

2025 consultation

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11 July 2025

Locked Bag 5022,
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To whom it may concern,

Climateworks Centre submission to the New South Wales Net Zero Commission

Climateworks Centre welcomes the opportunity to respond to the New South Wales (NSW) Net Zero Commission. Climateworks bridges the gap between research and climate action, operating as an independent not-for-profit within Monash University. Climateworks develops specialist knowledge to accelerate emissions reduction, in line with the global 1.5 degrees Celsius temperature goal, across Australia, Southeast Asia and the Pacific.

Climateworks has a long history of engagement with the NSW Government, including through submissions on the NSW Housing Strategy Discussion Paper, the inquiry into electric buses in regional and metropolitan public transport networks and the *Freight Policy Reform: Interim Directions* paper.

Climateworks Centre's decarbonisation scenarios 2023 (Climateworks Centre 2023a) is cited in the Commissions latest annual report (Net Zero Commission 2024), and we gave evidence to the Joint Standing Committee on Net Zero Future. With a decade-long history of using scenario modelling to inform debate around decarbonisation pathways for Australia's economy, we look forward to leveraging our technical insights and expertise to strengthen the Commission's ability to fulfil its legislated functions.

Climateworks commends ambitious climate action and the commitments taken by the NSW Government to date. It is particularly laudable that the NSW Government was the first jurisdiction to establish an institutional framework for Renewable Energy Zones. This is especially urgent, given the window to keep global warming within 1.5 degrees is still open, but narrowing.

Our submission draws on a range of Climateworks' modelling and research, in particular:

- [*Seizing Gladstone's low-carbon opportunity: A net zero industrial precinct approach*](#) (2025)
- [*Enabling Australia's home renovation wave*](#) (2024)
- [*Decarbonising Australia's transport sector: Diverse solutions for a credible emissions reduction plan*](#) (2024)
- [*Pathways to industrial decarbonisation: Positioning Australian industry to prosper in a net zero global economy*](#) (2023)
- [*Renovation Pathways: Defining zero carbon homes for a climate resilient future*](#) (2023)



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- [*Climateworks Centre's decarbonisation scenarios 2023*](#) (2023)
- [*Delivering freight decarbonisation: Strategies for reducing Australia's transport emissions*](#) (2023)
- [*Accelerating EV uptake: Policies to realise Australia's electric vehicle potential*](#) (2022)

Thank you for taking the time to consider our submission. We would welcome an opportunity to brief your team if you would like to explore our responses in further detail.

Yours sincerely,

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Submission summary

Climateworks recognises the importance of New South Wales' *Climate Change (Net Zero Future) Act 2023* and legislated greenhouse gas emissions reduction targets. To improve the state's ability to achieve these targets, as well as monitor, review and advise on progress towards these targets, Climateworks recommends that the New South Wales Net Zero Commission:

- **Recommendation 1:** Uphold the United Nations Declaration on the Rights of Indigenous Peoples in all activities and leverage pre-existing advice commissioned by the government.
- **Recommendation 2.1:** Evaluate the alignment of emissions reduction targets to a 1.5°C and well-below 2°C scenario, to guide progress between target points.
- **Recommendation 2.2:** Build the Net Zero Commission's capabilities to ensure their analysis of emissions, policies and pathways has appropriate independence from NSW government agencies.
- **Recommendation 3.1:** Provide advice to ensure new electricity infrastructure is planned and assessed at a regional level, rather than on a project-by-project basis, while ensuring that potentially significant adverse environmental or social effects are identified and avoided.
- **Recommendation 3.2:** Set out how to expand the use of digital mapping and data tools to assist with regional and state-level planning and analysis.
- **Recommendation 4.1:** Provide advice to:
 - Accelerate the uptake of zero emissions vehicles with financial and non-financial policies.
 - Enable mode shift in passenger and freight transport through integrated planning.
 - Show how the NSW Government can work with the federal government to increase the ambition of the New Vehicle Efficiency Standard (NVES) and develop a well-designed 'distance-based' road pricing scheme.

- **Recommendation 5:** Adopt a systematic and integrated approach to land use that considers competing land functions and seeks to optimise economic, social and environmental goals.
- **Recommendation 6:** Work with the federal government and energy planning bodies to create an energy system that supports strong industrial regions and enables Australia and NSW to become a 'renewable energy superpower', including analysis to forecast and plan supply, storage and transmission solutions for 'Regional ISPs'.
- **Recommendation 7.1:** Call for the adoption of a net zero industrial precincts (NZIP) approach, to build confidence in heavy industry and the energy sector stakeholders, including through the provision of investor-grade plans.
- **Recommendation 7.2:** Call for the NSW Government to work with the federal government on the adoption of demand-side measures designed to increase the maturity of markets for low and zero-carbon products.
- **Recommendation 8:** Work with the federal government and energy planning bodies to create an energy system that supports strong industrial regions and enables Australia and NSW to become a 'renewable energy superpower', including analysis to forecast and plan supply, storage and transmission solutions for 'Regional ISPs'.
- **Recommendation 9.1:** Provide advice on how to support the expansion of firmed renewable energy and fuel-switching for off-grid sites.
- **Recommendation 9.2:** Develop a biofuels supply chain strategy at the state level to ensure a sustainable and coordinated pathway for deploying bioenergy resources in the most high-impact use cases and taking due consideration of other land uses and wider objectives including biodiversity.
- **Recommendation 10.1:** Provide advice to ensure the NSW Government takes effective action to improve energy performance for new buildings, including:
 - calling for the implementation of the National Construction Code (NCC) to be current and to prioritise high energy performance for new buildings
 - calling for the introduction of a voluntary zero carbon building definition.
- **Recommendation 10.2:** Provide advice on ways to improve existing buildings' energy performance, including:
 - incentivising existing residential building retrofits, including a package of energy performance upgrades, switching from gas to electric appliances
 - further funding of upgrades for priority households.
- **Recommendation 11:** Develop metrics and indicators for each major emissions source identified, and associated policy interventions, within each sector.
- **Recommendation 12:** Set out how the Net Zero Commission and the NSW Government will develop or access modelling of least-cost pathways to reduce emissions within NSW in line with a 1.5°C pathway, coupled with economic information, and how this will be made available to decision-makers and stakeholders.

First Nations and Climate Action

- **Recommendation 1:** Uphold the United Nations Declaration on the Rights of Indigenous Peoples in all activities and leverage pre-existing advice commissioned by the government.

The United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) is often referenced in best practice frameworks for working with Indigenous people and knowledge (UN 2007; AIATSIS 2020; FNCEN 2022; CEC 2024; ICIN 2025; CAEPR 2019, 2021). The UNDRIP outlines Indigenous peoples' right to self-determination and prior and informed consent¹ (UN 2007). Climateworks recommends using the UNDRIP as the baseline for all engagement with First Nations people.

The NSW Department of Planning and Environment has noted the importance of avoiding duplication and managing consultation fatigue in communities (New South Wales Government 2023a, 2023b). Climateworks echoes its recommendation to invest time in reviewing existing studies and reports before embarking on further research and/or consultation.

The Australian Government commissioned independent research and advice to enhance Aboriginal and Torres Strait Islander peoples' engagement in the seventh Intergovernmental Panel on Climate Change report (DCCEEW 2023). Many of the recommendations and strategies to enhance Indigenous engagement are relevant to the NSW Net Zero Commission. For example:

- Recommendation 5: Do not categorise Aboriginal and Torres Strait Islander peoples as 'stakeholders'
- Recommendation 6: Provide opportunities for Indigenous peoples to be heard at all levels
- Recommendation 7: Support local and Indigenous-led climate change initiatives, including legal protections
- Recommendation 8: Recognise Indigenous knowledge as a system and integrate it equivalently with Western knowledge
- Recommendation 9: Create genuine partnerships with reciprocity, power sharing and respect
- Recommendation 10: Implement free, prior and informed consent for Indigenous peoples' engagement in climate change action and measures

Cultural knowledge needs to be protected by Indigenous data sovereignty and governance (DCCEEW 2023; NAILSMA and CSIRO 2020). The Maiam nayri Wingara Indigenous Data Sovereignty Collective and the Australian Indigenous Governance Institute (2018) note that:

- 'In Australia, "Indigenous Data" refers to information or knowledge, in any format or medium, which is about and may affect Indigenous peoples both collectively and individually.
- "Indigenous Data Sovereignty" refers to the right of Indigenous peoples to exercise ownership over Indigenous Data. Ownership of data can be expressed through the creation, collection, access, analysis, interpretation, management, dissemination and reuse of Indigenous Data.
- "Indigenous Data Governance" refers to the right of Indigenous peoples to autonomously decide what, how and why Indigenous Data are collected, accessed and used. It ensures that data on or about Indigenous peoples reflects our priorities, values, cultures, worldviews and diversity.'

Examples of implementation are noted at the Yoorrook Justice Commission (2022) and the Lowitja Institute (2023).

Accelerating emissions reductions

- **Recommendation 2.1:** Evaluate the alignment of emissions reduction targets to a 1.5°C and well-below 2°C scenario, to guide progress between target points.

¹ Articles 3, 18 and 19.

- **Recommendation 2.2:** Build the Net Zero Commission's capabilities to ensure their analysis of emissions, policies and pathways has appropriate independence from NSW government agencies.

Climateworks commends The Central Resource for Sharing and Enabling Environmental Data for publishing historical emissions data for NSW within each sector of its economy. Historical emissions can now be compared to NSW emissions reduction targets. Ensuring emissions data is analysed at a more granular level will enable the evaluation of sub-sector trends in emissions and give the Net Zero Commission reference points for evaluating policy effectiveness. In light of NSW's 2030, 2035 and 2050 emissions reduction targets, Climateworks recommends an evaluation of these targets' alignment to a 1.5°C and 2°C scenario to guide progress – ideally with carbon budgets allocated within each sector. Climateworks' 2023 decarbonisation scenarios have granular sub-sector data for 1.5°C and well-below 2°C aligned scenarios (Climateworks Centre 2023a). This could support the Net Zero Commission's evaluation of this progress.

Climateworks recommends completing an assessment of current policy effectiveness to ensure the drivers of historical emissions reductions are understood. This could be based on evaluation criteria for each key policy, such as:

1. Are the policies linked to specific emissions reductions?
2. Are the policies delivering the emissions savings they promised (to the extent measurable)?
3. Are the policies delivering emissions savings on time and within the carbon budget?
4. What external factors are aiding or hindering policy implementation?

Climateworks recommends analysing future policy implementations for each sector, alongside historical emissions trends. Current policy effectiveness can be used as a basis for projections of future emissions trajectories for NSW. This will facilitate an evaluation of whether NSW is on track to meet future emissions targets, and in which sectors targeted policy intervention is required.

Climateworks recommends that the Net Zero Commission's capabilities be further developed in these areas to ensure that emissions, policies and pathways analysis are independent of NSW government agencies. This capability will take time to develop, and using the Department of Climate Change, Energy, Environment and Water (DCCEEW) modelling and staff in the first annual report was a necessity.

Electricity and energy

- **Recommendation 3.1:** Provide advice to ensure new electricity infrastructure is planned and assessed at a regional level, rather than on a project-by-project basis, while ensuring that potentially significant adverse environmental or social effects are identified and avoided.
- **Recommendation 3.2:** Set out how to expand the use of digital mapping and data tools to assist with regional and state-level planning and analysis.

The timely delivery of renewable generation, storage and transmission infrastructure is critical to achieving emissions reduction targets in NSW. While the Renewable Energy Planning Framework addresses several historic planning barriers, current processes place the responsibility for navigating

complex environmental approvals, community engagement and social licence on individual project proponents. This has the potential to result in:

- inconsistent community engagement, often occurring only after substantial proponent investment
- delays and uncertainty, as each project negotiates approvals in isolation
- missed opportunities to coordinate infrastructure and balance environmental, social and economic considerations early on.

Shifting towards regional-level planning and permitting can address the root cause of delay and unlock faster, more coordinated deployment. This would involve the upfront identification of the elements needed for project success: sufficient renewable energy capacity, access to transmission infrastructure, no- to low-biodiversity risk and community and First Nations support. Denoting regions as 'go' or 'no-go' zones for renewable energy developments can speed up the planning assessment pathway for eligible renewable energy and transmission projects. It could enable qualified renewable energy projects to be granted priority status in the permit-granting process, ensuring project-focused concerns are addressed promptly unless significant adverse environmental or social effects are identified.

Climateworks advises:

- **Move from project-by-project to regional-level approvals.** Developing strategic regional energy plans that proactively identify suitable areas for renewable generation and transmission (through Renewable Energy Zones) while integrating nature, community and economic factors early to inform site selection and create pre-approved regions for energy projects.
- **Expand the use of digital mapping and data tools.** Advanced digital mapping platforms can support the NSW Government to visualise land use constraints, biodiversity values, cultural heritage and community priorities. The NSW Government could build on good practice examples, such as South Australia's biodiversity mapping for regional plans, to identify areas for protection and those suitable for development. Such tools could also be used by industry, communities and planners to support them in making better-informed planning decisions.
- **Proactively building social licence.** Climateworks supports the Benefit-Sharing Guideline (Department of Planning, Housing and Infrastructure 2024). By embedding early, genuine community engagement into regional planning, communities can shape where and how energy infrastructure is delivered before individual proponents invest. Providing communities with transparent information on trade-offs and benefits can build trust and reduce later opposition to developments. Exploring shared benefit models and local partnerships can also ensure communities see tangible value from hosting renewable and transmission projects.

Transport

- **Recommendation 4.1:** Provide advice to:
 - Accelerate the uptake of zero emissions vehicles with financial and non-financial policies.
 - Enable mode shift in passenger and freight transport through integrated planning.
 - Show how the NSW Government can work with the federal government to increase the ambition of the New Vehicle Efficiency Standard (NVES) and develop a well-designed 'distance-based' road pricing scheme.

Climateworks' latest transport scenario modelling shows a credible and effective approach for transport decarbonisation to meet the Paris Agreement goals (Climateworks Centre 2024a). This deploys a portfolio of solutions that includes zero emissions vehicles alongside increased focus on mode shift and improved vehicular, fuel and operational efficiency. This integrated approach would include a plan to:

- I. Accelerate the uptake of zero emissions vehicles with financial and non-financial policies.
- II. Enable mode shift in passenger and freight transport through integrated planning.
- III. Work with the federal government to increase the ambition of the New Vehicle Efficiency Standard (NVES) and implement a well-designed 'distance-based' road pricing scheme.

Climateworks recommends the following three-pronged approach.

I. Accelerate the uptake of zero emissions vehicles with financial and non-financial policies.

Climateworks recommends the Net Zero Commission review plans for the next phase of potential financial and non-financial incentives to make zero emissions vehicles accessible to a wider market.

Cheaper, zero emissions passenger vehicles and light-duty vans and trucks are available, and financial incentives can help to reduce the 'total costs of ownership'. This would be particularly relevant for lower-income households and small businesses in logistics, operators and owner-drivers (Climateworks Centre 2022, 2024a, 2024b).

Financial policies can also be complemented by non-financial incentives. Examples include 'cordoning' and 'low-emissions zones' in urban areas, and state or council road access for zero emissions vehicles.

Other important factors that drive uptake, such as developing a second-hand and ancillary parts market for zero emissions vehicles, can be encouraged by government fleet procurement.

II. Enable mode shift in passenger and freight transport through integrated planning.

The Net Zero Commission can evaluate the integration of plans across systems – transport, energy and infrastructure or urban planning. Transport decarbonisation will also need to integrate plans across modes and fuels to make low-emissions transport solutions more competitive.

Active and public transport can be enabled by the close integration of transport, energy and urban or infrastructure planning. 'Transit-oriented development' can reduce overall transport demand by bringing living, working, education and recreation areas closer to and more integrated with low-emissions transport options, such as public transport. This generates a 'win-win' for emissions reduction and core transport outcomes, including productivity, liveability and affordability.

Proposals such as a 'NSW freight master plan', 'freight corridors' and 'urban land use planning' can be used to integrate rail as a vital mode in both bulk and non-bulk freight. Freight rail can also be made more competitive by working closely with federal and other jurisdictions to prioritise and invest in policies and actions that improve the capacity, infrastructure availability, intermodal integration, operational reliability, service frequency and transport costs of freight rail (Climateworks Centre 2023b).

Climateworks also supports the recommendations in Attachment A: Towards Net Zero Emissions Freight Policy Actions (Freight Policy Reform Independent Advisory Panel 2025).

III. Work with the federal government to increase the ambition of the New Vehicle Efficiency Standard (NVES) and implement a well-designed 'distance-based' road pricing scheme.

The Net Zero Commission can evaluate the impact of the NVES on light zero emissions vehicle uptake in the state. While the legislation of the NVES was a significant step by the federal government to reduce emissions from transport, Climateworks estimates that, as currently designed, the NVES would not sufficiently reduce light vehicle emissions to align with a 1.5°C trajectory (Climateworks Centre 2024c, 2024d).

As next steps, we recommend that the NSW Government work with the federal government to review and strengthen the NVES headline targets in 2026. The currently legislated targets can be made more ambitious to align with national and state electric vehicle uptake and emissions reduction targets.

Climateworks also recommends that the federal government, supported by states and territories, assess the implementation of a similar efficiency standard for heavy vehicles (Climateworks Centre, 2023b).

Climateworks notes that reform of fuel taxing and road pricing is being widely discussed, especially with the transition to zero emissions vehicles and given the existing shortfall between infrastructure costs and charges.

Climateworks sees strong benefits from the NSW government working proactively with the federal and other states and territories to develop a 'distance-based road user charge' that could replace lost fuel-tax revenue and better internalise external costs (International Transport Forum 2023; Climateworks Centre 2024b).

Agriculture and land

- **Recommendation 5:** Adopt a systematic and integrated approach to land use that considers competing land functions and seeks to optimise economic, social and environmental goals.

There are a number of actions that could increase uptake of emissions reduction strategies in agriculture, both in the short and long term. Climateworks' whole-of-economy modelling includes a range of agricultural practices and technologies designed to improve efficiency, lower emissions and sequester carbon (Climateworks Centre 2023a). These include emerging actions for lowering livestock emissions, such as feed supplements and herd and pasture management techniques as well as land restoration actions such as environmental tree planting that can support the decarbonisation while contributing to biodiversity-related goals.

Improved agricultural technologies and practices are crucial for the net zero transition and warrant investment and increased support for uptake. Investment in technologies and practices assist in increasing efficiency in agriculture, build resilience and to protect or enhance natural capital within farming systems. However, the agriculture and land sector is highly complex, with interacting physical, economic, social factors, and with interactions both within and between different land uses and management techniques.

Land use decisions that focus only on improved practices and technology risk ignoring the broader system impacts and likely won't enable transformations to both mitigate and adapt to climate change

(both physical and transition impacts) while balancing other goals. If not analysed holistically in an integrated way, actions risk working against each other, and at best may support incremental change that does not reach sufficient pace. The future impacts of climate change on agriculture, varying potentials to reduce emissions intensity of different crops or products, and requirements for achieving global biodiversity targets are some of the main considerations of what should be produced and where to ensure optimal use of land.

Taking these interactions into account will assist Australia to meet a range of objectives from land use, which will be more effective when grounded in a clear vision of how the different uses and values of the land sector are balanced. A whole-of-government integrated land use management approach that proactively plans for land use change can deliver joined-up policy making and help reconcile competing commitments whilst ensuring that people and regions aren't left behind.

The primary considerations for credible ambition in NSW's land-sector policy are to simultaneously scale sequestration, minimise trade-offs and ensure that action to reduce emissions is not inadvertently discouraged.. Any carbon stored in nature is vulnerable to natural or human-caused disturbances, creating significant risks to sequestration permanence. Climateworks notes the growing concerns about permanence and temporal equivalence risks associated with the non-linearities of the carbon cycle (Carton et al 2021). Our scenario pathways highlight that land-based removals are only one part of reaching net zero emissions at sufficient pace - with action required in all sectors of the economy. Our work on least-cost pathways shows emissions reductions and carbon dioxide removals are complementary but separate efforts, with ambition maximised across both. Research suggests that separating targets comes with minimal cost impacts (Merfort et al 2025), yet significantly strengthens credibility and transparency (Lebling et al 2024) of meeting climate policy targets, reduces risks of stranded assets (Bindl et al 2025) and accelerates net-zero attainment (Ampah et al 2025). This work suggests separate targets to address the risk that mitigation actions are delayed or weakened, by providing clear guardrails to ensure deep and sustained sectoral emissions reductions while securing sufficient carbon removals to meet net reduction targets.

Acknowledging these equivalence challenges, Climateworks' modelling shows that land-based carbon sequestration will be essential to balance residual emissions to achieve net zero targets, even with rapid technological advancements. Carbon sequestration plays a vital role in addressing historical emissions that are playing an ongoing role in climate change and to compensate for unavoidable emissions from hard or late to abate sectors. This is essential for achieving net zero targets and if additional objectives are considered at the same time can help meet broader environmental goals including Australia's strategy for nature.

Climateworks' whole-of-economy modelling suggests that a cost-effective path to net zero could involve up to eight times more land-based sequestration than is occurring today. The scale of this potential increase presents challenges. Competition for the same land base will affect realisable sequestration. Achieving this requires careful consideration of land use priorities—balancing carbon sequestration with agricultural and forestry production, biodiversity conservation, and economic resilience. If done right, with appropriate incentives and well-aligned policies, it also represents a significant opportunity for landholders to diversify their income streams and build resilience.

Climateworks would emphasise the value of expanding the NSW protected area network for both emissions and biodiversity outcomes. Protecting intact ecosystems is essential for maintaining carbon stocks and their ability to continue sequestering carbon. Intact ecosystems, particularly forests, wetlands, and coastal habitats, are significantly more effective at storing carbon than degraded or fragmented ones. This is because they contain larger biomass, support more complex and long-lived organisms, and have slower decomposition rates, all of which contribute to greater carbon sequestration and storage (Keith H., Kun Z., Hugh S., Mackey B. 2024).

To increase the resilience of the existing carbon stock in a manner that meaningfully enhances the application of First Nations people's knowledge and practices, Climateworks highlights the importance of expanding co-management arrangements in the NSW protected area network with Traditional Owners. Consistent with advice commissioned by the Australian Government (Department of Climate Change, Energy, the Environment and Water 2023) Climateworks advises Parks NSW to cultivate genuine partnerships anchored in reciprocity, power sharing and respect. Australia's obligations under the United Nations Declaration on the Rights of Indigenous Peoples, mean that co-management arrangements should uphold Indigenous peoples' rights to access and manage their Country.

Industry

- **Recommendation 6.1:** Call for the adoption of a net zero industrial precincts (NZIP) approach, to build confidence in heavy industry and the energy sector stakeholders, including through the provision of investor-grade plans.
- **Recommendation 6.2:** Call for the NSW Government to work with the federal government on the adoption of demand-side measures designed to increase the maturity of markets for low and zero-carbon products.

Heavy industry decarbonisation requires a long-term, coordinated response from different levels of government in collaboration with industry, the financial sector and communities. Climateworks research consistently shows that this coordinated action is more effective than action by any single organisation. But the benefits of rapid and large-scale decarbonisation are clear, with Australia having the opportunity to be a global leader in low-carbon manufacturing, taking advantage of growing demand and existing strengths and assets. Climateworks therefore supports the establishment of net zero industrial precincts across Australia, including in NSW. This precinct-scale planning for industrial regions would provide long-term guidance for industry and assurance to communities transitioning to net zero emissions. This allows for place-based interventions, moving beyond decarbonisation strategies for individual companies, to engaging multiple stakeholders to achieve collective goals.

The shift away from fossil fuels in heavy industry will mean a significant increase in NSW's reliance on renewable electricity, renewable hydrogen and to a lesser extent bioenergy and targeted carbon capture, utilisation and storage. It will also require industry to adopt new technologies for low-carbon heat, abatement of non-energy (process) emissions, improved demand management, and energy and resource efficiency. With long investment cycles and build times in both the electricity system and industrial technology, it is critical to increase confidence in technology deployment timelines, long-term government policy and enablers of low operating costs.

An NZIP approach can enable investors and industry to develop infrastructure plans, building confidence for heavy industry and energy sector stakeholders. Working with the federal government and energy planning bodies to create an energy system that supports strong industrial regions will enable Australia and NSW to become a renewable energy superpower.

Precinct effectiveness would be enhanced if each major industrial region had a 'Regional ISP' or equivalent to show how much renewable energy, storage and transmission will be needed to support ambitious decarbonisation and how this integrates with local demand expansions. This place-based planning approach would make it easier for industrial actors to integrate and share resources, workforces and renewable energy. It can also support other kinds of shared infrastructure, such as port upgrades, roads and rail.

NSW has already progressed in this area, with the government committing funding to the Hunter and Illawarra, but more can be done to enable regional economic transformation. Climateworks has identified an issue in which industry is waiting for the public and private sector to invest in the infrastructure that will support decarbonisation, but the public and private sector are not making that investment without a commitment from industry.

An NZIP approach can also help unlock future economic development, including through the provision of high-quality investment prospectuses and plans. Momentum is building globally for this approach, with Climateworks's NZIP program operating in Australia, Indonesia and Vietnam, and other prominent programs such as the World Economic Forum Transitioning Industrial Clusters program.

Other important enablers beyond place-based interventions include:

- **Demand-side measures designed to increase the maturity of markets for low and zero carbon products.** Australia now has multiple mechanisms to support the development of these markets through support for supply. These include production credits under Future Made in Australia and financing through the Clean Energy Finance Corporation and the National Reconstruction Fund. However, this is not yet complemented by sufficient action to create demand for these products. Examples of demand-side interventions could include public procurement commitments or mechanisms to underwrite demand. .
- **Technology deployment enablers, including partnerships and industry knowledge sharing.** While industrial facilities often require bespoke engineering solutions to deploy new technologies, barriers to deployment may also be common to many. Obtaining mature technologies, such as heat pumps and electric boilers, can be challenging as Australia represents a small market for original equipment manufacturers (OEMs). This can be overcome by industry and OEM partnerships, supported by the government, or by fostering local manufacturing. Industry is often reluctant to invest without examples of successful deployment elsewhere in Australia. Coordinated support by state and federal governments can help to demonstrate successful deployment in just one facility, catalysing investment by others. Governments can also support the sharing of commercially sensitive data, either through third parties or directly, to build confidence. Gathering and maintaining data at a facility level is valuable for planning and coordination purposes.

- **Recommendation 7:** Work with the federal government and energy planning bodies to create an energy system that supports strong industrial regions and enables Australia and NSW to become a 'renewable energy superpower', including analysis to forecast and plan supply, storage and transmission solutions for 'Regional ISPs'.

Many aspects of the importance of, and challenges, for transition to clean energy system are well-understood. However there is still an over-emphasis on measures to increase the supply of renewable electricity. Demand management will support a lower-cost transition to renewables and help manage the rapid electricity demand growth required for decarbonisation. It will help optimise existing network assets and reduce the need for new infrastructure investment. Examples include improved energy efficiency, electrification, energy management, demand response, demand flexibility and load shifting. Climateworks recognise that different levels of government have different powers to act and the work of NSW Government to date. We still see benefits from further work to establish a comprehensive demand management policy framework with incentives for businesses and households to participate in demand response programs, and better coordinate planning across government and energy agencies.

Process heat is a major use of energy in industry, at present largely powered by high-emissions energy sources including coal and gas. One of the largest barriers to the adoption of industrial electrified heat is the cost and availability of renewable electricity to power such technologies. Heavy industry typically operates 24 hours a day and thus requires a firm supply of electricity for consistent heat production. Costs for this electricity can be particularly high due to:

- The inability of cheap solar generation to meet nighttime demand.
- The lack of sufficient utility-scale storage, which requires either expensive coal or gas-generated electricity or large quantities of on-site battery storage.

The relative infancy of low-carbon heat technologies compared to current fossil-fuelled assets creates additional barriers, including a lack of expertise for the procurement, installation and maintenance of these technologies, further raising the costs involved.

Another barrier to electrified heat is the lack of appropriate electricity infrastructure planning for industrial regions. Climateworks has found that the Australian Energy Market Operator (AEMO) modelling in the ISP – which is used to inform state-level energy planning – may significantly underestimate the energy demands of industrial regions. This means that industry is hesitant to make large upfront investments for electrified assets, given the significant doubt that the required infrastructure to support it will be constructed.

Heavy industry supply chains, particularly for manufacturing processes, present significant economic opportunities from NSW's energy transition. However, transitioning away from fossil fuels will substantially increase industry's reliance on electricity and, to a lesser extent, green hydrogen and bioenergy. This increase is substantially larger under scenarios where NSW and Australia make the most of green export opportunities. For this shift to be successful, industry and investors need confidence that there will be a sufficient renewable energy supply that is affordable and reliable.

- **Recommendation 8:** Set out how NSW Government can work with the federal government and energy planning bodies to create an energy system that supports strong industrial regions and enables Australia and NSW to become a 'renewable energy superpower', including through the provision of analysis to forecast and plan supply, storage and transmission solutions for 'Regional ISPs'.

Climateworks notes that mining sites are an important emissions source. The most promising solution for reducing emissions from energy in the NSW mining sector is mine site electrification. For example, Climateworks modelling for the Australian Industry Energy Transitions Initiative found that emissions from nickel, zinc, copper and lithium could be reduced by 48 per cent by 2030 from 2020 levels (Climateworks Centre 2023d). We note that electrification of minerals processing has been identified as a priority area in the *Electricity Infrastructure Roadmap* (New South Wales Government 2020). Strong ambition in this area is justified, with potential for Australia to become a leader in the supply of low-emissions and high-ESG commodities to the Asia-Pacific and beyond.

Electrification with renewable energy may reduce operations' energy costs in the long term because of the savings from switching from expensive oil and gas – particularly reducing high transport costs. Capital investments in electrification and lack of confidence in lower operating costs in the long term may require additional action by government. Due to the long investment cycles for mining, it is essential to enable businesses to deploy low-carbon technologies and avoid locking in new fossil-based assets, which could become stranded assets in the future.

Increasing the business case for electrification depends on integrating large-scale renewable energy, with appropriate firming capacity, at a sufficiently low cost. Operating off-grid presents unique challenges in renewable energy integration as energy supply would be dependent on wind and solar resources without additional backup from the wider grid. The NSW Government has supported the Broken Hill Silver City Energy Storage Facility, an example of government funding improving the business case for greater renewable energy integration by signalling the availability of firmed renewable energy. Climateworks supports action to improve process design and energy management practices at mine sites (i.e. demand-side measures), such as technologies allowing for flexibility in minerals processing and optimisation of haulage operations to enable battery-electric trucks. Where multiple companies operate in a given region, a strategy similar to an NZIP approach (see response to Question 13) can enable technology deployment at the scale and pace needed for mining companies to take advantage of the benefits of electrification.

As noted in the response to Question 13, supply chain constraints may present a barrier to businesses electrifying their operations. Climateworks' insights from relevant projects sees value in partnerships with OEMs, supported by government, to ensure that mature technologies like electrified haulage trucks and renewable energy infrastructure can be introduced at the scale required for full mine-site electrification.

Our modelling has shown that biodiesel may play a role in mining, particularly in the short term, while the transition to renewable energy is underway (Climateworks Centre 2023d). Climateworks recommends a biofuels supply chain strategy at the state level to ensure a sustainable and coordinated pathway for deploying bioenergy resources in the most high-impact use cases. Bioenergy is a limited resource, and applications such as industrial heat and sustainable aviation fuels may represent significant future

sources of demand. We also note that the production of biofuels can be in competition with other land uses - both agricultural production, biodiversity and other ecosystem services.

Built environment

- **Recommendation 9.1:** Provide advice on how to support the expansion of firmed renewable energy and fuel-switching for off-grid sites.
- **Recommendation 9.2:** Develop a biofuels supply chain strategy at the state level to ensure a sustainable and coordinated pathway for deploying bioenergy resources in the most high-impact use cases and taking due consideration of other land uses and wider objectives including biodiversity.

Climateworks recommends ensuring that NSW's implementation of the NCC is current and prioritises high energy efficiency for new buildings, including adopting a voluntary zero carbon building definition.

We recommend that NSW implement future versions of the NCC in full and without delay, including all energy efficiency measures, to improve energy performance and minimise operational emissions from new buildings. New South Wales could also adopt a voluntary zero carbon building definition in its regulations. A voluntary code could provide guidance to industry, allowing for quicker adoption of more stringent energy efficiency requirements, and could position NSW as a leader in low-carbon buildings. Climateworks has released a definition of zero carbon homes, which could guide the development of a voluntary standard (Climateworks Centre 2023c). The definition includes planning and design decisions, building orientation, thermal shell and materials, appliances and day-to-day operations to minimise emissions.

Improving the performance of new buildings is important because low-cost changes to construction have life-long benefits for occupant costs, emissions reductions and the energy system. However, existing buildings will be the majority of the building stock for many decades. This is particularly important for household costs and comfort. Climateworks therefore recommends a strong focus on existing residential building retrofits to include a package of energy performance upgrades and switching from gas to electric appliances.

Climateworks research indicates that, on average, it would be cost-effective for existing low-performing residential buildings in New South Wales to be upgraded with a package of energy performance improvements that includes ceiling and floor insulation, draught sealing and air tightness improvements alongside switching gas heating for an efficient electric heat pump and gas cooking and hot water for electric appliances. We define 'low-performing' as connected to the gas network for space conditioning, cooking and hot water systems with minimal ceiling insulation and poor air tightness. This is typical of homes built before energy efficiency standards were implemented in 2003.

Our analysis shows that in NSW, on average, each low-performing home could reduce its emissions by 2.3 and 2.6 tCO₂e per year when upgraded to a ‘modest’² level (Climateworks Centre 2024f). New South Wales’ existing policies, such as the Peak Demand Reduction Scheme, Energy Saving Scheme, and household energy upgrade rebates for air conditioning and hot water systems, are a good start (DCCEE 2025).

Additional measures to build on these existing policies would ideally include:

- rebates or subsidies expanded to include all components of the packages outlined in Climateworks’ Renovation Pathways research (Climateworks Centre 2023c)
- grants directed to priority households and social and community housing stock upgrades
- mandatory disclosure of home energy efficiency ratings at point of sale or lease
- minimum energy efficiency standards for rentals
- a ‘one-stop-shop’ enabling consumers to access energy performance upgrade information or connect with trusted tradespeople.

The transition to an all-electric built environment risks widening equity gaps between households that can improve their homes’ energy performance and those that cannot due to various structural barriers (such as lack of agency for tenants or inability to bridge upfront cost gaps). This could lead to some households experiencing higher levels of ‘energy poverty’ due to increasing gas network costs as other households leave the network. Households experiencing energy poverty reduce their energy consumption to a level that negatively affects well-being due to high energy costs and low home energy performance.

A key focus for the Net Zero Commission could be enabling energy performance upgrades for ‘priority households’ living in ‘low-performing’ existing homes. Climateworks defines ‘priority households’ as those that could benefit from additional focus from policymakers due to systemic barriers inhibiting their access to energy performance upgrades. We include households in social and community housing, low-income households, culturally and linguistically diverse households, First Nations households, and households already experiencing energy poverty (Climateworks Centre 2024f).

New South Wales is already taking steps to improve the energy performance of its social housing stock through the Social Housing Energy Performance Initiative, co-funded by the Australian Government. This would ideally be expanded to ensure all social and community housing is upgraded to include the following energy performance measures:

- switching from gas heating to an efficient electric heat pump
- ceiling and floor insulation

² In NSW, electrified water heating and cooking could reduce 0.63 tCO₂e per dwelling while thermal upgrades could reduce emissions between 1.66 tCO₂e and 1.92 tCO₂e per dwelling. Appliance electrification and thermal upgrades combined would see emissions reductions between 2.3 and 2.6 tCO₂e per dwelling. Policies in place in NSW to support thermal upgrades and electrification include the NSW Social Housing Energy Performance Initiative, Energy Savings Scheme, Peak Demand Reduction Scheme and Home energy assessments.

- draught sealing
- switching hot water and cooktops from gas to electric.

Climateworks analysed the costs and benefits of upgrading low-performing homes – those built pre-2003 and connected to gas for heating, cooking and hot water. We found that, on average, upgrading a low-performing home in NSW to the ‘modest’ level – including the measures listed above – returned a positive cost-benefit ratio at the household and societal level. Private benefits include estimated reductions in household energy bills, while costs include the upfront and installation costs of upgrades (Climateworks Centre 2024f).

New South Wales could work with community housing providers to identify priority upgrades that deliver the best ‘bang for buck’. These could be phased over time to incorporate all community housing. This could provide additional co-benefits by supporting workforce development in industries such as heat pump or insulation installers.

Renters risk missing out on the benefits of electrification due to split incentive issues between landlords and tenants, which increases the importance of government action to overcome this barrier. This can be addressed through policies directed at rental properties as part of any policy suite aimed at decarbonising the built environment. This could be in the form of mandatory disclosure of energy efficiency ratings at point of lease, followed by the introduction of minimum energy efficiency rental standards. This can build on targeted incentives through NSW’s energy savings scheme.

As part of any recommendations about the built environment, Climateworks advises the Net Zero Commission to consider the potential of the following options:

- **Recommendation 10.1:** Provide advice to ensure the NSW Government takes effective action to improve energy performance for new buildings, including:
 - calling for the implementation of the National Construction Code (NCC) to be current and to prioritise high energy performance for new buildings
 - calling for the introduction of a voluntary zero carbon building definition.
- **Recommendation 10.2:** Provide advice on ways to improve existing buildings’ energy performance, including:
 - incentivising existing residential building retrofits, including a package of energy performance upgrades, switching from gas to electric appliances
 - further funding of upgrades for priority households.

The following approaches align with Climateworks Centre (2023c) definition of zero carbon buildings, which emphasises energy efficiency, passive design and the elimination or reduction of high-Global Warming Potential (GWP) refrigerants:

Strengthen building design requirements to minimise space cooling loads

New South Wales can reduce reliance on refrigerant-based space conditioning by tightening minimum

standards across all policies, including development assessment requirements, appliance standards and rental standards. This includes:

- integrating passive design measures such as improved insulation, high-performance glazing (glass and frames), external shading and ceiling fans
- requiring mandatory air-tightness and thermal performance testing before commissioning HVAC systems to ensure buildings perform to their design specifications.

Prioritise Non-Refrigerant-Based Technologies in Standards and Codes

New South Wales can promote non-refrigerant technologies through supporting passive measures in upgrade programs that enhance energy performance and reduce cooling demand, thereby reducing the need for refrigerant-based systems. This includes:

- chilled beam systems, which use water rather than refrigerants for heat transfer, for example, as used in 36 Carrington Street and 30 The Bond, Sydney
- ensuring such alternatives are prioritised in the Greenhouse and Energy Minimum Standards scheme, NSW voluntary construction codes and standards, or ministerial variations to the National Construction Code.

Developing the monitoring framework to assess progress

- **Recommendation 11:** Develop metrics and indicators for each major emissions source identified, and associated policy interventions, within each sector.

As part of a monitoring framework, Climateworks advises publishing more detailed sectoral emissions data, including:

- more granular sector emissions data and trends
- a detailed mapping of which emissions sources are included within each sector, and to avoid any confusion, identification of both UNFCCC to ANZSIC codes for each emissions source
- an assessment of whether the confidentiality labelling of NSW emissions data is necessary, with the phasing in of mandatory climate-related financial disclosures, or if it can be freely published.

Climateworks recommends that additional metrics be developed based on economic analysis of pathways and policies being implemented within NSW. For additional comments on specific metrics and indicators, please see our response to the Climate Change Authority's consultation on *Setting, tracking and achieving Australia's emissions reduction targets* and our submission to Treasury on *Measuring What Matters* (Climateworks Centre 2023f, 2023e). We have attached these submissions and would welcome further discussions with the Net Zero Commission and its staff about these. In summary, we recommend developing metrics and indicators for each major emissions source identified and associated policy interventions, within each sector. We advise the inclusion of analysis to identify appropriate indicator data from economic analysis of least-cost pathways to decarbonise NSW and collation of progress to date against each of these data points. This allows for the comparison of these two data points and identification of trends developed within each sector to identify whether supporting decarbonisation policies are on or off track. Climateworks 1.5°C and well-below 2°C scenarios may support this work

(Climateworks 2023a). The tracked and projected metrics could include, but not be limited to, fields such as:

- **Energy:** generation capacity by fuel type, storage capacity by fuel type, timing of fossil fuel closures by fuel type and economy-wide energy efficiency.
 - **Buildings:** improvements in energy efficiency by building type, share of electricity use by building type, rooftop solar installations and home battery installations.
 - **Transport:** changes in the use of different modes of transport, zero emissions vehicle sales and total registrations by vehicle type (including private vehicles, public transport, trucks), electric vehicle charger installations and hydrogen usage.
 - **Resources:** share of electricity use, emissions reduction trends in major fugitive emissions sources in areas such as gas and coal.
 - **Industry:** share of electricity use, energy and emissions in key industries such as aluminium, steel, chemicals, water and waste – as absolute emissions and emissions intensity.
 - **Agriculture and land:** livestock emissions (absolute values and emissions intensity), agricultural energy usage by fuel type and intensity, carbon sequestered.
-
- **Recommendation 12:** Set out how the Net Zero Commission and the NSW Government will develop or access modelling of least-cost pathways to reduce emissions within NSW in line with a 1.5°C pathway, coupled with economic information, and how this will be made available to decision-makers and stakeholders.

Climateworks recommends policy advice based on the least-cost pathways to reduce NSW's emissions in line with limiting global warming to 1.5°C. This would support decision-makers in NSW through tools that enable them to estimate, track and forecast policy impacts on emissions. Ideally, these systems could be easily integrated into forecasting models once a policy is adopted. A system that supports this integration will reduce rework and modelling and add valuable insights into policy proposals and evaluation processes.

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