

## Chapter 8

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# Te Tahua Tukunga Hauwaro – Te Matatika, Te Urutika, Te Tautika

## Demonstrating emissions budgets can be fair, inclusive and equitable

### Summary

For our emissions budgets to be ambitious and achievable, they must be met in a way that is fair, equitable and inclusive. This means government must manage potential negative impacts and encourage positive benefits that come with climate action. These will vary across regions, parts of society and the economy, depending on the path the Government chooses and the policies it puts in place.

This chapter outlines the impacts and co-benefits considered when setting the emissions budgets. These include:

- **Impact on GDP:** Aotearoa can reduce emissions while continuing to grow the economy. We assess that in 2050, the level of GDP could be around 1.2% lower than if we continued with the policies we have today. Investment in low emissions technologies and processes now will open up new markets and reduce the risk of losing others. Delaying key action including the move to EVs and more efficient farm practices could result in GDP in 2050 being up to 2.3% lower.
- **Recognising Iwi/Māori:** climate action must recognise Iwi/Māori priorities and not exacerbate existing inequities. The Government will need to ensure that policies consider the different priorities and historic inequities that Iwi/Māori face.
- **Future generations:** it is important that future generations are not disadvantaged. Aotearoa must strike a balance in how quickly it acts so it does not pass on the cost of climate change. Young people have told us often that this is a concern.
- **Benefits to health:** there are many co-benefits from climate action, particularly to health because of warmer, drier homes, more walking and cycling, and less air pollution. These benefits are significant and immediate and can improve the quality of life for people now and in the future.
- **Cost of living:** in general, we do not think New Zealanders' living costs will increase. Some changes, for example how people travel or heat their homes, will save money. It is essential government considers the needs of groups such as Māori, Pacific peoples, the elderly, people with disabilities, and those on low incomes, as well the most impacted regions and sectors in its planning.

- **Employment and skills:** there will be fewer jobs in some sectors and more jobs in other sectors. Although there may be some job loss in the next few years, a lot of the change will occur through natural attrition and older workers retiring. One of the biggest challenges is making sure Aotearoa has the workers with the skills it needs to support the transition.
- **Rural communities:** communities that rely on the food and fibre sector could be impacted by widespread planting of new production forests. Limiting these forests aligns with the Commission's recommendation to focus on reducing gross emissions (rather than offsetting emissions with trees) and reduce negative impacts on communities.

### Changes in our final advice

We have added more detail on health benefits, the impacts on jobs, and the costs of inaction. We have updated our modelling results and included the results of new sensitivity analysis in our impacts analysis.

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## Introduction

- 1 The transition to a thriving, climate-resilient and low-emissions Aotearoa will bring opportunities, benefits, challenges and costs. Aotearoa has the opportunity to transition in a way that considers the wellbeing of people, the land, and the environment, both now and in the future.
- 2 We have specifically recommended emissions budget levels that can be met in a way that is fair, inclusive and equitable, that bring significant co-benefits to our wellbeing and environment, and that reduce existing inequities.
- 3 Under the Climate Change Response Act 2002 (the Act), we must consider the potential impact of our recommended emissions budgets on different generations, the economy, businesses, Iwi/Māori, different regions and communities, households, workers, the environment, and on government taxation and spending.
- 4 We must also recognise and respect the Government's responsibility to give effect to the principles of Te Tiriti o Waitangi/The Treaty of Waitangi. Where there are potential negative impacts, we have ensured we are satisfied that there are ways to manage those impacts. That could be through choosing a different transition path, or by implementing policies to manage the impacts.
- 5 We have not attempted to sum up the positive and negative impacts of the transition. Instead, we have addressed each potential impact in turn, considering where impacts could compound on particular groups of society and how negative impacts could be managed.
- 6 More detail on our assessment of impacts can be found in Chapters 11-15 of *the 2021 Supporting Evidence*.
- 7 Ultimately, the Government will decide on its course for meeting emissions budgets and the policies it will put in place. The impacts on different groups of society will depend on policy decisions the Government makes. Ensuring that these policy decisions are fair, inclusive and equitable is covered in more detail in *Chapter 20: Policy direction for a fair, inclusive and equitable transition*.

### Box 8.1: Themes from submitters on our consultation

Through consultation, we received feedback from a range of different population groups who were interested in understanding what our emissions budgets meant for them and their community.

We received strong support for the need for a transition that is fair, equitable and inclusive.

Submitters emphasised the need for a partnership approach with Iwi/Māori in line with Te Tiriti o Waitangi/The Treaty of Waitangi. Submitters also emphasised the need for co-designing transition planning and policies with Iwi/Māori, different population and community groups, unions and workers, businesses, regional economic development agencies, and central and local government.

Some submitters emphasised the need for equity – ensuring the transition does not exacerbate or create inequities for New Zealanders, and takes opportunities to reverse some existing inequities.

Some submitters also mentioned the importance of intergenerational equity and that it is unfair to leave the costs of climate change to future generations.

Some submitters noted that some groups could face greater challenges and would need support through the transition for their different circumstances. This included some Iwi/Māori, Pacific peoples, women, elderly people, people with disabilities, young people, people on low incomes and people living in rural areas.

Private sector submitters were particularly concerned about the cost of the transition, what it would mean for their business and their ability to be competitive. Submitters were also interested in the opportunities to produce low-emissions products or build new low-emissions industries, and noted how the business response would flow through to employment.

These themes are addressed throughout this chapter.

## 8.1 Intergenerational equity

- 8 Te ao Māori recognises the interconnectedness of all living things within nature and the reciprocal relationship between tangata (people) and the whenua (land).
- 9 In considering how New Zealanders will experience the impact of the transition to a low-emissions economy, we must consider how the actions we take today will affect the wellbeing of current and future generations.
- 10 Some industries, regions and communities of Aotearoa will be more affected by the transition than others. It is important that the speed and nature of the transition is well signalled to allow time to plan. People who work in industries that extract and use fossil fuels will be particularly affected by the transition. These people will increasingly need to move into new industries.
- 11 Carefully balancing our transition to a low-emissions society requires a considered approach that does not create or exacerbate social inequities. The transition can be economically affordable and socially acceptable if it is well-paced, planned together with communities, and well-signalled. Society will benefit from improved health and wellbeing.
- 12 Intergenerational equity is reflected in He Ara Waiora, part of the Government's wellbeing framework, through the dimensions of wellbeing ('ends') and the tikanga ('means'). Both of these are essential to intergenerational wellbeing. This aligns closely with the concept of tiakitanga and guides Aotearoa to carefully consider the pace of the transition.

<sup>13</sup> Climate change will disproportionately affect young people and future generations. However, if Aotearoa transitions too quickly, both current and future generations will also bear the brunt of the costs of disruptive change.

<sup>14</sup> We have recommended emissions budget levels that are both ambitious and predictable. Acting too hastily will result in abrupt and disruptive changes akin to the changes many people in Aotearoa experienced from the economic reforms in the 1980s. Delaying action carries the risk of a sharper and more disruptive transition later, locking in emissions intensive infrastructure that could become stranded and contribute to more severe climate change.

<sup>15</sup> A key part of intergenerational equity is ensuring sustainable prosperity over the long term. To ensure sustainable prosperity, we have not only considered the need to reduce emissions as quickly as possible, but also the need to set future generations up with the resilience and ability to make continual and lasting emissions reductions over the long term.

<sup>16</sup> This means not only passing on to future generations an Aotearoa that is low emissions, but also an Aotearoa with a productive economy where people are well, healthy and have jobs that are environmentally and socially sustainable.

## **8.2 The benefits, costs and savings from meeting emissions budgets**

<sup>17</sup> We looked at opportunities, benefits, costs and risks of the actions that would need to be taken to meet our recommended emissions budget levels. We have sought to recommend emissions budget levels that can be met by making the most of the opportunities and benefits, while minimising the costs and risks over time.

<sup>18</sup> We received a number of submissions concerned about the economic costs of our emissions budgets. Some submitters commented that the estimated impact on GDP was lower than they expected and lower than previous estimates. Some submitters were concerned that costs would fall disproportionately on particular sectors of the economy or groups of people in Aotearoa. Other submitters emphasised the need to consider the cost of inaction, the benefits to health and that acting now would save money later.

### **8.2.1 Costs and savings from the energy transition**

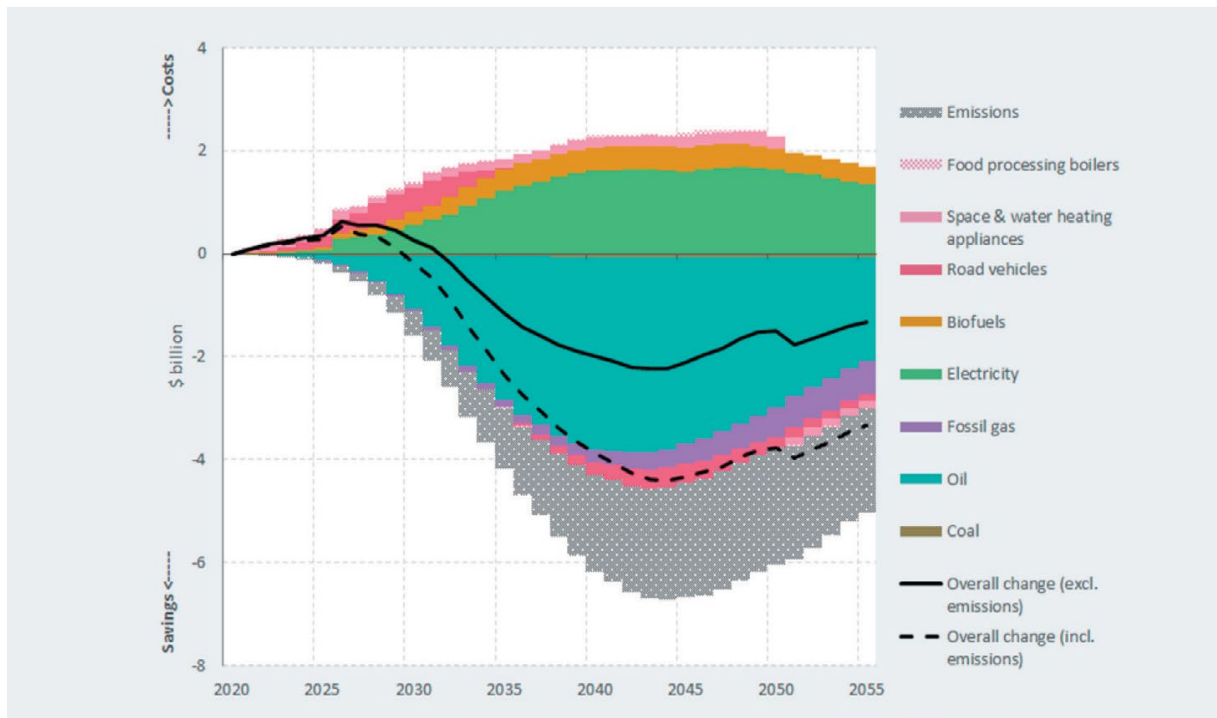
<sup>19</sup> There will be costs associated with meeting our recommended emissions budgets. Across the economy and society, businesses and individuals will need to look at their emissions and make changes to reduce them.

<sup>20</sup> However, in many cases the investments made now will more than pay for themselves in the long term. Such investments include those in energy efficiency, electric vehicles (EVs), renewable electricity generation, and improving on-farm efficiency.

<sup>21</sup> Delaying these investments would result in greater cost to the economy and society. There is also an opportunity now for increased investment to stimulate the economy and support the post COVID-19 recovery.

## *A decarbonised energy system can provide cost savings*

- <sup>22</sup> We have assessed the costs and savings of some of the key actions that can be taken to decarbonise the energy system. These assessments are based on the rate of uptake of these actions in the demonstration path (outlined in more detail in *Chapter 7: Demonstrating emissions budgets are achievable*).
- <sup>23</sup> This analysis looks at the costs of transitioning across three key areas: road transport, space and water heating, and food processing. We have focused on these areas as they are large sources of current emissions in Aotearoa and are likely to require some of the most significant transitions from fossil to renewable energy. Together, these areas account for around three-quarters of the reductions in long-lived gas emissions by 2035 under the demonstration path.
- <sup>24</sup> Our analysis estimates the costs incurred in each year from capital investments in vehicles, boilers and appliances, use of fuel and electricity, maintenance, and other associated costs. We have compared these estimates against the current policy reference case, where the uptake of these actions would occur more slowly. This allows us to show where there could be costs and where there could be savings from taking these actions over time.
- <sup>25</sup> Overall, we find that substantial additional investment will be required over the coming decades, but this is likely to be outweighed by even larger future cost savings. This is demonstrated in Figure 8.1. There are costs over the next decade or so. Beyond this, the savings outweigh the costs as avoided expenditure on fossil fuels outweighs the additional capital costs and expenditure on electricity and biofuels. By the 2040s, Aotearoa would be saving around \$2 billion each year (the solid black line in the figure).
- <sup>26</sup> The figures presented here consider only fuel-switching measures. They exclude the effects of energy efficiency improvements, mode shift and reduced travel demand in the demonstration path. We expect these to deliver further economic benefits, potentially more than doubling the net cost savings in the long term. However, a complete picture would need to consider wider implications such as transport infrastructure investment, which we have not been able to do.
- <sup>27</sup> The numbers above exclude the monetised value of emissions reductions. In Figure 8.1, the grey dotted area shows the avoided emissions costs if valued at the emissions values used in our modelling of the demonstration path (see *Chapter 7: Demonstrating emissions budgets are achievable* *Box 7.1: Emissions values* for more information). The black dashed line in the figure shows how the overall costs would change if avoided emissions costs were included.
- <sup>28</sup> The positive values (above the horizontal axis) in these figures (Figure 8.1, 8.2, 8.3, 8.4) indicate that the demonstration path would impose an additional cost above the Current Policy Reference case. Negative values (below the horizontal axis) indicate that the demonstration path would represent a cost saving relative to the Current Policy Reference case.

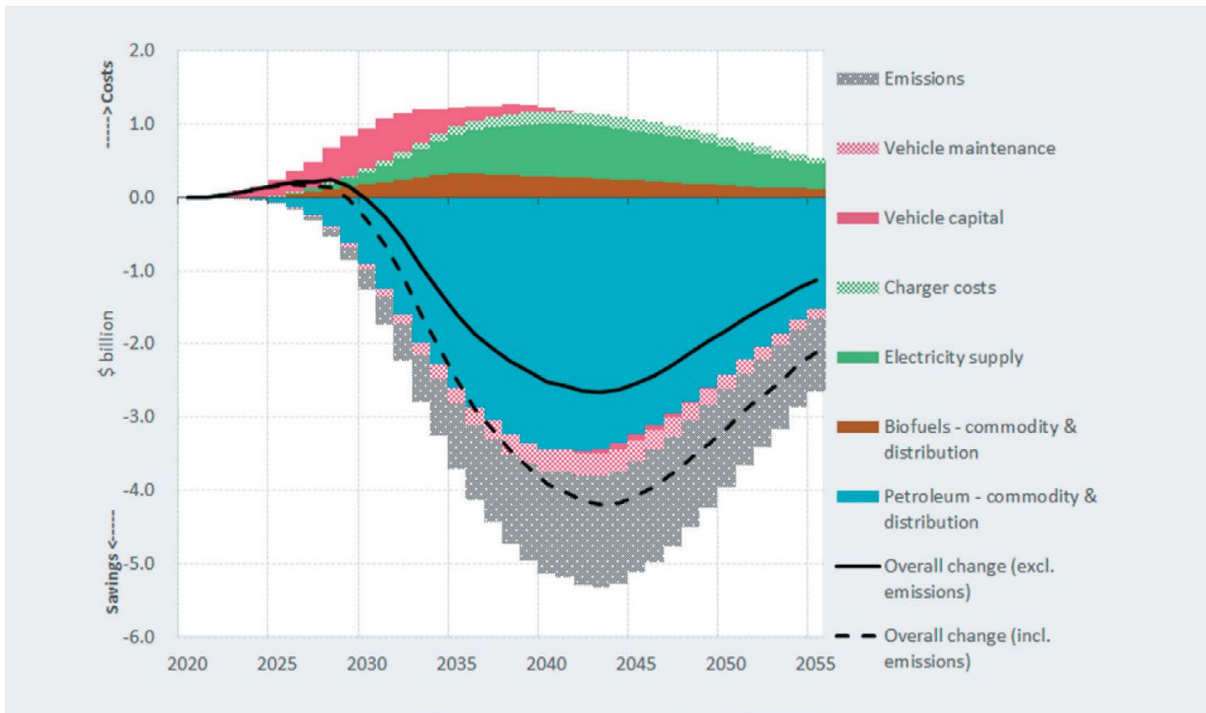


**Figure 8.1: Projected annual increase and decrease in costs from fuel switching across the road transport, buildings and food processing sectors in the demonstration path compared to the current policy reference. This excludes the effects of improved energy efficiency, mode shift and reduced travel demand.**

Source: ENZ modelling

### *Electrifying road transport could start to deliver cost savings within a decade*

- 29 Our analysis finds Aotearoa will save money if businesses and individuals decarbonise by electrifying transport. This accounts for most of the overall cost savings shown in Figure 8.1 above.
- 30 Figure 8.2 shows a more detailed breakdown of the various cost elements for road transport under the demonstration path compared to the Current Policy Reference case. Again, this does not include the effect of reduced road travel from greater walking and cycling, use of public transport, use of rail and coastal shipping, working from home, or other changes to demand. These mode shifts could lead to large additional cost savings, particularly through reducing the number of cars that Aotearoa imports.
- 31 Electrifying the vehicle fleet will require increased capital expenditure on vehicles, investment in electricity supply and distribution and charging infrastructure. However, our analysis indicates that these capital costs will be more than offset by savings in petrol and diesel use, along with lower maintenance costs. Our analysis suggests that annual cost savings will exceed the additional costs incurred by around 2030 under the demonstration path. Contributing to this is our assumption that the capital cost of EVs will continue to fall, with electric cars becoming cheaper than a petrol equivalent by 2031.
- 32 Our analysis indicates that biofuels will remain more expensive than fossil fuels. This would lead to an increase in fuel costs, but these costs would be small relative to the cost savings from electrification.



**Figure 8.2: The projected increase and decrease in different elements of road transport costs in the demonstration path compared to the current policy reference, excluding the effects of mode shift and reduced travel demand**

Source: ENZ modelling

### *Switching to electric space and water heating could deliver cost savings but there are transitional costs*

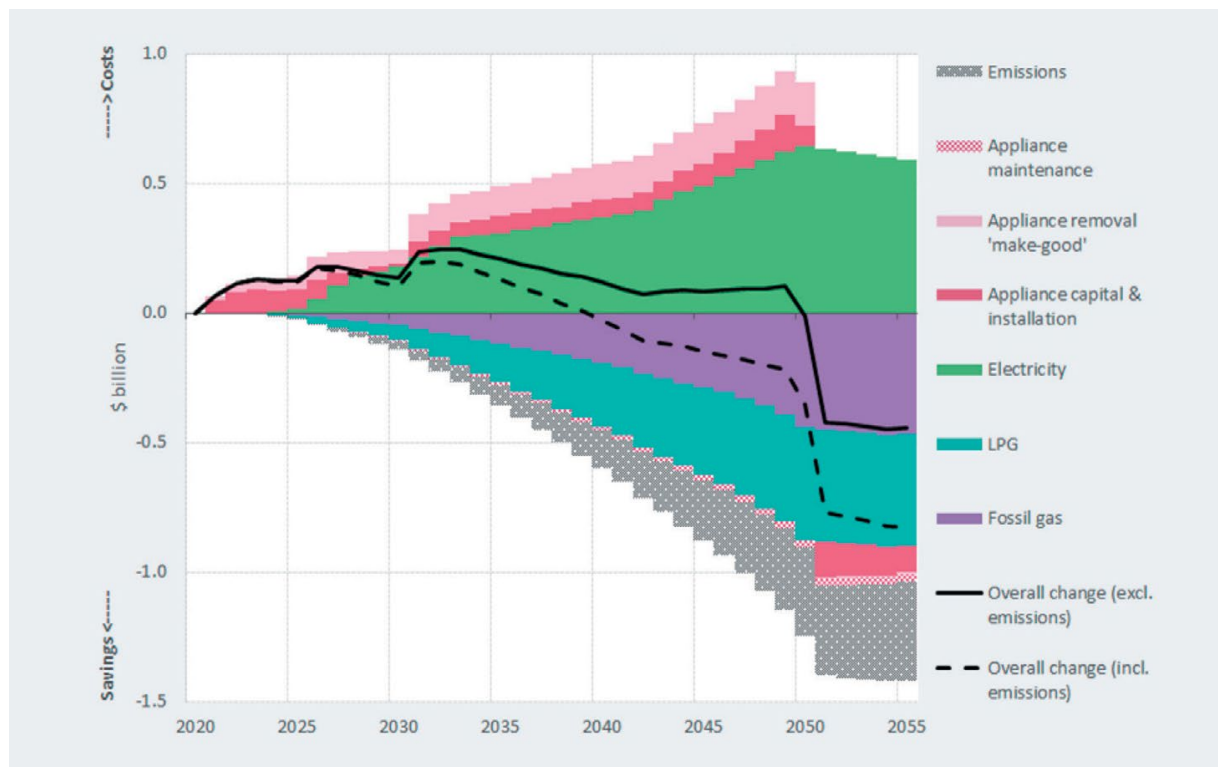
<sup>33</sup> In the demonstration path, fossil gas and LPG space and water heating systems are phased out and replaced with electricity by 2050. Our analysis finds that this would incur a net cost averaging around \$200 million per year out to 2050, excluding the emissions reduction benefits (Figure 8.3).

<sup>34</sup> We estimate that electric heating systems are slightly cheaper than a fossil gas system today in new buildings, but the costs of converting an existing building to electric would be substantial. This is particularly due to ‘make-good’ costs to properties from removing fossil gas appliances and making repairs to the property.

<sup>35</sup> While substantial, these are one-off transitional costs. As Figure 8.3 shows, after 2050 once all the conversions are completed, annual costs are lower. We therefore find that similar to road transport, the transition to electric heating would ultimately lead to lower costs, but this point will take longer to arrive.

<sup>36</sup> We have tested whether delaying the transition from fossil gas and LPG to electricity would improve the economic costs to Aotearoa. However, our analysis indicates that this would end up costing Aotearoa more over the long term as the post-transition benefits are delayed.

<sup>37</sup> The effects of energy efficiency improvements assumed in the demonstration path are not included here, but our analysis indicates there is potential for these to substantially offset the transitional costs.



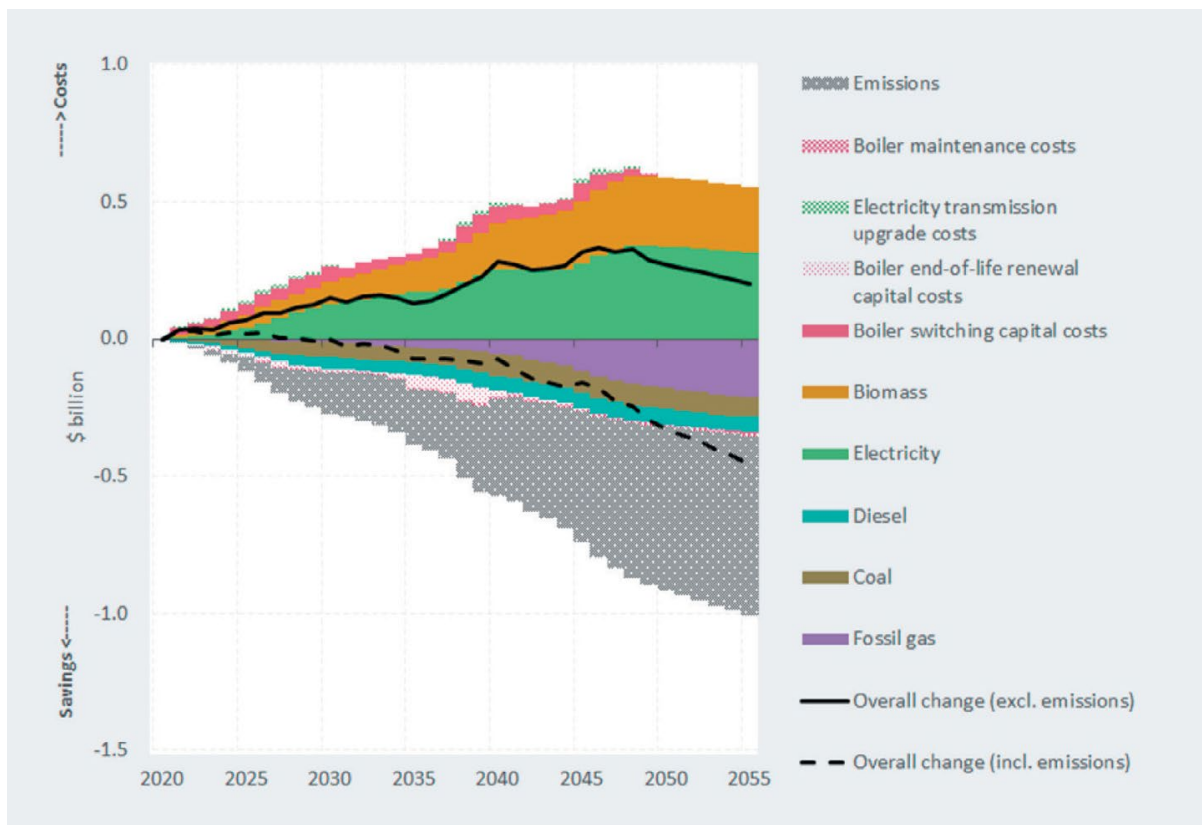
**Figure 8.3: The projected increase and decrease in different elements of space and water heating costs for homes and businesses in the demonstration path compared to the current policy reference, excluding energy efficiency improvements. Under our modelling all space and water heating in buildings is assumed to be electrified by 2050. There is a net cost of the transition while this happens due to the costs of converting existing building, but once complete there will be overall net savings from the transition.**

Source: ENZ modelling

### *Switching to biomass and electric heat in food processing will incur costs*

- <sup>38</sup> The demonstration path sees a full transition away from using coal, fossil gas and diesel to generate heat in the food processing sector by 2050. Figure 8.4 shows that this leads to costs on the order of \$200 million per year by 2035, largely due to higher fuel costs. This is because, unlike for EVs or space and water heating, conversion to a biomass or electrode boiler means using a more expensive fuel without any significant energy efficiency gain.
- <sup>39</sup> Again, this does not include the effect of further efficiency improvements assumed in the demonstration path, through measures such as improved heat recovery and heat pump integration. These would lead to significant fuel savings and could reduce overall costs, but there is uncertainty around the installation costs which are likely to be highly site-specific.





**Figure 8.4: The projected increase and decrease in different elements of process heat costs for the food processing sector in the demonstration path compared to the current policy reference, excluding the effects of improved energy efficiency**

Source: ENZ modelling

## 8.2.2 The economy will continue to grow

- 40 How the economy grows as Aotearoa transitions to a climate-resilient, low-emissions economy will depend on how quickly Aotearoa acts, the costs to transition and the action from the rest of the world.
- 41 With the technologies and practice changes available to Aotearoa, our modelling suggests that what Aotearoa produces and exports for the most part would not need to change significantly to meet our recommended emissions budget levels. However, some sectors such as mining and fossil gas would reduce production significantly.
- 42 We have modelled the potential overall impacts on the economy using a macroeconomic model built for the Climate Change Commission (the Commission), C-PLAN. This model is described in *Chapter 4: Evidence and models*. This assessment looks only at the impact of meeting the domestic emissions budgets. It does not include the impact of meeting the Nationally Determined Contribution, which could include international purchases of offshore mitigation.
- 43 In our *2021 Draft Advice for Consultation*, we assessed that the overall reduction to GDP, compared to a future without further policy action, would be less than 1.1% in 2035 and less than 1% in 2050. In response to feedback, we have further explored how sensitive this assessment is to the dependence on key emissions reductions options.

- 44 We have assessed, based on our modelling and other analysis, that our recommended emissions budgets are achievable at an overall reduction to the level of GDP in 2035 of around 0.5%. This considers only the mitigation costs associated with meeting the budgets and is not a cost-benefit analysis. It does not consider the significant co-benefits of action or the costs of delaying action (see Section 8.2.3). GDP also does not measure the impacts on wellbeing.
- 45 Our economic modelling indicates the economy would continue to grow under our recommended emissions budgets. Under current policy settings, GDP is projected to grow to \$388 billion by 2035 and \$487 billion by 2050. Whereas meeting our recommended emissions budgets through the demonstration path would result in GDP growing to about \$386 billion by 2035 and would put Aotearoa on track for GDP to grow to \$481 billion by 2050.
- 46 Our modelling shows that meeting the 2050 targets at lower cost to the economy relies on the successful roll out of EVs and improving the emissions efficiency of agricultural production so that production can be largely maintained. The overall impact to GDP would be higher – potentially reducing GDP by up to 1% in 2035 – if these key measures are not successfully rolled out.
- 47 EV technology is available now, and policy can be designed to remove barriers to speed up their roll out. Opportunities to improve on-farm performance are also available now, and achievable by farmers over time, with policy and programmes to address barriers.
- 48 Looking out to 2050 is more uncertain. There is more opportunity for currently emerging technologies, such as green hydrogen and methane inhibitors or vaccines, to play a role. We assess that the overall impact to GDP in 2050 would be a reduction of around 1.2%. However, the overall impact to GDP in 2050 could be a reduction of up to 2.3% if Aotearoa fails to deploy EVs and improve agricultural emissions efficiency at adequate rates.
- 49 This potential impact on GDP is significantly lower than what was estimated by the Government when the 2050 emissions reduction targets (2050 targets) were set. There are a number of reasons for this:
- Technology costs are reducing faster than previously projected.
  - Climate policy and other factors have evolved since the last estimates, so the baseline as to what would occur under current policy settings has changed.
  - The C-PLAN model has been specifically designed for modelling climate policy and has an improved representation of key emissions reduction technologies.
  - We have worked to calibrate and align C-PLAN with our bottom-up scenario analysis so that, while there are differences, there is much closer alignment than seen in earlier work.
- 50 Our findings are in line with international estimates, such as those by the United Kingdom Committee on Climate Change and the European Commission. In fact, some assessments suggest that the transition may increase GDP (see *Chapter 15: How we earn our way in the world of the 2021 Supporting Evidence* for more detail).

- <sup>51</sup> International experience shows that estimated costs are often overstated because technologies improve faster than expected. Internationally, the cost of deploying technology to meet emissions reduction targets is decreasing faster than expected. As a result, countries like the UK have re-assessed cost estimates of greenhouse gas emissions targets downwards over time.
- <sup>52</sup> The economy will continue to experience external shocks over time. The COVID-19 pandemic is an example of this. While these can be difficult times, they also provide opportunities to bring forward investment that stimulates the economy and accelerates the climate transition.

### Box 8.2: Sensitivity Analysis in C-PLAN

We have tested how sensitive the C-PLAN GDP results are to some key uncertainties in the economy. These include the international oil price, international emissions prices, Aotearoa population and GDP projections, and potential closing dates for the Methanex methanol plant and the Tiwai Point aluminium smelter. Note that we test the changes to population and GDP growth together as a single sensitivity because the change in projected GDP is partly driven by higher or lower population growth.

When testing these sensitivities, we are looking at how the changed input assumption(s) affect the modelled impact on GDP from meeting the recommended emissions budgets. This is the difference in GDP between the demonstration path and the Current Policy Reference case.

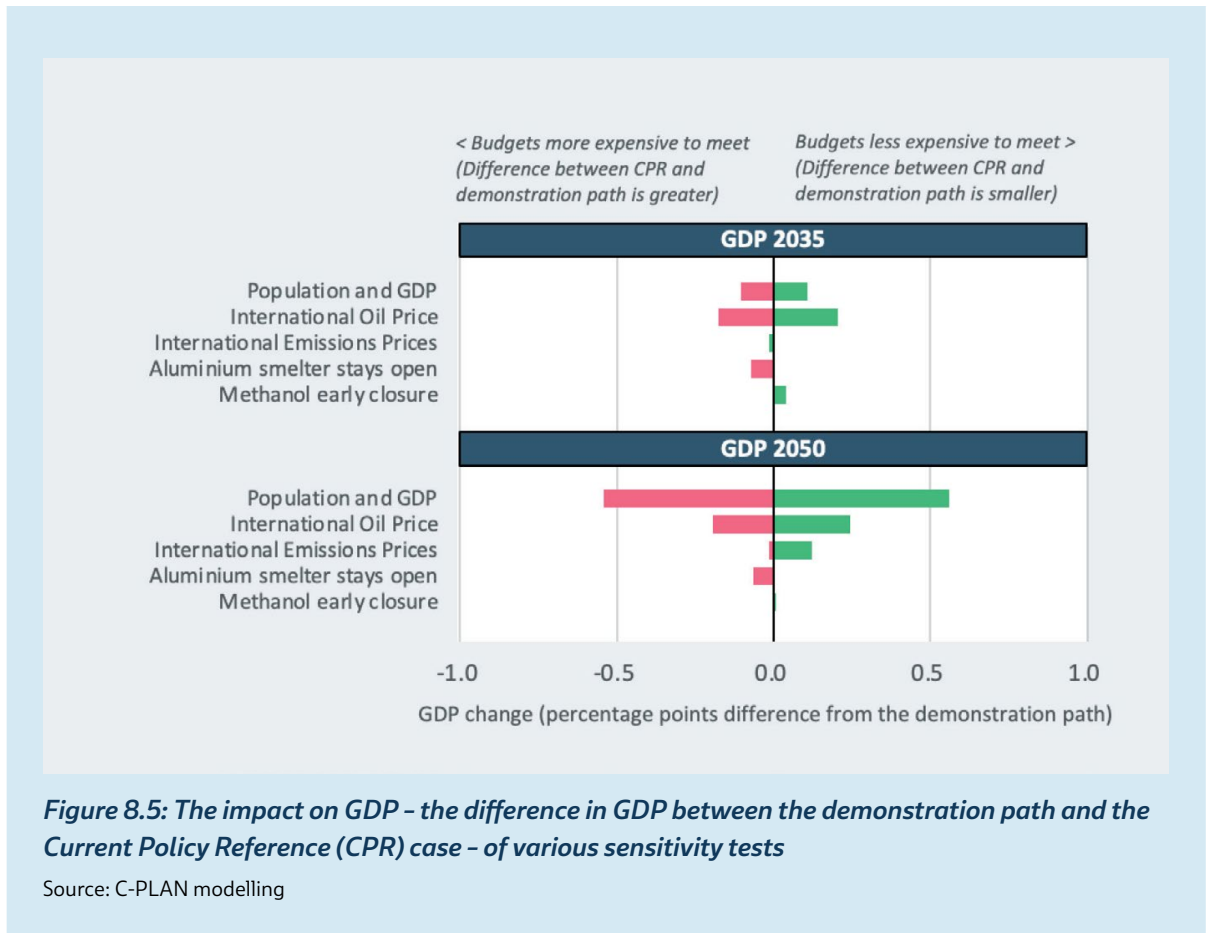
The level of GDP under the Current Policy Reference case is an input assumption, rather than something that is generated by the model. This reference GDP path is held constant across the sensitivity tests – except for in the ‘population and GDP’ test where we are deliberately testing the effect of lower or higher future growth rates. This method allows us to isolate the change in the impact of meeting our recommended emissions budgets in each sensitivity test.

While some of the sensitivity tests do affect the modelled impact on GDP, the effect is generally within about 0.6 percentage points (Figure 8.5).

Halving or doubling the international emissions price has a very small effect. Changing the potential closing dates for Methanex and Tiwai Point aluminium smelter also has a very small effect, including in a scenario where the smelter does not close before 2050.

Reducing the oil price from about \$70/barrel to about \$40/barrel increases the impact on GDP by about 0.15 percentage points in 2050. This means the difference in GDP between the demonstration path and the Current Policy Reference case is larger.

If population and GDP are about 10% higher in the Current Policy Reference case, then the impact on GDP of meeting the budgets increases by about 0.6 percentage points. However, note that the absolute level of GDP in this sensitivity would still be around 9% higher than projected in our main scenario.



**Figure 8.5: The impact on GDP – the difference in GDP between the demonstration path and the Current Policy Reference (CPR) case – of various sensitivity tests**

### 8.2.3 The benefits and opportunities of meeting emissions budgets are significant

- 53 International and domestic research suggests there are significant co-benefits to reducing emissions in the more immediate term. Benefits to health and health equity, productivity and incomes all tip the balance further in favour of acting earlier to reduce emissions. Health improvements from warmer drier homes, less air pollution, and from walking and cycling, reduce the burden on the health system. Section 8.6.1 outlines these benefits in more detail.
- 54 There are also opportunities for businesses taking the lead in reducing emissions. Creating new low-emissions products and services could open up opportunities in new markets and could add value to our exports. The flipside is the risk of businesses losing access to international markets if Aotearoa does not take timely action to reduce emissions.
- 55 The pace at which the world acts to reduce emissions, will also define how much climate change Aotearoa and other countries will need to adapt to. While there are estimates of the damages from more severe climate change, there is a growing body of research showing that these estimates significantly underestimate the true cost. This is because it is challenging to quantify many of the most serious consequences of climate change as they lie outside of human experience. However, these risks provide a compelling reason for the world to work together to reduce emissions.

<sup>56</sup> Our assessment of the impact on GDP provides some useful insights but it does not include these benefits and opportunities, nor the costs related to not acting. It is difficult to fully quantify the benefits of action on the economy and society with any accuracy as there is significant uncertainty in how and when the benefits will be realised.

#### **8.2.4 The impacts will not be evenly felt**

<sup>57</sup> The overall impact on GDP from meeting our recommended emissions budgets is small relative to the size of the whole economy. There will be significant benefits from the transition. However, opportunities, benefits, challenges, and inevitable costs will not be evenly felt across society. Some sectors of society will experience greater impacts, both positive and negative.

<sup>58</sup> Distributional impacts can be managed if the Government puts in place policies to support those most disadvantaged and least able to adjust, and to ensure a fair, inclusive, and equitable transition. The direction of policy is discussed in more detail in *Chapter 20: Policy direction for a fair, inclusive and equitable transition*.

<sup>59</sup> The following sections look in more detail at how the benefits and costs may be distributed across different groups of people, and how we can ensure that costs do not fall disproportionately on the groups of people who are the most vulnerable and least able to adjust.

### **8.3 How the transition could impact businesses and industries**

<sup>60</sup> Aotearoa has built up thriving industries that have provided New Zealanders with livelihoods and been significant contributors to our economy. Our country benefits from people working the land, with the food and fibre sector being a major employer and exporter of goods.

<sup>61</sup> Mining, oil and gas, aluminium, cement, oil refining, and pulp and paper have been important for regional economic development, providing many people with jobs. People built these industries without knowledge of the impacts of their emissions, and the industries have helped Aotearoa thrive, providing us with the products people rely on in their everyday lives.

<sup>62</sup> Many businesses in Aotearoa are connected to the global economy and compete in international markets. This provides opportunities and risks. We have heard from people who run businesses that they want to transition. But to do so, they need stable and predictable policy to allow them to plan, and an even playing field to compete on.

<sup>63</sup> Meeting our recommended emissions budgets provides opportunities for businesses to develop new low-emissions products and services. Climate change is a material financial risk and investors are increasingly taking account of it, including through financial reporting in line with the Task Force on Climate-related Financial Disclosures. Businesses are responding to consumer demand for low-emissions products, are increasingly looking at emissions across their supply chains and requiring their suppliers to reduce emissions.

<sup>64</sup> A number of Aotearoa businesses involved in the Climate Leaders Coalition have committed to setting public emissions reduction targets in line with the Paris Agreement's global 2°C goal. These businesses can also commit to a higher pledge in line with the global 1.5°C effort. Collectively, these businesses represent about 60% of Aotearoa emissions, more than a third of private sector GDP, and employ about 180,000 people.

<sup>65</sup> Our emissions budgets are paced such that businesses have time to plan, invest and innovate. This provides some level of predictability about the transition and helps to avoid unnecessary costs. It means that businesses can replace assets – such as coal boilers, gas appliances and internal combustion engine (ICE) cars – with low-emissions alternatives when they reach the end of their useful life.

<sup>66</sup> Businesses that rely heavily on fossil fuels will have to find alternative low-emissions ways of doing business, pivot into new areas or they may also face closure. In these cases, Aotearoa needs to think about the people working in those sectors and how to support them through change (see Section 8.7).

<sup>67</sup> Transitioning too quickly could increase costs for businesses that are able to transition and reduce their competitiveness. It will be important to monitor global markets and actions by competitors to understand the impacts. This is an important ongoing task for the Commission.

<sup>68</sup> The flipside is that a delayed transition could result in businesses missing out on opportunities, losing some social licence and as a result losing access to some markets or to investment. A delayed but more disruptive transition later could see businesses left with stranded assets.

### **8.3.1 Businesses in the food and fibre sector**

<sup>69</sup> As part of the climate transition, people who run farm businesses will need to reduce on-farm biogenic methane and nitrous oxide emissions, and businesses involved in food processing will need to reduce carbon dioxide emissions from transport and processing plants. Pasture-based agriculture in Aotearoa has one of the lowest emissions footprints in the world.

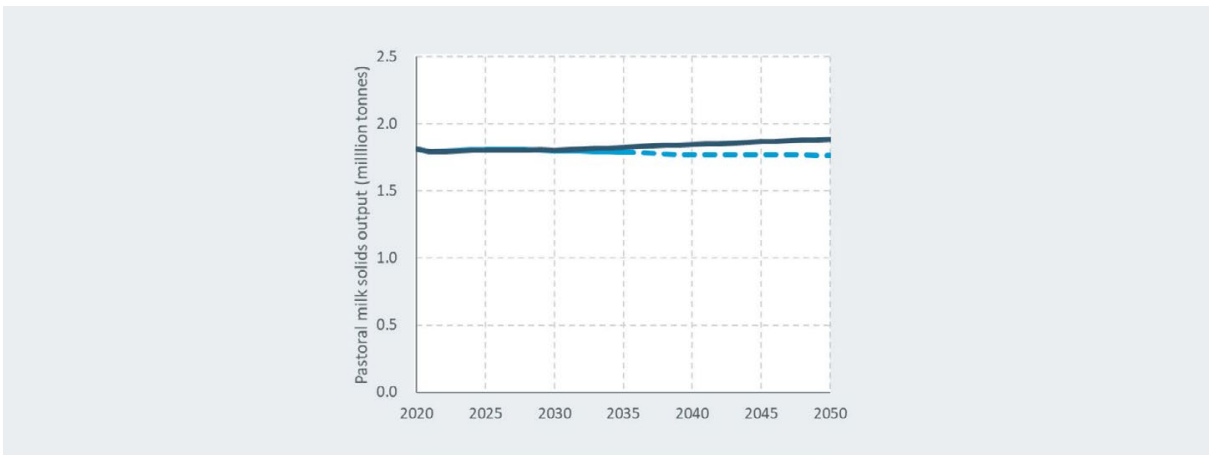
<sup>70</sup> There is good reason to believe that production in Aotearoa will be competitive in a low-emissions future where meat and dairy products are still consumed. However, delayed action could affect the country's trading position and businesses could lose market access as global markets increasingly seek low-emissions goods and synthetic proteins.

<sup>71</sup> Our analysis shows that the food and fibre sector can meet our recommended emissions budgets without reducing production (Figure 8.6). However, 20,000 to 30,000 farm businesses will need to change on-farm management practices and take up new technology as it becomes available. Some farmers are already making these changes. Many more are working towards them but will need to push these changes further. As prices are set by international markets, it may be challenging for the food and fibre sector to pass on costs of making these changes to consumers.

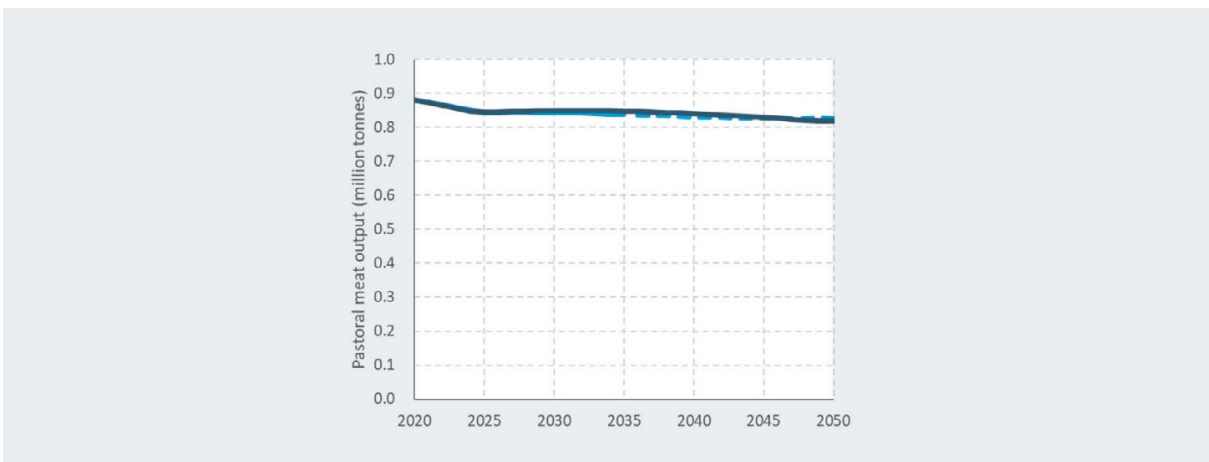
<sup>72</sup> We consider that the food and fibre sector's role in meeting our recommended emissions budgets is manageable. However, it will require farmers to make significant changes, and so will need government support and incentives.

<sup>73</sup> Making these changes will require skilled farm management and high-quality data. Well informed and trained farm advisers will need to work closely with farm managers to achieve this. Research and development will be needed into new technologies like a methane inhibitor and vaccine. Systems for deploying such technologies when they become available will benefit the sector and the economy. The direction of policy for enabling this is discussed in *Chapter 17: Policy direction for agriculture*.

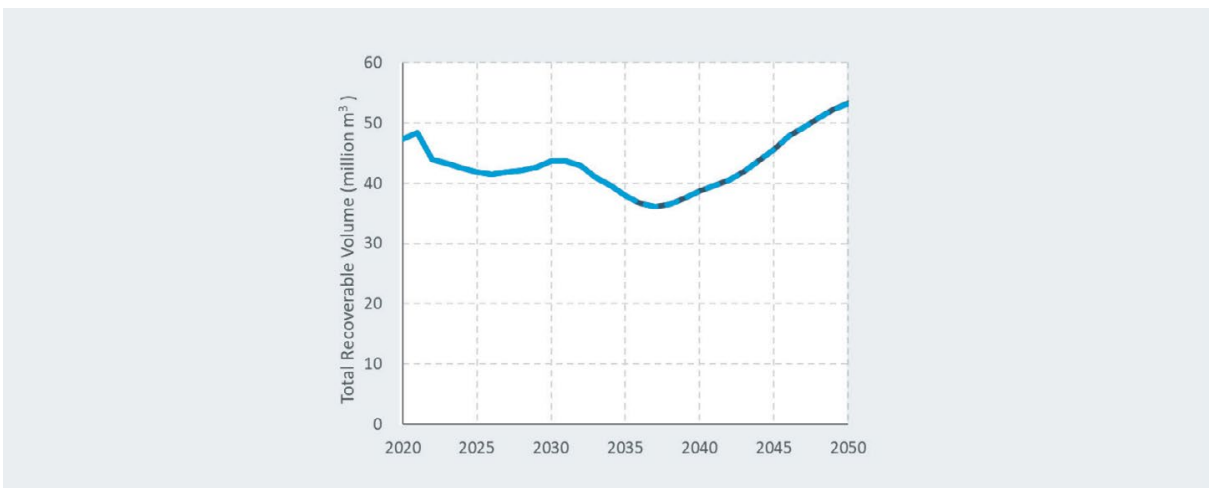
### Milk solids output



### Sheep and beef meat output



### Forestry output



— Demonstration path    - - - Demonstration path after 2035    — Current Policy Reference

**Figure 8.6: The change in output of milk solids, sheep and beef meat and forestry that would occur in the demonstration path over the first three emissions budgets and out to 2050**

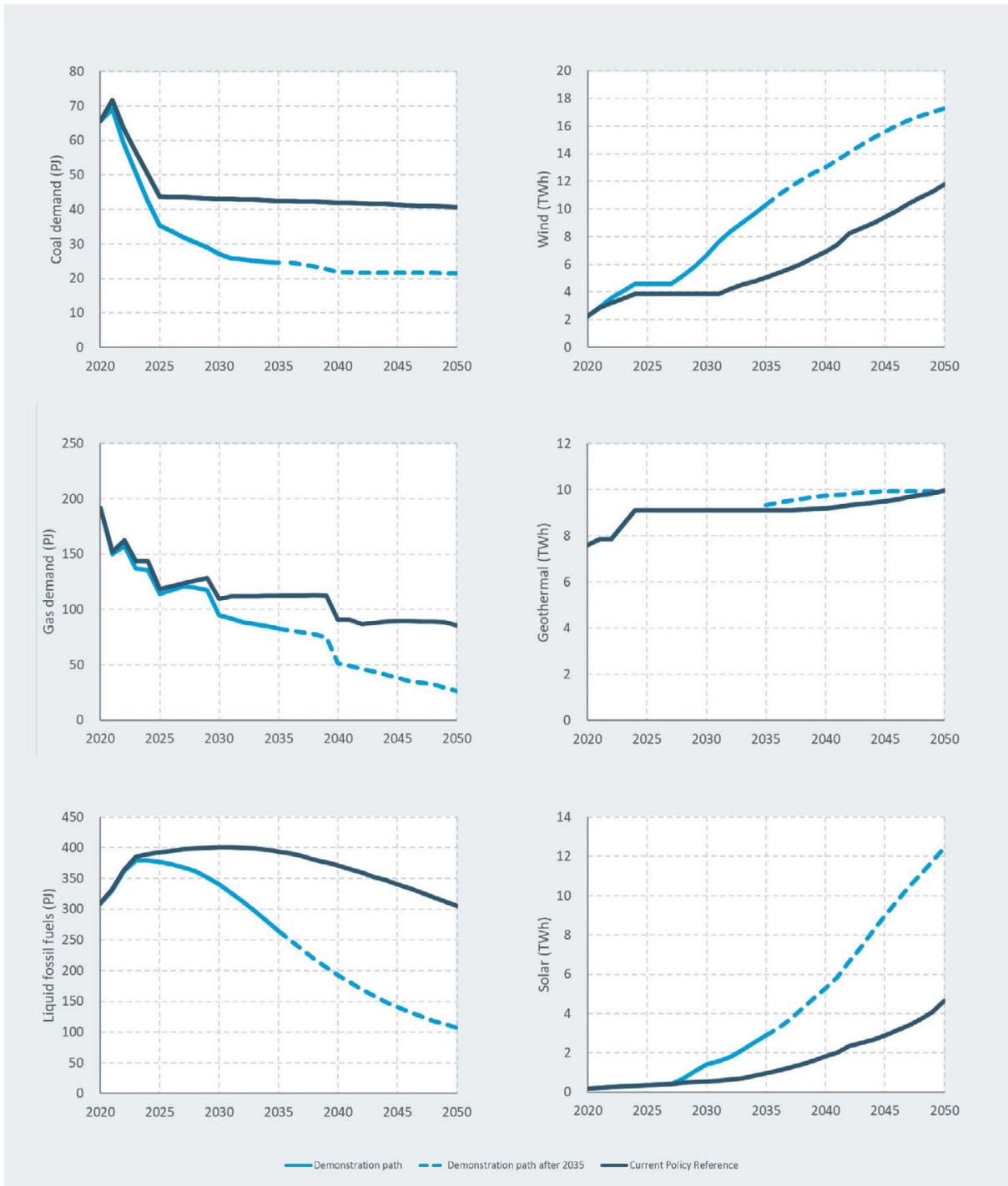
Source: Commission modelling

### 8.3.2 Business in the energy sector

- <sup>74</sup> Energy is a vital part of New Zealanders' day-to-day lives. As well as people using energy at home and to power vehicles, businesses use energy to produce goods that are used in Aotearoa and sold around the world.
- <sup>75</sup> Meeting our recommended emissions budgets requires Aotearoa to transform its energy system.
- <sup>76</sup> The energy system is interconnected, so the changes that are made cannot be thought about in isolation. This interconnectedness means there are challenges to reducing fossil gas supply while it still plays an important role. These challenges can have impacts on employment and infrastructure use.
- <sup>77</sup> The transformation in the energy system will impact businesses that currently use fossil fuels. Some of these businesses may be able to switch to low-emissions alternatives, or pivot their businesses into new areas.
- <sup>78</sup> However, several industries that are large employers in regions around the country and are fundamental to the economy have fewer options for decarbonising. Aotearoa needs to make key strategic decisions about the future of these industries (see *Chapter 15: Policy direction for energy, industry and buildings*).
- <sup>79</sup> Electricity generation will need to significantly increase to meet industry and transport needs. In the demonstration path in *Chapter 7: Demonstrating emissions budgets are achievable*, annual electricity generation would need to increase by around 20% over 2018 levels by 2035. Wind and solar generation and biomass would need to expand at a faster rate than expected under current policy settings to meet the country's energy needs and replace coal and fossil gas (Figure 8.7).
- <sup>80</sup> Electricity generators, Transpower and lines companies will need skilled workers and faster planning processes to deliver this expansion. There are also opportunities for entrepreneurs and independent generators with the new technologies available, such as batteries, and new digital tools.
- <sup>81</sup> The Government needs to ensure the electricity system can reliably generate enough supply as Aotearoa shifts away from fossil fuels and increases dependency on electricity generation. Currently, fossil gas and coal provide this security of supply, particularly at peak times and in dry years when hydro lake levels are low. Relying on electricity to meet much of the country's transport, heating, cooking and industry needs carries risk in a nation exposed to natural hazards and other potential disruptions.
- <sup>82</sup> Aotearoa currently relies on imported oil for products like petrol and diesel, exposing the country to oil price volatility. Moving to domestic sources of energy for transport would reduce the country's reliance on oil imports. However, there could be some risks with relying heavily on electricity as a major source of energy – having a diverse range of energy sources increases resilience.
- <sup>83</sup> The Government needs to work with those involved in the energy system to manage the risk around affordability and security of supply as a result of moving to a low-emissions energy system. Decarbonising energy will need to be prioritised over the more expensive task of completely removing emissions from the electricity system.
- <sup>84</sup> The Government is currently investigating options for managing dry year risk under the NZ Battery project, including the proposed Lake Onslow pumped hydro scheme and alternative storage options. The aim is to provide a large amount of storage capacity to manage the risk of dry years where hydro lake levels are low. This project could displace the requirement for thermal generation and achieve an abrupt decarbonisation of the electricity sector. Any solution for managing the dry year risk could be expensive.



- 85 Other actions to increase resilience of the electricity grid and the system include building new generation in the North Island, reinforcing the transmission and distribution infrastructure, deploying new technologies such as batteries, and diversifying into new fuels such as biofuels and hydrogen that boost energy security.
- 86 All of this will need to be considered when developing a long-term national energy strategy, which is discussed in more detail in *Chapter 15: Policy direction for energy, industry and buildings*.



**Figure 8.7: The changes in demand for coal, fossil gas and liquid fossil fuels (in PJ), and in geothermal, wind and solar generation (in TWh) that would occur in the demonstration path over the first three emissions budgets and out to 2050**

Source: Commission analysis.

### 8.3.3 Small business

- <sup>87</sup> Businesses with fewer than 20 employees make up about 97% of Aotearoa businesses. They contribute about 30% of employment and more than 25% of GDP. They play a crucial role in the economy, especially in supply chains and supporting larger exporting businesses. Many have been particularly affected by the COVID-19 pandemic.
- <sup>88</sup> Small businesses tend to be more vulnerable to change. The people running small businesses have limited time and resources to adjust to higher costs. Small businesses that work closely with large businesses in hard-to-abate sectors may be particularly impacted by our recommended emissions budgets.
- <sup>89</sup> Our recommended emissions budget levels and the transition to a low-emissions economy will affect all small businesses in some way. Most of this would come via electricity, fossil gas and transport prices.
- <sup>90</sup> Wholesale electricity prices will vary depending on supply and demand, and other factors, over the next decade. See Section 8.6.2 for more discussion on wholesale electricity prices. Businesses could make savings by improving their energy and fuel efficiency.
- <sup>91</sup> However, small businesses such as restaurants, cafes and bars that use fossil gas for cooking will need to move to lower-emissions solutions, such as biogas and electrification. We have recommended emissions budgets on the basis that businesses could replace fossil gas appliances at the end of their natural lifetime.
- <sup>92</sup> There will also be opportunities for new small businesses in the new clean technology industry. These new businesses will need an enabling regulatory environment.
- <sup>93</sup> In most cases, these impacts will be manageable. However, the ability for small businesses to respond, adapt and innovate will depend on information and support, skills and capability, access to capital, and how well the transition is signalled and planned.
- <sup>94</sup> By signalling early the changes that are needed, the Government will give people running small businesses time to respond. This will allow them to replace assets such as vehicles or gas appliances with low-emissions options on normal replacement cycles, reducing the cost to those businesses.
- <sup>95</sup> The Government will also need to understand the barriers that people in small businesses face, and tailor policy to encourage behaviour change (see *Chapter 13: Policy direction that cuts across sectors*).

### 8.3.4 Emissions leakage

- <sup>96</sup> Emissions leakage is a risk created by the uneven implementation of climate policies around the world.
- <sup>97</sup> Emissions pricing or other policies aimed at reducing emissions may increase costs for emissions intensive businesses and cause them to lose market share to international competitors that do not face similar costs. If this causes production and investment to shift in a way that increases global emissions, it would be counter to the intended effect of the policy, as Aotearoa would be exporting emissions rather than reducing them.
- <sup>98</sup> During consultation, some submitters expressed concern that the pace of our proposed emissions budgets could impact their competitiveness and result in emissions leakage.
- <sup>99</sup> In Aotearoa, emissions leakage risk is currently managed by providing potentially affected industrial activities with free allocation of units under the New Zealand Emissions Trading Scheme (NZ ETS). This substantially reduces the cost of the NZ ETS for these businesses. It is also expected that when biogenic methane and nitrous oxide emissions are priced, agricultural activities will receive a high level of free allocation that is likely to protect against emissions leakage. *Chapter 15: How we earn our way in the world of the 2021 Supporting Evidence* goes into the issue of emissions leakage in more detail.
- <sup>100</sup> Providing free allocation is similar to what is done in other countries that have emissions pricing. It has been found to be effective – studies have been unable to find evidence of substantial emissions leakage caused by these pricing schemes. We are therefore confident that emissions leakage risk can be addressed, so is not a reason to shy away from reducing emissions.
- <sup>101</sup> Over time as budget levels step down it may be necessary to look at other tools for addressing emissions leakage risk. Options for the longer term include consumption charges, product standards, and border carbon adjustments. However, these would need to be considered carefully as they may come with challenges – particularly around how consistent they are with international trade rules.
- <sup>102</sup> It is important to recognise that climate action can benefit competitiveness too. While it is unlikely that there will be a uniform price on carbon across the world in the foreseeable future, markets can shift much faster than government policy. Customers are increasingly interested in the environmental credentials of the products they buy. This is partly driven by institutional investors pushing companies to reduce their supply chain emissions. This trend could well shrink the market for emissions intensive products in future.
- <sup>103</sup> Emissions leakage risk will also decrease as more countries adopt ambitious targets to reduce emissions and policies to achieve them.

<sup>104</sup> The Commission will be doing further analysis on emissions leakage. In relation to agriculture, we will consider the risk of emissions leakage when providing advice on the level of assistance that should be provided to participants in the agricultural emissions pricing system. We expect to provide this advice in 2022.

<sup>105</sup> We will also advise on the phase out of industrial free allocation in the NZ ETS. Industrial free allocation phase-out rates could be slowed down or sped up depending on whether an ongoing and substantial risk of emissions leakage becomes evident. The emissions associated with a slower phase-out rate would then have to be compensated for by making further emissions reductions in other sectors.

<sup>106</sup> Policies other than emissions pricing can also contribute to emissions leakage risk. In our ongoing role in advising on policy direction and monitoring the emissions reduction plan, we will look at the design of policies with a view to minimise or otherwise manage emissions leakage risks.

## 8.4 Specific challenges for Māori-collectives and Māori in the workforce

<sup>107</sup> Regardless of the level at which emissions budgets are set, there are specific challenges for Māori-collectives and Māori in the workforce that the Government will need to address.

### 8.4.1 Māori-collectives

<sup>108</sup> The Māori economy (Box 8.3) represents \$69 billion or more in assets and is growing.

<sup>109</sup> Collectively, Māori own about \$24 billion in primary sector assets. Māori own 50% of the country's fishing quota, 40% of forestry, 30% of its lamb production, 30% of its sheep and beef production, 10% of its dairy production and 10% of kiwifruit production. The majority of the Māori economy sits outside the primary sector, and includes property, private equity, financial assets, tourism, geothermal energy, and technology and innovation.

### Box 8.3: The Māori economy

The term 'Māori Economy' captures a broad range of inputs which includes Iwi entities, Māori trusts and incorporations, Māori Authorities, Māori self-employed, and Māori employers. For the purposes of this report, we refer only to the component of the Māori economy comprised of Māori-collectives (definable by Iwi and hapū entities (such as PSGEs), Māori trusts and incorporations, and Māori Authorities).

As noted previously, in addition to whenua Māori being managed in accordance with tikanga and whakapapa, it is also subject to various legislation and regulations, which are often at conflict with Māori cultural values. Whenua Māori and associated operations account for a significant portion of the Māori-collectives' asset base. For this reason, and because whenua Māori has been the target of numerous government initiatives over the years, Māori-collectives are heavily invested in primary industries (forestry, fisheries, agriculture), and tourism.

- <sup>110</sup> Although Māori freehold land is estimated to comprise about 1.4 million hectares in Aotearoa, nearly 60% of all Māori freehold land is considered marginal land (land use capabilities of 6, 7 and 8) and many parcels of Māori land are small and fragmented.
- <sup>111</sup> Disruptions to ownership, governance and land management have led to Māori collectively-owned land being underutilised. The Ministry for Business, Innovation and Employment estimates that one third of Māori land has potential for development or increased utility.
- <sup>112</sup> For our recommended emissions budgets to be fair, inclusive and equitable for Iwi/Māori, the Government will need to consider the different priorities and historic inequities that Iwi/Māori face. The unjust acquisition and confiscation of Māori land, restrictive land management legislation, intervention by Crown officials or Crown appointed Trustees, and a significantly reduced population due to introduced diseases, left Māori alienated and disenfranchised.
- <sup>113</sup> By the mid-twentieth century, land that remained in Māori ownership was typically unproductive or the original owners had lost control – for example, by being locked into perpetual leases or under Crown-imposed management.
- <sup>114</sup> As an example of the impact of this, a significant amount of Māori collectively-owned land is locked up in production forestry. This is the case, for example, for Central North Island Forest, Lake Taupō Forest Trust, Lake Rotoaira Forest Trust. The Government will need to ensure that the policies it puts in place do not compound historic injustices, existing barriers or place disproportionate restrictions on Iwi/Māori.

- 115 Iwi/Māori need to be able to exercise their rangatiratanga and mana motuhake to make decisions on how to use or develop their land to meet their collective and culturally driven aspirations and needs. We heard through engagement that some Māori-collectives have received forested land through Te Tiriti o Waitangi/The Treaty of Waitangi settlements. If these forests were established before 1990, they are encumbered with a deforestation liability. However, Māori-collectives may have alternative aspirations for the use of their culturally significant land such as papakāinga development.
- 116 Consideration should also be given to any policies that could disadvantage Māori-collectives operating in the agriculture sector. When agricultural emissions are priced, free allocation should be provided in a way that does not disadvantage operators who were already managing resources in alignment with their kaitiaki values.
- 117 In addition, some Māori-collectives may not operate intensively due to insufficient resources or being precluded from exercising their decision-making functions as a result of historic arrangements, such as perpetual leases. These Māori-collectives should also not be disadvantaged. Any approach that uses grandparenting – such as free allocation based on existing land use – is likely to be problematic.
- 118 Approaches such as grandparenting have the potential to compound historic grievances, particularly for Iwi with limited resources. This could also add complexity for Iwi where redress assets are returned through a range of settlement entities. Potentially this can limit the ability for Iwi to exercise their rangatiratanga under Te Tiriti o Waitangi/The Treaty of Waitangi.
- 119 Access to reliable information and quality advice is a key enabler to enhance participation for Māori-collectives and ensure equitable outcomes. Establishing an emissions profile for Māori-collectives will improve their ability to manage and monitor emissions within their takiwā in the context of their broader social, cultural, economic and environmental objectives.
- 120 These barriers will need to be addressed to enable Māori to fully participate in climate action, and ensure that Māori-collectives, businesses and workers are not disadvantaged. Any additional costs arising from climate policy could result in additional barriers for continued Māori economic development which support Iwi/Māori wellbeing outcomes.
- 121 Iwi/Māori feedback from submissions stressed that outcomes will be inequitable for Iwi/Māori if existing barriers inhibiting Māori economic development and cultural vitality, which have flow-through effects to social and environmental wellbeing, are not factored into policy design and decision making.
- 122 These issues are explored in more detail in *Chapter 19: Policy direction for an equitable transition for Iwi/Māori*.

## 8.4.2 Māori in the workforce

- <sup>123</sup> Māori individuals could experience more job change as a result of our recommended emissions budgets. In 2018, Māori in the workforce held about 16% of jobs. Our modelling suggests that Māori make up about 20% of those who gain jobs and about 13% of those who lose jobs across the first three emissions budget periods. However, Māori who need to retrain or learn new skills as employment changes may be particularly impacted.
- <sup>124</sup> BERL has estimated that the current income gap for Māori is \$2.6 billion per year, equating to \$140 less income per person per week for the working age Māori population. Over half of the working Māori population are in lower skilled jobs, and almost half are in jobs that have a high risk of being replaced by automation.
- <sup>125</sup> The employment impacts on Māori can be managed through targeted policy. The Crown-Māori Economic Development Strategy, He kai kei aku ringa, already has a goal of growing the future Māori workforce into higher-wage, higher-skilled jobs.
- <sup>126</sup> Iwi/Māori feedback from submissions emphasised the need to grow skilled employment to ensure a level playing field so that Māori are not faced with reduced employment or low-skilled employment as a result of our emissions budgets.
- <sup>127</sup> Education and training developed by Māori for Māori will be important for reducing existing inequities, as research indicates that current education and training providers are not serving Māori well.

## 8.5 How the transition could affect different regions and communities

- <sup>128</sup> In our consultation, councils and economic development agencies highlighted the need to understand the regional impacts of our recommended emissions budgets. Submitters also outlined concerns that communities could be impacted if there was significant land-use change away from pastoral farming into forestry.

### 8.5.1 Impacts on different regions

- <sup>129</sup> While the cost to the Aotearoa economy of our recommended emissions budgets is expected to be small, these costs will be distributed differently from region to region. How each region is impacted depends on the structure of its economy, its emissions profile, and its ability to adapt and plan for the transition to a low-emissions economy.
- <sup>130</sup> Some regions and communities of Aotearoa will be more affected by the climate transition than others. Communities that are reliant on high-emissions industries may see the closure of large businesses that provide significant employment for the community. This would have a big impact as major job losses at a local level can lead to entire communities being left vulnerable and dislocated. It is also important to consider how regions are connected, as an impact in one region could have flow on impacts to a neighbouring region.
- <sup>131</sup> Several of the key hard-to-abate sectors are located in specific regions of the country. Aluminium is manufactured in Southland, methanol in Taranaki, pulp and paper in the Bay of Plenty, cement and oil refining in Northland.

<sup>132</sup> The structure of a region’s economy has a big impact on its emissions, and therefore its exposure to policies put in place to meet our recommended emissions budgets. Regions that are reliant on primary industries, such as Taranaki, Southland, Waikato, and the West Coast, could be more exposed.

**Regional employment**

<sup>133</sup> Regions like Taranaki and the West Coast will be affected by the transition away from coal, oil, and fossil gas. Other regions could be affected by the closure of hard-to-abate industries, such as the closure of Tiwai Point aluminium smelter in Southland. This will have particular impacts on employment.

<sup>134</sup> We used our DIM-E model to examine the expected regional employment effects of our recommended emissions budgets. This models where job change could occur with net job change being the difference between job growth and job decline. Job decline does not necessarily mean that individuals would lose their jobs, as some of the change can occur through natural attrition.

<sup>135</sup> Overall, our DIM-E modelling estimates that most regions would experience net job gain over the three emissions budget periods compared to what would occur under current policy settings. However, Taranaki and the West Coast would experience net job loss over the three emissions budget periods (Figure 8.8). This is likely driven by the concentration of jobs in the oil, fossil gas, and mining sectors in these two regions (see Section 8.7.1). However, the extent of net job loss for the region would be less than for these sectors because the model estimates that there will be job growth in other sectors in these regions.



**Figure 8.8: The overall net change in jobs that our modelling estimates could occur in each region under the demonstration path relative to the Current Policy Reference case**

Source: DIM-E simulation results



### *Regions' ability to transition*

- 136 The size and structure of a region's economy also indicates how able it is to adjust to the transition. Some regions will have a greater ability to adjust than others. Larger and wealthier regions are likely to have more resources to plan for the transition. Other regions may need more support.
- 137 Localised transition planning will be needed in areas where there is significant employment in emissions intensive sectors. Transition planning should support regional economic diversification and could look to create new industries, based on the skills, resources, and aspirations of the local community and Iwi/hapū.

### **8.5.2 Impacts of land-use change on communities**

- 138 Increasing the amount of native and exotic forest – afforestation – could play a role in helping achieve the country's emissions budgets and emissions reduction targets.
- 139 The impacts of any afforestation will depend on the scale, pace, and species of trees that are grown, the purpose for which the trees are grown, the type of land that is afforested, and the land use that is displaced.
- 140 Under current policy settings, the scale of afforestation that is expected to occur would in large part be driven by the emissions price in the NZ ETS. Other financial incentives, such as the One Billion Trees programme, and land and commodity prices, would also play their part.
- 141 Current policy settings and sector infrastructure heavily favour the planting of exotic *Pinus radiata* over other species. Increasing emissions prices would also incentivise greater establishment of permanent exotic carbon forestry.
- 142 We heard throughout our engagement and consultation about the concern that whole farms could be planted in exotic forests, either for production forestry or permanent carbon forestry. This could have negative impacts on rural communities and provincial centres that are reliant on the food and fibre industry for employment. This would include not only those working on the land, but also those involved in transporting and processing food and fibre products, and providing services to rural communities.
- 143 There are different estimates of the number of jobs provided across the value chain from a hectare of sheep and beef farming, production forestry, and permanent carbon forestry. The number of jobs in forestry and sheep and beef farming vary by time and location, and depend on the type of forestry. It is therefore difficult to compare the relative employment from each of these different land uses.
- 144 However, wholesale or large conversions of sheep and beef farmland to forestry would affect communities and reduce employment in the immediate area, as previous experience shows that forestry-related work is likely to be more concentrated in larger rural towns, particularly those involved in processing.
- 145 We have factored the potential impact on communities and the wider food and fibre sector from afforestation into our emissions budgets analysis. This is in line with our principle to focus on decarbonising the economy to ensure that Aotearoa can sustain net zero long-lived greenhouse gas emissions beyond 2050.
- 146 The impact on communities from afforestation can be managed through policy.
- 147 Constraining the price incentive for afforestation through the NZ ETS could help limit the overall scale of afforestation, including permanent exotic forests. However, it would not determine where this afforestation would occur, or remedy the relative disincentive for native species.

- 148 Managing where afforestation happens would likely require a regulatory approach, through  
planning rules or alternative interventions that place restrictions on land-use change.
- 149 Capacity-building and advisory services for landowners focused on integrating trees or forestry  
onto farms rather than wholesale land-use change could also limit the impacts of afforestation. This  
could be facilitated by developing carbon monitoring systems that allow for tracking and rewarding  
additional sequestration from smaller or dispersed areas of trees.
- 150 Pests will be a major issue when establishing new forests and maintaining existing forests, as they  
often eat seedlings and young trees. This can completely destroy newly established forests and  
compromise the long-term health of existing forests. Managing or eradicating pests will likely be  
labour intensive in the absence of large advances in technology.
- 151 Changing the balance of incentives for exotic versus native afforestation would also alter the impact  
on rural communities and the broader food and fibre sector. Establishing native forests might  
generate fewer jobs than exotic production forestry, particularly if the land is left to revert to natives  
rather than being planted, and if there is no intention to selectively harvest.
- 152 However, native afforestation could be suitable for areas of less-productive land where exotic  
afforestation is inappropriate. It would therefore not come at the expense of other economic activity.
- 153 Less productive land could be afforested with little impact on farming productivity or employment.  
Many sheep and beef farms have areas of land that are steep and susceptible to erosion. These  
areas could be particularly suitable for forests that would not be clear-fell harvested. This would also  
include Crown owned land.
- 154 The Biological Emissions Reference Group estimated that approximately 6% of hill country sheep  
and beef farms could be afforested without negatively affecting production. This equates to  
approximately 250,000 hectares. Recent studies put the total potential area of highly erodible land  
that could be suitable for forests across the country at 1,200,000 to 1,400,000 hectares. Other  
studies estimate that there might be 740,000 hectares that could naturally regenerate if pests are  
managed.
- 155 Efforts could also be made to promote a native forest industry, probably using selective harvesting  
techniques. This could have particular relevance for Iwi/Māori. Native afforestation could be  
incentivised by extending grant schemes such as One Billion Trees or by developing ecosystem  
services payment schemes that could reward the other environmental benefits of native forests.
- 156 Policies for managing the scale of afforestation, whether it is exotic or natives, and where  
afforestation occurs are discussed further in *Chapter 18: Policy direction for forests and other  
carbon stocks*.

## 8.6 How the transition could affect different households, their health, cost of living and access to transport

- 157 This section looks at the impact of our recommended emissions budget levels on households and  
communities. It considers the benefits to health and health equity, how households' energy and  
petrol bills might change, and impacts on New Zealanders' ability to get around.
- 158 We heard from some submitters during consultation that there are risks that the low-emissions  
transition will exacerbate inequities already experienced by many people in socioeconomically  
disadvantaged groups – including Māori and Pacific communities, low-income New Zealanders,  
women, and people with disabilities. These groups are also often hit the hardest in recessions.

159 In our assessment, we found that some households could bear more cost and benefit less from our recommended emissions budgets. Those on lower incomes, the elderly, people with disabilities, some Māori and Pasifika households, or those that live in remote areas could be disproportionately impacted despite benefiting the most from low-emissions technologies and practices. However, this could be managed through targeted policy.

### 8.6.1 Health benefits from action on climate change

160 Many of the actions Aotearoa could take to address climate change will have broader health benefits for people. People will benefit from warmer, drier homes, better air quality, and from walking and cycling more. These benefits are significant and immediate. They can help to improve the quality of life of current and future generations, reduce the burden on the health system, and improve productivity. The benefits add to the case for strong action to reduce emissions.

161 Global action to reduce emissions would also reduce negative health impacts from a changing climate. The health system could see effects such as increased heat stress from warmer temperatures and temperature extremes, changing patterns of infectious disease, and adverse mental health impacts. The health impacts of climate change would be unlikely to be spread evenly across the population, with more people in vulnerable groups being more exposed.

#### *Benefits of warmer, drier homes*

162 Warmer, drier homes and improved house design could improve people's health and improve health equity. Warmer, drier homes can have significant health benefits for those people on low incomes, including increased comfort, reduced time off school or work, fewer GP visits, fewer hospital admissions for circulatory and respiratory illnesses, reduced pharmaceutical costs, and reduced mortality.

163 A cohort of Aotearoa researchers evaluated the Warm Up New Zealand programme and found that low-income households received greater health benefits from installing insulation than higher income households. This is because those on higher incomes are more able to afford to live in higher quality homes. The evaluation found that low-income households saved on average \$818 each per year in health costs after insulation was installed, compared to \$227 for higher income households. The health benefits were found to be significantly greater than any potential bill savings.

#### *Benefits from reduced air pollution*

164 New Zealanders will benefit from less respiratory and cardiovascular illness by moving away from burning fossil fuels. Petrol and diesel vehicles, fossil gas heaters and stoves, and fossil fuel powered industry all contribute to indoor and outdoor air pollution.

165 Modelling carried out for the Health Research Council of New Zealand, Ministry for the Environment, Ministry of Transport and Waka Kotahi found that the social cost of air pollution is significant – it is estimated to cost Aotearoa \$4.28 billion every year. Of this, 22% is attributed to pollution from vehicles, equating to \$940 million.

166 In 2013, researchers at Utrecht University in the Netherlands reviewed 41 scientific studies and found that children are 42% more likely to develop asthma if they live in a home that uses fossil gas for cooking. Another study of over 12,000 households in Australia attributes 12% of childhood asthma to fossil gas cooking in the home. Adequate ventilation can reduce but not eliminate this risk.

167 Indoor air pollution from using fossil gas for heating or cooking can disproportionately impact people in lower income households, who may not be able to afford to properly maintain fossil gas appliances and are proportionately more likely to rent homes that use older fossil gas appliances.

### Benefits from increased walking and cycling

<sup>168</sup> New Zealanders will benefit from increased fitness by using cars less and walking and cycling more. This can lead to less chronic disease and improved overall wellbeing. Modelling by researchers at the University of Otago, University of Melbourne, and University of Oxford suggests that switching from short car journeys to a combination of walking and cycling improves people’s health, reduces emissions and reduces costs for the healthcare system.

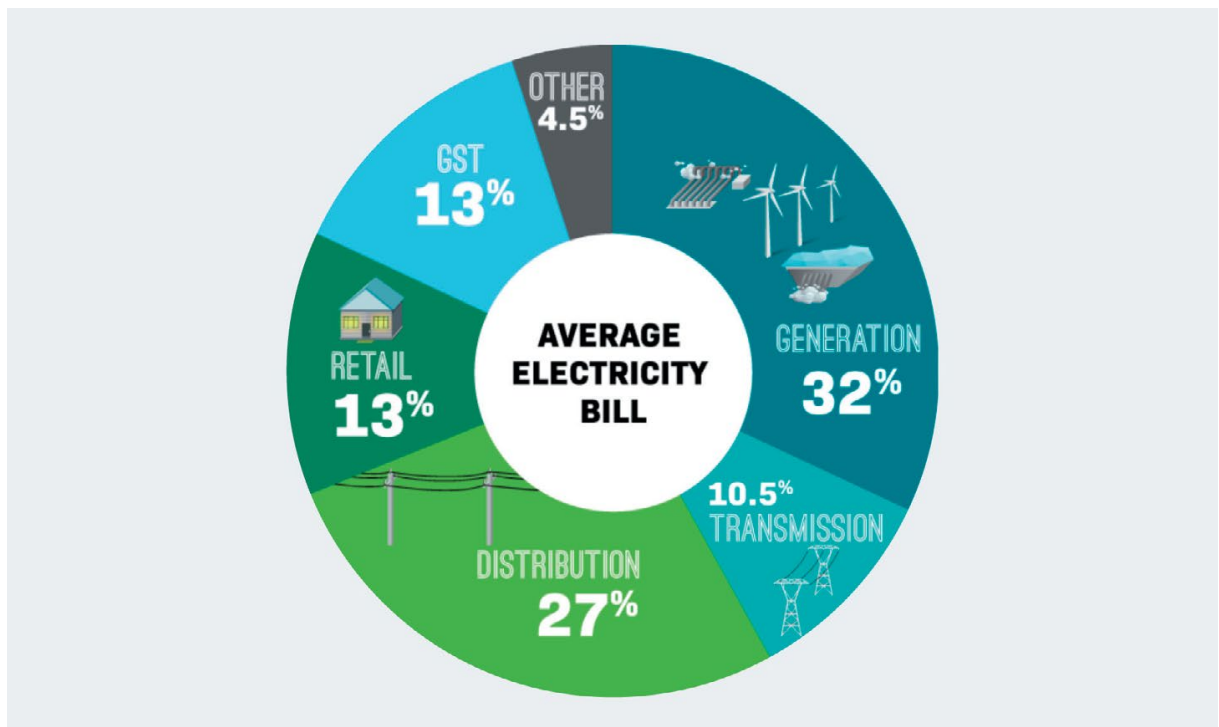
<sup>169</sup> Over the lifetime of the current Aotearoa population, these savings could be in the order of NZ\$127 million if 25% of trips under 1km were switched to walking, or up to NZ\$2.1 billion if all trips under 1km were switched to walking and all trips between 1 and 5km were switched to cycling.

<sup>170</sup> More detail on the health benefits can be found in *Chapter 16: Households and communities* of our *2021 Supporting Evidence*.

### 8.6.2 Electricity bills are unlikely to change due to emissions budgets

<sup>171</sup> Our analysis suggests that our recommended emissions budgets are unlikely to increase overall household electricity bills for heating, cooking, and lighting.

<sup>172</sup> However, exactly how household electricity bills could change is highly uncertain, and depends on both electricity prices and household electricity demand. The price that consumers pay for electricity covers the cost of generating the electricity as well as the lines and infrastructure that distribute it. There are also taxes, profit margins and other costs which contribute to an electricity bill (Figure 8.9).

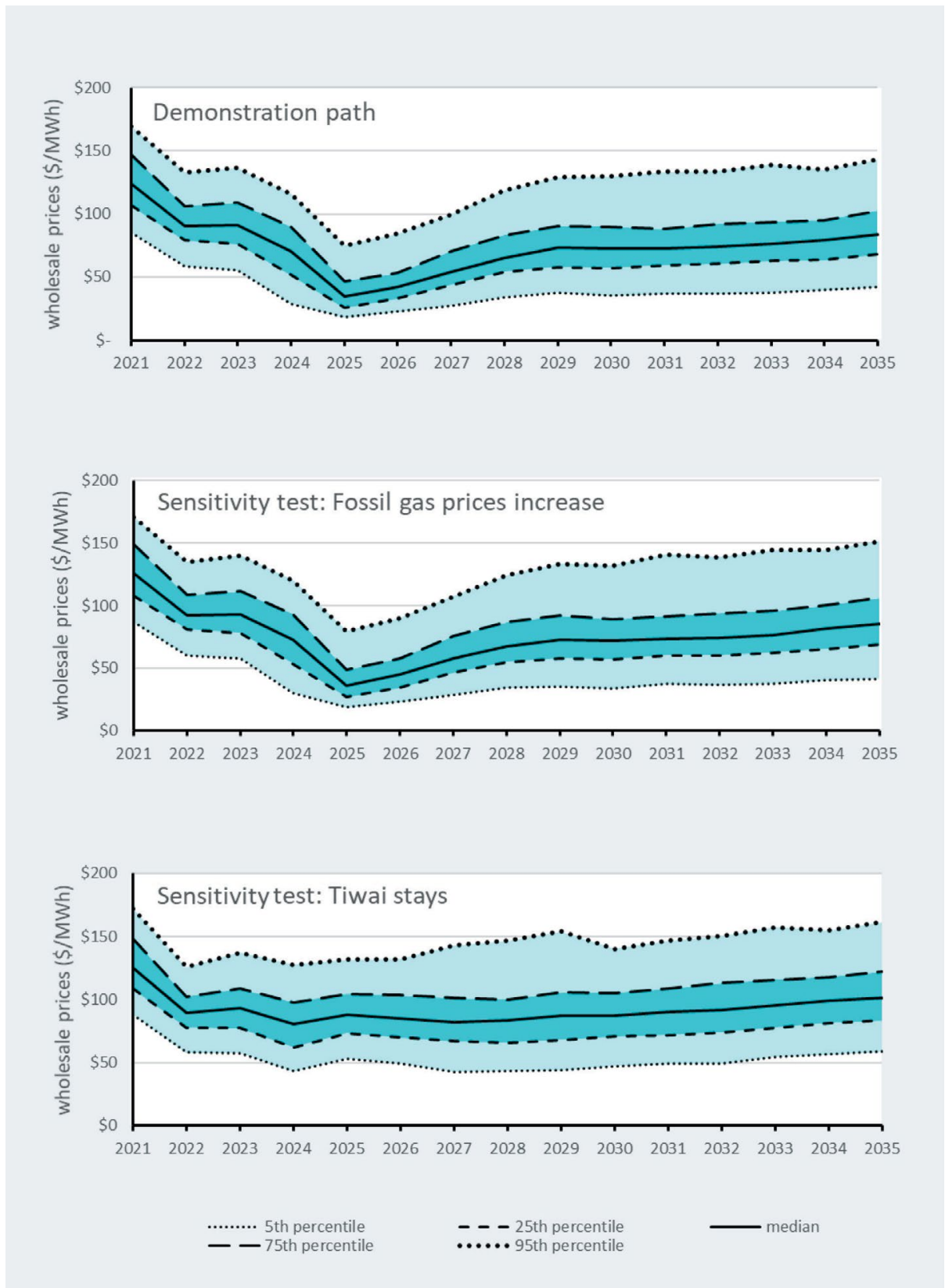


**Figure 8.9: The typical cost components of an electricity bill today**

Source: Electricity Authority

### *Wholesale electricity prices are expected to vary year-to-year*

- 173 Electricity prices vary due to a range of factors beyond climate policy, such as a consumer's demand, the weather, supply and demand of fossil gas, and pricing structures.
- 174 We used the EMarket model to understand how wholesale prices might evolve under the demonstration path. The model electricity price reflects the balance of supply and demand, the cost of operating existing generation and the new generation that needs to be built. This corresponds to the generation part of Figure 8.9 above – only one component of the household bill.
- 175 Our modelling suggests that, by taking action to meet our recommended emissions budgets, wholesale electricity prices across the country would continue to vary from year to year, depending on inflows into the hydro lakes. Prices start relatively higher, reflecting 2021 market conditions of low hydro storage and a shortage of fossil gas.
- 176 Over the next few years, the displacement of baseload fossil gas generation with lower cost wind and geothermal would reduce the average price. The assumed closure of the Tiwai Point aluminium smelter at the end of 2024 causes a further suppression of the price. The modelling suggests that the average wholesale price would eventually stabilise at around \$70-\$80/MWh (Figure 8.10) – this price covers the costs of building new generation to match the growth in electricity demand.
- 177 We carried out sensitivity analysis to test the uncertainty in wholesale electricity prices. We tested a sensitivity where the Tiwai Point aluminium smelter remains open and one where fossil gas prices are higher.
- 178 Our modelling estimates that, if the smelter was to continue operating beyond 2024, the average wholesale price would be around \$20/MWh higher, compared to the demonstration path, from about 2025 to 2035 (Figure 8.10). The higher price would occur as more renewable electricity generation would need to be built to meet the growth in demand.
- 179 In the fossil gas price sensitivity, we assumed that fossil gas prices increase by 20% by 2030. Our modelling suggests this would have a minimal effect on the wholesale electricity price (Figure 8.10). This is because much of the fossil gas generation that currently runs would have been displaced by renewable generation by 2025.



**Figure 8.10: Modelled wholesale electricity prices in real dollars in the demonstration path and for two sensitivity tests. The annual variation shows the impact of inflows into the hydro lakes**  
 Source: Commission analysis

180 Wholesale electricity prices are only one component of a household electricity bill. Electricity retailers would see these wholesale prices and determine how to pass these costs onto households – they often do this in a way that removes the day-to-day, month-to-month, and year-to-year variability.

181 Household electricity bills are also affected by changes in transmission and distribution costs. Figure 8.9 shows these make up a significant proportion of the bill for households, as well as for businesses and industrial consumers. Household bills could be significantly impacted by any changes in the cost of the transmission and distribution infrastructure and how those costs are allocated – for example, as a result of government changes to electricity pricing structures.

### *Electricity prices vary around the country*

182 Our recommended emissions budgets are unlikely to change regional electricity prices beyond the level of regional variation that already exists. However, there are numerous factors outside those in our emissions budgets that make future electricity prices highly uncertain.

183 Households' electricity bills vary from region to region, and even within regions. Different areas already face varying electricity prices. For example, electricity pricing surveys show that households in Kerikeri and the West Coast pay more for electricity than the national average. There can be as much as a 50% variation between regions.

184 This reflects the cost of not only generating electricity, but also transmitting and distributing it. Smaller communities and communities further away from where electricity is generated often pay higher prices. Lines companies have fixed costs that they need to recover from their consumers. Having a smaller base of consumers to recover network costs from, like in Kerikeri and the West Coast, means these charges may be higher than more populous areas or areas with different pricing structures that incentivise consumers to reduce how much electricity they use at peak times.

185 Average household electricity demand varies across Aotearoa and depends on things like climatic conditions, level of home heating, and whether the household uses fossil gas, electricity, or wood for heating. For example, the average household electricity consumption is twice as much in Queenstown as in Westport.

### *Electricity bills will reduce from improving energy efficiency*

186 Household electricity bills also depend on demand. Households that make energy efficiency improvements may be able to use less electricity or improve the level of comfort in their homes. Households can increase energy efficiency by, for example, switching to heat pumps, or installing insulation or LED lightbulbs.

187 Efficiency improvements can also reduce electricity use at peak times – in the mornings, evenings and in winter. Reducing demand at peak times helps the entire energy system as there is less need to upgrade electricity lines, which can reduce costs for all households. Scaling these benefits would require technologies for demand response, and innovative business and pricing models. Electricity pricing incentives, such as low-cost night rates, combined with smart charging technology could be effective.

188 Household electricity bills could also increase if a household purchases an EV. However, overall household energy bills could decrease if that EV is replacing a petrol car.

### *Some households may need support*

<sup>189</sup> Lower-income households, some Māori and Pasifika households, elderly, and people with disabilities will benefit more from making energy efficiency improvements. These groups are more likely to live in older, poorly insulated homes, and would therefore benefit more from cost savings, or improved health from being able to use savings for additional heating.

<sup>190</sup> The impact on lower-income households can be managed through policy. Government will need to assist those on lower incomes with the upfront cost for energy efficiency improvements.

<sup>191</sup> The Government's Warmer Kiwi Homes programme continues to provide funding to those on low incomes who own their own home to install insulation or more efficient heating. The Government has also introduced healthy home standards for rental homes that include standards for insulation and heating.

<sup>192</sup> Continued intervention will be needed to ensure that lower-income households can access these benefits. The Government will need to assess whether the existing programmes are delivering at an appropriate pace and scale, and consider whether these programmes have broader impacts on rental prices and affordability.

<sup>193</sup> *Chapter 20: Policy direction for a fair, inclusive and equitable transition* considers the direction of policy in this space.

### **8.6.3 Fossil gas bills are likely to increase from emissions budgets**

<sup>194</sup> Households that use fossil gas for heating and cooking are likely to see an increase in their fossil gas bills as a result of our recommended emissions budgets. The impact of our emissions budgets could increase the average household gas bill in 2035 by up to \$300 a year for homes with reticulated fossil gas and liquified petroleum gas.

<sup>195</sup> However, fossil gas prices are hard to predict as the fossil gas industry is at the beginning of a transition. This introduces considerable uncertainty into future fossil gas prices. The fossil gas transition story has many facets – these are discussed in *Chapter 5: Recommended emissions budgets* and *Chapter 15: Policy direction for energy, industry and buildings*.

<sup>196</sup> The transition away from fossil gas may mean that, over time, many households would benefit from replacing fossil gas appliances. The costs could come if households were to replace fossil gas appliances before the end of their useful life. There are also other costs associated with removing fossil gas pipelines into a home, additional wiring or changes to electricity meter boards, and the associated building work.

<sup>197</sup> Households could reduce costs by not installing new fossil gas appliances, and replacing existing fossil gas appliances with low-emissions alternatives when the appliance comes to the end of its life. We have specifically factored replacing appliances at the end of their useful life into our analysis of emissions budgets to avoid unnecessary cost.

### *Some households may need support*

<sup>198</sup> The impact on households of increasing fossil gas bills can be managed through the pace of the transition away from fossil gas and through policy.

<sup>199</sup> Analysis for the Electricity Price Review shows that those on higher incomes are more likely to use fossil gas. However, in policy design, the Government will need to pay particular attention to low-income households that use fossil gas, and may not have the money for the upfront conversion cost, or may rent homes with fossil gas appliances or heating.



200 Landlords who own properties with fossil gas appliances may not have any incentive to replace them with lower emissions, low cost options, as they would not benefit from the savings in running costs. There may be some efficiencies and cost savings from replacing old fossil gas heating systems with modern electric systems.

201 Portable fossil gas heaters are still used by some households in Aotearoa. They are used proportionately more in the North Island, particularly in Gisborne and Northland. These heaters tend to be used by lower-income households due to the low upfront cost and the ease of budgeting for heating bills.

202 Portable fossil gas heaters contribute to mouldy homes and cause health problems. Although the number of these heaters is decreasing, replacing them with more efficient low-emissions options will take continued government support. However, this will flow through to healthier households and less burden on the health system.

#### **8.6.4 Fuel costs and access to transport**

203 Transport is crucial to our livelihoods, wellbeing and economy. It connects us to our families, allows us to participate in wider society, and ensures we can access work, education, healthcare, supermarkets, banks, and activities.

204 The current system in Aotearoa tends to prioritise travel by car and disadvantages those people who do not have easy access to vehicles. This may include some of the country's youth, older people, people with disabilities, Māori, Pasifika, and low-income communities.

##### *Petrol and diesel costs are likely to increase*

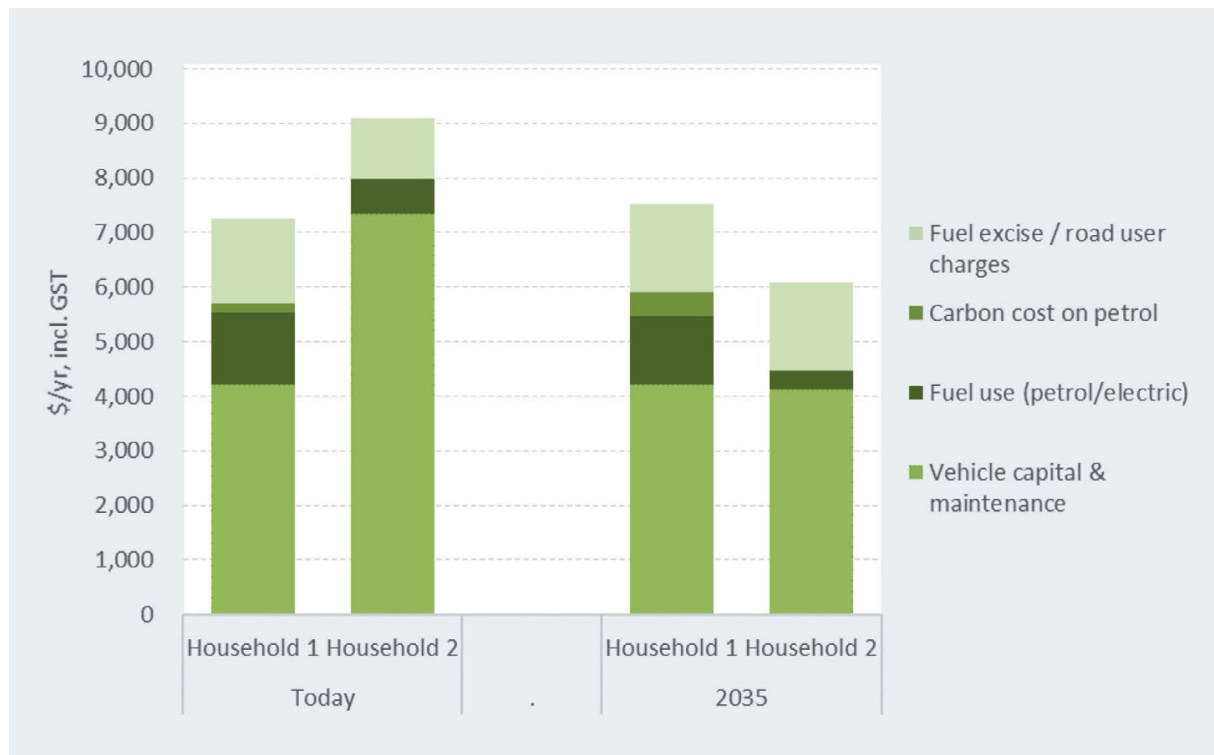
205 Improving fuel efficiency, a shift to EVs and more public transport, walking and cycling will all be important parts of meeting our recommended emissions budgets.

206 Our modelling indicates petrol and diesel prices could increase by up to 30 cents per litre in 2035 as a result of our recommended emissions budgets. The average household may expect to see transport costs increase, including increases in the cost of petrol and vehicle maintenance.

##### *Increasing transport bills can be offset*

207 However, there are ways to offset this increase. Households could purchase more fuel-efficient cars or walk, cycle, use public transport, or work from home more.

208 In 2035, our modelling indicates that households which replace an ICE car with an electric one could save more than \$1,300 a year. This is because EVs are already cheaper to run, and will become cheaper to buy than an ICE vehicle in the future. Although electricity bills will increase, the total household energy bill will decrease for households with EVs. The total private vehicle and energy costs for households with and without an EVs are shown in Figure 8.11.



**Figure 8.11: Average annual vehicle and fuels costs under the demonstration path. Household 1 has an ICE vehicle and household 2 has an EV**

Source: Commission analysis

### Ensuring New Zealanders have access to transport

- <sup>209</sup> Lower-income households may be less able to afford an EV than wealthier households due to the upfront costs. Currently the cheapest second-hand EVs still cost over \$10,000. It may also be challenging for those who cannot charge an EV at home, for example people living in apartments.
- <sup>210</sup> We have heard throughout our engagement and consultation that this challenge is particularly relevant for people with disabilities who often rely on a vehicle to get around, and for some Māori households who are disproportionately represented among those with low incomes.
- <sup>211</sup> Access to transport is a particular issue for some Māori. Transport is hugely important for Māori to connect to their whānau, haukāinga, and tūrangawaewae. About a quarter of Māori in Aotearoa live in Auckland. However, many have whakapapa connections outside of Auckland and may need to travel long distances to participate in Iwi, hapū, and whānau activities and events. Some Māori households are large or intergenerational and require larger vehicles. Transport, particularly utes, is also a key enabler for the haukāinga to collect resources and provide services to the marae.
- <sup>212</sup> Some people and businesses have specific transport needs that the transition will need to address. Farmers, contractors and other people in rural communities need vehicles that can carry heavy loads or access rugged or remote locations. Single- or double-cab utes, farm bikes and quad bikes are an essential part of farming and rural landscapes. Cost-effective and low-emissions solutions for these vehicles are available now, or will be in the next few years.

### *Some households may need support*

- <sup>213</sup> The Government will need to provide proactive, targeted support to ensure that New Zealanders have access to transport. This will need to help lower-income households reap the benefits of EVs and bring down costs. Policies that encourage a second-hand EV market, car sharing and leasing, and support to purchase an EV or electric bike could help.
- <sup>214</sup> More public transport, walking and cycling will have a positive impact, particularly on those who live in cities and larger urban areas. Central and local government will need to provide more and better transport options to increase access to transport for people with disabilities, on low incomes, or with large families. Currently public transport is not always a realistic option for people with disabilities and many therefore rely on cars. Good policy and planning will be needed to ensure that transport systems are integrated and accessible.
- <sup>215</sup> Submitters on our consultation also noted the importance of integrating transport into urban form. It will be important that central and local government factor this into their planning and decision-making.

## **8.7 How the transition could affect employment**

- <sup>216</sup> There will be inevitable changes to employment and jobs as Aotearoa moves towards a low-emissions society. This will flow through to the skillsets that are needed.
- <sup>217</sup> Transition to a low-emissions economy may see the closure of large businesses. Some of these businesses may be located in specific regions around the country and provide significant employment for the community. Closing could have a big impact on these communities. Some affected workers may have the mobility and means to acquire new jobs in other industries and regions. Others may not.
- <sup>218</sup> Rio Tinto has announced the Tiwai Point aluminium smelter will close. Other emissions-intensive industries and large employers have also announced strategic reviews. There are many reasons for such industry closures besides climate change policy. Rio Tinto cited energy costs and a challenging aluminium outlook. Closure, resizing or repurposing of these industries would have an impact on those people who work there.
- <sup>219</sup> There will also be industries that grow and new industries that emerge as part of the transition. There will be more opportunities for jobs in the circular economy and bioeconomy, in new industries such as hydrogen, in renewable electricity as transport and process heat are electrified, in energy efficiency and home energy audits, and advisory services for managing emissions on farms.
- <sup>220</sup> The following sections consider how employment could change in different sectors, and the impacts on different population groups. It also outlines at a high level the types of skillsets that will be needed in the jobs that emerge as part of the transition.
- <sup>221</sup> In response to feedback from consultation, we have carried out additional analysis on jobs, particularly the jobs that could be gained as a result of climate action. This analysis draws on results from modelling, as well as analysis by others.
- <sup>222</sup> We commissioned a new model called the Distributional Impacts Microsimulation for Employment (DIM-E) to provide information on the jobs that could be gained and lost as a result of the climate transition. The DIM-E model can only tell us about sectors already existing, however new sectors will emerge as part of the transition. The DIM-E model draws on data from Stats NZ (see Box 8.4 for the disclaimers).

<sup>223</sup> We also draw on analysis from the results of ENZ modelling. The ENZ model provides more technological and sectoral detail than the C-PLAN and DIM-E models, including on some emerging sectors (see *Chapter 4: Evidence and models* for more detail on our models). A more detailed description of what is included in the ENZ model can be found in *Chapter 11: Where are we currently heading of our 2021 Supporting Evidence*.

#### Box 8.4: Disclaimers for output produced from Stats NZ data

##### **Disclaimer for output produced from Stats NZ surveys or Census data:**

Access to the data used in this study was provided by Stats NZ under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in this study are the work of the author, not Stats NZ or individual data suppliers.

##### **Disclaimer for output produced from the IDI and/or LBD:**

These results are not official statistics. They have been created for research purposes from the Integrated Data Infrastructure (IDI) and/or Longitudinal Business Database (LBD) which is carefully managed by Stats NZ. For more information, please visit <https://www.stats.govt.nz/integrated-data/>.

##### **Disclaimer for Inland Revenue tax data:**

The results are based in part on tax data supplied by Inland Revenue to Stats NZ under the Tax Administration Act 1994 for statistical purposes. Any discussion of data limitations or weaknesses is in the context of using the IDI for statistical purposes, and is not related to the data's ability to support Inland Revenue's core operational requirements.

### 8.7.1 There will be fewer jobs in fossil fuel sectors

<sup>224</sup> The coal mining and oil and gas sectors, and the services that support them, will be impacted by the transition away from fossil fuels. This would particularly affect Taranaki and the West Coast where most of these jobs are located.

<sup>225</sup> Our recommended emissions budgets could see fossil gas and oil production reduce by about 60% by 2035 relative to 2019, compared to 40% under current policy settings.

<sup>226</sup> Our DIM-E modelling indicates there would be about 500 fewer jobs in these fossil fuel sectors by 2035 under the policy settings we have now. Taking action to meet our recommended emissions budgets would result in about 1400 fewer jobs in these sectors by 2035 – an additional 1,000 fewer jobs compared to under current policy settings (see Figure 8.12).

<sup>227</sup> This does not include the approximately 270 workers at Methanex. Like most businesses, Methanex will consider a variety of factors when making decisions about the future of their production facilities. Methanex recently announced that they would mothball one of their three methanol production facilities due to insecure gas supply. This would result in 75 permanent workers losing their jobs.

<sup>228</sup> Many of the workers in the oil and gas sector are highly skilled and therefore have high paying jobs. Their skillsets include engineering, earth sciences, surveying and logistics. These skillsets could be valuable in other sectors, including sectors emerging as part of the transition to a low-emissions economy.

<sup>229</sup> Changes in how we use fossil gas will also flow through to those working in gasfitting. In 2019/2020, there were about 5,700 licensed gasfitters in Aotearoa. Most gasfitters also work in plumbing, so the number of jobs that could be impacted by the climate transition is difficult to predict.

230 We heard through consultation that while the use of fossil gas needs to reduce over time, gasfitting skillsets will be important for maintaining and potentially decommissioning the existing fossil gas infrastructure, and for building up low-emissions hydrogen and biogas industries. There is a risk that the skillsets to do this could disappear if the number of people entering gasfitting apprenticeships reduces.

231 Gasfitting apprenticeships are 5 years. New training and certification would need to be developed for new low-emissions gases, particularly for hydrogen given its different chemical properties. Before developing any training on new low-emissions gases, the gasfitting industry would need more certainty about the technologies coming along and what those technologies would be used for.



**Figure 8.12: The average annual change in employment in the fossil gas, oil and coal sectors in each emissions budget period under the current policy reference case and the demonstration path**

Source: DIM-E simulation results

### 8.7.2 There will be fewer motor mechanics

232 Motor mechanics will also be impacted by changes in the transport sector, including the uptake of EVs and the shift to more walking, cycling and public transport. EVs require less maintenance as they have fewer parts, and do not need oil changes or spark plugs to be replaced. They also have less wear on brakes due to regenerative braking, but have more wear on tyres as they are heavier.

233 In 2018, there were about 17,700 motor mechanics across Aotearoa. Under current policy settings, the number of mechanics would need to increase to 20,300 – 20,800 as the population grows and more vehicles are on the road.

234 Our recommended emissions budgets could see the number of mechanics reduce from about 17,700 in 2018 to 15,400 – 16,800 by 2035. This would mean that there would be 900 – 2,300 fewer motor mechanics in 2035 compared to in 2018. This is based on a simplified assumption that all mechanics maintain light passenger and commercial vehicles. As a result, this is likely to overestimate the job impact.

235 While these numbers help to provide some indication, there are a number of things that are not factored in. This does not factor in the potential impact of disruptive technologies such as self-driving cars, which could impact the size of the fleet in Aotearoa.

236 Mechanics are already upskilling as cars are increasingly becoming more complex, incorporating new technologies, computers, and software. Mechanics will need further upskilling for maintaining and repairing EVs given the electrical systems and different drivetrain.

237 Beyond car maintenance, there are also likely to be new jobs in refurbishing and recycling batteries. There is unlikely to be any change in the number of jobs in car manufacturing as Aotearoa imports vehicles. Depending on where the market goes, there may be a new market retrofitting existing vehicles with electric drivetrains.

### 8.7.3 There will be more jobs in renewable electricity

238 New jobs will be created in renewable electricity. Renewable electricity generation will need to increase to meet our recommended emissions budgets. This could include a build of about 13 TWh of new renewable electricity generation to replace fossil generation and meet the increased demand from electrifying transport and process heat. Transpower and lines companies would also need to invest to transmit and distribute more electricity around the country.

239 More than 8,000 New Zealanders currently work in electricity generation, transmission, and distribution. These New Zealanders are highly skilled workers with specialised skills in areas such as electrical engineering, energy trading, pricing, sales, system design, demand management, network operations, maintenance and regulatory compliance. The industry is facing challenges as the current workforce is aging.

240 Transpower estimates that thousands more highly skilled workers will be needed in the electricity sector by 2035 to meet increasing electricity demand. Part of this will be from increased demand as transport and process heat are electrified. These jobs would be over and above replacing workers who retire in the coming years. As technology advances, the sector will increasingly need workers with skills in technological and digital innovation, automation, data science and artificial intelligence.

241 Many of these jobs will be outside the main centres, particularly in building new generation, distributed generation and distribution lines.

### 8.7.4 There will be more jobs in energy efficiency

242 New jobs could also be generated in energy efficiency. This was an area that the Government identified for stimulus spending as part of the COVID-19 economic response.

243 The Green Building Council estimates that more than 1,000 jobs could be generated by bringing 120,000 Aotearoa homes up to healthy standards – by installing insulation and more efficient heating.

244 According to the 2018 census, there are more than 1.8 million homes in Aotearoa. The BRANZ 2015 House Condition Survey estimates that 830,000 houses in Aotearoa have sub-optimal roof and/or floor insulation, so the potential for improving insulation and heating is significant.

245 As well as creating new jobs, improving insulation and heating in homes can deliver immediate health benefits and reduce health inequities, particularly for people on low incomes (see Section 8.6.1).

246 There are also employment opportunities in creating more energy efficient commercial buildings and improving the efficiency of appliances.

### **8.7.5 There will be more jobs in the waste sector**

247 Meeting our recommended emissions budgets requires us to reduce, reuse and recycle our waste.

248 New jobs could be created by reusing and recovering waste materials that would otherwise go to landfill. For every job in landfilling, 2 to 4 jobs could be created in resource recovery.

249 An assessment of the impacts of amendments to the waste levy in Aotearoa found that increasing the levy and expanding it to cover additional waste streams would create new jobs. Diverting about half a million tonnes of waste away from landfill between 2020 and 2023 could result in 230 to 345 new jobs. These jobs would be created around the country.

### **8.7.6 There could be changes in the types of jobs in the food and fibre sector**

250 Our recommended emissions budgets are likely to see some changes to the types of jobs in the food and fibre sector.

251 Farmers will need to change their farm management practices to improve efficiency while maintaining production to meet our recommended emissions budgets. As a result, farmers may reduce stocking rates, meaning that less labour may be needed on-farm.

252 However, there will be new jobs in advising farmers on how to change farm management practices in a way that optimises business, climate and other environmental outcomes. Making such changes are complex. These would be highly skilled jobs and the number of people working as farm advisers would need to be increased quickly.

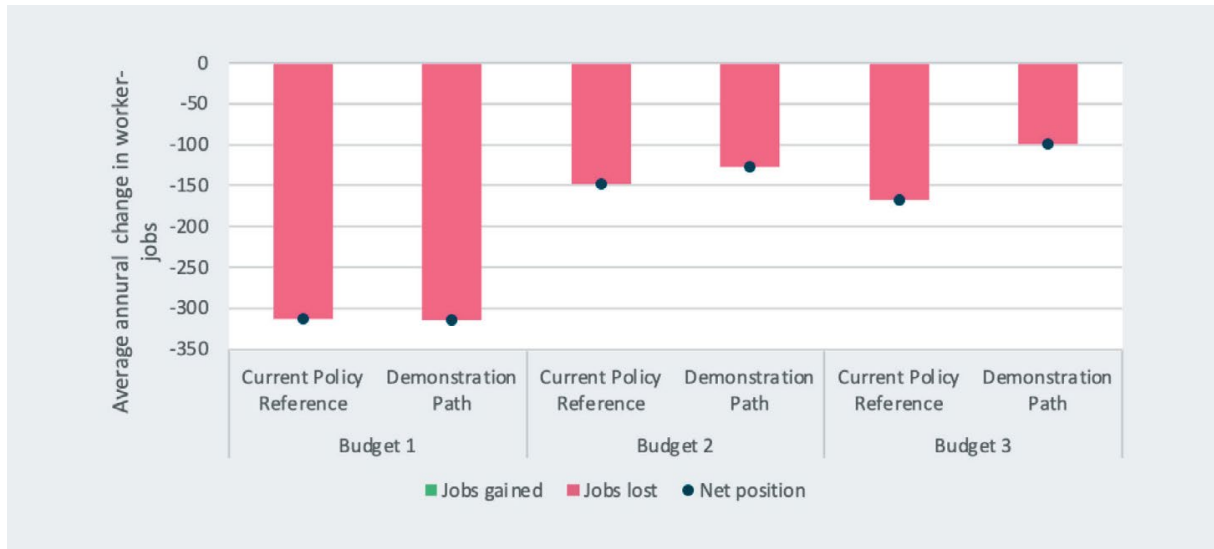
253 The number of jobs in meat and milk processing would be unlikely to change significantly if our recommended emissions budgets were met while maintaining milk and meat production.

### **8.7.7 How land-use changes will affect jobs**

254 Our recommended emissions budgets would see less land-use change from sheep and beef to forestry than under current policy settings. This is because we have put a focus on meeting emissions budgets by reducing gross emissions, and reducing the use of forest offsets, to ensure Aotearoa is able to meet and sustain net zero long-lived gases beyond 2050.

255 There were about 19,000 people employed in sheep, beef and grain farming in 2014 – the base year for our DIM-E modelling. Under current policy settings, our modelling estimates there could be about 3,000 fewer jobs in sheep, beef and grain farming by 2035. However, taking actions to meet our recommended emissions budgets could result in 2,600 fewer jobs in the sector by 2035 – 400 fewer job losses than would occur under current policy settings (Figure 8.13).

256 The potential for land-use change from pastoral farming to horticulture and arable is small at the moment, but has potential for growth. Land-use change to horticulture could increase the number of available jobs as horticulture is more intensive and generally requires more workers per hectare. However, many horticultural jobs are seasonal and as a result the sector experiences labour shortages. There are also opportunities for new jobs in food processing, for example in the proposed oat milk plant in Southland.



**Figure 8.13: The average annual change in employment in sheep, beef and grain farming in each emissions budget period under the Current Policy Reference case and demonstration path**

Source: DIM-E simulation results

### 8.7.8 There could be more jobs in native afforestation

257 Native afforestation will be needed to meet our recommended emissions budgets. Permanent native forests absorb carbon more slowly but will continue to do so for centuries until they reach maturity. As a result, carbon removals from new permanent native forests can be used to offset long-lived gas emissions in sectors with limited opportunities to reduce emissions from 2050. For instance, this could include offsetting nitrous oxide emissions from agriculture and residual industrial process emissions.

258 There is an opportunity to develop a native forestry industry in Aotearoa. Meeting our recommended emissions budgets could see close to 300,000 hectares of new native forests from 2021 to 2035. This would generate jobs throughout the country, particularly in nurseries to supply seedlings, labour for planting, fencing, pest control, and support and technical advice. Establishing and managing native forests could be more labour intensive than exotic forests. Native forests also create opportunities for jobs in honey, recreation and ecotourism, and forest-based pharmaceuticals.

### 8.7.9 There could be more jobs in bioenergy and the bioeconomy

259 Bioenergy will play an important role in meeting our recommended emissions budgets – both in the form of biomass and biofuels. To ensure the increase in bioenergy is feasible, we considered how much wood waste would be available in Aotearoa and could be used. However, other feedstocks, such as tallow for biofuels, and imported bioenergy could also be used.

260 Producing energy from biomass is much more labour intensive than conventional fuels. Much of the work is in growing the feedstock – work that is already happening in Aotearoa given we are considering using only existing wood waste. However, there would be new jobs in recovering forest and wood waste, transporting it and processing it ready to be used.

261 Much of the wood grown in Aotearoa is exported as raw logs. There are also opportunities to add value by processing wood in Aotearoa, which would create jobs.



### 8.7.10 It is hard to predict what will happen in hard-to-abate industrial sectors

262 Some industries face particular challenges when it comes to reducing emissions, such as cement and steel. These industries are large employers in regions around the country and are fundamental to the economy, but solutions for decarbonising these industries are further off. Some of these industries have announced strategic reviews, citing many reasons besides climate policy. There are key strategic decisions that need to be made about the future of these industries. The outcome of these decisions will impact jobs.

263 In our ENZ modelling, we assume that Tiwai Point aluminium smelter closes all potlines by the end of 2024 in line with Rio Tinto's recent announcements. The smelter's closure would see about 1,000 direct job losses in Southland between now and the end of 2024. Any job gains from lower wholesale electricity prices could be spread across the country.

264 For other hard-to-abate sectors, it is hard to predict. In our ENZ modelling, we assume that steel and cement production is unchanged. However, these industries may face other challenges outside of addressing climate change. As of September 2020, New Zealand Steel employed about 1,400 workers, but they announced there could be 150-200 job losses after a strategic review.

265 Methanol production, wood, dairy and meat processing are discussed in earlier sections of this Chapter.

### 8.7.11 It is hard to predict what jobs will eventuate from the hydrogen industry

266 Hydrogen is an emerging industry. It is highly uncertain what role hydrogen will play and therefore how many jobs could be created in the hydrogen industry. The number of jobs, skillsets needed and where those jobs are located will depend on how large the industry becomes, how hydrogen is used, and the role hydrogen plays compared to other fuels including electricity.

267 There is potential for the hydrogen industry to need mechanical skillsets if hydrogen was used in heavy trucks, engineering skillsets if hydrogen boilers were installed, and gas fitting if hydrogen was blended into pipelines.

### 8.7.12 How different population groups are impacted by job change

268 Some population groups will experience more employment impacts than others from our recommended emissions budgets. The exact impacts will depend on how the Government chooses to meet our recommended emissions budgets and the policies they put in place.

269 We are able to look at some of this impact using the DIM-E model. However, we must also consider existing inequities in employment for different population groups. For example, some population groups already experience higher unemployment rates than others (Table 8.1).

270 The impact on Māori in the workforce is discussed in Section 8.4.

### *Pacific peoples*

- <sup>271</sup> Pacific peoples currently disproportionately face higher unemployment, underutilisation and earn less than the national average (Table 8.1).
- <sup>272</sup> Our modelling suggests that Pacific peoples could disproportionately experience greater job change as a result of our emissions budgets. Our analysis suggests that Pacific peoples make up about 8% of those who gain jobs from the transition and about 7% of those who lose jobs from the transition. Overall, there are more job gains than job losses for Pacific peoples across all three emissions budget periods.

### *Age groups*

- <sup>273</sup> Our modelling suggests young people would see net job gain as a result of our recommended emissions budgets. People aged between 15-24 make up about 18% of job gains over the three emissions budget periods. Older workers, particularly over the age of 45, would be disproportionately impacted by job change.

### *Women*

- <sup>274</sup> Our modelling of employment flows, from our recommended emissions budgets, indicates that men may be more affected by the transition than women. This is because the industries that are most affected by the transition tend to employ more men. However, both women and men are likely to experience a net gain in jobs by 2050 compared to what they may experience under current policy settings.
- <sup>275</sup> In Aotearoa, women are disproportionately underutilised in employment and earn less (Table 8.1). Historically, there is evidence showing that women are more negatively affected during economic change.
- <sup>276</sup> Our modelling also does not capture the dynamics that could occur as employment changes. For example, the flow on impacts to women as men move out of high emissions industries and seek new work. This was a problem in the UK in the 1980s and 1990s – many women were displaced from manufacturing jobs as men who lost jobs in coal sought out new work. Additionally, women had to take on the ‘double burden’ of paid work as well as unpaid care work.

### *People with disabilities*

- <sup>277</sup> Our modelling does not address the impact of employment changes on people with disabilities. However, any changes to jobs could have disproportionate impacts on people with disabilities. This is because people with disabilities are more likely to face poor employment outcomes, as they are less likely to be in work or education, and are more likely to be unemployed, underutilised and earn less than people who don't have a disability (Table 8.1).

**Table 8.1: Key labour market indicators in Aotearoa in 2019/2020**

	All young people (aged 15-24 years) (%) *	50 and over (%) *	Māori (%) *	Pacific peoples (%) *	Women (%) *	People with disabilities (%) **	National average (%) *
Employment rate	55.8	54.8	62.7	60.2	62.4	39.0	67.3
Not in education, employment or training (NEET) rate	12.3	NA	19.1	18.0	13.3	43.2	12.3
Unemployment rate	12.0	2.3	8.3	8.2	4.7	10.0	4.4
Underutilisation rate	29.5^	8.2^	18.3	16.2	13.8	22.7	11.4
2020 Median weekly wages (\$) ***	575	978	999	954	924	400	1040

\* Annual average quarterly data from Households Labour Force Survey, Stats NZ

\*\* Labour market statistics (disability), December 2020 quarter

\*\*\* Based on Labour Market Statistics (Income) 2020 NZ Stats

^ Values obtained from Households Labour Force Survey, March 2021 quarter. 50 and over is for 55+ age bracket

### 8.7.13 How we manage the impact on jobs

278 The previous sections show that there will be more jobs available in some areas and fewer jobs in others as a result of our emissions budgets. In the early years, this may result in job losses. Some population groups will be more impacted by these employment changes, particularly people in groups that already face inequity in employment.

279 For later emissions budgets, there will be less job loss, as young workers entering the workforce go into different occupations.

280 Much of the change will occur gradually over the next 15 years. Some of the workers in these industries will retire over this time. However, there will be workers that may need support to transition into new areas of work.

- 281 Given the aging population in Aotearoa, there may be particular challenges to ensuring that the new industries that emerge as a result of the transition can get enough workers with the necessary skillsets.
- 282 In addition, there will be further disruption to the way we work, as we see more use of data science, digitalisation, automation, robotics, artificial intelligence, and machine learning.
- 283 Changes to employment are inevitable as a result of our recommended emissions budgets. However, these changes are manageable with good planning and support.
- 284 Transition planning will be vital for ensuring that the changes ahead are well signalled and that policies and programmes are put in place to support workers who need to move into new lower-emissions areas of work.
- 285 A nimble and responsive education system will also be critical for setting New Zealanders up with the skills – particularly engineering and technical skills – that will be needed in growing and new low-emissions industries.
- 286 The direction of policy needed to deliver the skillsets and support workers through the transition is described in *Chapter 20: Policy direction for a fair, inclusive and equitable transition*.

## 8.8 Environmental impacts

- 287 Moving to low-emissions technologies and changing land practices to meet our recommended emissions budgets would also bring broader environmental impacts.
- 288 The move to EVs, greater electricity use, and improved fuel efficiency would result in improvements to air quality, and the associated health benefits. Many submitters raised concerns about the total impact of EVs on the environment. This is because although EVs are low emissions, they are not zero emissions. The EV total supply chain (from cradle to grave) is extensive, including the extraction of raw materials, the battery manufacture, vehicle manufacture and shipping.
- 289 Evidence shows that the lifecycle cost of an EV on the environment in comparison to an ICE vehicle is significantly reduced. The lifecycle cost of an EV on the environment is expected to decrease further as countries move towards more renewable electricity generation, battery technology continues to improve, and global efforts to reduce emissions from EV supply chains increase.
- 290 An EV used in Aotearoa would emit about 60% fewer emissions over its full life cycle than petrol vehicles, even when you take into account raw material extraction, battery manufacture, vehicle manufacture and shipping. Studies have found that the total amount of energy used during the entire life cycle of the vehicle (cumulative energy demand) was around 40% less for EVs than for petrol and diesel vehicles. Both figures will improve as Aotearoa phases out the use of fossil fuels for electricity generation and global efforts to reduce emissions from EV supply chains increase.
- 291 Many technologies important in the transition to a low-emissions economy – including wind turbines, solar panels, and batteries – require mineral and metal inputs. How these minerals and metals are sourced, recycled and disposed of could have negative environmental impacts here and overseas. There could be opportunities for innovation in repurposing and recycling these materials.

- 292 These technologies can have high embodied emissions due to the energy requirements to produce some of these inputs. Additionally, when these technologies reach the end of their life, it can be difficult to dispose of them as they are not easily recycled. Supply chains will need to be carefully managed and Aotearoa needs to ensure it has access to the latest advances internationally to reduce the adverse environmental impacts. The need for a circular economy is discussed in *Chapter 13: Policy direction that cuts across sectors*.
- 293 Building new small or large hydroelectric dams could help provide flexible capacity to meet peak electricity demand. Pumped hydro schemes would also provide capacity in dry years where hydro lake levels are low. However, such schemes could have substantial landscape and ecological impacts. Flooding large areas of land for water storage could impact water flows downriver of the scheme. This could be to the detriment of nationally significant wetlands, archaeological sites, habitats for endemic bird and fish species, and in some cases endangered or threatened species. Hydro dams can also obstruct native freshwater fish from migrating up and down rivers.
- 294 Building new hydroelectric dams or expanding existing assets could be part of our response to meet emissions budgets and targets, even though our modelling does not overtly include new hydroelectric assets.
- 295 Practice changes – such as careful balancing of stocking rates, pasture management and supplementary feed – could reduce emissions on farms and bring co-benefits to water quality and soil health. The scope for practice change and associated co-benefits depends on the farm, the farm’s specific climate and soil conditions, the current management system, and the advice and skills that farm businesses could draw on.
- 296 Afforestation could also improve biodiversity, water quality and soil health, and reduce erosion if the right type of tree is planted in the right place at the right time. While pine forests can increase biodiversity, including for rare native species such as kiwi and falcons, native forests in Aotearoa host thousands of species, hundreds of which are threatened.
- 297 Native vegetation on farms can also provide large connected networks that can serve as stepping stones for birds that disperse tree seeds. Pest control, and fencing out grazing and browsing animals, would be important for improving biodiversity and enhancing carbon stocks as pests compromise the health of forests both by directly browsing trees and by killing birds that distribute seeds.
- 298 Land-use change from dairy to horticulture on flatter and more productive land could reduce biogenic methane emissions per hectare. However, it could also cause water quality to deteriorate due to the increased use of fertiliser, and consequential nitrogen and sediment losses.
- 299 Nutrient losses would vary depending on the crop, the site, weather conditions, the soil’s physical and chemical properties, and how the land is managed. Increasing the area of horticulture could also increase water demand in Aotearoa. In light of the physical impacts of climate change, this increased need for water would need to be weighed up when considering converting to horticulture as a climate action.
- 300 Reducing how much waste is generated and recovered means that landfills will take longer to fill up, potentially reducing the number of landfills needed in the future. Increasing landfill gas capture at legacy and non-municipal landfills could also lessen the negative impacts on air quality and leaching.

301 There could also be environmental impacts associated with decommissioning industries that close as a result of the transition to low emissions.

302 Our recommended emissions budgets can therefore bring environmental co-benefits such as improved air, freshwater and biodiversity. There are also some negative environmental impacts that will need to be managed. Innovation in repurposing and recycling materials will help to address some of these impacts.

## 8.9 How emissions budgets could impact government taxation and spending

303 Our emissions budgets will also impact government taxation and spending. For example, revenue from fuel excise duties and road user charges, which are ring fenced to be spent on land transport, will change over time. This is routinely monitored by the Government. The same would occur for the Waste Levy, which is put back into waste minimisation projects, as the amount of waste reduces over time. Reducing oil and fossil gas production in Aotearoa will also result in less tax revenue and will affect the balance of exports as less oil is exported.

304 The NZ ETS will generate income for the Government from selling emissions units. The income generated will depend on the volume of units sold, and the market price for units. The Government estimates this could equate to at least \$3.1 billion over the next five years under current settings. The Government has options for how to spend these proceeds, including putting them back into climate change projects.

305 Government spending on social assistance for workers and families, and for health could also be affected. The impact on this spending will depend on the transition strategy the Government puts in place, the pace of the transition, and how well the Government plans and signals the transition.

306 These changes to Government taxation and spending are manageable, however the Government will need to plan for this.