks, while locking in significant higher running costs, with some fixed appliances having expected lifetimes of 20 years or more.

IEEFA's modelling shows that if all new appliances purchased in NSW were electric from 2026, residential gas consumption would gradually phase down to near-zero by 2050 (Figure 3).

Figure 3: Impact of retiring gas appliances at end-of-life in NSW



Source: IEEFA

The NSW government should consider requiring gas appliances to be replaced with efficient electric alternatives when they reach end of life. IEEFA analysis states: "The residential sector is responsible for a quarter of NSW's gas demand, and is the sector with the most potential for cost-effective reduction of gas demand today. Supporting more households to go all-electric would free up critical supplies of gas that are needed by commercial and industrial customers, who may not be ready to switch to electricity or alternative fuels today."

NSW should prioritise flexible electrification of hot water

Hot water is NSW's single largest residential electrification opportunity. IEEFA research has highlighted to the NSW government that flexible, midday-optimised control of electric hot water systems could cut peak-period electricity consumption from that load by more than 85% compared with uncontrolled operation, meaning electrification could be managed while minimising peak impacts on the electricity system.

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Improving energy efficiency measures, including technology upgrades and improvements to thermal shells (e.g. insulation)

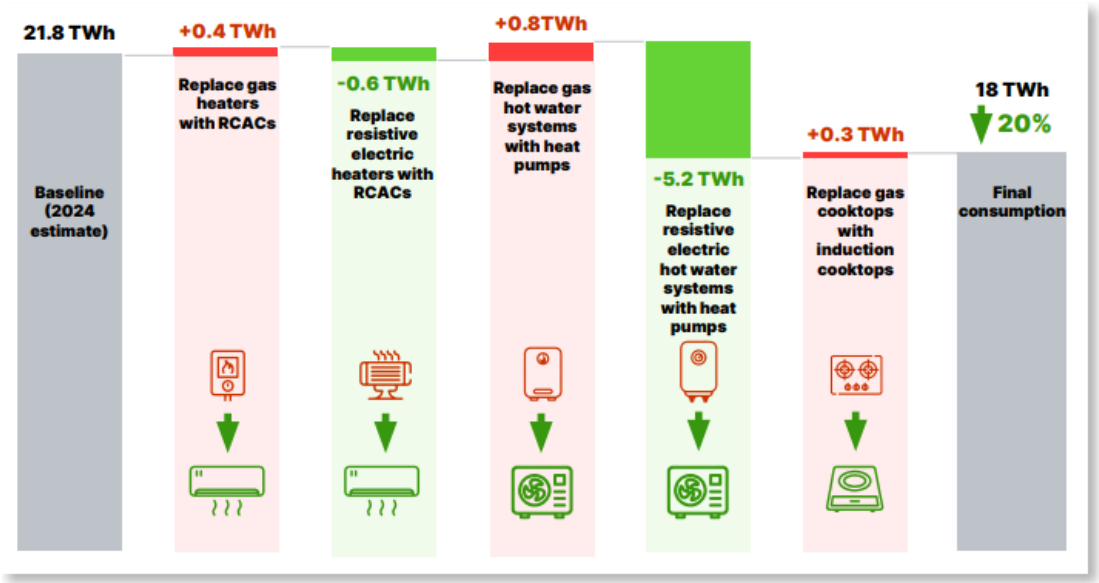
NSW should require inefficient appliances to be replaced with efficient electric appliances at end of life

In addition to a significant number of gas appliances, NSW homes host very large numbers of resistive electric heaters and hot water systems. Despite being cheaper upfront than efficient alternatives, these can consume three to five times the amount of energy as heat pumps.

IEEFA estimates that consumers in NSW are locking in around $1.1 billion in avoidable future costs for every year they continue to purchase these appliances.

Similarly to gas appliances, phasing out the use of fixed resistive electric appliances represents an opportunity to reduce emissions and energy demand in parallel with reducing consumer energy costs. In fact, upgrading the full stock of resistive electric heating and hot water systems in NSW could save as much as 5.8TWh of electricity demand annually, far outweighing the equivalent increase in demand from electrifying gas appliances (Figure 4).

Figure 4: Impact of appliance upgrades on NSW residential electricity demand



Source: IEEFA analysis. Note: RCAC = reverse-cycle air conditioner. Reduction in electricity demand from replacing resistive electric cooktops with induction cooktops was not modelled, and is likely to be negligible.

NSW should introduce minimum energy efficiency standards for rental properties

One in three homes in NSW is rented, and rental properties are far less likely than owner occupier properties to have energy efficiency features. The split incentive is a major barrier preventing cost savings and emission reductions from occurring in the rental sector.

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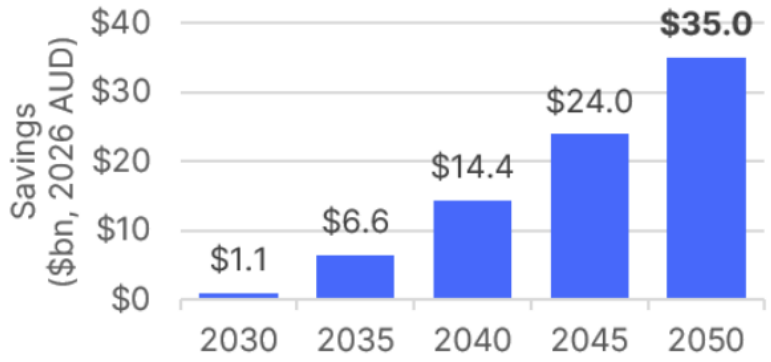
Minimum energy efficiency standards are a critical measure to lower the energy performance gap between rented and owner-occupier properties. IEEFA has found that minimum energy efficiency standards could save NSW renters a cumulative $35 billion by 2050 (Figure 5).

Our submission to the NSW government's consultation on minimum energy efficiency standards for rentals provided recommendations on how these standards could be implemented in NSW while ensuring renters are better off from day one.

Figure 5: Cumulative energy bill savings from upgrading rental properties in NSW



Source: IEEFA.

NSW should broaden its energy efficiency certificate schemes

IEEFA has previously observed, "NSW hosts the largest share of old homes in the country [...] CSIRO has noted that the average star rating of an Australian home built in 2003 was only 1.8."

In addition to comfort and health impacts, inefficient homes impose higher than necessary energy demand, driving up emissions from electricity production. This is especially true when high heating or cooling loads coincide with times when renewable output is lower, such as in the evening.

While NSW's Energy Savings and Peak Demand Reduction schemes provide incentives for certain energy upgrades, the potential benefits from these schemes are far from fully tapped.

IEEFA has recommended to the NSW government that the Energy Savings Scheme be updated to include a broader range of thermal efficiency upgrades, and that the Peak Demand Reduction Scheme be updated to include residential hot water upgrades, pre-heating and pre-cooling.

IEEFA has also recommended updates to the schemes that could improve access, and better support electrification.

Addressing fugitive emissions from refrigerants

IEEFA has also recommended that, "NSW should consider updating its Energy Savings Scheme to require heat pump hot water systems and reverse-cycle air conditioners to use low-GWP refrigerants to qualify for rebates. This should be a low-regrets update, as many products in the Australian market are already available with low-GWP refrigerants."

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Land and agriculture opportunities, barriers and timelines

IEEFA has limited expertise in the assessment of land and agricultural opportunities so will defer to other expertise on these sector-specific assumptions. However, assumptions on the benefits of these projects and their use in other sectors via the ability to offset emissions in the resource sectors (for example) are critical to the accuracy of the modelling pathways; especially given the reliance of coalmines on offsets to address their emission decline requirements.

To ensure consistency across sectors, land and agriculture opportunities for carbon sequestration need to be decoupled from offsets, otherwise there is a risk of double counting the emissions benefits of the opportunities. That is, if the projects are used to offset coal emissions, those emissions will be measured in the Resources scenario, so cannot be included in their own right. Therefore, a clear statement should be made if land and agriculture is used for offsets (and therefore excluded). Concerns have been raised on the appropriateness of the use of land-based offsets against fossil fuel emissions, so an option for consideration would be to not model offsets in the Resources sector, so they can be reported in their own right in this sector.