2025 consultation

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NSW Decarbonisation Innovation Hub

Response for Net Zero Commission 2025 consultation

Overview for Decarb Hub and Networks

The NSW Decarbonisation Innovation Hub (the Hub) fosters collaboration, partnerships and projects between industry, academia, and government to drive decarbonisation forward in NSW and beyond.

Co-hosted by UNSW, Western Sydney University and the University of Newcastle and supported through funding and in-kind contributions by leading universities across NSW, we bridge the gap between research and viability to drive decarbonisation forward in NSW by supporting the development, demonstration, deployment and commercialisation of technologies from TRL 3 to TRL 6.

Our three targeted Networks accelerate and attract investment into decarbonisation tech and services projects in NSW as we work towards net zero:

- **Land and Primary Industries Network (LPIN)**
- **Powerfuels including Hydrogen Network (PFHN)**
- **Electrification and Energy Systems Network (EESN)**

Question 1: What can you tell us about your experience of the impacts of climate change and how can the commission seek to reflect and respond to this in its work?

One of the Hub's focuses is on Power-to-X (P2X) technologies, which involves the use of renewable energy to produce green chemicals and fuels. Through PFHN we see that P2X technologies are emerging in response to increased climate volatility, energy security risks, and decarbonisation imperatives, particularly for the production of renewable fuels due to global climate policy changes. The Hub and **PFHN** are keen to work with the Commission to provide advice to the government and advocate for system-level enablers like infrastructure, regulatory certainty, and innovation funding that support industry adaptation.

Question 2: What actions can the commission take to engage across the community to help drive the shifts needed for the net zero transition and for effective climate change mitigation and adaptation?

From the Hub's perspective, deployment of emerging P2X technologies to drive net zero transition will require demonstration projects to be built since many of P2X technologies are new. Supporting the demonstration projects in local communities can help prove and show that the technology works, encouraging acceptance. Partnering with regional industry clusters to communicate benefits of clean fuel industries (jobs, export potential, regional revitalisation) will also be vital. Thirdly, engaging young professionals and students through internship, innovation, and training programs in clean technologies will support the future workforce enabling our transition.

Question 3: How should the commission best engage with First Nations people to learn about cultural knowledge and practices to support adaptation, and what information and evidence should it draw on to inform its understanding of these practices?

A deeper focus study is needed that brings out Indigenous knowledge in a range of such related matters. It should be mindful of modern urban development and how that knowledge can be applied in such contexts.

The **EESN** and Partner identified the existing gap and barriers below:

- Engagement is often ad hoc and lacks cultural depth. First Nations knowledge is underutilised in adaptation planning.
- Existing frameworks (e.g. Renewable Energy Zones (REZ) Guidelines) do not adequately incorporate local cultural knowledge or land council-specific aspirations.

What's Needed:

- Knowledge exchange workshops with Local Aboriginal Land Councils (LALCs) to facilitate two-way learning.
- Use of Community Land and Business Plans (CLBPs) to understand local values and aspirations.
- GIS mapping and site visits to integrate cultural, environmental, and technical data.
- Respect for free, prior, and informed consent and cultural protocols in all engagement.

Why This Matters:

- First Nations people hold deep, place-based knowledge critical for climate adaptation and land stewardship.
- Genuine engagement builds trust, legitimacy, and long-term partnerships.
- Incorporating cultural knowledge ensures adaptation strategies are locally relevant, sustainable, and equitable.

Question 4: What additional mechanisms, support, or incentives can meaningfully empower and enhance First Nations people's involvement in climate mitigation, adaptation and environmental stewardship?

The Hub identified the existing gap and barriers below:

- Local Aboriginal Land Councils (LALCs) lack funding, technical capacity, and access to capital.
- Most suitable land for renewable energy is under unresolved land claims.
- No dedicated support structures exist to guide LALCs through project development.

What's Needed:

- A dedicated NSW Government support team to assist LALCs with project planning, mapping, and partnerships.
- Targeted funding for feasibility studies, capacity-building, and equity participation (via ARENA, IBA).

- A NSW Aboriginal renewable energy research and resource centre to provide training, resources, and policy advice.
- Pilot programs for mid- and large-scale renewable energy projects on Aboriginal land.
- Faster land claim processing and stronger cultural heritage protections.

Why This Matters:

- Aboriginal land holds immense potential for renewable energy—particularly solar and wind—across both current and future NSW land estates. Resolving outstanding land claims could expand suitable land by a factor of 18.6 for solar and 22.2 for wind, unlocking up to 207,557MW of solar capacity across 8,302km^2 and 36,259MW of wind capacity across 7,252km^2.
- Empowering First Nations supports self-determination, economic development, and climate resilience.
- These actions align with the First Nations Clean Energy Strategy and Closing the Gap targets.

Question 5: What additional information and evidence should the commission consider when assessing progress towards NSW's targets for reducing net greenhouse gas emissions?

The **PFHN** recommends the Commission incorporate metrics beyond traditional GHG inventories, including data on the deployment and scaling of emerging clean technologies. Tracking indicators like installed electrolyser capacity, production volumes of renewable fuels (e.g. green ammonia, hydrogen), infrastructure readiness (e.g. refuelling stations, export terminals), and the level of industry investment and job creation in low-carbon supply chains would provide a more comprehensive picture. These metrics reflect the real-world momentum of the energy transition and are critical for identifying gaps and opportunities in decarbonising hard-to-abate sectors.

The **LPIN** advises that 2024 Net Zero Commission report notes the high uncertainty in the land sector. Responses below refer to new initiatives under development to improve monitoring and forecasting of land sector emissions, opportunities to increase effectiveness of this work, and resulting opportunities to maintain resilience.

Question 6: The speed of deployment of electricity generation and infrastructure is a key risk to emissions reduction targets. What more could be done to fast-track deployment?

Our Hub partner noted that The NZC consultation report makes no mention of the important role mature bioenergy technologies can play in firming up the grid - we do not need to rely on natural gas for that purpose. This issue has been explored in a series of recent scientific articles which show the opportunity and cost-effectiveness of biomass systems (more details in Li et al 2024; Middelhoff et al 2022a; Li et al 2022; Li et al 2020). In addition to existing mature technologies, opportunities exist for hybridisation of biomass and concentrated solar power systems, which can be deployed in regional areas, with the possibility of making regional communities self-sufficient in the generation of renewable electricity (more details in Middelhoff et al 2022b, Middelhoff et al 2022c and Middelhoff et al 2021.
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The **EESN** advised short-, medium- and long-term actions below to fast-track deployment of electricity generation

Short Term:

- Drive for alignment of the methodologies between regulators and proponents to perform more equipment validation via grid simulation / hardware in the loop set-ups.
- Drive investment in expanding existing Real Time Simulation facilities to absorb the scale-up required to meet imminent demand from developers of large-scale generation and storage facilities and distribution energy resources.

Medium Term: Invest today in a National Electrification Centre to de-risk the multitude of issues that will become a huge drag on connection approvals. This will also support the development of electrification technologies. A present day example of where an existing National Electrification Centre could provide evidence to answer key risks in multi-$B REZ decisions is the necessity or otherwise for conventional spinning generators to provide seamless, ultra-fast real power balancing or whether this can be delivered through inverter-based resources using advanced inverter controllers, and/or oversized inverter ratings (voltage, current, switching frequency), and/or whether near-real-time (<10us latency) are necessary. In fact, the longer we delay in developing the capability to assess and advise the outcomes of these fundamental questions the more likely we are to find ourselves in a situation where we must retreat from the current status, removing much or all that has been invested in thus far, to then re-invest in technology that gets us past the previous barrier. This process may take several cycles.

Long Term: Develop solid-state technologies that allow smart and intelligent technologies to be distributed around the grid to provide grid control.

Question 7: Are the measures now in place sufficient to ensure community engagement and benefit sharing from the build out of infrastructure for the energy transition?

Consider a platform to allow for direct electricity bill relief by those living adjacent to Renewable Energy Zones (REZ) installations. Alternatively consider driving regulations to remove the network costs on bills for those residents living in REZ. The purpose is to ensure local communities see direct benefits to themselves, rather than perceiving all benefits are green electrons that flow to areas of high population. This question is assuming that the infrastructure has been built or is close to being built but the nation is nowhere near even understanding the scale of the build out required to decarbonise, given that at least 2 thirds of decarbonisation will come from transitioning to electrical energy generated via renewables or low carbon energy.

Question 8: Are First Nations communities adequately engaged and included in sharing the benefits of the transition? What more could be done, and by whom?

The **EESN** advised the existing gap and barriers below:

- First Nations participation in NSW energy projects is minimal.
- No equity or ownership models have been implemented.
- NSW Electricity Infrastructure Roadmap's employment and procurement targets are not being met.

What's Needed:

- Mandate early and ongoing engagement with Local Aboriginal Land Councils (LALCs) in energy planning and procurement.
- Support equity partnerships and benefit-sharing models with developers.
- Provide technical and financial support to help LALCs become project partners, not just stakeholders.
- Government and industry must co-design projects with communities from the outset.

Why This Matters:

- The energy transition is a once-in-a-generation opportunity to address historical injustices.
- Without deliberate action, First Nations communities' risk being excluded from the benefits.
- Inclusive participation strengthens social license, improves project outcomes, and ensures a just transition for all.

Question 9: What are likely to prove the most effective approaches to accelerate rapid decarbonisation across freight and passenger transport?

To accelerate rapid decarbonisation across freight and passenger transport, the **PFHN** advised a clear and targeted government mandate is essential to drive investment and uptake of zero-

emissions technologies. This could include setting phase-out dates for fossil fuel use in heavy vehicles and shipping, coupled with incentives for the deployment of renewable fuels such as hydrogen and green ammonia. Priority should be given to supporting large-scale demonstration projects in sectors like long-haul freight, maritime, and aviation, where battery electrification is not viable. Government should also mandate the integration of clean fuel infrastructure along key freight and industrial corridors, while streamlining regulatory approvals to enable rapid rollout. Coordinated national and state policies—including fuel blending mandates, clean transport standards, and government procurement targets—will be crucial to sending strong market signals and reducing investment risk for early movers.

LPIN Partners identified that:

- Renewable diesel, methanol, ethanol and SAF all can play a role in decarbonising the transport sector - the development of this industry can drive significant investment towards regional NSW, while assisting with other circular economy goals and zero waste aspirations.
- stablish policy and regulatory frameworks that mandate resource efficiency and waste minimisation in land management and agricultural sectors, while incentivising circular practices through targeted subsidies, tax credits, and grants.
- The consultation paper notes the upcoming DPIRD/LPIN Emissions Reduction Roadmap for NSW Land. These include clear and evidence-based recommendations for priority pathways that combine feasibility with significant contributions to agricultural sector abatement.

EESN indicated that:

- Prioritise the decarbonisation of the electrical energy system, and the development of mixed renewable-fossil fuels. Improve energy efficiency of passenger transportation by improving the efficiency of the catenary supply, for example using stationary or train mounted storage elements, high efficiency electrical machine drives.
- Invest in economic studies to identify optimised incentives to open NSW markets D17to investment by e-mobility infrastructure and equipment providers, plus investigate incentives for transport operators to accelerate investment in renewable power transport systems. We also need to have access to solutions that have robust supply chains.

Question 10: What specific actions or policies could increase uptake of emissions reduction strategies in agriculture, both in the short and long term?

The Hub recommends education and better targeting on a sustained and on-going basis - not just ad-hoc and tick box way.

Question 11: Given the uncertainties in land-sector net emissions, how should NSW incorporate this sector into the state's climate policy and emissions profile?

The **LPIN** Lead advised that Fugitive emissions, particularly methane from current and former coal mines and feedlots, for example, contribute significant uncertainty to current emissions estimates. To eliminate these emissions, we need to first identify and quantify the sources. Monitoring based on satellite and aircraft measurements and modelling are available and should be embedded in emissions mapping and accounting frameworks.

Question 12: What specific actions could increase carbon storage and resilience of the existing carbon stock in the land sector and meaningfully enhance the application of First Nations people's knowledge and practices?

The **LPIN** Partner advised that: Regarding the first component of this question, there are several actions that could increase carbon storage and resilience in the land sector. Large areas of our existing forests are degraded and would benefit from active management, to unlock their growth potential and make them more resilient over time (e.g. https://www.forestry.org.au/wp-content/uploads/2025/06/EOI_EnhancingNativeForestResilience_12July2024.pdf) There is also significant potential to grow native trees in cleared marginal, degraded lands, to provide landholders with an alternative source of income as well as assisting to achieve a range of ecosystem outcomes (for more information: https://www.dpi.nsw.gov.au/forestry/science/forest-carbon/biomass-for-bioenergy/biomass-crops)

Question 13: What policies or programs at a sectoral level could complement the Safeguard Mechanism to support the accelerated decarbonisation of heavy industry in NSW?

To complement the Safeguard Mechanism, NSW should implement sector-specific policies that support the deployment of low-carbon alternatives, particularly in energy-intensive industries. This includes production credits or offtake guarantees for renewable fuels like green hydrogen and ammonia, and financial support for industrial fuel switching and electrification. Demand-side support such as offtake guarantees could prove powerful in helping projects get the investment and finance, they require. Programs that fund infrastructure upgrades and create demand-side signals—such as low-carbon product certification, government procurement standards, and green steel or cement targets—can help accelerate adoption. Regional industrial clusters should be supported through place-based strategies that co-locate clean energy, feedstock, and transport infrastructure.

Question 14: What measures could accelerate industrial heat electrification in NSW, where technology is viable?

The **LPIN** partner advises that a large proportion of industrial heat produced still relies on natural gas or diesel boilers. The use of sustainably derived biomass as feedstock instead provides an additional opportunity to decarbonise industrial heat generation in NSW.

EESN recommends 1. Investment in photovoltaics and solar thermal systems for commercial and industrial parks; and 2. Research incentive programs for common thermal storage infrastructure to be used across multiple industry groups.

Question 15: What short to medium term measures could be prioritised to address the systemic challenges regarding waste generation and resource recovery?

From a **LPIN** perspective, investment measures into regional circular infrastructure to operationalise circular economy principles in agriculture by enabling the reuse, recycling, and valorisation of organic and material flows across regional agri-food networks, would be

appropriate to address systemic waste challenges. Viable technology solutions are currently being explored especially for waste heat recovery in the dairy industry: https://www.decarbhub.au/our_projects/waste-heat-recovery-and-thermal-energy-sharing-towards-a-circular-economy/. Support of innovation and the development of scalable technologies in resource recovery and creating end markets for recovered materials through strategic public–private partnerships, is also a possible measure.
A current systemic challenge is also the barriers to investment in NSW regarding sustainable bioproducts, including challenges in the:

- Regulatory framework
- Transport cost
- Social perceptions (pollution, sustainability)
- Lack of policy or market signals mean support is required to assist the transition
- Carbon policy instability.

A low-cost action for the government is the fundamental reform of primary industries organic waste regulatory approvals (resource recovery and energy from waste frameworks). The following needs to be addressed:

- Definition of wastes include low risk substance and substances that have a clear commercial value: where a substance presents negligible risks to human health or the environment, it should be exempt from the definition of waste and associated regulatory regime. Examples include stubble (e.g. straw) or uncontaminated wood waste or sawmilling residues for which risks to human health, or the environment are negligible; where a substance has a value, it should be classified as by-product instead of waste.
- Pathways for approval are complex, lengthy and costly: clear and simple approval pathways should be provided for the most common agricultural, fisheries and forestry wastes. Currently, approval pathways are unclear. A lot is being determined during the application rather than upfront, making it difficult to build a business case.
- The Higher order use requirement in NSW is open to discretion and difficult to meet higher order use should be clearly defined with a list of proofs that can easily be provided by a proponent. For example, organic wastes can be used for compost or mulched for landscaping, which are described as a higher order uses. There is therefore a disincentive to use those for energy production, even though the compost or mulch market might be saturated, less economically valuable or generate more emissions than the biofuel feedstock market.
- The Resource Recovery Orders and Exemptions are uncertain: more certainty could be provided to industry by prescribing timeframes for approval, conditions in which an exemption can be revoked and extending the validity of RRO and exemptions to match bioenergy industry 10-year cycle requirements, so businesses can plan, ensure reliable supply and recover their costs. Currently, RRO and RRE under the POEO (Waste) Regulations are time-consuming (application processes for an RRO can take up to 3 years), expensive (testing of 20 samples of the waste, for up to 26 chemicals, is required), uncertain (“The EPA may vary or revoke an exemption granted”; “RRO and exemptions are only for 2-3 years”) and often difficult to meet for smaller operators.
- The thermal treatment of non-eligible wastes is restricted to 4 locations: this does not meet the need of primary producers. Consider unlocking all areas that do not meet the definition of high population density and poor air quality (as opposed to locking opportunities in the whole of NSW). In practice, this limitation means that the thermal treatment of non-eligible waste fuels (e.g., manure, litter, carcasses) is only be permitted

in four (4) regional NSW precincts. This reduces options for farms that are too far to viably transport their wastes to those locations. Across NSW, pyrolysis and gasification units should be facilitated for the treatment of primary industries organic waste, for the benefit of regional communities. Energy from Waste technologies and scales are extremely varied, and heat produced from thermal treatment of wastes can only be delivered to a certain distance. The framework needs to be practical.

- The air emissions regulations in NSW are "the strictest in the world": Revise air emissions requirements for small-scale facilities, and facilities located in rural areas, and apply a load-based approach that accurately considers human health and environment risk. Regulate based on bioavailability of substances of concern, rather than total concentration or emissions. Move to best practice, including risk-based approach. This will also ensure better comparison of results with the EU, WA, Queensland, etc. For instance: offering averaging period, sampling method and allowable exceedances that are more practical to implement; ensuring requirements are appropriate and proportionate to facilities' size and location
- Biochar and digestate production and use are governed by prescriptive requirements: A General Resource Recovery Order and Exemption could be developed for biochar and digestate produced from specific low-risk feedstocks. It could follow the Australia New Zealand Biochar Industry Group (ANZBIG) code of practice to address issues with quality control of biochar products. We also note ANZBIG is working with Standards Australia to create an Australian standard for biochar, based on the ANZBIG code of practice.
- Only businesses that did thermally treat their non eligible wastes to recover energy prior to July 2022 can continue to do so. On-site energy production using thermal processes (where the energy produced will replaces higher GHG intensive energies such as petroleum, natural gas and coal), should be able to do so as it would ensure higher value resource recovery outcomes are maximized. Consideration should also be given to businesses using wastes from another business: mixing organic wastes is often required to generate the most beneficial biochar, while at the same time generating energy.
- The minimum of 90% energy produced on-site to be consumed on site is too restrictive: The current rule means that businesses are not allowed to inject back in the grid more than 10% of their energy production. This means that beyond 10%, what has not been consumed cannot be sold to help with the costs of the bioenergy technology installation. For instance, a chicken farm using EfW to heat its sheds would not be able to use his equipment and inject the energy created back to the grid when he does not need the energy on site, likely making the purchase of the equipment in the first place non-viable. Where a regional energy provider has planned upgrades to the distribution network, they would not be able to offset their capital expenditure for establishing an energy from waste facility rather than undertaking that upgrade requirement.

Question 17: What measures would lead to coal mines prioritising on-site abatement over offsetting?

Please refer to comment above on Q11 re: emissions from feedlots. The same monitoring options apply to coal mines.

Question 18: What measures should be considered beyond the Safeguard Mechanism to reduce emissions of the resources sector, particularly methane emissions, to meet NSW's emissions reduction targets?

Methane emissions in the resources sector require measures beyond the Safeguard Mechanism. NSW should consider mandatory best-practice standards for methane leak detection, measurement, and abatement, aligned with international benchmarks. Support should also be given to projects that convert fugitive methane into usable energy or products (e.g. biomethane for P2X applications). Transparent public reporting of methane emissions, combined with penalties for non-compliance, can create accountability and drive technological upgrades. Incentivising methane mitigation through carbon pricing or offset crediting could also unlock rapid emissions reductions.

Question 19: What additional measures could accelerate electrification and increase energy efficiency of new and existing buildings?

There is huge amount of knowledge and evidence on why, what and how. National Construction Code (NCC) is moving much more slowly. Both old and new buildings should be targeted. Engagement with peak bodies like Australian Institute of Architect (AIA) is essential and ensuring knowledge and the business case reaches key stakeholders.

Question 20: How could social equity be better addressed in the transition to an electrified built environment?

The Hub notes a demand side efficiency and renewable energy deployment in affordable housing should be highly subsidised by Governments because they do provide long term return and emission reduction.

The **EESN** encourages incentives for landlords to invest in electrified residential resources (hot water heating, air heating / cooling, stovetops) for the benefits of renters. This should also encompass investment in energy efficiency measures (insulation, solar shading etc.). In general, one should expect that developing volumes of large-scale renewable technologies that require no fuel so can charge $0/MWh will lead to downward pressure on energy costs at the point of use.

Question 22: What should be included in a monitoring framework for NSW in the context of the transition to net zero, including any specific metrics and indicators?

The **PFHN** advises that a robust monitoring framework should combine greenhouse gas inventories with forward-looking and sector-specific transition indicators. This includes metrics on clean energy deployment (e.g. MW of electrolyser capacity, tonnes of renewable fuel produced), infrastructure build-out (e.g. hydrogen refuelling sites, port readiness), and industrial transformation (e.g. emissions intensity per tonne of steel or ammonia). Investment levels, workforce development, and supply chain resilience should also be tracked. Including spatial indicators—by region or industrial hub—would ensure equitable progress across NSW and support place-based policy design.

The **LPIN** Partner notes that one of the key sources of uncertainty in the Land Sector is the impacts of climate change, particularly climate extremes and associated disturbance, on land C storage. New methods of estimating above-ground biomass C via integrating Lidar with on-ground inventory offer promise for significant improvements in quantification of land C storage and impacts of disturbance. Scoping of methods, including potential to extend to a National Forest Observing platform, is currently underway through NSW DPIRD and the AFWI Centre for

Climate-Smart Forestry. Methods are currently being designed around management of wood production areas but there is clear scope for this work to support carbon emissions monitoring.

The **EESN** recommends measuring impact for any technology solution or initiative, the ability to scale needs to be taken into account. Any barriers to scaling (e.g. due to supply chain limitations, skill availability, complexity, risks, regulations or cost) will need to be factored into expected impact. Our framework must include ALL the relevant services that have to be offered in a electrical energy system. If one service can no longer be supplied (eg short term balancing) then the cost of re-establishing that service will be huge.

Question 23: The adaptation objective is for NSW to be more resilient to a changing climate. The Act allows for regulations to further define the adaptation objective. What does a more resilient NSW look like to you?

Human settlement (buildings and cities, towns) needs particular focus due to human habitation and risk, due to climate change such as extreme events like urban heat, floods, and fires amongst others. Planning and design play a major role in ensuring a more resilient and more adaptable settlement. Knowledge on this exists but deployment is lacking, so government particularly local and state governments should embed into requirements the resilient city planning guide.

PFHN: A more resilient NSW is one that can both adapt to the growing impacts of climate change and strengthen its energy and fuel security. Climate resilience means preparing for increasing heatwaves, floods, droughts, and other climate-related disruptions, particularly in regions with critical infrastructure or industrial activity. At the same time, NSW and Australia must address its heavy reliance on imported fossil fuels, which leaves the state exposed to global supply chain shocks and geopolitical risks. By accelerating the development of power-to-X (P2X) technologies—such as green hydrogen, ammonia, and synthetic fuels—NSW can produce its own clean, dispatchable, and transportable fuels domestically. These fuels not only support decarbonisation across sectors like transport and industry, but also provide sovereign energy security in a low-carbon world. A resilient NSW is one where local communities are supported by future-focused industries, essential services are safeguarded from both climate and supply risks, and our economy is powered by renewable, Australian-made energy.

LPIN: A resilient NSW means being ready to act to assist local communities when disasters such as floods and bushfires happen. One of the most pressing needs is to provide adequate temporary shelter for those who have been impacted by the disasters. The need is for systems with fast turn-around, affordable, easy to put together by community groups and using locally available materials rather than importing modular disaster recovery housing from China which has an incredibly high carbon footprint. A recent Land & Primary Industries project has demonstrated that this is possible for NSW, with a novel design suggested and a prototype built (see https://www.abc.net.au/news/2024-12-08/cardboard-homes-provide-emergency-shelter-after-disasters/104692704 and https://www.decarbhub.au/our_projects/low-carbon-and-bio-based-emergency-housing-system-for-northern-nsw/).

Question 24: What additional information and evidence should the commission consider when assessing progress towards the adaptation objective?

The Commission should include data on infrastructure vulnerability, industry supply chain risks, and community adaptive capacity across key regions of NSW. This includes how critical assets like ports, energy networks, and water systems will perform under different climate scenarios. Social indicators—such as workforce exposure, income diversity, and access to clean industries—are also essential for understanding resilience at a community level. Incorporating Indigenous knowledge, regional case studies, and lessons from adaptation trials can provide grounded evidence to support policy refinement.

Question 25: How can adaptation planning better use the NSW Government's climate change projections (NARCliM)?

From **PFHN**'s perspective, NARCliM projections should be more accessible and decision-ready for planners, project developers, and local governments. This includes integrating projections with land-use and infrastructure planning tools and translating climate data into risk scores or investment-adjusted models. Scenario analysis that links projected climate impacts to critical infrastructure and industrial development zones (e.g. clean fuel hubs) would improve proactive decision-making. Cross-agency alignment on how NARCliM data informs resilience standards and project approvals would also strengthen consistency in adaptation planning.

In response to Qs 25 and 26, **LPIN** Partner notes that: Development and adoption of modelling tools that enable exploration of impacts of alternative management strategies on carbon emissions from the land sector. Such tools can be (a) informed by enhanced monitoring of land carbon storage (see Q22) and (b) coupled directly to NARCLIM projections, facilitating effective use in decision-making. There is scope to operationalise modelling tools currently under development in the research sector for this purpose. For example, the LPJ-GUESS dynamic vegetation model can represent impacts of drought, fire and forest management on land C storage, can forecast these impacts for NARCLIM projections, and could be informed by ongoing monitoring through data assimilation. See https://doi.org/10.1016/j.scitotenv.2024.171748.

Question 26: What other information or tools are needed to support decision-makers in NSW?

PFHN recommends that Decision-makers need integrated tools that link emissions, economic impacts, infrastructure readiness, and climate risk. This includes clear decarbonisation pathways by sector, with cost and emissions abatement data for emerging technologies like green hydrogen, e-fuels, and carbon capture. A centralised, publicly accessible dashboard tracking transition progress—across emissions, infrastructure, jobs, and resilience—would enhance transparency and accountability. Tools that enable co-design with industry and regional stakeholders will also be essential to ensure policies are practical, investable, and equitable.

EESN advises the ongoing and consistent tracking of consumer sentiment - in particular in REZ-adjacent communities.

Question 27: What initiatives should the commission consider in assessing NSW's preparation and responses to extreme heat and humidity events in NSW?

World class knowledge and know how to exist in terms of predicting and better understanding planning implication of extreme urban heat. There is a need for smart evidence based and data-

led approach to city planning. The Hub is exploring a national urban heat observatory approach to providing, designing and planning intelligence with the help of DCCEEW (SCIENCE). This approach will be an exemplar in the global context and should be supported. Further references can be provided for all the above.

LPIN partners noted that:

- The commission should consider mention of and promoting policies that support the urban greening, linkages to urban heat mitigation and climate justice. Maintaining or increasing urban tree canopy cover and its equitable distribution could be incentivised via policy, particularly in new developments and in areas of lower social-economic status, where heat wave impacts on human health are disproportionately amplified owing to lack of tree canopy cover. It should be noted that urban trees provide multiple benefits linked to human health, heat mitigation and carbon storage. Green and environmentally sensitive designs that incorporate green space, stormwater capture are underutilised opportunities at present. Policy support for well-developed urban tree inventories will provide managers and planners with the information they need to manage urban tree canopy cover. Heat resilient design elements, including the built environment would further compound benefits of nature-based solutions though engineered solutions involving heat reflective surfaces, building design among other factors.

- Adaptation to extreme heat events has focused largely on managing human health. However, extreme heat has major impacts on crop production and ecosystem function. Adaptation to heat stress could also consider, for example, crop breeding, water and soil management and microbiome manipulations in agricultural systems, and options such as refugium provision, water resource allocation and restoration genetics in natural ecosystems.