OECD Economics Department Working Papers No. 1815

A fight on two fronts: Adapting to climate change and reducing GHG emissions in New Zealand

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https://dx.doi.org/10.1787/02936374-en

OECD

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ABSTRACT/RÉSUMÉ

A fight on two fronts : Adapting to climate change and reducing GHG emissions in New Zealand

New Zealand, like other countries, needs to address climate change on two fronts simultaneously. Adapting to a hotter world while meeting its emissions reduction targets. New Zealand will need to become better prepared for more extreme weather that climate change will bring about. Councils will need new sources of revenue to fund the infrastructure that adaptation requires. Maintaining a comprehensive package of private insurance for climate-related losses with sharper premium price signals will also be essential. Developing a long-term energy strategy that weighs up all the main options for reducing emissions, while ensuring security of supply in a hotter world, is also crucial. New Zealand has made important strides to strengthen the policy framework for reducing GHG emissions. An important part of the framework is the New Zealand Emissions Trading Scheme (ETS). However, the ETS should be reviewed with a focus on the treatment of carbon removals through afforestation. New Zealand's next overall emissions reduction plan should be underpinned by a rigorous and comprehensive cost-benefit comparison of the different emissions reduction options.

This Working Paper relates to the 2024 Economic Survey of New Zealand https://www.oecd.org/economy/new-zealand -economic-snapshot/

JEL codes : O13 O18 Q16 Q23 Q28 Q48 Q50 Q53 Q54 Q58 R11 R12 R14 R48 R52

Keywords: climate change, greenhouse gas emissions, adaptation, mitigation, New Zealand.

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Un combat sur deux fronts : Adaptation aux changements climatiques et réduction des émissions de GES en Nouvelle Zélande

La Nouvelle-Zélande, comme d'autres pays, doit lutter simultanément contre le changement climatique sur deux fronts : s'adapter à un monde plus chaud tout en atteignant ses objectifs de réduction des émissions. La Nouvelle-Zélande a besoin d'être mieux préparée aux conditions météorologiques extrêmes que le changement climatique engendre. Les institutions locales auront besoin de nouvelles sources de revenus pour financer les infrastructures nécessaires à l'adaptation. Il sera également essentiel de maintenir un ensemble complet d'assurances privées contre les pertes liées au climat, assorties de signaux adaptés en termes de majoration des primes d'assurance. Il est également crucial d'élaborer une stratégie énergétique à long terme qui considère toutes les grandes options de réduction des émissions, tout en garantissant la sécurité de l'approvisionnement en énergie dans un univers plus chaud. La Nouvelle-Zélande a fait d'importants progrès pour renforcer sa politique de réduction des émissions de gaz à effet de serre. Une partie importante de cette politique est le système néo-zélandais d'échange de quotas d'émission (ETS). Cependant, son système d'ETS devrait être revu en mettant l'accent sur le traitement des absorptions de carbone par le reboisement. Le prochain plan global de réduction des émissions de la Nouvelle-Zélande devrait reposer sur une comparaison coûts-avantages rigoureuse et exhaustive des différentes options de réduction des émissions.

Ce document de travail concerne l'Étude économique de la Nouvelle Zélande de 2024 https://www.oecd.org/economy/nouvelle-zelande-economic-snapshot/

Codes JEL : O13 O18 Q16 Q23 Q28 Q48 Q50 Q53 Q54 Q58 R11 R12 R14 R48 R52

Mots clés : changement climatique, émissions de gaz à effet de serre, plan d'adaptation, réduction des émissions, Nouvelle-Zélande.

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A fight on two fronts: Adapting to climate change and reducing GHG emissions

By David Haugh[1]

Introduction

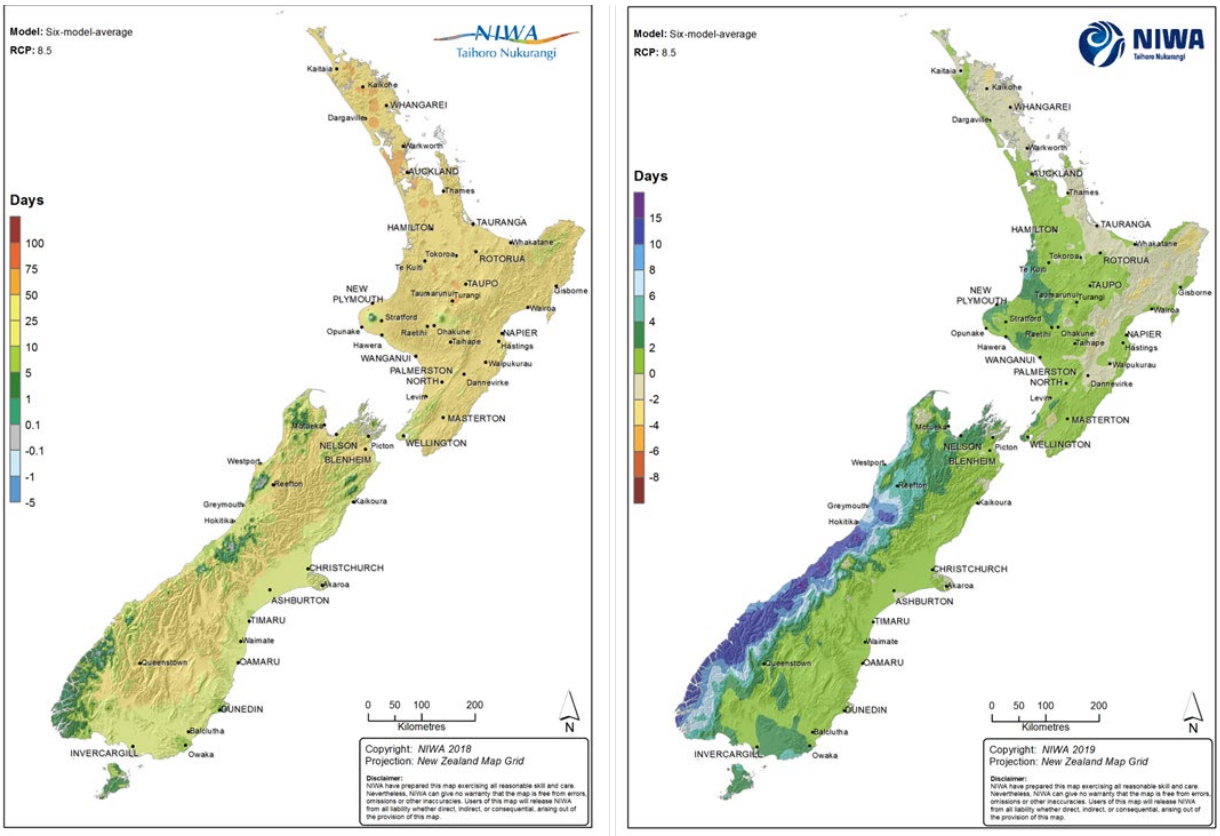
New Zealand, like other countries faces the simultaneous challenge in the fight against climate change of adapting to higher temperatures and reducing emissions. The New Zealand economy with a high share of the population living in coastal and fluvial areas, and a large share of agriculture and other primary activities and hydroelectricity, is particularly exposed to environmental and weather changes. As worldwide (IPCC, 2022), climate change will bring more extreme weather to New Zealand (MfE, Stats NZ, 2023). There will be more hot days in summer, particularly in the north of the North Island, and more wet days throughout the year, particularly in the west of both the South and the North Islands, bringing more storms and extreme weather (Figure 1). This raises natural hazard risk including droughts, land slips and flooding. The 2022-23 summer, the third warmest and second wettest on record in the North Island, shows the potential that climate change induced warming of the south-west Pacific Ocean has for increasing the intensity of storms in New Zealand. For example, storm events in Auckland and Cyclone Gabrielle in early 2023 led to extreme rainfalls, causing loss of life, injuries and widespread flooding and associated damage, including coastal erosion, landslips, and infrastructure destruction. The ensuing damage to physical assets is estimated at between NZD 9 and 14.5 billion (New Zealand Treasury, 2023). Global warming will also bring about slower changes including a rise in sea levels that will erode coastlines and damage coastal infrastructure. Higher

[1] David Haugh is a member of the OECD Economics Department. The author acknowledges valuable comments and inputs received from Vincent Koen, Luis de Mello, Isabell Koske and Charles Dennery (OECD Economics Department), Enrico Botta, Simon Touboul and other members of the OECD Environment Directorate, Simon Upton, Geoff Simmonds, Matt Patterson and the team at the Parliamentary Commissioner for the Environment, Greg Briner (formerly working at the Parliamentary Commissioner for the Environment and OECD Environment Directorate), Andy Reisinger (New Zealand Agricultural Greenhouse Gas Research Centre), Katherine Wilson, David Mead, Joseph Hagg and other members of the Ministry for the Environment, Arthur Grimes (Victoria University of Wellington), Tamzin Linnell (National Emergency Management Agency), Chris Kerr and other members the Ministry of Primary Industries, Gary Blick, Ben Brooks and other members of Auckland City Council, Michala Beacham, Jo Horrocks and other members of the Earthquake Commission, Barbara Tebbs, Geoff Cooper, Liz Innes and other members of the Infrastructure Commission, Ryan Walsh and Emma Bickerstaffe (Department of Prime Minister and Cabinet), Geoff Lewis (former member New Zealand Productivity Commission), James Beard, Vicki Plater, Steve Cantwell, Melanie Craxton, James Bibby, Giles Bollinger and other members of the New Zealand Treasury, Tim Grafton (Insurance Council of New Zealand), Alison Andrews, John Clarke and Chantelle Bramley (Transpower), Keith Millar (Department of Internal Affairs), Daniel Barber and other members of EECA, Ainsley Smith and other members of the Ministry of Transport. Special thanks are due to Axel Purwin for research and statistical assistance and Sisse Nielsen (OECD Economics Department) for editorial assistance.

temperatures on land and sea and changes in rainfall patterns will also affect where and what can be grown in New Zealand and the timing of planting and harvesting (MFE, 2022).

Figure 1. Climate change is expected to bring more extreme weather to New Zealand

A. Change in number of summer hot days, 1995-2090 B. Change in number of annual wet days (25mm), 1995-2090



Source: National Institute of Water and Atmospheric Research.

As well as adapting to climate change New Zealand will need to accelerate its efforts to meet its emissions reductions targets. This challenge is defined by the unusual structure of New Zealand's emissions profile of which, based on the Ministry of the Environment's national inventory submission to the United Nations Framework Convention on Climate Change (UNFCCC) in 2023, 48% (aggregated using the conventional 100-year Global Warming Potential metric, GWP-100) is from agriculture, of which 77% from biogenic methane. Afforestation provides a significant but complex to manage carbon removal opportunity to help reduce net emissions. New Zealand's emissions decoupled from GDP in 1993 and forest removals are a large part of the emissions reduction plan but there is room to improve the way forest removals are used and efforts to reduce gross emissions in all sectors will be needed.

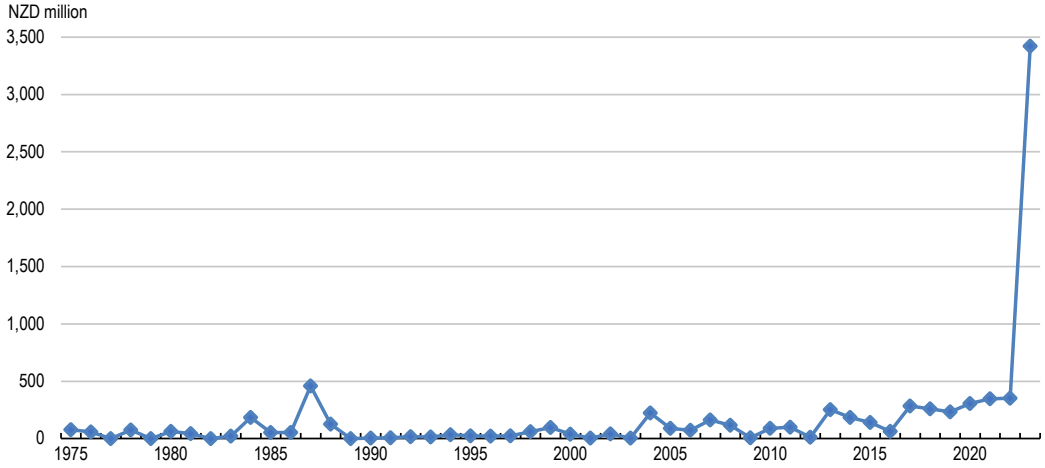
This paper discusses the two facets of the battle against climate change. First it introduces the policy issues that adaptation to climate change raises for urban New Zealand including in policy coherency, insurance, land planning and the electricity system. Second it describes the unique structure of New Zealand's emissions and the associated challenges, as well as the reduction efforts to date. It discusses how to improve its policy framework including in the pricing of emissions and in particular the treatment of forest removals but also regulatory and other instruments for reducing emissions.

Adapting to climate change

Climate-related hazard damage represents a large and growing contingent liability for the government, as the storm and cyclone that hit New Zealand in early 2023 have shown (Figure 2). The ensuing losses are being partly covered by private insurance and the public Earthquake Commission (EQC) – to be renamed the Natural Hazard's Commission from 1 July 2024 - that covers earthquake-related losses and some types of damage to land. However, the central government is acting as the insurer of last resort via the tax and welfare system and ad hoc disaster recovery funds. If only because the State owns the infrastructure that is often damaged in such events, there will always be some component of government funded disaster relief but the growing losses of life and property from climate-related hazards call for a comprehensive policy toolkit to mitigate damage and spread its costs more widely.

Figure 2. The North Island weather events in 2023 were costly[1]

Private insurance covered losses due to weather events



1. 2022 prices, calculated using CPI.
Source: Insurance Council of New Zealand and OECD calculations.

Aside from high cost, relying on ad-hoc disaster relief often involves long delays while solutions are devised and implemented, with a risk of variable treatment of those affected. A more comprehensive and systematic approach will require acting on many policy fronts to influence firm and household behaviour so that people, businesses, buildings, and infrastructure are less exposed and less vulnerable, and more capable of adapting to hotter weather and extreme weather events. This would reduce losses and ensure a faster and more consistent response. The need for coordination, the wide number of policy levers and the economic and social importance of improving New Zealand's resilience suggest the process should be a cooperative effort of central and local government and Māori leaders. Central government has much of the policy, scientific and technical expertise for fostering adaptation. Local government and Māori hold much of the local knowledge of risks, many of the implementation levers for improving resilience and are on the frontline in the case of a disaster. This paper introduces the overall adaptation policy framework and three of these levers: insurance, land-use planning and the electricity system for adaptation in urban areas but adaptation touches nearly every aspect of policy and society including beyond the urban boundary. New Zealand also faces a significant challenge to adapt its large agriculture, forestry and fisheries sectors to both more extreme weather and higher temperatures.

An enhanced policy and implementation framework for adaptation

New Zealand's first-ever national adaptation plan was introduced in 2022 (MFE, 2022). This is much later than in many other OECD countries. This plan has some strong features, in line with advice from the

Parliamentary Commissioner for the Environment (PCE, 2018), including a priority on enabling better risk-informed decisions, a cross-central-government-agency coordination body and implementation reporting.

To ensure the plan achieves adaptation in the most cost-efficient way, effective reporting on the implementation and evaluation of the plan's measures is key (OECD, 2015; PCE, 2018). Encouragingly, under the Climate Change Response Act, there will be bi-annual reports to the Climate Change Minister by the Climate Change Commission. Only around 40% of countries report on their strategies and of those only 20% of these reports, mainly in Europe, include monitoring and evaluations (Leitner, 2021). New Zealand's plan does not specify quantitative metrics for evaluating its goals so the evaluation process will need to do this as quantitative metrics are the best way to identify cost-efficient measures. Recent evaluation reports, including from Finland, Germany and the United Kingdom (Government of Finland, 2021, Kind et al. 2019 and Committee on Climate Change, 2021) may all help inform New Zealand evaluations and illustrate the implementation and evaluation challenges associated with such strategies.

Adaptation will require infrastructure investments. Although these are estimated to be only a small fraction of New Zealand's total infrastructure needs to accommodate population and economic growth, they should like all investments be based on value-for-money analysis and considered against non-built solutions like changes in land-use planning (New Zealand Infrastructure Commission, 2022). Indeed, using public investment projects to meet the plan's objectives should be based on joint central and local government efforts to ensure best practice (OECD, 2023e), with a quantified cost-benefit analysis in terms of the reduction in the expected loss (probability of event multiplied by the damage). The Netherlands is a leading example, with a long history of using extreme loss calculation and other statistical methods for this type of analysis, which are today part of the Dutch Flood Protection Programme (DFPP), an institutional and methodological approach to reducing vulnerability to flooding (Jorissen et al., 2016). Since massive floods that breached sea dikes in 1953, the Netherlands has taken an evidence-based and coordinated national and local authority approach to dike building to reduce flooding risks designed to minimise the cost per kilometre of dike nationwide. Today's DFFP also has a strategy to spread best practice and innovation among local authorities in flood protection projects, which appears to improve knowledge uptake (Tromp, 2022).

To implement this type of quantified approach, government in New Zealand at both central and local level will need a lot more information about risks and possible damage than it currently possesses. Information and risk modelling capability is highly variable across different local government areas and there will need to be an increase in best practice sharing between local governments and analytical support from central to local government.

Planning, investment decisions and accurate insurance pricing by EQC and private insurers requires widely available detailed information about the risk of climate-related hazards. Regular updates of climate projections are a critical action of the National Adaptation Plan so funding for these activities should allow the relevant agencies to be at the global scientific frontier of weather and climate projection science. This could include the greater use of big data and machine learning for predicting extreme weather events (Lam et al., 2023) – forewarning is essential to reducing damage and especially loss of life - and for longer-term climate change modelling (Mansfield et al., 2020; Kaltenborn et al., 2022). In line with Action 3.6 of the Adaptation plan, the government could also introduce mandatory sharing of climate-risk related hazards information between local and central government and private insurers so all key actors have access to the same information. The deep knowledge Māori have of the environment of their local area is a further important source of information about local hazards and should be integrated into government decision making.

Insurance in a hotter world with more extreme weather

Risk assessment capacity and risk management expertise of the insurance sector can be shared with the government to support risk reduction and adaptation decisions by households, businesses and governments (OECD, 2023a). The private insurance industry and the Earthquake Commission (EQC) have

up-to-date and detailed information and capacity to model how, where, and how much vulnerability to climate-change related risks are changing and will change in the future. For example, EQC has already used its claims data to show that its weather-related payouts are mainly in the northern regions of the North and South Islands and the average property making a claim is twice as close to the coast as the national average (EQC, 2018). Advances in probabilistic hazard modelling and the availability of other newer flood risk models (Kumar et al. 2023) will enhance this capacity further. Building on recent cooperation between the government and firms in the insurance industry on claims data in the context of the early-2023 weather events, the Commerce Commission should continue to facilitate competition-law-compliant cooperation between insurance firms and EQC to allow the construction of a national, regularly updated, confidential and anonymised individual claims database. Funding should be allocated to maintain and update this database regularly. This would help evaluate whether the plan is reducing vulnerability and help Ministers allocate funds to the actions with the largest impact. It could also be used by local councils to inform consenting decisions.

Household and firm decisions affecting their vulnerability to climate change-related hazards are influenced by the availability and price of insurance. Insurance premia should as accurately as possible reflect climate-related hazard risk to help them make better investment decisions. Insurance for loss or damage from climate-related hazards is provided by both private insurance and EQC but it is not compulsory to take out insurance. Up to a limit, EQC covers loss or damage arising from earthquakes, storms and related flooding and natural landslips damage to land. All homes covered by private insurance against fire are automatically covered by EQC. A flat rate premium is charged by EQC and collected by the private insurer. A flat rate was chosen to encourage the take-up of insurance and because of the extremely high unpredictability of where an earthquake may strike, with a large share of New Zealand exposed to earthquake risk making it difficult to fully price this risk by locality. Overall private flood insurance is easily available in New Zealand, well priced and offered as part of the standard “all risks” insurance offering (New Zealand Treasury, 2020). Although not compulsory, around 96% of homes have all risks insurance against fire, flood and storm damage (Insurance Council of New Zealand, 2022).

However, climate change combined with better hazard information may eventually create affordability and coverage challenges (New Zealand Treasury, 2021). Indeed, private insurers have started to introduce differential pricing for flood risk. This will not negatively affect most homeowners as around 90% of homes in New Zealand do not currently face flood risk and their premiums could even fall. However, EQC modelling with the Aon flood risk model, shows around 5% of homes are in areas where the risk-based pricing would imply an annual premium of 1% or more of the insured value (New Zealand Treasury, 2021). Given the high house-price-to-income ratio in New Zealand, this would impose a serous affordability challenge for many of those households. Climate hazard damage insurance may ultimately be offered only, if at all, at a high premium in areas heavily exposed to extreme climate events, resulting in rising under- or non-insurance as has been observed in northern Australia (OECD, 2023). Properties at risk of sea-level rise or floodplain flooding may eventually become uninsurable privately especially where even the best forward-looking risk models cannot calculate the probability of loss due to the highly unpredictable nature of climate change risk (NZPC, 2019).

One option is to retreat altogether from uninsurable areas but in some cases, the government may judge that this is not in New Zealand’s national interest or that the national social benefit of staying outweighs the costs. This could be especially the case if there are local activities that benefit a much wider part of the economy or society. Even if it is decided to retreat, it may be necessary to ensure that existing property owners, who did not always have accurate information about climate-related risks before they invested, have affordable insurance in the meantime. It is also important that insurance policy reforms to improve coverage should ensure the incentive for government and homeowners to invest to increase resilience remains. The government should continue to investigate options for insurance and other measures against climate disasters, considering the balance of public and private, optional and mandatory insurance

coverage, the nature of risks and household disadvantage as well as interaction with other policy levers (Box 1).

Box 1. international insights into improving insurance coverage and affordability in a hotter world

Insurance sector policies and insurance coverage differ substantially across countries. It is estimated that in 2022 the insurance market penetration against river flooding was 5% in Austria, 40% in Germany and 100% in France and Switzerland, where coverage is compulsory (Insurance Europe, 2022). The low take up of flood insurance in Austria may reflect a belief that government will step in to compensate in the event of flood damage (OECD, 2024).

Mandatory and comprehensive private flood insurance can improve accessibility and affordability of insurance contracts (European Commission, 2017). In France private insurers must include insurance against flood risk in property insurance policies. Insurers in turn benefit from government-backed reinsurance mechanisms against damages from extreme events. Nevertheless, mandatory insurance systems can imply substantial cross-subsidisation, whereby households living in less exposed areas subsidise households in more exposed areas.

The United Kingdom's Flood Re is a cross-subsidised insurance scheme that promotes the affordability and availability of flood insurance for around 2% of homes with the highest risk of flood. The scheme mitigates the perverse incentive it creates for development in flood-prone areas by only being available to homes built before 2009. New homes face full market pricing. Flood Re is planned to end by 2039 creating an incentive for continued investment in flood risk reduction by local governments and individuals for homes built before 2009. However, this depends on whether local governments and households believe the scheme is temporary (New Zealand Treasury, 2021).

Alternative policies include the implementation of specific adaptation actions to qualify for national insurance or reinsurance schemes. In the United States coverage by the National Flood Insurance Program is only provided to communities which have set flood management conditions such as building and floodplain management standards (OECD, 2016a).

Source: Adapted from Gamper et al. (2024), Accelerating Climate Adaptation: Towards a Framework for Assessing and Addressing Adaptation Needs and Priorities, *OECD Economics Department Working Papers*, forthcoming

Land-use planning and infrastructure

Efficient land-use planning can help mitigate the insurance losses problem. Land-use planning policies should be informed by updated natural hazard data and information. Land use, including the type of structures built on it, is a major factor in the vulnerability of the economy and people to climate-related hazards. Land-use planning can limit development in hazard-prone areas and mandate risk prevention measures for new and existing construction. The planning system in New Zealand is underpinned by four key pieces of legislation: the Resource Management Act (RMA) 1991, which has been the main planning framework law, the Local Government Act 2002, the Land Transport Management Act 2003, and the Building Act 2004. Māori customary rights, values and interests are widely reflected in this legislation and an important cross-system consideration.

Strong population growth has put the planning system under pressure. Over the past decade, New Zealand's population has grown by close to 18%. Around 80% of this was in the regions with major urban areas, putting the urban planning system under significant pressure. The system has not delivered the core objective of a sustainable management of resources required by the RMA. Based on price- and rent-to-income ratios, housing is some of the most unaffordable in the OECD (OECD, 2023d), the share of green space in urban areas is declining (PCE, 2023) and the environment has deteriorated, notably freshwater quality (OECD, 2017). Climate change adaptation requirements are adding to population pressure on the

system by adding constraints on where building can take place and raising infrastructure needs, including better flood protection, larger storm water systems and more public green space.

The planning system has struggled to cope with the combined demands of population growth and adaptation due to the absence of a national spatial plan (up until 2020) and of insufficient use of sub-national spatial planning (Auckland is one of several exceptions), broad public appeal rights over local government plans by international standards, a lack of clarity about and extensive litigation over the meaning of core concepts of the RMA such as “environment” and “sustainable management”, and finally an overreliance on regulation rather than price signals. Frustration and problems with the system have led to many amendments to the RMA, increasing its complexity and reducing coherence (NZPC, 2017). In addition, like the education system, the planning system is very devolved to sub-national actors, putting pressure on local implementation capability, which is highly variable.

In an attempt to address these problems, the previous government proposed three new pieces of legislation to replace the RMA, two of which were passed, the Spatial Planning Act and The Natural and Built Environment Act. They extended spatial planning nationwide and modified governance arrangements, with a smaller role for councils and a greater role for unelected regional planning committees. This new legislation has been criticized for lessening democratic accountability, for increasing complexity and for inviting litigation over new terminology. The new government has repealed both statutes. Given the widespread agreement that the planning system has not been working and that climate change will make the price of failure even higher, some reforms will still be required.

The new government having repealed the previous government’s new planning statutes intends instead to carry out reforms to the existing statute, the RMA. Whatever the final form of these reforms, international experience and best practice, efficiency and the demands of adaptation suggest that they should contain some key elements: democratic accountability (i.e. publicly-elected councils should be the main planning actor); coordinated spatial planning at the national and local level; national direction on the broad parameters of spatial planning, including tolerance limits for the risk of loss of life and property; only one layer of public hearings on spatial plans, with further appeals limited to points of law; and more balanced and a wider range of revenue tools for councils, including user charges and better land value capture; a more data-driven approach to planning; and more central government data collection, analysis and modelling support to local governments. Indeed, a significant barrier to better environmental regulation is a lack of information about what is happening in the environment and how much pollution and damage is occurring to inform that regulation (PCE, 2023a). While the complexity of the amended RMA suggests new statutes may be necessary, retaining core concepts, where they have settled meanings in case law or defining these terms more precisely in new legislation should be retained as far as possible to avoid overburdening the court system with decades of renewed litigation over the meanings of new terms.

Given that better infrastructure is part of the solution to adaptation, one of the most important problems with the planning system from a climate change adaptation perspective is that councils have faced difficulties recovering the full costs of infrastructure from those creating the demand. This has led many councils to ration the supply of new infrastructure, contributing to scarcity of land and housing resulting in higher prices (NZPC, 2017).

A more extensive revenue toolkit is required to better recover the cost of growth and climate change adaptation infrastructure without overburdening current residents, who experience shows will successfully oppose further levies on them to fund growth. Councils should make greater use of user charges and special higher rates for owners of properties in new developments to cover the cost of the infrastructure and other public amenities they enjoy there. Property owners would eventually benefit from better amenities directly. They should also benefit in theory from lower insurance premiums against climate-change hazards due to lower risks from higher-quality infrastructure and environmental amenities such as green spaces. As is often the case internationally, councils do impose developer charges, either in land or cash to recover the costs of infrastructure, roads, drainage etc as well as to provide parks and other public

amenities. However, they often do not seem to have charged enough to provide, for example, green spaces in the same quantity and quality as established parts of towns and cities, making them less adapted to climate change than established areas (PCE, 2023). It may be necessary to level the negotiating playfield between local government and developers by imposing some mandatory national rules on minimum developer contributions. This could be accompanied by requirements to employ water-sensitive design techniques (OECD, 2016).

An underexploited form of revenue pertains to the gap in value of land on the fringe of a residential area and the land just inside the boundary as well as the gap between land zoned as low and high density within the city boundaries. If the rural land is rezoned to residential, or land within the urban boundary is rezoned for higher density housing, it conveys a profit on the landowner. The gap at the urban fringe has grown substantially, signalling a lack of space or reluctance to build out or up (e.g., due to urban limits, density, and height restrictions or other factors) and has contributed to rising house prices. On the Auckland urban fringe, the difference has risen from NZD 200 to 1300 per square metre between 2010/11 and 2020/21 (New Zealand Infrastructure Commission, 2023).

To capture some of this value the central government should mandate that councils charge and collect an event-based (i.e., rezoning) incremental land-value tax on the owners of land on the city fringe that is rezoned or land that is rezoned to higher density or value activities within the urban boundary. This could take the form of a tax charged on the value increase of rezoned land when the landowner sells for development, combined with a recurrent incremental land value tax from the time of rezoning, with a higher net present value than the lump-sum tax rate. The primary purpose of this tax would be to raise revenue in an efficient and fair way, but this structure may also encourage landowners to sell rather than bank the land and speculate on further land price increases.

The use of strategic land management – buying land financed by debt before it is rezoned to capture more of the value is an additional tool for land value capture on the city fringes (OECD, 2022d). This has been used for example in high-growth cities in the Netherlands. More land value capture and flexibility to improve adaptation within existing urban boundaries could be achieved through greater use of land readjustment or pooling, which is widely used in Japan. This involves buying up contiguous plots of private land combined with regulation changes (e.g., in density limits) so that the redeveloped combined parcel, with for example better infrastructure and amenities that make it less vulnerable to climate change, is more valuable.

Spatial planning – deciding where and what firms and people are allowed to do in a certain land area – will also be key to climate change adaptation. The central government needs to provide direction and national spatial guidelines because it is exposed to the consequences of climate hazards as the social insurer of final resort, and because there are decisions, e.g., setting limits on permitted life and property loss risk as part of climate change adaptation, that require national democratic accountability and should reflect the majority preference of all New Zealanders. To be effective and ensure coherency, spatial planning needs to be coordinated between central and local government. Austria is one of the few countries that has a formal coordination mechanism, the Austrian Conference on Spatial Planning, supported by a secretariat and chaired by the Federal Chancellor. Its members include all federal ministers and representatives of associations of local governments (OECD, 2021). One of the central tasks of the organisation is the preparation of the Austrian Spatial Development Concept, which covers a period of 10 years and provides guidelines for national spatial development that is shared by all levels of government. It has also developed an online tool that provides important indicators at the municipal and regional level.

The high autonomy over planning of elected local governments has the large advantages of democratic accountability and in-depth local knowledge of the area. These advantages should not be lost through over-centralisation. However, this autonomous model needs better implementation support from the central government, and greater analytical capacity at the local level especially as the challenges of climate change hazards grow (OECD, 2023e). To ensure all local governments can take a more technically-driven

approach to consenting and planning that incorporates the latest information on climate-related risks, consideration should be given to requiring more cooperation between regional councils, larger councils and smaller rural neighbours, especially where they share an environmentally interdependent area. To ensure greater coherency across functionally similar areas, some compulsory cooperation amongst urban councils and with the regional council may also be warranted, for instance in the greater Wellington region, which has a population of around 420000 and four urban councils, whereas Auckland with a population of over 1.7 million has only one. A complementary and cost-effective measure to foster cooperation at local government level would be for central government to take responsibility for environmental data and monitoring and modelling (PCE, 2022a).

Towards a low emission and secure electricity supply

New Zealand's electricity system is an important source of vulnerability to extreme weather. Hydroelectricity supplies around 60% of New Zealand's electricity demand and is geographically concentrated. This is a boon for keeping energy-related emissions low but makes the country's electricity supply vulnerable to the "dry-year problem".

As electricity imports are not possible, and with growing electricity demand due to electrification of transport, increased security will need to be attained through other methods including: diversifying supply through building other types of low-emission generation, such as wind and geothermal; increasing storage of electricity to meet peak demand under unfavourable weather conditions; and reducing demand, e.g., by increasing energy efficiency or even periodically switching off certain types of energy-intensive production. Investments in storage are increasing and New Zealand's first utility scale battery energy storage system (BESS) was commissioned in December 2023 (Transpower, 2023; Electricity Authority, 2024). Multiple BESS projects are under construction sometimes in conjunction with renewable generation projects. This has the security advantage of diversifying risk as well as potentially lower transmission losses than a very large-scale single storage facility.

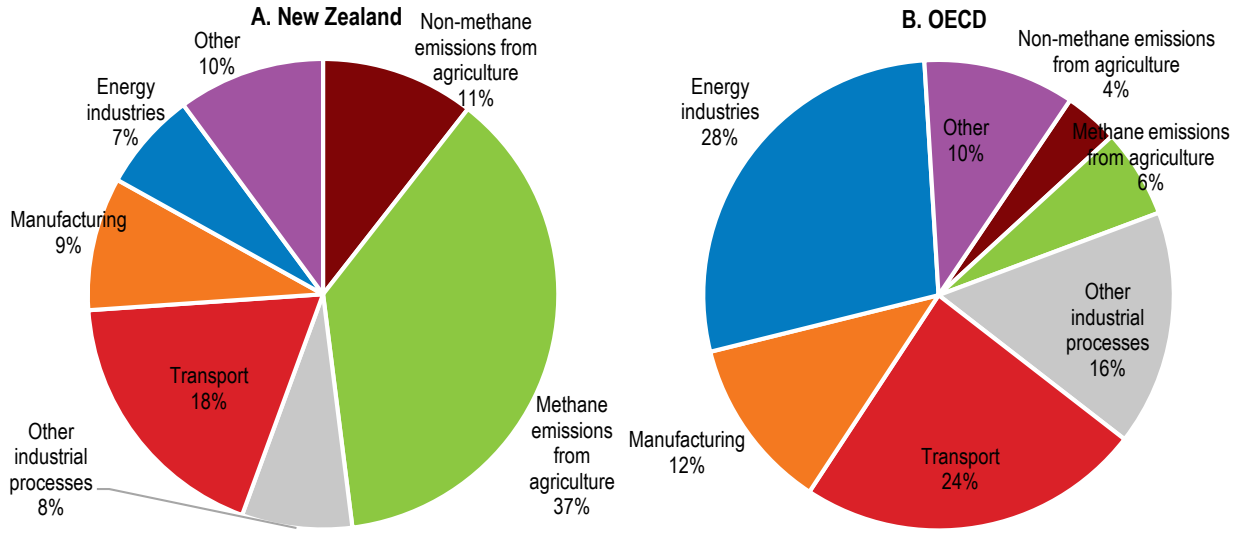
New generation capacity will also require more investment in the transmission grid. Transpower, the system operator and grid owner on behalf of the government, has a systematic, forward-looking, cost-benefit driven approach to investment plans, which are submitted to the Commerce Commission for approval. These include investments to enhance the security of supply including augmenting the critical high-voltage direct current link between the South Island and the North Island. However, the government needs to develop an overall strategy for the energy system, based on cost-benefit comparisons of different options to reduce emissions, while securing supply, using a similar methodology. The absence of a clear strategy leaves large investment decisions open to improvisation, which is in turn vulnerable to the short political cycle. This increases uncertainty for private investors about their most profitable option, thereby delaying investments that reduce emissions and improve adaptation, for example through building new renewable electricity generation or storage.

Accelerating efforts to reduce GHG emissions

New Zealand's emissions reduction challenge is defined by their unusual structure. Agriculture accounts for 48% of New Zealand's emissions, with 77% in the form of biogenic (i.e., emitted by animals) methane, CH_4, which is much higher than the OECD average (Figure 3). Around 18% of gross emissions are contributed by transport, 9% by manufacturing and 8% by other industrial processes. Only 7% comes from electricity and other energy generation, which is much lower than in the rest of the OECD.

Figure 3. The agricultural sector accounts for a large share of GHG emissions in New Zealand

2019

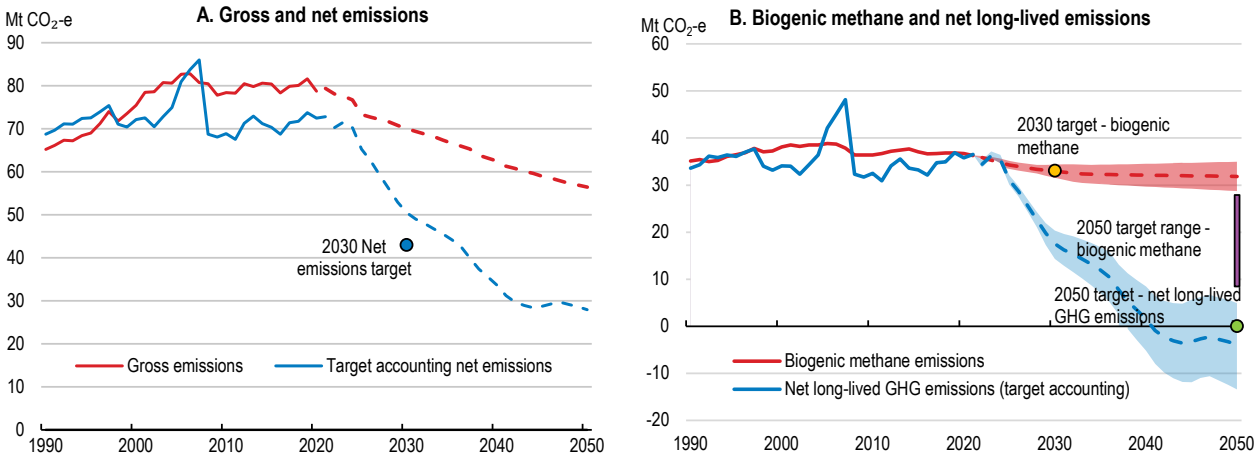


Source: OECD Calculations and OECD Greenhouse gas emissions and Agri-Environmental Database.

New Zealand's near-term international target is a reduction of target accounting net emissions to 50% below gross 2005 levels by 2030. This is a reduction in AR5 target accounting net emissions to 43 million tonnes of CO_2 equivalent as calculated by the Ministry of the Environment for the National Defined Contribution (Ministry of the Environment, 2023a). This is a reduction of 30 million tonnes between 2021 and 2030. The Ministry for the Environment's November 2023 GWP-100, AR5 projections for emissions from 2022 onwards show New Zealand would not meet this ambitious 2030 target domestically (Figure 4); requiring it to meet its obligation internationally. New Zealand has the following dual domestic emission targets enshrined in legislation: to achieve national net zero GHG emissions (excluding biogenic methane) by 2050; and to reduce biogenic methane emissions by 10% by 2030 and by 24 to 47% by 2050 relative to the 2017 levels. Comparing the Ministry of the Environment's projections for biogenic methane with the targets implies that New Zealand is on track to meet the 2030 target for biogenic methane and the 2050 target for net long-lived emissions but not the 2050 target for biogenic methane. These projections assume forest removals play a large role in meeting net emission reduction targets as evidenced by the large gap between net and gross emissions.

This dual target approach is appropriate as biogenic methane has a far more powerful heating effect but also is a shorter-lived gas than CO_2. When a pulse of methane is emitted, around two-thirds is removed from the atmosphere after 12 years (PCE, 2018a), unlike CO_2, which stays in the atmosphere for millennia. Modelling shows New Zealand will need to reduce biogenic methane emissions by around 10-22% below 2016 levels by 2050 to ensure no additional warming relative to warming caused by methane emissions to date (PCE, 2022). By contrast, CO_2 needs to be reduced to net zero emissions to prevent additional warming as it is far longer-lived. The dual target makes the temperature outcomes of New Zealand's emissions reduction targets clearer and helps avoid unintended outcomes that could occur from trade-offs between those gases under an all-gases target. Reducing methane has important benefits for the climate but it is not a substitute to reducing emissions of long-lived gases like CO_2 to net zero. Otherwise, the cumulative warming from long-lived gases will eventually outweigh any benefit from methane reductions (Reisinger, 2019). As discussed below these physical properties also have important implications for forest removals making it less clear why there should be a gross emissions target for biogenic methane and a net target for other GHG emissions.

Figure 4. Net emissions are expected to decline more than gross emissions

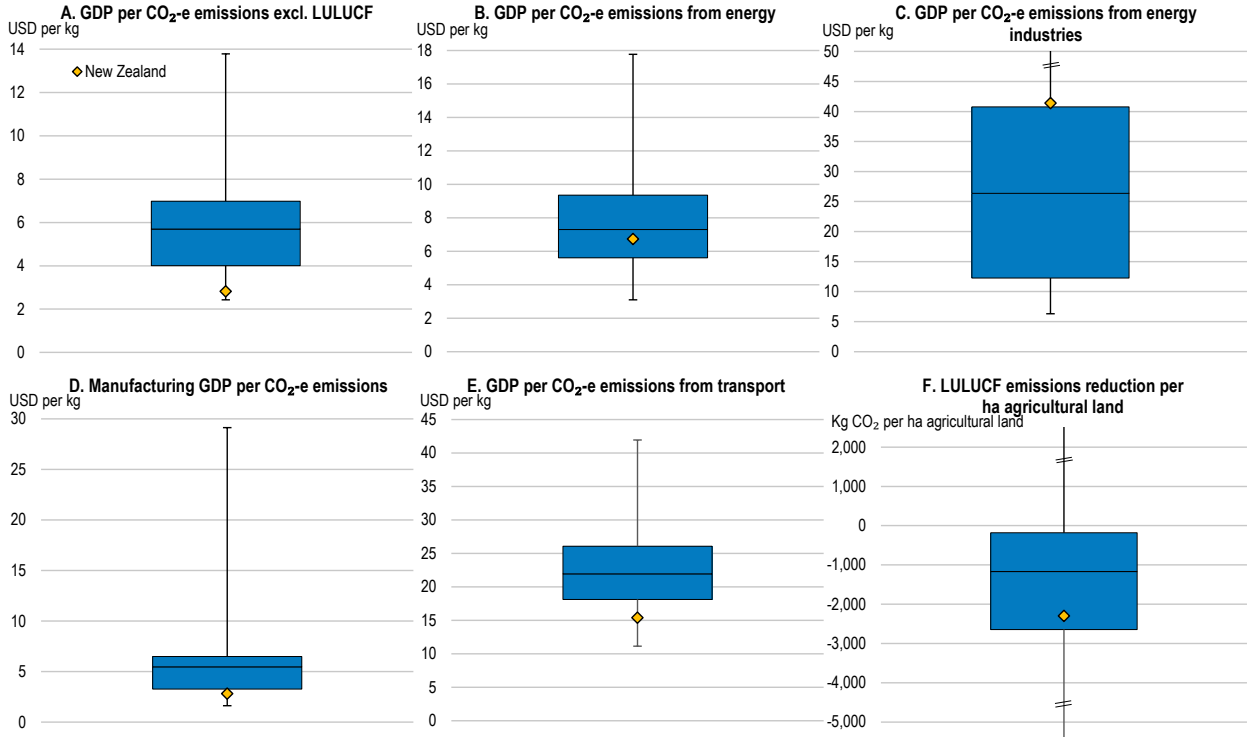


Note: Panel A shows historic total GHG emissions data extended by Ministry of Environment projections (AR5 November 2023). The series are calculated using GWP-100 (Global Warming Potentials over 100 years), the international standard that converts all GHG gases into CO_2 equivalents using fixed coefficients. The 2030 target (New Zealand's first nationally determined contribution under the Paris Agreement) and the 2050 target are defined in terms of net accounting emissions, which exclude offshore mitigation. The target range for 2050 shown by a vertical bar is that implied by the official target and using the GWP-100 method. Net long-lived emissions are total net emissions minus methane (CH4) emissions of the agriculture and waste sectors. The boundaries of the shaded areas represent the low and high emissions projection scenarios.
Source: Ministry for the Environment; OECD calculations.

Calculations suggest GHG emissions decoupled from GDP from 1993, with emissions per unit of GDP falling at an annual average rate of 1.9% since then, lower than the OECD median of 2.3%. A top priority of the first emissions reduction plan is appropriately increasing GHG efficiency in all sectors, i.e., output per kg of CO_2 equivalent. As discussed below, New Zealand has one of the most GHG efficient agricultural sectors in the world but agricultural emissions and particularly methane is a far more important source of emissions than in most countries. Reducing it should be a priority and further increasing GHG efficiency (i.e., output per kg of GHG) could make a valuable contribution to reduced warming potential provided the efficiency gains were not eaten up in increased livestock numbers.

In manufacturing and transport, New Zealand's efficiency is considerably below the OECD frontier (Figure 5), and despite improvement building energy efficiency standards for buildings are laxer than in other countries suggesting that adoption of more modern technology and policies can have a high payoff in these sectors. By contrast, because of the already high share of low emissions electricity generation (over 80% is renewable of which two thirds is hydro and one quarter geothermal), efficiency in energy industries is already in the upper quartile of the OECD. The contribution of forestry to reducing the net warming effect of agriculture in terms of CO_2 removals per hectare of land is also large.

Figure 5. There is large potential to improve GHG efficiency especially in transport



Note: The box shows the second and third quartile, the horizontal line indicates the median and the whiskers show minimum and maximum values.
Source: OECD, Air and climate (database) and OECD, National Accounts (database).

Policy priorities for emissions reduction

New Zealand has developed a sophisticated policy framework for reducing GHG emissions. There is a detailed emissions reduction plan informed by advice from the Climate Change Commission and a range of policy instruments for reducing emissions. A cornerstone of pricing tools is the New Zealand Emissions Trading Scheme (ETS) that establishes a price on virtually all emissions except agriculture. Taxation (e.g., fuel excise taxes), subsidies (e.g., for retrofitting buildings) and regulatory tools (e.g., fuel and insulation standards) are all used. A government-industry partnership, He Waka Eke Noa, to measure, manage and reduce agricultural GHG emissions was established in 2019.

However, the choice of instruments is not always based on a comprehensive cost-benefit analysis and is sometimes ad hoc. The strategy for reducing transport emissions focused on policy instruments that reduce CO_2 such as electric vehicle subsidies, which are generally amongst the most expensive options for reducing CO_2 (Gillingham and Stock, 2023). At the same time there was insufficient complementary investment in public charging stations leading to the highest ratio of electric vehicles to public charging stations in the OECD, notwithstanding statistical comparability limitations There has also been very little use by international comparison of biofuels for heavy vehicles (IEA, 2023a), which are still expensive but less so than electric vehicle subsidies per kg of CO_2 equivalent reduced (OECD, 2023b) and could play a transition role. There is also a need as discussed below to revisit the role forest removals should play in reducing net emissions.

Improving the emissions reduction plan

By law the government must produce emissions reduction plans regularly taking into consideration (but not bound by) the Climate Change Commission's advice. Each plan is associated with keeping emissions

within a specific emissions budget, which sets the total emissions allowed within a set period of years. The first reduction plan to meet New Zealand's first emissions budget (for the period 2022-2025) was released in May 2022 and the next plan focussed on achieving the 2nd emissions budget (for the period 2026-2030) is due by December 2024.While the first plan complied with the legislation, the process for developing plans could be improved. The first one failed to adopt a comprehensive approach taking account of economic, environmental and social impacts and systematically considering key trade-offs and questions, as well as alternative emissions pathways. This reduced its coherency (PCE, 2023).

In addition, international experience indicates some of the plan's policy goals, such as electrification of heavy vehicles, are unattainable in a small country like New Zealand until the technology matures in large markets (OECD, 2023b). The plan to substantially increase renewable electricity generation will also be much harder to achieve pending a definitive decision on whether to close the Tiwai Point aluminium smelter, which consumes 13% of New Zealand's electricity production at prices well below the market price. The ensuing uncertainty for potential investors in renewables electricity generation about future electricity demand makes them hesitant to invest (IEA, 2023a). This is in turn undermining one of the key pillars of emissions reduction, namely greater electrification of the transport and industrial sectors.

New Zealand's emissions reduction process needs a more systematic approach that compares as much as possible the costs and benefits of different emission reductions pathways using comparable methodologies (PCE, 2023). A more systematic approach to emissions reduction requires the development of a long-term energy strategy, which New Zealand lacks (IEA, 2023a). One is planned for completion by the end of 2024. The energy strategy should be made fully coherent with the second emissions reduction plan, as well as ensuring the long-term economic and social cost per kg of reducing energy-related GHG emissions is as low as possible.

Table 1. Past OECD recommendations on reducing GHG emissions and actions taken

Recommendations in past Surveys (key ones in bold)	Actions taken since the previous *Survey*
Increase the emissions price to a level consistent with New Zealand's intended transition to a low emissions economy.	The supply of permits at auctions is being reduced and the price of permits in the NZ ETS has increased from around NZD 50 in 2022 to around 70 per tonne at the end of 2023, close to the minimum auction price of NZD 72 for 2026 recommended by the Climate Change Commission.
Announce a date for inclusion of biological emissions in the NZ ETS or alternative pricing and regulatory measures to reduce them.	The new government has indicated it will give farmers the tools they need to measure on-farm agricultural emissions and recognise on-farm sequestration by 2025, and that a pricing mechanism for on-farm agricultural emissions will be implemented by 2030 at the latest.
Complement rising carbon prices from progressively tightening the supply of emissions permits with targeted measures that address market failures not corrected by carbon pricing alone.	Clean car discount introduced in 2021 with a subsidy for electric vehicles and fees for higher emission vehicles was repealed in December 2023.
Support research in new mitigation technologies, especially for farming.	A Centre for Climate Action on Agricultural Emissions has been established to accelerate research, development and commercialisation of new technologies for reducing agricultural emissions. The centre has two components: a research accelerator (the New Zealand Agricultural Greenhouse Gas Research Centre) and a commercial accelerator (AgriZero, a joint 50/50 government agribusiness investment fund).
Introduce an excise duty on diesel and ensure that petrol and diesel tax/charge rates consider the environmental costs of transport. Introduce fuel efficiency and air emission standards for new and imported used vehicles.	The new government has announced it wants to replace fuel excise charges with electronic road user charges for all vehicles starting with electric vehicles and to work with Auckland Council to implement time-of-use road charging.

The role of forest removals in the NZ ETS needs to be revisited

New Zealand's most important GHG emissions reduction policy instrument is the New Zealand Emissions Trading scheme (NZ ETS), introduced in 2008 and covering 96% of non-agricultural emissions (OECD, 2022a). Reforms legislated in the New Zealand Climate Change Response (Emissions Trading Reform)

Amendment Act 2020 moved the ETS to a cap-and-trade market. There are three main sources of supply of units: free allocations to emissions-intensive and trade-exposed (EITE) firms, government auctions and units supplied by the forestry sector. The government, although a key supplier of units via auctions, does not have full control of their supply as there is no limit on how many units forestry can supply. The overall limit on units, as set in regulation, in the NZ ETS is often referred to as its "cap". This limit covers units available by government auction (including through the Cost Containment Reserves), by other means including free allocations to Emissions Intensive Trade Exposed (EITE) firms, and approved overseas units (currently zero). This limit does not apply to units that can be earned by removals activity within the scheme, such as forestry. There are also a number of units within the scheme that pre-date the introduction of unit limits and contribute to what is referred to as the "stockpile". Legislation requires that the government in making decisions on unit and price control settings must be satisfied that these settings will ensure New Zealand will meet its emissions targets and budgets. The size of the stockpile and units earned by removals are taken into account in determining unit limits, but the limit does not apply to these categories. This is one of several complexities associated with the New Zealand scheme.

Increasing forest cover is an essential part of New Zealand's net emissions reduction strategy (Ministry for the Environment, 2022a). The Ministry of the Environment's net emissions projection assumes average forest planting of around 40000 hectares annually through to 2050, around the average of the 1980s and 1990s, a period of rapid afforestation. This target seems attainable as long as the ETS price remains high enough, as the key driver of afforestation appears to be the ETS price (MPI, 2021).

To help auction prices stay in line with what is anticipated to be needed to achieve emissions budgets, a price floor has been introduced, below which permits will not be auctioned. The 2020 reforms constrained the supply of units more, and their price rose considerably. The price rise appears to have induced a sharp rise in afforestation with 60000 hectares of new afforestation in 2022, far above plantings in the 2010s, and what is assumed in the government's emissions budget of 32000 hectares (Ministry for the Environment, 2022a). Forest removals are attractive as planting exotic Pinus radiata forests reduces CO_2 at a cost of NZD 25-50 NZD per tonne compared with around NZD 100 per tonne for many other emissions reductions options (NZCCC, 2023).

However, there are no limits on the quantity of afforestation units that may enter the ETS market, which is unique internationally (NZCCC, 2023). Relying so heavily on forest offsetting is risky. Gross GHG emissions, notably CO_2, linger in the atmosphere for hundreds to thousands of years. To be a full offset for these long-lived emissions, forests would need to remain in existence for equally as long, something no policy can be realistically expected to guarantee, especially in a warming world. If gross CO_2 emissions continue this would also require ever-increasing plantings and land-use change (PCE, 2022). It would also mean the inability to change this land to higher value uses than forests until a way is developed to transfer the carbon locked up in the trees underground or another more cost-effective carbon mitigation/sequestration alternative is found. The ETS also seems to carry a high risk of a boom-bust cycle, where the higher ETS price is boosting planting now, but the credits will not be earned for some years, at which point ETS supply will rise sharply pushing down prices and the incentive to plant as well as the incentive to reduce gross emissions. In addition, even if planting induced by the current ETS falls to that assumed by the emissions budget of 32000 hectares per annum, it will supply all the projected demand for units by the mid-2030s, at which point the ETS will no longer be effective in driving gross emissions reductions (NZCCC, 2023).

The ETS also does not appear to induce emissions removals from forestry in the most socially and environmentally efficient way. Forests are vulnerable to the risk of disease and fire, which will increase as droughts frequency rises with climate change. The ETS mitigates the risk of fire and decay by requiring forests to be replanted or units to be surrendered but the ETS does not fully price this risk; all forests wherever they are planted receive the same number of units. Under the ETS forests earn credits according to how much carbon they are sequestering, which varies across forest types but the ETS does not

distinguish between exotic and native forests in terms of risks and durability. Native forests grow more slowly but are potentially a much longer-lived store of carbon than Pinus radiata forests (PCE, 2022). Indeed, aside from their biodiversity benefits native forests are perhaps the only way to create a centuries long carbon sink and an important asset for New Zealand. Pinus radiata is usually harvested after 25 to 30 years but individual specimens have survived up to 150 years in botanic gardens in New Zealand (Woollons and Manley, 2012). New Zealand's native Kauri can grow to 50 metres in height and live for over 2000 years and many other native tree species live for many centuries. Rapid afforestation would also drive strong land-use change away from agriculture, with potential social and economic implications for rural communities, as forestry is for most of a forest's life less labour-intensive than agriculture, implying rural depopulation – particularly in the case of unharvested exotic forests grown for the primary purpose of earning carbon credits. This externality is not priced by the current ETS either.

The NZCCC recommended to prioritise gross reduction in the ETS and manage incentives for exotic forestry (NZCCC, 2023). In response, a consultation by the Ministry for the Environment (MfE, 2023) on the ETS suggested different options for reform including increasing demand for units. However, as the review notes, the effects of the proposed reforms are uncertain. The Parliamentary Commissioner for the Environment (PCE, 2022) has separately discussed issues related to the treatment of forest removals. The new government has announced it will not pursue ETS reforms further to increase certainty. However, without reforms, speculation about future policy is likely to continue, calling for the development of a specific set of policy proposals and implementing them building on the advice already received from these agencies.

One option to better incentivise gross emissions reductions of long-lived gases could be to remove forest removals entirely from the current ETS and confine issuing units for afforestation to a separate methane-based scheme discussed below. An intermediate option for example could be to use variable unit allocation accounting taking into account fire risk, social disruptions in rural communities and also the long-lived benefits of native forests. At present forest owners can choose to plant trees to earn credits but have no obligations to maintain the forest in a harvestable state. The policy framework for forest offsetting could be further improved by strengthening the forest management obligations on owners that receive ETS credits, as well as resourcing councils to improve enforcement of these obligations.

A possible approach to better match gross emissions with removals from afforestation could be to set a net biogenic methane target as well as the existing gross one and introduce a separate biogenic methane based ETS scheme that allows a limited amount of forest removals. Biogenic methane decays faster in the atmosphere than CO_2. Modelling using an alternative GWP* metric (Allen et al., 2018, 2022; Frame, 2018) rather than the international standard GWP-100 shows the timing of additional warming from an increase in methane emissions and that of additional cooling from carbon removals from exotic production forests are roughly matched, so that combining them can deliver a net zero temperature response. In addition, provided total methane emissions do not increase e.g., via an increase in animal numbers, there would be no need to continue expanding forest cover unlike when afforestation is used to offset CO_2 emissions (PCE, 2022). A further complementary policy option, provided the risk of loss to pest, disease and fire was priced in, would be to still allow native forests to earn credits in the general ETS given their much longer life more in tandem with long-lived gases.

There has also been significant price volatility, which can undermine the incentive to invest over the long run to reduce emissions. The ETS price peaked at the end of 2022 before falling sharply through to mid-2023 and then partially recovering as the market speculated on future government actions. The March, June, September and December 2023 permit auctions were all declined as the reserve price was not reached. Lower-than-expected ETS revenues have previously left a shortfall in government revenue and over time these proceeds will decline. From late 2021 cash proceeds from the ETS were allocated to the Climate Emergency Response Fund (CERF), which funded mitigation and adaptation projects. In December 2023, the government reallocated the remaining funding in the CERF to support tax relief as part of its fiscal plan

and agreed that future ETS proceeds should be used for this purpose. If the ETS achieves its aims, emissions and revenue will decline suggesting it should not be allocated to ongoing baseline spending or permanent tax cuts. Climate change mitigation and lump sum compensation for low-income households for loss of purchasing power due to higher ETS prices would seem to be a better match as the need for these will decline in tandem with emissions reductions and ETS revenue.

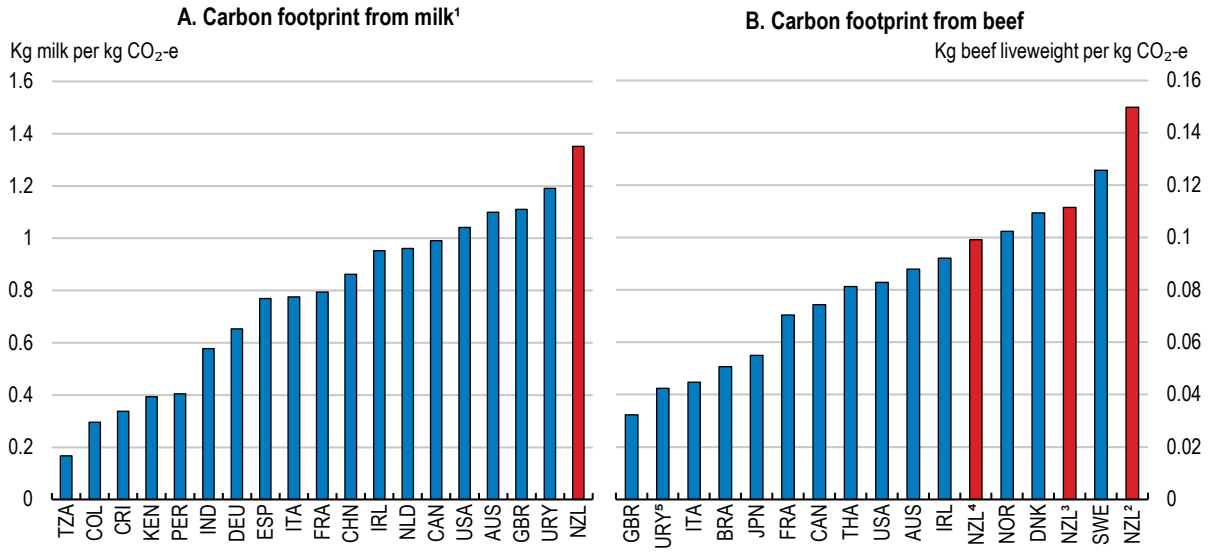
Reducing emissions in priority areas

New Zealand has made significant steps in improving the policy framework but gross emissions reductions are needed to meet targets. Significantly reducing emissions will require acting simultaneously in several key sectors including, agriculture, transport, manufacturing and buildings and further improving a wide variety of policy instruments from the ETS to taxation and standards.

Reducing emissions from agriculture

Agriculture contributes a high share of New Zealand's total GHG emissions so reducing these emissions is key. New Zealand is already one of the most, if not the most, GHG emissions efficient producer of milk, beef and lamb in the world (Figure 6) so the challenge of reducing emissions is a momentous one. The focus needs to be on further increasing on-farm GHG efficiency and also reducing absolute emissions, e.g. by reducing nitrogen fertilizer use (Reisinger et al., 2017). However, costs of mitigation is a key barrier, as is the lack of information, calling for more accurate and affordable emissions measurement, reporting and verification (MRV).

Figure 6. New Zealand milk and beef production is very GHG efficient



1. Fat- and protein-corrected milk. 2. Dairy beef. 3. Weighted average. 4. Traditional beef. 5. Uruguay, Argentina and South Brazil.
Source: Falconer et al. (2022); Beef + Lamb New Zealand.

Indeed, investment in accurate and affordable MRV procedures and technologies is particularly critical for policies that depend on providing incentives for precise emissions reductions. Despite significant progress, MRV has not advanced enough to allow a detailed farm-level pricing system yet (NZCCC, 2022) which would be needed to incentivise the widest range of mitigation options. Further R&D is needed to improve the accuracy of MRV approaches for mitigation sources, such as soil carbon sequestration where measurement is particularly tricky, and to ensure actions to reduce emissions are being rewarded (OECD, 2023c).

The pricing of agricultural emissions has been delayed by successive governments but should be introduced in some form (such as a levy, or separate agricultural ETS) to incentivise on-farm reductions in gross emissions as soon as there is sufficient improvement in MRV to make it feasible. If a separate agricultural ETS were considered, it could include free unit allocations that decline over time and keep the option to earn units for carbon sequestration by forests (and potentially other carbon sinks such as soils and wetlands) while maintaining research and technical support for gross emissions reductions. Farmers can already earn ETS units by planting forests. However, forest planting is often not their area of traditional expertise, so support for technical advice on integrating trees into farms and knowledge networks such as the New Zealand Farm Forestry Association should be scaled up.

Another key barrier to reducing emissions is a lack of viable technical solutions beyond de-stocking. Fonterra has released a plan to increase GHG efficiency within the cooperative which processes 80% of New Zealand's milk by 30%. The government, in partnership with industry, should continue to incentivise a wider set of projects that increase gross on-farm GHG efficiency including through the industry-government joint venture AgriZero, the New Zealand Agricultural GHG Research Centre, and expanding partnerships with dairy processing companies. This can involve better measurement of on-farm emissions, spreading best practices in feed and pasture quality and herd genetics and getting the sector ready for rapid uptake of new technological solutions such as methane inhibitors via feed supplements and vaccines to reducing methane (OECD, 2022b).

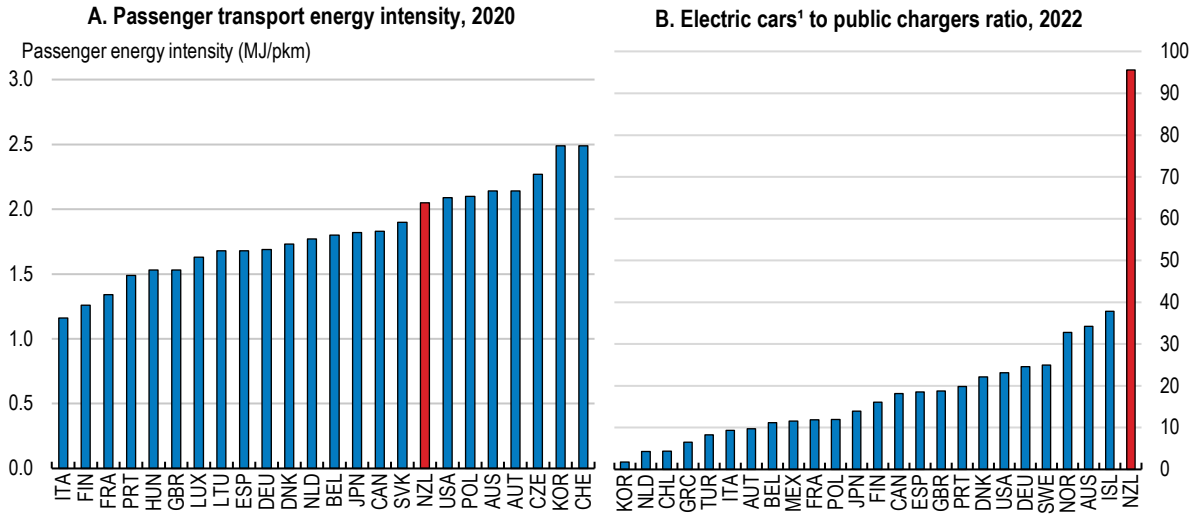
New Zealand's dairy processing companies have a key role in incentivising greater GHG efficiency by creating products and exports sales channels for lower-carbon milk, which can generate higher revenue to reward farmer suppliers. The government can support this inter alia through trade missions including representatives of the independent dairy companies and Fonterra. A Ministry for Primary Industries emission reduction project certification could also help facilitate farmers earning ETS credits.

Reducing transport emissions

As noted above, New Zealand's CO_2 efficiency in transport is low by international standards and the sector contributes 18% of total emissions. New Zealand's emissions reduction plan aims to reduce emissions from this sector through electrification. The options for supporting passenger vehicle electrification need to be carefully weighed against each other in terms of cost per emissions avoided and other emissions reduction options for the sector, such as increasing public transport. Greater electrification of passenger vehicles will require a coherent investment programme on several fronts, including the expansion of secure, low-emission electricity generation to meet significant extra demand. This investment programme should be done as part of the development of the overall energy strategy for New Zealand.

New Zealand's electric vehicle to total public charger ratio looks high in international comparison (Figure 7) (notwithstanding that some charging points and especially slow AC ones may not be counted in New Zealand) and the Kw of public charging per electric vehicle is low. Indeed, a large share of charging is done privately at single-family homes with access to off-street parking, meaning there is limited demand for public slow AC chargers. When considering the ratio of electric vehicles to public fast charging points (>22 kW), New Zealand's ratio is much closer to other OECD countries. Nevertheless, further electric vehicle uptake is likely to slow without more public chargers to reduce "range anxiety" by providing the same level of convenience for refuelling as for combustion engine cars and for those without access to home charging. The government plans to expand the charging network are a step in the right direction but this expansion needs to be done based on careful cost-benefit analysis and weighed against other options. International experience can also help inform an efficient rollout but would need to be adapted to the New Zealand context. Korea has one of the most ambitious and innovative public charging programmes in the world, installing chargers in pre-existing public spaces, such as streetlamps and building walls. Battery swapping stations, in which China and India are the leaders, are another alternative for investigation and may be suitable for taxis and light delivery vehicles (IEA, 2023b).

Figure 7. Transport is energy intensive in New Zealand, and the rollout of public charging stations has not kept up with the uptake of electric vehicles



1. Battery electric cars and plug-in hybrid electric cars.
Source: International Energy Agency.

Even with electrification expanding, combustion engine cars will remain prevalent for many years, so it is still important to increase the average fuel efficiency of passenger cars, which is low compared with many other OECD countries (Figure 5), partly due to a high share of SUVs. Environmental taxes in New Zealand are a low share of total revenue and outside of some farming, forestry, and tourism activities these vehicles are a preference and not a necessity. Greater taxation of vehicles at registration according to their level of emissions and tighter fuel efficiency standards are needed to better internalise environmental externalities. A large lump-sum payment at registration reflecting the net present value of emissions over the lifetime of a vehicle may be more dissuasive than incrementally increasing fuel excise taxes.

The government repealed the 'feebate' system, in which rebates were given to individuals purchasing low-emission vehicles and fees were charged to those buying high-emission vehicles. Any new attempt at using taxation therefore needs to be regarded as fair and consider distributional consequences. Options may include exceptions from the tax for farmers and others that have a business need for higher emissions vehicles and avoiding subsidies for expensive electric vehicles that primarily benefit the urban wealthy. The extra revenue from a revised scheme could be used to fund other transport emissions reduction investment including further expansion of public transport and cycling infrastructure on routes but with a greater focus on cost effectiveness and simpler solutions than in the recent past. This would suggest a preference for routes with high demand potential (for example to schools and universities and retirement villages). There should be a particular focus on identifying and addressing bottlenecks and gaps in existing public transport routes, as even in very densely populated cities like Paris, it is often just one part of a route that is responsible for most of the delays. Finally, given New Zealand's low population density cities, electric buses on busways are often likely to be a more cost-effective option than underground, tram and rail options.

Reducing emissions from buildings

A high share of renewables in electricity generation helps keep the emissions associated with buildings in check as around two thirds of energy consumption in buildings is electricity. Nevertheless, buildings (residential and other) account for around 20% of total energy consumption – as against 28% globally (OECD, 2022c) – and 20% of this is supplied by gas and oil (IEA, 2023a). Hence, improving building energy efficiency is an important and potentially very cost-effective way to reduce or indeed avoid emissions. For

example, it is far cheaper to avoid emissions using modern technology, for example by replacing standard incandescent light bulbs with LED ones that use up to 90% less energy and last 10 times longer (EECA, 2021), than building new hydro-electricity generation. Minimum insulation standards have been steadily increased but there is high potential to do more as they remain around half of those in Australia, California and the United Kingdom (IEA, 2023a). Insulation standards and other energy efficiency standards should continue to be progressively tightened.

Findings and recommendations

FINDINGS	RECOMMENDATIONS (key ones in bold]
Overall strategy for adaptation	
Until 2023, New Zealand's main response to extreme weather events damage has been ad-hoc government-funded disaster relief.	Carry out a coordinated reforms in a wide range of areas including planning, insurance and energy to increase resilience to a changing climate.
New Zealand's adaptation plan has many strong features but lacks evaluation metrics for monitoring progress.	To ensure the plan achieves adaptation in the most cost-efficient way, introduce effective reporting on the implementation and evaluation of the plan's measures using quantitative metrics and select investment projects based on quantified cost-benefit analysis.
Planning, investment and accurate insurance pricing by the Earthquake Commission and the private insurance industry requires detailed data about what is known about the risk of climate-related hazards.	**Ensure resourcing is appropriate for improving climate projections, hazard and vulnerability databases and modelling. Construct and maintain a national individual insurance claims database.**
Making insurance fit for a warmer world	
Household and firm decisions that affect their vulnerability to climate change-related hazards depend on the availability and price of insurance. Some properties at risk of sea-level rise or floodplain flooding may eventually become uninsurable by the private sector alone.	**Monitor the price and availability of insurance for climate related disasters, and, if required, stand ready with options for reform of the market, considering the balance of public and private, optional and mandatory insurance coverage, the nature of risks and household disadvantage.**
Adapting the planning system to a warmer world	
The planning system has not delivered the core objective of sustainable management of resources required by the Resource Management Act.	**Use spatial planning at national and local level more, reduce legal appeal rights, and offer more data and modelling support to local government.**
Councils struggle to raise sufficient funds for infrastructure required for adaptation. There is a large increase in the value of land on the fringe of cities when it is rezoned as residential, which could be taxed more.	Broaden the range of revenue tools for councils, including user charges and better land value capture. Introduce an incremental land-value tax on the owners of land on the city fringe or within the city boundary that is rezoned.
Local government capacity to pursue a more technically driven approach to consenting and planning that incorporates the latest modelling and data on climate-related risks is variable and partly dependent on its size.	Consider requiring collaboration between smaller rural and larger neighbouring councils and between urban councils and regional councils, especially where they share an environmentally interdependent area. Concentrate with central government responsibility for environmental data, monitoring and modelling.
Towards an even lower emission and more secure electricity supply	
The country's electricity supply is vulnerable to the "dry-year problem" that climate change will worsen. The approach to setting the overall strategy for the electricity system is too ad hoc, creating uncertainty.	Develop a long-term energy strategy including electricity informed by a cost-benefit comparison of options to reduce emissions, while securing supply, using a similar methodology.
GHG emissions reduction targets and strategy	
The first emissions reduction plan (ERP) (May 2022) failed to consider key trade-offs and questions as well as alternative emissions pathways. This reduced its coherency.	Take a more systematic approach when preparing the second ERP comparing as much as possible the costs and benefits of different emission reductions pathways using the same methodologies.
New Zealand's reduction plan is heavily reliant on carbon removals from forests. There are no limits on forestry units in the ETS, which is unique internationally. ETS pricing fails to adequately reflect the respective duration of carbon storage of native versus exotic forests, and risks such as fires.	**Develop and implement a plan for reforming the treatment of forest removals in New Zealand's emissions reduction strategy that gives clarity to the market, considering the wider costs and benefits of exotic and native forests and their potential to offset gross emissions.**
A rough temporal alignment exists between the warming caused by biogenic methane from a herd of livestock and the cooling caused by planting an exotic production forest. New Zealand's biogenic methane target is in gross terms only.	Consider adding a net biogenic methane target and allowing exotic production forests to earn credits in a methane-based pricing mechanism. In addition, consider allowing only new native forests to be registered in the NZ ETS.
ETS revenue will be allocated to tax relief but it will naturally decline as emissions are reduced.	Review the way ETS revenue is used and consider only using ETS revenue for climate change mitigation expenditure as well as lump-sum compensation to low-income households for the loss of purchasing power from higher ETS prices. The need for mitigation will decline in tandem with ETS prices and revenue.
Reducing agricultural emissions	
Agricultural emissions pricing has been delayed. Cost and a lack of information as well a lack of viable techniques for reducing emissions are barriers to increasing on-farm GHG efficiency and introducing pricing of agricultural emissions.	**Improve on-farm measurement of emissions in preparation for introducing agricultural emissions pricing. Maintain strong support for research and joint ventures to develop gross emissions reductions technologies.**
Reducing transport emissions	
The installation of public charging stations has not kept up with the expansion of the electric vehicle fleet. New Zealand's CO_2 efficiency in passenger transport is low by international standards due to high use of SUVs and other heavy vehicles.	If a wider cost-benefit analysis vis-à-vis other options including public transport shows vehicle electrification is a cost-efficient way to reduce CO_2, increase the number of public charging stations. Introduce greater taxation by vehicle emissions at registration and tighter fuel efficiency standards.
Reducing emissions from buildings	
Minimum insulation standards have been steadily increased but there is high potential to do more as they remain around half of those in Australia, California and the United Kingdom.	Insulation standards and other energy efficiency standards should continue to be progressively tightened.

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