He Pou a Rangi
Climate Change Commission

2023 Draft advice to inform the strategic direction of the Government's second emissions reduction plan

April 2023

Disclosure statement
As anticipated by the appointment criteria, the Climate Change Commissioners come from varying fields such as adaptation, agriculture, economics, te ao Māori and the Māori-Crown relationship. While a number of board members continue to hold roles within these fields, our advice is independent and evidence-based. The Commission operates under its Interests Policy, which is derived from the Crown Entities Act. You can read more about our board members on the Climate Change Commission website. The Commission regularly updates and publishes on its website a register of relevant board interests.

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Chair's Message

Aotearoa New Zealand can become a thriving, climate-resilient, and low emissions society.

The transition will require constant transformation. While there will be changes to where we live, how we get around, and how we earn a living, with change comes opportunity. A low emissions future is likely to be less vulnerable to disruption, more affordable, healthier, and more sustainable than our current way of living.

This draft advice is being released weeks after Cyclone Gabrielle reminded us that the impacts of climate change are here and now, and after the Intergovernmental Panel on Climate Change delivered a final warning to the world's governments on the need to swiftly and drastically reduce emissions.

The draft recommendations made in these pages are the most urgent, highest priority actions required to achieve Aotearoa New Zealand's 2026-2030 emissions budget and enable the country to meet its future emissions reduction goals.

Ultimately, lowering emissions is more about opportunities than obligations. To make the most of these opportunities, we must ensure we are reducing our gross emissions from all sources as much as possible and as soon as possible, rather than solely relying on offsetting our climate pollution. Storing carbon should be focused on offsetting emissions from activities that are really hard to decarbonise. In addition, all government investment decisions must support the transition to low emissions.

It is in our own self-interest to reduce emissions. By the middle of this century, high emissions lifestyles will be less affordable and high emissions industries will be more vulnerable to disruption. We cannot go down the path of doing as little as we can as late as we can or remain a high-cost producer.

Reducing emissions – and keeping them down – is a 30-to-50-year programme of work. Our draft advice is about the strategic direction of policy and recommendations to help hold the course to our goal of reaching our 2050 emissions reduction targets, including sustaining net zero long-lived gas emissions by and beyond 2050.

This draft advice also highlights the key issues we see that may prevent Aotearoa New Zealand reaching the net zero component of our 2050 targets. Forests will play an essential role in the transition to a low emissions future, including as a source of biofuel, and the benefits from expanding native forests. However, we need to make sure we cut the amount of greenhouse gases being released, as well as plant more trees. The role of forests in managing emissions needs to be addressed, and with urgency. Under current policies, there is a high risk that relying too heavily on carbon removals from forests will undermine the gross emissions reductions that New Zealand needs to maintain net zero long-lived emissions post-2050.

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Our current actions are committing new generations to keeping land locked in forests for centuries to come. With this comes the risk of slash, wildfires, storm damage, and diseased and dying trees. Crucially, land will not be able to be converted into new, better uses without significant deforestation and carbon emissions.

In such settings, it is necessary to consider the specific effects for Iwi/Māori within the forestry sector. This is particularly important in light of upholding Te Tiriti o Waitangi/The Treaty of Waitangi principles, the unique cultural, economic, social, and environmental considerations for tangata whenua, and the need for Iwi/Māori to play an integral part in any conversation about the future of forests.

More broadly, the Crown needs to work in partnership with Iwi/Māori to ensure the principles of Te Tiriti o Waitangi/The Treaty of Waitangi are embedded in efforts to accelerate our journey to reach our 2050 emissions reduction targets. Pathways that consider the Crown-Māori relationship, te ao Māori, and specific effects for Iwi and Māori are likely to lead to more enduring and equitable outcomes.

When it comes to integrated climate investment, some Māori-collectives are leading the way, incorporating social, cultural, environmental, and business goals into their analysis – often seeing risks, opportunities, and decisions through an intergenerational lens.

Investing in Iwi/Māori will give Aotearoa New Zealand the best chance to reach our 2050 climate change targets. Accelerating an understanding of mātauranga Māori and increasing collaboration with Iwi/Hapū will lead to more locally relevant and enduring climate change solutions.

When He Pou a Rangi Climate Change Commission released its first emissions reduction plan advice in 2021, *Inaia tonu nei: a low emissions future for Aotearoa,* we concluded that there are achievable, affordable, and acceptable pathways for Aotearoa New Zealand. That is still the case, and the imperative to act is greater than ever.

As with *Inaia tonu nei,* we are committed to true consultation on this draft advice and invite your review. We are prepared to change any part of our work and will consider all evidence we receive through consultation.

Our final advice to Government at the end of this year will help shape how Aotearoa New Zealand acts on climate change for the rest of this decade.

This draft advice contains fewer recommendations than *Inaia tonu nei,* but it is even more important that they are acted on decisively.

Rod Carr, Chair

Chief Executive's Message

At the Climate Change Commission, we understand that people are at the heart of good policy design. This consultation is a chance for you to share your concerns, priorities, and aspirations and help shape the advice we provide Government on the direction of policy needed to enable a thriving, climate-resilient, and low emissions Aotearoa New Zealand.

At the end of this year, we will deliver our advice to the Government on the urgent actions required to achieve Aotearoa New Zealand's second emissions budget and enable future climate change goals like reaching net zero emissions of long-lived greenhouse gases and reducing biogenic methane between 24-47% by 2050.

For our advice to be relevant, usable, and practical, our thinking needs to be informed by a range of diverse perspectives from across the motu. While the Government makes decisions on climate change policy, it is people on the ground who take action to reduce emissions and get us ever closer to achieving our climate targets. It is important for us to hear about the challenges you face, the opportunities you are creating, and the actions that would make a real, positive impact in your communities.

During this consultation period, our expert staff will be going out and talking to people across Aotearoa New Zealand to help support the submissions you may wish to make to inform our mahi. We will consider this draft advice against the evidence and insights we gather. Following consultation, we will review all submissions and take another look at our evidence base to develop final advice enhanced by what we have learnt from consultation. Our final advice to the Government, revised to reflect this consultation, will be delivered at the end of this year.

This draft looks a bit different from our first advice, *Inaia tonu nei,* which included advice on Aotearoa New Zealand's first three emissions budgets and the strategic direction of the first emissions reduction plan. The Government has now set its emissions budgets through to 2035 and has released its first emissions reduction plan, which outlines the actions it will take to meet the first emissions budget.

This draft advice is designed to guide the strategic direction of policies to meet the second emissions budget, which covers 2026-2030. We have focused on where there are critical gaps and where existing actions need to be urgently strengthened and accelerated to achieve the emissions reduction required to meet the second budget.

We have also centred our recommendations on identifying outcomes. If Aotearoa New Zealand can agree on the outcomes needed to achieve the second emissions budget and enable future climate goals, then it's up to the Government of the day to work through the details of the policies needed to achieve them.

To understand whether outcomes are being achieved, we need data and evidence. This draft advice is future-focused, and we have not run a detailed ruler over the first emissions reduction plan to see how effectively it is working. Part of the reason is lack of data – there hasn't yet been enough time to assess the real-world implications of that plan, as it was adopted just last year.

However, we will soon begin providing advice on Aotearoa New Zealand's progress on emissions reduction. Our first monitoring report, which will cover the Government's first emissions reduction plan, is due in the middle of next year. This timeline has been set by the Climate Change Response Act 2002, which links our monitoring role to the data we need to do this work.

Our monitoring reports will support a continual cycle of learning and improvement, and ultimately support maintaining ambition for climate action in Aotearoa.

In closing, I want to acknowledge the staff here at the Commission who have worked tirelessly to provide our independent, expert, evidence-based advice to the Government since the Commission was established three years ago. They have helped generate the clarity and momentum on climate action that Aotearoa New Zealand needs to achieve the 2050 targets.

Jo Hendy, Chief Executive

Contents

Executive Summary

The Commission's role, as laid out in the Climate Change Response Act 2002 (the Act), is to provide independent, evidence-based advice to successive governments on the actions needed to achieve the country's climate change objectives. It is the responsibility of the relevant Ministers and government entities to consider our advice and determine and implement specific policies and measures.

The Act put into law Aotearoa New Zealand's 2050 target, as well as the process for reaching it. Under the Act, the Government sets emissions budgets – which confirm the total allowable emissions across a five-year period – and emissions reduction plans, which outline the actions it will take to achieve those budgets.

In line with our role, we are preparing to provide advice to the Government on the direction of policy for its second emissions reduction plan. This plan will cover the second emissions budget period, from 2026-2030. This report is a draft of that advice prepared for public consultation. Our final advice will reflect the feedback we receive through the engagement process and will be delivered to the Government at the end of this year.

As an independent Crown entity, we have based our draft advice on research and analysis, and in the interests of helping the Government make decisions to transition to a thriving, climate-resilient, and low emissions Aotearoa New Zealand.

We are following a similarly robust and rigorous process to the one we employed when preparing our advice to the Government on its first emissions reduction plan, *Ināia tonu nei: a low emissions future for Aotearoa*. This includes drawing on a broad base of engagement and evidence, following our established methodology to develop proposed recommendations, and consulting on those proposals so that we can revise them as appropriate.

This consultation process seeks the input of Iwi/Māori, academics, businesses, communities, farmers, local government, NGOs, sector bodies, unions, individuals, and others. We are looking for evidence, perspectives, insights, and other information that tests and improves the advice we give to the Government.

Action is needed now

Actions underway as part of the first emissions reduction plan and actions taken by households, businesses, and communities are all positive signs that the country is committed to achieving a low emissions future. The uptake of electric vehicles, conversions away from coal, and awareness of the importance of and options for reducing agricultural emissions indicate that we are starting to make progress on reducing our emissions.

Aotearoa New Zealand now needs to build on that momentum to broaden, strengthen, and accelerate action to meet its climate change objectives.

This draft report contains proposed recommendations which are the urgent, critical actions required to achieve the second emissions budget and ensure Aotearoa New Zealand is on track to achieve the third budget (2031-2035) and beyond. We provide a strategic perspective across the second and third emissions budget period through the lens of achieving the 2050 target and contributing to the global effort under the Paris Agreement to limit the global average temperature increase to 1.5°C above pre-industrial levels.

Our draft report is divided into three parts:

- Fundamentals for success
- Creating low emission options
- Enabling system transformation

Each part contains chapters focused on specific areas of action required, including the context and rationale for our proposed recommendations. We have focused on identifying critical gaps in action as well as where existing actions need to be urgently strengthened and accelerated, as together these pose the greatest risks to Aotearoa New Zealand's ability to achieve its emissions reduction goals. In this way, our work draws and builds on our previous work, including *Ināia tonu nei*.

Aotearoa New Zealand has joined international efforts to address climate change in addition to and beyond its domestic targets. Emissions reduction plans, however, are focused specifically on meeting emissions budgets, the domestic 2050 target, and Aotearoa New Zealand's domestic contribution to limiting warming to 1.5°C. This advice on the direction of policy for the second emissions reduction plan therefore does not focus on these global contributions, including the Nationally Determined Contribution (NDC) under the Paris Agreement.

We note, however, that these international contributions remain relevant to this advice, as any emissions reductions achieved over and above those required within a budget period will help close the gap between Aotearoa New Zealand's domestic and global contributions.

Part 1: Fundamentals for success

The first part of our draft advice relates to the fundamental elements of success that underpin Aotearoa New Zealand's climate action. Getting these fundamentals right is critical for meeting our climate objectives, as they will lay the foundation for effective action across all emissions budget periods.

These fundamentals include the Government committing to a specific level of gross emissions reduction in the second and third emissions budget periods that ensures Aotearoa New Zealand is on track to meet the 2050 target, including achieving and sustaining net zero emissions of all long-lived greenhouse gases. A path that relies heavily on planting new forests to achieve net zero would increase exposure to risks such as fires, pests, and diseases. This could mean carbon is released back into the atmosphere and carbon storage is lost.

We propose recommending that in the second emissions reduction plan the Government provide clarity on the outcomes it is seeking on gross emissions reductions and carbon dioxide removals. This includes committing to a specific level of gross emissions for the second and third emissions budgets, no less ambitious than 362 $MtCO_2e$ and 322 $MtCO_2e$ respectively and ensuring that policy choices align with delivering this outcome. We also propose that the Government communicate indicative levels of gross emissions and carbon dioxide removals out to 2050.

These actions will help guide policy development and send clear signals to businesses and households about the importance of taking actions to reduce emissions.

Related to this, we propose recommending that the Government revisit the design of the incentives created by the New Zealand Emissions Trading Scheme (NZ ETS) to ensure it supports the desired outcomes for the transition to net zero long-lived gas emissions. The existing NZ ETS architecture, combined with the relatively low cost of using forests to capture carbon, is likely to result in extensive afforestation in the near term, which in turn is likely to slow efforts to reduce emissions at their source. In addition, over the long term the NZ ETS will not provide the durable incentives for planting forests needed to reach net zero long-lived gas emissions across the economy by 2050.

The NZ ETS is an important part of Government's strategy to reduce emissions. Putting a price on emissions, which in turn raises the price of emissions-intensive activities and goods, encourages participants to make different choices and innovate to find low emissions alternatives. However, to be effective it needs to be calibrated to achieve the outcomes the Government is seeking. The NZ ETS is a tool, not a strategy in and of itself.

We also highlight that industrial free allocation policy is not consistent with the 2050 net zero long-lived gas emissions target and does not appear to be proportional to the risk of emissions leakage, noting the global context has significantly shifted since industrial free allocation was first introduced.

We note that some Iwi/Māori entities have a significant stake in the NZ ETS, particularly in relation to forests, and have heard from some that the NZ ETS in its current form is inequitable. Any Government decisions about amending the NZ ETS uphold Te Tiriti o Waitangi/The Treaty of Waitangi.

Similarly, we recognise that the Crown and Iwi/Māori need to work in partnership to accelerate progress towards the 2050 targets and collectively build climate-resilient communities. Mitigation and adaptation pathways that consider the Crown-Māori relationship, te ao Māori, and specific effects for Iwi and Māori will lead to more enduring and equitable outcomes.

We propose recommending that the second emissions reduction plan accelerate Iwi/Māori emissions reductions and climate change adaptation initiatives by exploring and implementing a mechanism to allocate resourcing direct to Iwi and increase funding to Māori landowners. We also propose recommending that the plan support Iwi/Māori to drive the integration of mātauranga Māori into policy design, development, and implementation at central and local government levels by providing sufficient resources.

While transitioning to a low emissions and resilient future will improve the health and wellbeing of all New Zealanders, the Commission also recognises that the cost and impacts of the low emissions transition may not be experienced equally. Often those least able to take advantage of low carbon alternatives, therefore potentially facing higher costs, will also be most at risk from the physical impacts of climate change.

To address the compounding needs of different groups arising from mitigation and adaptation, we propose recommending that the Government expand the scope of the *Equitable Transitions Strategy* to include adaptation.

Emissions pricing through the NZ ETS will have greater impacts on low-income households than high-income households, as higher income households likely have more capacity to adapt. The Commission has previously advised (in its 2023 NZ ETS settings advice) that developing targeted, complementary policies will better enable Aotearoa New Zealand to address issues of social and economic equity and tackle climate change in parallel.

Rather than using the NZ ETS price control settings or otherwise delaying climate action, we propose recommending that Government utilise existing mechanisms to manage transitional impacts as it develops its *Equitable Transitions Strategy*.

Part 2: Creating low emissions options

The second section of our draft advice contains specific proposed recommendations for different sectors, all with a part to play in meeting the second emissions budget.

Ensuring that agriculture reduces emissions will be an important factor in meeting the second emissions budget and the 2030 biogenic methane target. A broad suite of actions and policies is required to ensure an equitable transition to a low emissions sector.

It is crucial that agricultural emissions pricing is not delayed, as this would make it less likely for Aotearoa New Zealand to meet its climate targets. We propose recommending that the Government advance the agricultural emissions pricing system to enable recognition of multiple gross emissions-reducing practices and technologies and drive gross emissions reductions in line with the 2050 target.

Farmers will need support to change practices, so we also propose recommending that the Government enhance advisory and extension services to farmers to accelerate the adoption of emissions-efficient practices, appropriate land-use diversification, and emerging technologies to reduce gross emissions. These services should be co-designed and implemented working with industry. The Government should also partner with Iwi/Māori and Māori-collectives to further develop and fund Māori-focused advisory services targeting the specific needs of Māori-collective landowners.

The way towns and cities are shaped impacts emissions across land use, transport, buildings, energy, and waste through our built environment. Existing urban form in Aotearoa New Zealand is not compatible with our climate challenges and change is required for the second budget period.

Our proposed recommendations include incentivising comprehensive retrofits to deliver healthy, resilient, low emissions buildings, prohibiting the new installation of fossil gas in buildings where there are affordable and technically viable low emissions alternatives, and implementing an integrated planning system that builds cities upward and mixes uses while progressively avoiding climate risks.

The largest share of emissions reductions in the second emissions budget period is expected to come from energy and industry. Therefore, getting the settings right to support electrification is crucial.

Our proposed recommendations include prioritising and accelerating renewable electricity generation build. We estimate that if renewable generation build is six months behind the Commission's updated demonstration path, emissions would increase on average by 0.9 $MtCO_2e$ and a 12-month delay would increase emissions by 1.8 $MtCO_2e$ across the second emissions budget period. This is because fossil gas generation will need to operate more to meet projected demand. Continued uncertainty and build delays could make it challenging to meet emissions budgets.

We also propose recommending ensuring electricity distribution networks can support the growth and variability of supply and demand. This will require appropriate consenting and network planning processes

to support the deployment of new renewable electricity, backed by energy efficiency and demand-side management.

We also propose recommending that the Government pursue widespread process heat decarbonisation and establish mechanisms for other industrial sectors to decarbonise, as industrial emissions reductions are crucial to meeting the second emissions budget. Industrial emissions can be reduced faster than the Commission originally assumed in *Ināia tonu nei*. However, barriers will need to be addressed and policy support must be broadened to address large industrial sites like those in the mining and construction sectors.

Forests are important for meeting long-lived gas targets through the removal and storage of carbon dioxide, and can provide wider benefits including enhanced biodiversity, better management of water and air quality, and the stabilisation of land to manage erosion.

However, we caution against over-reliance on this sector. We have therefore proposed recommending the Government set and implement integrated objectives for the role of forests with respect to emissions mitigation and adaptation, while giving effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi.

For the second emissions reduction plan, it is critical that the Government focus simultaneously on actions needed to meet the second emissions budget and to enable meeting the third. Transport is a clear example of this. For the second emissions budget period we propose recommending that the Government rapidly resolve the existing barriers to scaling up vehicle charging infrastructure, and at the same time develop incentives to accelerate the uptake of zero emissions commercial vehicles including vans, utes, and trucks.

The greatest opportunities to reduce emissions through increased uptake of walking, cycling, and public transport are in major population centres, which account for 65% of national light vehicle kilometres travelled. We are therefore proposing to recommend that the Government simplify planning and increase funding of integrated transport networks that optimise public and active transport. For major population centres, the Government should also complete cycleway networks by 2030 and take steps to complete rapid transport networks by 2035.

Finally, additional action is required in the waste sector, including F-gases. Emissions from waste can be reduced by decreasing the production of waste, phasing out the landfilling of organic waste, reducing the embodied emissions from waste, avoiding and preventing fossil-fuel waste generation, and ensuring highly efficient gas capture at landfills where organic waste is accepted.

A cohesive long-term waste infrastructure plan for Aotearoa New Zealand to deliver appropriate facilities is needed in the first emissions budget period to support these objectives.

For the second emissions budget period we propose recommending that the Government apply regulatory and policy instruments to achieve the optimal use and efficiency of landfill gas capture systems and technologies at all landfills. At the same time, it should improve the accuracy and transparency of landfill gas capture data by executing a review of relevant regulatory and policy tools.

Measures should be advanced to increase industry-wide knowledge of – and confidence in – low Global Warming Potential gas alternatives and to promote their uptake across different sectors in the economy. This includes establishing a robust policy and regulatory framework to promote the management and handling best practice of F-gases and refrigerants, enabling effective enforcement.

Part 3: Enabling system transformation

In our draft advice we have also included proposed advice relating to some key enablers that will support a low emissions system transformation. These include enhancing the research, science, innovation, and technology system, broadening, deepening, and accelerating climate funding and finance, and fostering a more circular economy and sustainable bioeconomy.

A strong research, science, innovation, and technology system is fundamental to transition Aotearoa New Zealand to a thriving and resilient low emissions future.

Strengthening this system requires further targeted investment. This will ensure that the climate change science capacity and capability developed over the last decade through funding mechanisms like the National Science Challenges will support an equitable path to achieving the 2050 targets and a resilient economy.

It also requires creating a regulatory environment that both enables and incentivises early adoption of green technology to drive innovation, backed by openly available social, economic, and climate change data and information.

In *Ināia tonu nei*, we highlighted that investment will be needed across the economy to support the transition to low emissions, and access to finance and investment capital will underpin emissions reductions in every sector.

While work is underway enabling and investing in a low emissions economy, meeting emissions reduction targets will depend on broadening, deepening, and accelerating current efforts in both the public and private financial sectors.[1] This work includes ensuring adequate funding is present for initiatives to lower emissions, aligning all public investment with climate goals, developing a unifying strategy to support decision-making, and encouraging and enabling private investors to urgently shift to sustainable finance.

Ultimately, a fair, inclusive, and equitable transition involves putting people at the centre of funding and finance.

A more circular economy and sustainable bioeconomy can promote long-term resilience, generate business and economic opportunities, and provide environmental and cultural benefits domestically and abroad. The failure to move towards this future could put Aotearoa New Zealand's global competitiveness at risk.

Establishing and implementing a sustainable bioeconomy strategy, supporting the participation of Iwi/Māori in the bioeconomy, improving information gaps, and ensuring appropriate resourcing and support are tangible steps the Government can take to support this growing industry.

Implementation of the circular economy strategy and a commitment to actions like enhancing product stewardship would help avoid the creation of waste through design and support renewable materials and the use of low carbon alternatives. This includes developing complementary right to repair legislation for electronic products.

Proposed Recommendations

Part 1: Fundamentals for success

We propose that in the emissions reduction plan for the second budget period the Government:

1. Commit to a specific level of gross emissions for the second and third emissions budgets, no less ambitious than 362 $MtCO_2e$ and 322 $MtCO_2e$ respectively, and ensure that its policy choices align with delivering this outcome.
2. Communicate indicative levels of gross emissions and carbon dioxide removals from forestry out to 2050 and beyond to guide policy development.

We propose that the emissions reduction plan for the second budget period must:

3. Make the emissions pricing system consistent with delivering the specific levels of gross emissions for the second and third emissions budgets, and with the 2050 net zero target, by:
    a. implementing an amended NZ ETS that separates the incentives for gross emissions reductions from those applying to forestry
    b. developing an approach that can provide durable incentives for net carbon dioxide removals by forests through to and beyond 2050.

We propose that the emissions reduction plan for the second budget period must:

4. Accelerate Iwi/Māori emissions reductions in conjunction with climate change adaptation initiatives by exploring and implementing a mechanism to allocate resourcing direct to Iwi and increase funding to Māori landowners (Te Ture Whenua entities).
5. Ensure Iwi/Māori can drive the integration of mātauranga Māori into policy design, development, and implementation at central and local government level, by delivering sufficient resources to Iwi/Hapū.

We propose that the emissions reduction plan for the second budget period must:

6. Enable a fair, inclusive, and equitable transition for New Zealanders by expanding the scope of the *Equitable Transitions Strategy* to include compounding impacts of climate change and adaptation as well as mitigation.
7. Make use of existing mechanisms to manage impacts of climate policies in the interim, rather than delaying climate action.

Part 2: Creating low emissions options

We propose that the emissions reduction plan for the second budget period must:

8. Enhance advisory and extension services to farmers to enable them to respond to pricing and accelerate the adoption of emissions-efficient practices, appropriate land-use diversification, and emerging technologies to reduce gross emissions. These services should be co-designed and implemented in partnership with industry and Iwi/Māori.
9. Advance the agricultural emissions pricing system to:
    a. enable recognition of a broader range of emissions-reducing practices and technologies
    b. incentivise gross emissions reductions in line with the 2050 target.

We propose that the emissions reduction plan for the second budget period must:

10. Implement an integrated planning system that builds urban areas upward and mixes uses while incrementally reducing climate risks.
11. Incentivise comprehensive retrofits to deliver healthy, resilient, low emissions buildings.
12. Prohibit the new installation of fossil gas in buildings where there are affordable and technically viable low emissions alternatives in order to safeguard consumers from the costs of locking in new fossil gas infrastructure.

We propose that the emissions reduction plan for the second budget period must:

13. Prioritise and accelerate renewable electricity generation build and ensure electricity distribution networks can support growth and variability of demand and supply.
14. Pursue more widespread process heat decarbonisation and establish mechanisms for other industrial sectors and processes to decarbonise.

We propose that the emissions reduction plan for the second budget period must:

15. Set and implement integrated objectives for the role of forests with respect to emissions mitigation and adaptation, while giving effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi.

We propose that the emissions reduction plan for the second budget period must:

16. Simplify planning and increase funding of integrated transport networks that optimise public and active transport. For major population centres, the Government should also complete cycleway networks by 2030 and take steps to complete rapid transport networks by 2035.
17. Rapidly resolve the barriers to scaling up vehicle charging infrastructure.
18. Develop incentives to accelerate the uptake of zero emissions commercial vehicles, including vans, utes, and trucks.

We propose that the emissions reduction plan for the second budget period must:

19. a. Apply regulatory and policy instruments to achieve the optimal use and efficiency of landfill gas capture systems and technologies at all landfills.
    b. Improve the accuracy and transparency of landfill gas capture data by reviewing and strengthening relevant regulatory and policy tools.

Part 3: Enabling system transformation

No recommendations proposed.

Chapter 1: Introduction

About He Pou a Rangi Climate Change Commission

He Pou a Rangi Climate Change Commission (the Commission) is an independent Crown entity set up to provide expert, evidence-based advice to successive governments to help Aotearoa New Zealand transition to a thriving, climate-resilient, and low emissions future.

The Commission is supported by a Board of Commissioners from varying fields. Our staff have a range of expertise, including public policy, kaupapa Māori, climate science, economics, strategy, land and resource management, behavioural sciences, forestry, agriculture, transport, waste, and energy.

The scope and timeframes for the Commission's advice are set out in the Climate Change Response Act (2002) (the Act). The Minister of Climate Change may also make a specific request to the Commission for advice on any topic.

The Act requires the Commission to draw from the best available evidence and analysis and think broadly about the impacts of climate change and the implications for Aotearoa New Zealand over time. We must also consider the Crown-Māori relationship, te ao Māori, and specific effects for Iwi/Māori in our work.

In doing so, we take a system-wide view so we understand what our advice will mean for central and local government, for individuals and households, for business sectors and communities, for Iwi/Māori, and for Aotearoa New Zealand's economy and environment now and into the future.

As an organisation we are endeavouring to build meaningful and respectful relationships with Iwi/Māori and are committed to taking an inclusive approach and working collaboratively with others so we can grow consensus and inspire action to change.

We recognise that our work sits within a broader context. Aotearoa New Zealand is facing several challenges as we publish this advice; there are ongoing concerns around the cost of living, Cyclone Gabrielle has had a devastating impact on communities across Aotearoa New Zealand, and supply chain challenges continue post-COVID-19.

The global context regarding climate change is also changing. Since the release of our advice on the direction of policy for the Government's first emissions reduction plan, *Ināia tonu nei*, there has been a successful United Nations Conference of Parties (COP) in Glasgow, countries such as the United States have made significant climate change investment and reform, and the Intergovernmental Panel on Climate Change (IPCC) has released its latest findings.

While the context in which we provide our advice continues to change, our purpose remains the same: to help Aotearoa New Zealand transition to a thriving, climate-resilient, and low emissions future.

The Commission has several statutory deliverables it will provide over the next year and a half

By 31 December 2024, we will:

- deliver the final version of this advice on the direction of policy for the Government's second emissions reduction plan
- provide the Government with advice on the New Zealand Emissions Trading Scheme (NZ ETS) unit limits and price control settings for 2025-2029

- monitor and report on progress towards meeting emissions budgets, emissions reduction plans and the 2050 target
- provide progress reports on Aotearoa New Zealand's national adaptation plans
- review the 2050 emissions reduction target
- review the inclusion of emissions from international shipping and aviation in the 2050 target
- provide advice for the preparation of future emissions budgets.

More information on the Commission's forward work programme can be found on our website, www.climatecommission.govt.nz.

About the transition

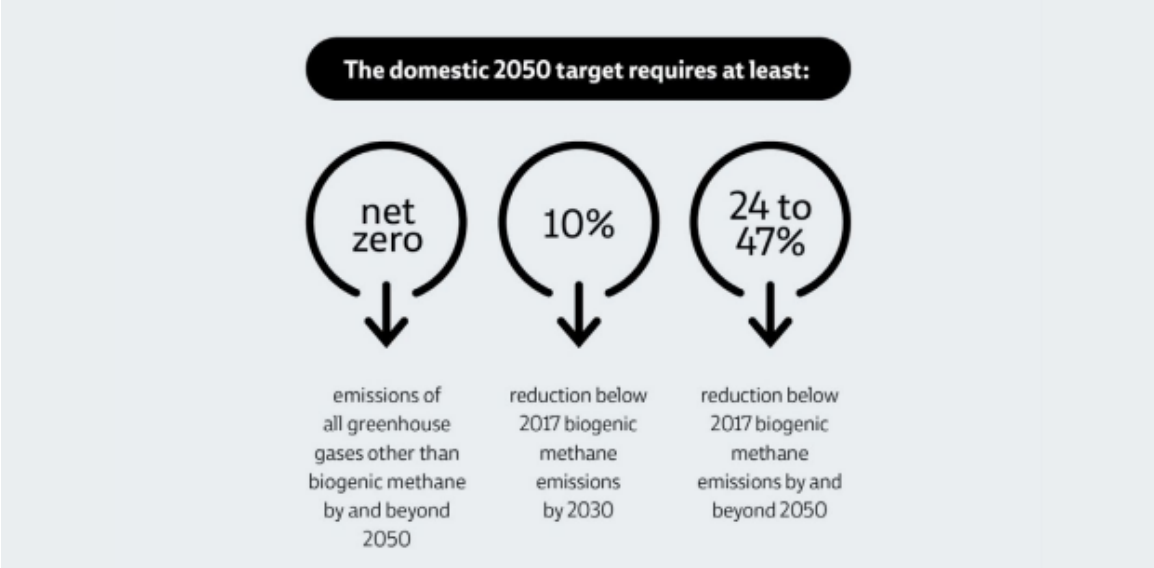
Aotearoa New Zealand has set a 2050 target for emissions reductions

Passed in 2019, the Climate Change Response (Zero Carbon) Amendment Act:

- established the Climate Change Commission
- established a system of emissions budgets to act as stepping-stones towards Aotearoa New Zealand's long-term targets
- made the development and implementation of climate change policies a requirement
- put into law a new 2050 emissions reduction target.

This target encompasses all domestic sources of greenhouse gases, but has two distinct components that must be reduced by different amounts:

Figure 1.1: Aotearoa New Zealand's domestic 2050 target



These actions provide the framework by which Aotearoa New Zealand can minimise and adapt to the impacts of climate change and contribute to the global effort under the Paris Agreement to limit the global average temperature increase to 1.5°C above pre-industrial levels.

The national Greenhouse Gas Inventory analyses Aotearoa New Zealand's current emissions profile

In 2020, biogenic methane emissions in Aotearoa New Zealand were 1.34 $MtCH_4$, and gross emissions of all other greenhouse gases (which we refer to collectively as long-lived gases) were 45.3 $MtCO_2e$ (**Figure 1.2**).

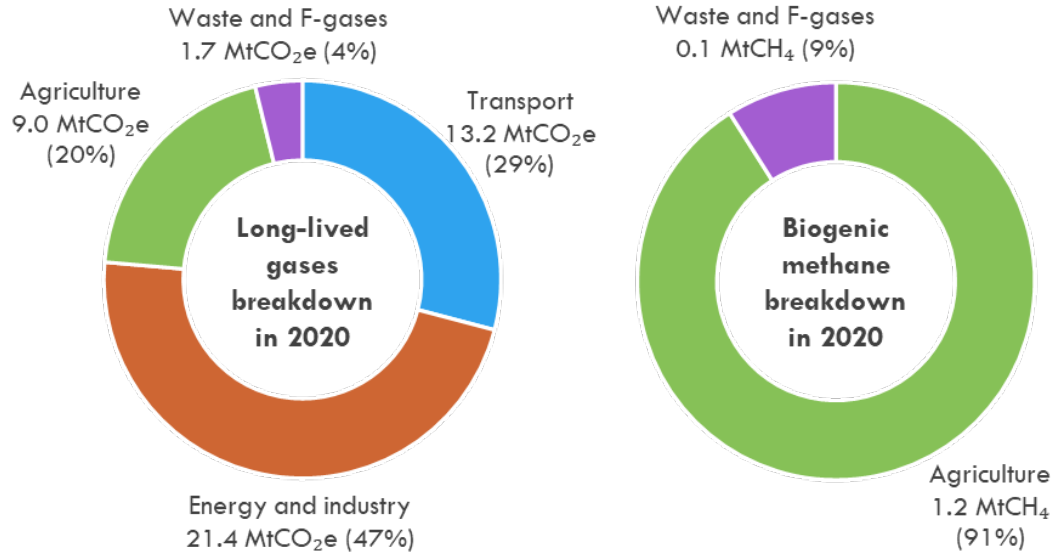
These numbers are from the 2022 national Greenhouse Gas Inventory (GHG inventory), published by the Ministry for the Environment. At the time of writing this report, the 2023 GHG inventory is yet to be published.

Most biogenic methane emissions come from agriculture, mainly from ruminant livestock such as cows and sheep. The remainder come from the decay of organic waste.

Long-lived gas emissions are mostly carbon dioxide, followed by nitrous oxide. We also include non-biogenic methane and F-gases in this category to align with how the 2050 target is defined in the Act, although non-biogenic methane and some F-gases are short-lived.

More than three-quarters of long-lived gas emissions come from transport, energy, and industry, mainly through the burning of fossil fuels in vehicles, factories, and homes. Around 20% come from agriculture, mainly nitrous oxide emissions caused by livestock urine and fertiliser use. The remainder come from F-gases (gases commonly used as refrigerants), wastewater treatment, and the burning of waste.

Figure 1.2: Aotearoa New Zealand's emissions of biogenic methane and other greenhouse gases by sector in 2020



Source: Commission analysis of the 2022 GHG inventory[2]
Note: CO_2e emissions expressed using GWP100 values from the IPCC's Fourth Assessment Report (AR4)

A system of emissions budgets has been agreed to meet the 2050 target

In May 2022, the Government set and published the first three emissions budgets (2022–2025, 2026–2030, 2031–2035).

As outlined in the Act, emissions budgets act as stepping-stones to achieving the 2050 target. Each represents the total quantity of emissions allowed to be released during an emissions budget period, expressed as a net amount of carbon dioxide equivalent. Emissions budgets cover a period of five years each (except the first emissions budget which covers the four-year period 2022-2025).

They must be set with a view to meeting the 2050 target and contributing to the 1.5°C global target. They must also be set in a way that allows them to be met domestically.

The amount of budgeted CO_2e for the first, second, and third budget period is shown in **Table 1.1** below.

Table 1.1: The Government's emissions budgets[3]

Budget Period	2022-25 (Budget 1)	2026-30 (Budget 2)	2031-35 (Budget 3)
All gases, net (AR5)	290 $MtCO_2e$	305 $MtCO_2e$	240 $MtCO_2e$
Annual Average	72.5 $MtCO_2e$	61 $MtCO_2e$	48 $MtCO_2e$

Aotearoa New Zealand is currently in the first emissions budget period. The first emissions reduction plan, containing the Government's strategies, policies, and actions for achieving the first budget, was released by the Government in May 2022.

The second emissions budget, for which a second emissions reduction plan must be developed, covers the period 2026-2030. The third budget and plan will follow, covering 2031-35.

While we have provided our advice based on the emissions budgets as they are currently set, there is the possibility for budgets to be changed. Under the Act, emissions budgets two and three may be amended as part of the 2050 target review, due on 31 December 2024. The Commission can also provide advice recommending a change to notified budgets – that is emissions budgets two and three – as part of our advice on the fourth emissions budget, due in December 2024.

About this advice

The Commission's role is to give evidence-based advice to Government on an emissions reduction plan to meet the second emissions budget

As discussed above, each emissions budget must be accompanied by an emissions reduction plan, setting out policies and strategies to be put in place to meet the budget. While the Government is responsible for drafting and implementing these plans, the Commission is required to provide evidence-based advice on policy direction to support their development.

The Commission provided its advice to inform the first emissions reduction plan in *Ināia tonu nei,* and in response the Government committed to 400 emissions-reducing actions in *Te hau mārohi ki anamata | Towards a productive, sustainable and inclusive economy: Aotearoa New Zealand's first emissions reduction plan.*

Now, ahead of the second emissions budget period, we are preparing to provide the Government with advice to inform the second emissions reduction plan.

For this advice, we have focused on identifying critical gaps in action, and where existing actions need to be urgently strengthened and accelerated to meet the second emissions budget.

Our advice also covers policies required to meet future budget periods – for instance, the third emissions budget – when they are relevant to Aotearoa New Zealand's ability to meet the 2050 target.

This draft report therefore contains proposed recommendations which represent the critical actions required to meet the second emissions budget and enable the achievement of the third, keeping the 2050 target in view.

The Commission is consulting on our draft advice before providing final advice to Government at the end of the year

This document is the Commission's draft advice, which has been developed for consultation. We are seeking input to inform our final advice, due to the Government by 31 December 2023.

Evidence and engagement are at the centre of our advice and our role as an independent advisor. This draft advice has drawn from evidence and engagement insights gathered over the course of the Commission's existence and has been informed by initial engagements focused on the second emissions budget period.

This consultation is an opportunity to strengthen our advice further and is a continuation of our work to understand the evidence base and bring in perspectives from New Zealanders across the motu. This part of the process is critical to ensuring we have a strong understanding of the different needs, perspectives, and concerns of New Zealanders.

This document is not intended to be a near-final version of our advice. Through this consultation we will test, refine, and improve our advice before delivering our final advice to the Government at the end of this year.

The Government will then consider our recommendations before setting the second emissions reduction plan at the end of 2024. The second emissions budget period starts on 1 January 2026.

Other relevant pieces of advice

While emissions reduction plans are a central component to Aotearoa New Zealand's climate change strategy, they are not the only lever for action available to the Government, nor the only area of focus for the Commission.

From 2024, the Commission will provide annual reports assessing Aotearoa New Zealand's progress towards meeting emissions budgets

A key part of the Commission's role is monitoring Aotearoa New Zealand's progress towards its climate change goals. As part of this, we must monitor the Government's progress towards meeting emissions budgets and targets, and report on this annually. We are also required to evaluate progress at the end of each emissions budget period.

The Act makes it clear that our monitoring role is separate from our role providing advice – including on the direction of policy for the emissions reduction plan.

Our advisory role is important for providing independent, evidence-based advice that must be considered by the Government when it prepares its emissions reduction plans. Our monitoring and reporting role is important for assessing how the country is tracking against the emissions budgets, and the effectiveness and delivery of emissions reduction plans. This information will support government agencies and others to

adjust plans and make course-corrections where necessary, supporting continual learning and improvement across the broader climate policy system.

From next year, the Commission will begin publishing annual progress reports on Aotearoa New Zealand's emissions reductions. The first progress report, due in mid-2024, must include an assessment of the adequacy of the first emissions reduction plan and progress in its implementation, including any new opportunities to reduce emissions.

This advice therefore is focused on informing the upcoming second emissions reduction plan and does not include analysis produced through our monitoring role.

In 2024, the Commission will report on its review of the 2050 target

Every five years (starting in 2024), the Commission must do an independent review of Aotearoa New Zealand's legislated 2050 target. This review sits alongside our five-yearly advice on emissions budgets.

As a result of this review, the Commission will provide advice on whether any changes should be made to the target or parts of the target.

At the same time as this review, we will provide advice on whether the 2050 target should be amended to include emissions from international shipping and aviation – and if so, how the target should be amended.

Some issues that may be raised in response to consultation on this advice may be better addressed in the target review. Where that is the case, we will make sure those issues are considered in that review.

Aotearoa New Zealand's global contributions

Aotearoa New Zealand has joined international efforts to address climate in change addition to and beyond its domestic targets. Emissions reduction plans, however, are focused specifically on meeting emissions budgets, the domestic 2050 target, and Aotearoa New Zealand's domestic contribution to limiting warming to 1.5°C. This advice on the direction of policy for the second emissions reduction plan therefore does not focus on these global contributions.

These international contributions remain relevant to this advice as emissions reductions that result from emissions reduction plans will contribute towards meeting them. Any overachievement of budgets – in other words achieving greater emissions reductions than required within an emissions budget period – will help close the gap between Aotearoa New Zealand's domestic and global contributions. Following through on this advice will also in many cases contribute towards achievement of the UN Sustainable Development Goals.

The Nationally Determined Contribution and offshore mitigation

In 2021, the Government updated the Nationally Determined Contribution (NDC) under the Paris Agreement. The target is now to reduce emissions by 50% below gross 2005 levels, or 41% below net levels, by 2030. The expectation is that this target will be met through a combination of actions achieved through the emissions reduction plan – domestic emissions reductions and removal of carbon through forests – and through offshore mitigation.

Offshore mitigation is expected to make a substantial contribution. In 2022, the Commission estimated that if the Government achieves its first and second domestic emissions budgets, 99Mt CO_2e of offshore mitigation will be needed to meet the NDC.[4]

In *Ināia tonu nei,* the Commission provided advice on the NDC in response to a specific request from the Minister of Climate Change. At this stage, there is no ongoing role for the Commission to provide further advice on this topic.

Global Methane Pledge

Aotearoa New Zealand has also signed up to the Global Methane Pledge to take voluntary actions to contribute to a collective effort to reduce global methane emissions by at least 30% from 2020 levels by 2030, which could eliminate over 0.2˚C warming by 2050. The pledge aims to catalyse global action and strengthen support for international initiatives to reduce methane emissions by advancing technical and policy work that will underpin participants' domestic actions. The Global Methane Pledge has over 100 countries on board, representing nearly 50% of global human-caused methane emissions and over two thirds of global GDP.[5]

Aotearoa New Zealand's primary contribution to the pledge is through progress towards the domestic methane target and the actions to reduce emissions in agriculture and waste.

The foundations of the Commission's thinking

This draft report provides advice to the Government on policy direction for the second emissions reduction plan to meet the second emissions budget. The Act requires the Commission to consider a range of matters in carrying out our analysis and developing advice, and sections 5M and 5ZC set out what must be considered when specifically creating advice for an emissions reduction plan.

The Commission has used two tools to help formulate this advice. These are:

1. A prioritisation framework, created using sections 5M and 5ZC of the Act
2. A policy framework

These two combined allow us to systematically develop our advice on the direction of policy, taking into consideration a number of factors as we do so. Each recommendation and chapter has been created and assessed on its individual merits against the prioritisation framework, and the balance of the whole has also been assessed.

The policy framework has been applied in relevant chapters based on the Commission's assessment of the opportunities, barriers, and potential solutions. We have considered critical gaps in the current policy landscape, potential for co-benefits, and wellbeing aspects.

Our prioritisation framework

The Commission has created a prioritisation framework against which to test the development of our advice. This framework allows the Commission to ensure we are meeting our statutory requirements to consider a number of factors. We have also used the framework to decide which elements of our advice to raise as recommendations.

As part of this consultation, we are seeking feedback on the framework itself and the outcomes of its use.

There are around 400 Government actions underway as part of the first emissions reduction plan, and a variety of other emissions reducing actions are being taken by others around Aotearoa New Zealand.

We have used the prioritisation framework to determine which of the actions that could be taken to reduce emissions over the second emissions budget period would be most important and allow for the second emissions budget to be achieved as intended.

Below is presented the prioritisation framework we have used to develop our proposed recommendations for this advice. There are six aspects that are each critical to consider:

- the **potential** of the mitigation opportunity, policy, or enabler for meeting the second emissions budget (and where relevant the third emissions budget, with a view to the 2050 target), taking into account scale, scientific evidence, technological development, economic feasibility and cost
- the **gap** in policy or ability to realise the opportunity, or in the ability to achieve an equitable and sustainable transition
- the **pace and timing** of the action in terms of sufficiency for meeting the second emissions budget and/or laying the foundations for achieving the third emissions budget and the 2050 target
- what **risks** are associated or present, including: to the achievement and permanence of emissions reductions or carbon dioxide removals; to the ability to adapt to climate change; and to other aspects of the environment or ecology
- what **equity** considerations are relevant, including: intergenerational equity; distributional effects on sectors, regions, and social groups; and issues relevant to the Crown-Māori relationship, te ao Māori and specific effects on Iwi/ Māori
- what **co-benefits** the opportunity brings, for example to health, wellbeing, economic development, other environmental or ecological factors, and the ability to adapt to climate change

In **Appendix 1***,* we discuss how these six issues connect with matters that the Commission is required to consider in developing its advice on emissions reduction plans under the Act.

Our policy framework

Nāia tonu nei described the Commission's approach to developing advice on policy direction. In this second advice, we are building on that foundation to provide direction for the policies needed to meet the second emissions budget.

We have developed this advice using our policy framework, adapted from one created by Professor Michael Grubb in his work on Planetary Economics[6]. We have also drawn on international research showing that developing and implementing a comprehensive suite of climate policies is the most effective way to combat climate change.

We prioritise effective policies that target a range of different problems and reduce emissions in a way that supports other goals, like improving health, increasing biodiversity, reducing existing inequities, and addressing historic grievances. We also seek to identify policies that are not in alignment with Aotearoa New Zealand's climate goals so that they can be amended or removed.

Ultimately, our objectives are to support Aotearoa New Zealand to reduce its emissions and to transition in a way that maintains and builds wellbeing, supports natural, social, and human capital, and endures over time.

Our approach to recommendations

For this draft advice, our recommendations are tightly focused on identifying and addressing critical gaps and areas requiring urgent strengthening and acceleration to achieve the second emissions budget and support Aotearoa New Zealand's longer-term emissions reduction targets.

Our prioritisation framework has not identified critical risks to achieving the second emissions budget in every sector. However, even in those sectors without recommendations, action is important to create the conditions for future outcomes, and to achieve emissions budgets and targets in a manner compliant with the matters in the Act.

We will be assessing progress and gaps in action in more detail across all sectors through our monitoring review in 2024.

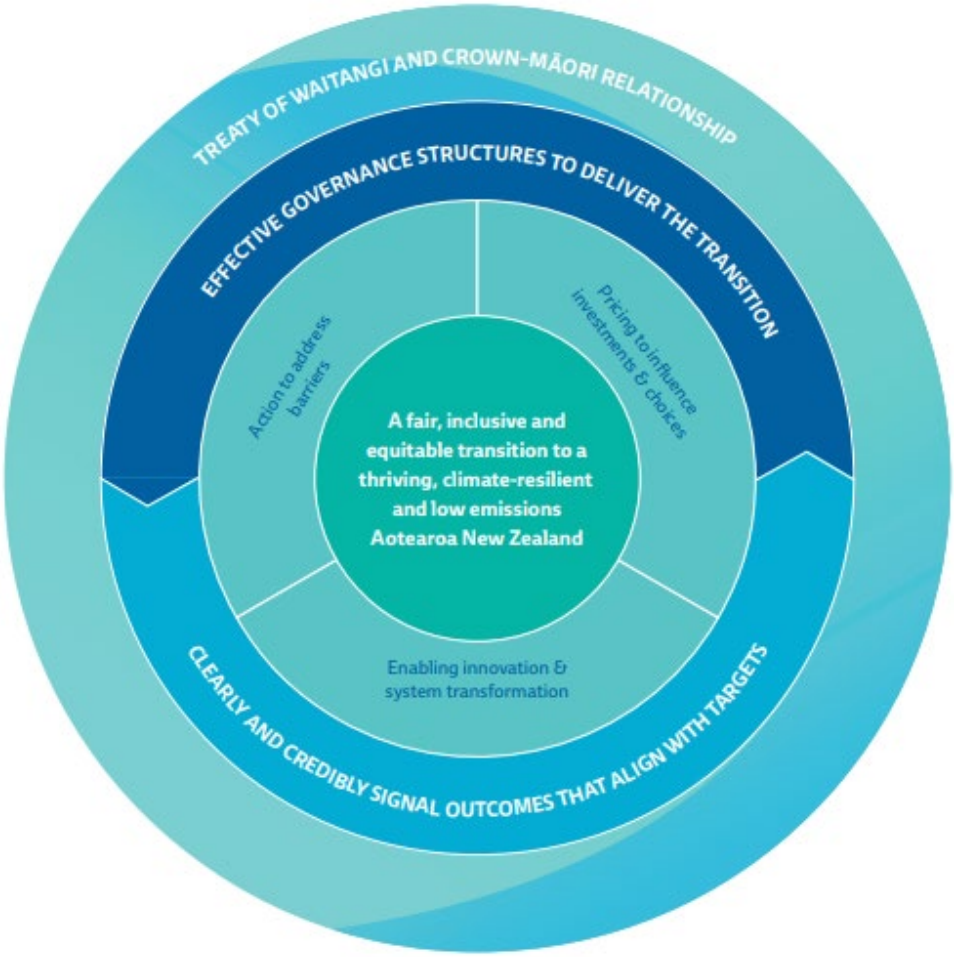
Elements of the policy framework

The Commission's overall vision is of a fair, inclusive, and equitable transition to a thriving, climate-resilient, and low emissions Aotearoa New Zealand. This can be found at the centre of our revised policy framework, below.

The climate transition can bring significant benefits to New Zealanders' health and wellbeing. A fair, inclusive, and equitable transition involves making sure that the benefits of climate action are shared across society, and the negative impacts do not disproportionately fall on those least able to adjust.

Our approach to developing advice on policy direction for the Government's emissions reduction plan is summarised in **Figure 1.3** and explained further below:

Figure 1.3: The Commission's policy framework



Creating an enabling environment

An enabling environment is one that supports people to participate in and contribute to Aotearoa New Zealand's efforts to achieve emissions budgets and targets. The elements of an enabling environment are:

1. The Crown-Māori relationship
2. Clearly and credibly signalled outcomes that align with targets
3. Effective governance structures for delivering the transition

The Crown-Māori relationship

In Aotearoa New Zealand, an enabling environment must be firmly rooted in Te Tiriti o Waitangi/The Treaty of Waitangi principles of partnership, participation, active protection, and equity. These principles underpin the unique relationship between the Government and tangata whenua.

As well as focusing on the importance of upholding Te Tiriti o Waitangi/The Treaty of Waitangi, the Commission has also applied the framework 'He Ara Waiora – A Pathway Towards Wellbeing' throughout our work.

He Ara Waiora is a developing framework, designed by Māori in collaboration with the Treasury. Drawing from mātauranga Māori, the framework has been designed for government, rather than for Māori, as a tool to help policy teams build a high-level understanding of Māori perspectives on wellbeing. It helps to improve awareness of how policy can impact Iwi/Māori, with the goal of achieving more equitable policy outcomes.

He Ara Waiora is anchored in wairua (energy/spiritual realm) as a source of wellbeing.
The taiao (environmental realm) sits at the centre, iterating a Māori perspective that environmental wellbeing is a precursor to human wellbeing. The framework also identifies
four dimensions of wellbeing within te ira tangata (human realm):

- Mana tuku iho – identity and belonging
- Mana tauutuutu – individual and community rights and responsibilities
- Mana āheinga – aspiration and capability
- Mana whanake – sustainable prosperity

In addition to thinking about integrated policy design, applying tikanga helps to qualify how policy will enhance intergenerational wellbeing. He Ara Waiora sets out the following tikanga to support policy development:

- Manaakitanga – having a deep ethic of care towards the people and systems involved.
- Tikanga – ensuring the right decision makers are involved, and the right decision-making process is implemented.
- Whanaungatanga – being mindful of the relationship between all things, our connections to each other and how we connect to our whenua.
- Kotahitanga – taking an inclusive approach and working collaboratively with other agencies/ organisations, to have access to the best information, and to do the best work we can, collectively.

Clearly and credibly signalled outcomes that align with targets

The Government must signal policy changes well in advance, while articulating a clear and credible vision for the future of different sectors, industries, and communities. People need to understand the speed and direction of travel for transitioning to a low emissions Aotearoa New Zealand.

To support this, the Government must take a long-term view and present a clear strategy for achieving climate goals. This will provide households, communities, businesses, and investors with the predictability that they need to plan.

Effective governance structures for delivering the transition

Developing, implementing, and monitoring effective climate policy which supports an equitable transition to low emissions will require coordination across a wide range of government agencies and levels of government, as well as with Iwi/Māori. Governance structures and institutional arrangements will support stability and coordination and keep the Government focused on long-term goals.

Driving the creation of options

Alongside creating an enabling environment, it is necessary to drive the creation and choice of low emissions options in different sectors and across the economy.

Three main pillars of policy intervention will support this:

- pricing to influence investments and choices
- action to address barriers
- enabling innovation and system transformation.

Emissions pricing and other market incentives to influence choices

Emissions pricing incentivises businesses and individuals to make choices that lower emissions. The main pricing tool in Aotearoa New Zealand is the New Zealand Emissions Trading Scheme (NZ ETS), but there are others that can also be used to incentivise investments and choices, such as taxation, electricity pricing, grants, and subsidies.

Emissions pricing is a strong and flexible lever for tackling climate change. Participants face the costs associated with their emissions while being free to decide how best to make reductions based on their individual circumstances. It also has broad coverage, affecting a much wider range of decisions than would be possible with more targeted policies.

However, no single policy will be able to overcome all the barriers to reducing emissions. While emissions pricing is a key component of effective and efficient climate policy, other policies will also be needed. This is due to the range of market barriers and coordination problems hindering action, and the potential impacts on social and economic equity that could emerge from relying solely on pricing.

Some sectors have characteristics that impact how effective emissions pricing can be, and some characteristics of the NZ ETS itself also moderate its ability to drive emissions reductions. Emissions pricing plays a more limited role where decisions are made by individuals, or by small businesses or firms, who are less likely to respond quickly due to behavioural factors, lack of information, or limited capability.

Complementary policies that sit alongside emissions pricing can put people and businesses in a better position to respond to a rising emissions price and lower their exposure and vulnerability to that price.

Regulation, information, and other action to address barriers

There are a range of structural, political, and behavioural barriers that prevent people and businesses from making the most of cost-effective opportunities to reduce emissions. These barriers vary by sector. Removing these barriers can boost responses to the emissions price and decrease the overall cost of reducing emissions.

Measures which can address these sorts of barriers include standards or regulation, information, support to address capacity gaps, and removing regulatory barriers that impede emissions reduction.

Enabling innovation and system transformation

To achieve the scale and pace of change needed, efforts to create and adopt new technologies and systems that provide better and less costly ways of reducing their emissions need to be accelerated.

There are many areas where low emissions options do not exist or are not yet commercially available at scale. Investment in innovation and infrastructure can help create and deploy new solutions to unlock and bring down the costs of future emissions reductions.

How we applied our approach

For this draft advice, we have focused on building on the work already progressing under the first emissions budget period, identifying where critical gaps might exist and where existing actions need to be urgently strengthened and accelerated to achieve the second emissions budget and Aotearoa New Zealand's longer-term climate goals.

We also looked at how emissions pricing is likely to drive change. For each sector, and across the broader system, we identified where barriers currently deter low emissions choices, and where strategic investment can help drive deeper change over the long term.

This engagement and sourcing of evidence is ongoing – it continues today through this consultation.

This draft advice builds on the evidence base created by the Commission

Our work has been informed not only by the policy approach discussed above, but also by the analysis carried out for the Commission's other pieces of advice.

The Commission has released several pieces of advice to the Government since its founding in 2019. The evidence informing this draft advice includes the collective evidence base gathered across the Commission's previous and ongoing work.

Previous advice delivered by the Commission includes:

- *Ināia tonu nei: a low emissions future for Aotearoa*
- *Advice on Agricultural Assistance: How financial assistance could support Aotearoa New Zealand's agricultural emissions pricing system*
- *Progress towards agricultural emissions pricing: Assessing how ready farmers and the agriculture sector are for emissions pricing, and advice on what work still needs to be done*
- *Advice on NZ ETS unit limits and price control settings for 2023-2027*
- *Advice on NZ ETS unit limits and price control settings for 2024-2028*

This draft advice builds on our previous work. Of particular relevance to this draft advice is the previous policy direction given in *Ināia tonu nei,* the key elements of which are listed below in **Table 1.3**. Although there have been some changes, many of the outcomes sought remain relevant.

We have also gathered and analysed data and evidence from a wide range of credible sources and reviewed a broad range of literature to support the development of this draft advice. We have used both quantitative and qualitative tools to guide our analysis, and tested the quality of our evidence, refining it along the way.

We have not undertaken new scenario work, extensive modelling, or forecast emissions reductions, as the opportunity for more extensive quantitative work will come when we give advice in 2024 on upcoming emissions budgets.

Table 1.3: the key elements of policy direction given in *Ināia tonu nei*

Key elements of our policy direction
Work in partnership with Iwi/Māori, and with local government, to ensure the transition to a low emissions economy is firmly rooted in the principles of Te Tiriti o Waitangi/The Treaty of Waitangi.
Send clear and consistent signals about how Aotearoa New Zealand will transition to low emissions and work together across political parties, government agencies and local government.
Improve the New Zealand Emissions Trading Scheme so that it provides stronger market incentives to drive low emissions choices.
Make sure all government policy and investment decisions support the transition to low emissions.
Drive system transformation by supporting innovation, mobilising finance for low emissions investments and supporting behaviour change.
Increase the circularity of the economy and develop a thriving bioeconomy that delivers emissions reductions.
Take action to reduce emissions from existing and new urban areas and improve understanding of how changes to urban form and function can reduce emissions.
Provide affordable, reliable and convenient low emissions alternatives to high emissions vehicles.
Introduce measures to make sure vehicles entering the fleet are efficient and to accelerate uptake of electric vehicles. Create options to decarbonise heavy transport and freight.
Develop a national energy strategy to decarbonise the energy system and introduce measures to make sure the electricity sector is ready to meet future needs.
Accelerate the switch to low emissions fuels for process heat and drive energy efficiency improvements. Develop a plan to transform buildings to be low emissions.
Reduce emissions from waste, through measures that reduce the amount of waste generated and increase resource recovery.
Introduce policies, incentives and tools to speed up emissions reductions from agriculture. Support farmers to identify changes and put them in place. Invest to open up more options for deeper emissions reductions.
Reduce reliance on forestry carbon removals and manage the impacts of afforestation.
Incentivise the reversion and planting of new native forests to create an enduring carbon sink.
Support a Māori-led approach to an equitable transition for Iwi/Māori and the Māori economy.
Design an equitable transitions strategy that results in a fair, inclusive and equitable transition.

The Commission relies on evidence and engagement to create the draft advice on the emissions reduction plan

As discussed in the above section *About this advice,* our approach to drafting and refining our advice relies on engagement with Iwi/Māori, academics, businesses, community groups, farmers, government agencies, industry groups, NGOs, individuals, and others.

This draft advice has been informed by engagement insights gathered over the course of the Commission's existence, as well as initial engagements focused on the second emissions budget period.

This consultation process is a continuation of our work to understand the evidence base and bring in perspectives from New Zealanders. Following consultation, we will review and refine our advice based on the evidence and perspectives shared with us, and deliver our final advice to the Government at the end of this year.

How we have structured our draft advice

This draft report is structured by chapters, each identifying the overarching opportunities and challenges facing Aotearoa New Zealand as it transitions to a low emissions future by theme.

Informed by our evidence base and engagement insights, we have applied our prioritisation framework and identified proposed recommendations, which outline actions needed to achieve the second emissions budget. These can be found throughout the draft report.

Each proposed recommendation indicates that we have found evidence of a risk to meeting the second emissions budget and/or Aotearoa New Zealand's longer-term emissions reduction targets. They are intended to serve as a signal to the Government that if action is not taken as we recommend, other actions of equal or greater impact will be required.

There are some areas in which the application of the prioritisation framework has led us to conclude that a recommendation is not necessary for the second emissions budget period. However, this does not mean that action is not required. Rather, it signals that there are numerous existing activities and work programmes underway that, if progressed and deepened in the second emissions budget period, will likely drive the change needed. In these sections of the report, our draft advice includes key messages on the important areas of activity.

Under the Act, the Government's emissions reduction plan must include:

- sector-specific policies to reduce emissions and increase emissions removals
- a multi-sector strategy to meet emissions budgets and improve the ability of sectors to adapt to the effects of climate change
- a strategy to minimise impacts from reducing emissions on employees and employers, regions, Iwi/Māori, and wider communities, including the funding for actions to reduce emissions
- any other policies or strategies that the Minister considers necessary.

We have structured our advice to cover the elements needed to enable Government's preparation of the next emissions reduction plan for 2026-2030. This is set out in three parts:

1. The context for change

Chapter 2 – The Task for the Second Emissions Budget

Chapter 3 – A Path to Net Zero

Chapter 4 – Emissions Pricing

Chapter 5 – Whāia Ngā Tapuwae

Chapter 6 – Maintaining and Enhancing Wellbeing through the Transition

2. Low emissions options

Low emissions options for the transition will look different across the economy. The following chapters outline the opportunities for Government action in specific sectors:

Chapter 7 – Agriculture

Chapter 8 – Built Environment

Chapter 9 – Energy and Industry

Chapter 10 – Forests

Chapter 11 – Transport

Chapter 12 – Waste and Fluorinated Gases

3. Creating an enabling environment for lasting change

Some systems, institutions, and arrangements may need to change to help to support the transition. These chapters outline how the Government can help create an environment that supports lasting change:

Chapter 13 – Research, Science, Innovation and Technology

Chapter 14 – Funding and Finance

Chapter 15 – Circular Economy and Bioeconomy

Chapter 2: The Task for the Second Emissions Budget

Introduction

The second emissions reduction plan will set out the Government's policies and strategies for meeting the second emissions budget, which covers the period 2026-2030. The plan must also deliver on the legislated 2030 target for biogenic methane and should set Aotearoa New Zealand up for meeting the third emissions budget (2031-2035), keeping the 2050 target firmly in view.

Meeting the second and third emissions budgets will require concerted and timely action at the local and national level and across all sectors. In this chapter, we give an overview of where and how emissions can be reduced to meet these budgets, based on the Commission's previous advice in *Ināia tonu nei*.

We anticipate the need for particularly large contributions from electricity generation and process heat in the second emissions budget, and from transport in the third emissions budget. Because changes like electrifying Aotearoa New Zealand's vehicle fleet take time to accomplish, the ability to meet the third emissions budget will be strongly determined by actions taken in the second emissions budget period.

As we discuss in further detail below, seemingly small delays in the near term can lead to much higher cumulative emissions.

This chapter gives an overview of what is needed to meet the second and third emissions budgets and how the package of policies in the Government's first emissions reduction plan could contribute towards these. The purpose of this is to provide context for later chapters, particularly *Chapter 4: Emissions pricing* and the detailed advice for each sector in Part 2. As such, this chapter does not provide any recommendations to the Government. The chapter does highlight key risks and issues regarding the government assessment of the first emissions reduction plan and its latest emissions projections, and points to areas for future improvement.

Context

The demonstration path models how Aotearoa New Zealand can meet the emissions budgets and 2050 target

As part of our advice in *Ināia tonu nei*, the Commission developed a set of scenarios to explore in detail how Aotearoa New Zealand can meet and sustain the 2050 target and contribute to the global efforts to limit the global average temperature increase to 1.5°C above pre-industrial levels. These scenarios tested uncertainty around the pace and nature of technology and behaviour changes that could be achieved over the coming decades, and the implications for meeting the 2050 target.

In accordance with the Climate Change Response Act 2002 (the Act), we considered a wide range of matters regarding Aotearoa New Zealand's transition. This included the potential economic, social, and environmental effects across time and across regions, the Crown-Māori relationship, te ao Māori, and specific effects for Iwi and Māori.

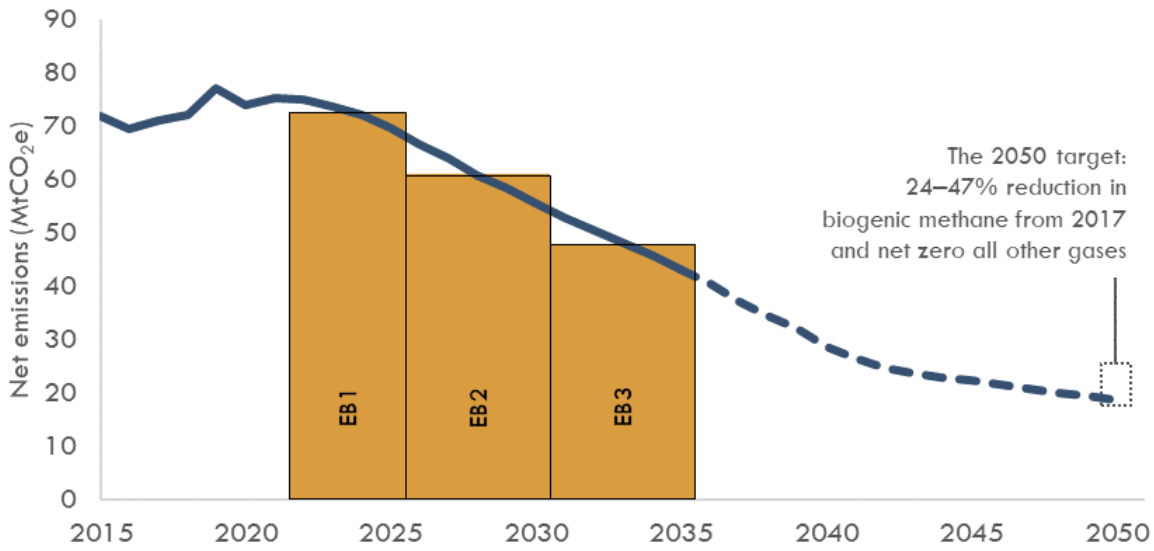
Together, our analysis led to the development of a pathway to 2035: the demonstration path. The demonstration path reflects a package of actions that would set the country up to deliver the 2050 target in line with the Act's considerations and create options to manage uncertainty. This path was used to set our recommended emissions budget levels for 2022-2025, 2026-2030, and 2031-2035, as illustrated in **Figure 2.1** below.

Overall, we sought to create a path that was equitable, ambitious, and achievable. Our economic modelling indicated that the economy would continue to grow under the recommended emissions budgets.

We assessed that the level of GDP could be around 0.5% lower in 2035 and 1.2% lower in 2050 than it would be otherwise, a conclusion consistent with findings overseas. Low emissions technologies and practices invested in now will open up new opportunities and reduce the risk of damaging the country's reputation due to a lack of credible climate action. However, delaying key actions like transitioning to electric vehicles and embedding more efficient farm practices could result in the level of GDP in 2050 falling by around 2.3%.

We updated the demonstration path in 2022 to reflect changes in underlying data sources and bring this into alignment with the Government's final emissions budgets (see **Box 2.1**).

Figure 2.1: The emissions budgets, the 2050 target, and the Commission's demonstration path with illustrative extension to 2050



Source: Commission analysis
Notes:
1. 2022 update to demonstration path (see Box 2.1).
2. Net CO_2e emissions expressed using GWP100 values from the IPCC's Fifth Assessment Report (AR5) and the 'target accounting' approach for forestry emissions and removals as described in the glossary.
3. Emissions budgets are expressed as a net total but are based on meeting the separate components of the 2050 target.

Box 2.1: Updates to the demonstration path in 2022

In 2022, the Commission made a set of updates to the demonstration path for use in our *Advice on NZ ETS unit limits and price control settings for 2023-2027*. We updated our Energy and Emissions in New Zealand (ENZ) model and our scenarios to incorporate new source data and information released since *Ināia tonu nei* was published. This included:

- the latest national Greenhouse Gas Inventory, which implemented several methodological changes
- updated forestry projections from the Ministry for Primary Industries, which the Government had incorporated in its decision on final emissions budgets
- decisions or announcements affecting future industrial activity, including the conversion of the Marsden Point oil refinery to an import terminal and the New Zealand Aluminium Smelter owners' revised intention to continue operation beyond 2024.

We published an updated data set and technical note with our 2022 NZ ETS settings advice and have republished these alongside this draft advice. This updated version of the demonstration path is used throughout this report.

Meeting the budgets requires concerted and timely action across all sectors

Our work in *Ināia tonu nei* identified a range of opportunities available now to reduce emissions across all sectors of the economy. The demonstration path we put forward to deliver the first three emissions budgets involves acting on these opportunities across the board.

Pursuing a range of opportunities will give Aotearoa New Zealand the best chance to deliver on its emissions budgets and the 2050 target. In some areas, policies and actions may achieve more than is anticipated, while in other areas progress may be harder than expected. A comprehensive approach will also enable learning and innovation based on new data and information, and course correction when necessary.

At the same time, resources and capacity for change are always subject to limitations and trade-offs. Identifying the opportunities offering the greatest emissions reduction potential and focusing efforts on these will therefore be greatly important.

Emissions budgets are the upper limit for allowable emissions rather than a goal. If achieving emissions reductions beyond the emissions budget requirements becomes possible, doing so would offer several advantages, including closing the gap to meeting Aotearoa New Zealand's Nationally Determined Contribution (NDC) under the Paris Agreement (see *Chapter 1: Introduction*).

Sector sub-targets were set based on the Commission's demonstration path

In the first emissions reduction plan, the Government set sector sub-targets as a tool to track progress across areas of the economy. These were based on the Commission's demonstration path from *Ināia tonu nei* and were expressed as the total emissions for each sector in each budget period.

Table 2.2 shows the sector sub-targets, also expressed as the annual average emissions for each budget period. The levels go up from the first to the second emissions budget because the first emissions budget period is a year shorter (4 years rather than 5 years).

Emissions levels from 2019 are shown for comparison. These are taken from the 2021 national Greenhouse Gas Inventory (GHG inventory), on whose data the sector sub-targets are based. As there have been refinements to the GHG inventory methodology since these sector sub-targets were set, the Government will need to update these to keep them aligned with Aotearoa New Zealand's current emissions reporting.[i]

Table 2.2: Sector sub-targets in the first emissions reduction plan

	2019 emissions ($MtCO_2e$)	Sector sub-targets ($MtCO_2e$)			Annual average emissions ($MtCO_2e$/year)		
		EB1 (2022 25)	EB2 (2026-30)	EB3 (2031-35)	EB1 (2022-25)	EB2 (2026-30)	EB3 (2031-35)
Transport	16.2	65.9	76.0	56.8	16.5	15.2	11.4
Energy and industry	21.4	70.1	72.8	63.3	17.5	14.6	12.7
Waste	3.7	13.7	14.9	12.7	3.4	3.0	2.5
F-gases	1.7	6.8	7.5	5.9	1.7	1.5	1.2
Agriculture	42.4	159.4	191.0	183.0	39.9	38.2	36.6
Forestry	-7.6	-26.4	-57.2	-81.6	-6.6	-11.4	-16.3
Emissions budgets		290	305	240	72.5	61.0	48.0

Source: Commission analysis of *Aotearoa New Zealand's first emissions reduction plan*[7]
Notes:

[i] Government agencies routinely update the methodology and historical data in New Zealand's GHG inventory to improve the accuracy of the emissions estimates. The 2022 GHG inventory saw updates in several areas, including the reassigning of a significant quantity of liquid fuel use from transport to stationary energy (see *Aotearoa New Zealand's first emissions reduction plan*, p. 222). The 2023 GHG inventory will see further updates.

1. 2019 emissions are based on the 2021 GHG inventory for methodological consistency with the sector sub-targets.
2. The total of the sector sub-targets may not match the emissions budgets due to rounding.

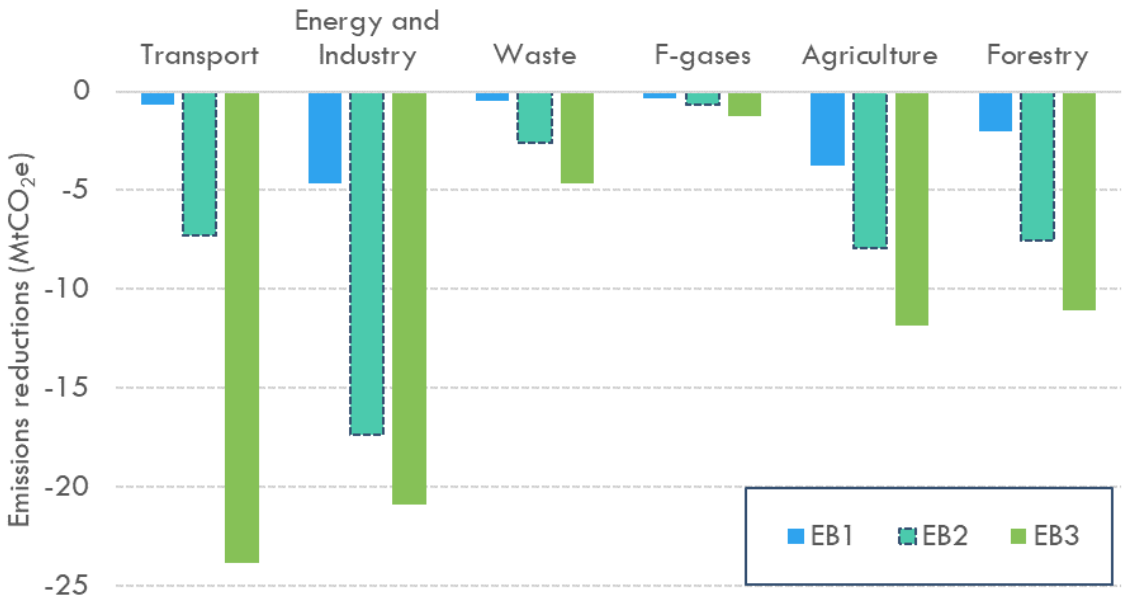
Quantifying the emissions reductions needed to meet the sector sub-targets

Both the Commission and government agencies use baseline scenarios to underpin analysis of emissions reduction scenarios and policies. These baselines represent the expected changes in each sector under a continuation of existing policies and trends, sometimes referred to as 'business as usual'.[ii]

Figure 2.2 illustrates the emissions reductions expected across sectors, spanning the first three emissions budgets. These figures represent the gap between the government's projected baseline emissions prior to the introduction of policies from the first emissions reduction plan, and the sector sub-targets. In other words, this shows where further emissions reductions are expected to come from, beyond business as usual, to meet the first three emissions budgets.

The figures we present here include adjustments for the Tiwai Point aluminium smelter remaining open. This increases projected energy and industry emissions.[iii]

Figure 2.2: Additional emissions reductions needed relative to the baseline to meet sector sub-targets in the first emissions reduction plan



Source: Ministry for the Environment[8]
Note:
1. Baseline emissions projections adjusted for oil refinery transition and aluminium smelter remaining open.

[ii] For more information see *Ināia tonu nei* Supporting Evidence Chapter 11.

[iii] Figures presented in the first emissions reduction plan report assumed the Tiwai Point aluminium smelter would close in 2024. The smelter causes direct process emissions of around 0.6 $MtCO_2e$ per year and has a significant wider effect on emissions from electricity generation. The government estimated the smelter staying open would result in an additional 2.4 $MtCO_2e$, 9.3 $MtCO_2e$, and 3 $MtCO_2e$ in the first, second, and third emissions budgets respectively (*Aotearoa New Zealand's first emissions reduction plan*, p. 222).

For the second emissions budget:

- The total quantity of emissions reductions needed is estimated at 43.5 $MtCO_2e$.
- The largest share is expected to come from energy and industry, totalling 17.4 $MtCO_2e$, or around 40%.
- The transport, agriculture and forestry sectors are each expected to deliver reductions of 7-8 $MtCO_2e$.
- The remaining 3.3 $MtCO_2e$ is expected to come from waste and F-gases.

The strong contribution expected from energy and industry in the second emissions budget period reflects the need for rapid emissions cuts from electricity and heat production. This can be done by building new renewable generation and switching coal and fossil gas heating in industry and buildings to electricity and biomass.

The main opportunities across other sectors include increased electric vehicle uptake, shifting to low carbon transport, ongoing improvements in farming practices, scaling up native afforestation, and reducing organic waste disposal to landfills.

The next emissions reduction plan must also deliver the 2030 biogenic methane target

While emissions budgets are expressed as a net quantity of CO_2e including all greenhouse gases, the Government must also consider the separate components of the 2050 target. This includes the requirement for biogenic methane emissions to be reduced by at least 10% from 2017 levels by 2030. The second emissions reduction plan needs to ensure Aotearoa New Zealand has the strategies, policies, and actions in place to deliver on this.

The sector sub-targets set by the Government are in line with fulfilling the 2030 biogenic methane target. The Commission's demonstration path (on which these sub-targets were based), sees biogenic methane emissions reduced by more than 12% from 2017 levels by 2030. This anticipates combined reductions of around 11% in agriculture and 29% in waste. The Commission assessed that these reductions beyond the minimum 10% level required were feasible and should be pursued.

Action is needed now to get on track for the second and third emissions budgets and the 2050 target

As **Figure 2.2** above shows, across all sectors emissions reductions need to build over time. The reductions achievable in the first emissions budget period are relatively small, as it takes time to implement and scale up actions and, in many cases, further time for these to have meaningful impact on reducing emissions.[iv] For instance:

- the pace at which low carbon technologies can replace high emissions technologies is often limited by the rate assets are retired and other aspects such as workforce availability and capability
- low carbon infrastructure takes time to consent and build before it can be used
- a newly planted forest absorbs little carbon dioxide initially, with the growth and absorption rate increasing over time (to an eventual limit).

These time lags and practical limits on the pace of change highlight the importance of prompt and decisive action to get on track for future emissions budgets and the 2050 target, as emission reductions accumulate over time. We demonstrate this with an illustrative example in **Box 2.2**.

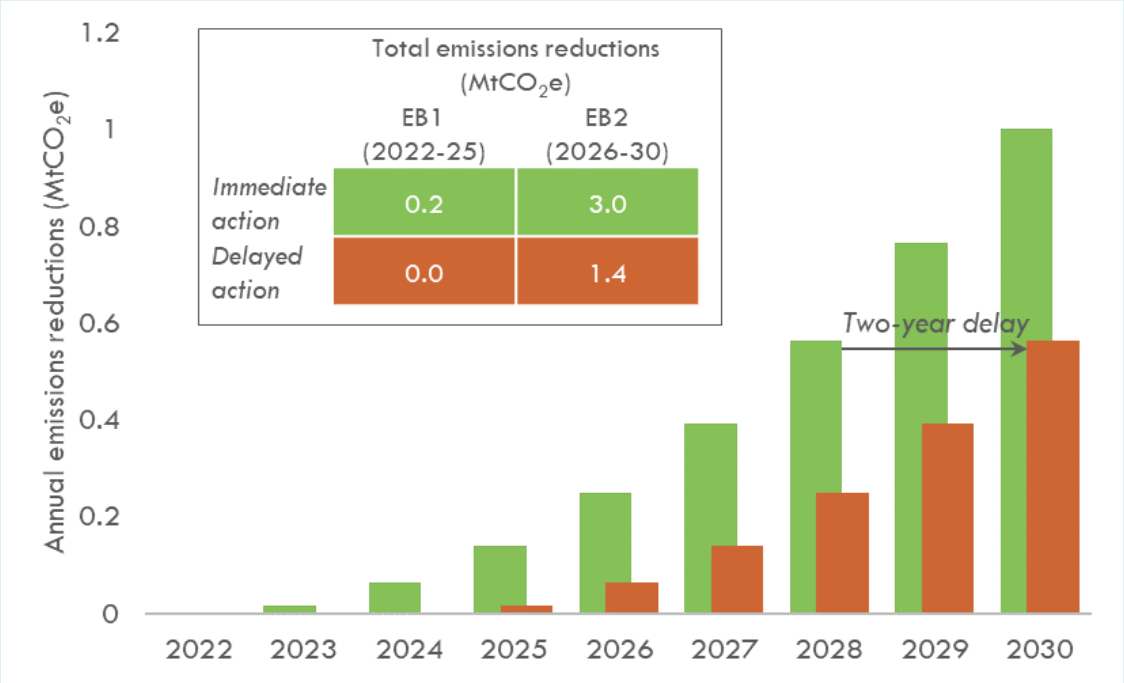
[iv] Total emissions reductions over the first emissions budget also appear smaller because the first budget period is a year shorter.

Box 2.2: Delayed action increases cumulative emissions

Figure 2.3 below presents an illustrative example of how a small delay to action can lead to much higher cumulative emissions. In green, we show a hypothetical action scaling up from 2022 to deliver one $MtCO_2e$ in annual emissions reductions by 2030. In dark orange, we show the same action delayed by two years.

The inset table shows the two-year delay would more than halve the total emissions reductions delivered out to 2030. It also shows how what might appear to be a small shortfall in the first emissions budget could become a much larger shortfall in the second budget, as the impacts of the delay accumulate.

Figure 2.3: Illustrative example of how delayed action leads to higher cumulative emissions. The chart shows annual emissions reductions, and the table shows the sum over each emissions budget period.



Source: Commission analysis

The dynamics of electric vehicle (EV) uptake and the gradual turnover of the vehicle fleet provide a specific example. The large jump in emissions reductions expected from transport in the third emissions budget (see **Figure 2.2** above) relies on a rapid scaling up of EV sales in the 2020s to steadily replace internal combustion engine (ICE) vehicles on the roads. Without that early scaling up, a higher-emissions vehicle fleet will be locked in and achieving the expected emissions reductions from transport will become more costly and disruptive.

These examples hold important lessons for how the second emissions reduction plan will impact momentum for the third emissions budget period. The ability to meet the third emissions budget will be strongly determined by actions taken before 2030. Likewise, meeting the second emissions budget depends on key actions being taken in the next two years under the first emissions reduction plan.

Benchmarking the action needed to deliver the second and third emissions budgets

Table 2.3 shows a collection of key changes occurring within sectors by 2030 in the demonstration path. This provides a tangible picture of the collective actions needed throughout the economy to meet the second emissions budget and to set up for the third.

This table is not intended as a prescriptive list but as a set of benchmarks to inform policy goals across the different areas, and against which to gauge actions taken. Actual outcomes could differ, and different combinations of actions and effort across sectors could also deliver the emissions budgets.

Table 2.3: 2030 benchmarks for action to meet the second emissions budget, based on the Commission's demonstration path

Sector	**2030 benchmarks for action** (Changes expressed from 2020 unless stated otherwise)
Passenger transport	67% of light vehicles entering the fleet and 14% of the total light vehicle fleet are EVs
	11% fuel efficiency improvement in non-EV light vehicles (from 2019)
	1.5%/7.7% of household passenger-kilometres travelled by cycling/public transport
	6.9% reduction in total light vehicle travel below baseline projection
Freight	36% of trucks entering the fleet and 3.6% of the total truck fleet are zero emissions
	16% efficiency improvement in road freight per tonne-kilometre (from 2019)
	3.5% of freight tonne-kilometres shifted from road to rail and coastal shipping
	6%/13% efficiency improvements in rail/coastal shipping (from 2019)
Aviation	16% efficiency improvement (from 2019)
Low carbon liquid fuels	4.8 PJ (135 million litres) used in transport, off-road vehicles, and other uses
Electricity supply	10.5 TWh of new renewable generation built
	Elimination of coal and baseload fossil gas generation
	96% of generation is from renewable sources (excluding co-generation)
Industry	14 PJ/year of coal use and 6.1 PJ/year of fossil gas use in process heat reduced through fuel switching to biomass and electricity, and efficiency improvements
	12% energy efficiency improvement in food processing
	12% of new off-road vehicle purchases are electric
Buildings	3.0 PJ/year reduction in fossil gas use through fuel switching and efficiency improvements
	25% reduction in energy demand for heating per commercial building and 8% reduction per residential dwelling through energy efficiency improvements
	7% reduction in other electricity use per building through energy efficiency improvements
Agriculture	11% reduction in emissions intensity for dairy and 7% for sheep and beef farming through improved farm management practices
	10% adoption of low-methane sheep through breeding

Sector	2030 benchmarks for action (Changes expressed from 2020 unless stated otherwise)
	100% of urea fertiliser coated with urease inhibitor
Horticulture	14,000 hectares increase
Forestry	150,000 hectares of new native forest established
	360,000 hectares of new exotic forest established
	Zero deforestation of pre-1990 forests and projected deforestation of post-1989 forests halved from 2026
Waste	22% reduction in overall organic waste sent to landfills
	25% of emissions from landfills currently without capture systems avoided through installation of new capture systems or diversion to other landfills
F-gases	21% reduction in emissions of hydrofluorocarbons (HFCs)

Source: Commission analysis
Notes:
1. Based on the 2022 update to the demonstration path (see Box 2.1).
2. Transport changes are expressed relative to 2019 due to the short-term effects of the COVID-19 pandemic in 2020.
3. Changes in industry fossil gas use exclude projected reductions in methanol production and oil refining.
4. Organic waste refers to all waste containing organic matter that decays to create methane emissions.

As discussed in *Chapter 1: Introduction*, the policy advice in this report builds upon our previous advice and takes into account the Government's response through its first emissions reduction plan. The policies set out in that plan will contribute towards delivering the actions listed in **Table 2.3** above.

For this advice, we did not undertake a detailed mapping or quantitative assessment of policies against these benchmark actions. Rather, our analysis has been guided by the prioritisation framework and approach described in *Chapter 1*.

The Government's first emissions reduction plan

While policies in the first emissions reduction plan contribute to meeting future budgets, more action is required

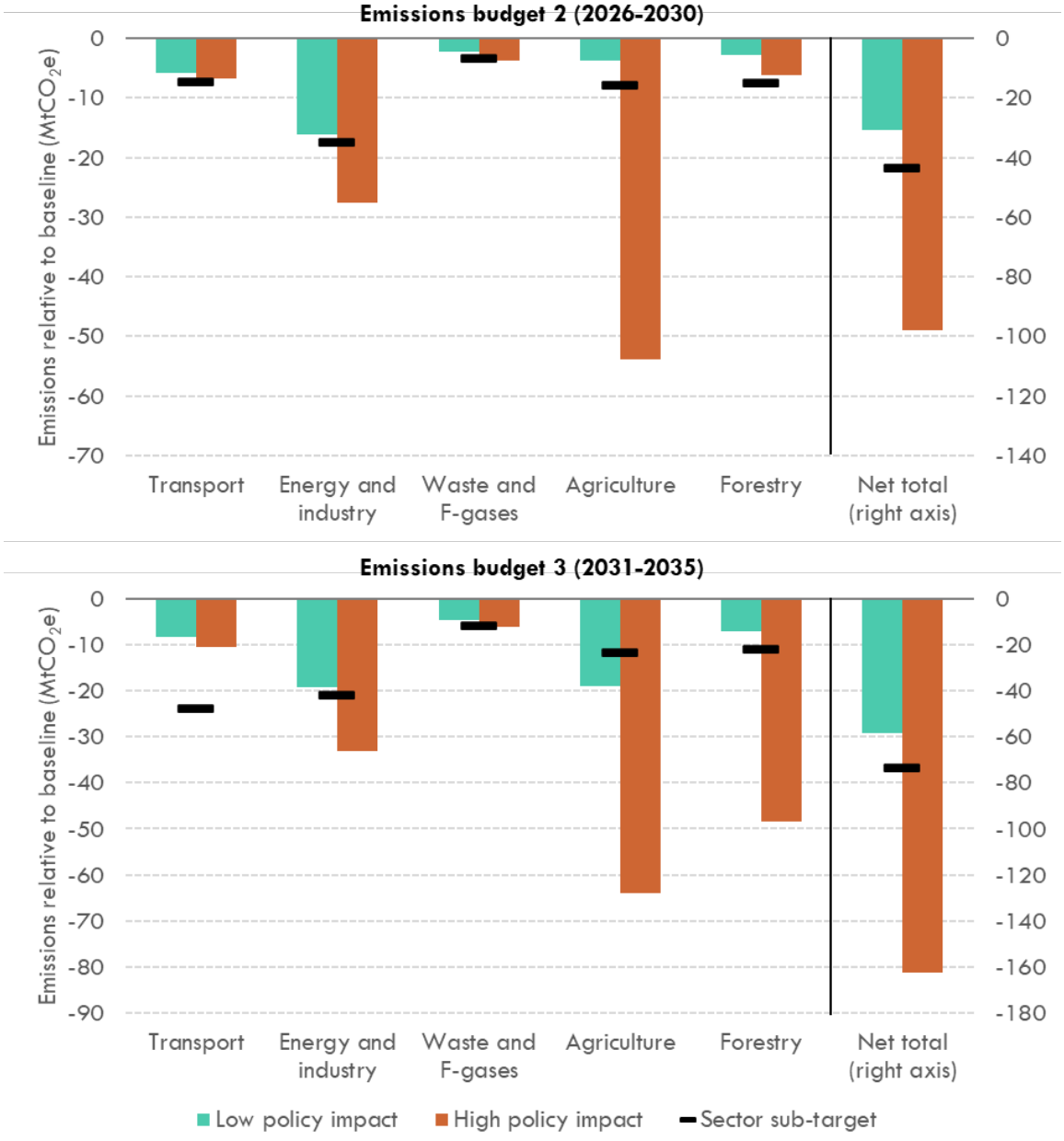
The Government's first emissions reduction plan put forward a set of policy commitments across all sectors. The plan included an assessment of how much the policies were expected to reduce emissions in each sector, noting that not all policies in the plan were quantified.

The assessment extended out to 2035 to look at the impact on emissions reduction across all three set budget periods, though the primary focus of the first plan was to meet the first emissions budget. Alongside the plan, the Government published supplementary information and data providing further detail on its quantified policy impact assessment.[9]

In this section, we present and discuss some results from the government's policy impact assessment for the second and third emissions budget periods. This is not an assessment of the adequacy of the first emissions reduction plan for meeting the first emissions budget. In alignment with the Act, the Commission will provide this assessment in its first annual monitoring report on progress towards meeting emissions budgets, due in 2024.

Figure 2.4 shows the total estimated emissions reductions in each sector over the second and third emissions budget periods, compared with the level of reductions needed to meet the sector sub-targets (as in **Figure 2.2** above). The government produced 'low impact' and 'high impact' estimates for most policies, which are used to provide the ranges shown in the figure.

Figure 2.4: Government estimates of the impact of policies in the first emissions reduction plan towards meeting the second (top panel) and third (bottom panel) emissions budgets



Source: Commission analysis of data published with *Aotearoa New Zealand's first emissions reduction plan*[10]

Notes:

1. The ERP data presents multiple ranges for forestry. The range shown is based on Table 14.1 in the ERP.
2. The required emissions reduction for energy and industry assumes the aluminium smelter continues to operate.
3. We have combined the Waste and F-gases sector sub-targets in this figure.

Overall, compared with the estimated 43.5 $MtCO_2e$ net emissions reductions needed to meet the second emissions budget, the government assessment suggests outcomes ranging between a shortfall of 13 $MtCO_2e$ under the 'low policy impact' estimates, and an overachievement of around 55 $MtCO_2e$ under the 'high policy impact' estimates. For the third emissions budget, the possible range expands to between a shortfall of 15 $MtCO_2e$ and an overachievement of 89 $MtCO_2e$.

The potential overachievement under the 'high impact' case comes mainly from agriculture, with further contributions from energy and industry and, in the third emissions budget, from forestry.

In this next section, we provide comment on the assumptions underlying the government estimates and on risks and other relevant issues within each sector. We first summarise our overall findings.

Overall findings

Our overall findings regarding the government's first emissions reduction plan policy impact assessment and its implications for the second and third emissions budgets are:

- The policies in the first emissions reduction plan, if fully implemented, would contribute to meeting the second and third emissions budgets. However, further and stronger policies will likely be needed. This result is not surprising, given the plan's focus on meeting the first emissions budget.
- While the government's policy impact assessment suggested the policies in the first emissions reduction plan could achieve the second and third emissions budgets, there are risks around some of the underlying assumptions and questions regarding the plausibility of its 'high impact' estimates.

These findings are based on our analysis presented below and are subject to the information available. We note the level of data and information provided to the public could be improved in future emissions reduction plans.

Agriculture

Compared with the sector sub-target, the government estimates for the second emissions budget range between a shortfall of 4 $MtCO_2e$ (low impact) and overachievement of 46 $MtCO_2e$ (high impact).

These emissions reductions are solely attributed to 'additional funding for mitigation research', which is expected to accelerate the roll-out of technologies which can reduce agricultural emissions. The specific technology assumptions used were not provided in the reports, making it difficult to understand the numbers and assess their credibility. However, it is clear from the magnitude of the 'high impact' estimate this would rely on new technologies such as a methane inhibitor being rolled out early in the second emissions budget period.

The assessment therefore suggests a likely shortfall for the second emissions budget in the absence of new technologies.

However, the government's impact assessment did not include the impact of pricing agricultural emissions, beyond a very low price assumed in the baseline.[v] The pricing scheme developed through the He Waka Eke Noa partnership is designed with the goal of meeting the 2030 biogenic methane target. Implementing this from 2025 will be key to closing the gap to meeting agriculture's sector sub-target.

New technologies could significantly boost the ability to cut emissions in agriculture. On this, we note that the Commission's recommended emissions budgets in Ināia tonu nei were based on what could be achieved

[v] The baseline assumed an emissions price of $35 per tonne CO_2e charged at the processor level at a 95% discount.

with technologies that were commercially available at the time. We also signalled that the successful deployment of new technologies could be grounds for tightening the emissions budgets in the future.[11]

Energy and industry

Compared with the sector sub-target, the government estimates for the second emissions budget range between a shortfall of 1.2 $MtCO_2e$ (low impact) and overachievement of 10 $MtCO_2e$ (high impact).

Most of these emissions reductions (around 90% in the high impact case) are expected to result from increased New Zealand Emissions Trading Scheme (NZ ETS) emissions price and the Government Investment in Decarbonising Industry (GIDI) Fund. However, the Commission's assessment is that there is risk that the government has overestimated how quickly emissions reductions from process heat can be achieved and the 'high impact' outcomes are very unlikely to be plausible (see *Chapter 9: Energy and Industry*).

Both the low impact and high impact estimates also assume the emissions price in the NZ ETS rises in line with the Commission's demonstration path. This is at significant risk under the current NZ ETS design, which is likely to drive high levels of afforestation putting downward pressure on the emissions price (see *Chapter 4: Emissions Pricing*). Further, the Commission's modelling of the effect of this emissions price path on energy and industry emissions is closer to the government's 'low impact' estimate.

The main figures presented in the Government's first emissions reduction plan assumed the closure of the New Zealand Aluminium Smelter in 2024 in the baseline scenario. As mentioned earlier, the figures we have presented adjust for the smelter remaining open, which the Ministry of Business, Innovation and Employment has estimated would increase baseline emissions in the second emissions budget by 9.3 $MtCO_2e$.

While there is uncertainty about the smelter's future, it is critical for the Government to plan for the case that it continues operating to ensure emissions reduction policies are adequate.

If the smelter were to close, this would lead to significantly lower baseline emissions compared with what the Commission based its emissions budget recommendations on.[vi] This change may be grounds for the Commission to recommend tightening the current emissions budgets when it reviews these as part of its fourth emissions budget advice in 2024.

Forestry

Compared with the sector sub-target, the government estimates presented in **Figure 2.4** show a shortfall of between 4.7 and 1.3 $MtCO_2e$ in the second emissions budget. Looking out to the third emission budget, outcomes range from a shortfall of 4.0 $MtCO_2e$ to an overachievement of 37 $MtCO_2e$.

For context, the Commission's demonstration path had exotic afforestation staying at the projected baseline level out to 2030 and gradually decreasing from then on, assuming changes to current NZ ETS design and incentives. All additional net emissions reductions came from establishing new native forests and reducing deforestation.

[vi] In *Ināia tonu nei*, our baseline scenario assumed the closure of the smelter in 2024 based on company statements at the time. We also assumed the Marsden Point oil refinery would continue to operate. However, the refinery converted to an import terminal in 2022, while the smelter owners are currently negotiating a new electricity purchase agreement to continue operation beyond 2024. The effect of these two changes would roughly cancel out in the second emissions budget period, leaving baseline emissions close to what the Commission had originally projected.

The government estimates include a rising NZ ETS 'price corridor' along with three additional policies aimed at increasing natural carbon sequestration, native afforestation, and supply of woody biomass.[vii]

The range shown assumes a central NZ ETS price path, with lower removals assuming exotic forests are restricted from registering as permanent forests in the NZ ETS and higher removals assuming they are not restricted from doing so.[viii] The government analysis suggests the restriction would significantly reduce the rate of exotic afforestation to below the baseline level despite a rising NZ ETS price, but this is questionable given strong economic incentives would remain.

New exotic forest planting is currently proceeding well above earlier expectations: over 60,000 hectares was estimated to be planted in 2022,[12] compared with the government's baseline projection of around 32,000 hectares per year between 2022 and 2030 when the emissions budgets were set. If similar rates were sustained, carbon removals from forestry would significantly exceed its sector sub-targets.

As already mentioned, under current NZ ETS design higher levels of afforestation are expected to put downward pressure on the emissions price and displace gross emissions reductions (see **Figure 4.1** in *Chapter 4: Emissions pricing*). These interactions were not considered in the government's emissions reduction plan modelling.

Transport

Compared with the sector sub-target, the government estimates for the second emissions budget give a shortfall ranging between 1.4 $MtCO_2e$ (low impact) and 0.5 $MtCO_2e$ (high impact). Looking out to the third emissions budget, the estimated shortfall would increase to 13-16 $MtCO_2e$.

The estimates are provided for a package of policies including the Clean Car Discount and Standard, the Sustainable Biofuels Obligation, and more. The Sustainable Biofuels Obligation was expected to deliver up to half of the total emissions reductions. The government's decision to halt this increases its assessed shortfall by around 3.0 $MtCO_2e$ in the second emissions budget and 4.4 $MtCO_2e$ in the third emissions budget.[13]

This would suggest the transport sector is most off track to achieving its sub-targets. However, uptake of low-emissions vehicles has grown rapidly since the introduction of the Clean Car Discount in 2021, exceeding Te Manatū Waka Ministry of Transport's modelled impact of the Clean Car policy package.[14]

The share of light vehicle registrations that were electric in 2022 grew to over 10% – a level not achieved until 2028 in the Ministry's modelling.[ix] This also exceeds the Commission's demonstration path, which projected a 6% share in 2022, reaching 11% in 2025. The share of hybrids also grew well beyond what was expected. This highlights the opportunity for electric and hybrid vehicles to deliver significantly higher and faster emissions reductions than previously thought.

[vii] The impact of these additional policies is estimated at 4.2 $MtCO_2e$ in the second emissions budget and 10.5 $MtCO_2e$ in the third emissions budget.

[viii] This range is presented in Table 14.1 in the main ERP report. The ERP technical annex also provides ranges for each case assuming lower or higher NZ ETS price paths based on the NZ ETS 'price corridor' (the auction reserve price and cost containment reserve threshold) in regulations. These suggest an even larger range of possible outcomes for forestry.

[ix] Based on the 'default' scenario which was used in the emissions reduction plan's policy impact assessment.

The Government also committed to four transport targets in the first emissions reduction plan:

1. Reduce total kilometres travelled by the light fleet by 20% by 2035 (relative to baseline)
2. Increase zero-emissions vehicles to 30% of the light fleet by 2035
3. Reduce emissions from freight transport by 35% by 2035
4. Reduce the emissions intensity of transport fuel by 10% by 2035.

Its assessment suggests delivering on these would overachieve on the transport sector sub-targets for the second emissions budget and the third emissions budget. While not yet backed by firm policies, it is helpful for the Government to set out clear, quantified outcomes it intends to achieve through its policies to enhance understanding and predictability (see the Commission's policy framework in *Chapter 1: Introduction*).

Waste and F-gases

Compared with the sector sub-targets for the second emissions budget, the government estimates for the waste sector range between a shortfall of 0.7 $MtCO_2e$ and overachievement of 0.1 $MtCO_2e$. For F-gases the range is a shortfall of 0.3 $MtCO_2e$ and overachievement of 0.3 $MtCO_2e$.

The waste sector is important to delivering the 2030 biogenic methane target. While only accounting for 9.5% of biogenic methane emissions in 2017, its relatively higher potential to reduce emissions as assessed by the Commission sees it contributing nearly a quarter of the reductions in biogenic methane from 2017 to 2030 in the demonstration path. The policies and actions in the emissions reduction plan broadly align with the demonstration path.

Recent government emissions projections

The government's latest emissions projections also show progress, but a gap remains

The government published new emissions projections in December 2022 as part of Aotearoa New Zealand's reporting obligations under the United Nations Framework Convention on Climate Change.[15] These new projections give further evidence of the potential size of the gap to be filled to meet the second and third emissions budgets.

In line with UN reporting guidelines, the government's 'With existing measures' scenario includes currently implemented and adopted policies and measures. The 'With additional measures' scenario includes some further planned policies and measures from the first emissions reduction plan.

Table 2.4 shows the further emissions reductions that would be required to meet the second and third emissions budgets under these latest projections.[x] We also show the assessment from the baseline projection used in the first emissions reduction plan, presented in earlier figures in this chapter.

[x] We have made an adjustment for the continued operation of the aluminium smelter. As stated earlier, while uncertainty remains, planning on this basis is necessary to ensure efforts are adequate.

Table 2.4: Further emissions reductions required to meet the second emissions budget under the government's emissions projections (adjusted for continued operation of the aluminium smelter)

	Further emissions reductions needed to meet budgets ($MtCO_2e$)	
Relative to:	**EB2 (2026-2030)**	**EB3 (2031-2035)**
First emissions reduction plan baseline (March 2022)	43.5	73.6
Fifth Biennial Report 'With existing measures' scenario (December 2022)	20.7	34.6
[Uncertainty range]	[4.4 to 38.9]	[5.2 to 66.5]
Fifth Biennial Report 'With additional measures' scenario (December 2022)	14.0	22.9

Source: Commission analysis of government emissions projections[16]

The latest projections suggest a gap to meeting the second emissions budget of around 21 $MtCO_2e$ under currently implemented policies. With the further policies included in the 'With additional measures' scenario, the gap reduces to 14 $MtCO_2e$.

These show a significant reduction in emissions compared with the previous baseline, which is largely due to assuming a higher New Zealand Emissions Trading Scheme (NZ ETS) emissions price path. However, a gap remains to meeting the second and third emissions budgets, reinforcing our earlier findings. The projections suggest a larger gap than the first emissions reduction plan policy impact assessment.

We provide further information and analysis of the emissions projections in **Appendix 2**.

Chapter 3: A Path to Net Zero

Introduction

Aotearoa New Zealand's target to reach net zero emissions of long-lived greenhouse gases by 2050 (the 2050 net zero target), put into law by the passing of the Zero Carbon Bill, does not include a limit on the use of carbon dioxide removals – actions that take greenhouse gases out of the atmosphere and store it. This means that the Government has choices about the combination of gross emissions reductions – reducing at the source the volume of emissions being produced – and carbon dioxide removals it will use to reach and sustain net zero long-lived gas emissions.

It will be important for the Government to clarify and communicate its decisions, as this will impact how the 2050 net zero target is met and the risks and impacts that will need to be managed as a result.

To achieve this component of the overall 2050 target, Aotearoa New Zealand will need to reach net zero emissions of long-lived gases by the year 2050 and maintain net zero in each subsequent year.[xi] Any emissions of long-lived gases after 2050 must therefore be balanced by an equal or greater quantity of removals from the atmosphere.

Currently, the only source of removals in Aotearoa New Zealand is establishing new forests, which absorb carbon as they grow. In the future, other methods of removing and storing carbon from the atmosphere may be possible.

Defining the 2050 net zero long-lived gas emissions target on a net basis provides a high degree of flexibility about how the target can be achieved. Net zero could be achieved by focusing on gross emissions reductions, thereby requiring fewer removals to achieve net zero. Alternatively, net zero could be achieved by focusing on increased removals, with limited reduction in gross emissions.

This chapter provides advice and proposed recommendations on what factors should drive the balance struck by the Government between gross emissions reductions and carbon dioxide removals to meet the second emissions budget and enable Aotearoa New Zealand to achieve its longer-term climate targets.

Reducing gross emissions will bring benefits

The Climate Change Response Act 2002 (the Act) contains three considerations which are particularly relevant to assessing the role of carbon removals in achieving net zero long-lived gas emissions:

- the principal risks and uncertainties associated with emissions reductions and removals
- the likely impact of actions taken to achieve an emissions budget and the 2050 target, including on the ability to adapt to climate change
- the distribution of those impacts across the regions and communities of Aotearoa New Zealand, and from generation to generation, including specific effects on Iwi/Māori.

A lack of clarity on the approach to achieve net zero long-lived gas emissions by 2050 and beyond is likely to create ongoing policy uncertainty and impact decision-making in the public and private sectors. This could

[xi] For ease of presentation, this report refers to all greenhouse gases other than biogenic methane collectively as long-lived gases, although this includes a small amount of other short-lived gas emissions (non-biogenic methane and certain fluorinated gases). The 2050 target separately specifies that biogenic methane emissions should reduce by at least 10% by 2030 and between 24% and 47% by 2050 below 2017 levels.

undermine the purpose of the Act to "provide a framework by which Aotearoa New Zealand can develop and implement clear and stable climate change policies"[17] and increase related risks for businesses and investors. Ultimately, prolonged uncertainty is more likely to lead to a more disruptive transition with higher costs and more significant impacts.

The question of how to meet the 2050 net zero target is therefore of core importance to the second emissions reduction plan.

In *Ināia tonu nei,* the Commission outlined how gross emissions can be reduced across all sectors. A range of opportunities are available through proven clean technologies, alongside supporting changes in behaviour. We showed that gross emissions from road transport can be reduced to almost zero by 2050 through a combination of switching to zero emissions vehicles and increasing walking, cycling, and public transport use. Industrial process heat and buildings can decarbonise by switching to electricity and biomass as fuel sources. Alongside this, energy efficiency improvements can help reduce emissions across all sectors, including in industrial sectors where emissions reduction is more challenging.

We also showed in *Ināia tonu nei* that reducing gross emissions and transitioning to a low emissions economy could provide significant benefits, including:

- leading to healthier homes and buildings
- encouraging new ways of moving around
- opening up new market opportunities
- changing how land is used and managed
- improving the lives and choices of young people and future generations.

Transitioning towards lower gross emissions will also be important for the economy. As the world transitions towards low emissions, new markets and low emissions products will be created. At the same time, producers of high emissions products may face challenges as consumers become increasingly aware of the impact of their decisions. If slow to decarbonise, Aotearoa New Zealand risks being left behind in favour of competitors who are able to show that their products are lower emissions.

Storing carbon on land creates risks

While neither the 2050 target nor conventional net emissions accounting distinguish between gross emissions reductions and carbon removals, they are not directly equivalent. Here we discuss the risks and limits specifically associated with storing carbon on land.

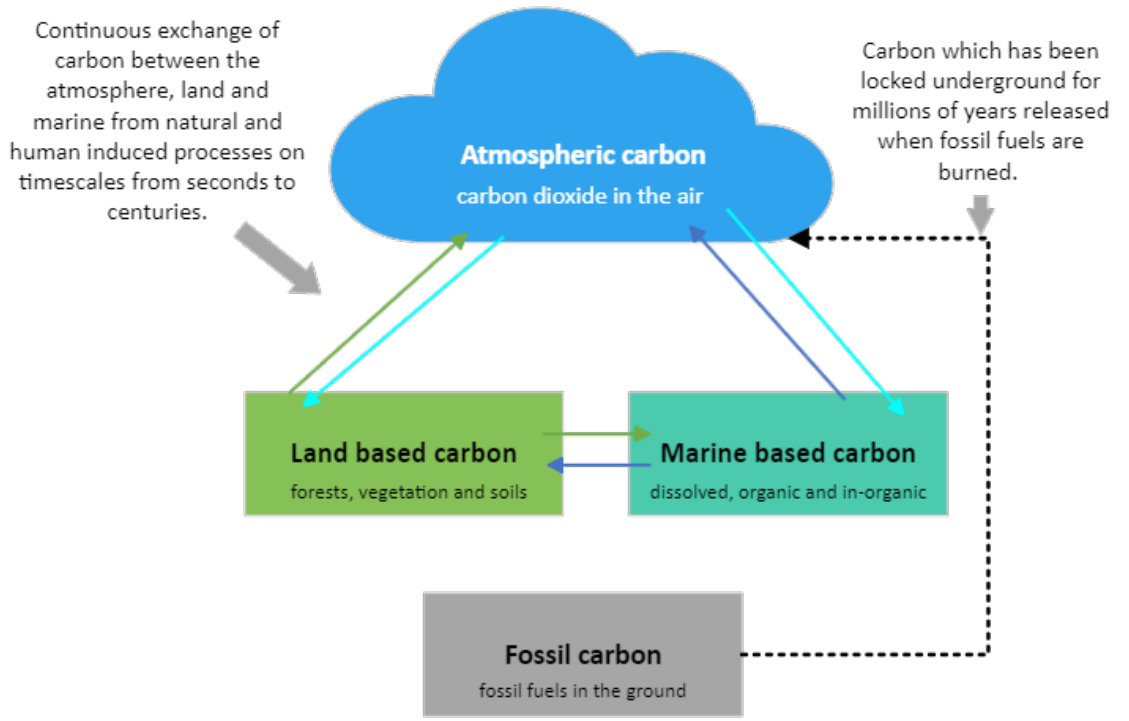
The main issue with substituting carbon removals for gross emissions reductions is inconsistent timeframes. The carbon stored in fossil fuels has been locked away deep underground for millions of years. When fossil fuels are burnt, this carbon is released to the atmosphere and adds to the "active" carbon cycle – the continual exchange between the atmosphere, land, and ocean. Fully reversing this process takes hundreds of thousands of years. The addition of fossil carbon into the atmosphere is therefore effectively permanent on human timescales.

Releasing fossil carbon is fundamentally different from the release or storage of carbon on land from human activities. This does not add carbon to the active carbon cycle and can generally be reversed over timeframes of years to centuries. **Figure 3.1** below illustrates the difference.

The recent experience of Cyclone Gabrielle shows how adverse weather events can damage and destroy forests. Climate change will exacerbate forest fires, strong winds, storms, droughts, pests, and pathogens.

Carbon removal from forests could also be reversed if those forests are harvested and not replanted. Because of both natural and human-based risks, land-based carbon removals may not be permanent.[xii]

Figure 3.4: Illustration of the difference between fossil carbon and land carbon



Source: derived from Climate Council of Australia (2016)[18]

Forests have an important role in getting to net zero

The Commission expects some residual gross long-lived gas emissions to remain in 2050 from sectors where there are currently no feasible means to avoid them, such as nitrous oxide emissions from food production. Therefore, in any path to net zero long-lived gas emissions, carbon removal will have an important role to play.

The Commission's demonstration path to meeting the 2050 net zero target included establishing new native forests to build a long-term carbon sink to offset residual emissions from hard-to-abate sectors. We also recognised that new exotic forestry planting would be needed to help achieve net zero.

Plantation forestry will also have an important role in developing the bioeconomy (see *Chapter 15: Circular Economy and Bioeconomy*). Forests are expected to be an important source of biomass feedstock for both direct combustion and conversion into biofuels. Burning biofuels returns carbon stored in trees to the atmosphere rather than adding new carbon from deep under the ground. This can support decarbonisation of industrial process heat and replace liquid fossil fuels.

[xii] Nitrous oxide differs from fossil carbon in its longevity but still has an average atmospheric lifetime of over 100 years. While more of a case can be made for equivalence between land-based carbon removals and nitrous oxide emissions, the risks around permanence still apply.

The Act requires us to stay at net zero beyond 2050

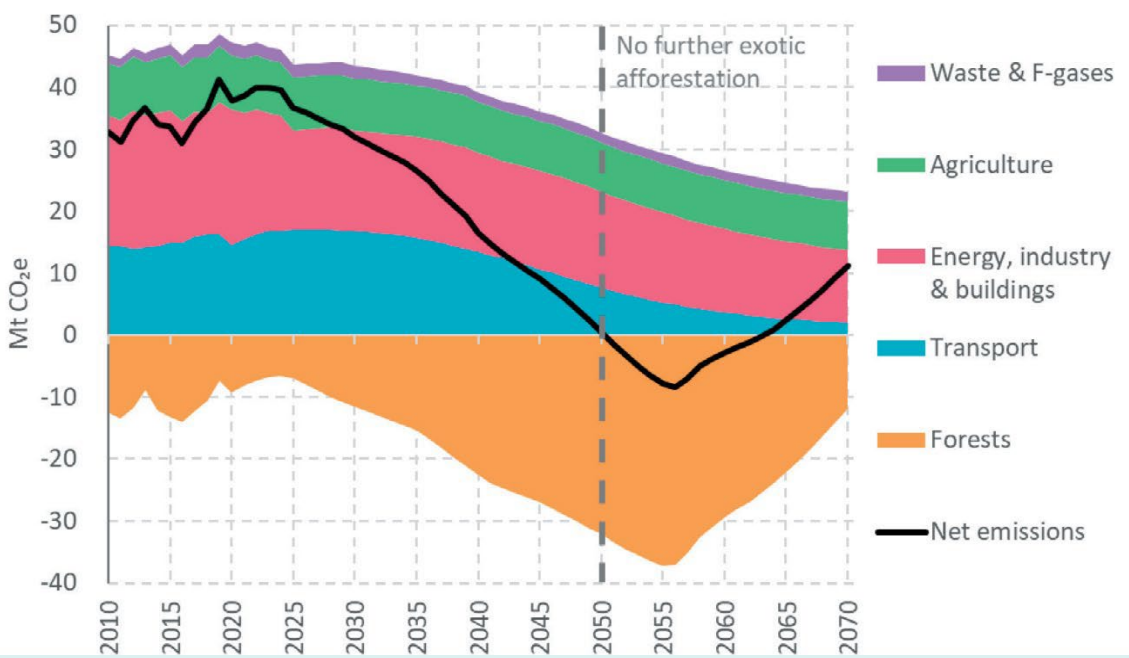
Getting to and remaining at net zero for long-lived gases requires long-term planning given the nature of the carbon removal and storage cycle associated with forestry planting. Avoiding gross emissions reductions and maintaining a lower rate of net emissions through forestry requires ongoing land conversion since trees reach a natural limit to the amount of carbon they can store sooner or later. The Commission illustrated this in *Ināia tonu nei*, showing that in a scenario where gross long-lived gas emissions were not significantly reduced before 2050, net emissions would quickly rebound without ongoing forest planting after 2050. This is set out in **Box 3.1** below.

Box 3.1: Implications of an unconstrained removals pathway

As part of our analysis in *Ināia tonu nei*, we examined a scenario where there were no constraints placed on the level of carbon removals by forests. We found that, combined with assumptions about how emissions would reduce under the Current Policy Reference case, an increase in the emissions price of from $35 to $50 a tonne would come close to meeting net zero long-lived gas emissions by 2050.

However, this path would require a greater area of forests to be planted before 2050, and further forests to be planted after 2050 to maintain net zero long-lived gas emissions. **Figure 3.2** shows that if there were no further forestry planting or policy changes after 2050, long-lived gas emissions would bounce back above net zero before 2065 as the amount of carbon stored in the forests reaches its long-term maximum.

Figure 3.2: Long-lived greenhouse gas emissions in the 'unconstrained removals' scenario, with a $50/tonne emissions value applied to forestry, energy and transport



Source: Commission analysis.

Because the amount of carbon that can be stored on land is ultimately limited, reaching net zero long-lived gas emissions by balancing ongoing fossil carbon emissions with removals to land cannot be sustained

indefinitely. Instead, a "durable net zero" is needed, where any residual emissions of fossil carbon are balanced by permanent geological removals.[19]

Clarity on the intended contribution from gross emissions reductions is required

Defining the roles of gross emissions reductions and carbon removals in meeting 2050 net zero target is particularly important for Aotearoa New Zealand. Unlike most other developed countries, the potential scale of land-based carbon removals in Aotearoa New Zealand is very large relative to the size of gross emissions. The Government therefore needs to make a choice about how far it will go in reducing gross emissions versus using removals from forests to meet the 2050 net zero target. This decision will determine the nature of the opportunities, impacts, risks, and specific effects for Iwi and Māori associated with meeting the net zero target.

As the number of countries, companies, and other entities with net zero goals grows, so too does scrutiny of plans to deliver on commitments. Many climate researchers and organisations have recommended that net zero commitments should focus foremost on directly reducing emissions and should specify intended levels of gross emissions reductions.[20] Doing so will enhance transparency and credibility, and provide more direction and certainty for policymakers and investors on the shape of the transition.

Making transparent the level of gross emissions to meet budgets two and three will lead to better policy

In *Ināia tonu nei,* the Commission set out a recommended breakdown of gases for meeting the first three emissions budgets as required by the Act. The Government's response to this recommendation was ambiguous, "agreeing in part" with the recommendation and saying it will implement policies that will result in a balance "along similar lines to those produced by the Commission in its modelling".[21]

However, without setting out the level of gross emissions it intends to allow in the second and third emissions budgets, the Government cannot align its policies to ensure that it is on-track to meeting the breakdown of gases it has accepted are required to meet the budgets.

Overall, the Government has not specified the intended level of gross emissions that it is aiming for in achieving the second and third emissions budgets. Failure to specify the intended levels of gross emissions reductions will mean that it is difficult to ensure that appropriate and comprehensive policies are put in place to achieve the necessary gross emissions reductions.

The ambiguity over the intended level of gross emissions reductions that the Government is pursuing in the second and third budgets creates risks for the transition. Without a clear signal from Government, it is difficult for businesses to know whether investments they could make are consistent with the path for gross emissions the Government intends to follow. Low emissions investments which rely on an emissions price to be economic may not proceed if businesses are unsure about the degree to which removals can be substituted for gross emissions reductions.

The ambiguity about the intended level of gross emissions is a particular problem for the operation of the New Zealand Emissions Trading Scheme (NZ ETS). To design and operate effective climate policies, and particularly to run the NZ ETS, it is essential to have a clear objective for the balance sought between gross reductions and carbon removals. This issue is discussed further in *Chapter 4: Emissions Pricing*.

Uncertainty in the desired levels of emissions and removals out to 2050 will have costs

It would also be helpful for Government to set out an indicative range for the level of gross emissions it is intending for 2050, and the role it sees gross emissions reductions playing in achieving net zero long-lived gas emissions.

Setting out intended long-term outcomes now is important for a well-managed transition. This can help provide guidance to sectors to support planning and investments which are consistent with the overall emissions outcomes envisioned by the Government. This intent is consistent with the Commission's policy framework (set out in *Chapter 1: Introduction*) which includes the need to "clearly and credibly signal outcomes that align with targets". By not setting out a long-term path for gross emissions, the Government would risk locking in continued investment that is not compatible with meeting targets.

Signalling a path is not intended to restrict the Government from changing the path in the future if necessary. It is not possible now to prescribe how emissions should reduce all the way to 2050. However, such a path can signal the overall direction of travel intended by the Government which can be adjusted and adapted as new information becomes available.

Proposed recommendations

These proposed recommendations seek to address the challenges related to balancing carbon removals and gross emissions reductions and to help enable Aotearoa New Zealand to meet the second emissions budget and its longer-term emissions reduction targets.

Proposed Recommendations 1 and 2

We propose that in the emissions reduction plan for the second budget the Government must:

1. Commit to a specific level of gross emissions for the second and third emissions budgets no less ambitious than 362 $MtCO_2e$ and 322 $MtCO_2e$ respectively, and ensure that its policy choices align with delivering this outcome.
2. Communicate indicative levels of gross emissions and carbon dioxide removals from forestry out to 2050 and beyond to guide policy development.

Chapter 4: Emissions Pricing

Introduction

Emissions pricing is a key component of an effective and efficient policy package to reduce emissions. As highlighted in *Chapter 1: Introduction*, emissions pricing is one of the three pillars of policy interventions needed to drive emissions reductions.

Putting a price on emissions changes the relative prices of goods and services across the economy. This influences the behaviour of both producers and consumers, by discouraging high emitting activities and rewarding low emissions choices. It promotes cost-effective emissions reductions by empowering businesses and individuals to make their own decisions about how to reduce emissions based on their own circumstances, rather than mandating specific actions that must be taken.

The main emissions pricing tool in Aotearoa New Zealand is the New Zealand Emissions Trading Scheme (NZ ETS). It covers around half of the country's emissions, with the major exception being biological emissions from agriculture.[xiii] A separate emissions pricing system for these emissions is under development and is discussed in *Chapter 7: Agriculture*.

This chapter focuses on the incentives created by the NZ ETS. Aotearoa New Zealand's climate policies need to encourage both decarbonisation and afforestation, as both have essential roles to play in an equitable and sustainable low emissions transition. The NZ ETS is a key climate policy tool, but it is not currently structured to do this. This chapter outlines why the NZ ETS is not fit to drive gross emissions reductions over the second and third emissions budget periods, or to deliver the carbon dioxide removals by forests needed to achieve net zero emissions of long-lived greenhouse gases by 2050 (the 2050 net zero target). We therefore propose a recommendation to amend the NZ ETS to separate the incentives for gross emissions reductions from those applying to forestry, and to develop a way to provide durable incentives for carbon dioxide removals by forests through to and beyond 2050. Some options to alter NZ ETS incentives are discussed, to provide information about possible changes.

Issues related to expanding the scope of the NZ ETS and to reforming industrial free allocation are also highlighted.

[xiii] There are also small exceptions in other sectors. For example, in the waste sector, emissions from non-municipal landfills, farm fills and wastewater treatment are not covered.

NZ ETS Incentives

It is important that NZ ETS incentives support an equitable and sustainable low emissions transition

The NZ ETS is a tool, not a strategy

The NZ ETS is a government-created market with the purpose of assisting Aotearoa New Zealand to meet its emissions budgets, 2050 target and Nationally Determined Contributions (NDCs) under the Paris Agreement. It is the Government's role to design and operate the NZ ETS to support desired outcomes for the transition. This step is necessary to enable the NZ ETS to then "*let the market decide*" how those outcomes are delivered.

The Government's first emissions reduction plan sets outs intentions that the transition to a low emissions economy is equitable, enhances resilience, benefits all, and incorporates and reinforces the principles of Te Tiriti o Waitangi/The Treaty of Waitangi. As a key tool for the climate response, the NZ ETS needs to be run in a way that aligns with these intentions.

Chapter 3: A Path to Net Zero outlines that gross emissions reductions and carbon dioxide removals by forests are not equivalent across a range of considerations. It proposes a draft recommendation that the Government commit to a specific quantity of gross long-lived emissions in the second and third budgets. It sets out that providing clarity on the intended level of gross emissions will lead to better policy, manage risks from meeting emissions budgets primarily through forests, and put Aotearoa New Zealand on track to achieve net zero long-lived gas emissions by 2050 in a way that can be sustained over the long-term.

Flowing from this, it will be important for the Government to develop a clear view on the NZ ETS's role in delivering reductions to stay within the allowed quantity of gross emissions. Communicating this role clearly to participants, and operating the scheme consistent with it, will be key to building the confidence in the market needed to drive investment in emissions reductions. Failing to do this will undermine the effectiveness of the NZ ETS and hinder implementation of clear and stable climate change policies in line with the purpose in the Act.

The NZ ETS is not currently structured to drive gross emissions reductions

The NZ ETS currently treats gross emissions reductions and carbon dioxide removals by forests as fully equivalent. Every New Zealand Unit (NZU) generated from a forest and sold into the NZ ETS allows a further tonne of emissions. Establishing and growing a pinus radiata forest delivers removals at relatively low cost ($25-$50 per tonne of CO_2e), while many opportunities to reduce gross long-lived gas emissions cost upwards of $100 per tonne of CO_2e.[22]

The structure of the NZ ETS, combined with these economics, will likely result in extensive afforestation, allowing gross emissions to continue largely unabated. This does not align with our draft advice, outlined in *Chapter 3: A Path to Net Zero*, that the approach to meeting emissions budgets and the 2050 target should drive down gross emissions.

The purpose of the NZ ETS needs to shift from focusing only on net emissions to ensuring gross emissions also reduce. This requires decoupling the incentives for gross emissions reductions and afforestation, so the amount of gross reductions driven by the NZ ETS is no longer dependent on the amount of removals achieved by forests.

In the longer term, the NZ ETS will not provide necessary incentives for carbon dioxide removals by forests

Alongside decarbonisation, forests have an essential role to play in the low emissions transition.

A second, longer term issue for the NZ ETS is that by the mid-2030s it will lose the ability to incentivise carbon dioxide removals. There will not be enough demand from covered sectors to drive the further afforestation needed to reach net zero long-lived gas emissions across the economy by 2050.

This is because a significant amount of long-lived and hard-to-abate emissions, like agricultural nitrous oxide, are expected to stay outside the NZ ETS. These emissions will still need to be offset, but currently planned policy approaches do not include a mechanism to enable this.

To reach net zero long-lived greenhouse gas emissions by 2050, it will be necessary for the Government to ensure continued incentives for afforestation over emissions budgets two and three and to start considering now how incentives for removals will be maintained over the longer term.

Amending incentives must be considered via a process that upholds Te Tiriti o Waitangi/The Treaty of Waitangi

Aligning emissions pricing incentives with goals for gross emissions and driving afforestation longer term will require carefully thought through amendments to the NZ ETS. The potential impacts on groups affected by the NZ ETS, including those who have already made investment decisions, need to be understood and considered.

In particular, some Iwi/Māori-collectives hold significant interests in land and an important stake in the NZ ETS. Determining the quantities of gross emissions allowed over emissions budgets two and three, and the resulting changes to policies including to the NZ ETS, should be undertaken in a way that upholds the principles of the Te Tiriti o Waitangi/The Treaty of Waitangi. It is critical that Government decisions about the NZ ETS recognise the guarantee of rangatiratanga and kaitiakitanga for Iwi/Māori.

Proposed recommendation

This proposed recommendation seeks to address the two problems with NZ ETS incentives described above and to help enable Aotearoa New Zealand to meet the second emissions budget and its longer-term emissions reduction targets.

Proposed Recommendation 3

We propose that the emissions reduction plan for the second budget period must:

3. Make the emissions pricing system consistent with delivering the specific levels of gross emissions for the second and third emissions budgets, and with the 2050 net zero target, by:
    a. implementing an amended NZ ETS that separates the incentives for gross emissions reductions from those applying to forestry
    b. developing an approach that can provide durable incentives for net carbon dioxide removals by forests through to and beyond 2050.

It builds on the recommendation we made in *Ināia tonu nei* that the NZ ETS should be amended to strengthen the incentive for gross emissions reductions and manage the amount of exotic forest planting it drives. The Government response was that it would do further policy analysis to assess whether change was needed. We understand this work is still underway. We therefore are expanding on this issue to more clearly outline why altering the NZ ETS incentives should be a key element of the Government's second emissions reduction plan.

The following sections explain the reasoning for this recommendation in more detail.

The current state of the NZ ETS

The Kyoto Protocol set key features of NZ ETS design

The NZ ETS was established in 2008. Its design was strongly influenced by the Kyoto Protocol, the international agreement that at the time set Aotearoa New Zealand's target to reduce emissions.

Several features of the Kyoto Protocol were embedded into the NZ ETS. These included no domestic cap on emissions and a short-term lens, focused on achieving targets looking out only over the next few years. It also resulted in the NZ ETS being the only emissions trading scheme in the world that fully incorporates the forestry sector, for both carbon dioxide removals and emissions, and that treats all types of emissions reductions and removals as equivalent.

Since then, the Paris Agreement and the passing of the Zero Carbon Bill have prompted significant reforms to the NZ ETS. It now has features taking it closer to having a cap on emissions, with a rolling five-year system for managing unit limits and price control settings in line with emissions budgets, the 2050 target and the NDC. There remain no constraints on the ability of forestry to supply units into the scheme.

Reforms have strengthened NZ ETS incentives, but some view it as inequitable

In recent years the emissions price has increased, with the spot price more than tripling from around $25 in 2019 to a peak of almost $90 in November 2022.[23] It is too early to tell what impact this price may be having on gross emissions. It is, however, known to be strongly driving afforestation. Preliminary evidence indicates over 60,000 ha of new exotic forests were planted in 2022, a significant increase on previous years.[24] Even though the NZU spot price sunk back to around $55 by the end of March 2023, it is still in the range expected to drive further afforestation.

This is raising social licence issues for the forestry sector, particularly in terms of its effects on the environment and on rural communities (also see **Box 6.1** in *Chapter 6: Maintaining and Enhancing Wellbeing through the Transition*). There is also concern that the NZ ETS's focus on emissions objectives in isolation and lack of recognition of the multiple benefits of a range of forest types are driving perverse outcomes. For example, if pine forests intended to be harvested are planted on highly erodible land.

In our initial engagement for this advice as well as for other Commission work, we have heard from some Iwi/Māori entities that in its current form the NZ ETS is inequitable and does not support their aspirations. We heard that the NZ ETS was not established in a way that properly considered Te Tiriti o Waitangi/The Treaty of Waitangi, and that Iwi/Māori-collective landowners were disadvantaged when the NZ ETS was introduced as they were not resourced or sufficiently informed to participate.

Furthermore, while some Iwi/Māori-collectives own land or will take ownership of land in future, they will not always own the forests on the land. By default, this restricts decision-making over assets on their land, which is compounded when those forests have NZ ETS liabilities.

The NZ ETS is expected to play a key role in meeting emissions budgets, but how is unclear

The first emissions reduction plan indicates that the Government expects the NZ ETS to be central to emissions reduction efforts, although it recognises the that other policies are also needed.

According to Government modelling presented in the first emissions reduction plan, the NZ ETS was estimated to contribute between 0.9 – 3.5 $MtCO_2e$ net emissions reductions in the first emissions budget, 8.2 – 12.4 $MtCO_2e$ in the second, and 13.0 – 19.8 $MtCO_2e$ in the third. Most of this contribution comes from the energy and industry sector, with a moderate amount from transport.[25] The first emissions reduction plan also states that it is important that gross emissions reduce.

The Government has given mixed signals, however, about the outcomes it wants regarding gross emissions and about the role it sees the NZ ETS playing in driving them. The Government's NZ ETS unit limits and price control settings consultation document from September 2022 included statements indicating that its focus is only on net emissions.[26] Government's eventual decisions on those settings also appear to be at odds with the expectations it set in the first emissions reduction plan that the NZ ETS will deliver gross emissions reductions.

The current NZ ETS structure has risks and implications for Aotearoa New Zealand's climate goals

The uncertainty about the Government's objectives for the NZ ETS is likely to undermine the scheme's effectiveness. It makes investments to reduce emissions that rely on the emissions price riskier, increasing costs and likely delaying action.

If the Government does not resolve this uncertainty, it will become increasingly problematic for market participants – emitters, foresters, intermediaries, and consultants – whose businesses and decarbonisation efforts depend on the NZ ETS. It will be difficult for them to proceed with investments when it is not clear if they are consistent with the path to reduce emissions that the Government intends to follow. In the absence of clear signals and incentives to decarbonise, the least risky approach will be to plant more trees. This then has flow-on implications for those affected by land-use change, particularly rural communities that thrive on a diversity of land uses.

If the NZ ETS is to operate effectively and in line with a sustainable and equitable transition over the second and third emissions budget periods, this uncertainty must be resolved in the second emissions reduction plan. The forest planting driven by the NZ ETS in the second emissions budget will be critical for the emissions trajectory in the 2030s and 2040s. For example, forests planted in the second emissions budget period will only start to capture and store significant amounts of emissions in the third emissions budget period, due to the lag between planting and tree growth.

It is therefore timely to revisit the fundamental design of NZ ETS incentives.

Afforestation driven by the NZ ETS is likely to displace gross emissions reductions

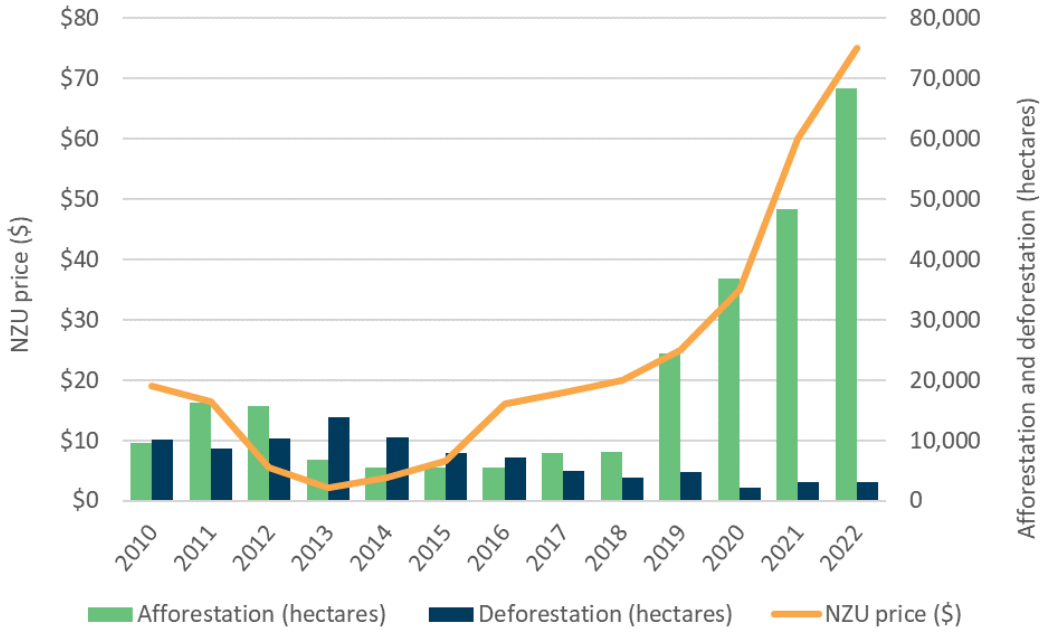
The NZ ETS creates strong economic drivers for afforestation. Aotearoa New Zealand has a large area of land which could be suitable for afforestation. Te Uru Rākau estimated in 2019 that up to 3.3 million hectares of non-forest land (typically low-producing pasture) could be suitable for afforestation.[27] A study by the Ministry for the Environment estimated that around 4 million hectares could be converted to forestry at $50 per tonne of CO_2e or less.[28] Planting just a small proportion of that land would be enough to displace gross reductions and lead to emissions prices that are not sufficient to drive most decarbonisation opportunities.

This is illustrated by the "unconstrained removals" scenario described in **Box 3.1** of *Chapter 3: A Path to Net Zero*

For clarity, this issue relates to all planting of fast-growing tree species, irrespective of whether it is for production or permanent forestry purposes.

Increased emissions prices are already driving an uptick in forest planting. Over 60,000 ha of new exotic planting was intended for 2022.[29] This is well above the 2022-2030 average of 32,000 ha per year projected by the Government when setting emissions budgets and assumed in the Commission's updated demonstration path.

Figure 4.1 Historical NZU price, deforestation, and afforestation (2022 figures are provisional estimates)

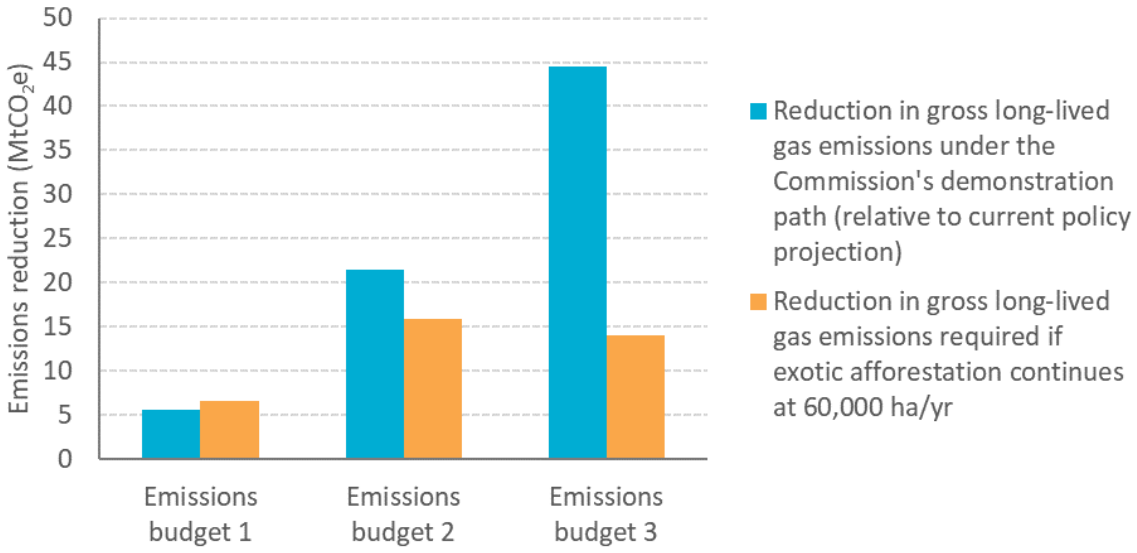


Source: Adapted from figure 1 in Ministry for Primary Industries (2022).[30]

If similar planting rates continue, a large number of forestry units would enter the NZ ETS in the 2030s. While there is uncertainty about when foresters might sell these units to others in the market, the large volume risks depressing NZU prices. The NZ ETS would be unlikely to generate the steadily increasing emissions price needed to drive gross emissions reductions.

While we heard through engagement doubts that these high planting rates could be sustained over time, it is unclear why that would be the case. The sector has ramped up capacity to plant quickly, and we have not been able to identify robust reasons why this would not be maintained if it is economically favourable to do so. The area suitable for conversion to forestry is large and land availability does not appear to be a constraint. For example, planting 60,000 hectares every year from 2022 to 2035 would use 840,000 hectares cumulatively, only a quarter of the 3.3 million hectares estimated as suitable for afforestation by Te Uru Rākau. We therefore warn against downplaying the risk of afforestation displacing gross emissions reductions outlined above.

Figure 4.2 Illustrative example of how continued high afforestation rates could undermine gross emissions reductions



Source: Commission analysis

Stock change accounting exacerbates risk that gross emissions reductions will be displaced

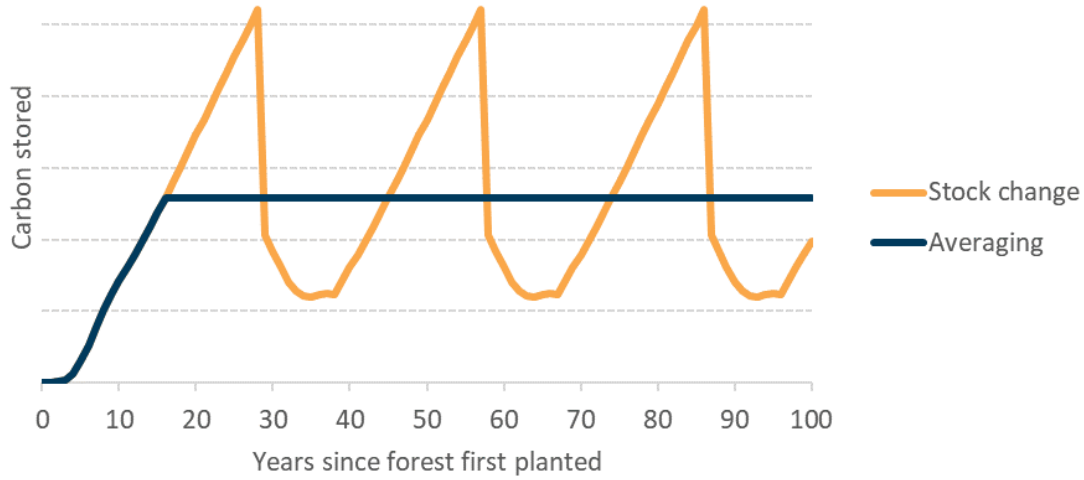
From this year (2023), there will also be two accounting systems in the NZ ETS for emissions and carbon dioxide removals by production forests planted after 1989. Averaging is being introduced, a new approach reflecting how Aotearoa New Zealand will account for forests in its emissions budgets, 2050 target and NDC under the Paris Agreement. Stock change accounting, the previous approach used under the Kyoto Protocol, will still be used by many forests registered in the NZ ETS before 2023. No decisions have been made about whether – and if so, how – stock change accounting will be phased out of the NZ ETS.

Box 4.1: Stock change and averaging accounting for forests in the NZ ETS

Under stock change accounting, a production forest planted after 1989 (post-1989) and registered in the NZ ETS earns units as it grows. A substantial number of units must be paid back when the forest is harvested, although more units can be earned if the forest is replanted. Over multiple rotations, this gives the saw-tooth pattern in the graph below.

Under averaging accounting, a post-1989 forest only earns units up to the amount of carbon it is expected to store long-term, averaged over many rotations. Units are earned for the first rotation only, and there is no requirement to repay units on harvest as long as the forest is replanted. There is still a requirement to repay units if the land is deforested.

Figure 4.3 Emissions and removals under stock change and averaging accounting for a production forest over multiple rotations.



Source: Commission analysis.

Stock change accounting does not match the accounting used for emissions budgets, the 2050 target and the NDC. Forests registered in the NZ ETS on stock change accounting will be allocated units that do not correspond to removals that can be counted towards these targets. This is not a problem if these units are retained by foresters and surrendered when the forests are harvested. But if they are sold to and used by emitters, they risk increasing emissions overall because these units could be "hot air" – that is, they may not represent genuine carbon dioxide removals occurring within the relevant time period that can be counted towards emissions budgets or the NDC.

Recent analysis indicates that at prices of around $70-80 per NZU, not harvesting forests on stock change accounting is more profitable than production forestry for most forests.[31]

This means that foresters could decide not to harvest their forests to continue earning NZUs under stock change accounting. This would cause more units to become available to the market, as they would no longer be needed for future harvest liabilities. It is very uncertain to what extent this option might be taken up. Anecdotally, our engagement with forestry stakeholders indicates that the option to not harvest some areas of NZ ETS-registered post-1989 forests on stock change accounting is being considered.

Not harvesting forests originally intended to be production forests has potential to cause other problems too. While exotic forests that are actively and appropriately managed can transition to native forests over

time, exotic forests planted for production purposes may not be suitable for this and may cause negative environmental impacts if not managed well. If significant areas of production forests go unharvested, this could also reduce wood supply available for processing.

There is very little evidence currently about the magnitude of this risk. Further research on harvest intentions could provide more information about the scale of this issue.

The current situation creates risks for foresters too

The NZ ETS structure risks generating a boom, and then a bust for both the emissions price and forestry. This is partly due to the time lags between planting and tree growth. Current NZU prices are incentivising increased forest planting, but it will be several years before the growth rate of these forests accelerates and they earn significant amounts of NZUs. But increased planting will eventually feed back through to increases in NZU supply which would put downward pressure on emissions prices.

In addition to putting decarbonisation at risk, the effects on price that could result would also be bad for the forestry sector. It could drive a large amount of afforestation for several years, followed by a drastic decline in planting rates.

As a result of the above foresters may also not get the return on NZUs that they were anticipating when they planted their trees. Foresters who bought land to plant may be particularly negatively impacted, because of the way price expectations for NZUs feed into land prices. For example, the Real Estate Institute of New Zealand reported that median forestry farm prices increased 45% over 2018-19 (from $6,487 per ha to $9,394), linked with the increase in incentives for forestry.[32]

The current increase in planting comes on top of an existing peak this decade due to the harvest and replanting of forests established in the 1990s. In future this could cause bottle necks when large areas of forest are due for harvest at the same time as well as uneven wood supply which may be a problem for the processing industry. Slower but steady planting over time would likely be preferable for the sector, both for managing social impacts of land-use change to forestry and for meeting emissions reductions targets.

There is a lack of long-term incentives for carbon dioxide removals to reach net zero

The effectiveness of the NZ ETS beyond the mid-2030s is at risk as there will not be enough demand from NZ ETS-covered sectors to drive the carbon dioxide removals by forests to reach the net zero 2050 target. This is because not all gases included in that target are covered by the scheme, notably agricultural nitrous oxide.

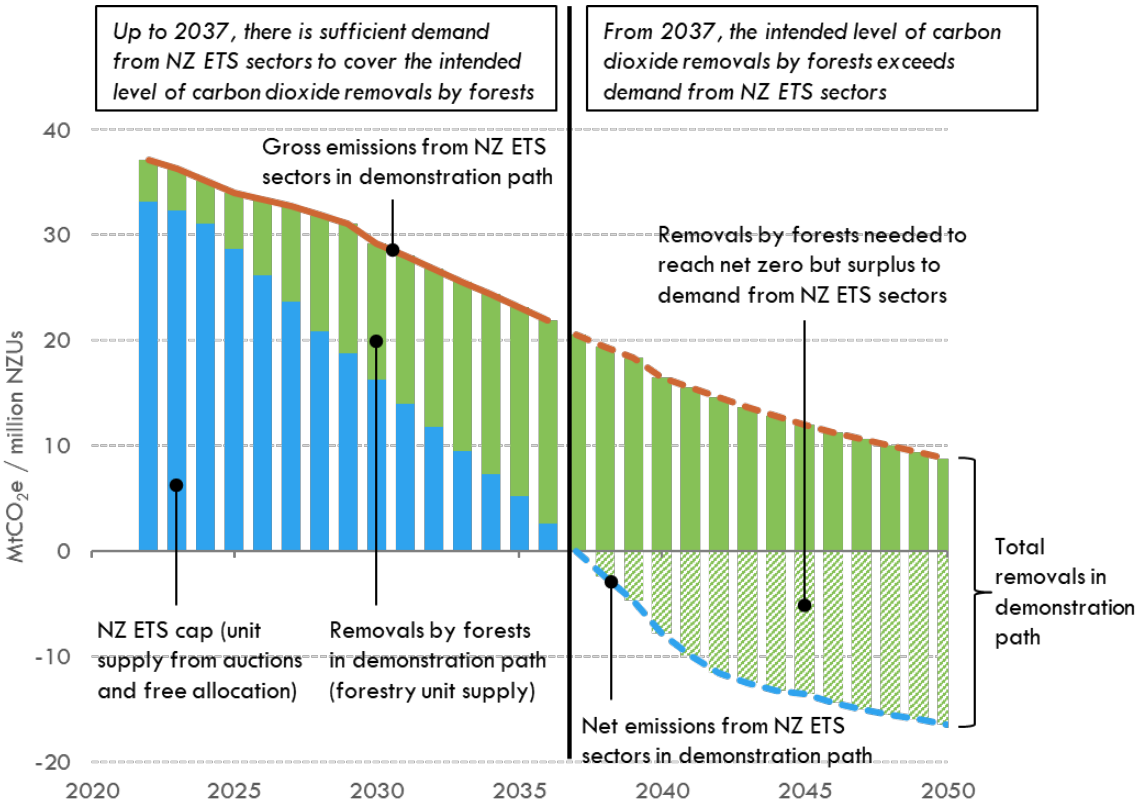
In other words, the NZ ETS will reach net zero in supply and demand terms before net zero long-lived greenhouse gas emissions is reached in the economy. At that point, the NZ ETS will lose its ability to drive further decarbonisation or afforestation. It will be unable to incentivise the further removals needed to offset residual long-lived gas emissions that are outside the NZ ETS.

Under the Commission's demonstration path, which is currently used to set the NZ ETS cap trajectory consistent with meeting emissions budgets, this point would be reached around 2037, illustrated by **Figure 4.4** below. Meeting the net zero 2050 target would require covered sectors to go net negative, which is not possible for an emissions trading scheme to achieve.

This absence of a long-term price signal for afforestation could contribute to a possible decline in planting rates as it becomes understood by market participants. The Government needs to start the process to work out how to address it now, because of the long-term investment horizon of the forestry sector and the forward-looking nature of the NZ ETS market.

Solutions could involve changes to the NZ ETS or the development of separate policies to incentivise removals by forests. It may even be possible to design an approach or package that addresses this issue at the same time as separating the emissions price incentives for forestry from gross emissions reductions.

Figure 4.4 The NZ ETS cap reaches zero in 2037 but further removals are needed to reach the 2050 net zero target



Source: Commission analysis of NZ ETS unit limit settings[33]

Most alternatives to amending NZ ETS incentives would not be effective

Amending NZ ETS incentives would be a big change. The process of considering how the NZ ETS could be altered and implementing changes could create uncertainty and disruption for NZ ETS participants. It could even delay action to reduce emissions if it causes investments to be put off until the Government makes decisions and the outcome is known.

Despite these drawbacks, we judge that there is little alternative to this course of action. We have considered whether there are other ways that the risks and potential outcomes outlined above could be avoided. Below we briefly outline alternatives raised since we first made this recommendation in *Ināia tonu nei*. Based on current information, strengthening complementary policies appears to be the only other viable option to give increased certainty about the achievement of gross emissions reductions.

Driving gross emissions reductions primarily through complementary policies

The Government could accept that the NZ ETS will not significantly reduce gross emissions, and instead drive most decarbonisation through a much stronger package of complementary policies. In this case, the purpose of the NZ ETS could be clearly redefined as a mechanism for afforestation.

Similar approaches have been used elsewhere. For example, in the United States, California has an emissions trading scheme but its strong complementary policies are expected to do most of the work to reduce emissions. Its emissions trading scheme is regarded as a "backstop" to reduce remaining emissions after other regulations have had effect.

There would be challenges with this approach. Aotearoa New Zealand has traditionally preferred market-based policies. If the mix of policies chosen are not sufficiently complementary or are poorly designed, the NZ ETS could shift away from "polluter pays" to an approach where taxpayers bear a larger cost burden. The cost of reducing gross emissions might still be as high or higher, just not as visible as in an explicit NZU price.

The Government would need to be clear – as California is – that it is choosing this route. This would give clarity about expectations for the NZ ETS and enable participants to factor it in to the NZU price.

Other options do not address the core problem

Several other options or reasons against amending NZ ETS incentives have been put forward since we made the recommendation to decouple incentives in *Ināia tonu nei*. They mostly focus on restricting forestry or new sources of demand for forestry units in the hope that this will support the NZU price. Our assessment is that these options do not provide improved certainty about sufficiently strong incentives for decarbonisation or a sustainable pace of afforestation.

These ideas have included:

- **Restrictions on land use under the Resource Management Act 1991.** The potential for land use change to forestry in Aotearoa New Zealand is large. For example, there are around 8 million hectares of land used for sheep and beef farming,[34] and at current NZU prices most sheep and beef land would be more profitable in forestry.[35] Land use restrictions would have to be widespread and stringent to counterbalance the NZ ETS incentive effectively.
- **Restricting the NZ ETS permanent forestry category.** Limiting the incentives for permanent forests could reduce the area of permanent forest planted, but it would not prevent further planting of production forests from displacing gross emissions reductions.
- **Demand from agriculture.** The agricultural emissions pricing scheme being developed does not incorporate any requirements to use NZUs for compliance purposes. This means that significant agricultural demand for NZUs is unlikely to materialise.
- **Reducing the NZ ETS cap faster than is required by emissions budgets.** Reducing NZUs allocated to the market through auctions and/or free allocation would not guarantee strong incentives for decarbonisation as it could simply drive more forest planting or more decisions by foresters not to harvest existing forests. It would also not address the social impacts of rapid afforestation or the intergenerational impacts from locking land up and delaying decarbonisation.
- **Purchase of forestry NZUs by other countries or by the voluntary market.** Again, this could just drive more forestry rather than stronger incentives for decarbonisation. These approaches may not even be feasible. It is not clear that forestry NZUs would comply with Paris Agreement rules for international

trading[xiv] or with voluntary carbon market standards' requirements about additionality and sustainable development. Article 6 is also subject to detailed commentary by the UN Local Communities and Indigenous Peoples Platform regarding the risks of trading on the homelands of indigenous peoples utilised for forestry credits without free prior and informed consent.

In the context of carbon markets, additionality generally means that an emissions reduction or removal traded should be above and beyond what would happen under current policy and business-as-usual conditions.[xv] Forestry is one of Aotearoa New Zealand's lowest cost mitigation options. It is already incentivised by government policy (the NZ ETS) without the need for international finance, making it unclear that it would fulfil additionality requirements.

Social licence issues arising around both production and permanent forestry, particularly concerns about the social, economic, and intergenerational impacts of rapid and extensive afforestation, also raise questions about whether forestry NZUs would satisfy sustainable development conditions aimed at ensuring that projects producing offsets avoid contributing to social and environmental harms.

- **Purchase of forestry NZUs by the Government to help meet the NDC and reduce reliance on offshore mitigation.** It is too late for forest planting to help much with the 2030 NDC, due to the time trees need to start significantly sequestering carbon, although planting forests now would help with meeting future NDCs. Like other options focused on forestry, this would not increase the incentives for decarbonisation and may drive socially unacceptable afforestation rates.

Note that a key reason why offshore mitigation is needed for meeting the current NDC is because Aotearoa New Zealand made little progress in reducing gross emissions to meet its previous emissions reduction targets (over 2008-12 and 2013-2020). Ensuring climate policies drive gross emissions down will help avoid a repeat of this situation.

There are several options for amending NZ ETS incentives

After our similar recommendation in *Ināia tonu nei*, the Commission has been asked several times by stakeholders about how the NZ ETS could be changed to separate the incentives for decarbonisation and forestry. This indicates a desire for more information about how this recommendation could be implemented.

To be clear, our role is to provide independent advice on policy direction. Policy development and implementation is the role of government ministries, which are better placed to do the collaborative and detailed work required. Engagement, consultation, and co-design will be crucial, so impacts for Māori-collective landowners and Iwi/Māori foresters are understood.

Nonetheless, we describe below some possible options for amending NZ ETS incentives. This is not an exhaustive list, there may be other options available as well as variations or hybrids of these options. It is also not intended to indicate that the Commission favours these approaches. We simply outline them at a high level to give a sense of available approaches, international experience of them, and how they might differ in their effects, to inform the debate.

[xiv] Article 6 of the Paris Agreement and its rulebook set out that emissions trading between countries is a mechanism to drive higher ambition, to promote sustainable development and environmental integrity. Environmental integrity includes the concept of additionality.

[xv] Note this differs from the definition of additionality used in national accounting for forest emissions and carbon dioxide removals under the Kyoto Protocol and in Aotearoa New Zealand's target accounting, where removals by any forest planted after 1989 are deemed to be additional.

Limit the proportion of forestry units that emitters can surrender

This approach has been used internationally in several other emissions trading schemes. For example, in California's cap-and-trade scheme, participants can meet only up to 4% of their surrender obligations with offset units (prior to 2021, the limit was 8%).

Such a limit would reduce demand and therefore price for forestry NZUs, relative to the price of other NZUs in the scheme. Emitters would be subject to an incentive that is a mix of the two prices, with that incentive strengthening with the stringency of the limit on forestry NZUs.

A challenge with this option is that it may be difficult to determine the appropriate limit to implement. It would not give direct control over the amount of afforestation driven by the NZ ETS. It would also add complexity as participants would have to consider two different types of units and prices.

Careful consideration would need to be given to how this might apply to forestry NZUs that are already in the market or that will be generated from forests already registered in the NZ ETS. It may be seen as unfair to impose this limit on all forestry units, given investment decisions and plans for managing surrender obligations, such as offtake agreements, will have already been made based on the previous rules.

An opportunity with this option would be to differentiate the price of units from native forests. For example, if the limit only applied to units generated by fast-growing exotic species, units generated from native or slower growing forests would trade at a premium to those units.

Introduce a minimum emissions price for emitters via an additional levy or fee

This has been used in the United Kingdom. Since 2013, UK power generators have had to pay Carbon Price Support on top of their unit surrenders to the UK ETS (or previously, to the EU ETS). This is an extra charge per tonne that changes over time and is based on government calculations of the price that is needed on top of the ETS price to drive low carbon investment. It has been assessed as contributing to significant falls in coal electricity generation.[36]

In this approach, the price of forestry NZUs would remain undifferentiated from other units, but the fee would subject emitters to a higher incentive, even if NZU prices dropped.

A challenge with this approach is that it may be difficult for the Government to determine the appropriate level at which to set the additional fee. An opportunity is that it would raise revenue, which could be reinvested into the climate response.

Limit the area of new forest land that can register into the NZ ETS each year

This option would offer more direct control over how much forest planting the NZ ETS would drive each year. This would be useful if maintaining a steady, measured pace of afforestation is valued.

An overall quota would be set to limit the forest area that could register into the NZ ETS each year. Registered forests would still receive one NZU for each tonne of carbon dioxide sequestered. There would be no differentiation of the prices applying to different types of NZUs, as the quota would provide the brake that prevents excessive afforestation and downward pressure on the NZU price.

How the quota is allocated would have to be considered. A first come, first served system might be viewed as unfair. Another option would be to auction the rights to entry each year. This would create a new source of revenue for the Government but could also create unfair barriers to participation. For example, many Iwi/Māori entities are relatively capital constrained, and any upfront cost could further disadvantage them in their ability to participate in the NZ ETS.

Move forestry into a separate project-based mechanism

A separate mechanism could be created to incentivise afforestation, leaving the NZ ETS to focus on driving gross emissions reductions. An example is Australia's Emissions Reduction Fund (ERF), a voluntary scheme which operates via a reverse auction mechanism.

The Australian government regularly holds auctions for achieving a set level of emissions reduction. Entities wishing to participate bid at auction to achieve part of this reduction via emissions reduction projects, with the lowest cost projects winning. This ensures efficiency, with the most cost-effective projects taken up. These projects then can earn units when emissions reductions are achieved.

In Aotearoa New Zealand, such a scheme could focus on forestry only, although it could potentially expand to other activities not covered by the NZ ETS, such as peatland restoration. It could use the systems and processes already developed for forestry in the NZ ETS for carbon measurement and reporting.

This approach would enable direct control over the rate of afforestation incentivised. It would also likely make it easier to specify criteria, such as environmental benchmarks, that must be met by participating projects. These features could enable a design that makes the mechanism more compatible with the voluntary carbon market than the current approach to forestry in the NZ ETS.

Decisions would be needed on whether projects winning the auctions could sell their abatement only to the Government, or also to voluntary carbon market buyers and into the NZ ETS. This would affect the extent to which the NZ ETS incentive for decarbonisation is separated from forestry.

Introduce an exchange rate between forestry and other NZUs or reduce the quantity of NZUs allocated for carbon sequestration by forests

These are two variations which would have a similar effect of dampening the incentive for forests by reducing the return on carbon sequestration.

The exchange rate option would specify that a certain number of forestry NZUs are equivalent to only one tonne of gross emissions, for example that two forestry NZUs must be surrendered for one tonne of gross emissions. Other units would remain one-for-one. This would halve the value of forestry NZUs and the incentive for forests.

The other approach would reduce NZUs allocated by applying a discount to sequestration by forests, for example a 10% discount would mean that a forest would have to remove 1.1 tonne of CO_2e to earn one NZU.

The exchange rate or the discount could be varied over time, depending on progress made to reduce gross emissions or to meet emissions reduction targets.

A disadvantage is that these options undermine the basic carbon market principle that a tonne is a tonne. The multipliers or discounts would make it complex for both market participants and the Government to understand how unit supply matches up to emissions budgets and the NDC, as in target accounting each tonne of carbon dioxide removed would still be counted as such. Settling on an appropriate exchange rate or discount would likely be challenging.

Reduce the ability to bank forestry NZUs by applying an expiry date ("vintaging")

This option would put a time limit on forestry NZUs, so after a certain date they would not be valid for surrender. This would reduce the usefulness of forestry NZUs to emitters as they would not be able to be banked indefinitely, reducing demand and their price relative to other units.

This issue has been looked at before, when the NZ ETS was established and in previous NZ ETS reviews. It was rejected previously partly because under stock change accounting, forestry participants need to hold units for decades as part of planning for future harvest liabilities. From this year, averaging accounting will be compulsory in the NZ ETS for newly registered forests, so this reasoning is now less compelling.

In addition to reducing the incentive for forests relative to that for decarbonisation, this option could help manage risks associated with units being carried over in the NZ ETS across NDC periods, as the Paris Agreement does not allow countries to bank overachievement to count towards future NDCs.

A downside of this option is that it would add complexity. It might also change how market participants approach obtaining units for hedging and surrender obligations, using some units earlier or later. This could affect market dynamics and potentially cause perverse outcomes.

Redesigning incentives presents opportunities

As outlined in *Chapter 3: A Path to Net Zero*, how emissions budgets and the 2050 target are achieved matters – for the climate, for our economy, and for an equitable transition.

As a key tool for reducing emissions, NZ ETS incentives should be redesigned to be consistent with the outcomes sought. This also presents opportunities for improvement.

The way climate policy treats forestry could be reconsidered, in terms of whether there is a more holistic way to incentivise forests, so they contribute to our climate, economic, and wider environmental objectives. The NZ ETS by its nature focuses on carbon only, but forests are much more than carbon sequestration mechanisms and have multiple benefits.

How this redesign is undertaken and implemented also matters. As part of this, the Crown should work with Iwi/Māori-collectives to understand their existing barriers and aspirations for land use, and what this means for policy approaches under consideration.

The unique characteristics and historical circumstances of the varied and nuanced contexts across Māori collectively-owned land must be taken into account, and effect must be given to Te Tiriti o Waitangi/The Treaty of Waitangi principles of partnership, active protection, participation, and equity while also recognising the guarantee of rangatiratanga and kaitiakitanga.

The Government should take this opportunity to undertake a full, up to date Te Tiriti o Waitangi/The Treaty of Waitangi analysis of the current NZ ETS incentives for post-1989 forestry and of any options for change that may alter how those incentives operate and seek to address the specific effects for Iwi and Māori, consistent with the principles of Te Tiriti o Waitangi/The Treaty of Waitangi.

Expanding NZ ETS scope

There is growing interest in expanding NZ ETS scope to other activities that store carbon

Ideas have included extending the NZ ETS to activities which are already counted in Aotearoa New Zealand's emissions reduction targets, such as the storage of carbon in harvested wood products or improved management of pre-1990 forests. There is also enthusiasm among some stakeholders for using the NZ ETS to incentivise carbon dioxide removals or better management of carbon stocks where these are not yet included in target accounting, for example in relation to soils, vegetation, wetlands, or the marine environment ('blue carbon').

Investigating these opportunities is important. For some, further research is needed to quantify their sequestration potential as well as the costs and practicalities of interventions to enhance carbon storage. Others, such as harvested wood products, are better understood but raise questions about what policy approach should be used to encourage them.

The Commission supports further work in these areas. In *Ināia tonu nei*, we recommended that methods be developed for tracking emissions and removals by sources and sinks not yet included in target accounting, prioritising carbon in organic soils (such as peat) and biomass (such as small lots of trees and regenerating vegetation). We also recommended that the Government maintain and increase carbon stocks in pre-1990 forests, encourage carbon dioxide removals by new and additional small blocks of trees and vegetation, and prevent further loss of carbon from organic soils due to the degradation of drained peatlands and the destruction of wetlands.

Any expansion of the NZ ETS needs careful consideration

We urge caution, however, about assuming that these opportunities should be included in the NZ ETS. It is not the appropriate policy mechanism for all emissions reduction activities. Nature based solutions often have multiple benefits and may be better pursued using more holistic approaches. The NZ ETS by its nature focuses on greenhouse gases only and could result in unintended consequences if emissions outcomes are narrowly pursued at the expense of other issues.

Expanding NZ ETS scope at this point, before the Government has clarified the NZ ETS's role in delivering gross emissions reductions and removals, could also exacerbate the risk of removals displacing gross emissions reductions.

Undertaking thorough policy analysis before decisions are made to include new categories or activities in the NZ ETS would help avoid perverse outcomes. Questions to consider include:

- Are these carbon stocks or sinks accounted for in Aotearoa New Zealand's emissions reduction targets? If not, what is the process for incorporating them into target accounting and how will any policy to incentivise them be made consistent with meeting targets?
- What is the role for these carbon dioxide removals in Aotearoa New Zealand's low emissions transition pathway?
- What is the full scope of diverse Iwi/Māori rights and interests and Te Tiriti/The Treaty considerations? Is including these activities in the NZ ETS consistent with those?
- Is emissions pricing the appropriate tool taking into account the abatement opportunity and actors involved, for example large businesses or small landowners? What other policy options exist (e.g., resource management tools, grants), and are they more suitable?

- If emissions pricing is appropriate, what type should be used, for example the NZ ETS or a separate scheme? If incorporation into the NZ ETS is preferred, how should this happen, for example through project crediting or through full coverage of both emissions and removals?

These emissions storage opportunities, if they are not yet already included in target accounting, should not be seen as ways to make achieving our targets easier. In *Ināia tonu nei*, we advised that if accounting was expanded beyond the scope used to set emissions reduction targets, this should trigger a review of the targets to ensure their integrity. This is important to prevent undermining the ambition of Aotearoa New Zealand's climate commitments, and another reason to follow a proper process before NZ ETS scope is widened.

Industrial free allocation

Under current NZ ETS rules, some companies receive free allocations of NZUs if they are judged to be both emissions-intensive and trade-exposed (EITE). This protects these firms from a portion of the costs of their greenhouse gas emissions. The purpose of this is to reduce the risk of emissions leakage, which is when costs from climate change policies – like NZ ETS costs – cause production to shift offshore in a way that increases global emissions. This would be a perverse outcome, contrary to the goals of a policy to reduce emissions such as the NZ ETS.

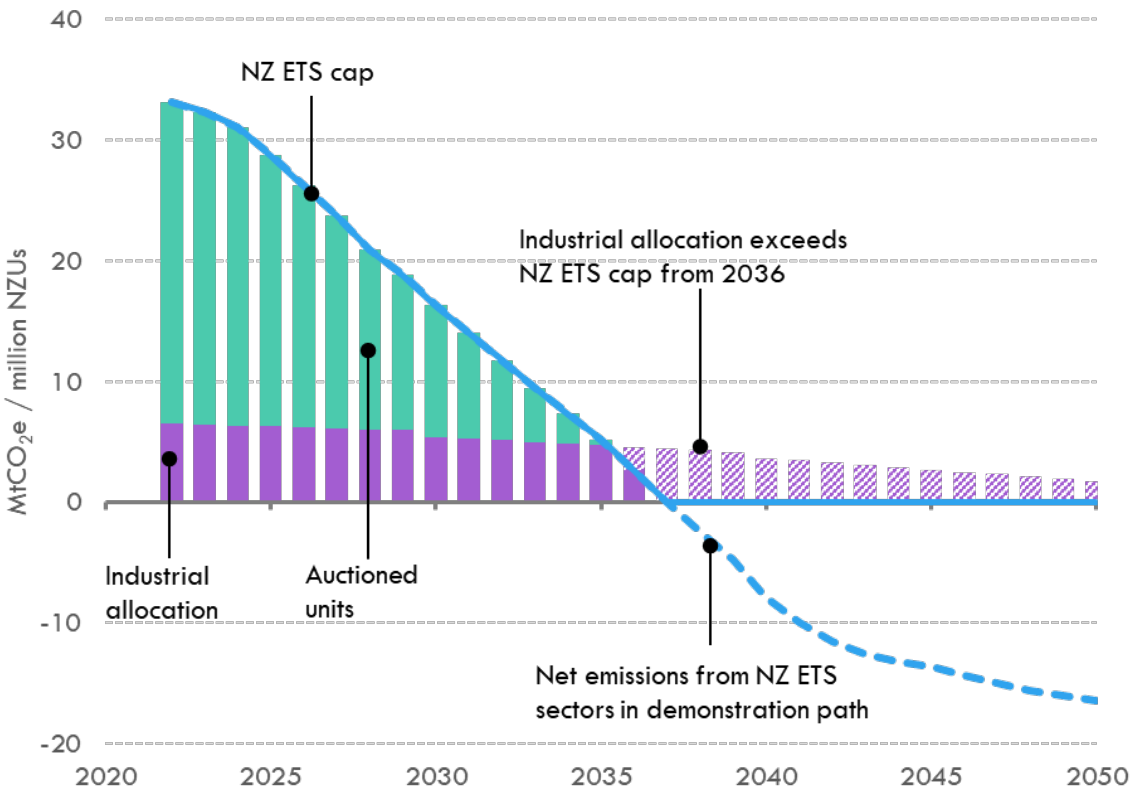
As countries increasingly take action on emissions, the need for industrial free allocation is expected to reduce. Industrial free allocation is therefore a temporary measure, and the NZ ETS legislation contains provisions to phase it out over time as well as a process for the Commission to give advice, when requested by the Minister, on increasing or decreasing the phase out rate.

Current industrial free allocation policy is not fit for the long term or proportionate to emissions leakage risk

Current industrial free allocation settings are, however, inconsistent with the NZ ETS incentivising net zero long-lived gas emissions by 2050. In combination with other elements of NZ ETS design, industrial free allocation contributes to the lack of incentives for forestry in the 2030s described earlier in this chapter. Based on projections of current settings, it brings forward the point where NZ ETS demand will be insufficient to drive further carbon dioxide removals by a year, to 2036 (see **Figure 4.5** below).

In addition, under the legislated phase-out rates industrial free allocation volumes will still be above zero in 2050. To achieve net zero long-lived greenhouse gas emissions in this case, cost would shift onto the taxpayer as the Government would have to fund removals outside the NZ ETS to compensate for the ongoing free units provided to EITE activities.

Figure 4.5: Under current settings industrial free allocation exceeds the NZ ETS cap from 2036 onwards



Source: Commission analysis of NZ ETS unit limit settings[37]

The Government has also recently reviewed industrial free allocation policy, due to evidence that industrial allocation rates are higher than intended. An amendment Bill[38] is now being progressed, including proposals that have the potential to reduce industrial free allocation volumes through updating allocative baselines and the electricity allocation factor. This aims to correct over-allocation, where firms are receiving more units than they need.

The amendment Bill also includes a proposal to change eligibility thresholds for industrial free allocation to make it easier for activities to be considered emissions intensive. Unfortunately, the proposed revised eligibility test is not well targeted to emissions leakage risk and will likely lead to more activities becoming eligible or shifting to receive a greater level of industrial free allocation.

This increases risk that industrial free allocation volumes will not decrease over time in a way that allows the NZ ETS to support achievement of net zero long-lived gas emissions. It risks giving more units to firms than they need, weakening incentives to reduce emissions and making it more difficult to meet emissions budgets. It also disadvantages other participants in the NZ ETS and incurs costs to the taxpayer; every unit allocated for free is a unit that cannot be auctioned, forgoing revenue that could be reinvested in the climate response.

Appropriately designing policy to address emissions leakage risk

Emissions leakage risk is important to consider in the design of climate policies, but mechanisms to address it such as industrial free allocation should be proportional to the risk.

The risk posed by emissions leakage to climate change and to the economy of Aotearoa New Zealand substantially differs from 2009 when NZ ETS industrial free allocation policy was designed.

The world has moved from the Kyoto Protocol to the Paris Agreement. Now both developed and developing countries are obliged to act on climate change, with NDCs under the Paris Agreement and an increasing number adopting targets for net zero emissions by 2050. Greater action and targets by multi-national corporations and sub-national actors further limit the probability that increased efforts to reduce emissions in Aotearoa New Zealand would simply result in a compensating increase in production and emissions elsewhere.

With the proposals in the amendment Bill, the Government does not appear to have assessed current emissions leakage risk to ensure industrial free allocation is commensurate to it. This could result in the Government providing more industrial free allocation than is necessary, to the detriment of taxpayers and further undermining the ability of the NZ ETS to help achieve emissions budgets and reach the 2050 net zero target.

It is also important to evaluate the costs and trade-offs of continuing to provide support through industrial free allocation. Industrial free allocation is a cost to taxpayers, and in some cases it may be better to redirect these resources towards reducing emissions.

It would be worthwhile for the Government to explore other policies to address emissions leakage. It may need to work more actively with the sectors that receive industrial free allocation, some of which are industrial sites with hard-to-abate emissions and production processes unique to this country, to identify transition pathways and transformation strategies (also see *Chapter 9: Energy and Industry*). There may be opportunities to replace industrial allocation with other forms of assistance, including potentially those that more directly drive decarbonisation.

Chapter 5: Whāia Ngā Tapuwae

Advancing Iwi/Māori climate change leadership – following in the footsteps of tūpuna.

Introduction

Pathways that consider the Crown-Māori relationship, te ao Māori, and specific effects for Iwi and Māori will lead to more enduring and equitable outcomes.

In providing independent expert advice, the Commission must consider the Crown-Māori relationship, te ao Māori, and the specific effects on Iwi and Māori (section 5Mf CCRA). The effectiveness of the Crown-Māori relationship is critical for an equitable transition for the benefit of all people of Aotearoa New Zealand. Partnership with mandated Iwi representatives supporting Māori in navigating climate change upholds Te Tiriti o Waitangi/The Treaty of Waitangi (including Iwi/Māori exercising rangatiratanga) and facilitates kaitiakitanga.

Assessing the Crown-Māori relationship involves consideration of sufficient resourcing to mandated Iwi/Māori-collective representatives. Assessing te ao Māori includes consideration of tikanga and mātauranga Māori responses to climate change. Both these approaches support the assessment of specific effects for Iwi and Māori.

The draft advice in this chapter builds on the Commission's previous work in *Ināia tonu nei*. While progress has been made regarding the mechanism for developing enduring partnerships, there is considerable work yet to be done regarding co-designing a strategy for an equitable transition and building emissions profiles within respective takiwā. In our previous advice, we emphasised the importance of "equitable access to resources, services, and funding".

In this draft advice we stress the importance of Iwi/Māori leadership and exercising rangatiratanga under the principles of Te Tiriti/The Treaty in emissions reduction, and the key role this should play in meeting emissions targets.

For these reasons, the draft advice in this chapter includes proposed recommendations that in its second emissions reduction plan, the Government direct resourcing to mandated Iwi/Māori representatives and enable Māori-led mātauranga Māori responses to climate change.

An equitable Treaty Partnership to achieve a low emissions future

The Government needs to work in partnership with Iwi/ Māori to accelerate our transition to low emissions and collectively build climate resilient communities.

Aotearoa New Zealand can achieve a fair, inclusive, and equitable transition to a low emissions future when Iwi/Māori can actively exercise rangatiratanga and mana motuhake; have the means and capability to achieve emissions reductions within their takiwā across their portfolios; and can ensure their communities are resilient and adapted to the effects of climate change while sustaining economic, environmental, social, and cultural wellbeing intergenerationally.

To achieve this, the Government needs to consider the role Iwi/Māori play in Aotearoa New Zealand's emissions reductions approach as well as their specific, localised needs. This includes consideration of what steps can be taken to ensure Iwi/Māori are resourced and enabled to help accelerate progress towards achieving national climate change targets in accordance with tikanga and mātauranga Māori and while realising the aspirations of their people and communities.

Many Iwi/Māori-collectives have a strong commitment to climate action, and control significant assets that can contribute to a scalable low emissions transition. Through shared tikanga values, assets, and a growing membership base, Iwi/Māori have large networks, key infrastructure, and a range of skills and knowledge that can be mobilised quickly in response to climate emergencies.

Direct investment in Iwi/Hapū and Te Ture Whenua entities will help accelerate Iwi/Māori action to reduce emissions and increase preparedness to adapt to the effects of climate change. It will also facilitate accelerating understanding of mātauranga Māori across society and enable collaboration with local Iwi/Hapū leadership in applying mātauranga Māori to local government climate responses. This would help Aotearoa New Zealand design and implement more enduring, locally relevant solutions in a sustainable way, thereby strengthening our collective climate resilience.

Indigenous climate change leadership

Tangata whenua, as rangatira and kaitiaki, embody ongoing climate leadership grounded in tikanga and mātauranga Māori which benefits Iwi/Māori and all New Zealanders.

As tangata whenua, rangatira, and kaitiaki, many Iwi/Māori-collectives already demonstrate climate leadership in their rohe, through investment in low emissions initiatives and intergenerational taiao strategies. Iwi/Māori-collectives control an asset base estimated to be worth $70 billion with a projected growth rate of 5% per annum showing an opportunity for investment and the leading role Iwi/Māori will continue to play in the economy.[39] These strategies are grounded in tikanga and mātauranga Māori which encompass a wealth of localised knowledge, history, indicators, tools, and practices useful for understanding the nature and rate of change in an environment and for determining localised solutions to the impacts of climate change.

Recognising mandated Iwi representatives as partners under Te Tiriti/The Treaty and facilitating partnerships in Aotearoa New Zealand's national climate action strategy could help fast track Iwi/Māori local climate action and initiatives to reduce emissions and accelerate preparedness to adapt. Consequently, communities across the motu would be better resourced with the skills, assets, networks, and infrastructure necessary to reduce emissions and respond to climate change events.

This approach is also in keeping with Aotearoa New Zealand's international commitments under the United Nations Framework Convention on Climate Change and the affiliated Local Communities and Indigenous Peoples Platform which upholds indigenous leadership in formulating climate solutions. International research around nature-based solutions to climate change has increasingly recognised that policies are most effective when led by indigenous peoples and their lived experience of guardianship of the natural environment.[40] Uplifting Iwi/Māori climate change leadership is also critical to implementing the UN Declaration on the Rights of Indigenous Peoples.

Through our case study work we saw numerous examples of Iwi/Māori-collectives applying tikanga and mātauranga Māori to shape their taiao strategies, business models, transitional pathways for land use, and other social and cultural initiatives that have a direct effect on emissions reductions and climate adaptation. We also saw how Iwi/Māori across the motu demonstrate indigenous climate change leadership. Consistent

with other indigenous peoples, Iwi/Māori recognise that human wellbeing is dependent on the wellbeing of te taiao/te ira atua. We saw how Iwi/Māori-collectives designed strategies that are measured by their outputs, outcomes, and impacts across economic, social, cultural, and environmental goals and aspirations. This integrated wellbeing approach could help guide Aotearoa New Zealand as we work to achieve an equitable transition to a low emissions future.

Direct investment in Iwi/Māori to accelerate our national response

Investing directly in Iwi/Māori will help Aotearoa New Zealand accelerate emissions reductions and enhance our preparedness for climate change adaptation.

The leadership of Iwi/Māori is critical to our climate change response. Iwi/Māori have an established history of nurturing economic and social prosperity whilst protecting te taiao through kaitiakitanga and practices such as tūrāhui and rāhui for conservation of taonga and taonga species. In more recent times, Iwi/Māori have broken new ground on the international stage through innovative legal mechanisms which manage financial transfers directly from the Crown to mandated Iwi/Māori representatives following any relevant Waitangi Tribunal processes, and settlement negotiations. This demonstrates that Iwi/Māori have long asserted their mana motuhake and kaitiakitanga through financial management, including direct resourcing from the Crown.

When Iwi/Māori have access to appropriate tools and mechanisms, they can decide what approach to climate change and emissions reductions is best for the protection of their taonga in a manner consistent with their aspirations and tikanga. Current funding allocation often goes to government initiatives designed and administered by central government, which can create barriers for Iwi/Māori.

We heard through engagement with Iwi/Māori that while there are some instances where the Government has been proactive in responding to inequity in the Treaty Partnership, the current level of funding to support Iwi/Māori to achieve an equitable transition is not sufficient. Further financial commitment from the Government is needed to address issues created through historic injustices as well as to progress emissions reductions and climate adaptation strategies.

For example, the loss of land and lack of resourcing slows Iwi/Māori-collectives from reducing emissions and effectively building climate resilience for whānau, Hapū, marae, and Māori landowners. The initiatives many Iwi/Māori are eager to progress include:

- development of land-use transition strategies
- development of native afforestation and transitional forest strategies
- restoration of wetlands and the associated whakapapa and mātauranga
- exploration of blue carbon and other low emissions and environmentally sustainable economic prospects
- progression of food security and food sovereignty strategies
- progression of parakore and sustainable waste management and waste minimalisation initiatives
- increase of planning along coastlines and waterways
- the relocation of urupā and other culturally significant taonga.

Under the current approach, the Crown still holds the balance of decision making and resource allocation functions. These Crown-held functions determine the mechanisms for distributing and administering resources, which in turn largely determines co-design and co-governance arrangements.

To be most effective for Iwi/Māori, the current mechanisms whereby the Crown implements these functions must be realigned and made relevant to the way Iwi/Māori-collectives organise themselves economically,

socially and culturally, and prioritise their goals and aspirations. Overall, the current approach should be reassessed through a co-design process in order to create an enabling environment where Iwi/Māori can fully exercise their rangatiratanga, participate in decision making, and protect their taonga.

Whakapapa, tikanga, kawa, tribal kōrero, tribal structures, and tribal assets are unique for every Iwi/Hapū, as are the continuing impacts of colonisation and settlement redress. Not all Iwi/Hapū are resourced equally, and different Iwi/Hapū and other Māori-collectives manage different emissions profiles and face different climate risks.

To achieve our climate targets through an equitable transition, the Government needs to act more swiftly to improve equity in the Treaty Partnership. Allocating funding directly to mandated Iwi/Hapū entities as well as specific funding to Te Ture Whenua entities would uplift equity under the Treaty Partnership and create an enabling environment for Iwi/Māori that upholds the principles of Te Tiriti/The Treaty and mitigates against compounding historic grievance or creating ongoing disadvantages for Iwi/Māori.

Proposed recommendation

This proposed recommendation seeks to address the need for Iwi/Māori to have appropriate access to resources and mechanisms to reduce emissions and to help enable Aotearoa New Zealand to meet the second emissions budget and its longer-term emissions reduction targets.

Proposed Recommendation 4

We propose that the emissions reduction plan for the second budget period must:

4. Accelerate Iwi/Māori emissions reductions in conjunction with climate change adaptation initiatives by exploring and implementing a mechanism to allocate resourcing direct to Iwi, and increase funding to Māori landowners (Te Ture Whenua entities).

The Māori Fisheries Act 2004 provides a framework for the allocation and management of settlement assets to Iwi entities individually and collectively, and the Public Finance Act sets out a framework for the use of public financial resources through an appropriation or legislative provision.

Creating a legislative environment where mandated Iwi representatives (Hapū and marae) could be directly allocated an appropriation in their own mana (in connection with their respective Hapū and marae) as whānau under te Tiriti o Waitangi/The Treaty of Waitangi, specifically to accelerate their emissions reductions and climate adaptation initiatives, would be an optimal expression of equity in the Treaty Partnership. However, a phased approach with interim mechanisms should be explored given the urgency to achieve our climate change targets.

A specific mechanism would need to be assessed for Māori landowners, both through Te Ture Whenua entities and through Māori freehold land.

Te Ture Whenua entities hold ancestral lands (Māori freehold land ~1.4 million hectares) originally within the mana whenua of Hapū.[41] Over time government interventions fragmented the land and the ownership base, and what remains today is vested in various trusts and incorporation constructs under Te Ture Whenua Māori Act 1993 (TTWM Act). The intent of the TTWM Act is to promote the retention, use, development, and control of Māori (ancestral) land as taonga tuku iho by Māori landowners.

Māori freehold land is collectively held by individuals who share a whakapapa connection to the whenua like whānau and Hapū, but is not necessarily commonly owned by all Iwi members. Therefore, the legislative frameworks referenced above are not applicable. However, the Whenua Māori Fund provides a current example of funding allocated for Te Ture Whenua entities, and could be extended to support Māori-collective landowners to accelerate their emissions reductions and climate adaptation initiatives. Other options could include exploring ways to offer specific support for Te Ture Whenua entities through the New Zealand Green Investment Finance (NZGIF), New Zealand Green Bonds, and the Climate Emergency Response Fund.

Allocating funding directly to mandated Iwi representatives and to Te Ture Whenua entities would uphold the principles of Te Tiriti/The Treaty by supporting Iwi/Māori to exercise their rangatiratanga. This would also help ensure that Iwi/Māori are resourced to participate in decision-making, co-design, and to lead the implementation of critical kaupapa supporting Iwi/Māori to protect their taonga for current and future generations. This would elevate the mana of both partners under Te Tiriti/The Treaty and acknowledge Iwi/Māori in their mana as rangatira, kaitiaki, and indigenous climate change leaders.

Recognising mātauranga Māori

Accelerating a general understanding of mātauranga Māori through collaboration with local Iwi/Hapū will build more locally relevant and enduring climate change solutions.

Mātauranga Māori encompasses a wealth of localised knowledge, history, and indicators useful for understanding the nature and rate of change in the natural environment and determining localised solutions to the impacts of climate change. Iwi/Māori already demonstrate climate action and leadership in their rohe/tribal areas through application of mātauranga Māori.

Throughout our engagement we heard about a range of Hapū-led projects in progress scoped to address some of the critical gaps in mātauranga Māori because of climate change impacting the environment and tohu, including initiatives which build on existing networks and knowledge to boost Iwi/Hapū climate resilience. We heard that nationally, there is still a significant gap in resourcing and prioritisation of mātauranga Māori that imposes constraints on the speed at which Iwi/Māori can progress climate change initiatives. The benefits of these approaches apply to all New Zealanders across Aotearoa New Zealand.

We heard concerns regarding the current imbalance in the prioritisation of western science over mātauranga Māori in the Government's climate change response. This has particular impacts for Iwi/Māori led initiatives, especially in settings where the essential supporting infrastructure (like policy/legislative frameworks and local council bylaws) is not supportive of an ao Māori-led approach to climate solutions. The prevalence of a western scientific approach devoid of ao Māori framing or methodologies constrains comprehensive policy development that can fully assess the specific impacts of climate change for Iwi/Māori, and subsequently restricts Iwi/Hapū/Māori from effectively executing climate action in a timely manner. It is therefore necessary to implement systems supportive of valuing mātauranga Māori-based frameworks, data collection, and research methodologies.

For Aotearoa New Zealand to design and implement enduring and locally relevant solutions to climate change in a sustainable way, the Government will need to accelerate a general understanding of mātauranga Māori across the motu and develop means for local government to deepen collaboration with local Iwi/Hapū. A greater and more consistent application of mātauranga Māori responses to climate change will strengthen our collective climate resilience as we adapt to the effects of climate change and reduce emissions.

In *Ināia tonu nei* we recommended that the Government should fund research and development in mātauranga Māori to support the development of policy, strategy, technology, and innovation that is informed from an equitable knowledge base (i.e., western science and mātauranga Māori).

Iwi/Māori require specific investment into research development to understand the tohu within their rohe to help influence funding decisions in the future. The research and implementation of this mātauranga should be led by Iwi/Māori to ensure it is applicable to their regionalised needs and knowledge systems. Current incorporation of mātauranga systems in central government are not led directly by Iwi/Māori in a way that is specific to regions, Iwi/Hapū, and their tikanga, meaning that the benefits of these systems are limited.

We have heard in our engagements that nationally there is still a significant gap in resourcing and prioritisation of mātauranga Māori that imposes constraints on the speed at which Iwi/Māori can progress climate change initiatives. This in turn delays the benefits for Aotearoa New Zealand.

Within te ao Māori, the natural environment is viewed as an integrated eco-system that needs to be considered in its entirety. In other words, the impacts of climate change fall within the broader holistic context of kaitiaki obligations to the taiao. Māori-led research and development of mātauranga Māori, and integration into policy frameworks, will help Aotearoa New Zealand grow our understanding of how te taiao, te ira atua and te ira tangata interact with one another. It is essential that Aotearoa New Zealand contributes to the global efforts to support indigenous-led solutions to reduce emissions and adapt to climate change.

Proposed recommendation

This proposed recommendation seeks to address the need for Iwi/Māori to drive the integration of mātauranga Māori into Aotearoa New Zealand's strategy to meet the second emissions budget and its longer-term emissions reduction targets.

Proposed Recommendation 5

We propose that the emissions reduction plan for the second budget period must:

5. Ensure Iwi/Māori can drive the integration of mātauranga Māori into policy design, development, and implementation at central and local government level, by delivering sufficient resources to Iwi/Hapū.

This recommendation addresses an imbalance in the knowledge and practitioners available to effectively integrate mātauranga Māori in central and local government climate policy and solutions.

Accelerating the collation, understanding, dissemination, and application of mātauranga Māori across central and local government responses to climate change will lead to outcomes that uphold the principles of Te Tiriti/The Treaty, and create more inclusive and enduring climate solutions relevant to Iwi/Māori and the regions.

Enduring benefits for Aotearoa New Zealand

Investing in Iwi/Māori under the Treaty Partnership will give Aotearoa New Zealand the best chances to reach our 2050 climate change targets.

Iwi/Māori control critical assets and infrastructure which they operate in accordance with kaupapa Māori/tikanga values, which has the potential to create balanced economic, environmental, and social outcomes for their whānau and Hapū.

In recent months, Iwi/Māori have demonstrated strong leadership qualities during times of crisis. The climatic events experienced so far in 2023 have highlighted the way Iwi/Māori can swiftly and effectively take action to help restore their communities by mobilising networks, infrastructure, skills, and assets to take care of people's needs in devastating circumstances.

To give Aotearoa New Zealand the best chance of reaching our 2050 goals, it is important for the Government to quickly elevate Iwi/Māori leadership under the Treaty Partnership/Crown-Māori relationship. The recommendations put forward in this chapter would introduce mechanisms to significantly accelerate equity in the Treaty Partnership, more rapidly reduce emissions, and strengthen climate resilience across communities.

Chapter 6: Maintaining and Enhancing Wellbeing through the Transition

Introduction

The transition to a low emissions future is an opportunity to maintain and enhance wellbeing, and ensure it is experienced across society. The wellbeing of current and future generations in many ways will depend on ambitious global action. Wellbeing considerations therefore need to be a core part of the effort to reduce emissions.

Many actions to reduce emissions, including those recommended in this advice and those already committed to in the Government's first emissions reduction plan, provide wellbeing benefits alongside benefits to the climate and the economy. Some of the opportunities for wellbeing co-benefits arise directly from the reduction of emissions, some opportunities build on existing strengths of Aotearoa New Zealand, and others contribute to reducing existing problems.

Reducing emissions may also sometimes risk causing undesirable wellbeing impacts. In an equitable transition, these impacts will be addressed proactively as part of policy design, with particular attention paid to those in situations least able to absorb the impacts or adjust their behaviour.

Considering wellbeing and the principles of a fair, inclusive, and equitable transition will help make emissions reduction more achievable and sustainable for a larger group of people,[42] meaning they will be more likely to endure.

This chapter sets out recommendations to ensure the wellbeing of New Zealanders is at the centre of decisions about taking climate action under the second emissions reduction plan. Wellbeing can be maintained and possibly even enhanced through careful consideration of climate change policies and complementary policies.

Some of the impacts of policy to reduce emissions relate to the impacts of policy to adapt to climate change. In many cases, the groups at greatest risk of experiencing inequitable impacts from climate change and from policy to address it and adapt to it are the same. We are therefore proposing to recommend that the Government's *Equitable Transitions Strategy* be broadened to incorporate consideration of all these impacts.

While the *Equitable Transitions Strategy* is currently in development, both the need and options to address concerns about the impact of climate policy on wellbeing exist now. This is why we are proposing a recommendation for the Government to continue using existing mechanisms to manage the impacts, so that concerns about the impacts of climate policy do not delay climate action.

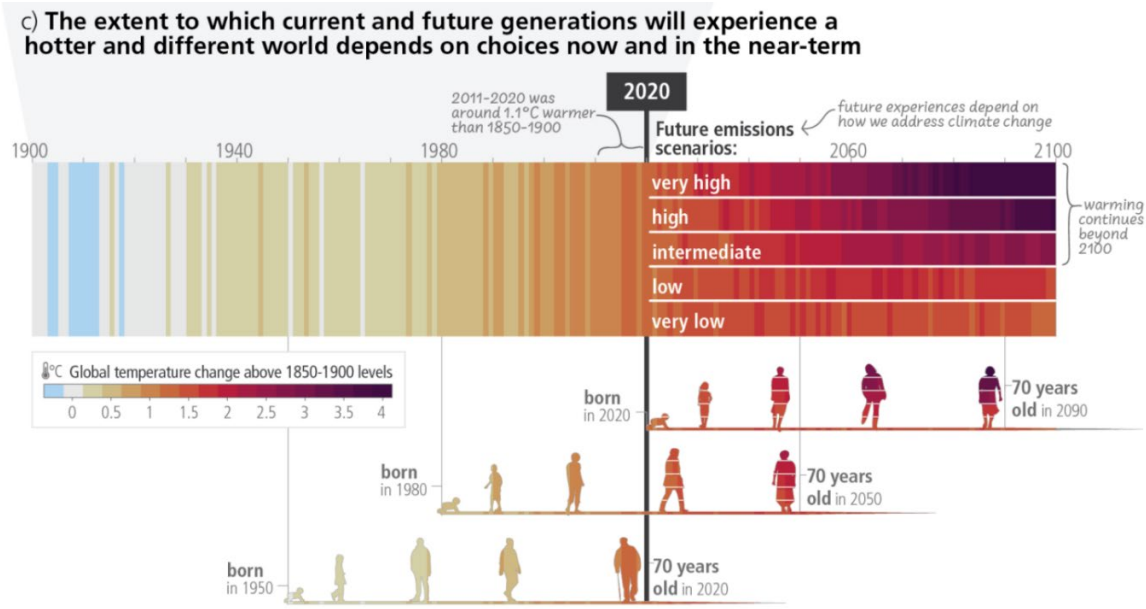
Wellbeing benefits

The transition presents opportunities to improve the wellbeing of rangatahi

Young people today are expected to be disproportionately affected by climate change as the risks and impacts of a changing climate are likely to worsen and intensify over time. It is, therefore, important for intergenerational equity to be considered when making policies to reduce emissions.

Climate change anxiety is increasingly reported globally, with children and young people particularly vulnerable.[43] The Commission's early engagement suggests this is a concern for many rangatahi in Aotearoa New Zealand as well. In Aotearoa New Zealand, teenagers and young adults also have rapidly increasing levels of psychological distress and teen suicide rates continue to be among the worst in the OECD.[44]

Figure 6.1: Young people will face greater effects from climate change than earlier generations



Source: IPCC[45]

Māori youth also face culturally distinct risks such as the loss of wāhi tapu from sea level rise, which is a loss of centuries of identity. Climate change is likely to threaten cultural taonga that Hapū whakapapa to, such as marae, urupā, wāhi tapu, and archaeological sites, as they are frequently located by coasts and rivers at risk of flooding.[46]

Enabling rangatahi, particularly Māori youth, to participate in the transitions to a low emissions Aotearoa New Zealand can have a positive impact on their mental health through increasing a sense of control, hopefulness, and resilience.[47]

Physical health can be improved by reducing air pollution and decarbonising transport

Air pollution has a serious impact on people's physical health and wellbeing and is associated with respiratory and cardiovascular illnesses. As discussed in *Chapter 11: Transport,* there is a significant opportunity to improve air quality through decarbonising transport. Research suggests the social cost of air pollution in Aotearoa New Zealand is at $16.3 billion per year.[48]

Access to active types of transport such as walking and cycling can also improve individuals' health, and public transport can improve mental health through connecting people, families, and communities together.

Health and wellbeing can be improved through warmer, dryer buildings

As discussed in *Chapter 8: Built Environment*, improving buildings' energy efficiency and switching to clean heating choices can contribute to improved health and wellbeing, and reduce emissions from energy use. Insulated housing increases indoor temperatures and helps to prevent outdoor pollutants and allergens from entering a home. Proper insulation reduces exposure to mould and respiratory issues, allergies, and the risk of lung cancer.

Māori and Pacific peoples are more likely to be admitted to hospital with asthma than those of other descent, and this disparity increases with age.[49] Tū Kotahi Māori Asthma Trust suggests that healthy homes with sufficient heating can improve this.[50]

Employment and wellbeing

Transitioning to a low emissions economy is likely to impact economic activity in a way that changes patterns of employment across different sectors. For some sectors, such as renewable electricity generation and transport infrastructure, the transition will require more workers to support their growth. Some sectors tied to higher emissions, such as fossil fuel extraction, will likely require fewer workers. Internationally, the evidence suggests growth in emissions-reducing sectors creates more jobs than those lost in fossil fuels sectors.[51]

According to the New Zealand Productivity Commission, Aotearoa New Zealand "*has a flexible labour market that has historically adapted well to economic change, while also creating an abundance of employment opportunities.*"[52] This means New Zealanders are likely well positioned to adapt to the transition, but workers will need to adopt new skills and ways of working.

As discussed in our previous advice, providing information and support to workers can help them make the most of the opportunities presented by a low emissions economy. We highlight three examples below.

Appropriate training and retraining enable workers to change careers

To successfully change jobs, workers often need to develop new skills, or learn to apply existing skills in a new context. For some sectors, this focus on worker skills may provide an opportunity to help address current skills shortages.

Sectors tied to higher emissions are anticipated to reduce in scale as part of the transition, but some level of workforce will likely be maintained for a time. This is due to sector-specific skills needed to safely manage existing infrastructure, and safely decommissioning it when it has been phased out.

Good geographic matching helps wellbeing

Access to friends, family, social support networks, suitable housing, and amenities are important considerations when people look for jobs and enhance wellbeing. Matching the location of jobs to workers can support this. For many Iwi/Māori, living within their rohe is central to the concept of ahikā and upholding kaitiakitanga of te taiao.

Since the COVID-19 pandemic, location-independent working has become more prevalent across many sectors. About a quarter of businesses in Aotearoa New Zealand have increased flexibility around location of work in the last two years.[53] Encouraging location-independent working can help to improve the matching of workers to jobs and reduce transport emissions from commuting.

Many jobs require a physical presence to do the work. For these jobs, improving matching can help ensure workers are happy to live where the jobs are and creating these jobs in the places these workers want to live.

Box 6.1: Rural communities and forests

The Commission has heard that some changes in land use may impact job availability for agricultural workers in areas where large-scale afforestation occurs. While plantation forestry does not necessarily support fewer jobs, the workers in those jobs tend not to be permanently based in the rural communities. Instead**,** they are often centrally located in urban areas, travelling to the site they are working at each day.

The conversion of land from agriculture to forestry may therefore result in fewer jobs in rural communities, causing people to leave to find work elsewhere. As well as managing the volume of land conversion to forestry (see *Chapter 3: A Path to Net Zero*, *Chapter 4: Emissions Pricing*, and *Chapter 10: Forests*), this might also be addressed by making it possible to work in other industries from those communities including providing good broadband for people with jobs that can be done from anywhere.

Many small-to-medium enterprises need support to participate in the transition

The impacts of climate change will vary depending on a business's size, location, industry, and vulnerability. Many small-to-medium enterprises (SMEs) lack the resources to assess the risks they face and decide how to adapt. According to Stats NZ, a lack of information to support decision making and uncertainty around future policy direction are the main reasons businesses do not invest in climate measures.[54]

With a clear understanding of what the transition to a low emissions economy will look like, business owners can work out the transformational changes to make. However, even after policies become more certain, the Commission has heard that many SMEs will need support to understand how to implement the policies in their particular context. Resources, financial and non-financial, will help businesses navigate the transition.

Climate impacts and the *Equitable Transitions Strategy*

Government action has already started

The Government is progressing several actions to address wellbeing and equity in the transition to a thriving, low emissions economy. The Ministry of Business, Innovation and Employment and the Ministry of Social Development have partnered with local communities to develop Just Transition plans for Taranaki[55] and Southland.[56] It will be important to develop and fund similar plans for all regions. If these are co-designed, the affected communities will be empowered and the plans more likely to be appropriate and impactful.

For Iwi/Māori, it is also important to partner with and allocate resourcing directly to mandated Iwi representatives as highlighted in *Chapter 5: Whāia Ngā Tapuwae*.

The Ministry of Business, Innovation and Employment has partnered with Business New Zealand and the New Zealand Council of Trade Unions to create the Future of Work Tripartite Forum,[57] and with business, workers, Māori, and government to create Industry Transformation Plans.[58] Alongside climate change, these initiatives consider other issues affecting the labour market like automation and globalisation.

Equitable transition strategies need to plan for a changing climate

The Government's *Equitable Transitions Strategy* is currently under development. It will need to be actively implemented in the second emissions budget period, if not earlier, if it is to be in place before the largest impacts occur.

At present, and as included in the Government's first emissions reduction plan, the *Equitable Transitions Strategy* will only consider the impacts from emissions reduction policies.[59] However, robust emissions reduction policy must consider impacts on adaptation needs, and similarly adaptation policy must consider the ability to reduce emissions.

The Government separately outlined principles for an equitable adaptation transition in its *national adaptation plan*. This notes some policies that will address inequity. The plan lacks, however, an explicit strategy covering climate impacts, resilience, and adaptation.

Failing to consider emissions reduction and adaptation together can lead to decisions to prioritise one over the other, rather than making decisions that meet both goals. Aotearoa New Zealand has seen this in the wake of Cyclone Gabrielle. The Government is revising the *Government Policy Statement on Land Transport* to focus less on reducing emissions and more on reconstructing damaged roads and bridges and building greater resilience into the land transport system.[60]

In *Ināia tonu nei*, the Commission emphasised the importance of proactive transition planning for industries, regions, and communities. This is as important for proactive adaptation as it is for emissions reductions. While emergency management will continue playing a key role in responding to natural hazards like Cyclone Gabrielle, proactive adaptation, which anticipates changing risks, helps build community resilience.

This allows councils, communities, and tangata whenua to work together towards adaptation goals. It reduces the need to react to immediate events and continually expose communities and their assets to foreseeable risk and the ongoing associated social, cultural, and financial impacts that a reactive response brings.

Box 6.2: Considering adaptation and mitigation together – the example of disabled communities

The experience of the disabled community illustrates how important it is to plan for an equitable transition that considers both adaptation and mitigation. People with disabilities are often among those most adversely affected in an emergency, sustaining disproportionately higher rates of morbidity and mortality, and at the same time being among those least able to access emergency support.

Climate-related events can disrupt vital social networks and support services for people with disabilities. It is important that the Government considers the impacts of its decisions on disabled communities, including their ability to adopt a lower emissions lifestyle, contribute to the reduction efforts, and adapt to climate change.

Proposed recommendation

This proposed recommendation seeks to address the need for equitable transition strategies that encompass Aotearoa New Zealand's plans for both minimising and adapting to the impacts of climate change.

Proposed Recommendation 6

We propose that the emissions reduction plan for the second budget period must:

6. Enable a fair, inclusive, and equitable transition for New Zealanders by expanding the scope of the *Equitable Transitions Strategy* to include compounding impacts of climate change and adaptation as well as mitigation.

Climate policies for a fair, inclusive, and equitable transition

Barriers exist that make it harder to access energy savings

Overall, the transition to low emissions is an opportunity to reduce ongoing costs faced by households. However, some people face barriers to taking up options to reduce their emissions that prevent them from realising these cost savings. These barriers can include:

- lack of access to capital for improvements that save money over the longer term
- split incentives where the person who can make the change is different from the person who benefits, for example, insulating a rental home
- lack of time and capacity to act, such as households and SMEs that lack resources to research different options and develop something new.

The largest of these barriers is often access to capital. Many technologies to reduce emissions result in lower running costs but have higher upfront costs. These upfront costs can prevent people on lower incomes from taking advantage of lower emissions technology that would save them money in the long run. For example, insulating a home incurs upfront costs, but can lead to significant energy savings over time in addition to non-financial benefits such as health improvements.

These barriers may create a transitional hurdle where some households – especially those with fewer financial resources – cannot invest in technologies that will reduce their emissions and ongoing energy costs. If energy costs, particularly for fossil fuels, are also rising the impact on household costs for those who cannot afford to transition early will be even greater.

Targeted policies could improve equity while reducing emissions

Targeting policies to support low-income groups to reduce their emissions can help those who need it most, without being diffused across people who are already able to adjust. Targeted policies can improve equity and achieve emissions reductions at the same time.

Examples of such policies include the existing subsidies for household insulation and clean heating (EECA's Warmer Kiwi Homes programme), proposed policies like social leasing or low-cost loans for emissions-reducing technologies.

Non-targeted complementary policies that address wider barriers are also useful in addressing inequity. Policies to improve cycling and public transport infrastructure and services and lower costs, while not driven by equity considerations, can provide lower-cost options for people to avoid car trips and reduce fuel bills. In some cases, it may remove the need to own and maintain a car.

Climate policies will affect different groups differently

The impact of climate policies on people will not be felt evenly. Different groups will have different capacities to adjust and some face specific barriers to reducing their emissions.

For example, people with disabilities may not have the same ability as others to use public transport without universal design and may not have the same range of low emissions vehicles that would meet their needs. People in this position may be excluded from climate policies that encourage emissions reduction and could simply impose higher costs on them.

The Government is developing an *Equitable Transitions Strategy* as part of its emissions reduction plan. A good equitable transitions strategy will identify groups who face specific barriers to reducing emissions and target policies to them and their particular needs, to help avoid disproportionately burdening them.

The impacts of emissions pricing are likely to be moderate but could be inequitable if improperly managed

In *Ināia tonu nei,* we highlighted the importance of a transition that is well-paced, well-planned, well-signalled, and co-designed for ensuring equitable and sustainable outcomes. In many cases, good policy design and implementation can reduce the risks of inequitable impacts. However, some important and well-designed climate policies may still present a higher risk of inequitable impacts. Addressing these risks requires specific consideration and management to ensure a fair, inclusive, and equitable transition.

The emissions price in the New Zealand Emissions Trading Scheme (NZ ETS) affects total household costs. With support from the Treasury, the Commission has analysed the impacts of the emissions price on households as part of its 2022 NZ ETS Settings Advice as shown in **Table 6.1**.[61]

This modelling assumes that consumer behaviour does not change in response to price, low emissions alternatives are not taken up, no additional measures are introduced to manage the impacts, and that the economy remains the same. It is therefore not a projection of impacts – this would be an inappropriate use of this data. Instead, it gives a snapshot of *relative* potential impacts across a range of emissions prices under this NZ ETS. This helps to identify what groups might be exposed in the short-term by a change in emissions price.

For lower income households, our analysis estimates that a $50 increase in the price of a New Zealand Unit[xvi] (NZU) could result in a median change in absolute weekly household spending on food and fuels by around $3.30/week. This is 0.56% of disposable income.[62]

For higher income households, a similar increase could result in a median change in absolute weekly household spending on food and fuels by around $7.30/week. This is 0.18% of disposable income. This impact is, therefore, inequitable in that the increase for lower income households is a larger share of their disposable income.

Additionally, because of the upfront costs and split incentives for renters, it is generally easier for higher income households that are owner occupied to reduce their emissions than lower income households and renters. This means higher income households can more easily reduce their exposure to NZU price increases, further contributing to the inequitable impacts of emissions pricing on its own.

Table 6.1: Modelled median change in household expenditure on food and fuel for a $50/tonne increase in NZU price in dollars per week and as a percentage of household disposable income assuming no behavioural or technological change[63]

Emissions price ($/tCO$_2$e)	Quintile 1 (low-income households)	Quintile 2	Quintile 3 (middle-income households)	Quintile 4	Quintile 5 (high-income households)
For a $50 change in NZ ETS price					
$/week	$3.30	$5.00	$5.90	$6.40	$7.30
% of disposable income	0.56%	0.42%	0.35%	0.29%	0.18%

The risk of inequitable impacts on households can be managed

For the low emissions transition is to be fair, inclusive, and equitable, the risk of inequitable impacts of climate policies – particularly emissions pricing – need to be managed.

The Commission has previously recommended the Government use complementary policies to address equity issues and distributional impacts rather than suppressing the emissions price.[64] Emissions prices are a key part of the Government's emissions reduction plan, so muting the pricing signal will require more reductions from other policies or risking harm to intergenerational wellbeing by failing to meet emissions budgets.

Increased costs for the poorest can be met through the existing welfare system

The Government is developing its *Equitable Transitions Strategy*, which aims to address many of these equity issues, and identify the targeted policies to support people to reduce their emissions.[65] The Government recently rejected the Commission's advice to increase the price control triggers in the NZ ETS, citing the *Equitable Transitions Strategy* still being developed and the potential impact on household costs.[66]

[xvi] Each NZU is equivalent to one tonne of emissions.

There are actions than can be taken even while the *Equitable Transitions Strategy* is being developed. For example, providing increased income support to low-income households using the existing welfare system can more quickly address current issues and act as a bridge to a longer-term strategy to mitigate these effects. Recent initiatives like the COVID-19 support payments and half-price public transport show that the Government can act fast to counter cost of living impacts.

Increased income support has been flagged as an action in the Government's first emissions reduction plan.[67] This has a low administrative burden, and there are many different options with different reaches and distributional impacts. The Winter Energy Payment is one scheme intended to help those who may be impacted by higher energy costs over the winter.

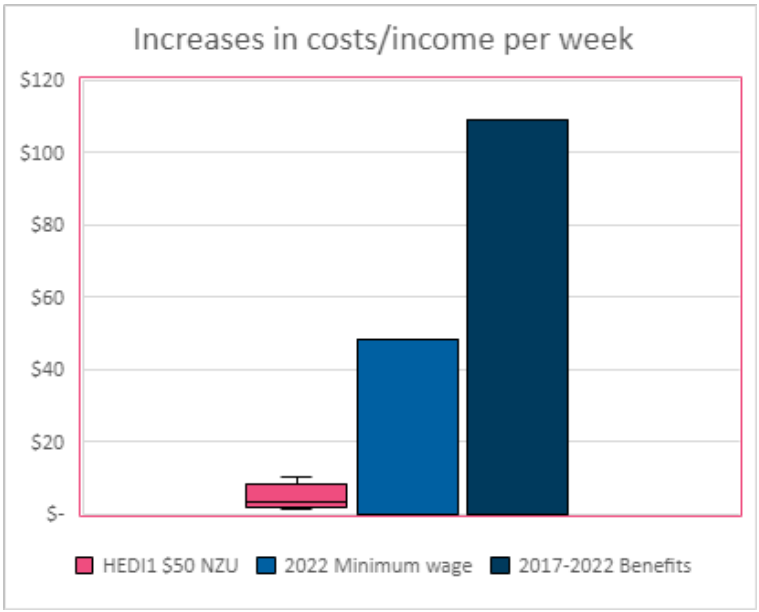
Figure 6.2 compares the impact of changes in the NZU price with increases in minimum wages and benefits in the welfare system.

If the NZ ETS price rose by $50/tonne the median household spend on food and fuel would increase by about $5.90 per week, and that of a low-income household would increase by about $3.30 per week. In contrast, New Zealanders on the main benefits are better off in 2022 by an average of $109 per week compared with 2017.[68] The increase to minimum wage in 2022 was $48 per week before tax for someone working 40 hours per week.[69] The minimum wage increase in 2023 will be a further $60 per week.[70]

This shows that the impact of changes in the NZU price are much smaller than these broader increases in income from wages and the welfare system.

While these increases in main benefits and the minimum wage are addressing more cost pressures than just those from the change in NZU price, they illustrate how the impacts of the NZ ETS on low-income households could be managed through existing levers.

Figure 6.2: Comparing cost increases for lowest disposable income quintile (HEDI1) of a $50 increase in the price of an NZU, the 2022 minimum wage increase, and the average increase in benefits between 2017 and 2022.



The pink bar shows the range of price increases faced by different households in the lowest income quintile, with a quarter of households facing a cost increase of less than the lowest point of the bar and half of households facing a cost increase somewhere between the top and bottom of the bar

Direct recycling of NZ ETS proceeds could make impacts progressive

Some stakeholders, political parties and commentators propose recycling some or all of the NZ ETS proceeds as payments to households. This could be an automatic mechanism to make the NZ ETS impacts progressive, and depending on the design, payments to low-income households could exceed cost increases.

Currently, NZ ETS proceeds are 'soft-recycled' through the Government's Climate Emergency Response Fund (CERF). The CERF is a dedicated multi-year budget intended to help fund the mitigation and adaptation programmes and actions needed to transition Aotearoa New Zealand to a low emissions future. The NZ ETS funds are not ring-fenced for CERF use, but the CERF is intended to at least match NZ ETS proceeds in size. Current criteria for using CERF funds includes "*address[ing] the distributional impacts of climate policy*",[71] which possibly could allow for payments to households.

There would be trade-offs, however, to using the CERF to redistribute NZ ETS proceeds to households, whether in part or in whole. Those funds would not be available for other climate-related measures such as investing in the transition or meeting adaptation needs.

Use existing tools rather than delay action

Weakening action on climate policy during times of adverse economic conditions – which climate change is only likely to exacerbate – is not sustainable and will greatly compromise the ability to meet the climate change targets in the Act.

Ultimately, a fair, inclusive, and equitable transition means pursuing in parallel issues of social and economic equity and tackling climate change. One set of issues cannot be used to justify inaction in the other. While the *Equitable Transitions Strategy* remains in development, there are multiple options to target support using levers and funding sources already available to government and we encourage the Government to make use of them.

Proposed recommendation

This proposed recommendation seeks to address the need for immediate action to both minimise the impacts of climate change and manage any risks of inequitable impacts.

Proposed Recommendation 7

We propose that the emissions reduction plan for the second budget period must:

7. Make use of existing mechanisms to manage impacts of climate policies in the interim, rather than delaying climate action.

Chapter 7: Agriculture

Introduction

One of the key tools for achieving the biogenic methane target will be an agricultural emissions pricing system. In *Ināia tonu nei*, we recommended that the Government commit to a pricing mechanism to incentivise on-farm emissions reductions. Since then, the Government has proposed a farm-level split-gas levy which is due to be implemented in 2025.

Implementation and the rapid advancement of this system are critical to achieving the biogenic methane target of a reduction to 10% below 2017 levels by 2030 and putting Aotearoa New Zealand on a path towards a 24-47% reduction by 2050 and beyond.

As agriculture transitions to become a lower emissions sector, it will also be important to use this opportunity to build resilience and provide co-benefits by adapting to climate change and enhancing other environmental outcomes such as improving water quality.

As farmers make these changes and respond to upcoming climate change and freshwater legislation, they would greatly benefit from trusted, well-resourced advisory and extension systems to support them. This will place farmers in a better position to seize opportunities to reduce emissions and help transition the sector.

Agriculture accounts for 91% of biogenic methane emissions and 94% of nitrous oxide emissions within Aotearoa New Zealand.[72] This represents approximately 50%[xvii] of the country's gross emissions. Reducing agricultural emissions will be crucial in meeting the biogenic methane and long-lived gas target set out in the Climate Change Response Act (2002) (the Act).

Farmers have already made progress in reducing emissions, but further changes will be needed if we are to meet the biogenic methane target.[73] There is an opportunity for Aotearoa New Zealand's agriculture sector to be global leaders in combatting climate change. With new technologies, some land-use diversification, and on-farm efficiency increases, the sector could achieve the target while limiting impacts on agricultural production.[74]

Safe food and animal welfare remain priority considerations, therefore new technologies will need to reduce on-farm emissions whilst maintaining food safety standards. These technologies are being developed all over the world. Pricing emissions will incentivise more technologies, faster development, and greater uptake. Streamlining the approval process for new emissions reduction technologies could help Aotearoa New Zealand to achieve its methane targets faster while limiting reductions in agricultural production.

An equitable transition will need to consider the impacts of policy implementation on rural communities. The agricultural landscape is continuously evolving, and this will be accelerated by the implementation of environmental and climate policies. It will be crucial to understand how different regions or communities are impacted by these and any future resulting land-use change.

Agriculture plays a significant part in the Māori economy; therefore, it is essential that policy is developed to reflect the unique characteristics of Māori collectively-owned land and to minimise disproportionate impacts on Iwi/Māori.

[xvii] When compared using the GWP100 metric

Sufficient resourcing allocated to further upskill Iwi/Māori advisors would improve the response to any new policies relating to agriculture. This approach must uphold Te Tiriti o Waitangi/The Treaty of Waitangi principles of partnership, active protection, participation, and equity, while also recognising the guarantee of rangatiratanga and kaitiakitanga.

Pricing agricultural emissions

In 2022, the Government released its proposal for an agricultural emissions pricing system.[75] The proposed system is based on the farm-level split-gas levy designed by He Waka Eke Noa, the Primary Sector Climate Action Partnership.

Emissions from agricultural activities are legislated to be priced from 1 January 2025. As an interim measure, the Government has proposed a simplified, basic farm-level system. It is critical this be advanced quickly in the second emissions budget period to a more detailed pricing system to create more long-term incentives to reduce emissions.

Box 14.1 Agricultural emissions pricing

The 'Pricing of Agricultural Emissions' report was prepared by the Minister of Climate Change and Minister for Agriculture in late December 2022 to meet the requirements of Section 215 of the Climate Change Response Act. The report outlines a system to put a price on emissions from agricultural activities as an alternative to the New Zealand Emissions Trading Scheme (NZ ETS).

The Government is proposing a farm-level split-gas levy for agricultural emissions that would price emissions from biogenic methane and nitrous oxide (including from fertiliser) separately. The legal point of responsibility would be with the business owner and reporting could be done via a collective.

Payments would be available as incentives to reward the uptake of technologies and eligible sequestration. The NZ ETS would be reformed, and parties incentivised to conduct science and research to include new categories of sequestration.

Advancing towards a more detailed pricing system will be a key tool in meeting the second emissions budget and the 2030 biogenic methane target

In our 2022 report *Progress towards agricultural emissions pricing*, the Commission supported a farm-level pricing system (as opposed to having the point of obligation at the processor level) as the best approach to pricing agricultural emissions in the long term.[76] We also found that the system needs to have enough detail to recognise and incentivise the full range of mitigation options for farmers.

A detailed pricing system would recognise more inputs through on-farm emissions calculations, including fertiliser application methods used and grazing dates for different feed types, allowing the calculator to reflect more on-farm actions. Advancing the system to include more inputs would mean that the impacts of new emissions reduction technologies can be measured as they come online.

We heard through our initial engagement for this draft advice that farmers want more emissions reduction actions to be recognised under the pricing system. A detailed system would recognise and reward more emissions minimisation actions, allowing farmers to reduce emissions while limiting impacts on production.

It would also provide more choice about how to respond to price signals, enabling farmers to make decisions that best align with the wellbeing of the businesses.

It is crucial that agricultural emissions pricing is not delayed, as this would make it less likely for Aotearoa New Zealand to meet its climate targets. A basic farm-level system may provide a path towards a more detailed and effective system, but it is important that the system is advanced as soon as possible over the second emissions budget period.

Technologies for reducing on-farm emissions

Removing barriers to the deployment of emerging technologies that reduce agricultural emissions

Farm management changes such as adjusting stocking rates and managing supplementary feed and nitrogen inputs will be important to meeting targets, especially as they can be implemented now. However, the development of new technologies could result in significantly greater and faster emissions reductions.

The development of new technologies and practices which reduce on-farm emissions would give the agriculture sector greater flexibility in meeting the 2030 and 2050 biogenic methane target. If new technologies are successfully developed and widely adopted, it could allow Aotearoa New Zealand to achieve these targets while limiting impacts on agricultural production.

There are several emissions reduction technologies currently under development. Some, such as urease inhibitors, are already commercially available and widely used in Aotearoa New Zealand. Others, such as methane inhibitors, are yet to be formulated for pastoral use.[77]

The Government in Budget 2022 allocated $338.7 million over the next 4 years towards accelerating the research and development of new technologies to reduce agricultural emissions in Aotearoa New Zealand. A new Centre for Climate Action on Agricultural Emissions has been established with a Government-Industry joint venture that has made its first investment in developing a slow-release methane-inhibiting bolus.

While these technologies could have significant benefits, it is crucial that they do not negatively impact the environment or human and animal health. Aotearoa New Zealand's food safety system will need to ensure agricultural products are safe and trusted, while minimising barriers to the regulatory approval of new technologies.

Food safety regulation

It is critical that new technologies are safe, but getting approval can take time

The food safety system in Aotearoa New Zealand includes the Agricultural Compounds and Veterinary Medicines Act 1997 (ACVM Act), under which agricultural compounds are authorised for sale, and the Codex Alimentarius, which sets international health and trade standards for food.

Regulatory tools play a crucial role in ensuring agricultural products from Aotearoa New Zealand are safe and trusted in overseas markets. However, the system means that it takes time to get new technologies approved for widespread use.[78] Streamlining the approval process to ensure that new emissions reduction technologies can be approved faster will help achieve the second emissions budget and Aotearoa New Zealand's longer-term emissions reduction targets.

In the first emissions budget period, the Government committed to strengthening the role of research and development to get emissions reduction tools to farmers sooner and established a new Centre for Climate Action on Agricultural Emissions. It also committed to supporting clear and effective regulatory paths for agricultural emissions reduction tools, which included adding inhibitors as *"agricultural compounds*" under the ACVM Act.

Opportunities

Streamlining the process for introducing new technologies would have multiple benefits

Biogenic methane emissions are largely a function of the amount of feed an animal eats, so it can be challenging to reduce emissions without reducing production. Technologies such as methane vaccines or inhibitors would allow the sector to significantly reduce emissions while limiting impacts on production.

Minimising the lead time for emerging emissions reduction technologies would enable the sector to move faster in reducing gross emissions and give Aotearoa New Zealand the best chance of achieving its climate targets.

In *Ināia tonu nei*, the Tailwinds scenario found that developing and widely adopting new technologies like methane inhibitors, methane vaccines, and low emissions breeding could enable Aotearoa New Zealand to exceed the 2030 biogenic methane target and meet the more ambitious end of the 2050 biogenic methane target range.[79]

The Headwinds scenario assumes that slower changes in technology and behaviour change make it challenging to meet the 2030 and 2050 biogenic methane components of the 2050 target. Without new technologies, meeting the 2050 target range would likely require significantly lower agricultural production from livestock and more land-use change.

Agricultural emissions are set to be priced from 2025, and we heard through our engagement that the rollout of new technologies would allow farmers more options to respond to an emissions price. If the pricing system can include a range of emissions reduction technologies, farmers will be able to respond according to the characteristics of their farm and minimise financial impacts.

Some emissions reduction technologies like nitrification inhibitors could have environmental co-benefits, such as supporting water quality and biodiversity. These technologies could also align with the principles of Te Taiao and Tiakitanga under the He Ara Waiora framework.[80]

It is important that support is continued for mātauranga Māori-based approaches for reducing emissions

Mātauranga Māori can inform approaches that further reduce biogenic methane and nitrous oxide emissions over and above what is already in development. Bringing emphasis to these approaches could accelerate the transition for all farmers and lower costs.

Approaches led by Iwi/Māori will support all levels of Māori participation in the agriculture sector. Examples of these programmes can be seen at organisations like AgResearch, where a Māori Research & Partnerships Group has been established.

Building resilience in the agriculture sector

Diversifying land use can reduce emissions and provide other benefits

Diversifying agricultural land use has the potential to provide several benefits including reducing emissions, diversifying income, building climate resilience, and enhancing environmental outcomes.[81]

Many farmers have already reduced emissions by planting areas of pasture into cropland, allowing native bush to regenerate, planting on steep pockets of land, and planting along waterways in response to freshwater policy. These actions, forming mosaic land uses, have several co-benefits such as increasing biodiversity, water quality, soil health, and carbon capture and storage.[82]

In some places large-scale land-use changes from agriculture to forestry could offer higher profit per hectare while producing lower biological emissions.[83] However, there are multiple barriers and risks associated with whole farm conversions to forestry, including not achieving significant gross emissions reductions (this is addressed in *Chapter 10: Forests*). These concerns reinforce the need for the right tree to be planted in the right place for the right purpose.[84]

Beyond forestry, other land-use changes from agriculture to horticulture may increase profit while reducing biological emissions.[85] However, barriers such as lack of infrastructure, markets, access to water, skills, or labour, as well as unsuitable growing conditions limit the potential for this. Therefore, to enable different production types and land use diversification, gaps within supply chains need to be identified and addressed.

Investment in science will be required to identify suitable options for land-use diversification within individual landholdings on a regional basis. Suitable research areas include evaluations of a range of parameters such as commercial viability, water availability, soil properties, growing conditions and potential climate risks.

The agriculture sector is likely to experience impacts from extreme weather events and gradual changes in the climate

The National Climate Change Risk Assessment for New Zealand[86] stated that climate change will directly impact many industries including horticulture, viticulture, agriculture, and forestry through changes in climate variables, pests, and diseases.

Therefore, as landowners consider changing land use – especially large-scale land use change – regional climate change impacts and potential adverse outcomes require evaluation to avoid maladaptation. For example, widespread conversion from agricultural land use to forestry in some areas may result in increased risks including fires, destruction from debris during floods, and pest or insect predation. Opportunities will depend on shifts in labour markets, skills, and availability of resources.

Supporting producers to make changes

A trusted and skilled farm advisory system would help individual farmers make the changes that best suit their land and business. To create such a system, collaborating with farmers and industry in the design of advisory services will be critical.

To be in the best position to seize opportunities associated with transitioning the agriculture sector, farmers will require adequate support to reduce emissions.[87] Advisory and extension services provided through industry groups[88] provide farmers with knowledge and skills to identify possible changes to achieve improved economic, social, and environmental outcomes.[89]

Advisory services will be essential for enabling farmers to access information on low emissions practices and technologies, and to better understand which options would be most effective and appropriate for their specific business. As new technologies become available, it will be critical to support and enable uptake at farmer and grower level, translating research and science into on-farm action.

Aotearoa New Zealand's agriculture sector has a diverse range of farm types, geography, climate, and farmers. Therefore, multiple methods of advisory services and training will be required to support decision making and changes at the farm level.[90] There are a range of advisory approaches and ways farmers get information, such as through rural professionals, sector bodies, demonstration farms, rural media, catchment groups, and formal and informal networks.[91]

Research shows farmers respond to peer-to-peer learning and farmer or regionally-led groups, using them to understand what other farmers are doing and talk about the benefits, challenges, and technical details of lowering their emissions.[92] In addition, utilising demonstration hubs and farms to display science and research on-farm was shown to increase confidence in low emissions strategies and emissions reduction technologies. Demonstrations enable farmers to access strong evidence of success before making a change themselves.[93]

Environmental legislation designed cohesively will minimise the administrative burden on farmers

Through our engagement we also heard that upcoming environmental legislation may place a large administrative burden on farmers. Reporting and planning requirements for agricultural emissions pricing and freshwater farm planning will both be introduced over the next few years. While it is important that there are enough skilled farm advisors available to help with these requirements, environmental legislation designed cohesively will minimise the administrative burden.

Services co-designed with Iwi/Māori will be necessary to ensure an equitable transition

Māori collectively-owned land faces unique constraints and challenges compared to general freehold title land ownership and management structures.[94]

There is evidence that the mainstream models of agricultural education, training and advisory services are not fit-for-purpose for Iwi/Māori needs.[95] Therefore, sufficient investment in programmes and advisory services that focus on the specific needs of Iwi/Māori landowners will be necessary to ensure an equitable transition which avoids disproportionate impacts.

Investment in training and upskilling the workforce will be crucial in the transition to a low emissions sector

The impacts of climate change are already being felt across Aotearoa New Zealand's agriculture sector, with the frequency and intensity of extreme weather events such as flooding and drought likely to increase in different regions.[96] As the agriculture sector is directly exposed to the changing climate, it is important to upskill regional advisory services to inform farmers of climate risks and adaptation options.

Future advisory services can build on the services and networks that already exist to avoid duplication. This will improve integration with other advice and training farmers are receiving on outcomes like productivity, water quality, biodiversity, and soil health.

Existing education, training, and advisory programmes will also need to be scaled up to meet the growing demand for these services, which will be critical for supporting farmers to transition to a low emissions sector.[97]

Experienced farm advisors are currently in short supply, and difficulties in attracting and retaining employees mean that the industry is struggling to grow.[98] Therefore, investment in upskilling rural professionals and extension and advisory services is equally important to enabling farmers to reduce agricultural emissions.

Impacts on rural communities

There are multiple pressures contributing to land-use change away from sheep and beef farming. We have heard through our engagement that in areas where sheep and beef farming generates a lot of jobs, land-use change may have wider impacts on communities.

Identifying the impacts on rural communities and other flow-on effects will help support an equitable transition towards a lower emissions agriculture sector. Land-use change has many drivers

Key drivers of land use change include:[99]

- economic factors such as profit, commodity prices, capital, interest rates and markets, and availability of labour
- biophysical factors such as soil type, topography, climate
- regulation and technology
- the objectives of the land manager.

Over recent years, the relative profitability of forestry when compared to extensively farmed sheep and beef has increased. This is in part driven by product prices and in part by climate incentives for forestry. Where livestock is farmed more extensively, there may be fewer management practices and technologies available to reduce emissions without reducing production. This means agricultural emissions pricing will likely further push this dynamic away from sheep and beef farming.

Land-use change has impacts on rural communities

The Commission has heard that rural communities in some farming regions will experience flow-on effects of land-use change to forestry. Land-use change may impact the availability of sheep and beef farming work, and permanent carbon forestry may not generate enough permanent local jobs to replace it.

The Commission has heard that fewer employment opportunities could in turn impact the population of rural communities and reduce expenditure in other businesses. The viability of institutions such as schools could also be impacted if there are not enough pupils.

Land-use change could also disproportionately impact Iwi/Māori. Around 24% of Māori collectively-owned land is farmed in sheep and beef.[100] It is also more likely to be steeper and less versatile. Such land is often less agriculturally productive per hectare and therefore more likely to be bought out by forestry interests.[101]

Land-use change from sheep and beef farming into forestry is unevenly distributed across the country and will impact different regions in different ways. To manage an equitable transition, it is important to understand where the impacts will occur, and how the rural communities in these areas could be affected. The *Equitable Transitions Strategy,* co-led by the Ministry of Business, Innovation and Employment and the Ministry of Social Development, will be a key vehicle for ensuring an equitable transition.[102]

Proposed recommendations

These proposed recommendations seek to address the policy gaps identified above and to help enable Aotearoa New Zealand to meet the second emissions budget and its longer-term emissions reduction targets.

Proposed Recommendation 8 and 9

We propose that the emissions reduction plan for the second budget period must:

8. Enhance advisory and extension services to farmers to enable them to respond to pricing and accelerate the adoption of emissions-efficient practices, appropriate land-use diversification, and emerging technologies to reduce gross emissions. These services should be co-designed and implemented in partnership with industry and Iwi/Māori.
9. Advance the agricultural emissions pricing system to:
    a) enable recognition of a broader range of emissions-reducing practices and technologies
    b) incentivise gross emissions reductions in line with the 2050 target.

Chapter 8: Built Environment

Introduction

Urban form, infrastructure, and buildings are part of the solution to reducing emissions and adapting to climate change

The way cities, towns, and communities are designed affects emissions from land use, transport, buildings, energy, and waste. Emissions are generated throughout the lifecycle of infrastructure and buildings. The built environment has a secondary effect on emissions and the transition too. For example, the type of transport infrastructure people have access to will impact their ability to reduce their emissions.

The results from changes made to reduce emissions related to built environments often have long lead times. Impacts from decisions and changes made today are not always immediately evident. Te Waihanga Infrastructure Commission released its 30-year infrastructure strategy in 2022, setting out sustained actions that can meaningfully reduce emissions.[103] It specifically highlights enabling net zero carbon emissions – through a combination of increased clean energy generation capacity, reducing emissions from the infrastructure sector, and building attractive and inclusive cities.

Not only will decisions across urban form, infrastructure, and buildings impact our emissions, they can also enables us to adapt and be more resilient to the current and future impacts of climate change. Aotearoa New Zealand has a high exposure to natural hazard risks and much of our built environment is in vulnerable coastal and lowland locations. Continued climate change impacts will put coastal infrastructure, buildings, and land at risk. The impact of Cyclone Gabrielle on lives, homes, and infrastructure has been extensive. It highlighted the country's increasing reliance on electricity, and how important it is for that infrastructure to be resilient in the face of increasingly wild weather.

In addition to the clear benefits in emissions reductions, the right policy settings offer the chance to deliver sustainable transport modes, greater social equity, and lower energy consumption.[104]

This chapter provides advice and proposed recommendations on how well-integrated policy, planning, and funding frameworks related to the built environment can help to meet the second emissions budget and enable Aotearoa New Zealand to achieve its longer-term climate targets. This includes weaving mātauranga Māori into decision-making frameworks and increasing understanding of the impacts of urban form and infrastructure development on Iwi/Māori communities and their taonga tuku iho, whenua, and taiao. Refer to *Chapter 5: Whāia Ngā Tapuwae* for additional discussion on appropriately resourcing Iwi and Te Ture Whenua entities.

Urban form

Urban form has numerous links to emissions, but the most significant links are through buildings, infrastructure, and transport

Table 8.1: Examples of emissions sources linked to urban form

Emissions source	Example
Transport energy	Petrol and diesel use in vehicles
Infrastructure embodied carbon	Transport and utilities infrastructure materials, and construction energy use
Building energy	Fossil gas cooking and heating, electricity
Building embodied carbon	Concrete, steel, timber

Consumption-based emissions accounting is not used in Aotearoa New Zealand's Greenhouse Gas Inventory. Accounting for international and domestic greenhouse gas emissions reporting is done using a production-based accounting system, in line with international practice. However, when decisions are made in the design and build of infrastructure, considering the whole-of-life of that piece of infrastructure can reduce system-wide emissions and contribute to a more circular economy. For more discussion on the circular economy, refer to *Chapter 15: Circular Economy and Bioeconomy*.

Box 8.1: Emissions in the built environment

Operational emissions occur during the use stage of a building. They stem mainly from the energy required to heat and cool a building, to heat water, for cooking, and to power devices plugged in at the wall.

Embodied emissions stem from the materials and products the building or piece of infrastructure is made from, the construction process itself, construction waste disposal, maintenance and refurbishment throughout the infrastructure's life, and final disposal of the infrastructure at the end of its life.

Upfront emissions refer to the embodied emissions up to the point of practical completion, but excluding maintenance, refurbishment, and building end-of-life.

The way cities and towns are shaped impacts emissions across land use, transport, buildings, energy, and waste

Urban form refers to the physical characteristics that make up urban areas, including the shape, size, density, activities, and configuration of settlements. Making changes to how Aotearoa New Zealand approaches and shapes urban form can reduce emissions and strengthen climate change resilience. The rate of change will likely vary across different sizes of urban areas, influencing the pace and scale of emissions reductions that can be achieved.

Two of the main aspects that shape urban form are transport and development. Transport investments can drive urban development, and urban development can influence transport investments in response. What

results is an urban form that can be classified as people-oriented (dense and well-connected) or car-dependent (low density and vehicle-dependent).[105] Spatially planning urban developments in a way that helps reduce emissions can support meeting emissions budgets.

Transport investments that reduce emissions can also reduce total vehicle-kilometres-travelled (VKT). The Government has set a goal of reducing light fleet VKT by 20% by 2035 through improved urban form and providing better travel options, particularly in large urban areas. These changes can help incentivise people to shift to using public transport, the rail network, walking, and cycling, meaning they travel less in cars.

Transport investments such as road and highway improvements can also lead to higher emissions, both from development itself and the choices it incentivises people to make.[106] The Government has also announced multiple such transport projects that will increase emissions and make it more difficult to meet emissions budgets. Refer to *Chapter 11: Transport* for additional discussion.

Urban development and expansion have resulted in significant demographic, social and cultural change for Māori

Most places in Aotearoa New Zealand were built around or on top of existing Iwi/Māori settlements. In addition to involuntary land acquisitions and seizures, many rural Iwi/Māori environments were gradually subsumed within an expanded urban boundary as settlements and towns evolved into cities. The Māori ethnic population currently represents a significant proportion of the urban population. Between the 1960s and 2010s, the percentage of Māori living in urban areas increased by more than 20%, driven by manufacturing booms and higher wages in cities, population pressures on sparse rural resources, and targeted government relocation programmes.[107]

Urbanisation can result in cultural dislocation with impacts on important aspects of te ao Māori including whakapapa and whanaungatanga. It will be important for urban planning and design to fulfil obligations under Te Tiriti o Waitangi/The Treaty of Waitangi and to weave mātauranga Māori into the decision-making framework to increase understanding of the impacts of urban form on taonga Māori, Māori communities, and Māori values.

Existing urban form in Aotearoa New Zealand is not compatible with our climate challenges

Post-colonial urban planning in Aotearoa New Zealand has followed a model to suit what is described as the "quarter-acre dream". This emphasised standalone homes with sections as the main residential development type. This has created sparsely populated residential areas that continue to expand urban boundaries, even in the largest centres.[108]

When measuring urban form, the '7Ds' can be used to understand system outcomes. They are design, distance, density, diversity, destination accessibility, demand management, and demographics.[109] These factors drive emissions reductions when used for effective street and infrastructure design. For example, design can enable shorter distance to transit, higher density, higher land-use diversity, higher destination accessibility, and complementary demand management measures, informed by an understanding of demographic needs and behaviours.

Together the 7Ds can result in "density done well." Combined with other emerging knowledge, like the Parliamentary Commissioner for the Environment's report *Are we building harder, hotter cities? The vital importance of urban green spaces*, policy direction can be set which enables emissions reduction, climate risk reduction, and co-benefits.[110]

High density urban development reduces emissions from urban form, but density needs to be in the right places.

International studies have demonstrated that denser urban forms result in significantly fewer overall emissions – including embodied, enabled, and operational emissions.[111] These studies show that greenhouse gases per person in high density areas measured less than half of those in low density areas.[112] Operational emissions from energy use – for either transport or buildings – are much more significant than embodied emissions, though embodied emissions should not be underestimated.[113]

It is important, however, that density does not occur in areas susceptible to natural hazards and the impacts of climate change. For example, increasing density in areas prone to flooding and sea level rise increases the risk that those communities will suffer loss and incur more costs in the future.

Transport and urban development in Aotearoa New Zealand are not well linked, as the funding and planning systems are completely different

When undertaking a land transport project, planning responsibility is determined by the type of transportation being developed. While much of the planning occurs at the local government level, state highways sit at a central government level, public transport sits at a regional council level, and other land transport modes rest with local councils.

The majority of urban development, however, is planned and undertaken by the private sector working with local government as a regulator, either at the regional or local council level. This fragmentation does not lend itself to whole-of-system outcomes like emissions reduction. Additionally, Aotearoa New Zealand's transport and development markets both operate primarily on a one-off basis. In Auckland, for example, there are separate entities for the City Rail Link (the country's largest ever infrastructure project) and Auckland Light Rail.

To improve emissions reduction potential, transport and development projects for an urban area could be implemented on a consistent and coordinated network basis – as opposed to standalone corridors.

Current financing structures are not well integrated, which overwhelms the capacity to pay for transport and urban form improvements

Financing of infrastructure, particularly at the local government level, has been a significant challenge. The political economy of assessing rates for the level of funding required is difficult. Rates have been historically low compared to many international jurisdictions[114] and Aotearoa New Zealand has not fully explored options like land-value capture to fund infrastructure, which have been used effectively in places like London, the Gold Coast, and Curitiba, Brazil.[115]

To deliver a denser, more mixed urban form through transport and urban development would require planning integration, delivery integration, and access to all four key types of funding – existing central government funding mechanisms, existing local government funding mechanisms, existing private funding mechanisms, and novel Government funding.

Restrictive land-use policies can add cost, time and complexity to projects and prevent climate-resilient design

Urban form and developments are influenced by local government policies, including zoning and land use, building regulations or ordinances, covenants, and procurement policies. Design decisions would in turn determine construction methods and materials (embodied emissions) and thermal performance (operational emissions).

The Government could ensure that local and national land-use policies, as well as other land-use instruments, do not impede or conflict with emissions reduction and climate change adaptation activities.

Proposed recommendation

This proposed recommendation seeks to address the misalignment between existing urban form and Aotearoa New Zealand's emissions reduction targets.

Proposed Recommendation 10

We propose that the emissions reduction plan for the second budget period must:

10. Implement an integrated planning system that builds urban areas upward and mixes uses while incrementally reducing climate risks.

Infrastructure

Infrastructure is part of the solution when reducing emissions, but it also produces and enables emissions

Infrastructure lays the foundation for Aotearoa New Zealand to thrive and is a critical part of the solution to reducing emissions and adapting to climate change.

A growing and more urban population affects the need for new or strengthened infrastructure, against a historical infrastructure deficit. Meeting the country's 2050 target requires an energy and transport system transformation enabled by high levels of investment in new infrastructure.

However, infrastructure can also be a significant cause of emissions. The emissions are associated with the material required to build it (such as concrete and steel), how it is built, and how it is maintained or decommissioned. Infrastructure design affects the emissions it enables or saves. For example, building more roads results in more cars on the road,[116] which (if petrol or diesel-fuelled) increases emissions.

Making use of existing infrastructure and making it more resilient to the effects of climate change reduces the pressure on resources.

Demand on the consenting system out to 2050 may exceed the likely ability of the system to respond in the short term

In the Commission's demonstration path, by 2035 annual energy and transport emissions reduce by over 12 $MtCO_2e$ relative to 2020 levels. Most of these emissions reductions will come from projects that have not yet been consented. Gross electricity demand is projected to increase 28% by 2035 and 68% by 2050, compared to 2020, as electricity is used to transform the transport and industrial sectors.[117] There will be distribution and transmission lines additions and upgrades, and renewable energy developments. In addition, around 40% of today's current renewable generation capacity will need to be reconsented during the second emissions budget period.

When new infrastructure is necessary, its development relies on the resource consenting system to run effectively and efficiently to build the infrastructure needed. Demand on the consenting system out to 2050 will be high, given the amount of infrastructure that needs to be built or reconsented.

Addressing resource constraints and the complexity of project approvals will reduce the demand each consent has on the system. Aotearoa New Zealand does not have unlimited personnel to manage the anticipated increase in consent applications. Under the current consenting system where consenting resources are constrained, between 29-34% of emissions targets will be in jeopardy by 2050.[118]

For additional discussion, refer to *Chapter 9: Energy and Industry* and *Chapter 11: Transport*.

Simplifying consenting for low emissions infrastructure, especially renewable energy and transport assets, will be necessary to achieve our 2050 emissions reduction target

The need for a more efficient consenting system is well understood. But its link to the importance of electrification, low emissions transport, and low emissions process heat for meeting our emissions reduction goals should not be underemphasised.

Infrastructure is essential to the transition and, because of its long-lived nature, essential to the intergenerational impacts the Commission is required to consider under the Climate Change Response Act. Currently it can take several years to gain consent. It is becoming increasingly costly, often requiring more resources to complete. While this is especially true for large infrastructure, it is also disproportionately onerous on smaller or local infrastructure projects.[119]

The largest legislative reform of the resource management system in 30 years is currently underway. This reform seeks to balance development with environmental and social outcomes, and to give effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi. The transition to the new resource management system is expected to take 10 years, extending across the second and third emissions budget periods. Any further delay, or ineffective reform, could make it unnecessarily difficult for Aotearoa New Zealand to consent the infrastructure needed to support its climate change goals.

Additionally, there are clear barriers to developing renewable generation under the existing resource management legislation, needing urgent resolution. These include the unresolved conflicts between the National Policy Statement for Renewable Electricity Generation (NPS-REG) and the National Policy Statement for Freshwater Management (NPS-FM). Aotearoa New Zealand's two largest hydropower generation schemes will require renewal of water permits within the next 15 years. They are likely to have to compete for water use, but the incomplete regulatory framework means the outcomes for the electricity system are uncertain.

Box 8.2: Progress on the reforms of the Resource Management Act

The Resource Management Act 1991 is currently undergoing a process of reform. This will split the Act into three pieces of legislation – the Natural and Built Environments Act (NBA), the Spatial Planning Act (SPA), and the Climate Adaptation Act (CAA). The reform intends to provide consistency, streamline current planning and consenting processes, and move to an outcomes-based approach rather than an effect-based system. It also will require decision makers to 'give effect to' rather than 'take into account' the principles of Te Tiriti o Waitangi/The Treaty of Waitangi.

The Bills for the SPA and NBA were introduced to Parliament in November 2022 with intention for the Acts to be passed into law in 2023. The CAA will be looked at separately, with its Bill to be introduced to Parliament in 2023.

The Commission made a submission on the Bill for the NBA. In the submission it was noted that some of the climate change outcomes may come into conflict with other outcomes. For example:

- Renewable electricity will play a key role decarbonising the wider energy system. New generation will need to be built rapidly to meet an increase in electricity demand. However, building new renewable generation, such as hydropower, wind and geothermal, can be at odds with other outcomes, such as the protection and restoration of waterways and Iwi/Māori rights and interests.
- How urban expansion takes place, where and what gets built, and how it is built can lock in emissions and increase exposure to climate impacts creating further path dependencies for development. Building urban areas upwards, rather than out, can allow residents to meet most of their needs within a short walk or bicycle ride from their homes. The outcome of making "ample supply of land for development" may encourage more building out, rather than upwards.

In our submission, we recommended the Government provide clear direction and approaches for balancing and resolving the conflicts between system outcomes.[120]

Buildings

How buildings are designed, built, used, and located will impact emissions and our ability to adapt to climate change for generations

Buildings are long lived, setting emissions patterns for the future and driving emissions in other sectors through demand for materials and fuels.

While emissions from the operational energy use of buildings account for about 4% of long-lived greenhouse emissions, they are estimated to account for about 20% of total greenhouse gas emissions through a consumption-based accounting lens.[121]

The Government's Building for Climate Change programme has started the process of addressing emissions from new builds. It is essential to continue and deliver on this commitment to high quality new builds. However, much work remains to achieve the same with the existing building stock.

Buildings are also exposed to inland flooding, sea-level rise (and associated groundwater rise), coastal flooding, extreme weather events, wildfires, and drought. The magnitude of loss from storms in Aotearoa New Zealand has increased over the past decade.[122] New buildings and settlements can be designed and built with a much higher level of adaptive capacity, to be tolerant to a wider range of climate and weather extremes.

Greater incentives are required to encourage uptake of low emissions options

Some of the technology required to make homes and businesses more energy efficient can be costly, and this is often a barrier to adoption – particularly for those on low incomes. Installing insulation, upgrading windows, improving weathertightness, and switching away from fossil fuel heating and cooking can improve health outcomes, reduce exposure to a rising carbon price, increase resilience to extreme weather events, and lower overall running costs, but come with upfront purchase and installation costs.

Lack of easily understood and relevant information for consumers, conflicting incentives between tenants and building owners, poor transparency of credible energy performance data, and limited awareness, skills, and capabilities of the sector can also prevent uptake of low emissions alternatives.

Retrofitting existing buildings can be complex

The condition and performance of existing buildings is highly variable and makes them more complex to address than a new building. There may also be an emissions trade-off between a deep retrofit of an existing building versus building a new, high performance and low carbon building.

Data from mandatory participation in energy performance programmes for existing commercial and public buildings could support design of options. A pilot programme for residential building retrofits could also inform design of a durable, long-term programme that meets the needs of New Zealanders.[123]

Existing buildings also have an inherently low level of adaptive capacity as buildings are generally designed to be long-standing permanent structures and are served by complex infrastructure systems. Enhancing adaptive capacity will require strong government leadership, governance, funding mechanisms, and community engagement.[124]

Electrification is essential for reducing emissions from building heating

Heat pumps have rapidly reduced in price, and costs are projected to continue to decline, even without the cost of carbon. Coupling heat pump installation with better insulation and improved weathertightness will immediately reduce the amount of energy required to heat or cool a home to the same temperature.

Reducing electricity demand through building thermal performance improvements can reduce the pressure to build new generation assets and network infrastructure. Transpower estimates peak demand could increase from 7.3 GW in 2020 to 8.9 GW by 2035 and 10 GW by 2050.[125] Building low or near zero emissions buildings now has been estimated to reduce electricity demand by over 8,000 GWh by 2050 compared to if only code compliant buildings are built.[126] Grid planning, time-of-use pricing, and demand-side measures could further help minimise peak demand growth.

Continued fossil gas use and asset expansion will add additional cost to consumers as well as raise equity issues for future generations

Fossil gas assets installed during the second emissions budget period could endure to 2050 and beyond, despite the fact that affordable low emissions alternatives are available now. Continued expansion of the fossil gas asset base may be incompatible with sustainable, intergenerational prosperity (mana whanake) if it locks tangata whenua and other households, communities, and businesses into this path. Electricity is a more efficient and lower emissions source of energy for heating homes and businesses than fossil gas.

While the total delivered volume of fossil gas has remained steady, the number of new connections to the network continues to grow. Many households, businesses, marae, and community centres use fossil gas for heating, cooking, and hot water. However, the use of fossil gas needs to decrease to meet the 2050 target.

Low emissions gases such as biogas or green hydrogen are currently more expensive than fossil gas. Putting new, low emissions gases through pipelines is also likely to require some reinforcement or replacement. The costs to do so will need to be recovered through users' bills as the gas network is a regulated asset base. A substantial decline in fossil gas use could mean that those left on the gas network could bear increasing costs as a high proportion of gas pipeline costs are fixed and must be recovered from the remaining user base.

Households are not best placed to manage the risk of economic stranding of gas pipeline businesses' assets or to support continued gas use by large industrial users. There are few levers for households to manage this risk and there are limits to absorbing any price increases, especially during periods of high inflation. For example, vulnerable groups like the elderly, medically vulnerable, or those with disabilities may be less able to change their energy demands or use patterns to manage costs.

The Government's *Gas Transition Plan* and *National Energy Strategy*, and the Commerce Commission's regulated investment framework, should provide clear strategic direction on the future of fossil gas and options for regulated cost recovery models for gas pipeline businesses which are equitable, give consumers time to transition, and support hard-to-abate industries.

Targeted support for retrofitting existing fossil gas infrastructure in residential and non-residential properties may be required

Replacing fossil gas infrastructure will be expensive for some households and businesses. Wealthier households and businesses may be more able to convert to electricity in response to the NZ ETS price signal or other factors, and have the time, resources, and capacity to access support. Targeted support should also address barriers for lower income households with limited financial capital and information, renters who have less autonomy, or small businesses with limited resources and capacity.

With initiatives underway to develop options to provide specialist advice and grants to support households and options to expand eligibility under the Warmer Kiwi Homes programme, it may be possible to implement support by the start of the second emissions budget period, if not earlier. Ensuring compliance with the Healthy Homes Standard is also important.

There are currently limited incentives or requirements for building owners to undertake retrofits given the upfront capital costs associated with the equipment and installation. Targeted support could include expanded co-funding for small-to-medium sized businesses through the Energy Efficiency and Conservation Authority or potential financial incentives for building owners to undertake building retrofits where practical.

The Government could help drive this shift and underpin market demand by leveraging its procurement power through mechanisms like Kāinga Ora or the Carbon Neutral Government Programme.

Proposed recommendations

These proposed recommendations seek to address the need for stronger low emissions incentives and to help enable Aotearoa New Zealand to meet its second emissions budget and longer-term emissions reduction targets.

Proposed Recommendation 11

We propose that the emissions reduction plan for the second budget period must:

11. Incentivise comprehensive retrofits to deliver healthy, resilient, low emissions buildings.

Proposed Recommendation 12

We propose that the emissions reduction plan for the second budget period must:

12. Prohibit the new installation of fossil gas in buildings where there are affordable and technically viable low emissions alternatives in order to safeguard consumers from the costs of locking in new fossil gas infrastructure.

    The restriction on gas connections is intended to include:
    - New buildings, whether in new subdivisions or in existing centres where gas is piped
    - Network piped gas and delivered LPG bottles

    It is not intended to include:
    - Connecting new gas appliances, even where they have reached end of life and need to be replaced
    - Industrial connections
    - LPG barbeques
    - Camping gas canisters

    There is a need to exercise pragmatic judgment here; commercial cooking does not have a good alternative at the moment, or isolated properties or marae may need bottled gas for heating and cooking.

    Electric and induction technologies should be encouraged and incentivised pragmatically and ambitiously.

Optimising building design through improved data access, standardised methodologies, and upgraded regulations and guidelines will assist with achieving low emissions construction

Low carbon and low cost or cost-neutral building construction can be achieved through deliberate optimisation and better design. Credible and accessible data, standardised approaches, and easy-to-use tools will be critical to ensuring the sector can deliver on key outcomes.[127]

Government leadership through its Carbon Neutral Government Programme, Construction Sector Accord, the Building for Climate Change programme, and procurement policies will be important in setting a clear and ambitious pathway.

Box 8.3: Distributed energy resources and buildings

Distributed energy resources (DER) are controllable energy resources, located in the distribution network or within consumer premises. They include battery storage, EVs, demand response/demand side participation, and distributed generation like solar photovoltaics and small-scale hydropower generation.

DER can operate quickly and flexibly, which could help manage the electricity system by offsetting the need for grid supply, network capacity, or new generation. While different DER have different capabilities, together they can support grid resilience by providing back-up power and improving system flexibility.

For distributed generation to support community resilience during extreme weather events, the systems must be designed to withstand storm conditions. For example, high winds and flooding could damage solar PV system conduits, inverters and electrical cabinets through high pressure loads and water ingress. Adequately designed and constructed systems can be reasonably expected to provide a full 25-year service life.

Having a back-up power system (e.g., solar PV plus battery storage) on community buildings such as marae, recreation centres, community halls or schools can reduce the buildings' energy demand, lower energy bills, support energy awareness and education, and provide services during power outages or emergency situations.

Other DER like electric vehicles with bi-directional charging capabilities (vehicle-to-grid or V2G) can also provide back-up power support for households in emergencies or help to manage peak demand. Refer to *Chapter 11: Transport* for additional discussion.

Increasing use of timber products in buildings can reduce embodied emissions

Engineered wood products (EWPs) such as laminated veneer lumber, glulam, and cross-laminated timber can displace some steel and concrete used in building construction. Increasing use of EWPs may require a corresponding increase in domestic consumption of logs. This could be an opportunity to diversify the forestry and wood processing sector as part of an emerging bioeconomy. Refer to *Chapter 15: Circular Economy and Bioeconomy* for additional discussion.

A clear compliance pathway for using EWPs and an understanding of how to develop code compliant designs that would be accepted by consenting authorities would be beneficial. This includes knowledge and education for the designers as well as the consenting officials and territorial authorities.[128]

Papakāinga development can support Iwi/Māori aspirations and connection to whenua

Some whānau are collaborating in papakāinga housing developments, for example through the Parihaka Papakāinga Trust or Kōkōhīnau Papakāinga Trust. From a land development perspective, papakāinga are generally considered to be communal housing and facilities on ancestral land owned by Māori-collectives. The Kōkōhīnau Papakāinga Trust's mixed housing community development near Edgecumbe will be made up of 34 houses with shared facilities, wraparound services, and connection with the marae next door. Each house will be fitted with a heat pump and a solar PV plus battery system.

Government support through the Māori and Public Housing Renewable Energy Fund and the Energy Efficiency and Conservation Authority can further help Iwi/Māori-collectives develop papakāinga and renewable energy projects to offset energy bills and support community cohesion. Other initiatives that consider circumstances specific to Māori communities are also beneficial. For example, the Whai Kāinga Whai Oranga fund through Te Puni Kōkiri and the Kāinga Whenua Loan Scheme through Kāinga Ora and Kiwibank.

Chapter 9: Energy and Industry

Introduction

Energy supply and industrial emissions are considerable and need to significantly reduce in the second emissions budget

Energy supply emissions are from the generation of electricity, and from the production and distribution of fossil fuels. In 2020 the combustion of coal, fossil gas, and diesel in thermal power plants contributed 4.6 $MtCO_2e$, and fugitive emissions from geothermal plants contributed 0.6 $MtCO_2e$. Producing and distributing fossil gas caused 1.0 $MtCO_2e$ of emissions through fugitive methane leaks from pipes, the carbon dioxide vented and flared from wells, and from own use for energy. Additionally, refining oil into petrol and diesel fuel released 0.7 $MtCO_2e$ of emissions in 2020, but the country's sole refinery converted to an import-only terminal in 2021.

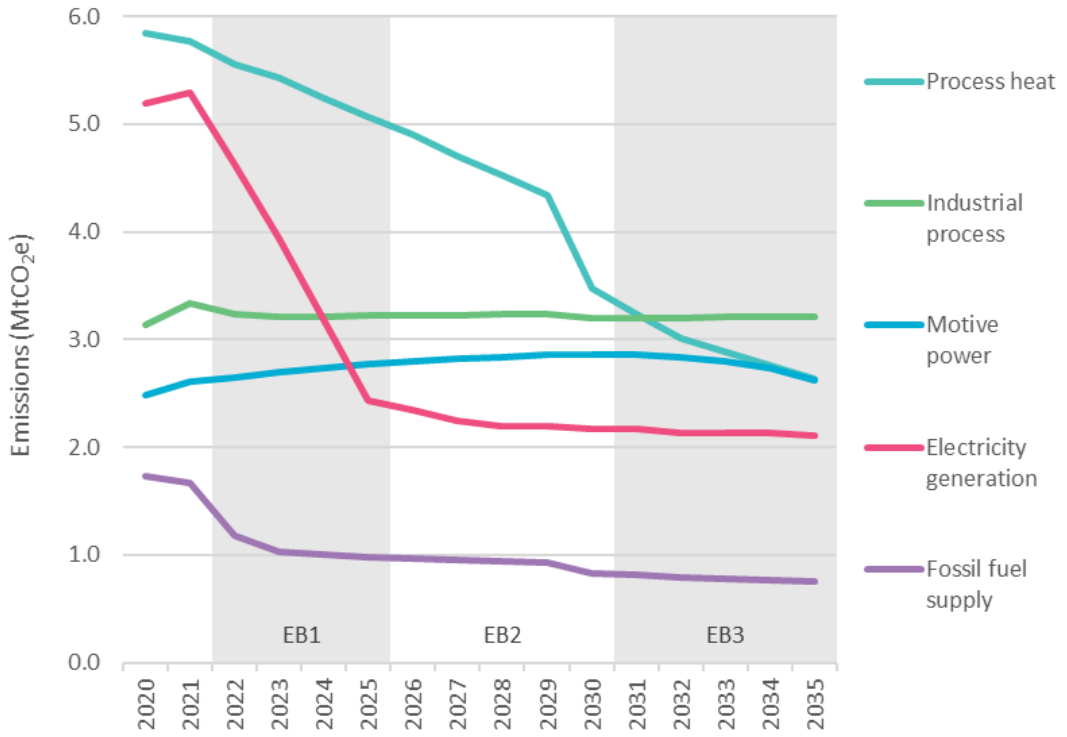
Industrial emissions come from the combustion of fossil fuels for energy and the chemical reactions which occur in industrial processes. Fossil gas and coal are combusted in boilers, burners, and ovens for process heat in sectors such as food processing and wood pulp and paper production. These low temperature applications released 3.9 $MtCO_2e$ of emissions in 2020. Higher temperature process heat applications, such as the production of chemicals, released 2.0 $MtCO_2e$. Petrol and diesel use in off-road vehicles and machinery for motive power in the agriculture, mining, construction, and other industrial sectors caused 2.5 $MtCO_2e$. Industrial process emissions come primarily from the production of cement, steel, and aluminium, which contributed 3.1 $MtCO_2e$ in 2020.

Energy supply and industrial emissions totalled 18.4 $MtCO_2e$ in 2020. The Government set a sub-sector target for energy and industry emissions which averages at 14.6 $MtCO_2e$ per year for the second emissions budget,[xviii] based on the Commission's demonstration path. An updated version of this (**Figure 12.1** below) is used here to show the action required to meet the first, second, and third emissions budgets.[xix]

[xviii] The Government includes emissions from residential and commercial sectors in its energy and industry sub-sector target, whereas in this report they are included as building emissions and are discussed in *Chapter 8: Built Environment*.

[xix] The update to the demonstration path was made for our NZ ETS settings advice in 2022. Amongst other changes, it assumes that the aluminium smelter at Tiwai Point continues to operate beyond 2024 and reflects the conversion to an import terminal of the oil refinery at Marsden Point.

Figure 9.1: Demonstration path emissions projections of energy supply and industrial emissions.



Source: Commission analysis

Note:

1. Projections are from the 2022 update to demonstration pathway published with our NZ ETS settings advice.[129]

Renewable electricity generation build needs to scale up quickly in order to reduce electricity generation emissions and support electrification of transport and heat. However, policy settings and other factors are creating investment uncertainty and delaying build. The current consenting system is complex, onerous and time consuming. If policy uncertainty and barriers within the consenting system are not addressed, it may be difficult to meet emissions budgets because renewable generation build will be delayed and electrification could be more expensive than it otherwise would be.

There are wider barriers (engineering, technical constraints, workforce, etc) that need to be addressed to reduce industrial emissions. While the Government has focused on capital cost barriers in low to medium temperature process heat to date, there are opportunities for further emissions reductions if policy support was in place.

Building renewable generation can cut electricity emissions in the first emissions budget, and maintaining build during the second and third budgets will keep the system low emissions

During the first emissions budget period, emissions from electricity generation need to be reduced dramatically by eliminating the use of fossil gas and coal for baseload electricity generation – generation which operates most of the time. Geothermal and hydro generation can provide this sort of steady supply at lower cost and with less emissions. Increasing wind and solar generation can reduce the portion of the year where fossil generation is required, and flexible gas and hydro generation can provide support during periods of intermittency.

There are several large renewable generation projects currently being built. The Tauhara geothermal power plant and the Harapaki and Turitea wind farms will displace around 2.2 TWh of fossil gas or coal generation per year, avoiding over 0.9 $MtCO_2e$ of emissions per year. In our demonstration path, new generation which contributes a further 2.0 TWh per year is completed by the end of the first emissions budget period.

The build of renewable generation needs to continue into the second and third emissions budgets to minimise the use of fossil gas generation and to meet new demand from transport electrification, heating, and industrial load. In our demonstration path, during the second emissions budget period new renewable generation which contributes around 5.0 TWh per year is completed. This is more than twice the generation currently being built, indicating that a ramp up of generation build needs to take place between now and the end of the second emissions budget.

Significant decarbonisation can occur in low to medium temperature process heat during the first and second emissions budget periods

For the coal used in industrial boilers, our demonstration path showed a 30% reduction by 2025 and 61% by 2030 relative to 2020 levels. The use of coal as a boiler fuel is concentrated at a number of large industrial sites, and the 2030 reduction could be achieved if all 17 dairy product manufacturing sites in the South Island converted to biomass or electricity.[xx]

Fossil gas used in low to medium temperature process heat also needs to reduce during the first two budget periods. Our demonstration path showed an 11% reduction in fossil gas consumption by 2025 and 26% by 2030, relative to 2020 levels. Some reductions can be achieved by improving energy efficiency, but some fuel switching to biomass or electricity will also be required.

Emissions reductions might be achievable in other sectors as well

Our demonstration path assumes limited availability of technology and high costs for decarbonising other sectors. No technology breakthroughs were assumed to reduce emissions in industrial processes or high temperature heat. For motive power, only 12% of new purchases of off-road vehicles are electric by 2030 under the demonstration path, and low-carbon liquid fuels make up 1.9% of supply.

Aotearoa New Zealand's energy transition is taking shape

There is a wave of energy policy development currently underway. The Government committed to developing an energy strategy in its first emissions reduction plan to provide long-term direction for an energy system transition. This is due to be completed in 2024 and it will bring together the *Gas Transition*

[xx] There are many other industrial sites using coal in boilers, including in the North Island and the exact sequencing of switching from coal is not critical.

Plan, the *Hydrogen Roadmap*, the NZ Battery Project, and the *Decarbonising industry plan*, all of which are currently under development.

The New Zealand Emissions Trading Scheme (NZ ETS) can drive much of the decarbonisation of the energy system. However, as set out in the policy framework section in *Chapter 1: Introduction*, complementary policies are needed to guide the transition, ensure it is equitable, and to address non-price barriers. Although all fossil fuel consumers pay the cost of emissions, the relative impact of the carbon price across different groups and their ability to reduce emissions in line with the changing price varies considerably.

Energy supply

Electrification is key for decarbonisation, and the system must be able to deliver secure, affordable, and low emissions electricity

Aotearoa New Zealand has one of the lowest emitting electricity systems in the world, reaching 82.1% renewables share in 2021.[130] The use of electricity as a low emissions fuel can therefore be maximised.

More renewable generation will need to be built to further reduce electricity system emissions. It will enable emissions reductions across the economy through increased electrification – of transport, space and water heating, and industry. This would best be accompanied by expansion of transmission and distribution infrastructure and increased system flexibility through demand response, energy storage, and potentially more flexible generation.

Electrifying transport and heat are some of the greatest opportunities to reduce emissions and will contribute substantially to demand growth. Gross electricity demand has been relatively stable over the past two decades but is projected to increase 28% by 2035 and 68% by 2050, compared to 2020.[131]

Policy settings and other factors could delay renewable generation build

Aotearoa New Zealand relies heavily on renewable electricity to replace fossil fuels. To meet anticipated demand, each year from 2025 generation that can supply over 1 TWh per year will need to be built. For scale, this is equivalent to around two very large wind farms being completed every year (although we are expecting a mixture of renewable generation types including geothermal and solar).

There is ample generation that can be developed, with over 27 GW of potential generation interest and the potential for offshore wind significant.[132] However, barriers related to consenting and investment certainty must be removed for this generation potential to be realised. Build delays will both directly and indirectly impact emissions.

We expect that the market can deliver this new generation. However, there are factors that may delay investment decisions and construction schedules. For example, any new electricity supply contract for New Zealand's Aluminium Smelter (NZAS) will be a high-profile factor which developers will likely consider when considering new generation. Other factors such as global supply chain constraints, labour shortages, and consenting times could also delay construction build. Developers also control the timing of their generation investment and may look to secure purchase agreements and will consider the broader impact across their portfolio before committing to build.

Some policy settings are introducing investment uncertainty

Government policy uncertainty may also be delaying the build of new generation. For example, the Government has set a target of reaching 100% renewable electricity by 2030, but under the Commission's demonstration path, the electricity system is projected to reach only 96% renewable by 2030. To achieve

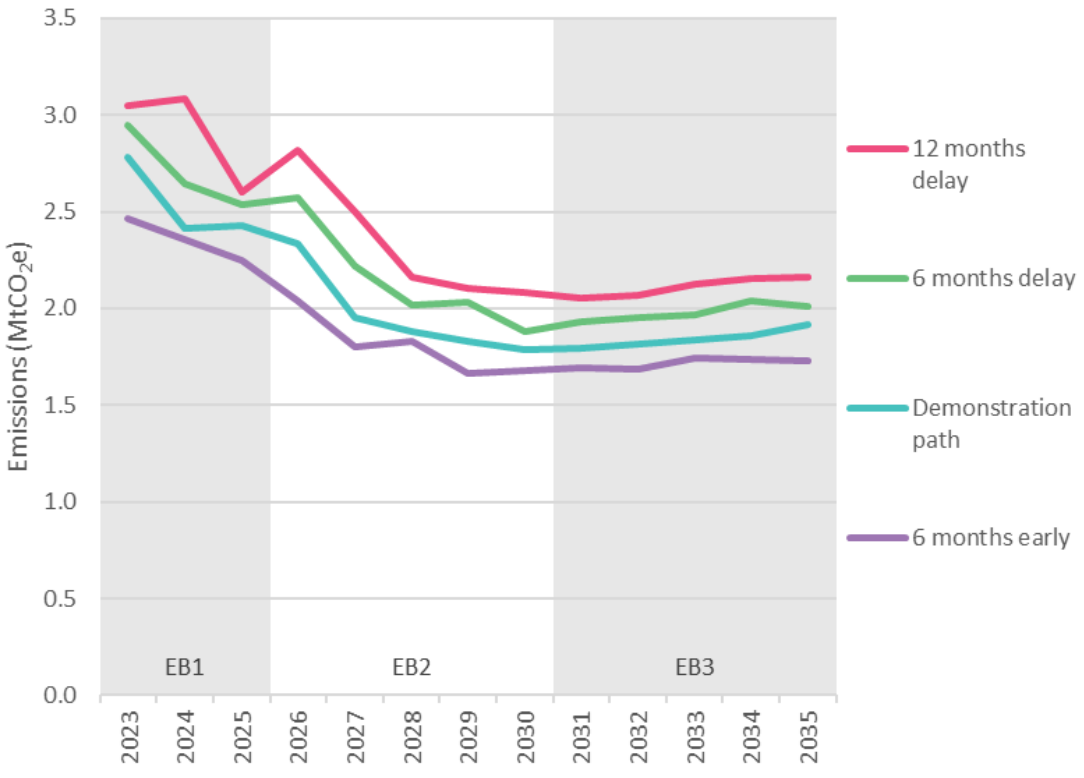
100% renewable electricity generation by 2030, some market intervention will likely be required. This introduces investment uncertainty for developers of new generation. The Government has committed to reviewing this target in 2024.

Although a 100% renewable electricity system is technically feasible, it may come at significant cost and could increase economy-wide emissions if it led to higher electricity prices. The NZ Battery Project is investigating pumped hydro storage and other potential solutions to the country's dry year problem and to achieve 100% renewable electricity supply. The Government has committed to developing a detailed business case for a solution by the end of 2024. Any dry year solution should be implemented in a manner consistent with Te Tiriti o Waitangi/The Treaty of Waitangi principles.

Renewable generation build delays can directly increase emissions

We estimate that if renewable generation build is six months behind the Commission's updated demonstration path,[133] emissions would increase on average by 0.9 $MtCO_2e$ and a 12-month delay would increase emissions by 1.8 $MtCO_2e$ across the second emissions budget period (**Figure 12.2** below).[134] This is because fossil gas generation will need to operate more to meet projected demand. Continued uncertainty and build delays could make it challenging to meet emissions budgets.

Figure 9.2 Projected electricity generation emissions with varied build timing. Note that emissions are averaged across simulated weather years and include co-generation.



Source: Energy Link modelling

Box 9.1: Case study on build delays

As an illustration of how market uncertainty can impact emissions, the Commission has considered how the New Zealand Aluminium Smelter's contract termination and renegotiation in 2020/2021 may have affected renewable build timing and emissions. NZAS consumes 14% of the country's electricity, and so whether it continues to operate has a significant impact of the balance of generation capacity and demand. NZAS's contract termination caused significant uncertainty in the wholesale electricity market.

The power supply contract renegotiation took six months and during this time investment development for the Tauhara and Harapaki renewable generation projects went on hold. [135] Final investment decisions for these projects coincided with the new power supply agreement for the smelter, when this specific uncertainty had been resolved. These renewable generation projects are now under construction and scheduled to be completed in 2023. Supply chains and workforce capacity may have also delayed construction build.[136]

If this renewable generation was operating six months earlier around 0.4 $MtCO_2e$ of emissions from fossil gas generation could have been avoided in 2023. While this is the duration of the contract renegotiations, many factors could have impacted the timing of this generation build. It is informative to explore the potential consequence of the timing of early investment decisions on emissions. Developers need to commit to significant generation build and delays will increase electricity generation emissions.

Delayed build impacts wholesale electricity prices and can indirectly increase emissions

A slower renewable generation build also impacts wholesale electricity prices, as more expensive fossil gas and coal generation will be required to meet demand. This indirectly influences emissions, as the higher electricity prices will hinder the electrification of process heat and transport. The Commission estimates that during the second emissions budget period, a six-month delay in build increases wholesale electricity prices by $14/MWh and a 12-month delay by $30/MWh, corresponding to a 14-30% increase over the modelled wholesale electricity prices under the updated demonstration path.[xxi]

The consenting system can enable a fast-paced and sustained build of renewable generation, but stronger direction is needed to remove barriers to building new renewable generation or reconsenting existing generation

Resource management system reform is underway, but existing processes will remain in place across the second and third emissions budget periods as the system transitions. The lengthy transition period, uncertainty around currently unspecified environmental limits, and the potential provision of exemptions could create additional uncertainty that delays renewable generation build. A simplified or streamlined consenting process that makes renewable build easier and quicker is needed by the start of the second emissions budget period, if not earlier.

The current system lacks joined up thinking across energy, water, infrastructure, housing supply, and climate change outcomes. The current system is no longer fit to help Aotearoa New Zealand respond to emerging

[xxi] Note that these prices are time-weighted-average-prices across simulated weather years for the Haywards grid exit point

issues and does not adequately uphold the principles of Te Tiriti o Waitangi/The Treaty of Waitangi. This adds complexity, cost, and delay to generation projects. Some of these issues may be addressed through reforms to the Natural and Built Environment (NBE) Bill as part of the National Planning Framework (NPF). However, the first iteration of the NPF will not be published until 2025.[137]

As stated in the Commission's submission on the NBE bill, transitional measures need to be put in place to support local government to take proactive climate mitigation and adaptation steps prior to reforms being implemented. To ensure a fast-paced and sustained build of renewable generation and network infrastructure, the Government could also provide clear direction and approaches for balancing and resolving conflicts between system outcomes. It would be particularly beneficial if the Government provided stronger directive language within existing policy instruments to remove barriers to building new renewable generation or reconsenting existing generation in the interim.[138]

It would also be beneficial if the consenting system recognised the national importance of renewable energy and could adapt to ongoing technological innovations that provide system flexibility and more efficient generation of electricity – for example, energy storage technologies and modern, advanced wind turbine technology. Slow resource consenting times can impact the attractiveness of projects to investors, increase the risk of project abandonment, and increase overall project costs.

Refer to *Chapter 8: Built Environment* for further discussion on consenting.

Genuine public collaboration and consultation, especially with Iwi/Māori, is important for the development of renewable electricity generation

Prioritising and accelerating the development of renewable electricity generation is best done through genuine public collaboration and engagement, in consultation with mana whenua and mandated Iwi/Māori representatives. The natural resources located within the rohe of Māori-collectives must be carefully considered to uphold mana motuhake and to restore/maintain the mauri of that which is being developed.

The prioritisation and acceleration of renewable electricity generation should be done in a manner that gives effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi and upholds over 60 pieces of Te Tiriti/The Treaty settlement legislation. Emphasis on rangatiratanga and a genuine partnership is essential to ensuring future energy developments take a kaitaiki approach to resource management within their takiwā. Further exploration of mātauranga Māori should be prioritised to identify potential future impacts of natural resource utilisation for energy use.

Having regard to the reasonable concern of affected parties in the development of projects can support community awareness and acceptance of local energy infrastructure.

Proactively managing demand growth through efficient, forward-looking investments will be useful for critical electricity infrastructure providers

Electrifying transport and heat are some of the greatest opportunities to reduce emissions and will contribute substantially to electricity demand growth. Electricity distribution businesses (or lines companies) will need to evolve to accommodate rising electricity demand, as well as emerging technologies or services that allow greater consumer participation in how, when, and where electricity gets generated, used, and compensated.

Lines companies have a critical role in managing peak demand and delivering services for the long-term benefit of consumers. The regulatory system needs to provide the appropriate incentives for lines companies to manage peak demand through existing tools and to invest in other ways to manage demand, such as through batteries, distributed energy resources, or network reinforcement.

Uncertainty about future requirements and potential solutions has increased. The existing regulated investment framework for transmission and distribution infrastructure needs to be future proof by looking to meet outcomes related to emissions reduction, system security and reliability, and affordability. Expenditure forecasting approaches and allowable revenues for lines companies need to be able to support the accelerated pace of investment in generation and electrification that is required. Physical grid capacity must keep pace with generation build. Control and operation of the grid also needs to evolve as generation becomes more distributed and digitisation increases.

Realising the vision of an electrified economy could require an investment of over $40 billion by 2030 across generation, transmission, and distribution infrastructure providers to address historical under-investment, meet future needs, and strengthen grid resilience.[139]

Improving grid resilience has become increasingly urgent

Transmission and distribution infrastructure is exposed to climate risks such as coastal and inland flooding and slips and has less ability to make the changes to adapt (compared to electricity generation assets), with many networks at or near capacity.

In turn, distribution networks likely have even less ability to adapt than the transmission network.[140] Varying size and capabilities of lines companies may result in different levels of network vulnerability across regions as the climate changes. Heavy reliance on a single source of energy across the economy can impact Aotearoa New Zealand's resilience. Investment decisions need to support future proofing network infrastructure to improve resilience, particularly in areas with historic under-investment or at high risk of climate hazards.

Energy efficiency and demand side management can be better leveraged to reduce network costs and support system flexibility

Although Aotearoa New Zealand has a predominantly renewable electricity system, energy efficiency improvements can still have significant emissions benefits. This is particularly the case if it can reduce energy demand at peak times, when fossil gas or coal fired power generation is used alongside renewables to meet demand.

Reducing peak demand defers the need to build a bigger network and improves utilisation of existing assets. This can extend the life of network infrastructure, reduce the need for upgrades, and reduce the costs to be recovered from consumers.

Recent introduction of real-time pricing in the wholesale electricity market will provide consumers with a clearer price signal to inform decisions, improve the types of services that can be accessed, and better enable distributed energy resources (DER) to participate in the market. DER and demand side management can help manage the variability of supply from an increasingly renewable electricity system.

The electricity industry has made progress in balancing the energy trilemma as the country transitions to a low emissions economy through, for example, phasing out low fixed-charge tariff regulations, amendments to the Electricity Industry Participation Code, and improved information disclosure. However, it will be important for the Electricity Authority and other electricity sector entities to continue delivering on initiatives related to pricing and cost allocation including DER integration and investment.

Proposed recommendation

This proposed recommendation seeks to address the need for greater and more reliable access to renewable electricity and to help enable Aotearoa New Zealand to meet its second emissions budget and longer-term emissions reduction targets.

Proposed Recommendation 13

We propose that the emissions reduction plan for the second budget period must:

13. Prioritise and accelerate renewable electricity generation build and ensure electricity distribution networks can support growth and variability of demand and supply.

Fossil gas will begin to transition out of the system, but will remain important for the security of electricity supply and some industrial users through the second emissions budget period and beyond

Fossil gas plays an important role in the energy system. It provides secure energy supply for electricity generation (30% of consumption in 2020), and for users of process heat (18%), as well as a feedstock and fuel for chemicals and fertiliser (43%) such as methanol and urea. Many households use fossil gas for cooking, heating, and hot water (4%), and many commercial businesses use it for space heating and cooking (4%).

Fossil gas combustion emissions made up 9% of gross greenhouse gas emissions in Aotearoa New Zealand in 2020 and need to be reduced. In the Commission's demonstration path, fossil gas emissions reduce by 18% by 2025 and 37% by 2030, relative to 2020. However, this must be done in a measured way that ensures the energy system can deliver an equitable transition to net zero long-lived greenhouse gas emissions. Removing fossil gas too quickly from the system could increase electricity prices and reduce reliability. This may have significant consequences for the electrification of transport and process heat. For further discussion, see *Chapter 8: Built Environment* and *Chapter 11: Transport.*

To reduce emissions from electricity generation, fossil gas is better used as support for renewable generation and not as baseload

Fossil gas (and coal) electricity generation currently fills the gap when hydro inflows are low or when renewable supply falls short due to the intermittency of wind and solar. In absolute terms, most thermal electricity in Aotearoa New Zealand currently comes from fossil gas. However, coal results in about double the emissions per TWh of electricity produced. In *Ināia tonu nei,* the Commission set out how generating electricity with coal must end and that this would be a key priority for the first emissions budget.

Much of current fossil gas generation operates almost year-round as baseload. As more renewable generation comes online, fossil gas use for electricity generation will decrease, and its role will change to being about backing up renewable generation.

Historically, Aotearoa New Zealand has been concerned with seasonal dry periods. However, from the second budget period – with more homes and businesses using electricity to power their cars, heating, and cooking – the daily peaks will require further capacity. Currently this is likely to come from fossil gas generation, and/or from additional demand response.

Managing down the remaining fossil gas should occur in a planned and measured way

Globally, methanol production is dominated by production from coal and fossil gas, but increasingly alternative feedstocks are being used such as biogas, hydrogen, and carbon dioxide. The company Methanex produces methanol from fossil gas and consumes about 40% of the total domestic fossil gas supply. As a large user of gas, Methanex's demand incentivises gas producers to continue production to supply all users. Methanex also has the ability to provide flexibility to producers by reducing its demand and methanol production when there is an interruption to supply or in dry years when hydro lakes are low. For example, Methanex has suspended production from the Waitara Valley plant in response to tight gas market conditions and in recent years freed up gas for electricity generation in winter.

It would benefit Aotearoa New Zealand to align investment in fossil gas infrastructure and supply with the gradual phasedown of the user base. To do that, the Government could engage with large users of fossil gas (such as Methanex and electricity generators, as well as mandated mana whenua representatives) so the transition away from fossil gas is as smooth as possible and fossil gas is available when and where it is strategically required.

Careful thought is required when considering winding down fossil gas infrastructure in the future, including close partnership with mandated mana whenua representatives. For example, some electricity distribution companies will be under significant additional pressure with the increased uptake of electric vehicles and/or industrial load. Taking residential and commercial users off the gas network would add to this pressure.

Biogas could play a role in replacing fossil gas, but there is currently limited supply and different sectors that could make use of it

Biogas, when transformed into biomethane, is chemically identical to fossil gas. However, over the full value-chain it prevents up to 95% of associated carbon emissions,[141] making it a highly valuable resource. It has been estimated that using existing and available organic wastes in Aotearoa New Zealand, around 7% of existing fossil gas use could be met with biomethane. This could avoid 1.5 $MtCO_2e$ of emissions per year.[142]

However, the biogas industry in Aotearoa New Zealand is underdeveloped. Bringing the available quantities of biogas to market at affordable prices will likely require Government support and coordination. Biogas production costs could be up to $60/GJ for some feedstocks,[143] around six times the current wholesale gas price.

There is not enough biogas to completely replace fossil gas, so choices will have to be made for where it is used. It could be injected into the pipeline network to partially supplement fossil gas. Biogas could also be very valuable for use in industrial heat and processes, for which alternative decarbonisation solutions may be harder and more expensive. Co-location of the production of biogas and its consumption have obvious efficiency benefits. More work is required including an assessment under Te Tiriti o Waitangi/The Treaty of Waitangi to ensure best use of this limited resource.

There is insufficient evidence around the possible future availability of biogas, including its technical viability and cost to consumers, to warrant continued expansion of the gas network. Fossil gas assets installed during the second emissions budget period would endure to 2050 and beyond, despite the fact that affordable low emissions alternatives are available now. The Commerce Commission's last price path reset for gas pipeline businesses brought forward the expected recovery of capital to mitigate asset stranding risk from declining use of gas networks. The capital is recovered from users remaining on the network. Electricity is a more efficient and lower emissions source of energy for heating homes and businesses than fossil gas. More information on this can be found in *Chapter 8: Built Environment*.

Box 9.2: Hydrogen

Hydrogen is a versatile fuel that could be used to decarbonise many applications that currently use fossil fuel. Some applications will require low emissions hydrogen. However, for most potential uses there are alternative decarbonisation options which are likely to be more efficient, cheaper and have less system impact. There are also some applications where there is uncertainty around hydrogen's potential future role as technologies are currently immature and not at scale.

At this stage, the Commission understands that low emissions hydrogen will be required to decarbonise some domestic industrial processes:

- For urea and methanol production hydrogen is an essential feedstock. The hydrogen production needs to be decarbonised to reduce the emissions from these processes.
- Green hydrogen also looks like a promising way to decarbonise primary steel making in Aotearoa New Zealand. Increasing the use of recycled steel is also an alternative or complementary pathway for reducing emissions.

Other potential future uses of hydrogen are cases which direct electrification would struggle to support. Examples include:

- remote vehicles and machinery used in forests and mines, to which it would be very costly to bring charging infrastructure.
- some high temperature industrial heating applications, which may be better served by a combustible fuel.
- a niche role in heavy freight for trips that are both long and heavy. For these applications using batteries comes at the expense of carrying payload, and downtime for charging could impact operational efficiency. However, battery electric trucks should be able to support most freight operations in Aotearoa New Zealand and it is not yet clear for what range and weight hydrogen trucks would be preferable.
- aviation and shipping although a path to decarbonisation is not yet clear. The space and weight required to store hydrogen make it a challenging substitute for existing fuels. Hydrogen ships and aircraft are likely to have limited range, or higher fuel costs which will constrain use cases.

The use of hydrogen for building heating would increase system and consumer costs[144] and add a considerable burden for new renewable generation which adds risk to decarbonisation. This means it is unnecessary to convert the existing fossil gas network over to hydrogen. For example, to convert all existing residential fossil gas users to green hydrogen would require around six large wind farms to produce the hydrogen. If instead their heating was provided by heat pumps, then only one of these wind farms would be required.

There is also a risk that exporting green hydrogen could impede domestic decarbonisation if the required renewable generation comes at the expense of other builds. Although Aotearoa New Zealand's generation potential is considerable, the capacity to consent and develop projects is currently constrained and social license to develop may increasingly become an issue, with particularly close assessment needed under Te Tiriti o Waitangi/The Treaty of Waitangi. The Commission notes that there is ongoing Hapū-led litigation in this space.

Green hydrogen has featured strongly in the Government's energy policy development and decarbonisation funding. To enable decarbonisation through hydrogen, but to avoid supporting inefficient uses, the Government could consider:

- Prioritising support for applications where hydrogen is likely to play a significant future role. Hydrogen experience and technology can then be developed that other applications may eventually benefit from.

- offering fuel neutral support. Generally, there are competing electric technologies under development and there is uncertainty around which process will ultimately be optimal and be adopted at scale.
- ensuring the development of hydrogen infrastructure is sized to sensible future demand. A view of sensible demand for hydrogen should consider alternative low emissions fuel options for all potential applications.

There is opportunity to reduce more fugitive emissions from fossil fuels

Fugitive emissions result from production, transmission, and storage of fuels, and from non-productive combustion. In 2020, fugitive emissions from domestic oil and fossil gas production contributed 0.8 $MtCO_2e$ – around 1% of gross emissions. Examples are emissions from the venting of CO_2 at the Kapuni Gas Treatment Plant, gas flaring at oil production facilities, and methane leaks from the pipeline network. Fugitive emissions also result from geothermal generation.

Generally, it is assumed that fossil fugitive emissions will reduce in line with fossil gas reductions. However, there is considerable variation between production fields. It may be possible to make significant reductions in fossil fugitive emissions by targeting key sources such as vented and flared production emissions. As a signatory to the Global Methane Pledge, Aotearoa New Zealand has committed to a collective global target to reduce global anthropogenic methane emissions by at least 30% from 2020 levels by 2030.

The NZ ETS should incentivise producers and distributors to minimise fugitive emissions. However, fugitive emissions are not a focus area in the Government's first emissions reduction plan, and the evidence base on sources and opportunities to reduce fossil fugitive emissions could be improved.

Industrial emissions

Rapidly reducing industrial emissions is crucial to meeting the second emissions budget

There is a large opportunity to reduce industrial emissions, and there are cost effective options available now. Under the Commission's demonstration path, industrial emissions reduce from 11.5 $MtCO_2e$ in 2020 to 9.5 $MtCO_2e$ in 2030. The Government's work programme is helping to unlock these reductions; current policy consists primarily of the NZ ETS, the Government Investment in Decarbonising Industry (GIDI) fund, national direction under the Resource Management Act (RMA) to prevent the installation of new coal boilers and a backstop on the reconsent of existing ones. Work has also begun on a plan for decarbonising industry.

However, the Commission's assessment is that the Government may have overestimated how quickly emissions reductions from process heat can be achieved. The current policies, outlined in the Government's first emissions reduction plan, have combined policy impact ranging from 12 $MtCO_2e$ to 20 $MtCO_2e$ during the second emissions budget period. For the higher estimate to be achieved, all coal, fossil gas, and diesel industrial boilers will have to be converted to electricity or biomass by 2025. The Commission's assessment is this likely exceeds the sector's capability to deliver decarbonisation in this area in the short term.[145]

This means that some of the task of reducing emissions in this sector is likely to move from the first to the second emissions budget and that emissions reductions may have to be made elsewhere in the sector.

Wider problems preventing industries reducing emissions will need to be addressed and policy support broadened to include new sectors

The Government's goals for the sector are unlikely to be achieved without expanding the pool of emissions reductions it is targeting and working to overcome more of the problems preventing the industrial sector reducing emissions.

The rate at which industrial emissions will be reduced will be limited by several factors. For example, fuel switching decisions involve long-lived assets and have high upfront capital costs, which is what the GIDI is helping to overcome. Continual assessment and readjustment of the fund or alternative policy mechanisms will support emissions reductions in line with budgets.

The NZ ETS will need to maintain an effective carbon price signal into the future

Lower emission fuels are generally more expensive than fossil fuels and a high emissions price is needed to make these fuels cost competitive. It is important that there is an effective carbon price signal into the future. Refer to *Chapter 4: Emissions Pricing* for additional discussion.

Other barriers like engineering, workforce, and supply chain constraints will limit the amount of decarbonisation possible during the second budget period

The GIDI fund is addressing capital barriers, but there are others to be addressed to build the momentum of the transition.

A study for the Commission identified some key technical challenges which need to be overcome. These include electricity distribution businesses (EDBs) processes, an underdeveloped biomass market, future uncertainty about pricing and technology, and onerous consenting.[146] Some of this can be resolved through improved information provision and coordination.

There may also be practical engineering constraints around the integration of new technologies and fuels into established plants, and limits on shut down periods for plant conversions. Upscaling the domestic workforce and supply chains will help support the transition.

Security and cost of electricity and bioenergy supply will be critical in enabling the decarbonisation of process heat

There is uncertainty in the availability of biomass supply and growing competition, so additional coordination will be required. Some biomass suppliers are reluctant to enter into long-term contracts, which are important for users to be able to secure continuity of supply and certainty of price.[147] A strategic assessment of the best use of bioenergy, including where the fuel should be used and for what purpose, could be useful. Further discussion on the bioeconomy is found in *Chapter 15: Circular Economy and Bioeconomy*.

The electricity system must be able to support the additional pressure that will come from industrial conversions to electricity. Decarbonisation projects occur on a much shorter timeline than EBDs are used to or the regulatory system can easily allow for. There can also be a first mover disadvantage if the project triggers a network upgrade, and the company is required to disproportionately bear the costs of that. EDB resources and systems also vary significantly around the country, and they may be understaffed to facilitate large decarbonisation projects, resulting in demand peaks. This can often lead to project delays due to the time taken for network upgrades and projects not proceeding because the network cost is too great to justify the project.[148]

See section on *Electrification* above for more information.

Other opportunities could be pursued such as large industrial users and chemical production

So far, the Government's primary policy support has been targeting low to medium temperature process heat, which is mainly boilers which produce steam. This is likely due to the readily available technology and relative achievability of emissions reduction. Policy support to reduce emissions in this space has been expanding, however, and support will need to encompass other opportunities outside of low to medium temperature process heat to help Aotearoa New Zealand meet its emissions budgets.

Technology for industries with hard-to-abate emissions is still developing

Aotearoa New Zealand has several single company industries with industrial processes unique to this country, such as primary steel production or aluminium smelting. Emissions reductions from these industries is challenging and the scale of investment needed to decarbonise is significantly larger than the size of what the GIDI fund is designed to provide.

Technologies to reduce emissions for these users are progressing, and if the Government choses to support these users, bespoke arrangements may be required and with longer term support. In the meantime, incremental emissions reductions should be encouraged.

There are some sectors that have received little attention to date, resulting in a lack of information or enabling policies to reduce emissions

Other sectors have not received much attention to date, such as mining and construction. This includes off-road vehicles and machinery that contribute significant emissions, but often fall between central government agencies' focus. There is a lack of evidence on abatement opportunities and enabling policies for these sectors meaning these opportunities have yet to be unlocked.

Proposed recommendation

This proposed recommendation seeks to address the need to rapidly reduce industrial sector emissions and to help enable Aotearoa New Zealand to meet its second emissions budget and longer-term emissions reduction targets.

Proposed Recommendation 14

We propose that the emissions reduction plan for the second budget period must:

14. Pursue more widespread process heat decarbonisation and establish mechanisms for other industrial sectors and processes to decarbonise.

Box 9.3: Carbon capture, utilisation, and storage (CCUS)

CCUS refers to a suite of technologies that capture carbon dioxide emissions from a point source or remove carbon dioxide from the atmosphere for permanent storage or reuse in a service or product. Permanent storage can be biological (vegetation, soil, oceans) or geological (underground geologic formations, rocks and minerals).

In 2022, 61 new facilities were added to the global project pipeline bringing the current total to 30 CCUS projects in operation, 11 under construction, and 153 in development. [149] Most of these facilities are associated with coal power generation or oil and fossil gas production. Many of these projects have been supported through substantial tax credits and enabling legislation such as the United States' Inflation Reduction Act and the Infrastructure Investment and Jobs Act.

In Aotearoa New Zealand, CCUS technology has not progressed beyond the concept and research stage. This is likely because forestry is currently a lower-cost emissions removal option and because low emissions substitutes for fossil fuel combustion for energy are increasingly economic under current policy settings.

Estimated costs for carbon capture are wide-ranging, from USD \$25-35/tCO_2 for ammonia production to USD \$60-120/tCO_2 for cement production, and USD \$40-100/tCO_2 for iron and steelmaking.[150] Future capture cost estimates for direct air capture are wide-ranging and uncertain, reflecting the early stage of technology development, but are estimated at USD \$125-335/tCO_2 for a large-scale plant built today.[151]

Aotearoa New Zealand also does not have an enabling legislative framework for CCUS compared with Australia, Canada, or the United States, and existing legislation is not adequate to manage the risks and liability around CCUS.

Under the Climate Change Response Act, carbon capture and storage is categorised as an 'other removal activity'.[152] However, unless the activity is undertaken via direct air capture and storage (DACCS) or bioenergy with carbon capture and storage (BECCS), it is more an emissions reduction activity than a removal. Categorisation as a carbon dioxide removal would be dependent on Aotearoa New Zealand's emissions accounting rules.

Until decisions are made on the NZ ETS's role in driving gross emissions reductions and removals, it may be premature to expand the NZ ETS scope to more removals. It will be important to think carefully and undertake a proper policy development process before deciding to include other types of removals.

Since the release of *Ināia tonu nei*, stakeholder interest in CCUS has increased. For example, Ara Ake released a summary document on CCUS and its possible application in meeting climate change targets to renew discussion.[153] A report by Energy Resources Aotearoa*, Fuelling the Energy Transition: A low emissions energy future for New Zealand*, assumes deployment of CCUS from 2030 under a preferred technology-led gas transition.[154]

There could be a role for CCUS to play in addressing hard-to-abate residual emissions in the medium-term and achieving net negative emissions in the long-term. However, an enabling regulatory framework would need to be in place by the end of the second emissions budget period to take advantage of any potential opportunities.

Intergenerational wellbeing and equity

Transformation of the energy system requires a considered approach as part of a broader strategy that supports intergenerational wellbeing

Meeting Aotearoa New Zealand's net zero 2050 target requires a steady transformation of the energy system where fossil fuel use is phased down, and the supply and use of renewable energy is maximised. An energy system transformation with people and communities at its centre can deliver positive outcomes across many dimensions – energy affordability and accessibility, community resilience, health, and socio-economic opportunities.

The transformation will require substantial investment in renewable energy – across renewable electricity generation capacity, transmission and distribution infrastructure, distributed energy resources such as demand response and grid-scale batteries, potentially more flexible generation, and new consumer services. Some of these investments may have flow-on effects to consumers and will vary across regions.

Investment that improves grid resilience and energy security would be a good thing. Recent extreme weather events such as Cyclones Hale and Gabrielle have shown that some networks are not ready to withstand increasingly impactful weather.

The complexity of intergenerational wellbeing and energy hardship cannot be addressed through an individual policy measure or fuel-specific policies. Proactive and targeted measures as part of a comprehensive policy package could manage potential impacts during the transition to a low emissions society. Refer to *Chapter 6: Maintaining and Enhancing Wellbeing through the Transition* for additional discussion.

The energy system transformation may have some flow-on effects to consumers, but average household energy bills will reduce

Companies will seek to recover their investments, and this could result in pass-through costs to consumers. However, delaying investment in network infrastructure may impede renewable generation build, in turn impacting the pace of electrification and directly and indirectly increasing emissions (see **Figure 12.2**).

As households and businesses increasingly shift towards lower emissions choices and fuels, and as buildings, vehicles, and equipment become more efficient, this will lead to lower average household energy bills.[155] Analysis shows that New Zealanders who can by 2026 transition their households to all electric appliances and use an electric vehicle stand to save thousands of dollars in the long term.[156]

Some households may have little visibility over what they are currently paying for emissions as part of their expenses and may have few opportunities to avoid rising costs if they cannot reduce their consumption or purchase new vehicles and appliances.

New Zealanders' exposure to the cost of carbon on average will also reduce and associated costs will go down as household energy use is decarbonised. However, some groups will need assistance during the transition to take advantage of these energy savings. For example, the upfront capital cost of electric vehicles remains a barrier to uptake, particularly for lower income households. Continued use of internal combustion engine vehicles prolongs their exposure to a rising carbon price and increasingly high petrol costs.

For households who cannot afford to transition early, the potential impacts could be greater, and it will be important for supportive policies to be put in place to help accelerate their shift. Complementary policies can increase the ability of consumers and businesses to shift behaviour in response to prices and can

address non-price barriers to adoption of lower emissions options. More information about targeted support for retrofitting existing fossil gas infrastructure is discussed in *Chapter 8: Built Environment*. Additional discussion on potential household impacts and policy measures is in *Chapter 6: Maintaining and Enhancing Wellbeing through the Transition*.

The transition will vary across firms

Small businesses make up 97% of all firms in Aotearoa New Zealand and account for 29% of employment.[157] Many businesses are interested in taking action to reduce their emissions. Larger firms typically have more resources and capability to respond to regulatory requirements and are in a better financial position to seek external support.[158]

Smaller firms are more likely than larger firms to report that they lack the time, organisational resources, or technical know-how to identify and implement measures which might make them more resilient to the impacts of climate change. Amongst high inflation rates and labour shortages, climate action may not be a high priority for businesses.[159] They may also be less likely to have the capital available to invest in low emissions technology.

However, there are many existing opportunities to reduce emissions within the business community that can be shared through peer-to-peer networks. For example, the Climate Leaders Coalition is a CEO-led community leading the response to climate change through collective, transparent, and meaningful action. In the upper South Island, Mission Zero and Businesses for Climate Action help businesses understand their carbon emissions, coach them towards positive climate outcomes and facilitate projects for the greater business community. The Energy Efficiency and Conservation Authority also provides co-funding and support for businesses; however, additional support for smaller firms may be needed.

Many benefits and opportunities can be realised during the energy system transformation

The transition will generate jobs and economic opportunities

The transition to a low emissions economy requires a robust workforce to undertake the technical and everyday actions needed to both reduce emissions and be resilient to a changing climate. Labour shortages and lack of skills and capabilities have been cited by the energy and industry sector as a barrier to faster action.

Measures to improve the efficiency of urban areas, buildings, industry and transport systems are labour intensive, providing opportunities for new businesses, services and jobs. For example, a ramp up in heat pump uptake will require technicians trained for installation and maintenance but also in the correct handling, destruction and substitution of high Global Warming Potential (GWP) refrigerants with lower GWP refrigerants.

Transpower estimates that thousands more highly skilled workers will be needed in the electricity sector by 2035 to meet increasing demand. Part of this will be from increased demand as transport and process heat are electrified. These jobs would be over and above replacing workers who retire in the coming years. As technology advances, the sector will increasingly need workers with skills in technological and digital innovation, automation, data science and artificial intelligence.[160]

Community participation and local generation projects have a range of benefits

Community-scale renewable electricity generation projects can provide local and regional benefits. Transparent and participative decision-making can enhance energy literacy and awareness, social cohesion, and generate economic opportunities through reinvestment of profits into the community.[161]

It may also be possible for communities and Iwi/Māori to invest in renewable generation projects to provide lower cost energy. For example, by establishing a community retailer that receives electricity from a local project via a power purchase agreement. Government support, such as the Māori and Public Housing Renewable Energy Fund by the Ministry of Business, Innovation and Employment, alongside regulatory measures to ensure equal access to network infrastructure and data, may be beneficial in enabling more community energy projects.

Energy efficiency improvements can save money and improve building comfort and safety

More than 130,000 households in Aotearoa New Zealand (or 7.3% of all households) cannot afford to keep their home adequately warm. More than 90,000 households also had a major problem with damp and/or mould, with renters more likely to experience dampness and mould than homeowners.[162]

Coupling heat pump installation with better insulation and improved weathertightness will immediately reduce the amount of energy required to heat or cool a home to the same temperature.[163]

Reducing fossil fuel use can improve health outcomes

Switching to low emissions fuels such as electricity or biomass can result in improved indoor air quality, particularly for households that use portable LPG appliances or unflued gas heating appliances.

The use of fossil gas cooking appliances, especially without an exhaust hood or if not well maintained, can also contribute to lower indoor air quality. The combustion of fossil gas for cooking emits nitrogen dioxide, carbon monoxide and formaldehyde, all of which can exacerbate various respiratory symptoms and other health issues.[164] In the United States, switching to an electric stove reduced patients' need for asthma medication which resulted in savings of USD $175 per year per person. Indoor air pollution from fossil gas cooking is estimated to cost the EU at least €3.5 billion per year in healthcare costs, lost earnings and productivity, and disability adjusted life years.[165]

Indoor air pollution from using fossil gas for heating or cooking can disproportionately impact people in lower income households, who may not be able to afford to properly maintain fossil gas appliances and are proportionately more likely to rent homes that use older fossil gas appliances.

Chapter 10: Forests

Introduction

Forests are important for meeting the emissions reduction targets, but present challenges for long-term climate change action

Forests are important for meeting the long-lived gases reduction target, as they contribute significantly to the removal and storage of carbon dioxide. While heavy reliance on forests may enable Aotearoa New Zealand to meet its 2050 target, it would only delay the need to reduce gross emissions and may not ensure that a 'durable net zero' is reached.

However, there are opportunities for forests, both exotic and native, to contribute to outcomes for adaptation, as well as broader social, cultural, environmental, and economic outcomes.

In *Ināia tonu nei*, the Commission recommended a comprehensive national programme to establish more native forests. There were a few steps toward this in the first emissions budget period, including more accurate yield tables in the New Zealand Emissions Trading Scheme (NZ ETS) and research into the reduction of costs associated with native afforestation. However, progress to date is unlikely to deliver large-scale native planting or reversion in the second budget period.

There is currently a lack of clear direction and objectives for the amount and type of forestry required to achieve the 2050 target. In the development of objectives, climate change mitigation and adaptation must be considered as well as the broader social, cultural, environmental, and economic outcomes. Furthermore, there is an opportunity for the Government to articulate the role forests and other emissions removals will play in achieving budgets and targets.

This draft advice builds on previous advice we have provided to the Government; defining the role of forests is critical to the pathway to achieve the 2050 target and as forests take a long time to establish and grow, clear policy direction is needed quickly.

The context for change

Aotearoa New Zealand currently has a total of 10.1 million hectares of forest, of which 8 million hectares are native and 2.1 million hectares are exotic.[166] Forestry exports from Aotearoa New Zealand are worth approximately $6.6 billion per year and the sector contributes 1.6% of GDP.[167] This ranks forestry as the third largest export behind dairy and meat products. The forestry sector is also responsible for between 35,000 to 40,000 jobs across all industries in the sector.[168]

90% of exotic production forestry is Pinus Radiata (pine)[169], with other species including Douglas Fir, Redwood, and Eucalyptus. Exotic forests are typically planted in singular species and harvested at a desired age – for example pine is typically harvested after 26-28 years. Pine is a fast-growing tree in relation to native species and has several potential uses after being harvested.

Native forests have environmental, social, and cultural uses. However, some native timber is sustainably commercially harvested.

Exotic forests generally sequester carbon from the atmosphere much faster than native forests, but the sequestration rate of some exotic species also declines sooner. Exotic production forests reach their long-term average carbon storage level within around 20 years depending on species and silvicultural regime.

Native forests can continue to sequester carbon for hundreds of years, giving the opportunity to create long-term carbon sinks.[170] Existing native forests could be threatened if pests are not managed, potentially leading to the release of the carbon they store, and the loss of their biodiversity and other values.

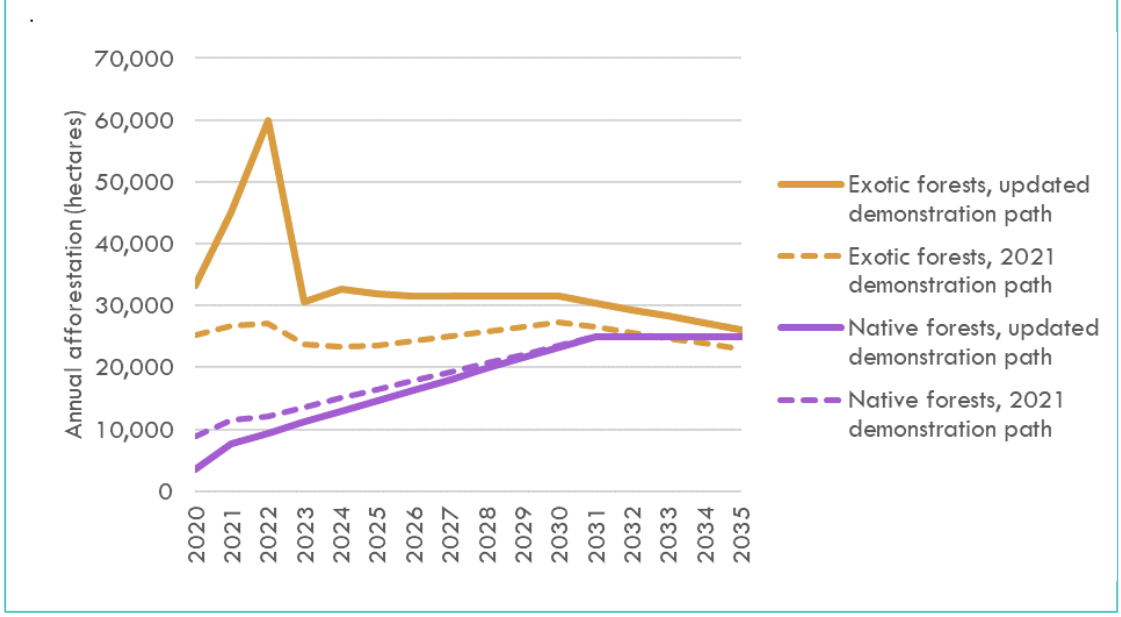
All forms of forests support emissions reductions and can provide environmental benefits including the management of water quality, air quality, and stabilisation of land to manage erosion. Native forests in particular can provide the opportunity to build an enduring carbon sink beyond 2050 and have added cultural and biodiversity benefits.

In our July 2022 advice to the Government on the settings for the NZ ETS, the Commission updated the demonstration path originally laid out in *Ināia tonu nei*. Changes included incorporating updated figures from the national Greenhouse Gas Inventory and new afforestation projections (see **Box 2.1** in *Chapter 2: The task for the second emissions budget*).

In the updated demonstration path (**Figure 10.1**, below), total exotic afforestation over the period 2021-2035 increased from 380,000 ha, as described in *Ināia tonu nei*, to 500,000 ha. This aligns with the Government's updated forestry projections that were used in setting the first three budgets.

On the other hand, total native afforestation decreased in the updated demonstration path from 300,000 ha to 280,000 ha. The updated demonstration path still assumes that native afforestation rates reach 25,000 ha per year by 2030. The lower overall figure reflects that native afforestation rates over the past three years were beneath the levels expected in the original demonstration path, with a more rapid increase in afforestation through to 2030.

Figure 10.1: Updates to the demonstration path for forests



Source: Commission analysis

Mandated Iwi representatives and Māori collectives play an important role with forests due to their cultural and spiritual connection to the forest and the land. A large proportion of Māori collectively-owned land comprises both exotic and native forests or land that is best suited to forests. Therefore, setting and implementing objectives for the role of forests must be done in partnership to give effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi.

Box 10.1: There are different types of forest with different characteristics [171]

Native forests

Native forests are comprised of predominantly indigenous species. They are typically multi-age, multi-species forests that grow slowly and continue to remove carbon dioxide for centuries. Harvesting is generally prohibited in existing native forests that are publicly owned.

High-value native trees, however, can be selectively harvested on private land. Native forests can be established through methods such as reversion (setting up the conditions for land to revert through activities like pest control and fencing) and planting seedlings. Enrichment planting of additional plants within these existing forests can increase their carbon stock.

Exotic forests

Exotic forests consist of tree species that are not native to Aotearoa. Most exotic forests in Aotearoa are conifers, mainly radiata pine, with some Douglas fir and redwoods. There are also other species, such as eucalyptus, oaks, and acacia. Most exotic forests are planted as single species, though some self-seed. Conifers that have self seeded in undesirable locations are termed wilding pines, wilding conifers, or tree weeds.

Production forests

Production forests are planted to be harvested. Production forests in Aotearoa currently are largely exotic trees planted as a single species which are then usually clear felled (completely removed) after the trees have reached the desired age.

Permanent forests

Permanent forests are established with no intention of clear-fell harvest. These could be established through either reversion or planting and might be native or exotic species. Some permanent forests are established with the intention of selective harvest and/or to act as nurse crops transitioning to mature native forests.

A forest can be registered in the New Zealand Emissions Trading Scheme (NZ ETS) as permanent if it meets certain conditions, such as maintaining canopy cover.

Some forests are planted as mixed species (sometimes a mix of exotic and native), and these forests are more likely to be selectively harvested rather than clear felled, due to the different ages of trees. Forests selectively harvested in this way can still be considered permanent.

Pre-1990 and post-1989 forests

For accounting and policy purposes, a distinction is made between forests established prior to 1990 (pre-1990 forests) and forests established after 1989 (post-1989 forests).

Clear direction and objectives for forests are needed to achieve targets

Forests will help Aotearoa New Zealand reach targets and budgets while providing wider benefits such as enhancing biodiversity. However, overreliance on carbon storage in forests is risky as this could slow action to reduce gross emissions.

There is currently a lack of clear direction and objectives on the amount and type of forests required to achieve the 2050 target. This means that different policies such as the New Zealand Emissions Trading Scheme (NZ ETS) and the Resource Management Act (RMA)[xxii] are sometimes not aligned to deliver good climate outcomes. In the development of objectives, considering climate change mitigation and adaptation alongside the broader social, cultural, environmental, and economic outcomes is important.

Some Māori-collectives have strong interests in forests and forestry. Policies and objectives need to be co-designed so that the diversity of their rights and interests is understood and recognised correctly, including the complexity of historical grievances between rohe.

The content in this chapter has a cross-over with other chapters in this report, namely *Chapter 4: Emissions Pricing*, *Chapter 7: Agriculture*, and *Chapter 15: Circular Economy and Bioeconomy.*

Opportunities for the role of forests

Articulating the role of forests would provide a range of benefits and opportunities

There is an opportunity for the Government to articulate the role of forests and other emissions removals, and how they will contribute to achieving emissions budgets and targets. It is important that in articulating the role of forests, how the sector will contribute to other environmental, economic, social, and cultural outcomes – including increasing resilience to climate change – is defined.

If the role of forests is clearly articulated, other policies can be aligned. For example, it will make it easier for policies like the NZ ETS and the RMA to be aligned in incentivising or delivering forests, while also maximising benefits to economy, environment, society, and culture.

Setting objectives on the role of forests will be important for determining what types of forests to plant where. There are carbon advantages and disadvantages to different types of forests. Fast growth forests, which are usually exotic, can sequester carbon dioxide much faster than slow growth forests, usually natives. However, while native forests remove carbon at slower rates than exotic planted forests, they can continue to sequester carbon for hundreds of years.

It is important that other outcomes besides carbon removals are considered when defining the role of forests. There are significant benefits to the reversion and planting of native forests, including enhancing native biodiversity, and better social and cultural outcomes. For example, native planting is more likely to uphold the principles of Te Taiao and Tiakitanga under the He Ara Waiora framework.[172]

Articulating the role of forests also gives Aotearoa New Zealand an opportunity to ensure the right trees are planted in the right place. Small areas of forest can be interspersed with other land uses, such as farms, to

[xxii] Or any replacement resource use and planning regime

create mosaic landscapes. Currently, the Government is working with the agriculture sector to develop a strategy for including on-farm sequestration in the upcoming farm-level emissions pricing system.

Once the objectives are clearly articulated, broader policies could be introduced that support outcomes for the wider roles forests could play for freshwater and biodiversity. Examples include tools such as biodiversity credits or grants that could also make native forestry more financially appealing.

Risks of forests

There are risks from relying heavily on forests to meet emissions reduction targets

Forests sequester carbon as they grow, but the carbon is only stored for as long as the trees remain standing, or the wood products produced from them endure. Under the accounting approach used for forests in Aotearoa New Zealand's emissions reduction targets, sequestration by a production forest is counted up to its long-term average carbon stock (an amount per hectare estimated over multiple harvest cycles).

In order to remove more carbon dioxide after this point, more land would have to be converted to forests. The need for ongoing land conversion to maintain a lower rate of net emissions through forests will reduce land use flexibility and shift the burden of reducing gross emissions to future generations.

Relying heavily on forests also presents permanence risks. There are several threats to forestry that already exist, and which will be exacerbated by a changing climate. Changes to the climate could impact tree growth rates and increase the risk of fire or pathogens.[173] Extreme weather events such as cyclones may also increasingly threaten forests.

If large sections of forest land are impacted by these events and the forest is not replaced, this can result in a return of carbon dioxide back into the atmosphere over the long-term.

The current structure of the NZ ETS is also likely to incentivise extensive afforestation in a way that would displace gross emissions reductions. This is addressed in *Chapter 4: Emissions Pricing.*

There are risks around rapid and unmanaged exotic afforestation

We have heard concerns that permanent forestry is being planted on productive sheep and beef farmland, raising concerns that there could be wider impacts on communities in rural areas. These flow-on effects of land-use change are addressed in *Chapter 7: Agriculture*.

There are also examples of debris from harvested forests clogging waterways and damaging or destroying infrastructure, such as in Tairāwhiti following Cyclone Gabrielle. There are currently inquiries looking at further regulating the industry at regional and national levels. The more extreme weather events there are, the more this is likely to be an issue.

Some Māori-collectives view permanent exotic afforestation as a means to establish forestry in areas that are not be suitable for harvesting but are exposed to erosion and run off. A large amount of Māori collectively-owned land is landlocked (surrounded by other people's land, constricting access), and lacks commercial options other than permanent forests. Limits on new plantings may have Te Tiriti o Waitangi/ The Treaty of Waitangi implications around tangata whenua exercising their rangatiratanga over their whenua.

There are also challenges related to native afforestation which need to be considered

Native planting has a high establishment cost. Native forests lack a clear financial return, which makes it hard to justify commercial planting. Native planting is also more susceptible to pests and diseases during their establishment phase than other exotic forests, such as pine.[174] There is opportunity for the establishment of native forest to occur naturally through natural regeneration, but without incentives this will be slow and small-scale.

While any current plantings through 2026-2030 will not significantly contribute to the second emissions budget, they will represent significant progress toward achieving future emissions budgets and the 2050 target.

Iwi/Māori have an important role in forestry

Mandated Iwi representatives and Māori-collectives have an important role when it comes to forestry. It is necessary to consider the specific effects for Iwi/Māori within the forestry sector, in light of Te Tiriti/The Treaty principles and the unique cultural, economic, social, and environmental considerations of tangata whenua. Many such entities participate in the forestry sector at a range of levels including being forest owners, forest workers, and kaitiaki. Furthermore, forests act as a source of food, rongoā (medicine), and building materials.

The Māori forestry asset base was estimated at $4.3 billion in 2018.[175] This has been estimated to cover 48% of all production forestry land within Aotearoa New Zealand.[176] This emphasises the fact that Māori-collectives play a key part in sequestering carbon dioxide through the establishment of forestry.

Much of the whenua that has been returned through Te Tiriti/The Treaty settlements is either already established in production forests, or land that is better suited to forests than other uses, such as steep, landlocked, or erosion-prone land.

Some representatives from Iwi and Māori-collectives have expressed an interest in transitioning existing pine forests to native and using exotics as nurse crops for converting pasture to native forests over a longer period of time. Different policy settings such as Te Ture Whenua Māori Act have an impact on what these entities can do with their land. These may have wider implications under Te Tiriti o Waitangi/The Treaty of Waitangi.

Often Māori collectively-owned land is either managed by the Crown or private forestry companies which are typically in long-term leases – up to 99 years or a defined number of rotations. As these leases start to cease, many such entities are starting to undertake management responsibilities for their forests. This will enable these groups to make more decisions on their own whenua, including whether it is more commercially viable to be planting permanent forests.

Forests have wider co-benefits

There are many cultural, economic, social, and environmental co-benefits associated with forests. From an environmental viewpoint, forests can help regulate waterflow through watersheds, support and increase biodiversity, and help stabilise land, which in turn can decrease rates of erosion. However, differing management practices, for example clear-fell harvesting, can greatly restrict these benefits and result in negative outcomes.

Through the planting of forests, many employment opportunities arise both within the industry and within the wider supply chain.[177] Land-use change to forestry may affect employment in rural communities, therefore it is important that the transition is managed to maximise positive and minimise negative impacts. Employment within this sector ranges across both skilled and unskilled labour, making it attractive for all levels of experience and qualifications. Forests are also an important part of the bioeconomy. For example, the use of timber in mid-rise buildings both stores carbon and reduces the need for the intensive emissions associated with the production of steel and cement. Biofuel can replace coal in some high-heat industrial processes.

Clear direction for the role of forests

To give certainty over the outcomes being sought and guide the design of climate policies relating to forests, it is essential that there is a clear direction on:

- the quantity of removals desired over the second and third emissions budgets
- expected planting rates over the second and third emissions budgets
- the role of forests in the transition to a low emissions economy
- the types of forests to be used in different contexts and for different purposes

Proposed recommendation

This proposed recommendation seeks to clarify the role of forests in Aotearoa New Zealand's efforts to meet its second emissions budget and longer-term emissions reduction targets.

Proposed Recommendation 15

We propose that the emissions reduction plan for the second budget period must:

15. Set and implement integrated objectives for the role of forests with respect to emissions mitigation and adaptation, while giving effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi.

Chapter 11: Transport

Introduction

Transport is critical for connecting people, families, and communities, and for a thriving economy, but is a major source of emissions

Aotearoa New Zealand's transport system connects individuals, whānau, and communities to one another and to places where they learn, work, live, and play. It delivers essential goods and services around the country.

A well-connected transport system is a mechanism for social equity and can create access for all people: children and older populations; tangata whenua and tauiwi; the abled and disabled; those who live in urban spaces and rural spaces; and parents, workers, and those enjoying recreation.

Currently, however, the transport system in Aotearoa New Zealand is a major source of greenhouse gas (GHG) emissions. In 2020, it produced 17% of gross emissions and 29% of long-lived gas emissions.[178]

More than 90% of transport emissions come from road transport. Three quarters of road emissions come from light vehicles – those under 3.5 gross tonnes – and about a quarter come from heavy vehicles (those over 3.5 gross tonnes). The remaining transport emissions are from domestic aviation (5%), and shipping and rail (3% combined).

Transport emissions need to decrease rapidly over successive emissions budget periods

As we discuss in *Chapter 2: The Task for the Second Emissions Budget*, the Government's sectoral targets for transport reduce at a progressively greater amount across the first three emissions budget periods and beyond.[179] This reflects the time it takes to consent and build low carbon infrastructure and the pace at which low emissions technologies can replace high emissions technologies.

This rapid decrease in transport emissions across budget periods, as seen in **Figure 11.1**, means it is critical during the second budget period for the Government to focus simultaneously on actions needed to reduce emissions within the second emissions budget period (2026-2030) and on actions needed to reduce emissions in the third emissions budget period (2031-2035).

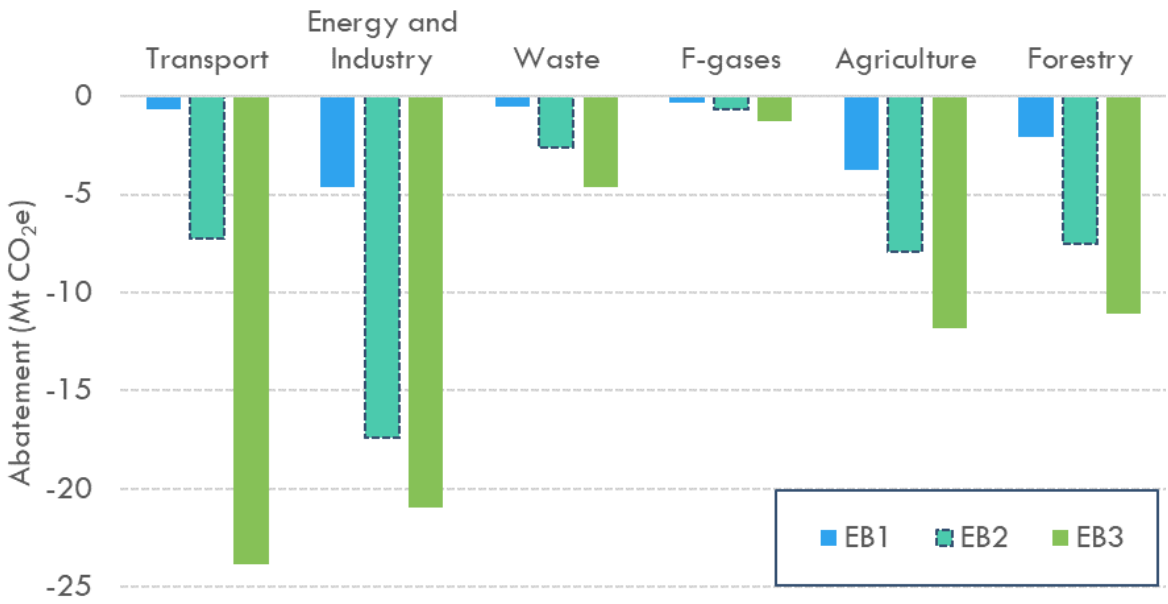
The transport system needs change at all levels to provide New Zealanders with more low emissions options.

Achieving this scale of decarbonisation requires pursuing many opportunities simultaneously. As in *Ināia tonu nei,* our approach has been informed by the internationally established 'Avoid, Shift, Improve' hierarchy to guide the approach to decarbonising transport in Aotearoa New Zealand. This hierarchy prioritises action to have the greatest cumulative impact and maximise the co-benefits available in transport.

- **Avoid:** reducing the need to travel and the time and distance travelled, while improving or maintaining accessibility
- **Shift:** changing how New Zealanders move to lower emissions transport. For example, shifting to greater amounts of public transport, cycling and walking

- **Improve:** improving the emissions efficiency in the vehicle fleet, especially electrifying vehicles to eliminate tailpipe emissions.

Figure 11.1: Additional emissions reductions needed relative to the baseline to meet sector sub-targets in the Government's first emission reduction plan.



Source: Aotearoa New Zealand's first emissions reduction plan: Technical information annex

The major opportunity to decarbonise by avoiding transport emissions is through changes to urban form

We primarily discuss this opportunity in *Chapter 8: Built Environment*. Changes to urban form can enhance people's access to the essential services they need for thriving lives in a way that requires less time spent in vehicles.[180,181] Designing the nation's planning system around people-oriented communities is a useful explicit outcome. In doing so, land-use and transport planning can also be better funded and integrated to deliver change at pace.

Changing the distance of trips and shifting shorter trips to active transport (namely, walking and cycling) are in line with achieving the Government's target for reducing Vehicle Kilometres Travelled (VKT) in the light vehicle fleet by 20% relative to the baseline projected VKT forecast for 2035.[182]

The major opportunity to decarbonise by shifting how New Zealanders move is through infrastructure supporting more walking, cycling, and public transport.

Our first transport recommendation focuses on the changes needed to create greater options for safe walking, cycling, and public transport. In addition to reducing emissions, this will improve health outcomes and create more equal access for all New Zealanders.

The major opportunities to decarbonise by improving emissions efficiency of transport come from replacing fossil-fuelled vehicles with low carbon alternatives.

Our second and third transport recommendations focus on improving the emissions efficiency of transport by replacing internal combustion engine (ICE) vehicles with low emissions alternatives – primarily through electric vehicles (EVs). This looks at both the light vehicle fleet – especially vehicle charging infrastructure – and freight and commercial vehicles including vans, utes, and trucks.

Decarbonising transport can support Māori to access places essential for identity and wellbeing, and address inequities

Within te ao Māori, access to whenua Māori, especially tūrangawaewae, is an essential part of identity and wellbeing.[183] The transport system provides a means to reach these important places, but often offers limited options for doing so by low emissions means, such as limited or no public transport service.[184,185]

Historic and systemic socio-economic inequities can also restrict the ability of some Māori-collectives to transition to lower transport emissions. This reduces access to high-value assets such as electric vehicles, while disproportionate mahi obligations may limit options for walking, cycling, and public transport. This, combined with ownership of lower safety rated, often older vehicles, contributes to the higher rates of death, serious injury, and accidents for Māori.[186]

These negative impacts underline that the transport system in Aotearoa New Zealand needs to be decarbonised in a manner consistent with the Crown's obligations under Te Tiriti o Waitangi/The Treaty of Waitangi. This should be informed by our advice in *Chapter 5: Whāia Ngā Tapuwae*.

Decarbonising transport can improve health, wellbeing, and equity.

Social equity also needs to be a central consideration when developing action to decarbonise transport in Aotearoa New Zealand. Transport inequity exists within the current system due to two main reasons:

- transport disadvantage resulting from a lack of transport options
- transport poverty resulting from people paying more for transport than what they can reasonably afford.[187]

While there are different pathways to decarbonise transport in Aotearoa New Zealand, prioritising those that alleviate transport inequities will result in better outcomes for New Zealanders, build stronger communities, and better meet the needs of current and future generations over time.

One critical way to achieve this is by ensuring there are more options for all New Zealanders, and centring the needs of people with disabilities, the young, and the elderly so that they can travel safely and affordably.[188] Changes to urban form and safely opening streets to grow walking, cycling, and public transport are effective ways to enhance wellbeing and equity.[189]

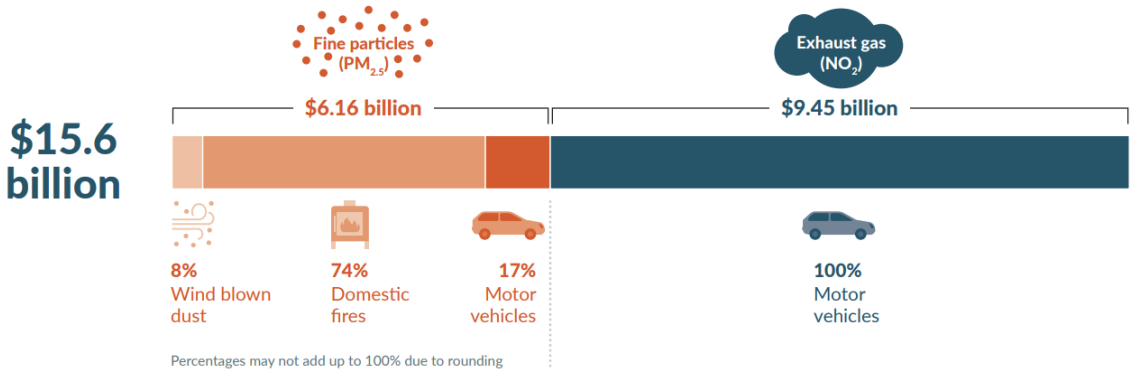
Decarbonising transport can realise significant health and wellbeing co-benefits in Aotearoa New Zealand at all levels of the 'Avoid, Shift, Improve' hierarchy:

- changes to urban form that reduce vehicle kilometres travelled will reduce harm and road deaths. Motor vehicle deaths are also one of the leading causes of premature mortality in Aotearoa New Zealand, especially for Māori[190,191]
- changes that improve walking, cycling, and public transport contribute to a healthier population[192,193]
- changes that replace fossil-fuelled vehicles with low carbon alternatives will significantly improve air quality.

While there are some challenges in quantifying these health co-benefits, the latest Health and Air Pollution in New Zealand study found "*air pollution in New Zealand was responsible for approximately 3,300*

premature deaths per year and social costs of $15.6 billion per year,"[194] as illustrated in **Figure 11.2**. This is primarily attributed to ICE vehicles.

Figure 11.2: Social costs of health impacts from human-made air pollution



Source: Health and Air Pollution in New Zealand 2016 (HAPINZ 3.0): Findings and Implications

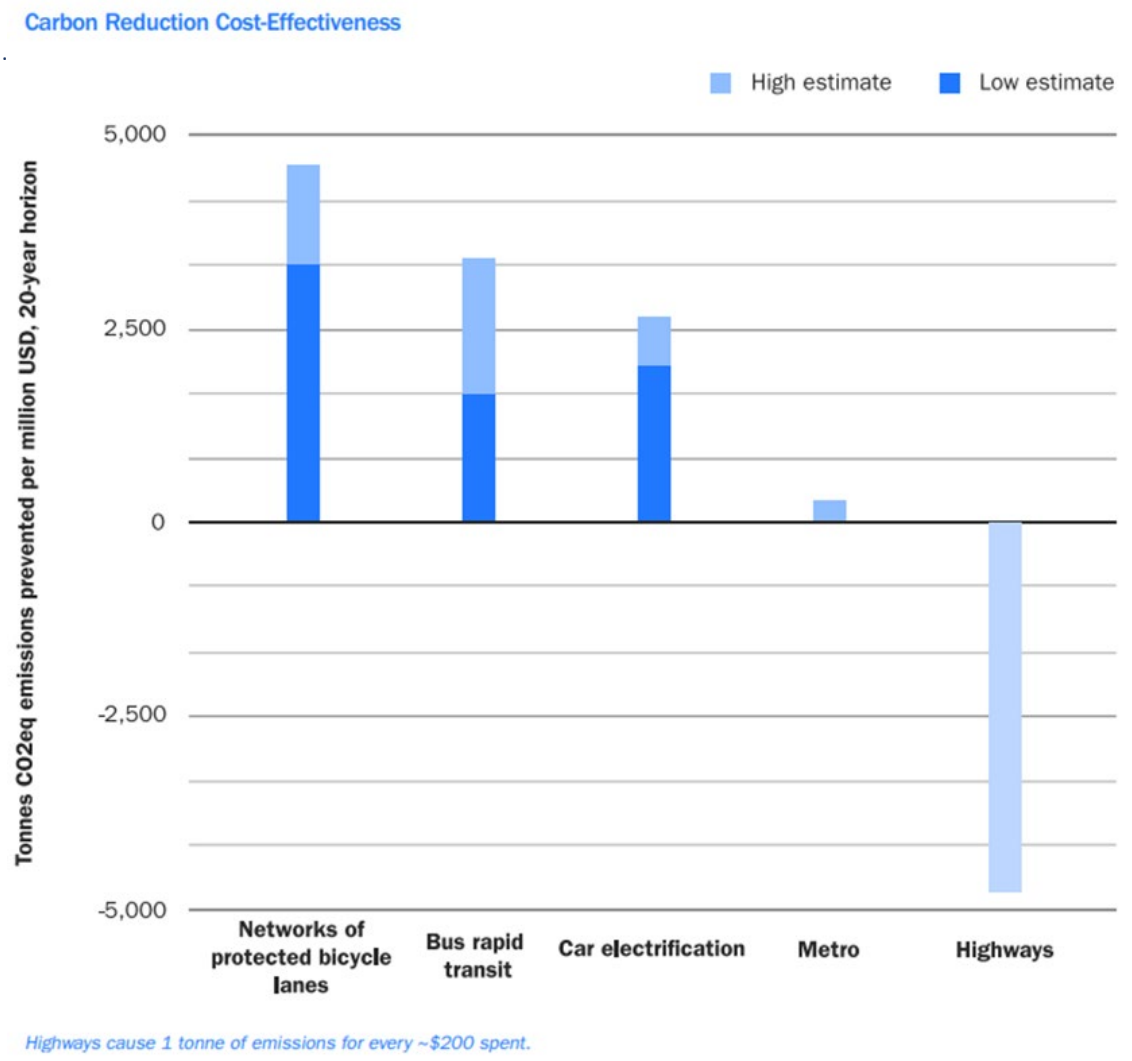
Increasing walking, cycling, and public transport

Transport infrastructure supporting safe walking, cycling and public transport would provide New Zealanders with low emissions options to connect

Walking, cycling, and public transport can provide zero or low emissions forms of transport and contribute to reducing emissions. International evidence indicates that when comparing cities with and without walking, cycling, and public transport networks, those with the networks can reduce emissions and pollution substantially.[195] This is increased when paired with changes to urban form, as per *Chapter 8: Built Environment*.

International research from the Institute for Transport and Development Policy has shown that biking networks and smart public transport upgrades yield high rates of decarbonisation on a per-dollar-expended basis, as illustrated in **Figure 11.3**.[196,197] By providing more options for New Zealanders, the greater the opportunities to capture co-benefits to health, economies, and wellbeing.[198]

Figure 11.3: Carbon reduction efficiency per dollar spent (USD)



Source: Institute for Transport and Development Policy[199]

Currently, the level of active and public transport in Aotearoa New Zealand is low. In the most recent household transport survey, from 2018 to 2021 only 5% of person-kilometres-travelled (PKT) were by active or public transport.[200]

This level lags many countries in the proportion of travel using low emissions modes, like walking, cycling, and public transport. While the categories differ slightly, comparators like the 27 countries of the European Union have 17.5% of PKT happening on non-car modes across the whole EU. More specifically, comparator countries like Ireland at 18.2%, and the United Kingdom at 12.6%, each outperform Aotearoa New Zealand in this respect.[201]

In our demonstration path, the percentage of PKT by active or public transport grows to 11% by the end of the second emissions budget. The growth in these activities directly reduces emissions and contributes towards the second and third emissions budgets.

Transport is exposed to the NZ ETS, but this is insufficient on its own to substantially grow rates of walking, cycling, and public transport. The impact at current NZ ETS prices is relatively low compared to other impacts on the price of liquid fuels. Consumers paid an extra 21 cents per litre of petrol (including GST) because of the NZ ETS in 2022.[202] The price signal is also insufficient to overcome barriers related to safety and convenience.[203]

These barriers need to be overcome through safe and dedicated infrastructure for walking, cycling, and public transport for these to be able to make a substantial contribution to reducing emissions. This will require changes to the funding and planning system.

Transport infrastructure has been underfunded, especially that which supports safe walking, cycling, and public transport.

Transport infrastructure in Aotearoa New Zealand has been chronically underfunded. Te Waihanga Infrastructure Commission estimates the current infrastructure deficit to be approximately $100 billion looking to the past across all types of infrastructure (that is, not just transport), and $100 billion in the future.[204]

In addition, transport funding has generally privileged high emissions vehicle infrastructure. The recent National Land Transport Programme allocations have had capital expenditure significantly weighted away from public and active transport.[205] With limited other options, Aotearoa New Zealand has one of the highest car ownership rates in the world on a per capita basis, embedding a high emissions transport system.[206]

Delivering a low emissions transport system in Aotearoa New Zealand will require significant investment to overcome the existing infrastructure deficit, and a reorientation of this funding to prioritise infrastructure that enables low emissions forms of transport. This combination of solutions would provide New Zealanders with more low emissions choices.

In Aotearoa New Zealand, local governments are responsible for a large portion of the funding for transport infrastructure. They also make many of the funding decisions that shape our cities. Allocating central government funding to achieve needed emissions reductions will be a key challenge and require stronger coordination between central, regional and city/district entities.

There needs to be greater clarity about what different local government entities are expected to deliver to support decarbonising transport.

Simplifying the planning and funding of integrated transport networks is needed to deliver transport infrastructure at the pace required

The Government's target to reduce VKT by 20% by 2035 represents significantly less VKT per capita than in the last two decades in Aotearoa New Zealand.[207] Meeting it will therefore require an investment in infrastructure to deliver rapid change.

However, the current planning and consenting process contains significant complexities, and major projects are funded inconsistently between central and local government. Both contexts create additional barriers to delivering transport infrastructure at the pace required.

Pressure is building on the consenting system, with demand projected to increase by 40% by 2050.[208] That increase, combined with compounding delays in the consenting system, threatens 29-34% of the emissions reductions required to meet targets across the energy and transport sectors.[209]

The planning and funding system for transport is slow and fragmented, carried out one project at a time instead of at a network level. This is changing in Auckland,[210] and delivering the same change to each of our largest cities' centres will be essential.

The process to get to delivery of infrastructure takes too long. Both *Let's Get Wellington Moving*, which originated in 2016, and *Auckland Light Rail*, which originated in 2018, are yet to commence building public transit.

These challenges need different solutions. Creating a consistent approach to how major projects are funded would give greater certainty to local government in developing projects in their areas. Simplifying the planning process to optimise public and active transport would enable these projects to be consented faster, and consequently, begin development earlier.

There are also different timeframes to develop safe infrastructure for walking, cycling, and public transport. Given the pace at which transport needs to decarbonise, the balance of investment directed at achieving different outcomes is another challenge to consider.[211] Infrastructure for walking, cycling, and public transport can be delivered faster than changes in urban form.[212]

Some of this may be delivered through the reforms to the Natural and Built Environment Bill. However, as stated in our submission on this Bill, transitional measures will need to be put in place to support local government to take proactive climate mitigation and adaptation steps prior to the reforms being implemented.

These transitional measures could include clear direction on what existing levers and tools local government should use to avoid further development in areas at risk from climate change, or development that locks in high emissions.[213]

The greatest opportunities to reduce emissions by increasing uptake of walking, cycling, and public transport are in major population centres. Auckland, Wellington, and Christchurch account for over a third of the national light vehicle VKT. This increases to 65% of national light vehicle VKT when all the Tier 1 areas are included (see **Box 11.1**).[214] An additional 13% of VKT is in Tier 2 cities and the remainder is in Tier 3 or rural areas.[215]

Focusing safe infrastructure for walking, cycling, and public transport in major population areas is therefore critical to reducing transport emissions.

Box 11.1 What does the Commission mean by "major population centres"?

In Aotearoa New Zealand, major population centres are defined in several different ways across regulations and policy frameworks.

For this advice, the Commission considers 'major population centres' to be the Tier 1 urban environments as defined in the *National Policy Statement on Urban Development 2020*. It also specifies the corresponding Tier 1 local authorities and aligning the focus of transport infrastructure with urban form will allow for greater synergies and emissions reductions.

Proposed recommendation

This proposed recommendation seeks to address the transport infrastructure challenges described above and to help enable Aotearoa New Zealand to meet its second emissions budget and longer-term emissions reduction targets.

Proposed Recommendation 16

We propose that the emissions reduction plan for the second budget period must:

16. Simplify planning and increase funding of integrated transport networks that optimise public and active transport. For major population centres, the Government should also complete cycleway networks by 2030 and take steps to complete rapid transport networks by 2035.

Shared transport modes and enhanced transport modes are transformative investments which should be funded to support connection

Walking, cycling, and public transport can be supported by greater use of shared transport – such as car share services – and enhanced modes such as e-bikes, and to a lesser extent e-scooters.

Car sharing services, which enable people to hire a vehicle on demand for only the time needed, are one of the only transport investments that enables reduced car ownership – clearing roads of vehicles that sit empty much of the time.[216] Studies indicate that each car share vehicle added reduces the need for approximately 11 vehicles.[217] This allows more road space to be devoted to connecting New Zealanders through active and public transport.

Similarly, private and shared e-bikes allow people to travel farther than normal bikes[218], emit less than cars[219], and even reduce travel time for those using motor vehicles[220] by decongesting vehicle lanes. To be effective and safe, shared bikes, e-bikes, and even e-scooters need to be enabled with separated cycle lanes and docking infrastructure.

The Government's Low Emissions Transport Fund has supported demonstration projects that expand car sharing services and grow vehicle charging infrastructure. However, after demonstration projects, the market is left to deliver these essential (for example, charging infrastructure) and valuable (for example, car sharing) services in a competitive market with numerous barriers.

These barriers include access to road or parking space, cost, information gaps, and suboptimal operating models because of challenges imposed by other entities – for example, local government or electricity lines distribution companies. Where initiatives do proceed, lower socio-economic neighbourhoods and rural communities are often the last to receive these services, contributing to transport inequity.

The gap between initiative demonstration and maturity would benefit from funding and policies to address barriers – in partnership with local government.[221] One solution would be for the Government to bring car sharing and e-bikes into the funding framework with incentives intended to reduce overall costs, to expand access to quality transport options. These may be particularly useful for pā/papakāinga and marae-based partnerships.

Decarbonising the light vehicle fleet

Transitioning to zero emissions battery electric vehicles is needed as quickly as possible

Alongside increasing walking, cycling, and public transport, transitioning ICE vehicles to zero or low emissions technologies will play a critical role in decarbonising transport in Aotearoa New Zealand.

Outside of urban centres, private vehicles are often the only available practical mode of transport for medium or long-distance trips. In the absence of safe, reliable alternatives, they provide mobility for New Zealanders. For many New Zealanders, they are the main option available, and will remain critical for many people with disabilities.

Decarbonising the light vehicle fleet in Aotearoa New Zealand requires electric vehicles (EVs) to quickly increase as a share of vehicles new to the country, and for this increasingly high share to be sustained.

From 2025 to 2030, our demonstration path sees annual light EV registrations climb from 11.5% to 67% of the market and reach 100% percent by 2035. This means 100% of cars entering the Aotearoa New Zealand fleet, whether new or new second-hand imports, are electric in 2035.

As older vehicles – predominantly ICE vehicles – are retired, the EV percentage of the entire fleet will rise. By the end of the second emissions budget, the demonstration path sees EVs comprising 14% of the total light fleet – almost 700,000 vehicles.

Shifting from ICE to EV vehicles has several benefits. In addition to eliminating emissions from operating the vehicles, from a life cycle emissions perspective that includes emissions from production, a new battery EV reduces emissions by 60% when compared with a new ICE vehicle.[222] Coupled with appropriate product stewardship that ensures battery reuse and recycling, their overall environmental impact can be minimised.

While EVs are already cheaper to operate than ICE vehicles, Commission modelling projects new EVs will also be on average cheaper on a total cost of ownership basis by 2026, without subsidy.[223] The shift to EVs also has health co-benefits from reducing the harmful effects of air pollution.

The rapidly climbing share of EVs in vehicles new to Aotearoa New Zealand needs to continue growing throughout the second emissions budget, with sustained support

During the first emissions budget, there has been progress in the uptake of EVs in Aotearoa New Zealand under policies introduced to address the barrier of greater upfront purchasing cost.

Figure 11.4 illustrates the Commission's demonstration path modelling for the share of EVs entering the fleet (in green) and the share of EVs in the total light fleet (red). The actual share of EVs entering the fleet each month is shown in orange. In 2022, the EV share of light vehicle registrations was 11%. This is nearly twice that of the Commission's demonstration path, and significantly exceeds Te Manatū Waka Ministry of Transport's modelled policy impact.

The S-shaped uptake curve in the demonstration path is typical for the adoption of new technologies. While the number of EV registrations may change in response to policy and other factors, long-term we expect it to follow an S-shaped curve.

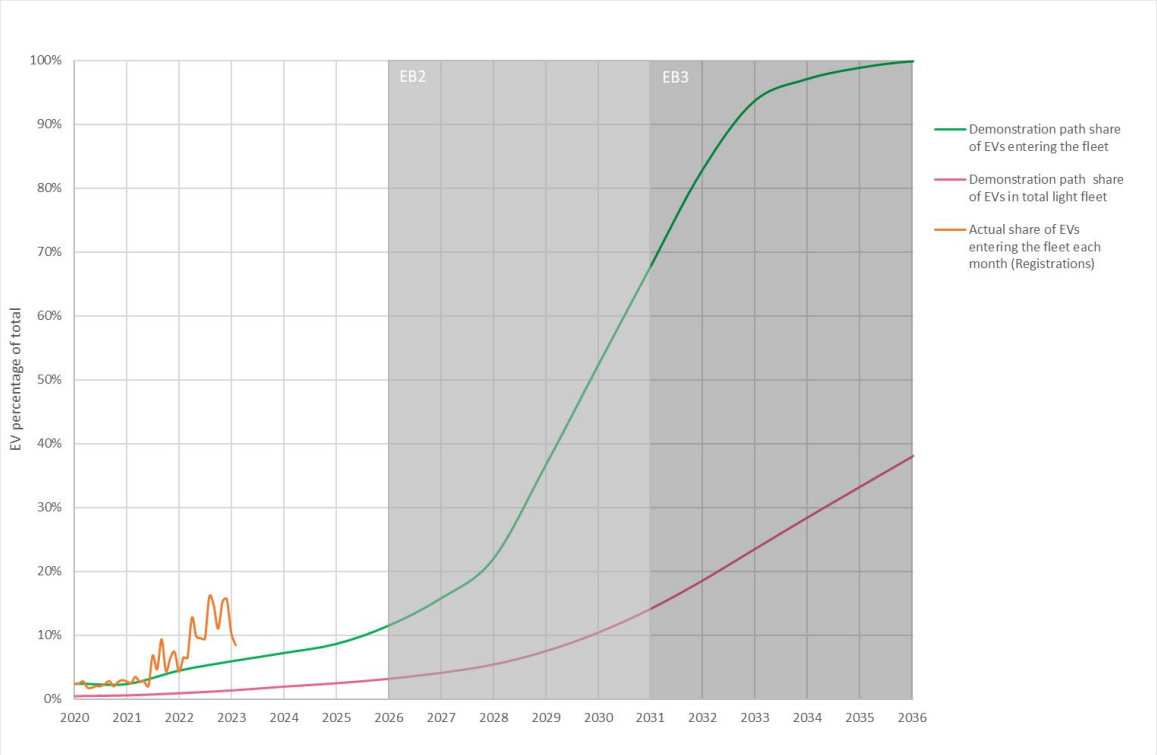
At the end of 2022, there were 65,000 registered electric vehicles.[224] This is 1.5% of the entire vehicle fleet in Aotearoa New Zealand. While this is progress, significant work remains to transition the entire fleet to low emissions vehicles. This needs continued policy support to encourage the purchase of new EVs – especially

addressing the upfront cost barrier – to meet the trajectory required for the second and third emissions budgets.

While the *Clean Car Standard* sets increasingly stringent carbon dioxide emissions targets for imported vehicles out to 2027, and allows subsequent years to be set by regulation, it falls short of announcing a complete phase-out of ICE vehicles.

Setting a phase-out date would align Aotearoa New Zealand with the European Union, the United Kingdom, and other economies that have announced similar policy. This would also provide certainty for industry and send a clear signal to vehicle manufacturers about the direction of policy requirements in Aotearoa New Zealand.

Figure 11.4: EV adoption mapped against the Demonstration path 2020–2036



Source: Commission analysis[225]

Targeted support for low income and disadvantaged groups is needed to ensure an equitable transition to a zero emissions vehicle fleet

A challenge for the second emissions budget will be ensuring that all New Zealanders who want to buy an EV are able to access them. Second-hand vehicles have been a major portion of vehicles imported to Aotearoa with around 40% of the light vehicles registered being imported second-hand.[226] These vehicles are affordable to more New Zealanders than new vehicles and have provided a critical means of transport for many households.

During the second emissions budget, supply of second-hand EVs may be constrained. In our demonstration path modelling, 55,000 used electric cars and electric SUVs are imported in 2030. Currently Japan is a key

supplier to Aotearoa New Zealand's second-hand market and vehicles entering the Japanese fleet now will only just start being available to the Aotearoa New Zealand market during the second emissions budget.

However, Japan is not adopting electric vehicles as quickly as Aotearoa New Zealand. In 2021, only 45,000 new electric vehicles were registered in Japan.[227] Not all these EVs will be available for export as second-hand vehicles and there is an increasing competition from markets like Australia.

Likely constrained supply from Japan may be alleviated by increasing EV imports from other second-hand markets such as the United Kingdom, but with the pace of the EV transition there may be limited supply of used vehicles for right-hand drive markets globally.

To address the likely shortage of second-hand EVs, households are likely to need support to reach into the new vehicle market. Targeted support for low income and disadvantaged groups will ensure an equitable transition to a zero emissions vehicle fleet. This could take the form of new ownership models like car sharing, social leasing, low-cost loans, or targeted capital cost subsidies. Targeted policy to enhance fleet turnover may also be required.

Vehicle charging infrastructure is likely to limit electric vehicle uptake unless existing barriers are removed

Charging infrastructure, both public and private, is crucial to the success of the EV transition. If the network rollout leads EV uptake, it has the potential to support consumer demand. If it lags, it has the potential to dampen EV uptake.[228]

During the Commission's initial engagement for this advice, many stakeholders said that the main constraint on EV uptake during the second emissions budget period would be sufficient vehicle charging infrastructure – not access to low emissions vehicles.

There are currently barriers to increasing both public and private vehicle charging infrastructure that will need to be overcome to support EV uptake.

At present, Aotearoa New Zealand lags behind similar countries in terms of public chargers.[229] A high-quality public charging network that enables longer journeys will help relieve range anxiety and incentivise EV uptake.[230]

A major constraint for the public charging network and for vehicle charging depots for private companies is the capacity of electricity distribution lines. This can create a first-mover disadvantage as the first to fund installation of vehicle charging infrastructure may also need to fund the upgrade of distribution lines. This barrier is shared with electrifying process heat as discussed in *Chapter 9: Energy and Industry*.

Currently, 82% of EV owners do most of their charging at home. This has multiple benefits including the ability to charge at off-peak times, which lowers the operating costs.[231] However, electric vehicles will increase residential electricity demand significantly.

The best way to manage this is by requiring smart charging that ensures charging is done at off-peak times of the day (ordinarily overnight), and in as efficient a manner as possible. This will reduce the burden on the grid and reduce costs for homeowners.[232]

There are also barriers to scaling up vehicle charging infrastructure at home. In Aotearoa New Zealand, one third of the population are tenants in rental properties.[233] This creates conflicting incentives between the tenant and building owner to install vehicle charging infrastructure.

Using another metric, around 15% of households lack a dedicated car park.[234] This can support increased urban density but if such households need to charge an electric vehicle, it will depend on a public facility.

There are policy options that could incentivise local authorities, landlords, pā, and marae to provide charging facilities in recognition that these facilities are an asset to the properties and local communities.

Without focused policy intervention, these and other barriers to scaling up both a nation-wide public charging network and sufficient private charging capacity are likely to constrain EV uptake in the second emissions budget period. This will limit the contribution of EVs to meeting the second emissions budget period and beyond.

Proposed recommendation

This proposed recommendation seeks to address the current challenges related to EV charging infrastructure and to help enable Aotearoa New Zealand to meet its second emissions budget and longer-term emissions reduction targets.

Proposed Recommendation 17

We propose that the emissions reduction plan for the second budget period must:

17. Rapidly resolve the barriers to scaling up vehicle charging infrastructure.

Decarbonising freight and commercial vehicles

The freight network is essential for a thriving economy, including enabling exports, but creates a quarter of transport emissions in Aotearoa New Zealand

The freight network is essential to the Aotearoa New Zealand economy, both for moving goods around the country and for connecting to our export markets. This was underlined by the COVID-19 pandemic.

Freight in Aotearoa New Zealand is predominantly delivered by road; around 75% on a tonne-kilometres basis. Heavy vehicles – those over 3.5 gross tonnes and frequently involved in delivering freight – are around 4% of the vehicle fleet but generated around a quarter of road transport emissions in 2020.

The freight network is also supported by light commercial vehicles, such as vans and utes, which are under 3.5 gross tonnes. These vehicles play a critical role in 'last mile' freight delivery and for many small and medium enterprises (SMEs). They are around 16% of all vehicles in Aotearoa New Zealand. Collectively, light commercial vehicles and heavy vehicles constitute only 19% of all vehicles, yet they contribute 49% of road transport emissions.

Coastal shipping, rail, and aviation provide the remaining 25% of freight on a tonnes-kilometre basis, each playing a different role depending on the cargo characteristics and delivery needs.

There are different challenges to decarbonising the different forms of freight. The Commission's demonstration path sees total emissions from freight (medium and heavy trucks, rail, and marine emissions) reduce from 3.9 Mt in 2021 to 3.5 Mt by the end of the second emissions budget period. However, with freight volumes anticipated to increase by 18% by 2030 relative to 2019,[235] decarbonising freight will be critical in achieving transport emissions reductions in the second emissions budget period.

Policy support and incentives are needed to decarbonise freight and commercial vehicles

There is significant potential for emissions reductions from transitioning ICE trucks to zero or low emissions alternatives. There is a commercial imperative for these vehicles to be in use on the road, which means that on a per-vehicle basis, they generate significantly more emissions than private, light passenger vehicles, which spend significantly more time unused. This is true, although to a lesser extent, for the vans and utes in commercial use around Aotearoa New Zealand.

The Government has signalled support for decarbonising this segment of the transport sector by committing to the Global Memorandum of Understanding to enable 100% zero emissions new truck and bus sales by 2040, and 30% by 2030 for Aotearoa New Zealand.

Uptake of such vehicles is currently slow, due to a combination of significantly higher capital cost, limited supply, and the lack of supporting infrastructure. For SMEs, a commercial vehicle may be their single largest capital asset. Converting this to a less familiar low emissions commercial vehicle may create risks that slow uptake.

By the second emissions budget period, however, around 300 low emissions medium and heavy vehicle models are anticipated to be available globally.[236,237] To realise the opportunity this presents for the second emissions budget period, clear direction and policy certainty is needed for operators investing in zero emissions commercial vehicles.

Sending a demand signal for these vehicles is important for global supply chains. This could include intervention such as an importer mandate – where a minimum portion of heavy vehicles sold are required to be zero emissions – and capital cost interventions as seen with the light vehicle fleet.

The capital costs for zero emissions vehicles are currently significantly higher than their diesel alternative – for trucks this is approximately two to four times more costly.[238] Although on a total cost of ownership level this cost is anticipated to decrease, freight operators – particularly SMEs with fewer resources – see this high upfront cost as a significant barrier to decarbonise.

The lack of public charging infrastructure capable of supporting zero emissions road freight is another significant barrier to uptake. There are currently no public chargers that cater for the capacity needed for battery electric trucks. Rapidly resolving the barriers to scaling up vehicle charging infrastructure should also address those barriers related to the freight network.

Outside of core transport sectors, it is estimated that 1.5 billion litres of petrol and diesel are consumed by off-road vehicles, contributing 2.9 $MtCO_2e$ per year.[239] This includes farm vehicles, forest machinery, and recreational marine activities.

To address the emissions from these vehicles, policies incentivising decarbonisation will be required. This could include extending existing policy frameworks to include off-road vehicles as was done with the Low Emissions Transport Fund.

Proposed recommendation

This proposed recommendation seeks to address the current challenges related to commercial EV uptake and to help enable Aotearoa New Zealand to meet its second emissions budget and longer-term emissions reduction targets.

Proposed Recommendation 18

We propose that the emissions reduction plan for the second budget period must:

18. Develop incentives to accelerate the uptake of zero emissions commercial vehicles, including vans, utes and trucks.

Supporting rail and coastal shipping provides resilience to climate impacts

Rail and coastal shipping also offer lower emissions forms of freight,[240] but can service fewer destinations than road freight. While this constrains the ability to shift freight from road, government support for rail and coastal shipping can support a more resilient freight network.

Cyclone Gabrielle damaged over 400 kilometres of roads, with a significant impact on road freight and other critical services.[241] This illustrates the vulnerability of the roading network to the impacts of climate change and underlines the resilience gained from a thriving, multi-modal freight network.

Continued investment for coastal shipping will be needed to upgrade port infrastructure to support increasing freight volumes, larger anticipated vessels, and resilience to increasing risk from extreme weather events and sea-level rise. For domestic carriers to remain competitive and to support a thriving, resilient local shipping industry, the Government needs to ensure regulations do not unduly favour international carriers.

For rail, the $1.3 billion Government investment within the first emissions budget period will help upgrade more of the existing network up to standard.[242] However, the nature of rail movement can mean it is not considered a reliable or cost-effective freight mode to meet market expectations for operators.[243]

In its emissions reduction plan, the Government has committed to preparing a national freight and supply chain strategy. It will be important this strategy includes a clear understanding of the freight tasks that are achievable with rail but not currently utilised, and addresses the barriers to increasing rail freight.

Aotearoa New Zealand needs to prepare now to enable future decarbonisation of aviation

As well as delivering high value freight, passenger aviation also connects people across regions faster than road travel. While upgrading aircraft and other efficiencies will contribute to emissions reductions, long-term, sustainable decarbonisation will be achieved through new aircraft types and low carbon fuels.

Within the second emissions budget period, the biggest opportunity for reducing emissions is likely to come from sustainably produced drop-in biofuels as a component of aviation fuels.[244] Air New Zealand, for example, announced that by 2030 it expects its fleet to be fuelled by 10% aviation biofuels.[245]

Demand for such fuels, however, will increase significantly as the International Civil Aviation Organization's *Carbon Offsetting and Reduction Scheme for International Aviation* commences in 2027.[246] The Government's first emissions reduction plan committed to developing an aviation-specific obligation for such biofuels. This would send an important signal to global supply chains and help secure the supply of this fuel.

In our modelling for *Ināia tonu nei*, domestically produced biofuels played an important role in addressing hard-to-abate transport emissions, rather than imported biofuels. Sustainably sourced biofuels can benefit most when prioritised for aviation, shipping, and other applications that cannot be easily electrified.

Supporting domestic production of high value aviation biofuels would be useful as part of a greater strategic use model for the Aotearoa New Zealand bioeconomy, as discussed in *Chapter 15: Circular Economy and Bioeconomy*.

The introduction of zero or low emissions aircraft – for example, battery electric or hydrogen fuel – is anticipated in Aotearoa New Zealand during the third emissions budget, servicing short or medium haul routes.[247] It is important that regulations are developed during the second emissions budget to enable this.

Chapter 12: Waste and Fluorinated Gases (F-Gases)

Waste

Introduction

Reducing waste emissions is a critical action for achieving the 2030 methane target, and climate change is a key catalyst for the transformation of the waste sector. Waste management and minimisation are also crucial for incorporating circular economy practices and can support the decarbonisation of the economy more generally.

Globally, solid waste management is estimated to account for approximately 5% of all emissions.[248] In 2018, Aotearoa New Zealand generated approximately 781 kg of municipal waste per person, nearly 50% more than other OECD countries, which average approximately 535 kg/per capita.[249]

In addition to reducing the production of all waste, this chapter recognises the importance of long-term waste infrastructure and resourcing recovery planning within Aotearoa New Zealand. Our draft advice relatedly supports the phase out the landfilling of organic waste where appropriate waste diversion facilities exist.

However, even with diversion of organic waste to landfill in place, there will still be a need to mitigate the methane coming from landfills. Organic waste will continue to go to landfill for some time, and even with a diversion system, some organic waste will end up in landfill. The proposed recommendation in this chapter seeks to improve the incentives to continuously improve the efficiency of landfill gas capture systems to reduce the methane emitted from landfill.

The context for change

It is critical that waste management and minimisation policies are developed in partnership with mandated Iwi representatives in a manner consistent with Te Tiriti o Waitangi/The Treaty of Waitangi and incorporate mātauranga Māori, to the benefit of all New Zealanders.

In 2020, emissions from waste in Aotearoa New Zealand contributed to 3.2 $MtCO_2e$, or 4.1% of gross greenhouse gas (GHG) emissions. These include emissions generated from solid waste disposal, biological treatment, the incineration and burning of solid waste, and from wastewater. Approximately 92% of these emissions are from biogenic methane, primarily generated by the decomposition of organic waste (for example, food, garden, wood, and paper waste). Other GHG emissions from waste include nitrous oxide (5.1%) and carbon dioxide emissions (2.7%).[250]

For context, 9% of the total biogenic methane produced in Aotearoa New Zealand comes from organic waste breaking down in landfills and 91% of our total biogenic methane emissions comes from ruminant animals in agriculture. As such, emissions reductions within the waste sector will contribute to the achievement of the 2050 biogenic methane target.

The first emissions budget period (2022–2025) set a waste sub-sector emissions target of 13.7 $MtCO_2e$. The Ministry for the Environment estimates the Government's work programme in the first emissions reduction plan will support the transition to a low emissions economy but will not be enough to achieve the waste sub-sector target,[251] potentially resulting in a shortfall of between 0.1 and 0.3 $MtCO_2$-e in 2025. This

potential shortfall highlights the significance of the subsequent actions and initiatives for inclusion in the second emissions reduction plan.

A starting point for reducing emissions from waste

Waste management and minimisation planning in Aotearoa New Zealand is currently in a state of flux. There is increasing awareness of the importance of diverting organic waste from landfill, enhancing resource efficiency, and promoting more sustainable waste treatment and disposal practices. There is also awareness of the need to transition into a more circular economy.

The waste actions contained in the first emissions reduction plan are primarily premised on reducing the amount of biodegradable waste sent to landfill and expanding landfill gas capture systems. As detailed in the emissions reduction plan for 2022-2025, key focus areas include:

- enabling households and businesses to reduce organic waste
- increasing the amount of organic waste diverted from landfill
- reducing and diverting construction and demolition waste to beneficial uses
- exploring the use of bans or limits to divert more organic waste from landfills
- increasing the capture of gas from landfills
- improving waste data and prioritising a national waste licensing scheme.

Most of these focus areas seek to reduce greenhouse gases produced by landfills, or landfill gas.

Landfill gas is a by-product of decomposing organic waste in landfills. It is mainly composed of biogenic methane and carbon dioxide. With appropriate equipment, modern landfills can capture some of the gas and either flare (burn) it or use it to produce energy. The process converts biogenic methane to carbon dioxide, which has a lower Global Warming Potential (GWP). Capturing landfill gas is a valid way to reduce harmful biogenic methane emissions and, in some cases, gain added benefits.[252]

Organic waste avoidance and diversion is critical for emissions reduction. However, where the disposal of organic waste to landfills cannot be avoided, or where organic waste disposal prohibitions will take several years to take effect, highly efficient landfill gas capture systems will enable emissions reduction.

While this chapter addresses direct emissions from waste, *Chapter 15: Circular Economy and Bioeconomy* addresses related issues, including product stewardship and the embodied emissions within the materials that become waste.

Key opportunities to reduce emissions from waste in 2026-2030

Waste Hierarchy Consideration

Objectives central to reducing the emissions from waste in Aotearoa New Zealand need to include:

- reducing the production of waste
- phasing out the landfilling of organic waste
- reducing the embodied emissions from waste
- avoiding and preventing fossil-fuel waste generation
- ensuring highly efficient gas capture at landfills that accept organic waste.

Applying the Waste Hierarchy can be effective for achieving a range of these objectives. As discussed in *Chapter 15: Circular Economy and Bioeconomy*, the Waste Hierarchy is a useful evaluation tool which can support and inform waste management and minimisation decision-making. It can also help identify pathways for maximising resource recovery throughout different waste management stages.

In our previous advice to the Government, we stated that the Waste Hierarchy should be used as a guiding principle for action. We also recommended that the revision of the *New Zealand Waste Strategy* include the Waste Hierarchy to:

- significantly decrease waste generation and increase resource recovery across waste streams
- reduce emissions via specific, time-bound goals
- identify and implement regulatory changes to assist people to take actions to reduce waste emissions.[253]

Recognition of the Waste Hierarchy will also be important within the new waste management legislation proposed to reform the Waste Minimisation Act (2008) and the Litter Act (1979). The Government has signalled this new legislation will create tools to deliver the waste strategy and ensure Aotearoa New Zealand makes good use of funds generated by the expanded Waste Disposal Levy. It is also intended to reset the purpose, governance arrangements, and roles and responsibilities in legislation, and strengthen and clarify regulatory and enforcement powers.

New legislation has the potential to further require the consideration of the Waste Hierarchy in decision-making at central and local government levels.

The Waste Disposal Levy[xxiii] can also be used effectively as a pricing mechanism to promote waste reduction. Through increasing the cost of waste disposal, the levy encourages organisations and individuals to take responsibility for the waste they produce and to find more effective and efficient ways to reduce, reuse, recycle or reprocess waste. The Government could strategically use Waste Disposal Levy price increases to achieve waste reduction. Providing clear long-term price signals with respect to future levy increases would help provide certainty relating to the value of waste reduction for the waste sector and investors.

Address organic waste disposal to landfill

The waste-related policies contained in the first emissions reduction plan predominantly focus on reducing biodegradable waste going to landfill. This is proposed to be achieved through enabling the separation of organic waste and investing in organic waste processing facilities. Relatedly, a 2030 ban or a limit applied to disposal of organic waste to landfill is being investigated by the Government.

Currently, a lack of funding is considered a barrier to reducing the emissions from waste by some councils, particularly those with a smaller rating base. We have also heard that food waste diversion is not a priority for some councils and there remains uncertainty about who would fund the ongoing costs of related servicing and processing infrastructure.

In our previous advice, *Ināia tonu nei,* we recognised that increases in the Waste Disposal Levy and New Zealand Emissions Trading Scheme costs impacting municipal landfills could lead to organic waste being diverted to non-municipal landfills that do not have landfill gas capture, resulting in increased emissions. To prevent such an increase in emissions, we recommended that high performance gas capture systems be mandated for all landfills that accept organic waste. We further recommended that the Government ensure that all landfills (except farm fills) that accept organic waste have effective gas capture systems in place.

While the first emissions reduction plan does not require the installation of landfill gas capture requirements to all landfills accepting organic waste, it does commit to undertaking feasibility studies to determine whether additional landfill gas capture requirements or organic material bans should be implemented.[254] It also requires all municipal (Class 1) landfills to have landfill gas capture systems in place by 31 December

[xxiii] From 1st July 2009 the Waste Disposal Levy came into effect, adding $10 per tonne to the cost of landfill disposal at sites that accept household solid waste. This levy is collected and managed by MfE who distribute half of the revenue collected to territorial authorities on a population basis. The other half is managed by MfE as a central contestable fund for waste minimisation initiatives. The levy for Class 1/Municipal landfills is currently set at $30/tonne, but scheduled to increase to $60/tonne in 2024. Beyond that, future levy increases remain uncertain.

2026. Notwithstanding these actions, installing high-performance gas capture systems within landfills is an opportunity for further emissions reductions. This matter is discussed in more detail below.

As appropriate waste diversion facilities become available, limits on the amount of organic waste that goes to landfill can be implemented. Investing in organic waste processing and resource recovery infrastructure is also required to support the achievement of the waste sub-sector targets in the second emissions budget.

Long-term planning for waste infrastructure in Aotearoa New Zealand

In *Ināia tonu nei,* we recommended the Government accelerate investment in infrastructure for waste collection, processing, and resource recovery.

In 2021, the Ministry for the Environment identified the need for the release of a long-term waste infrastructure plan. A long-term waste infrastructure plan was considered necessary to ensure that recently increased Waste Disposal Levy funds were managed in a way that enables coordinated decision-making and investment as a fit-for-purpose resource recovery system is built for Aotearoa New Zealand. Release of a long-term waste infrastructure plan remains forthcoming.

Creating a fit-for-purpose resource recovery network remains essential to large scale resource recovery and waste emissions reduction in Aotearoa New Zealand. The absence of a long-term waste infrastructure plan increases the risk that the country will lack the facilities necessary to significantly divert organic waste away from landfills by 2030. This would undermine the achievement of future waste sub-sector targets.

A long-term waste infrastructure plan is still required. This plan would inform investment in resource recovery infrastructure required across the country and provide transparency and confidence for territorial authorities, business, and Iwi/Māori who may be interested in investing in the resource recovery sector. The plan would further provide transparency on the emissions reduction potential and climate change mitigation benefits of the infrastructure proposed.

Establishing a national resource recovery network is an opportunity for the Government to promote equitable access to resource recovery services and facilities, which can further support community wellbeing through redistributing goods to help meet household needs. Ensuring reasonable community access to resource recovery services and facilities, irrespective of the size of the rating population base of a district or town, is important. The expansion of the resource recovery network could also be a commercial opportunity for partnership with mandated Iwi representatives and Māori-collectives. To realise these opportunities, the Government would need to address the barriers which limit Iwi/Māori-collectives from participating.

Enhance the performance of landfill gas capture

A package of emissions pricing and regulation is currently applied to reduce methane emissions at landfills. Emissions are priced via the New Zealand Emissions Trading Scheme (NZ ETS), and the Waste Disposal Levy encourages the reduction of waste going to municipal landfills, which further lowers emissions. Disposal facility operators are obliged to report their emissions and surrender New Zealand Units under the NZ ETS. A disposal facility is any facility including a landfill which operates as a business to dispose of waste, at which waste is disposed, and the disposed waste includes that from households, which is not entirely from construction, renovation, or demolition of a house. Operators of disposal facilities are mandatory NZ ETS participants.[255]

The cost of NZ ETS emissions obligations from landfills is effectively passed from the landfill owner to the person paying gate fee/landfill disposal charges when disposing of their waste.

In addition to pricing instruments, the Resource Management (National Environmental Standards for Air Quality) Regulations 2004 stipulate a maximum level of permitted GHG emissions at landfills. In effect, this

creates a minimum baseline for gas capture efficiency, but does not incentivise the installation of highly efficient landfill gas capture technologies. As the financial impacts of the NZ ETS are passed on the landfill user, and due to the minimum standard set by the air quality regulations, the current policy package does not efficiently work to incentivise innovation or promote the installation of optimal landfill gas capture systems.

The first emissions reduction plan requires all municipal (Class 1) landfills to have landfill gas capture systems by 31 December 2026 and commits to undertaking feasibility studies to determine whether additional landfill gas capture requirements or organic material bans should be implemented at non-municipal landfills. However, it does not address landfill gas capture performance.

Ensuring the installation of high-performance landfill gas capture at landfills could increase innovation and enhance the efficiency of gas capture infrastructure at landfills that accept or have recently accepted organic waste.

We have, however, heard concerns about the possible implications of the extended landfill gas capture requirements. There was a view that these existing requirements will increasingly result in the closure of smaller territorial authority landfills due to costs, and that such closure could result in a landfill monopoly that is dominated by the commercial sector, resulting in less control over price. There was also concern expressed over a possible ban of organic waste within Class 1 landfills, and uncertainty about the impact this might have on the efficiency of existing landfill gas capture systems.

For the second emissions budget period, there nevertheless remains an opportunity for the Government to incentivise greater gas capture performance and efficiency. To ensure the installation of high-performance gas capture systems, the Government should review the regulatory and policy settings, and apply regulatory and policy instruments to achieve the optimal use and efficiency of landfill gas capture systems and technologies at all landfills. Steps should also be taken to improve the accuracy and transparency of landfill gas capture data.

In light of the current emissions reduction plan requirement for all municipal (Class 1) landfills to establish landfill gas capture systems by 31 December 2026, Government action to improve landfill gas capture performance needs to be progressed with urgency. Improvement measures also present the opportunity to support effective and efficient investment and decision-making associated with landfill gas infrastructure.

As discussed in *Ināia tonu nei*, regular monitoring and auditing of landfills will additionally be necessary to ensure that gas capture systems are high performance.

Broader policy intervention initiatives for consideration

A broader range of policy intervention opportunities exists to reduce the emissions from waste and further support the transition of the circular economy in Aotearoa New Zealand. The following opportunities would benefit from further investigation:

- broadening emissions reduction plan efforts to reduce commercial, industrial, and manufacturing waste.
- establishing a more strategic approach to food rescue sector resourcing, funding, and research across Aotearoa New Zealand, including understanding and robustly quantifying the emissions impacts of food waste and food rescue at the national level.
- establishing a proportion of contestable Waste Minimisation Funds for related initiatives led by Iwi/Māori groups to address current inequities. Waste Disposal Levy revenue provides the basis of the Government's Waste Minimisation Fund, which provides grants funding to accelerate the transition towards a low emissions and low waste circular economy. Currently, $120 million of contestable funding is available for projects over the next two years, however, funding requirements neither address issues related to Iwi/Māori inequity, nor the barriers that limit Iwi/Māori competing for funding.

- improving the level and accuracy of available emissions data for farm-based waste disposal sites, potentially through farm waste management planning processes and through regional council regulatory processes.
- accelerating action necessary to establish national waste operator licensing, leveraging territory authority progress already established within this area.
- identifying opportunities to reduce emissions from wastewater discharge in Aotearoa New Zealand.
- applying appropriate policy mechanisms to promote the reduction of fossil fuel waste, including initiatives to reduce the use of virgin plastic used in packaging in Aotearoa New Zealand.
- leveraging territorial authority waste-related procurement processes to promote equity. However, to realise this opportunity, council procurement processes and considerations need to reflect the equity considerations as well. When dominated by cost weighting, community groups and NGOs cannot effectively compete with the commercial sector.

Box 12.1: The co-benefits of food rescue

"Food rescue can contribute to social good by nourishing people, including those experiencing food insecurity, and can provide broader social benefits including: contributing to community building and a sense of whanaungatanga or belonging; linking people experiencing food insecurity to wrap around services; and providing an opportunity for volunteerism and the associated benefits. A recent New Zealand-based study estimated that every dollar invested in food rescue provides a social return of $4.50."[256]

Food loss and food waste are a national and global issue for GHG emissions. While the extent of this emissions issue remains unknown for Aotearoa New Zealand, research has found that 13.4% of children live in households experiencing moderate-to-severe food insecurity. Due to the cross-cutting benefits of food rescue, a more strategic approach to funding and research would benefit Aotearoa New Zealand.[257]

Tensions over thermal waste-to-energy for emissions reductions

During our initial engagement for this advice, we heard concerns about thermal waste-to-energy operations potentially undermining resource recovery in Aotearoa New Zealand.

The Commission has not previously provided advice to the Government on thermal waste-to-energy, and this matter is not addressed in the first emissions reduction plan.

Thermal waste-to-energy technology broadly refers to a family of technologies that process waste material to generate energy. It uses combustion ranging from incineration to more advanced methods such as pyrolysis and gasification. Different technologies use a range of waste materials as feedstock for the processing plant, and each plant might produce energy in the form of heat, electricity, or a fuel.[258]

Establishing thermal waste-to-energy facilities can lock in the supply of waste as feedstock. When waste-to-energy facilities compete with the same material as recycling, it has the potential to constrain or undermine national recycling efforts.[259]

As recently observed in England, the use of waste-to-energy is now more prevalent than recycling. Emissions have subsequently increased from incinerators and waste-to-energy facilities. Both Scotland and Wales have recently established moratoriums on the establishment of new waste-to-energy facilities, subject to varying

conditions. More broadly, the United Kingdom recognises that if continued unchecked, growth in waste-to-energy incineration could undermine the sector's contribution to the United Kingdom's emissions goals.[260]

Thermal waste-to-energy premised on non-renewable feedstock is less favourable within the waste hierarchy. Such facilities have the potential to undermine future national waste reduction and recycling goals and displace the use and advancement of alternative renewable electricity generation options within Aotearoa New Zealand.

For the reasons identified above, a precautionary approach could beneficially inform waste-to-energy policy and investment considerations in Aotearoa New Zealand.

Relatedly, the experience of the United Kingdom illustrates the importance of understanding current and future waste disposal and recycling capacity within New Zealand Aotearoa, as well as the need to ensure that the establishment of any new waste to energy facilities will not undermine waste and emissions reduction targets.

Proposed recommendation

This proposed recommendation seeks to address the misalignment between current landfill gas capture and Aotearoa New Zealand's emissions reduction targets.

Proposed Recommendation 19

19. We propose that the emissions reduction plan for the second budget period must:
    a) Apply regulatory and policy instruments to achieve the optimal use and efficiency of landfill gas capture systems and technologies at all landfills
    b) Improve the accuracy and transparency of landfill gas capture data by reviewing and strengthening relevant regulatory and policy tools.

Fluorinated Gases

Introduction

Fluorinated gases (F-gases) are a class of fluorine-containing compounds that are gases at ambient temperatures.

There are three classes of F-gases used in Aotearoa New Zealand: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6). These gases are all imported into Aotearoa New Zealand, and are used in a range of industrial, commercial, and domestic applications – including refrigeration, air-conditioning and heat pumps, medical inhalers and aerosols, electrical switchgear, fire protection systems, and other specialist applications.[261]

F-gases were commonly introduced to replace harmful ozone-depleting substances. While not ozone-depleting, F-gases are powerful greenhouse gases, with a Global Warming Potential (GWP) that can be many thousand times higher than carbon dioxide.

In 2020, F-gases collectively contributed to 2.0% of gross emissions in Aotearoa New Zealand. These F-gas emissions equated to 1.6 $MtCO_2e$.[262] These emissions mainly comprise of HFCs (93%), which are the most common type of refrigerant.[263]

HFCs imports are expected to reduce over time, largely due to the phasedown of these gases in accordance with the Kigali Amendment to the Montreal Protocol. However, due to high levels of existing stock, emissions from HFCs are anticipated to decline at a much slower pace.[264]

A suite of policy intervention measures is necessary for establishing a robust F-gas and refrigerant management framework effective in reducing GHG emissions. These measures need to be developed and implemented in partnership with mandated Iwi representatives and in line with Te Tiriti o Waitangi/The Treaty of Waitangi, and in a manner that incorporates mātauranga Māori and is consistent with mana motuhake.

Context of F-gas policy advice

In *Ināia tonu nei,* we recommended the Government commit to measures to reduce HFCs, including expanding import restrictions where feasible, improving industry practice to reduce leakage, and enabling businesses and consumers to switch to low climate impact alternatives.[265] There are a range of measures within the first emissions reduction plan, including actions to:

- develop training and accreditation for handling alternative gases[266]
- prohibit imports of pre-charged equipment[267]
- investigate prohibiting F-gases with high GWP[268]
- introduce a mandatory product stewardship scheme for refrigerants.[269]

While the existing work programme intersects with the following opportunities to reduce emissions from F-gases, delivering and implementing existing actions remains essential. The opportunities below are additional actions that will support the establishment of a robust regulatory framework for effective emissions reduction.

Key opportunities to reduce F-gas emissions in 2026-2030

Enabling robust F-gas regulation

Refrigerants and other synthetic gases are one of six priority products under the Waste Minimisation Act 2008. Appropriate F-gas monitoring and the enforcement of F-gas regulation, including requirements for F-gas labelling and traceability, will be a critical part of scheme success.

Uptake of low global warming potential (GWP) alternatives

The transition to low-GWP refrigerants will be essential to lowering F-gas emissions without significantly affecting industries that rely on refrigerants. Measures to promote the uptake and safe use of these more volatile low-GWP gases would also help.

A robust and transparent refrigerant training, management, and tracking framework reflecting industry best practice and overseen by the government, could further support the transition.

Import restrictions on pre-charged equipment with high-GWP F-gases

The phase down of the bulk import of HFCs imported into Aotearoa is in place but does not currently include imports within pre-charged equipment, like air conditioning units in vehicles. Prohibitions that target the import and sale of equipment pre-charged with high-GWP F-gases would prevent the continued use of these gases in areas where a viable pathway exists to shift to alternatives with lower environmental impact. As signalled in our previous advice, the Commission supports the establishment of import restrictions where feasible.

Box 12.2: New refrigerant destruction plant proposed for Aotearoa New Zealand

The Trust for the Destruction of Synthetic Refrigerants is commissioning the first refrigerant waste management destruction facility in Kawerau. Acquired from PyroGenesis Canada, it will use steam technology to destroy high-GWP gases.

To date, the Trust's Cool-Safe voluntary product stewardship scheme has recovered synthetic refrigerants in Aotearoa New Zealand and shipped them to Australia for destruction. However, destroying the refrigerants onshore means a reduced risk of leakage associated with transporting these gases, and provides enhanced tracking transparency associated with their destruction. It also reduces transport emissions. An onshore refrigerant destruction will additionally be in line with the commitments of the Basel Convention, which seeks to reduce the movement of hazardous waste between nations.

The Cool-Safe programme has a goal of reducing greenhouse gas emissions from the refrigerants industry by 90% by 2035. The destruction facility is proposed to be built by 2024 and will have the capacity to destroy up to 100 tonnes of gases annually.

Policy intervention to promote equity

As steps are taken to reduce emissions from waste and F-gases, we are aware communities look to government and government agencies to lead through their own actions. This will require integration across government agencies, applying the waste hierarchy and considering equity in central and local government waste planning and decision-making.

Equity is inherently connected with reducing emissions from waste. For example, coordinated long-term planning and investment into waste and resource recovery infrastructure presents an opportunity to promote community wellbeing and equity through the provision of resource recovery services and facilities.

The provision of more strategic governmental support and resourcing to support food rescue could also promote equity and support wellbeing for many people facing food insecurity in Aotearoa New Zealand.

Chapter 13: Research, Science, Innovation, and Technology

Introduction

In *Ināia tonu nei*, we highlighted the importance of driving the creation of options through enabling innovation and systems transformation. Meeting emissions budgets will require the research, science, innovation, and technology (RSI&T) system to provide the knowledge and insights needed to transform to a low emissions economy that is both resilient and prosperous.

RSI&T activities occur across the economy, in both the public and private sectors. These efforts include inventing new ways of generating energy, new fuels, developing more efficient processes or technologies to reduce emissions from agriculture, converting knowledge and ideas into new and better methods, as well as adapting, absorbing, and extending the reach of technologies and knowledge.

In *Ināia tonu nei,* we identified that whether businesses succeed in driving innovation depends on access to knowledge, skills, and finance. Well-designed policies and stable support enable researchers, industry, and businesses to develop, adapt, and deploy innovative technologies.

Since *Ināia tonu nei,* the Government has embarked on a programme to reform RSI&T, called *Te Ara Paerangi – Future Pathways*. Through their consultation, the Government heard that there is a clear desire for real transformation within the RSI&T system.[270] *The White Paper*, produced as part of *Te Ara Paerangi – Future Pathways,* charts a course to:

- set National Research Priorities
- build the workforce Aotearoa New Zealand needs
- embed the principles of Te Tiriti o Waitangi/The Treaty of Waitangi into the design of the RSI&T system
- create a sustainable, resilient, cohesive system that fosters science for the public good.[271]

Although the application of our policy and prioritisation frameworks (described in *Chapter 1: Introduction*) have not identified any proposed recommendations for RSI&T, action is still needed. This chapter provides advice on the important activities and pieces of work required to continue driving research and innovation to help meet the second emissions budget and enable Aotearoa New Zealand to achieve its longer-term climate targets. These actions focus on increasing access to and uptake of new knowledge and technologies, including those within and informed by mātauranga Māori.

Enabling innovation and systems transformation

A strong research, science, innovation, and technology system is fundamental to transform Aotearoa New Zealand to a thriving and resilient low emissions future

A strong RSI&T system enables the growth of new sectors, market opportunities, and high-value jobs. It creates low emissions options and technologies, and supports adaptation information and technology needs to drive the transformation to a low emissions economy that is prosperous, equitable, and resilient.

Government has a significant role to play in enabling and driving innovation and broad system transformation, and its options to do so go beyond financial support. They include regulations, procurement, trade agreements, workforce development, resource and development infrastructure, intelligence, foresight, and standards-setting. Exercising these options can help support the development, demonstration, and deployment of innovation, and shift behaviour away from emissions-intensive practices towards low emissions activities.

However, government actions will not be the sole driver of enabling innovation and system transformation. The private sector will need to play a significant role in accelerating the transition by embracing the need for transformation across the economy.

Targeted investment in climate change within the research, science, innovation, and technology system is required

To ensure the knowledge and technology needed is available, targeted investment in climate change within the RSI&T system is required. A clear set of priorities for climate change science and research will help guide investment towards the matters of greatest importance.

The Environment and Climate Research Strategy (ECRS) is expected be a driver of setting clear direction for climate change research.[272] It is also expected to help ensure research across disciplines is well connected and can meet the needs identified in the first national climate change risk assessment, the national adaptation plan, and the first emissions reduction plan. It will be important for the ECRS to enable a strategic and coordinated approach to investing that can inform the wider National Research Priority setting of *Te Ara Paerangi – Future Pathways*.

Currently, investment in climate change within the RSI&T system is difficult to measure. The New Zealand Research Information System under development by Ministry of Business, Innovation and Employment (MBIE), is expected to provide information on climate change projects underway, including how they are funded and what resources are being used and by whom.[273] This system could act as the foundation to measure targeted investment in climate change in the RSI&T system.

Robust research and innovation take time, and therefore sufficient forward planning is required. While clear direction is an immediate gap, the pace of investment from government and the private sector needs to accelerate to drive the transformation the transition requires.

In line with the Government's stated commitment,[274] the *Te Ara Paerangi – Future Pathways* White Paper proposes an increase in research and development expenditures to 2% of gross domestic product (GDP) by 2030. While this increase is an improvement, the overall ambition still falls below the OECD research and development average expenditure of 2.5% of GDP.[275]

Without dedicated investment in climate change activities within the RSI&T system, Aotearoa New Zealand will not be able to capitalise on opportunities for low emissions transformation and the RSI&T system reform underway will not have a meaningful impact.

Continuity of people, infrastructure, technology, and information will ensure we have the right resources at the right time

As *Te Ara Paerangi – Future Pathways* is implemented, it will be critical to retain the human, infrastructure, technology, and information capacity developed over the last decade. Investments, like those delivered through the National Science Challenges, have been instrumental in the first emissions budget period, and the second emissions reduction plan will need to ensure no funding gaps emerge.

A recent study revealed that Aotearoa New Zealand's research workforce has been growing since 2010, with an average annual rate of increase of 4.3%.[276] The report noted a three-fold increase in the number of PhD research graduates between 2003 and 2020, many of whom were foreign students. However, the proportion of Māori PhD research graduates has decreased from 6.4% in 2004 to 3.8% in 2019,[277] indicating that representation of Māori in graduate training is falling and focused efforts may be needed to address this.

We have heard from the research community that recruitment has been difficult and there is a need to ensure that the workforce planning within *Te Ara Paerangi – Future Pathways* is prioritised. While there has been an increase in the number of research graduates, retention in the workforce is declining.[278] A focus on growing capabilities within research institutions across the country will help, as will ensuring that immigration policies support recruitment of foreign skilled workers to fill gaps where needed.

Resourcing of the RSI&T system goes beyond people, and a range of investments is needed. *Kitmap - A Stocktake of research infrastructure in Aotearoa New Zealand's Government Research Organisations* noted that not all research infrastructure can be accessed by external users and, in some cases, there is a fee for external users.[279] Increasing access to a wider range of researchers across the RSI&T system will improve the capacity for collaboration.

There is a lack of clarity regarding the Government's immediate actions to address the looming funding gap, created by the conclusion of the National Science Challenges. To ensure the country has the right resources at the right time, continuity in funding and programmes will be key.

Openly available climate change data and information is essential for the transition

Monetisation of climate change data and information can hinder its use for the public good by creating inequitable access to information. While there are several policies in Aotearoa New Zealand that support open government and the release of open data, there remain significant roadblocks that result in insufficient openness of climate change data and information.

The revenue model of Crown-owned entities, such as CRIs or MetService, appears to be a driver of the limited access in many cases. In 2018, MBIE commissioned a review of open access to weather data. The review looked at the viability of releasing government-held data (beyond what is currently released) to the public to encourage innovation and drive economic growth.

The review found that the existing state-owned enterprise and CRI models that MetService and NIWA operate under have led to more restricted access to observational weather data in Aotearoa New Zealand, compared to other countries.[280] This is primarily due to the need to earn commercial revenue to support data collection and to cover operating costs of these organisations.

The review noted that making more data open to the public would require significant changes to MetService and NIWA legal and operating models. To address this and similar issues across the RSI&T system, institutional reforms such as those indicated in the White Paper from *Te Ara Paerangi – Future Pathways* are necessary.

During the Commission's early engagements, we heard that there are limitations for sharing data across government organisations and CRIs. The European Commission's strategy for data considers open data to be "an essential resource for economic growth, job creation and societal progress".[281] Failure to enable open data access for environmental, weather, and climate data and information will result in poor outcomes for the transition.

Our regulatory environment needs to both enable and incentivise early adoption to drive innovation

Early adoption of new technologies can be risky. During early engagements, the Commission heard that a barrier to early adoption of new technology is uncertainty around how regulations apply or restrict its use. A 2021 study into frontier firms by the Productivity Commission found that innovation is key and Aotearoa New Zealand's innovation ecosystem requires reform to enable firms to innovate and export at scale.[282]

We also heard about the need to ensure policies and investments are not decided in isolation. Regulation reform and investment need to be aligned to avoid stalling the progression of new technologies. If regulations are not updated to reflect new technologies that have been developed, they cannot be brought into the market domestically. Creating incentives for early adopters and strengthening tax incentives will likely drive domestic investment from the private sector.

Developing a strong digital economy will be necessary to support digitalisation across sectors and improve resiliency across the economy by supporting innovation

The economic transformation required for the transition will be strongly dependent on digitalisation across most, if not all, sectors. New low emissions sectors will emerge and create opportunities that, in some cases, change components of existing sectors. There are many aspects of the digital economy that have the potential to support a significant transformation over short time frames. To develop a strong digital economy, it will be necessary for the Government to support innovation and digitalisation across sectors.

According to MBIE's *Building a Digital Nation* report, Aotearoa New Zealand's digital technology sector is performing well but is a relatively small component of the overall economy.[283] The report emphasises the need to accelerate the digital transformation. To achieve this, there is a need to grow the digital skills of New Zealanders, enhance domestic and international connectivity, balance security, privacy, and innovation, and support digital technological innovation through regulation.

Chapter 14: Funding and Finance

Introduction

In *Ināia tonu nei*, we highlighted that investment will be needed across the economy to support the transition to low emissions, and access to finance and investment capital will underpin emissions reductions in every sector.

A November 2022 report from the Ministry of Business, Innovation and Employment found that while work is underway enabling and investing in a low emissions economy, meeting emissions targets will depend on broadening, deepening, and accelerating current efforts in both the public and private financial sectors.[284]

Funding and finance decisions will also have an impact on social and economic equity for current and future generations. It is important that the Government's actions are based on the principles of Te Tiriti o Waitangi/The Treaty of Waitangi, tikanga-informed, and reflect strong consideration of potential equity opportunities and consequences.

Although the application of our policy and prioritisation frameworks (described in *Chapter 1: Introduction*) have not identified any proposed recommendations regarding funding and finance, action is still needed. This chapter provides advice on the important activities and pieces of work required to meet the second emissions budget and enable Aotearoa New Zealand to achieve its longer-term climate targets, including:

- ensuring adequate funding for initiatives to lower emissions
- aligning all public investments with Aotearoa New Zealand's climate goals
- developing a unifying strategy to support decision-making
- encouraging and enabling private investors to urgently shift to sustainable finance.

Public investment

A strategic and ambitious approach to public investment is needed

The way the Government spends public funds to lower emissions matters. In addition to the direct impacts felt from individual projects or policies, Government decisions send a message about what is important to New Zealanders and demonstrate what kind of change is possible at a large scale.

With the introduction of initiatives and institutions like the Climate Emergency Response Fund, Sovereign Green Bonds, and New Zealand Green Investment Finance, the Government has in place multiple avenues to directly invest in a carbon-neutral future.

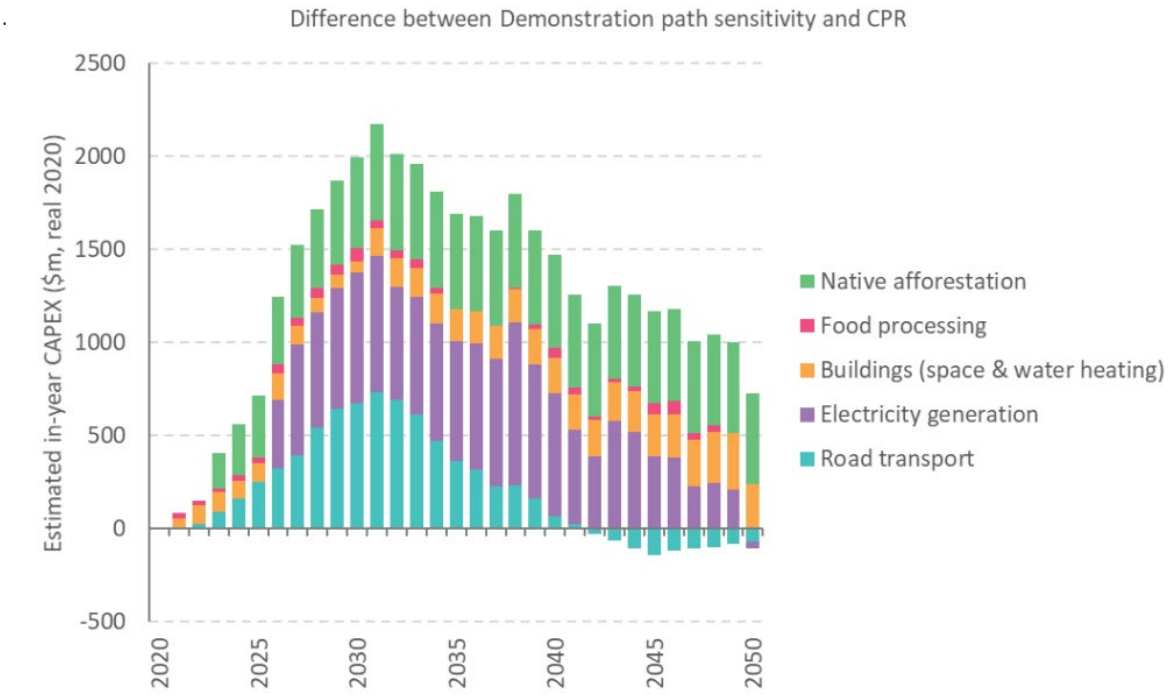
It can now continue its progress by identifying ambitious and measurable financial commitments for the second emissions budget period and beyond in areas like renewable energy and electrification, reducing methane emissions, new energy technologies, public transport, and low emissions public services like hospitals and schools.[285]

In 2022, the Commission published analysis provided to government agencies on the capital investments that could be required to meet emissions budgets in areas including electricity generation, building heating appliances, road transport vehicles and electric vehicle chargers, and native afforestation.[286]

Figure 14.1 below shows the estimated yearly difference between expected capital investment under government policies (Current Policy Reference) and the Commission's demonstration path, the core scenario underlying our recommended emissions budgets. This capital investment will be come from a

variety of sources, including government and private and institutional investors. Having a financial system tuned to help this capital flow is of the utmost importance.

Figure 14.1: Differences in annual capital investment between the modified demonstration path and Current Policy Reference case



There is a relationship between investment to reduce emissions now and future investment required for adaptation

In the second emissions budget period, allocation of public funds in carbon-lowering initiatives will require careful consideration alongside the rapidly growing costs of adaptation and disaster management. In the weeks following Cyclone Gabrielle, Finance Minister Grant Robertson together with the Treasury estimated that recovery from the storm could reach $13 billion.[287]

Investment in lowering emissions cannot be delayed to off-set immediate climate-related costs, however, as advances in efforts to reduce emissions now will impact the scale of adaptation needs later. The UK Government, for example, estimates that for every £1 invested well in climate-related risk reduction, more than £3 (and up to £50) is saved through avoidance of disaster impacts.[288] There are also significant financial benefits and efficiency gains that come from opportunities to invest in emissions reduction and adaptation together.

Regularly reviewing the impacts of government-supported actions and assessing processes and criteria for decision-making will help ensure the right projects are being funded at the right time and in the right way to meet emissions budgets, as will increasing the visibility and accountability around publicly funded initiatives. Providing evidence to taxpayers showing that their money is having a positive impact in reducing Aotearoa New Zealand's emissions will lead to greater support for specific emissions reduction projects, and for the Government's climate strategy more generally.

Striking the right balance between necessary ambition and effective investment requires careful consideration and regular review

The New Zealand Emissions Trading Scheme (NZ ETS) provides revenue for the Climate Emergency Response Fund but is subject to market variability. Relying too heavily on funds from the NZ ETS may therefore expose emissions reduction initiatives to risk.

Projects like the Carbon Neutral Government Programme and Crown Responsible Investment Framework also require regular review to confirm they remain ambitious and achievable. Including in those reviews consideration of scope expansion or timeline acceleration – for example moving towards a net-negative emissions government by 2030 – will ensure government is understood to be proactive and a positive example for private investors and individual households.

More broadly, if the Government wishes to meet the second emissions budgets and transition to a low emissions economy, it will need to ensure the full suite of its investments align with Aotearoa New Zealand's climate goals. Each funding decision the Government makes will have an impact – positive or negative – on emissions and the climate. If emissions impacts are not carefully and consistently considered, non-climate related financing decisions could serve as unintended roadblocks to a low emissions future.

Private investment

The role of private finance in emissions reduction is growing, and requires an enabling environment from the Government

In *Ināia tonu nei*, we discussed the importance of mobilising private investment, and the need to identify and address the barriers hindering flows of private capital towards low emissions investments.

Since the publication of that advice, the role of private investment within the landscape of climate funding and finance has continued to grow. A 2021 report from the UNFCC's Race to Zero campaign found that from 2026, a global investment of USD $4.5 trillion in decarbonisation per year is needed to reach net zero by 2050, with private actors accounting for up to 70% of those investments.[289]

However, if perception of risk amongst private investors is too high, they will refrain from committing funds to new sectors and initiatives, even at the expense of low or negative real returns.[290]

Private investment requires both policy clarity and investment confidence to redirect the flow of capital. The Government therefore has a key role to play in incentivising and de-risking private investment in the innovative and sustainable economic activities needed to meet its emission budgets and 2050 climate goals.

Private investors are increasingly taking action and experiencing positive investment outcomes

Already, investors able withstand higher short-term costs can expect low emissions technology investments to yield higher long-term returns.[291] By 2030, 70-80% of decarbonisation technology investments could be better value than previous, more emissions-intensive alternatives.[292] Through an integrated financial system, and monitoring and reporting mechanisms like the External Reporting Board-issued climate standards, the Government can provide access to information about the dual financial and environmental benefits of low carbon investments.

Demand is also on the rise: the Intergovernmental Panel on Climate Change (IPCC) has found that market appetite for sustainable finance products has increased significantly over the past decade.[293] As reported in the 2018 Global Sustainable Investment Review, the Responsible Investment Association of Australasia

found that investment which systematically considers environmental, social, and corporate government and/or ethical factors is the expected minimum standard of good practice in Aotearoa New Zealand.[294.]

Domestically, private organisations like the Climate Leaders Council – a group of New Zealand CEOs who together represent 34% of Aotearoa New Zealand's GDP[295] and 60% of the country's gross emissions[296] – are taking action. In addition to measuring, reporting, and reducing their own emissions, signatories must assess and disclose climate change risks related to their businesses and proactively support their employees and suppliers to reduce their emissions. Within two years of joining the Council, signatories must expand their actions to include incorporation of te ao Māori perspectives, assessment of climate opportunities within the value chain, and consideration of long-term climate positive targets.[297]

Through blended finance, the Government can help realise the full potential of the private sector's involvement in decarbonisation

By sharing and reducing investment risks with private investors, the Government can attract more funding for low emissions initiatives. Blended finance also presents a likely high yield investment of public funds: analysis produced by the United Nations Framework Convention on Climate Change suggests that in each year from now to 2030, $110 billion of global public finance could enable $300 billion of private finance.[298] It can enable support for more innovative, entrepreneurial, or leading-edge projects which otherwise might be considered too high-risk by private or public investors alone.

The Government can also accelerate uptake by private investors by amending components of the tax system, for example depreciation schedules and rates for eligible projects.

A coherent and coordinated approach to climate finance

The economic consequences of climate change are growing, making the links between emissions reduction and adaptation even stronger

As the climate warms, each year brings more negative impacts and higher costs caused by the increasing occurrence of floods, droughts, severe storms, and forest fires.

The Ministry for the Environment estimates that between 2007 and 2017, climate-change related floods and droughts cost the New Zealand economy $840 million.[299] Storms like Cyclone Gabrielle, which has an estimated recovery and rebuild cost of $13 billion, are expected to become more and more frequent. The United Nations Environment Programme's *Adaptation Gap Report 2020* reported that worldwide, current commitments are not enough to address the adaptation finance gap and additional adaptation finance is needed.[300]

As Aotearoa New Zealand ramps up efforts to fund and finance decarbonisation, and as the costs of adaptation and reducing emissions swiftly rise, a coherent and coordinated approach to climate finance may prove vital to meeting emissions reduction targets.

Currently the Government's approach to climate finance is articulated across several plans and strategies, including in its *emissions reduction plan*, *International Climate Finance Strategy,* and *national adaptation plan*, and is expressed annually in the budget. A holistic and centralised Government investment strategy will help guide Aotearoa New Zealand's transition and ensure a clear, consistent, joined up approach that will maximise impact, minimise delays, and better enable individuals, businesses, agencies, and communities to play an active role.

The IPCC's *Annual Report 6* discusses the merits of considering emissions reductions, adaptation, and other climate finance matters like disaster risk reduction together. Emissions reduction efforts and adaptation are closely linked, with emissions reductions impacting the scale of need for adaptation, and adaptation presenting both co-benefits and potential trade-offs with emissions reduction activities.

Public and private sector actors make point-in-time determinations about prioritisation and allocation of their investments. Informed assessments of need and impact potential are vital to ensuring the Government and private investors can respond to immediate demands while making necessary progress on medium-term and long-term goals.[301]

A centralised climate finance strategy can empower actors across the market to invest effectively to lower emissions

As highlighted by Toitū Tahua: Centre for Sustainable Finance, a centralised climate finance strategy like the UK Government's *Green Finance Strategy* can position a country as an international leader in sustainable finance, accelerating the establishment of shared priorities across government, clarifying roles and responsibilities, embedding a long-term approach, and supporting the development of robust and consistent market frameworks.[302]

Market frameworks featuring agreed standards, definitions, and performance indicators can support potential public and private investors to make strategic low emissions investments and provide the basis for verifying and reporting on climate goals and outcomes in a consistent manner.[303] Climate finance providers and recipients could use the measures to improve the tracking, reporting, and dissemination of best practices, and help to ease growing concerns about 'greenwashing' amongst private investors.[304]

For local government, these frameworks, as well as other aspects of a unifying strategy, could form the basis of robust decision-making guides to provide support as they navigate competing priorities.

Aotearoa New Zealand's strategy can learn from te ao Māori approaches

In many ways, Māori businesses are leading the way when it comes to integrated investment, frequently incorporating social, cultural, and environmental goals – often through an intergenerational lens – into their business analysis. In addition, Māori businesses tend to centre outcomes increasingly attractive to investors like sustainability, accessing and building people skills, community development, ethical production, and social impact.[305]

By learning from both science and mātauranga Māori, the Government can develop a strategy for navigating the rising costs of emissions and adapting to climate change with goals, outcomes, and measures appropriate for a carbon neutral Aotearoa New Zealand.

Putting people at the centre of funding and finance

He aha te mea nui o te ao? He tāngata, he tāngata, he tāngata.

To achieve a fair, inclusive, and equitable transition, it is critical that the Government's funding and finance decisions are based on the principles of Te Tiriti o Waitangi/The Treaty of Waitangi and tikanga-informed. As discussed in *Chapter 5: Whāia Ngā Tapuwae,* the Commission recommends that the Government explore and implement a mechanism to allocate resourcing directly to Iwi and to increase funding to Māori landowners (Te Ture Whenua Māori entities). This will help to create an enabling environment where Iwi/Māori can fully exercise their rangatiratanga, participate in decision making, and protect their taonga.

Sound funding and finance decisions in Aotearoa New Zealand include consultation with Iwi/Māori and consideration of te ao Māori approaches to both investment and emissions reduction. As discussed in the earlier section on a coherent and coordinated approach, many Māori businesses already put people at the centre of finance decisions. It is now to Government to ensure their approach in the second emissions reduction plan does the same.

The negative impacts of climate change are being felt now and they are being felt disproportionately, with Māori, Pacific peoples, those living in rural settings, and lower income households amongst those most at risk from harm. More broadly, large economic shocks like the COVID-19 pandemic and the growing climate crisis are known to worsen inequalities. In fact, the UN estimates that climate change could drive an additional 100 million people into poverty by 2030.[306] Aotearoa New Zealand's relationship with and responsibilities to our Pacific neighbours are also key considerations for funding and finance, as outlined in the Government's *International Climate Finance Strategy.*[307]

Community voice is therefore vitally important to funding and finance decisions. Direct public and private funding of community initiatives designed to tackle locally experienced inequities is crucial, as are place-based investments which honour the uniqueness of different rōpū across Aotearoa New Zealand and our Pacific neighbours. Through its funding avenues like the Climate Emergency Response Fund and Sovereign Green Bonds, the Government can ensure that initiatives in its second emissions reduction plan which respond to local and national equity needs are given appropriate priority.

The Government's funding and finance decisions will directly impact the extent to which climate and other long-standing inequities continue to be experienced by New Zealanders, Pacific peoples, and the broader international community.

A low emissions economy can empower households, communities, and businesses

Through its 2026-2030 funding and finance decisions, the Government has the opportunity to guide Aotearoa New Zealand's transition to a thriving, resilient, and prosperous low emissions economy. Partnering with mandated Iwi representatives and Māori stakeholders and putting people at the centre of its decision-making process will tautoko efforts to tackle social and economic inequity and ensure its strategy reflects the needs, perspectives, and aspirations of all New Zealanders. Taking an expansive, collaborative, and consistent approach will enhance research and business innovation, and help mobilise all corners of the economy to do their part. Providing a unifying strategy will reduce financial risks related to the changing climate and ensure Aotearoa New Zealand has the necessary funds in place to meet its emissions budgets.

Chapter 15: Circular Economy and Bioeconomy

Introduction

Through its second emissions reduction plan, the Government has the opportunity to contribute to global decarbonisation efforts and advance a transition towards a more circular economy and sustainable bioeconomy within Aotearoa New Zealand. This transition can also be effective in promoting long-term climate resilience, generating business and economic opportunities, and providing environmental and cultural benefits.[308]

Currently, Aotearoa New Zealand's economy predominantly uses resources in a manner consistent with the linear extract-make-use-dispose model. In contrast, a circular economy maximises the circularity of resources and energy within production systems.

Working in partnership with Iwi/Māorii, the Government needs to commit to circular and bioeconomy strategy development and implementation, as well as establishing the necessary resourcing, information, data and tools to reduce both production-based and consumption-based emissions. Accounting for the embodied carbon of products, goods and services will be an important component of this. For the bioeconomy, closing the information gap to bioproducts as trusted replacements for conventional products, and making sure biomass is used for its most emissions reducing use, will advance the shift towards a low emissions economy.

Aotearoa New Zealand is in the early stages of transitioning towards a more circular bioeconomy, and the establishment process will extend well beyond the second emissions budget period. Our draft advice in this chapter focuses on putting in place the necessary fundamentals, including the need to:

- address consumption-based emissions
- enshrine the consideration of the waste hierarchy within central and local government decision-making requirements
- realise the role of product stewardship for designing out and reducing the emissions from waste.
- commit to the biomass strategic use assessment and strategy
- address the bioeconomy information gap through education, government procurement, and setting standards.

The context for change

In its first emissions reduction plan, the Government recognised the role of the circular economy as a framework to support societal and environmental objectives, develop more resilient supply chains, and create a low carbon future for Aotearoa New Zealand.[309] The plan also included a range of actions premised on developing a thriving bioeconomy that delivers equitable and inclusive outcomes.

The term 'circular economy' generally refers to an economic system based on designing out waste and pollution, and reusing products and materials.

The concept of circularity can be applied to both renewable and finite materials within the economy. This system promotes the circularity of resources and energy within production systems by establishing a restorative cycle and regenerating natural systems.

Premised on eliminating waste and pollution through design and regenerating nature, the circular economy seeks to:

- keep materials circulating and in use as long as possible
- extract the maximum value while in use
- recover and regenerate products at the end of useful life.[310]

Within the cycle of the circular economy, the most effective way of retaining the value of products is to maintain and reuse them. For finite products, it is only when parts cannot be reused or remanufactured that they should be broken down into their constituent materials and recycled.

Within the circular economy, recycling is considered an option of last resort because it means the value embedded in products and components is lost.

Recycling, nevertheless, remains a necessary process as it enables the circulation of resources and exists as a tool to prevent waste. The important role of metals recycling from commercial construction and electronic waste is an example of this.

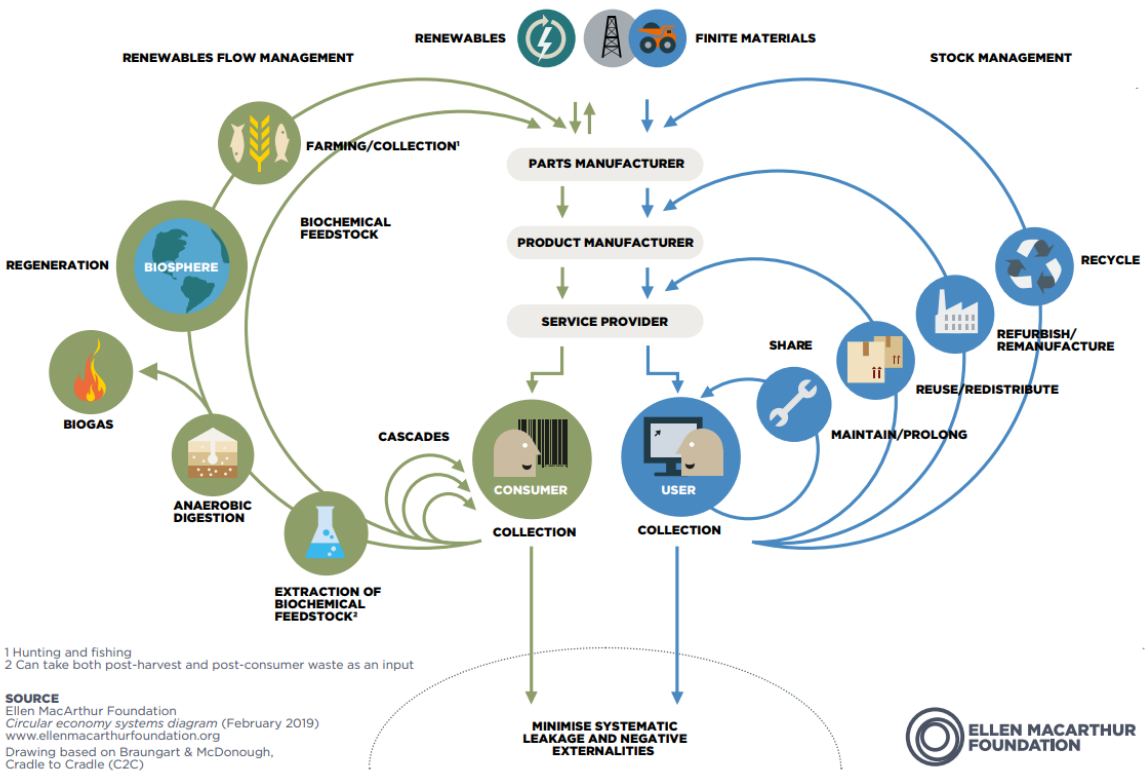
According to a report done for the Heavy Engineering Research Association, approximately 74% of steel in Aotearoa New Zealand is collected for recovery or further metallurgical processing. This recycling is less carbon-intensive than newly produced steel, with around 1000 kilograms of avoided emissions per tonne of steel recycled. Increasing recycling rates would further lower emissions.[311]

Achieving emissions reductions through initiatives that minimise waste and increase recycling of unavoidable materials that would otherwise become waste therefore exists as an essential part of the transition to a more circular economy.

The 'bioeconomy' refers to the parts of the economy that use renewable biological resources (biomass) to produce food, products, and energy.[312] A bioeconomy can use biomass waste (residue) from forestry, fisheries, agriculture, and households as raw materials for other products. When the bioeconomy advances the circularity of biomass via regeneration, it becomes a circular bioeconomy.

In the biological cycle, biodegradable materials are returned to the earth through processes like composting and anaerobic digestion (**Figure 15.1**).

Figure 15.1: Circular Economy Systems.



Note[313]

Developing and implementing a circular and bioeconomy strategy will be important for emissions reduction

The development and implementation of a circular and bioeconomy strategy is an opportunity to increase resource use efficiency, slow material extraction, and regenerate natural cycles that will reduce emissions and minimise future climate change impacts.

Shifting towards a more circular economy can reduce greenhouse gas emissions by:

- eliminating waste and pollution to reduce greenhouse gas emissions across the value chain
- circulating products and materials to retain their embodied energy
- regenerating nature to sequester carbon in soil and products.[314]

Within the circular economy, emissions reduction can therefore be achieved throughout a product's life cycle, including its design, production, distribution, use, and end of life reclamation and reuse.

Global pressure to reduce the extraction of non-renewable resources and fossil fuel-derived materials means that early adoption of circular principles has the potential to promote more self-sufficient businesses, reduce economic risk, and result in less reliance on imported goods and materials for Aotearoa New Zealand. [315]

Research suggests that the bioeconomy can support a range of climate change adaptation opportunities, including:

- biodiversity conservation and sustainable use
- ecosystem restoration
- efficient and resilient new value chains that are flexible to uncertain climate events and potential market disruptions
- supporting indigenous and local livelihoods based on biological products and services
- building the conditions for more sustainably managed forests and fisheries.[316]

As well as offering climate adaptation benefits, the bioeconomy has the potential to increase the value of the economy overall. Estimates suggest that the value of the global circular bioeconomy is projected to grow and reach a value of USD 7.7 trillion in 2030.[317]

The establishment of a circular and bioeconomy strategy is therefore an important step towards realising these benefits for Aotearoa New Zealand. Associated actions within the first emissions reduction plan include:

- investing in data collection and research
- integrating circular practices across government, communities, and businesses
- supporting businesses moving to circular economy business models
- developing a bioeconomy framework to guide the use of our bioresources and maximise wellbeing
- accelerating sustainable and secure supply and uptake of bioenergy in Aotearoa New Zealand.

While the Government's planning for a circular economy and bioeconomy strategy has commenced, it is important that implementation occurs in the second emissions budget period with appropriate budgetary provision and resourcing.

The second emissions budget period is a moment of opportunity for the circular economy

A range of opportunities exist to reduce emissions through more circular practices during the second emissions budget period. These include: recognising mātauranga Māori as being essential to the foundation of circular economy policy design; enhancing data and transparency around the embodied emissions at the materials level within the economy; and leveraging the potential of regulated forms of product stewardship and right to repair legislation as tools to create low emissions outcomes.

Through active partnership under Te Tiriti/The Treaty, Aotearoa New Zealand has the potential to create a unique circular economy informed by mātauranga Māori

Mātauranga Māori reflects the holistic and interconnected relationship between Iwi/Māori and the natural world.[318] Appropriately incorporating mātauranga Māori into circular economy policy design would enable wider Aotearoa New Zealand to learn from and apply many of the sustainable practices which sit at the heart of tikanga Māori. [319]

Box 15.1: Para kore (zero waste) and the circular economy

"He tirohanga Māori i te para me te mahi hangarua (Māori views on waste and recycling) emphasise whakapapa (genealogical) connections between humans and the natural world. The respect for natural resources and the materials made from them is demonstrated by maintaining their value for as long as possible before they reach the end of their life, at which point they are disposed of in a way that causes the least harm to Papatūānuku. In this way, he tirohanga Māori i te para precedes the concept of a circular economy (ōhanga āmiomio) but similarly acknowledges the mauri (life force) of natural resources." [320]

Active partnership under the principles of Te Tiriti o Waitangi/The Treaty of Waitangi need to be a core part of the implementation of circular economy policy. This will help ensure mātauranga Māori is appropriately woven into the design, and Iwi/Māori-collectives are able to equitably participate in business opportunities and initiatives within the circular economy.

The implementation of a circular economy strategy is also an opportunity to invest in innovation and technological solutions for circularity in a way that honours Te Tiriti o Waitangi/The Treaty of Waitangi, supports communities, and create jobs, businesses, and markets.[321]

Building awareness and increasing transparency around the opportunities for more sustainable, low emissions supply chains and businesses may also be beneficial for Iwi/Māori-owned businesses, as well as other existing and emerging businesses within the circular economy. As such, the transition to a more circular economy can generate intergenerational benefits.

Embodied emissions accounting within a circular economy

In the second emissions budget period, improving the understanding of embodied emissions at the materials level will be important for enabling the transition to a more circular economy.

The national Greenhouse Gas Inventory exists as the official source of emissions and removals data for Aotearoa New Zealand. In line with the United Nations Framework Convention on Climate Change (UNFCCC) guidelines and using Intergovernmental Panel on Climate Change (IPCC) 2006 methodologies, the inventory applies a production-based accounting approach, which measures emissions produced within Aotearoa New Zealand's geographic zone from the domestic production of goods and services.

In contrast, consumption-based emissions accounting considers the emissions 'embodied' in a good or service across the global supply chain. This method accounts for embodied emissions required to produce that good or service for final use, including the emissions from materials and products imported from overseas. This approach assumes that the people who consume or use a good, product or service, should take responsibility for the emissions generated in the processes of creating those consumables.

In our previous advice to the Government, we signalled our support for the ongoing use and advancement of consumption-based emissions estimates as a complement to the Greenhouse Gas Inventory. While Stats NZ do usefully report on consumption emissions for households, government, non-profits, and investment in physical assets, this reporting does not currently provide emissions detail at the material or product level.

While the first emissions reduction plan includes several actions centred on realising opportunities to reduce embodied emissions, these predominantly apply to the building and construction sector.[322]

By targeting consumption-based emissions, Aotearoa New Zealand can reduce emissions throughout the supply chain of materials, products, and services.[323] To enable the consideration of embodied emissions by

consumers, businesses, industry and government organisations, more data and transparency related to the embodied emissions of products, goods, and services will be necessary.

Box 15.2: Making sense of corporate emissions

The GHG Protocol Corporate Standard provides a framework for measuring greenhouse gas emissions across private and public sector operations, value chains, and associated mitigation actions.

The GHG Protocol Corporate Accounting and Reporting Standard covers the accounting and reporting of seven greenhouse gases covered by the Kyoto Protocol – carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PCFs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). For corporate greenhouse gas accounting and reporting purposes, three scopes (scope 1, scope 2, and scope 3) are defined. These scopes address direct and indirect emissions created through company operations.

Scope 1 emissions include the direct greenhouse gas emissions, which occur from sources that are owned or controlled by the company (e.g., emissions from combustion in owned or controlled boilers, furnaces, vehicles).

Scope 2 emissions include the indirect emissions from the generation of purchased electricity (including steam, and heating/cooling) consumed by the company.

Scope 3 emissions includes other indirect emissions that are a consequence of company activities, but which occur from sources not owned or controlled by the company (e.g., the use of sold products and services). Scope 3 reporting therefore addresses the consumption-based emissions that are generated throughout the supply chain. Targeting these emissions can present significant opportunities for greenhouse emissions reductions for companies.

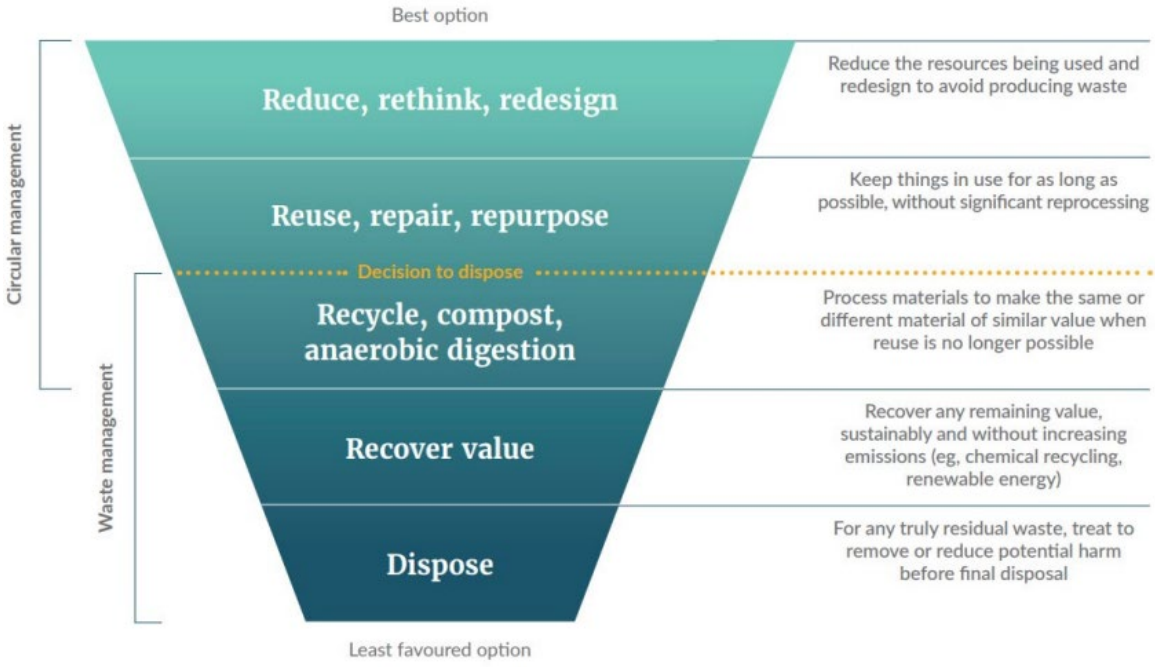
Product stewardship and right to repair legislation are important tools in a circular economy

Regulated product stewardship and right to repair legislation are important tools for avoiding waste, minimising adverse environmental impacts from product disposal and achieving more effective forms of emissions reductions. Further developing these tools will help normalise behaviour change within society and support the transition towards a circular economy.

The Waste Hierarchy (the Hierarchy) (see figure 9.4) provides a framework for supporting the delivery of circular economy outcomes relating to waste. It also exists as an essential tool for waste management and minimisation decision making, prioritising waste minimisation in the form of prevention and reuse while discouraging waste disposal.

Waste prevention can be encouraged through eco-design, reuse, repair, refurbishment, re-manufacturing, and extended producer responsibility schemes, regulated product stewardship and right to repair legislation.

Figure 15.2: The Waste Hierarchy



Note[324]

Regulated product stewardship refers to the use of regulation to increase circular resource use by putting regulated responsibilities for managing end-of-life products on producers, importers, and retailers rather than on communities, councils, neighbourhoods, and nature.[325]

In 2020, the Government identified the following products as 'priority products' in accordance with the Waste Minimisation Act 2008: tyres; e-waste (including large batteries, such as those used in electric vehicles); plastic packaging; agrichemicals and their containers; refrigerants (including synthetic greenhouse gases); and farm plastics. This necessitated a requirement for regulated product stewardship schemes for each of these products – a milestone for moving towards a more circular economy in Aotearoa New Zealand.

Regulated forms of product stewardship are now well established internationally. For example, in Germany manufacturers are required to take responsibility for any product that creates waste, particularly taking products back and recycling them. Related provisions also apply for the development of long-lasting products, the use of secondary raw materials for manufacturing, and recycling end-of-life products in a manner that is eco-friendly.[326]

We continue to recognise the need to regulate those who produce and import products to ensure they are responsible for minimising their environmental impacts, including emissions reductions.

There is now an opportunity to strengthen regulated product stewardship processes to ensure that emerging schemes are robust, have integrity, and are effective in realising opportunities for emissions reductions. This includes ensuring that regulated product stewardship is established with the oversight of government, avoids industry capture of regulators and that the Waste Hierarchy directly informs scheme development.

The consideration and accounting of both biogenic methane and embodied emissions is important to the development of regulated product stewardship schemes if they are to be effective in reducing emissions. Regulated product stewardship schemes also need to be independently monitored, with findings actively applied to improve scheme effectiveness. Ensuring these actions are addressed will help to realise the potential of regulated product stewardship in Aotearoa New Zealand.

The establishment of right to repair legislation could also be advanced as an opportunity for emissions reductions within Aotearoa New Zealand, particularly relating to electronic waste (or e-waste). E-waste typically refers to electrical and electronic equipment that has been discarded as waste without the intent of reuse. E-waste is now recognised as being one of the fastest-growing global waste streams. OECD estimates suggest that New Zealanders generate 19.2 kg of e-waste per capita.[327]

Right to repair legislation establishes a legislative right for a consumer to repair their products, potentially through access to repair information, the provision of diagnostic tools, and the supply of appropriate parts. Right to repair legislation is now becoming increasingly common internationally.[328] For example, various forms of legislation have been established across a number of states in America. It has also been established in Europe, with the goal of providing cost savings for consumers and as a means to facilitate the transition to a circular economy.

Box 15.3: Reuse and recycling of low emissions technologies

Many technologies important in the transition to a more circular economy (including wind turbines, solar panels, and batteries) require mineral and metal inputs. How these minerals and metals are sourced, recycled, and disposed of could have social and environmental impacts.

Wind turbines typically have a 20-to-25-year operational lifespan. Today 85-95% of a wind turbine can be recycled, but cost-efficient recycling of the blades remains a challenge.[329] Wind turbine blades are made of glass or carbon fibre composites bonded through a chemical process. There is an estimated 12-15 tonnes of reinforced fibre material per MW.[330]

Internationally, the wind energy industry is working to find novel methods to recycle composite waste. For example:

- Danish wind energy giant Vestas developed a new chemical process capable of breaking down epoxy-based wind turbine blades into virgin-grade materials.[331]
- The DecomBlades project is a consortium of 10 wind industry companies seeking to provide the basis for the commercialisation of sustainable techniques for recycling wind turbines. The project focuses on three specific processes:
    - shredding of wind turbine blades such that the material can be reused in different products and processes
    - use of shredded blade material in cement production
    - a method to separate the composite material under high temperatures, also known as pyrolysis.[332]
- Carbon Rivers, an American company that produces advanced material and energy technologies, has commercialised a process to recover clean, mechanically intact glass fibre from blades for reuse.[333]

Box 15.4: Waste and agriculture within the circular economy

The primary sector in Aotearoa New Zealand has increased its reliance on external inputs such as synthetic fertilisers and imported feed, enabling productivity gains but also leading to increasing on-farm costs, waste, emissions and environmental degradation.[334] Circular principles that aim to utilise materials across the economy, increase nutrient use efficiency, keep resources in use for as long as possible and regenerate natural cycles have the potential to achieve several co-benefits across sectors.[335]

For the horticulture and agriculture sectors, utilising organic waste by-products for composting or fertiliser can increase soil health while reducing costs and embodied emissions associated with procuring synthetic fertiliser.

For example, the Ecogas Reporoa Organics Processing Facility opened in 2022. It is estimated to produce and distribute 200 tonnes of nitrogen in the form of bio-fertiliser per year from the anaerobic digestion of 75,000 tonnes of organic waste from Auckland.[336] Additionally, the plant is estimated to produce 185TJ of biogas energy per year, displacing fossil gas in the energy sector.

Waste from the horticulture sector, crop residues and human food production can provide high feeding value for livestock, reducing costs and embodied emissions with importing feed.[337] For the waste sector, this has benefits as the circular flow of materials keeps organic waste out of landfills, reducing biogenic methane emissions and other environmental risks.

Therefore, implementing circular practices in one sector has the potential to produce a cascading effect across the economy.

The second emissions budget period is a moment of opportunity for developing a sustainable bioeconomy

The Government can develop a sustainable bioeconomy to reduce emissions by replacing fossil-based goods with renewable biomass.

Emissions-intensive goods and services can be displaced through the bioeconomy

Ināia tonu nei proposed ways the bioeconomy could reduce emissions across sectors, including:

- decarbonising energy and transport (wood fuel for process heat, sustainable aviation fuel)
- replacing fossil-fuel derived materials in supply chains (agri-food, biofertilizers)
- increasing the carbon stored in long-lived products (advanced wood products like cross-laminated timber instead of concrete in construction)
- reducing emissions from waste (landfill gas capture).

The bioeconomy can support emissions reductions in the short and long-term by displacing higher emissions energy alternatives. For example, in the demonstration path, biofuel use avoids significant fossil fuel emissions. Forestry residue and pulp logs are used for process heat in place of fossil gas and coal, and liquid biofuels are used in place of petrol and diesel for on and off-road vehicles.

Avoided emissions from the use of this bioenergy over the first three budget periods are estimated at 1.5 $MtCO_2e$ in the first emissions budget period, 4.8 $MtCO_2e$ in the second emissions budget period and 8.1 $MtCO_2e$ in the third emissions budget period.

The Energy Efficiency and Conservation Authority (EECA) summary of the Government Investment in Decarbonising Industry (GIDI) fund demonstrates the gains possible from bioeconomic initiatives in businesses in Aotearoa New Zealand.[338] Policies that increase accumulated emissions, such as the Government's decision on the biofuel bill, still challenge adoption of these technologies.

A strategic use of bioresources could maximise and sustain emissions reductions

It would be beneficial for the Government to provide direction and prioritise the strategic use of resources in the bioeconomy, aligning policies accordingly.

In its forthcoming bioeconomy strategy, the Government can demonstrate its commitment in this area by focussing on the most emissions-efficient use and of biomass resources and considering how they can be sustainably managed. A range of opportunities with varying emissions reduction potential exist, and both public and private investors will likely require guidance to identify options with the greatest emissions reduction potential.

The Government must also ensure its strategy reflects the principles of Te Tiriti o Waitangi/The Treaty of Waitangi, and that active partnership is upheld. Decision-making relating to biomass use must include Iwi/Māori to the fullest for successful outcomes. Iwi/Māori contribution to the current bioeconomy is significant, with holdings of over $2 billion in assets today.[339] Although this is expected to continue growing through Te Tiriti/The Treaty settlements, sustained effort by the Government is needed to ensure appropriate land ownership and access to working capital to support bioeconomic production.

Strategic planning is important to get the most out of the existing biomass resource in terms of emissions reductions.

Forestry is a large part of the existing national bioeconomy (1.6% of GDP[340]) and transforming forestry residue to forms of fuel and higher value wood-based construction products could further reduce emissions. Wood processing plants already recognise this by recovering costs using their onsite residue as fuel.[341] However, the benefits diminish with the distance to transport it.

Data on efficient matching of regional supply and demand is necessary to make bioresources available in a way that does not compromise the emissions savings. Although regional biomass availability data can be used as a proxy to forecast emissions reductions, the uncertainty in its end use precludes accurate estimates for the second and third emissions budget periods.

As discussed in *Chapter 5: Whāia Ngā Tapuwae,* the NZ Bio Forestry Director believes that the bioeconomy offers an avenue for Māori in forestry communities to apply their mātauranga to build sustainable and renewable alternatives to fossil and petrochemical products. These can in turn generate significant cultural, social, and economic returns.

The bioeconomy information gap is a barrier to lowering emissions

Realising opportunities to develop a sustainable and circular bioeconomy depends on people having access to the information they need to make informed decisions.

Market participants need to know that a bio-based product will perform at the same level as the equivalent carbon-intensive product for the bioeconomy to develop. An essential step to achieve this is to align

industry standards with bioproducts. Doing this allows industry professionals to recognise bioproducts that meet state-of-the-art requirements and thereby present a credible alternative to higher emissions solutions.

Bioproduct standards would also complement emerging regulations such as net zero energy codes (that require buildings to meet their own energy needs through renewable sources) without sacrificing upfront carbon emissions.[342]

Government procurement can also be used to create demand by providing a secure pipeline of work and reducing costs. The innovation programme run by Kāinga Ora, where innovation teams collaborate to introduce new technology (including bioproducts) to improve the quality of new homes, is an example of this within the construction sector.

Industry training will increase general awareness of bioproducts and their benefits. Effectively incorporating this knowledge in training institutes will help transition the currently qualified and experienced workforce towards bioproducts in the near term, equipping future graduates with knowledge in the design and use of bioproducts from the outset.

Robust data systems with accessible, transparent information are also needed to support the development of a bioeconomy. Tracking opportunities and development of bioenergy – as is done within the European Union's bioeconomy monitoring and data systems – and publishing potential bioeconomy platforms are actions that can bring immediate value.

Centralised governance may provide needed support

A centralised governance structure could be effective in transitioning Aotearoa New Zealand to a more circular economy and sustainable bioeconomy. The expansion of a decarbonised bioeconomy will further require clear leadership and administrative structures within government.

It will be key in the second emissions budget period for all government entities with oversight of the circular and bioeconomy to align their goals with a view towards meeting the 2050 target. Centralising cross-sector bioeconomic policy will minimise the risk of inconsistencies between the goals of each sector and their obligations to reduce emissions.

Government support for the bioeconomy is likely to be required for investment in large scale deployment or technological advances. For example, Air New Zealand have noted that switching from fossil fuels to sustainable aviation fuel is the only credible option to decarbonise long haul flights.[343]

Centralised governance may also assist in more effective funding to realise the potential of the bioeconomy. The first emissions reduction plan combined funding for the circular economy and the bioeconomy under the Climate Emergency Response Fund (CERF). Further clarity would be beneficial on defining clear objectives and increasing transparency on where long-term capital funding could be effectively used.

Addressing barriers to transition to a more circular economy and sustainable bioeconomy

The circular economy and bioeconomy strategy could set a path for overcoming the following transition barriers:

- Aotearoa New Zealand's geographical isolation, reliance on imported goods, and existing infrastructure and supply chains that challenge circularity.

- Lack of transparent and reliable data on recycling and waste volumes at a national level, which will be critical in evaluating the infrastructure required to recapture resources at the end of a product's lifecycle.
- Inability for materials to be reused, refurbished, or recycled due to lack of a market supply and demand. Reuse and recycling can only be sustained if there is a market demand for reclaimed materials, so these materials can be fed back into the economy.[344]
- The absence of circular economy data, which exists as a barrier for businesses or organisations to innovate and adopt more circular practices.
- The need to shift mindsets and redefine values of businesses and consumers.[345] Policies that incentivise consumer change such as product labelling or standards with information on product life span, repairability, and durability will help.
- The embodied emissions within lateral infrastructure are not currently considered in decision-making, nor factored in waste management planning. This is a missed opportunity for emissions reduction.
- Adverse equity impacts. The transition to a circular economy has the potential to result in job destruction in sectors that may not have direct replacements (e.g., mining and waste disposal), however employment may increase in other areas, such as product refurbishment and bio-manufacturing. Measures such as re-training programmes for the affected workforce would ease job transition.
- The potentially rising cost of first-hand goods, which many people may not be able to afford.
- Varying regional impacts depending on the distance and access to resource recovery infrastructure and reuse hubs.

Appendix 1: Prioritisation Framework

In **Table 16.1** below, we discuss how the Commission's six identified criteria (co-benefits, equity, pace and timing, policy gap, potential, and risk) connect with matters that the Commission is required to consider in developing its advice on emissions reduction plans under the Climate Change Response Act (2002).

Table 16.1: the prioritisation framework used to develop this draft advice

Relevant considerations in the Act	Criteria
Section 5M Matters Commission must consider In performing its functions and duties and exercising its powers under this Act, the Commission must consider, where relevant,	
a. current available scientific knowledge; and	Potential, gap, pace and timing, risk, co-benefits
b. existing technology and anticipated technological developments, including the costs and benefits of early adoption of these in New Zealand; and	Potential, pace and timing
c. the likely economic effects; and	Potential, equity, co-benefits,
d. social, cultural, environmental, and ecological circumstances, including differences between sectors and regions; and	Equity, co-benefits
e. the distribution of benefits, costs, and risks between generations; and	Equity, gap, pace and timing, risk
f. the Crown-Māori relationship, te ao Māori (as defined in section 5H(2)), and specific effects on Iwi and Māori; and	Equity, co-benefits
g. responses to climate change taken or planned by parties to the Paris Agreement or to the Convention.	Pace and timing
5ZC Matters relevant to advising on, and setting, emissions budgets[1] (2) The Commission and the Minister must—	
(a) have particular regard to how the emissions budget and 2050 target may realistically be met, including consideration of –	
(i) the key opportunities for emissions reductions and removals in New Zealand; and	Potential, gap

(ii) the principal risks and uncertainties associated with emissions reductions and removals; and	Risk
(b)have regard to the following matters:	
(i) the emission and removal of greenhouse gases projected for the emissions budget period:	Potential, gap
(ii) a broad range of domestic and international scientific advice:	Potential, risk, co-benefits
(iii) existing technology and anticipated technological developments, including the costs and benefits of early adoption of these in New Zealand:	Potential, pace and timing, co-benefits
(iv) the need for emissions budgets that are ambitious but likely to be technically and economically achievable:	Pace and timing, risk
(v) the results of public consultation on an emissions budget:	
(vi) the likely impact of actions taken to achieve an emissions budget and the 2050 target, including on the ability to adapt to climate change:	Gap, risk, equity, co-benefits
(vii) the distribution of those impacts across the regions and communities of New Zealand, and from generation to generation:	Equity, co-benefits
(viii) economic circumstances and the likely impact of the Minister's decision on taxation, public spending, and public borrowing:	Equity
(ix) the implications, or potential implications, of land-use change for communities:	Equity, co-benefits
(x) responses to climate change taken or planned by parties to the Paris Agreement or to the Convention:	Pace and timing
(xi) New Zealand's relevant obligations under international agreements.	Pace and timing

Appendix 2: Further information on the latest government emissions projections

The government published new emissions projections in December 2022 in *New Zealand's Fifth Biennial Report*[346] and *Eighth National Communication*.[347] These reports are part of Aotearoa New Zealand's reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC). A summary and dataset are also published on the Ministry for the Environment's website.[348]

In line with UN reporting guidelines, the government produced emissions projections for three scenarios, which differ in the policies they include and exclude:

- 'With existing measures' (WEM) – currently implemented and adopted policies and measures
- 'With additional measures' (WAM) – includes planned policies and measures, in addition to implemented and adopted policies and measures
- 'Without measures' (WOM) – excludes implemented, adopted, and planned policies and measures (this acts as a reference scenario against which the others can be compared).

The 'With existing measures' scenario effectively provides an updated baseline, reflecting changes in policy and other drivers (such as projected population growth) since the previous projections used in formulating the first emissions reduction plan. The government also produced 'low emissions' and 'high emissions' variations for this scenario to quantify the potential uncertainty range.

'With existing measures' excludes policies from the first emissions reduction plan yet to be implemented. Unexpectedly, it also excludes existing transport policies (such as the Clean Car Discount policy implemented in 2021) except for the Road User Charge exemption for EVs.[xxiv]

One key change from the previous projections is a higher assumed emissions price path in the NZ ETS, reflecting changes to the regulated 'price corridor' in 2021. This leads to significantly lower energy emissions and higher cardon dioxide removals from forestry.[xxv] The scenario also assumes that agriculture emissions will be priced via the NZ ETS from 2025 with 95% free allocation.

'With additional measures' includes estimated impacts of further policies in the first emissions reduction plan in the energy, forestry, waste and F-gases sectors. It does not include any further policies in transport or agriculture. More information on policies included in the scenarios and other assumptions can be found in the *New Zealand's Fifth Biennial Report*.

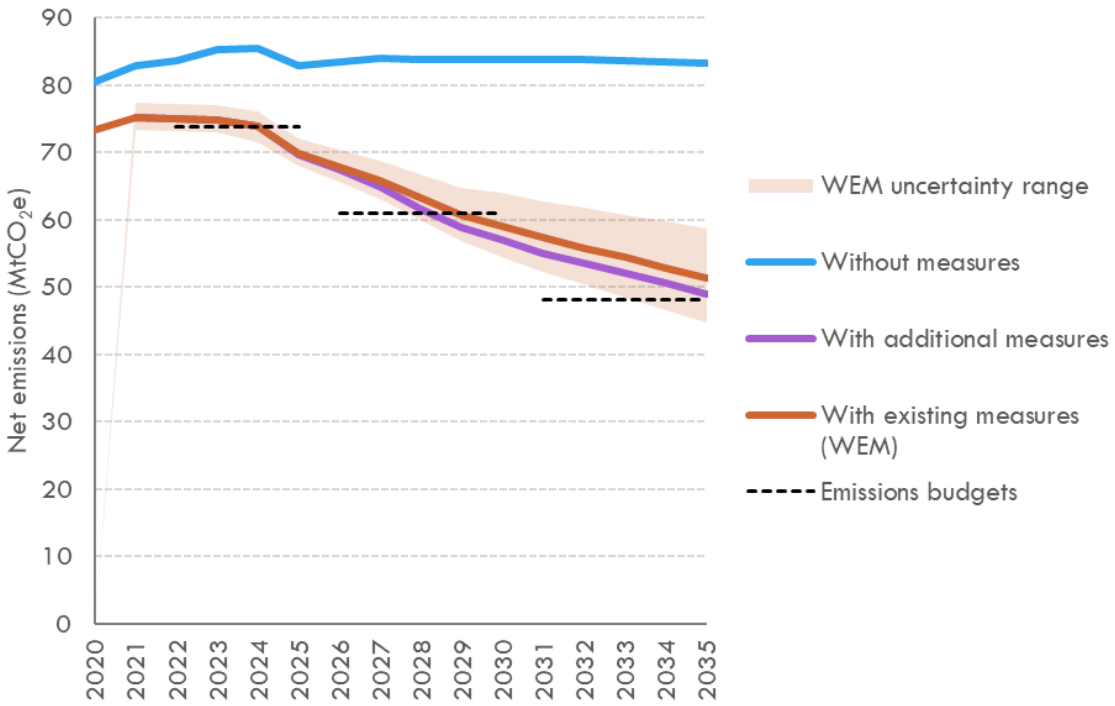
Figure 17.1 presents the projected net emissions (under target accounting) for the scenarios. The emissions budgets are shown as annual average quantities. Note that the aluminium smelter was assumed to close in 2024 in all scenarios.

[xxiv] The reports state this was due to time and capacity constraints.

[xxv] The Commission understands from MBIE staff that other energy policies included in the ERP analysis were indirectly included in the 'With existing measures' scenario and attributed to the NZ ETS. However, this is not mentioned in the reports.

Biogenic methane emissions in 2030 are projected to be 8.4% and 9.2% below 2017 levels in the 'With existing measures' and 'With additional measures' scenarios respectively, compared with the targeted reduction of at least 10%.

Figure 17.1: Net emissions (under target accounting) in the government's Fifth Biennial Report emissions projections



Source: Commission analysis of government emissions projections[349]

Note:

1. Net CO_2e emissions expressed using GWP100 values from the IPCC's Fifth Assessment Report (AR5) and the 'target accounting' approach for forestry emissions and removals as described in the glossary.

Table 17.1 shows the further emissions reductions that would be required to meet the second and third emissions budgets under these latest projections. We also show the assessment from the baseline projection used in the first emissions reduction plan, which was shown in earlier figures in this chapter. In all cases we have made an adjustment for the continued operation of the aluminium smelter.

Table 17.1: Further emissions reductions required to meet the second emissions budget under the government's emissions projections (adjusted for continued operation of the aluminium smelter)

	Further emissions reductions needed to meet budgets ($MtCO_2e$)	
Relative to:	**EB2 (2026-2030)**	**EB3 (2031-2035)**
First emissions reduction plan baseline (March 2022)	43.5	73.6
Fifth Biennial Report 'With existing measures' scenario (December 2022) [Uncertainty range]	20.7 [4.4 to 38.9]	34.6 [5.2 to 66.5]
Fifth Biennial Report 'With additional measures' scenario (December 2022)	14.0	22.9

Source: Commission analysis of government emissions projections[350]

We note again that these projections did not include implemented or planned policies for the transport sector, other than the Road User Charge exemption for EVs. This suggests projected transport emissions are likely overstated and the gap to meeting the budgets may be smaller.

However, we highlight risks around how the NZ ETS is represented in the projections. The projections are driven by an assumed emissions price path in each sector, and it is not clear whether or how agencies have considered supply and demand dynamics in the NZ ETS.

The emissions price is assumed to rise to $140 in 2030 for the energy sector and to $97 in 2030 for forestry. However, the current NZ ETS design delivers a single emissions price across energy and forestry, and ongoing price increases are unlikely to play out due to the strong afforestation response at relatively low emissions prices. We discuss this in greater depth in *Chapter 4: Emissions Pricing*.

In summary, the latest government emissions projections suggest a significant gap remains to meeting the second and third emissions budgets. The discussion above highlights issues and risks for policy to address and areas for improvement in future emissions projections.

Technical Glossary

2050 targets	The targets set out in the Climate Change Response Act for Aotearoa New Zealand to: • reduce emissions of greenhouse gases, other than biogenic methane, to net zero by 2050 and beyond. This relates to emissions of carbon dioxide, nitrous oxide, non-biogenic methane and F-gases (hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride). • reduce biogenic methane emissions by at least 10% by 2030 and 24-47% by 2050 and beyond, compared to 2017 levels.
Adaptation	Actions that can help people or natural systems adjust to the actual or expected impacts of climate change. Actions can be incremental and temporary in their effect or transformational by changing systems and their functions, depending on the scale and pace of change and what is at stake.
Afforestation	The conversion of land from another use, such as pasture for grazing, to forest.
Allocative baseline	An amount of emissions attributed to a unit of product, set at the national sector level, used to calculate the amount of industrial free allocation provided to firms undertaking an eligible activity.
Bioeconomy	Bioeconomy describes the parts of the economy that use renewable biological resources to produce food, products and energy.
Biogenic methane	Methane emissions resulting from biological processes in the agriculture and waste sectors.
Biomass	Material originating from living organisms. Some forms of biomass in the environment store significant amounts of carbon. Solid biomass such as wood chips, wood pellets and briquettes can be used as fuel in residential, commercial and industrial situations.
Carbon capture, utilisation and storage (CCUS)	Refers to a suite of technologies that capture carbon dioxide emissions from a point source or remove carbon dioxide from the atmosphere for permanent storage or reuse in a service or product.
Circular economy	Refers to an economic system based on designing out waste and pollution, reusing products and materials. This system promotes the circularity of resources and energy within production

	systems by establishing a restorative cycle and regenerating natural systems.
Climate Change Response Act 2002 (the Act)	The Act that establishes the Climate Change Commission and contains the framework for the 2050 emissions reduction targets and emissions budgets. It also provides a legal framework to enable Aotearoa New Zealand to meet its international obligations under the United Nations framework Convention on Climate Change, the Kyoto Protocol and the Paris Agreement; and provides for the implementation of the New Zealand Emissions Trading Scheme (NZ ETS) and the synthetic greenhouse gas levy.
Climate resilience	Climate resilience is the ability to anticipate, prepare for, and respond to the impacts of changing climate, including those that we know about and can anticipate and those that occur as extreme events. This includes planning now for sea level rise and more frequent flooding. It is also about being ready to respond to extreme events like forest fires or extreme floods, and to trends in precipitation and temperature that emerge over time like droughts.
CO_2e	Carbon dioxide equivalent. This is a way to describe different greenhouse gases on a common scale that relates the warming effect of emissions of a gas to that of carbon dioxide. It is calculated by multiplying the quantity of a greenhouse gas by the relevant global warming potential.
CRIs	Crown Research Institutes
Deforestation	The conversion of forest land to another use such as grazing. In greenhouse gas emissions accounting and policy relevant to Aotearoa New Zealand, deforestation is defined as clearing forest and not replanting within four years. It does not include harvesting where a forest is replanted.
Dry year	In Aotearoa New Zealand, hydro lakes only hold enough water for a few weeks of winter energy demand if inflows (rain and snow melt) are very low. When inflows are low for long periods of time, hydro generation is reduced and the system relies on other forms of generation such as natural gas and coal. These periods of time are often colloquially referred to as 'dry years'.
ECRS	Environment and Climate Research Strategy
EECA	Energy Efficiency and Conservation Authority

Electric vehicle (EV)	An electric vehicle has an electric motor that is powered by a battery which is charged by an external source of electricity. There are two main types of EVs: • Battery electric vehicles (BEVs) – these are powered by a battery only. • Plug-in hybrid electric vehicles (PHEVs) – these have two engines – one powered by a battery that is charged externally, the other is fuel powered and generally uses petrol or diesel. Conventional forms of petrol hybrids aren't considered EVs as they aren't charged by 'plugging in'. Their batteries are only charged by re-capturing energy when braking or from electricity generated by the engine.
Embodied emissions	The sum of emissions involved in making a product, sometimes termed the "carbon footprint".
Emissions	Greenhouse gases released into the atmosphere. The Climate Change Response Act 2002 covers the following greenhouse gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride.
Emissions budget (EB)	A quantity of emissions to be emitted within a given period to stay within the boundaries of New Zealand's target. The cumulative amount of greenhouse gases that can be emitted over a certain period. In the Climate Change Response Act 2002, emissions budgets are the total amount of all greenhouse gases (expressed as a net amount of carbon dioxide equivalent) that can be released over a five-year period (or four years in the case of 2022-2025).
Emissions intensive and trade exposed (EITE)	To be eligible to receive industrial allocation in the NZ ETS, an activity must meet two tests in the Climate Change Response Act 2002. These are: • An emissions intensity test, looking at whether the activity produces a large amount of emissions in relation to the revenue it generates. • A trade exposure test, looking at whether there is international trade of the activity's output and if importing or exporting the output is viable.
Emissions leakage	Emissions leakage would occur if efforts to reduce emissions in one location caused an increase in emissions somewhere else so that global emissions overall do not reduce. Emissions leakage risk is created by the uneven implementation of climate policies around the world.

Emissions Reduction Plan	A plan setting out the policies and strategies for meeting an emissions budget, as required by the Climate Change Response Act 2002.
Equitable Transitions Strategy	Strategy under preparation by the Government to achieve a low emissions Aotearoa New Zealand that is fair and inclusive.
European Union Emissions Trading System (EU ETS)	A cap-and-trade scheme established in 2005 that applies to EU member states and three members of the European Economic Area (Norway, Iceland and Liechtenstein).
Exotic production forests	Forests consisting of non-native species, such as pine, that have been planted for harvesting.
Farm-level, split-gas pricing system	A levy with different rates for short and long-lived greenhouse gas emissions. The point of obligation sits with individual farms or collectives.
F-gases	Fluorinated gases, such as hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.
Global Warming Potential (GWP)	A factor relating the warming effect of a tonne of emissions of a particular greenhouse gas to those of a tonne of carbon dioxide emissions.
Greenhouse gases	Atmospheric gases that trap heat and contribute to climate change. The gases covered by the Climate Change Response Act 2002 are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).
Greenhouse Gas Inventory	New Zealand's Greenhouse Gas Inventory is the official annual report of all anthropogenic (human induced) emissions and removals of greenhouse gases in New Zealand.
GDP	Gross Domestic Product
Gross emissions	Gross emissions include total greenhouse gas emissions from agriculture, energy, industrial processes and product use (IPPU) and waste. Greenhouse gas emissions and removals from land use, land use change and forestry (LULUCF) are excluded.
Heavy vehicle	A vehicle over 3.5 gross tonnes. These are typically trucks and buses.

Industrial free allocation	The provision of free New Zealand Units (NZUs) to firms undertaking activities considered emissions-intensive and trade-exposed (EITE). This reduces the cost of the NZ ETS for these firms and is intended to reduce the risk of emissions leakage.
Industry Transformation Plan	Industry-based plans under development by the Government in partnership with business, workers, and Māori for industries that have significant potential to contribute to a high productivity, high wage, lower emissions economy.
Internal combustion engine (ICE)	The engine, typically associated with transport, found in petrol and diesel vehicles.
IPCC	Intergovernmental Panel on Climate Change.
Just Transition Plan	Region-based plans for sharing and coordinating the work of transitioning Aoteroa New Zealand to a low emissions economy.
Kyoto Protocol	An international treaty under the UNFCCC that deals with emissions limitation or reduction commitments for ratifying developed (Annex 1) countries.
Light commercial vehicle	A goods vehicle, including vans, trucks and utility, weighing up to 3.5 gross tonnes as defined by the Ministry of Transport.
Light vehicle	A vehicle under 3.5 gross tonnes. These are typically cars, suvs, utes, vans and motorbikes.
Long-lived gases	Greenhouse gases that have a long lifetime in the atmosphere, i.e. they persist in the atmosphere for without breaking down for multi-decadal, centennial or millennial timeframes. For ease of presentation, this report refers to all greenhouse gases other than biogenic methane collectively as long-lived gases, although this includes small amount of other short-lived gas emissions (non-biogenic methane and certain fluorinated gases).
MBIE	Ministry of Business, Innovation and Employment.
Methane inhibitors and vaccines	Chemical compounds that reduce the production of methane in animals' rumen (stomachs). They typically do this by targeting enzymes that play a key role in the generation of methane.
MfE	Ministry for the Environment.

Mitigation	Human actions to reduce emissions by sources or enhance removals by sinks of greenhouse gases. Examples of reducing emissions by sources include walking instead of driving or replacing a coal boiler with a renewable electric powered one. Examples of enhancing removals by sinks include growing new trees to absorb carbon, or industrial carbon capture and storage activities.
MPI	Ministry for Primary Industries.
Mt	Megatonnes (million tonnes).
MSD	Ministry of Social Development.
Nationally determined contribution (NDC)	Each country that is party to the Paris Agreement must define its contribution to achieving the long-term temperature goal set out in the Paris Agreement. The first NDC adopted by Aotearoa is a target to reduce greenhouse gas emissions by 30% below 2005 levels by 2030.
Net emissions	Net emissions differ from gross emissions in that they also include emissions from the land use, land use change and forestry (LULUCF) sector as well as removals of carbon dioxide from the atmosphere, for example due to the growth of trees.
New Zealand Unit (NZU)	The unit of trade in the NZ ETS, representing one tonne of CO_2e emissions or removals.
New Zealand Emissions Trading Scheme (NZ ETS)	The NZ ETS is Aotearoa New Zealand's main emissions pricing policy. It creates a market for emissions by requiring certain businesses to acquire and surrender one New Zealand Unit (NZU) for every tonne of carbon dioxide equivalent emitted.
Offshore mitigation	Emissions reductions or removals, or allowances from emissions trading schemes, that originate from outside Aotearoa New Zealand.
Organic waste	Waste containing organic matter that decays to create methane emissions.
Paris Agreement	An international treaty under the UNFCCC to address climate change after 2020.
Petajoule (PJ)	A unit of energy equal to 10^{15} joules.

Permanent forest	Permanent forests are not intended to be clear fell-harvested, although they may be subject to selective or small coupe harvesting. The permanent forestry category in the NZ ETS came into effect from 1 January 2023 and allows owners to earn NZUs from post-1989 forests that are not intended to be clear-fell harvested for at least 50 years after they are registered.
Person-kilometres-travelled (PKT)	The number of kilometres travelled across a number of people. For example, 4 people in one car travelling 1 kilometer is 4 PKT.
Pinus radiata	An introduced tree species used for timber production, which makes up about 90% of Aotearoa New Zealand's plantation forests.
Post-1989 forests	New forest established after 31 December 1989 on land that was not forest at that date.
Pre-1990 forests	Forest land established before 1 January 1990.
Production forest	Production forests are planted to be harvested. Production forests in Aotearoa New Zealand currently are largely exotic trees planted as a single species which are then usually clear felled (completely removed) after the trees have reached the desired age.
Removals	The removal of carbon dioxide from the atmosphere, a synonym for sequestration. In Aotearoa New Zealand, this usually refers to absorption of carbon by forests as trees grow.
Rotation (in relation to forests)	The cycle of growth and felling or cutting of trees in production forests.
RSI&T	Research, science, innovation and technology
Sector sub-targets	A level of emissions for each sector as outlined in the Government's first Emissions Reduction Plan to track progress across sectors towards meeting the emissions budgets.
Sequestration	The removal and storage of carbon dioxide from the atmosphere, for example by vegetation.
Surrender of NZUs	The submission of units to the Crown by an NZ ETS participant to meet an emissions obligation under the NZ ETS.

Target accounting	The accounting system used to measure progress towards Aotearoa New Zealand's emissions reduction targets. Target accounting emissions include all gross emissions, but only a subset of emissions and removals from land-use and forestry – namely emissions and removals that are the result of recent and future forestry activities. Target accounting is designed to incentivise emissions reductions and to avoid relying on actions that occurred before 1990 (such as forest planting in the 1970s and 1980s) that continue to result in emissions and removals today. It also applies an averaging approach to production forests to smooth out emissions and removals over harvest cycles.
tCO_2e	Tonnes of carbon dioxide equivalent
Tier 1, 2 and 3 urban environment	Classes of urban environment as defined in the National Policy Statement on Urban Development 2020.
Tonne-kilometres	The number of kilometres a good is moved for freight purposes multiplied by its weight. For example, a truck carrying 10 tonnes of goods 1 kilometres is 10 tonne-kilometres.
United Nations Framework Convention on Climate Change. **(UNFCCC)**	This is the major foundation global treaty focused on climate change that was signed in 1992 at the Earth Summit in Rio de Janeiro.
Urban Form	The design and structure of an area or community. Including what type of development is allowed and where.
Vehicle-Kilometres-Travelled (VKT)	The number of kilometres travelled across a number of vehicles. For example, 4 people in one car travelling 1 kilometer is 1 VKT.
Voluntary carbon market	Markets where emissions units (credits) are purchased, usually by organisations, for voluntary use rather than to comply with legally binding emissions reduction obligations.
Watt-hour (Wh)	A unit of energy usually used for measuring electricity generation and consumption. One Watt-hour is the amount of energy used by a 1 Watt appliance running for 1 hour. 1 kWh = 1,000 Wh and 1 TWh = 10^{12} Wh.
Zero emissions vehicle (ZEV)	A vehicle with zero tailpipe emissions.

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