

Chapter 15

Aronga Kaupapa – Ahungao, Ahumahi, Ahuwhare

Policy direction for energy, industry and buildings

Summary

Emissions from energy, industry and buildings contribute around 44% of long-lived gases in Aotearoa. To reduce these emissions, Aotearoa must decarbonise how it produces and uses energy. It needs to transform to an energy system that is low emissions, affordable and secure.

Our recommendations to achieve this have been split under the below headings:

1. Energy

Energy production, supply and use, including electricity, is a large complex system relied on by people, business and industry across Aotearoa. Because of this, actions taken to lower emissions from how energy is used and produced must be considered and coordinated across public and private sectors. We recommend that:

- **Government develop a comprehensive energy strategy** to ensure actions to decarbonise are considered across the whole energy system. This includes setting a system-wide renewable energy target and increased investment in energy efficiency. A strategy would help Aotearoa leverage its extensive renewable electricity to decarbonise areas like transport and industry and reduce fossil fuel use in buildings.
- **Government develop this strategy in partnership with Iwi/Māori** to ensure there is equitable and proactive partnership with Iwi/Māori and enable opportunities for a Māori-led approach to a thriving, low-emissions, climate-resilient Māori economy.
- **Government develop this strategy in collaboration** with communities, industries, local government and others to make sure the strategy reflects their experience and knowledge.

The transition must deliver low-emissions electricity that is affordable, accessible and reliable, and which enables the decarbonisation of process heat and transport. **We have made a series of recommendations aimed at ensuring that we have an electricity sector that is ready to meet future needs.**

2. Industry

There are two main ways in which industry creates greenhouse gases. One is from using energy to create heat to process products, for example turning milk into milk powder (process heat). The second is using energy to drive chemical reactions for products, for example steel.

The opportunity to reduce emissions across both is through ending the use of fossil fuels. We have recommended a plan for actions to decarbonise the industrial sector. This should include:

- **Stopping the installation of new coal boilers** and setting a timetable to phase out fossil fuel use in existing boilers.
- **Supporting innovation for decarbonising hard-to-abate industries**, accounting for sector-specific circumstances and their interdependencies and the need for bespoke solutions requiring research and development.
- **Acting in partnership** with Iwi/Māori and in collaboration with industrial and manufacturing stakeholders.

3. Buildings

Aotearoa needs low emissions, energy-efficient, warm, healthy homes and workplaces. Buildings should be constructed using designs and products that lower emissions and improve New Zealanders' health and wellbeing.

There must be standards and legislation to support this. Our advice recommends:

- Considered and continued upgrades of minimum Building Code requirements to overcome key barriers that lead to buildings that are not low emissions or as energy efficient and healthy as possible.
- Encouraging construction based on low-emissions designs and practices, because embodied emissions represent a significant proportion of building sector emissions.
- Scaling up energy efficiency assistance to low-income households, so that low-income households can benefit from lower emissions, lower energy costs and healthier buildings.
- Mandating participation in energy performance programmes for existing commercial and public buildings.

Changes in our final advice

The Commission has changed the name of this chapter and associated work programme from 'Heat, Industry and Power' to 'Energy, Industry and Buildings'. This gives a clearer picture of how energy is produced and used in Aotearoa and where the opportunities to reduce emissions are.

We have emphasised the need for a cohesive energy strategy. We heard concern that decisions on energy are being made in silos and without a complete system view. Energy is used and produced in Aotearoa every day and plays a crucial role in how people live, work and learn.

We have also suggested more work is needed to manage the diminishing role of fossil gas across the energy system, and to develop low emissions gases like biogas and green hydrogen. To better distinguish gases with high emissions from their low emissions alternatives, we have renamed natural gas to be fossil gas.

We did further analysis and refined our assumptions around some of the larger industrial facilities. We call for a plan to decarbonise the industrial sector and have made clearer the need to identify and decarbonise industry that is strategically important to the Aotearoa economy.

We further emphasised the importance of low-emissions buildings, both in terms of energy efficiency and embodied emissions.

Introduction

- 1 The energy, industry and buildings sectors encompass a wide range of sub-sectors and emissions sources. Together these accounted for about 44% of long-lived greenhouse gas emissions in 2019.
- 2 Reducing emissions from sources in these sectors will be critical to meeting emissions budgets and achieving the 2050 net zero target for long-lived greenhouse gases. However, reductions are likely to take place at varying rates, across different sources.
- 3 Our policy direction focuses on a package of actions to transform the way energy is produced and used in Aotearoa, with a view to largely decarbonising it by 2050 – in line with emissions targets. We also recommend actions to reduce emissions associated with industrial heat use and chemical processes, as well as to reduce emissions from the way buildings are constructed and operated.
- 4 The three recommendations in this chapter fit across all three pillars of our policy approach: actions to address barriers; pricing to influence investment and choices; and enabling innovation and system transformation.
- 5 Within the energy, industry, and buildings sectors, the New Zealand Emissions Trading Scheme (NZ ETS) influences the choices and investments commercial actors make. It will continue to drive action and reduce emissions, particularly as the emissions price increases. However, emissions pricing has limited impact on the choices made by individuals and households, who, for a range of reasons, cannot always make decisions in a way that optimises costs (see *Chapter 11: Approach to developing advice on policy direction* for more information).
- 6 In the process heat and energy efficiency arenas there are barriers that need to be addressed. For example, lack of information and issues around access to capital or financing can mean low-cost options are not taken up. For hard-to-abate industrial sectors, the NZ ETS provides only a partial incentive for innovation.
- 7 Our advice on policy direction stresses that the most urgent area for action is for the Government to set direction of travel through a national energy strategy. Transforming energy production and use requires investment and certainty to allow businesses and individuals to plan and respond.
- 8 Planning so that technologies, assets, and infrastructure can be replaced with low-emissions alternatives on as natural a cycle as possible will help avoid unnecessary costs and stranded assets.
- 9 Ensuring that the Government upholds Te Tiriti o Waitangi/The Treaty of Waitangi as it considers the transformation of the energy system is fundamental. Energy is a natural resources intensive sector. When developing plans and policies, the Government should ensure there is equitable and proactive partnership with Iwi/Māori, and that opportunities for the advancement of a Māori-led approach to a thriving, low-emissions, climate-resilient Māori economy are enabled.

15.1 Energy

¹⁰ Energy is a necessity in the modern world, as a critical input into every good and service. In 2019, energy use in Aotearoa resulted in 34 MtCO₂e, with 30% of total energy consumption renewable and the remaining 70% from oil, fossil gas and coal.

¹¹ This energy is used across the economy in transport, electricity, for heating and by industry.

¹² To meet the 2050 target of net zero long-lived gases Aotearoa needs to transition away from fossil fuels. Instead, the country will need to rely more heavily on renewable electricity and low-emissions fuels like bioenergy and hydrogen, while also improving energy efficiency.

¹³ Energy efficiency improvements are often the lowest-cost option for reducing energy demand and emissions. Reducing energy demand can decrease the total amount of energy the system needs to supply and related infrastructure that needs to be built.

15.1.1 A national energy strategy would support a coordinated approach

¹⁴ At present, the Government does not have a coordinated approach to support the development and deployment of different low-emissions technologies, fuels and industries.

¹⁵ Developing a national energy strategy would help to ensure different aspects of the energy system in Aotearoa are considered in a coherent way, including:

- Emissions reductions and removals
- System reliability and affordability
- Future energy developments
- Infrastructure
- Equitable industry transitions
- Regional and national economic development planning
- Supply chains
- Workforce and skill needs

¹⁶ The objective of a strategy would be to ensure a smooth and appropriately sequenced phase down of fossil fuels, and a scale up of renewable electricity generation and new low-emissions fuels in the context of changing supply and demand requirements.

¹⁷ The national energy strategy should also consider a plan for the diminishing role of natural gas, which is a fossil fuel (fossil gas), and associated consequences for network infrastructure and workforce in the transition.

¹⁸ Choices the Government makes as the energy system decarbonises should keep options open as far as possible, and a strategy can help to ensure this.

¹⁹ For example, consideration should be given to whether gas pipeline infrastructure should be retained, to repurpose it for low emissions gases like biogas or hydrogen. Similarly, consideration should be given to whether a low emissions steel industry is critical for the security of supply for the country's construction industry.

²⁰ The current energy system in Aotearoa is extensive, with a dedicated infrastructure and workforce behind it that is spread throughout the regions. The transition away from fossil fuels will therefore need to be carefully managed.

²¹ It will be important that the national energy strategy is developed in partnership with Iwi/Māori, gives effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi, and aligns with the He Ara Waiora framework. The strategy must also account for Treaty settlement commitments, and obligations between energy-system stakeholders and Iwi/Māori.

²² The national energy strategy should also be developed in collaboration with communities, industries, workers, local government and others.

²³ During consultation, some submitters were supportive of the need for such a strategy. However, there were other submitters who were concerned that the development of a strategy would delay action on reducing emissions from the energy system.

Setting a renewable energy target sends a clear signal

²⁴ The Government can signal the emissions reductions that are required across the full energy system by setting a renewable energy target. The target could be set as part of an energy strategy.

²⁵ A renewable energy target would signal the move away from petrol to electricity or other low-carbon fuels in transport, as well as the transition away from fossil fuels in heat and electricity. A system-wide target allows for flexibility, where the switch to lower-emissions fuels is balanced and made across a number of sectors.

²⁶ This type of target is also technology-neutral, as it does not determine what type of low-emissions fuels should be implemented: bioenergy, hydrogen or electricity from a variety of sources. Energy efficiency can also play a role.

²⁷ There are different forms that a renewable energy target could take, outlined in Box 15.1 below. The Climate Change Commission (the Commission) recommends a target of 50% of all energy consumed to come from renewable sources by 2035. This target is across the energy system, which includes electricity, process and building heat, and transport.

²⁸ This target is broadly equivalent to a target of 60% renewable energy as a share of total primary energy supply, as outlined in our *2021 Draft Advice for Consultation*. The Commission recommends a consumption-based renewable energy target because a supply-focused target can be distorted by geothermal energy used for electricity generation. This is because geothermal generation has a very low conversion efficiency from heat to electricity.

Box 15.1: Renewable energy targets

A system-wide renewable energy target can be measured in different forms:

- As a share of total primary energy supply (TPES)
- As a share of total final energy consumption (TFEC)
- As an absolute emissions target from energy production

TPES is the total amount of energy available for use in Aotearoa. Much of this is converted to other forms of energy before it is used.

The Ministry of Business, Innovation and Employment (MBIE) currently reports on renewable energy (wind, solar, geothermal, hydro, biomass, other) as a share of TPES in their annual *Energy in New Zealand* report.

This measure includes all the waste heat lost during fuel combustion in a generator, boiler or internal combustion engine. It also includes non-energy use of fossil fuels, such as the fossil gas which becomes embedded in methanol.

One disadvantage of using TPES as a measure is that geothermal energy used for electricity generation distorts the renewable totals as it has a very low conversion efficiency to electricity.

TFEC is the total amount of energy consumed or used across different sectors of the economy. It does not account for the energy or waste heat lost through electricity production or oil refining. This metric is currently not reported in the annual *Energy in New Zealand* publication.

²⁹ Within this context, the Government's current 100% renewable electricity target should be treated as aspirational. The Government should consider replacing the 100% target with a goal of aiming to achieve 95-98% renewable electricity by 2030.

³⁰ Work undertaken by the Interim Climate Change Committee (ICCC) demonstrated that moving from 98% renewable electricity to 100% renewable electricity would cost about \$1,280 for every tonne of carbon dioxide abated, and would result in higher electricity prices. Higher electricity prices could make switching to electricity as a low-emissions fuel relatively less attractive.

³¹ Instead of doing this, the ICCC recommended prioritising the accelerated electrification of transport and process heat. Moving to 98% renewable electricity would require the use of coal to be phased out, a substantial reduction in the use of fossil gas, and the build of renewable electricity (such as wind and solar) to be accelerated.

³² During consultation, some energy sector submitters were concerned about the effectiveness of a renewable energy target, while others debated the most effective form for a target. A number of submitters supported a renewable energy target as being more favourable than the Government's current renewable electricity target.

The most cost-effective way to reduce energy emissions is to reduce the amount of energy consumed.

³³ Scaling up investment in energy efficiency will reduce the amount of energy that needs to be produced, the amount of infrastructure that needs to be built, and will improve energy affordability.

³⁴ In particular, energy efficiency measures that reduce demand for electricity at peak times can have a large system impact, because this can avoid the need to build expensive additional generation plants that are then used infrequently. In this way, avoiding large peaks can reduce costs for consumers.

³⁵ Energy efficiency generally improves at a rate of 1% per year, but this needs to increase.

36 Investing in energy efficiency measures, particularly in the residential sector and for at-risk communities, is also an effective way to improve health and wellbeing outcomes.

15.1.2 Aotearoa needs to maximise the use of electricity as a low- emissions fuel

37 Aotearoa has one of the lowest emission electricity systems in the world. More renewable generation, like wind and solar, will need to be built to further reduce the emissions of the electricity system, and fossil-fuelled generation will need to be phased out.

38 This low-emissions electricity can be used to reduce emissions elsewhere through electrifying transport, process and space heating.

39 For consumers and industry to invest and convert to electricity, they need to have confidence that electricity will be available, affordable and reliable, as well as low emissions. This was reinforced in submissions across all stakeholder groups, who highlighted the importance of balancing these considerations against the need to decarbonise the energy system and rapidly increase renewable electricity generation.

40 Some submitters from the electricity sector, NGOs, academia and individuals also expressed concern that other areas of the Commission's advice could have impacts on electricity prices. The need for well-targeted assistance for some groups to address energy equity in the transition was also highlighted.

41 In times when the ability to produce renewable electricity generation is limited, wholesale electricity prices can rise dramatically. This makes electricity a less attractive fuel for some consumers.

42 Aotearoa is unique in that its hydro lakes contribute around 60% of total electricity supply. However, these lakes only hold enough water for a few weeks of winter energy demand if inflows (rain and snow melt) are very low.

43 When inflows are low for long periods of time, hydro generation reduces, and the system relies on other forms of generation – such as fossil gas and coal. These periods of time are often referred to as 'dry years', and often result in very expensive wholesale electricity prices.

44 The Government's NZ Battery project will advise on potential solutions to the challenge of dry year energy security. While a solution to this challenge could enable Aotearoa to reach 100% renewable electricity, it could cost taxpayers billions of dollars.

45 As noted above, electricity is part of a broader energy transition. Alternative options for reducing emissions should be considered, because other actions may have a larger impact on emissions for the same cost as a solution to the dry year problem. For example, action to electrify the vehicle fleet or accelerate fuel switching in industry.

46 This came through as a theme in consultation, with some energy sector submitters cautioning that pursuing a pumped hydro storage project under the NZ Battery project, like Lake Onslow, could come at the expense of lower-cost emissions reductions elsewhere in the economy.

47 Some submitters highlighted the IPCC's conclusion that while it is technically feasible to achieve 100% renewable electricity, a solution may be very costly in terms of achieving the last few percentage points.

48 Solving the dry year problem avoids relatively few emissions. By 2050 our modelling shows remaining emissions from fossil gas for electricity generation are around 0.6 MtCO₂e per year.

⁴⁹ Some submitters also raised concerns around continued coal mining, particularly on conservation land. There were also concerns that government policies on offshore oil and gas exploration, coupled with the phase out of coal for heat and electricity generation in the absence of a 'dry year solution', would result in the import of coal and gas, leading to poor economic outcomes.

New generation will be needed to meet increased electricity demand

⁵⁰ We anticipate a steep increase in demand for electricity as the number of electric vehicles (EVs) on the country's roads grows, and industrial demand electrifies. The industry will need to rapidly build more renewable generation to meet this.

⁵¹ Big changes in demand or supply, like the Tiwai Point aluminium smelter closing (see Box 15.2) and the NZ Battery project, can create uncertainty in the market and result in generators delaying investment in new renewable generation, transmission and distribution infrastructure.

⁵² New generation will need to be built rapidly to meet this increase in electricity demand. However, many forms of renewable generation, especially hydropower, wind and geothermal, have the potential to come into conflict with the resource management system. This is because these types of generation can impact other environmental goals and domains, such as freshwater and biodiversity.

⁵³ To ensure the fast-paced and sustained build of low-emissions electricity, Resource Management Act (RMA) processes, other national and local government instruments, and settings for transmission and distribution investment decisions need to uphold Te Tiriti o Waitangi/The Treaty of Waitangi and be aligned with the required pace for build.

⁵⁴ This is an opportunity to enable the implementation of tools, such as the Mana Whakahono ā Rohe provisions under the RMA, whereby tangata whenua and local authorities can discuss and agree on how they will work together under the RMA, in a way that best suits their local circumstances.

Box 15.2: Manapōuri hydro station and the Tiwai Point aluminium smelter

The Tiwai Point aluminium smelter consumes 10-14% of the electricity generated in Aotearoa each year. A significant amount of this electricity is generated at the Manapōuri hydropower station.

If Tiwai Point closes at the end of 2024 this electricity will become available for alternative uses. Some of these new sources of demand could produce widespread benefits for the transition to a thriving, climate-resilient and low-emissions economy in Aotearoa, for example, replacing the fossil fuels used in transport and process heat with renewable electricity.

Other sources of new demand, such as data centres or creating hydrogen for export, may not directly reduce emissions in Aotearoa. Broader benefits from such investments could include tax revenue or spillover benefits, like bringing in skills, knowledge and helping to develop hydrogen production for domestic uses, such as steel making.

Modelling shows the change in dynamics of supply and demand could lower wholesale electricity prices by as much as \$20 per MWh, for as much as a decade. This does not necessarily translate to an equivalent drop in electricity bills.

Ensuring equitable access to affordable, secure, low-emissions electricity for residential, commercial, and industrial consumers will be essential to the success of the country's low emissions transition. It would be beneficial for the Government to assess and communicate to the public the potential impact of a significant change in the balance of supply and demand on the accelerated electrification of transport and process heat. This should involve an evaluation of the costs, benefits, risks and opportunities of how and when this electricity is used.

The use of coal for generating electricity must end

- ⁵⁵ In absolute terms, most electricity emissions in Aotearoa currently come from fossil gas. However, coal results in about double the emissions per TWh of electricity produced.
- ⁵⁶ In the future, electricity emissions may be dominated by geothermal emissions. By 2050, geothermal emissions in our demonstration path are modelled to be marginally more (0.1 MtCO_{2e}) than the emissions from fossil gas.
- ⁵⁷ Aotearoa has committed to ending the use of coal, as part of the 'Powering Past Coal' alliance. This states that to meet the Paris Agreement, there should be no more coal for unabated electricity generation (coal without carbon capture and storage (CCS)), and that OECD countries should achieve this by no later than 2030.
- ⁵⁸ As outlined above, a combination of fossil gas and coal currently provides the energy storage required to meet dry year needs. However, Aotearoa must move away from these fuels, with coal being the priority.
- ⁵⁹ There have been public announcements from the electricity sector about ending the use of coal for electricity generation. Our analysis shows that as the cost of carbon rises, it is more economic to build more renewables to displace existing thermal generation plants.
- ⁶⁰ Rising New Zealand Unit (NZU) prices, driven by a well-functioning NZ ETS, would likely end coal generation in the mid-2020s.
- ⁶¹ There is the possibility that electricity generators could choose to keep coal generation plants running for other reasons, even with a rising NZU price – for example, security of supply. As a backstop, the Government must take action to ensure that coal is phased out as soon as possible.

15.1.3 The regulatory regime must be able to deliver the services needed to electrify the vehicle fleet, buildings and industry

- ⁶² The regulatory regime must continue to adapt and respond to innovations, to ensure it can deliver abundant, affordable, and reliable low-emissions electricity.
- ⁶³ It must be able to deliver the services that will be needed to support the electrification of different parts of the economy. This includes providing the additional electricity supply that will be needed.
- ⁶⁴ Traditional ways of operating may not deliver the most efficient solutions at the pace required for the transition. The capacity and capability of electricity distribution businesses (EDBs) or lines companies will be important.
- ⁶⁵ Some submissions reinforced this, including submissions from EDBs, local councils and others. These submitters highlighted the need to ensure the overall regulatory regime is sufficiently adaptive to enable EDBs to undertake the innovation and investment required to meet climate change outcomes.
- ⁶⁶ The Electricity Price Review and others have called for these businesses to undertake more innovation. Continued implementation by the Government of the recommendations from the Electricity Price Review will be crucial, as will evaluating whether the current regulatory environment and ownership structures of lines companies are fit for future needs.

Regulatory settings will need to meet the needs of diverse communities

- ⁶⁷ Technology has the potential to change the way New Zealanders generate, store and consume electricity. It will affect how the market could work, and will create greater potential for independent and distributed generation, micro-grids and demand response (collectively referred to as distributed energy resources, see Box 15.3).

Box 15.3: Distributed energy resources

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. Different DER have different capabilities.

DER are already in use in Aotearoa but the volume could increase significantly in the future as technology prices decline.

- 68 Innovations are emerging, including peer-to-peer trading, automation and digitalisation. These disruptions create opportunities for Māori-collectives, remote and rural communities, urban groups and others. The regulatory system needs to allow for, and encourage, this.
- 69 Innovations that enable consumers to participate in the market can help to reduce the amount of fossil-fuelled generation required to meet peak electricity demand, defer the need for new generation capacity and replace the need for diesel as back-up generation.
- 70 Measures that government could take to reduce the barriers to participation in the electricity market and deployment of distributed energy resources may include standardised power purchase agreements, open access to electricity networks, development of flexibility markets or access to capital or low-cost financing.
- 71 A number of submitters from the electricity sector, NGOs, individuals, Iwi/Māori and others voiced broad support for technology innovation, decentralised and local energy generation and alternative ownership structures as means for local climate resilience, energy security and economic development. For example, some marae are used by Iwi/Māori as civil defence management centres and community hubs.
- 72 Energy sovereignty, using both innovative and existing technology, is a critical component of ensuring an equitable transition. Ongoing support through government programmes, such as the Māori and Public Housing Renewable Energy Fund, to trial small-scale renewable energy technologies and help inform future larger-scale projects, will be important.
- 73 Government efforts to maximise the use of electricity as a low-emissions fuel must give effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi by working with hapū and Iwi to identify equity partnerships and to develop a collective approach to the build of low-emissions electricity generation.

15.1.4 Producing low emissions fuels is important for meeting the 2050 emissions reduction target

- 74 The Government has a role to play in increasing the amount of clean energy Aotearoa can produce, and opening up future options, in line with the third pillar of our policy approach (see *Chapter 11: Approach to developing advice on policy direction*). This will help ensure the emissions reductions required in later emissions budgets can be met.
- 75 Aotearoa will need a range of energy sources to support decarbonisation and to retain choices along the path to 2050. Some activities, such as industrial processes that use high temperature heat, will be hard to electrify, and so will need low-emissions alternatives to electricity.

- ⁷⁶ Diverse energy sources will also be needed to maintain energy security. During consultation we heard general support from a range of stakeholder groups for maintaining fuel diversity in Aotearoa.
- ⁷⁷ Some submitters emphasised the importance of energy diversity in ensuring energy system resilience, particularly in the face of a changing climate. Relying solely on the electricity grid to deliver energy could increase national and community vulnerability, and impact the ability of Aotearoa to adapt to climate change and respond to extreme weather events.
- ⁷⁸ Bioenergy (such as biogas, liquid biofuels, wood pellets), and hydrogen, hold promise, and can either be produced domestically or imported. Our analysis indicates that these fuels have significant potential for reducing emissions in transport, space and process heat, and industrial processes.
- ⁷⁹ However, Aotearoa needs to better understand how best to make use of their potential. Data sharing and building an evidence base prior to making decisions is key, and government will have a role in facilitating this.
- ⁸⁰ This includes building an evidence base of the costs and deployment opportunities in Aotearoa. It will be important that government understands the value of providing fuel, employment and economic development to regions, as well as alternative emissions reduction opportunities. More work is needed to support the establishment of supply chains and infrastructure, to help make them more cost competitive.
- ⁸¹ Low-emissions hydrogen is versatile in how it can be used and where it can be produced. It has potential for supporting energy security, generating high temperature process heat and meeting the needs of certain industries – for example, ammonia-urea production. It will be important to work with industry to identify when and if emissions reductions can be achieved by transitioning to hydrogen.
- ⁸² The costs, benefits, trade-offs and risks of a hydrogen economy will need to be carefully assessed. This includes assessing the costs of production and storage, the costs to maintain, upgrade and repurpose existing infrastructure, and the practicality and affordability for all consumers.
- ⁸³ There are existing and planned green hydrogen pilot and demonstration projects in Aotearoa. It will be important for government to understand the results from these and other projects, to assess the place of hydrogen in the economy and wider energy system.
- ⁸⁴ Scaling up the provision of low-emissions energy sources will need to be considered alongside the national energy strategy and bioeconomy strategy to support a coordinated, multi-sectoral approach that considers the role and interlinkages between fuels, sectors, supply and demand.
- ⁸⁵ More consideration on scaling up the production of bioenergy, as part of a larger strategy for a thriving bioeconomy, can be found in *Chapter 13: Policy direction that cuts across sectors*, Recommendation 15.

15.1.5 Use of fossil gas will need to reduce as Aotearoa moves towards net zero emissions

- ⁸⁶ Fossil gas plays an important role in the current energy system. It provides a secure energy supply for electricity generation and for users of industrial heat, as well as a feedstock into chemicals such as methanol.
- ⁸⁷ Many households use gas for heating, cooking and hot water. Having access to a diversity of energy options makes Aotearoa more energy secure. However, the use of fossil gas will need to decrease as Aotearoa moves towards net zero emissions. During consultation we heard broad consensus across all stakeholder groups for the need to move away from using fossil gas by 2050, in most situations.

- 88 However, some concerns were expressed. There was considerable concern around the consequences of any changes in the availability of gas on energy affordability and reliability. This was a particular concern for Iwi/Māori. It was also a concern for remote and rural communities, communities who live off grid, small businesses, and those who rely on it in emergencies.
- 89 We also heard from business and industry submitters about the need to ensure that the pace of the transition allows time for plumbers, gas fitters and others who are affected to retrain and upskill.
- 90 Rising emissions prices through the NZ ETS will help to drive a reduction in the use of fossil gas for generating electricity and process heat, and to make renewable options more competitive.
- 91 The use of fossil gas in homes and buildings also needs to be phased down. However, smaller users generally do not have access to accurate information about what the future supply and costs of fossil gas, and low-emissions gases, are likely to be. Electricity is a more efficient and lower-emissions source of energy for heating homes and businesses than fossil gas.
- 92 To get on a low-emissions path Aotearoa needs to:
- Avoid locking in new fossil gas assets; and
 - Phase down how much fossil gas is used in existing residential, commercial and public buildings.
- 93 It is possible that low emissions gases, such as hydrogen or biogas, could be blended into fossil gas to lower its emissions intensity, and this was noted in some submissions.
- 94 Some submitters said continued expansion of gas network infrastructure should be allowed, given that low-emissions gases may be able to be distributed through the same or upgraded infrastructure in the future. However, the extent to which this is possible, or cost effective, remains uncertain. Doing this would also have costs for consumers.
- 95 Low emissions gases 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 of the gas network are spread across users through their bills, as the network is a regulated asset base. This means that the same costs need to be recovered, no matter how many users there are.
- 96 The Commission's position, based on existing evidence, is that the possible future availability of low emissions gases is insufficient reason to warrant continued expansion of gas network infrastructure. Until there is substantial evidence that blending or fully converting the gas network to low emissions will not increase costs to consumers, expansion of the fossil gas network to serve residential, commercial and public buildings should not be permitted.
- 97 The NZ ETS will play a role in deterring expansion of fossil gas infrastructure. But other measures are also needed to safeguard consumers – until such time as it can be demonstrated that the transition to low emissions gases would benefit consumers and substantially reduce emissions in a way that aligns with emissions budgets and targets.
- 98 One option to reduce emissions from fossil gas use, and safeguard consumers, would be to place a moratorium on new fossil gas connections. Another option would be to set a date after which no new fossil gas connections would be permitted in residential, public and commercial buildings.
- 99 These options avoid locking in new fossil gas assets where there are existing low-emissions alternatives, until it can be proven that low-emissions gases are technically feasible and economically affordable.

- 100 Alternatively, a cap on operational emissions from fossil fuel use in buildings that tightens over time could be applied to ensure substantial reduction in emissions. This could discourage new gas connections in new buildings but would not necessarily prevent the expansion of the gas network.
- 101 These options would provide time for industry to assess the effectiveness of low-emissions gases as a way to significantly reduce emissions, while maintaining affordability. Under any option, the Government will also need to consider how to transition existing fossil gas users towards lower-emissions alternatives.
- 102 As the use of fossil gas decreases, additional measures will be needed to support security of supply, residential consumer choices around gas, energy affordability and accessibility, network considerations, workforce planning and high temperature heat needs.
- 103 Maintaining a reliable and affordable electricity supply will be important to support the electrification of transport and industrial and building heat. It will also be important for producing the materials needed for a fast-paced and sustained build out of renewable electricity generation.
- 104 The use of fossil gas must be phased down where low-emissions alternatives are available. Because fossil gas is less emissions intensive than coal, it lends itself to critical applications that support services needed in the transition, such as security of supply and high temperature process heat.
- 105 Longer term, innovation and investment will be needed to develop ways to displace these remaining uses of fossil gas. Government will have a role to play in supporting innovation (see also Recommendation 13, *Chapter 13: Policy direction that cuts across sectors*).

Recommendation 20

Decarbonise the energy system and ensure the electricity sector is ready to meet future needs

We recommend that, in the first emissions reduction plan, the Government commit to:

Delivering a strategy to decarbonise the energy system and ensure the electricity sector is ready to meet future needs.

This should include:

1. Developing and implementing a national energy strategy to decarbonise the system.
The scope would need to cover:
 - a. Setting a target so that 50% of all energy consumed comes from renewable sources by 31 December 2035. Consideration should also be given to replacing the target for 100% renewable electricity with achieving 95% - 98% renewable electricity by 2030.
 - b. How to ensure access to affordable, secure, low-emissions electricity for residential, commercial, and industrial consumers. Regard needs to be given to the impacts on Iwi/Māori, those in regional/rural areas, and vulnerable groups.
 - c. Ensuring the use of coal for electricity generation is phased out as soon as possible.
 - d. Creating a plan for managing the diminishing role of fossil gas across the energy system, covering the associated consequences for network infrastructure and workforce during the transition. This recommendation should be considered alongside Recommendation 28 for a fair, inclusive and equitable transition.

- e. The strategy should be developed in:
 - i. Partnership with Iwi/Māori, give effect to the principles of Te Tiriti o Waitangi/ The Treaty of Waitangi, account for settlement commitments and obligations between energy-system stakeholders and Iwi/Māori, and align with the He Ara Waiora framework.
 - ii. Collaboration with energy-system stakeholders.
2. Scaling up of investment in energy efficiency to reduce the amount of energy produced and improve energy affordability.
3. Supporting the evolution to a low-emissions electricity system fit for technology evolution. This should include work to increase the participation of distributed energy resources including demand response, and determining whether lines companies can integrate new technologies, platforms and business models by:
 - a. Assessing whether they have the necessary capacity and capabilities to support climate resilience and the transition.
 - b. Evaluating whether the current regulatory environment and ownership structures of lines companies are fit for future needs.
4. Designing regulatory settings that meet the needs of diverse communities, ensuring that they enable independent and distributed generation, especially for remote, rural and Māori communities.
5. Enabling a fast-paced and sustained build of low-emissions electricity generation and infrastructure by ensuring resource management processes, other national and local government instruments, and settings for transmission and distribution investment decisions are aligned to the required pace for build.
6. Assessing the consequences of significant changes to the balance of supply and demand of electricity (such as significant blocks of capacity), on the pace, equitable availability, and cost of electrification in Aotearoa.
7. Supporting development and deployment of low-emissions fuel options such as bioenergy and hydrogen. Māori-collectives should be enabled to participate in the associated business opportunities. This recommendation should be considered alongside Recommendation 26 for an equitable transition for Iwi/Māori, Recommendation 15 for the bioeconomy, and Recommendation 19 for transport.
8. Determining how to eliminate fossil gas use in residential, commercial and public buildings. Actions should include:
 - a. Setting a date to end the expansion of pipeline connections in order to safeguard consumers from the costs of locking in new fossil gas infrastructure.
 - b. Evaluating the role of low-emission gases as an alternative use of pipeline infrastructure.
 - c. Determining how to transition existing fossil gas users towards low-emissions alternatives.

Recommendation 20

Provisional progress indicators

1. Government to undertake with urgency, and have published by 31 March 2022, an assessment of the consequences of significant changes in the balance of supply and demand of electricity (such as significant blocks of capacity) on the pace, equitable availability and cost of electrification in Aotearoa.
2. Government to have, by 30 June 2023, delivered a draft strategy to decarbonise the energy system for consultation. To have published the final strategy by 30 June 2024.
3. Government to have, by 30 June 2022, set a renewable energy target of at least 50% total final energy consumption, or equivalent - to be achieved by 31 December 2035.
4. Government to report, from 31 December 2022, on a suite of indicators annually including the emissions intensity of the electricity grid, annual investment in electricity infrastructure, average retail electricity prices for households, volume of low-carbon fuels produced.

15.2 Industry

¹⁰⁶ Reducing emissions from low- and medium-temperature process heat will be critical for meeting the 2050 emissions reduction target. Low- and medium-temperature process heat is generated mainly from boilers, and is used primarily in food processing and wood, pulp and paper production. Emissions associated with these activities were around 4 MtCO₂e in 2019.

¹⁰⁷ Improving energy efficiency, optimising processes and equipment, and switching to cleaner energy sources, like electricity and biomass, are key opportunities to reduce emissions.

¹⁰⁸ During consultation, we heard from some industry, energy system stakeholders, businesses and others who highlighted that many manufacturers who use low- and medium-temperature process heat are taking action.

¹⁰⁹ Some manufacturers have set emissions reduction goals, committed to no new coal-fired boilers, and invested in technologies to reduce energy use while improving productivity. Submissions from these groups generally supported phasing out coal use in boilers for low- to medium-temperature process heat, but there was some hesitation around phasing out of fossil gas use in boilers.

¹¹⁰ Other industrial sector submitters raised concerns over the balance of effort across different sectors in the economy, for example, users of low- to medium-temperature process heat relative to high temperature heat users.

15.2.1 Aotearoa needs to accelerate emissions reductions from process heat

- ¹¹¹ About 30% of the country's coal demand in 2019 was used in food processing. This is roughly 20 PJ. Meeting emissions budgets and targets requires a reduction in the use of coal in boilers of around 1.4 PJ per year. This is a substantial amount, roughly equivalent to the energy used by one or two very large dairy processing factories.
- ¹¹² Continued improvements in energy efficiency across industry (including in hard-to-abate sectors) will be important for reducing emissions and will improve the economics of switching to low emissions fuels.
- ¹¹³ At the same time, conversion away from coal must begin immediately. Conversion away from fossil gas will happen incrementally as the NZ ETS price increases. Boilers are enduring assets with life cycles of up to 40 years, so urgent action must be taken to avoid locking in new fossil-fuelled boilers.
- ¹¹⁴ The rate at which industry emissions can be reduced will be limited by several factors. For example, fuel switching decisions involve long-lived assets and have high up-front capital costs. There may also be practical engineering constraints around the integration of new technologies and fuels into established plants. This includes the time required to conduct feasibility and engineering studies, procure equipment and workers, and shut down plants for conversion.
- ¹¹⁵ Additional factors include the need to establish or expand low-emissions fuel supply chains, or the need to upgrade grid infrastructure and build new renewable electricity generation, which can add significant time and cost to a project.
- ¹¹⁶ Government measures like well-targeted, contestable funding, such as the Government Investing in Decarbonisation of Industry Fund, as well as support for energy audits and feasibility studies, can help to identify fuel-switching and efficiency opportunities, and support their uptake.
- ¹¹⁷ The Government recently announced a ban on new coal boilers used in manufacturing and production and have proposed a phase out of existing coal boilers by 2037. Consideration is also being given to phasing out other fossil fuels in existing sites through consenting processes and best practice requirements in a National Environmental Standard.
- ¹¹⁸ Government leadership and cross-sector collaboration will be important to support the development of robust low-emissions fuel supply chains – for example, as part of the bioeconomy strategy and the national energy strategy.
- ¹¹⁹ It will also be important that measures are put in place to ensure workers have the skills to identify site-specific emissions reduction opportunities and deliver plant conversions at a pace and scale that supports our emissions budgets.

15.2.2 Innovation will be important for reducing emissions from hard-to-abate sectors

- ¹²⁰ Aotearoa has several single company industries with industrial processes that are unique to this country, such as steel or cement. These industrial processes create emissions through burning fossil fuels, and through chemical reactions. These can be challenging to abate.
- ¹²¹ Supporting innovation for these hard-to-abate industrial sectors will therefore be critical for unlocking future emissions reduction opportunities.
- ¹²² The country's heavy industrial manufacturing plants were built several decades ago to accommodate specific industrial processes, and there is potential to transform some of these. Entirely new industrial processes and technologies could potentially be adopted. Alternatively, plants could be modernised between now and 2050, or retrofitted to make use of alternative fuels and reactants.

123 Other choices are also available; for example, Aotearoa could import products from low-emissions manufacturing plants overseas. During consultation, we received submissions from the construction, infrastructure and industrial sectors who expressed concern that reliance on imported products exposes Aotearoa to supply chain disruptions, long lead times, increased price volatility and risk of poor-quality materials.

124 Based on current cost estimates, retrofitting industrial plants with new technologies or developing new low-emissions processes for the hard-to-abate sectors will be expensive. Doing so may influence the cost of production, which could impact industry competitiveness.

125 This was highlighted in some industrial sector and other submissions, which also emphasised the importance of reducing the risk of emissions leakage, international collaboration on research and development, and maintaining domestic economic activity.

A long-term strategy for hard-to-abate industries is needed

126 Hard-to-abate industries are likely to still create significant emissions in 2050, but they provide products that are fundamental to the economy, like cement, steel and iron. Aotearoa has a choice as to whether it is critical to keep these industries and manufacturing plants based in this country.

127 Several submitters expressed concern that reliance on imported products exposes Aotearoa to supply chain disruptions, long lead times, increased price volatility and risk of poor-quality materials if these industries were to close here.

128 Research, development and demonstration (RD&D) and innovation is needed to identify cost-effective approaches to reducing emissions associated with industrial processes in Aotearoa. Technologies developed overseas may need to be adapted to work in unique local processes.

129 If Aotearoa keeps existing emitting plants, it may be possible to use forests to offset the emissions associated with some of these processes. Investigating the potential of other options to remove emissions from hard-to-abate industries, such as CCS or bioenergy combined with CCS, could be worthwhile.

130 However, considerable RD&D and investment would be required because these technologies are still largely in a concept phase in Aotearoa. Government measures would likely be needed to support the necessary innovation and system transformation (see *Chapter 11: Approach to developing advice on policy direction*, and Recommendation 13 in *Chapter 13: Policy direction that cuts across sectors*).

131 The Government should develop a long-term strategy for hard-to-abate industries, closely linked to the country's broader economic plans – including the national energy strategy, national infrastructure plans, industry transformation plans and equitable transitions planning.

132 Government should engage with hard-to-abate industries, related sectors and communities to fully understand the opportunities, trade-offs, risks, interdependencies, and the potential future role of hard-to-abate industries in Aotearoa.

133 During consultation, some industrial sector submissions called for the inclusion of sector-specific approaches or plans in the long-term strategy. The strategy must also give effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi.

134 If the Government decides these hard-to-abate industries are critical national infrastructure, it must work collaboratively and inclusively to ensure that people working in these industries are upskilled appropriately.

Recommendation 21

Reduce emissions from industry

We recommend that, in the first emissions reduction plan, the Government commit to:

Outlining a plan for actions required to decarbonise the industrial sector.

This should include:

1. Acting in partnership. To be enduring the policy approach must be created in partnership with Iwi/Māori, give effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi, and align with the He Ara Waiora framework.
2. Developing the policy approach in collaboration with industrial and manufacturing stakeholders.
3. Accelerating industry switching to low-emissions fuels for process heat and uptake of energy efficiency measures. A high NZ ETS price signal is central to delivering this, along with policies that reduce barriers related to access to capital, behaviour change and infrastructure access (see also Recommendation 11 in *Chapter 13: Policy direction that cuts across sectors*, on the NZ ETS).
4. Ensuring no new coal boilers are installed and setting a timetable for the phase out of fossil fuels used in boilers (see also Recommendation 20, on energy).
5. Supporting innovation for decarbonising hard-to-abate industrial sectors. This will require accounting for sector-specific circumstances and their interdependencies and investigating the need for bespoke solutions requiring research, development and demonstration specific to Aotearoa. This recommendation should be considered alongside Recommendation 15, in *Chapter 13: Policy direction that cuts across sectors* (bioeconomy strategy), and Recommendation 20 (national energy strategy).

15.3 Buildings

¹³⁵ Although Aotearoa 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 stations are used alongside hydro to meet demand.

¹³⁶ It is essential to continue improving the energy efficiency of existing buildings, particularly in large commercial buildings and public buildings that use a lot of energy.

¹³⁷ It will also be important that new buildings are designed to be more energy efficient and constructed with less emissions-intensive materials. Such buildings will be able to maintain warmth in winter, stay cool in summer, and have better indoor air quality. They will also require less energy to run.

¹³⁸ The importance of energy efficiency came through as a key theme during consultation. Some submitters urged more ambitious improvements to energy efficiency across new and existing buildings.

¹³⁹ Submitters from the building and construction sector, designers, architects and academia suggested a range of measures. This includes improvements to the minimum requirements under the Building Code, updates to product and building standards, requirements for distributed generation on new buildings, mandatory energy performance certificates and improved design and construction practices.

- 140 Some NGOs and research organisations suggested the need for a systems approach to better account for the co-benefits of improved energy efficiency, improved air quality and higher quality buildings.
- 141 Some of the technology required to make homes or businesses more efficient can be costly, and this is often a barrier to adoption – particularly for those on low incomes. For example, measures like installing insulation and more efficient heating can significantly improve energy efficiency and health, but come with upfront purchase and installation costs. For more information see *Chapter 8: Demonstrating emissions budgets can be fair, inclusive and equitable*.
- 142 Designing and constructing high-performance, resilient buildings that exceed minimum Building Code requirements is perceived as costly. There are also sometimes mismatches between those bearing the cost of building beyond the minimum Building Code requirements, and those accruing the benefits over time.
- 143 There is also the risk that the cost of building beyond the Code will impact housing affordability if developers and property owners seek to pass costs on to tenants or purchasers. The introduction of mandatory energy performance measures, such as energy and emissions benchmarking and reporting, may be required to address information asymmetries and other barriers.
- 144 Government support for energy efficiency measures should be scaled up so low-income households can benefit from lower-emissions, lower-energy costs and healthier buildings. We heard support from submitters across all stakeholder groups for expanding well-targeted support programmes as a way to address some of the barriers to improving energy efficiency, and enable energy equity in the transition.
- 145 Support should be viewed within the context of an equitable transition – many low-income households are less able to transition due to inequities in education, welfare, labour force and other factors. For example, some land and building ownership models can make it difficult to access programme funding, such as buildings on Māori land owned by multiple trusts.

15.3.1 Fossil gas needs to be phased down to meet emissions reduction goals

- 146 Electricity is a more efficient and lower-emissions source of energy for homes and businesses than fossil gas. To get on a low-emissions path Aotearoa needs to avoid locking in new fossil fuel assets that will endure beyond the 2050 emissions reduction target where affordable low-emissions options are available.
- 147 Reducing emissions from energy use in buildings will require the phase down of fossil gas in existing residential, commercial and public buildings. It also means avoiding the addition of new fossil gas demand from new buildings.
- 148 While some submitters understood that achieving net zero emissions from long-lived gases by 2050 meant a transition away from fossil fuels for operational energy use in buildings, they disagreed on the means to achieving the goal.
- 149 Some submitters, including individuals, small businesses and industry, expressed concern about unintended consequences – including on energy prices, impacts on the energy industry, and impacts on workers and communities. Clarity around the timing and scope of government measures will be crucial for providing greater predictability so that businesses, households and industry can plan.

150 In addition to the NZ ETS price signal, measures will also be required to deter growing use of fossil gas and the expansion of associated infrastructure. At the same time, a supportive regulatory environment would help to enable the delivery of low emissions gases, should that become feasible and affordable in the future.

151 To ensure an inclusive transition it is important that people can equally access affordable electricity to adequately meet their energy needs for heating, hot water and cooking. The Government and industry should consider how they can support participation in the move to a low-emissions future.

15.3.2 Low-emissions design and construction can reduce energy use and embodied emissions

152 The built environment is a key driver of demand for emissions intensive materials. A number of submitters from the building and construction sector including designers, architects and research organisations called for greater ambition for reducing emissions from buildings through low-emissions design and construction practices.

153 In particular, they suggested that a focus on embodied emissions and a consumption-based approach to accounting for emissions would help to drive behaviour change across multiple supply chains – from material manufacture to waste management. Increased use of timber in construction was often cited as an option to reduce a building’s embodied emissions.

154 A consumption-based accounting approach accounts for all emissions that are ‘embodied’ in a good or service. This includes emissions resulting from the entire supply chain required to produce that good or service – for example, carbon emissions from raw material extraction, manufacture and use in construction, processing and disposal.

155 Embodied emissions represents a significant proportion of building sector emissions. Some goods, like steel and cement, are high in embodied carbon because of the processes used to make them. These process emissions are hard to abate because there are limited technically and commercially feasible alternatives.

156 MBIE is undertaking two significant work programmes focused on the building and construction sector:

- **The Building Law Reform work programme** will support the sector to shift to new, more effective ways of working, help support productivity improvements, lift the efficiency and quality of building work, and improve trust and confidence in the building regulatory system.
- **Building for Climate Change (BfCC)** is focused on creating a high performing building and construction sector prepared to deliver on the outcomes of reducing greenhouse gas emissions and improve the sector’s resilience to climate change. Action areas include reducing whole-of-life embodied emissions, improving operational efficiency and improving buildings’ resilience to future climate change events.

157 While the BfCC work programme is currently focused on new buildings, it will be important to extend the programme to existing buildings. Continued development and implementation of these complementary work programmes, as well as regular updates to the Building Code, will be critical to reducing emissions from the building and construction sector and meeting the country’s climate change goals.

Recommendation 22

Upgrading existing buildings and constructing new buildings that are low emissions

We recommend that, in the first emissions reduction plan, the Government commit to:

Developing a plan to transform buildings to be low emissions and climate resilient.

This should include Government:

1. Acting in partnership. To be enduring the policy approach must be created in partnership with Iwi/Māori, give effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi, and align with the He Ara Waiora framework.
2. Developing the policy approach in collaboration with the building and construction sector.
3. Upgrading existing buildings and constructing new buildings that are low emissions, healthier and climate resilient. Measures should include:
 - a. Continuous improvements to minimum Building Code requirements such as energy efficiency standards.
 - b. Encouraging construction based on low-emissions designs and practices to reduce building energy use and embodied emissions.
 - c. Scaling up energy efficiency assistance to low-income households to enable them to benefit from lower emissions, lower energy costs and healthier buildings.
 - d. Mandating participation in energy performance programmes for existing commercial and public buildings.

Recommendation 22

Provisional progress indicators

1. Government to have, by 31 December 2022, implemented measures to improve the energy performance of existing buildings, such as mandating participation in energy performance programmes.
2. Government to have, by 30 June 2022, scaled up energy efficiency assistance to low-income households.
3. Government to report annually, from 31 December 2022, on a suite of indicators, including residential and commercial energy intensity.

Assessment of our recommendations against our policy approach

Recommendation 20	Action to address barriers	Pricing to influence investment & choices	Enable innovation & system transformation
Decarbonise the energy system and ensure the electricity sector is ready to meet future needs			
Develop and implement a national energy strategy	✓		✓
Scale up investment in energy efficiency	✓		
Support the evolution to a low-emissions electricity system	✓		✓
Design regulatory settings that meet the needs of diverse communities	✓		
Enable a fast-paced and sustained build of low-emissions electricity generation and infrastructure	✓		✓
Assess consequences of significant changes in the balance of supply and demand of electricity	✓		
Support development and deployment of low-emissions fuel options	✓		✓
Determine how to eliminate fossil gas use in residential, commercial and public buildings	✓		✓
Recommendation 21	Action to address barriers	Pricing to influence investment & choices	Enable innovation & system transformation
Reduce emissions from industry			
Accelerate industry switching to low-emissions fuels for process heat and energy efficiency measures	✓	✓	✓
Ensure no new coal boilers are installed and set timetable for the phase out of fossil fuels used in boilers	✓		
Support innovation for decarbonising hard-to-abate industrial sectors	✓		✓
Recommendation 22	Action to address barriers	Pricing to influence investment & choices	Enable innovation & system transformation
Reduce emissions from buildings			
Upgrade existing buildings and construct new buildings that are low emissions, healthier and climate resilient	✓		✓