

**Deloitte.**



Aotearoa New Zealand's  
Turning Point

**March 2023**

# Foreword

New Zealand has a unique economy, emissions profile and location relative to other countries. Given this, it is clear specific solutions are needed to support the transition to a decarbonised economy.

New Zealand is taking solid steps towards this but there is an opportunity for further targeted actions.

This report challenges the assumption there is an additional cost burden to decarbonising New Zealand's economy over the next decade, by showing the direct connection between decisive climate action and future economic prosperity.

Using the latest data, research and modelling, the analysis presented illustrates the economic consequences of insufficient climate action, as well as the economic benefits of decisive action to New Zealand's future economy.

Importantly, this report also demonstrates the bold plays New Zealand can take to position the economy for rapid

decarbonisation, through clear policy direction and targeted support from government and industry.

The decisions New Zealand makes today, and over the next decade are the decisions that will shape our future. We are at a turning point, and it is time for New Zealand to work together for a better future.

There is no better time than now.

**Mike Horne**  
Chief Executive Officer, Deloitte New Zealand



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# Executive summary

Decarbonisation can be an economic engine



\* Inadequate climate action aligns with the SSP2-4.5 scenario.

\*\* Decisive climate action aligns with the SSP1-1.9 scenario.

# Executive summary

## Decarbonisation can be an economic engine

Decisive action on climate change, now, could change New Zealand's future for the better by generating additional economic growth, while avoiding the worst impacts of climate change. Decisive action could deliver \$64 billion of additional economic gain to New Zealand's economy by 2050 if warming is limited to 1.5°C.

New Zealand has the opportunity to be a leader in economic growth and prosperity through rapid decarbonisation. We have modelled what the country's economic future could look like with decisive action. Our modelling shows that New Zealand's turning point – the point at which the initial costs of decisive action on climate change are outweighed by the benefits of rapid decarbonisation – could occur in 2036. After 2036, the transition to a low-carbon economy results in stronger, more durable and more sustainable economic growth.

These benefits are not guaranteed. To achieve these potential gains, a change in mindset is required. Clear and consistent policy direction on climate change and support from both government and the private sector to transition New Zealand's economy to a low-carbon one are crucial.

If there is inadequate action on climate change and the planet warms by 3°C by the end of the century, New Zealand's economy could lose \$4.4 billion of GDP by 2050, compared

to projections that do not take into account the effects of climate change. These losses get exponentially worse beyond 2050.

This report helps to redefine the debate around climate action. It shows that efforts to limit climate change, and achieve net zero emissions by 2050, are opportunities for growth instead of costs.

At the centre of our research and analysis is Deloitte Access Economics' unique Computable General Equilibrium (CGE) Climate Integrated Assessment Model, the *D.CLIMATE* model. In the past, traditional economic models have not adequately accounted for the consequences of climate change. Instead, these models assumed economies will grow to a 'business as usual' trend unaffected by the economic costs of climate change. Our *D.CLIMATE* model creates a new baseline projection of New Zealand's economy by integrating the economic impacts of physical climate change. By factoring in these costs, we demonstrate the significant economic opportunities of taking decisive action, as well as the economic harms of inadequate action to the country's economy.

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Decisive climate action could deliver **\$64 billion** to New Zealand's economy by 2050

Climate inaction could cost the economy **\$4.4 billion** by 2050

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# New Zealand's unique position



# New Zealand's unique position

## Commitments to emissions reduction

### New Zealand has passed into law its international commitments

Successive governments have passed legislation and policy committing to emissions reduction since ratifying the Kyoto Protocol in 2002. New Zealand still has work to do, but it now has a roadmap through the recently announced Emissions Reduction Plan (ERP) to meet its emission reduction goals.

**2002**

The Government introduces the Climate Change Response Act 2002 addressing New Zealand's obligations under the Kyoto Protocol and introduces mechanisms to record domestic emissions.<sup>1</sup>

**2008**

The New Zealand Emissions Trading Scheme (ETS) is created and is introduced via the Climate Change Response (Emissions Trading) Amendment Act 2008.<sup>2</sup>

**2009**

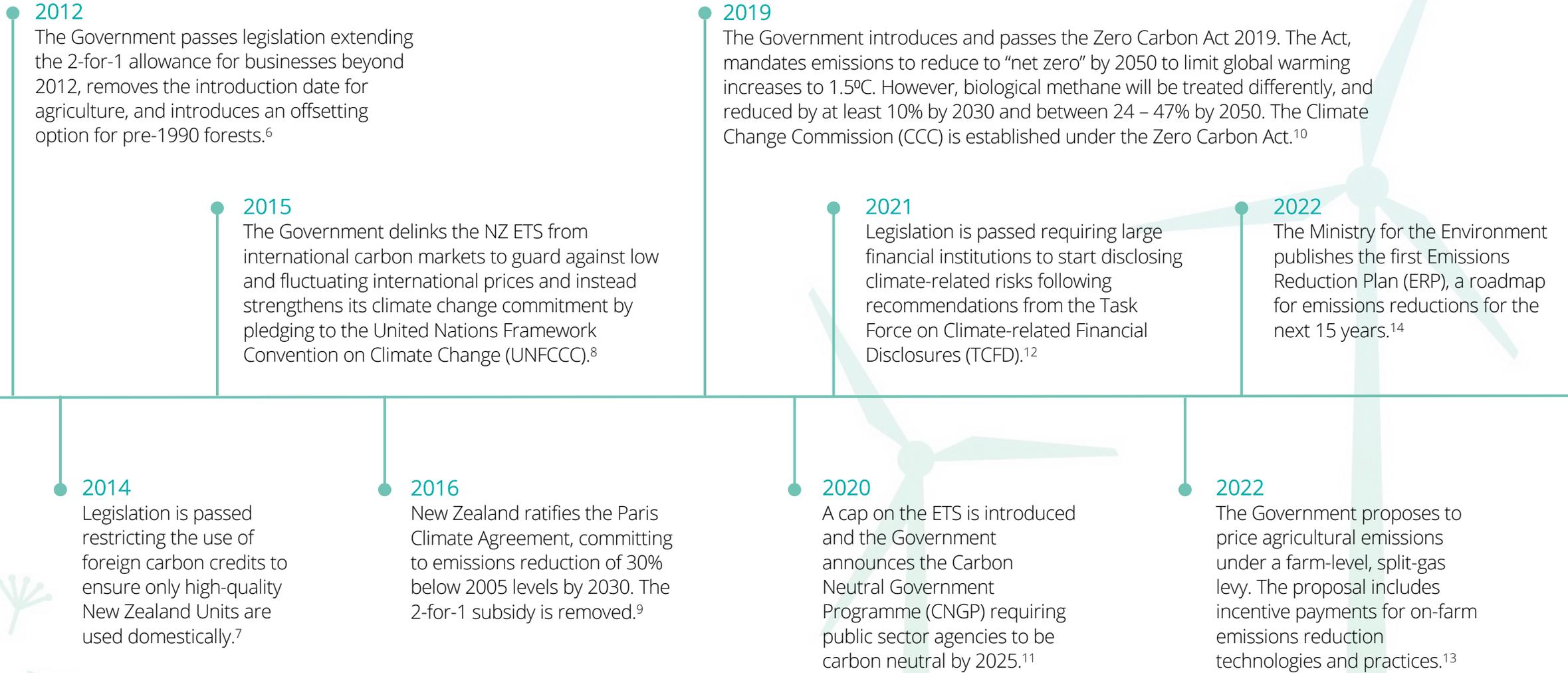
The ETS is reviewed for the first time and amendments are made to help industries transition during the early years of the scheme. This includes a 2-for-1 emissions unit deal between July 2010 and December 2012, and postponing agriculture's introduction into the ETS due to difficulties in measuring farm-level emissions.<sup>4</sup>

**2009**

New Zealand co-founds the Global Research Alliance on Agricultural Greenhouse Gases (GRA) to support international efforts to grow food without increasing greenhouse gas emissions.<sup>3</sup>

**2011**

After a second review of the ETS, the 2-for-1 arrangement is phased out over three years. An ETS price cap is also introduced and set to increase by \$5 per year from 2013. When agriculture is introduced into the ETS in 2015 it will start with a 2-for-1 allowance to help the industry transition into the scheme.<sup>5</sup>



# New Zealand's unique position

## A unique emissions profile requires unique solutions

New Zealand has an emissions profile unlike many other OECD countries.<sup>15</sup> Rather than the majority of emissions coming from electricity generation, over 50% of New Zealand's total GHG emissions come from its primary industries, the majority of which come from biogenic methane in the agriculture sector.<sup>16</sup> Being a small and distant economy, emissions are also embedded in many of New Zealand's trade-oriented sectors.

This places New Zealand as the top emitter of methane emissions per capita in the OECD and fifth in the OECD for total emissions per capita, behind Luxembourg, the United States, Canada and Australia.<sup>17</sup> However, New Zealand is also one of the most efficient dairy and meat producers in the world, with a carbon footprint nearly half that of other international producers.<sup>18</sup>

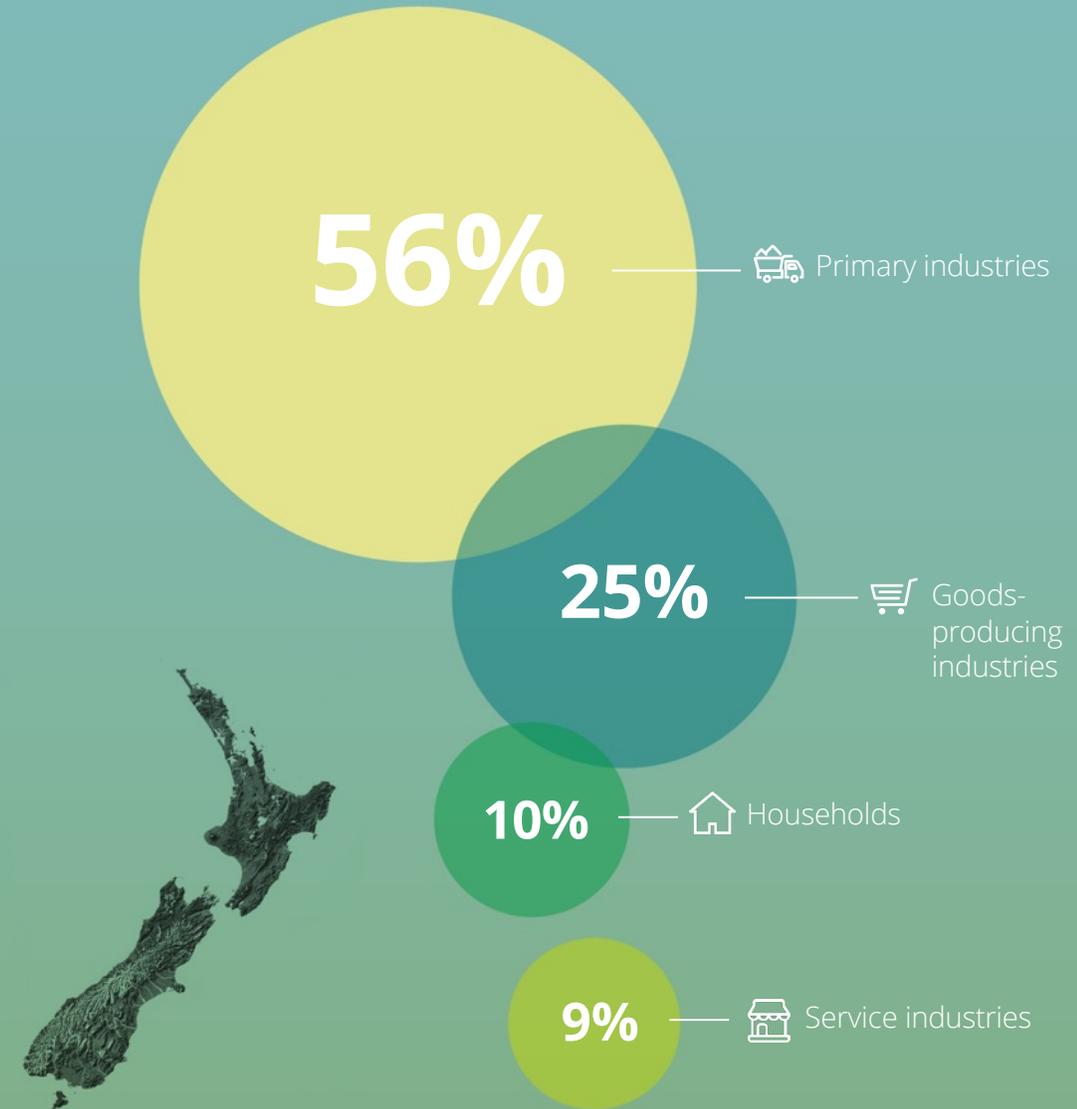
New Zealand also has one of the largest shares of renewable energy in the world, with only Norway (98%) and Brazil (84%) generating more.<sup>19</sup> In 2021, 82% of New Zealand's electricity was generated

from renewables, which is expected to rise to 90 – 97% over the next 20 years without further policy intervention.<sup>20</sup>

### **New Zealand's unique position means it will need equally unique solutions**

To reflect New Zealand's unique economic, policy and geographic landscape, the public and private sectors' response to reducing emissions must be equally unique. To resolve New Zealand's international commitments to emissions reduction, the pricing and accounting of New Zealand's agricultural emissions is being pioneered, and the country is continuing to innovate, research and develop technologies to support the transition to a low-carbon economy.

Percentage of total greenhouse gas emissions by industry



# New Zealand's unique position

## Climate change, equity and the Treaty of Waitangi

### The impact of climate change

Climate change is predicted to have a disproportionate impact on vulnerable populations.<sup>21</sup> In New Zealand, Māori, Pacific, low-income and disabled people are most likely at risk.<sup>22</sup> To reflect this aspect of climate change in addition to the disproportionate impact of other economic shocks and policies, New Zealand has integrated an equity lens through many of its public institutions and legislation.

### The Treaty of Waitangi

This is most evident in the recognition of the Treaty of Waitangi and its standing in legislation. On climate action, both the Zero Carbon Act and the ERP have a dual mandate to reduce emissions and to ensure Māori have a leading role in New Zealand's transition to a low-carbon economy and that it is equitable for Māori.

### The Pacific Region

New Zealand has also demonstrated a wider commitment to the Pacific, both internationally and to residents and citizens. To date, over

one-quarter of the \$1.3 billion climate budget in the ERP is dedicated to Pacific climate adaptation.<sup>23</sup> The investment will support clean energy projects, and improve infrastructure and crop resilience to storms, droughts, floods, sea level rise and pests brought about by and worsened by climate change.

### Equity and the wider environment

Wider commitments to accessibility, wellbeing, and inclusivity have also been strongly signalled in the ERP's five core principles, while biodiversity and the environment have been positioned as large components of New Zealand's strategy to reach Net Zero.



# Economics for a new climate



# Economics for a new climate

## Our economic modelling accounts for the effects of climate change

### Many economic projections don't account for climate change

Despite the clear and growing evidence of the costs of climate change on the world's economy, many economic projections still assume the global economy can continue to grow the way it traditionally has: completely unaffected by the negative economic impacts of climate change.

Scientific evidence tells us the relationship between increasing emissions and economic growth cannot continue as it has done, and the costs of climate change must be reflected in how decision-makers evaluate their choices.

### Our economic modelling accounts for the effects of climate change

In our modelling, we explicitly take into account the economic costs of climate change and rising global temperatures. This allows us to quantify the impact climate change could have on New Zealand's economy and the sectors within it if left unchecked.

In line with the long-term impacts of climate change and New Zealand's Net Zero targets, we have modelled to the year 2050. Many uncertainties that come with modelling such a long period, and these only increase when incorporating the impact of climate change and the world's response to it. As such, the results in this report should not be viewed as a forecast. Rather, they should be viewed as an economic *scenario analysis*, designed to answer "What if?" and prompt debate and discussion.

### Climate damages

How climate change negatively impacts the economy



#### Heat stress

Lost labour productivity from extreme heat 'slows down' workers and reduces their ability to perform tasks



#### Sea level rise

Rising sea levels result in loss of productive land, both agricultural and urban, and reduced productivity of low-lying and coastal areas



#### Stalling productivity and investment

Economies suffer as investment goes to repairing existing assets rather than contributing to new, more productive capital



#### Health and wellbeing

Increased incidence of disease and mortality disrupts living standards and the lives of the working population



#### Tourism loss

Loss of tourism and disrupted flow of global currency circulating in economies, impacts business, jobs and livelihoods



#### Agricultural loss

Reduced agricultural yields from changing climate patterns

# Economics for a new climate

Real-life examples show how the effects of climate change are already being felt in New Zealand

We spoke to a range of industry leaders, and discussed the effects of climate change already being felt in New Zealand. Interviewees have provided real-life examples highlighting the impact of climate change on the economy:



## Heat stress

### Changing schedule

While much of New Zealand is relatively temperate, some regions already experience hot summers. In these areas, farming businesses have had to reschedule their summer work shifts earlier in morning and later in the evening to avoid peak heat.

### Reduced operations

A farm in the North Island reported having to pause farm work during the peak of summer, reducing their normal output.



## Sea level rise

### Coastal track washout

Coastal walking tracks in the South Island have been washed out by coastal inundation. More investment was required to move these tracks to higher ground.

### Managed retreat

Residents in coastal towns have experienced severe flooding in recent years, causing damage to their properties. If trends continue, some coastal communities may need to relocate or organise a managed retreat.



## Stalling productivity and investment

### Storm damage

Many councils have had to spend money responding to the impact of severe weather events, diverting capital away from other infrastructure investments. For example, Wellington City Council deployed staff and equipment to clear ~100 landslips in the capital last winter and there will be significant funding required for the recovery from Cyclone Gabrielle this summer.

### Warming waters

Several salmon farming businesses are struggling for stock, due to warming water temperatures disrupting operations. In the event the salmon farms need to relocate to cooler waters, significant capital investment and time will be needed, which could otherwise have been spent elsewhere.

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“Due to excessive heat during hot summer days, we have had to alter live-stock shifting schedules to avoid animal and employee heat stress”

[Ātihau-Whanganui Incorporation](#)

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# Economics for a new climate

Real-life examples show how the effects of climate change are already being felt in New Zealand



## Health and wellbeing

### Employee wellbeing

The Ministry for Primary Industries says increased volatility in weather patterns has led to production challenges within the food and fibre sector. This volatility negatively affects productivity, and the wellbeing of people in the sector as they deal with the impacts on stock health and stock losses, damaged crops and property.

### Illness and Injury

New Zealand studies show rising temperatures and extreme events will lead to health threats including causing (or worsening) illness, and injury.<sup>24</sup>



## Tourism loss

### Seasonal volatility

Unpredictable weather creates a lack of certainty for tourism operators and customers, disrupting operations and potential bookings.

### Heat stress

While most of New Zealand has a relatively temperate climate, many popular travel destinations will face very hot summers, impacting tourism vendors.

### Glacier retreat

New Zealand's glaciers are already in retreat and are expected to shrink further with rising temperatures. The decline in glacier size and accessibility is likely to further impact tourism in these areas.



## Agricultural loss

### Biosecurity incursions

As temperatures increase, conditions for certain animal and plant diseases may become more amenable in New Zealand, placing pressure on the biosecurity system.

### Fruit harvesting

Horticulture businesses are facing swings in conditions – from too much rain to drought and from hail to excessive heat. This affects production reliability.

### Crop yields

Crop varieties currently suitable for growth in New Zealand may suffer from increasing temperatures, such as ryegrass currently grown in Northland. New crops, better suited to conditions, may need to be imported or developed.

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“Our climate risk assessment has identified issues such as rising temperatures in summer and spring along with an increase in dry days. This combined with more severe weather events has the potential to impact our crop yield and growing systems”

[Zespri International Limited](#)

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# Economics for a new climate

Inadequate action will be costly,  
but there is enormous potential if  
the country takes decisive action

We modelled two climate scenarios to compare what could happen if the planet warms by 3°C by the end of the century, against the economic opportunities if the world acts decisively and limits global warming to as close to 1.5°C above pre-industrial levels as possible by 2050.

## Inadequate action

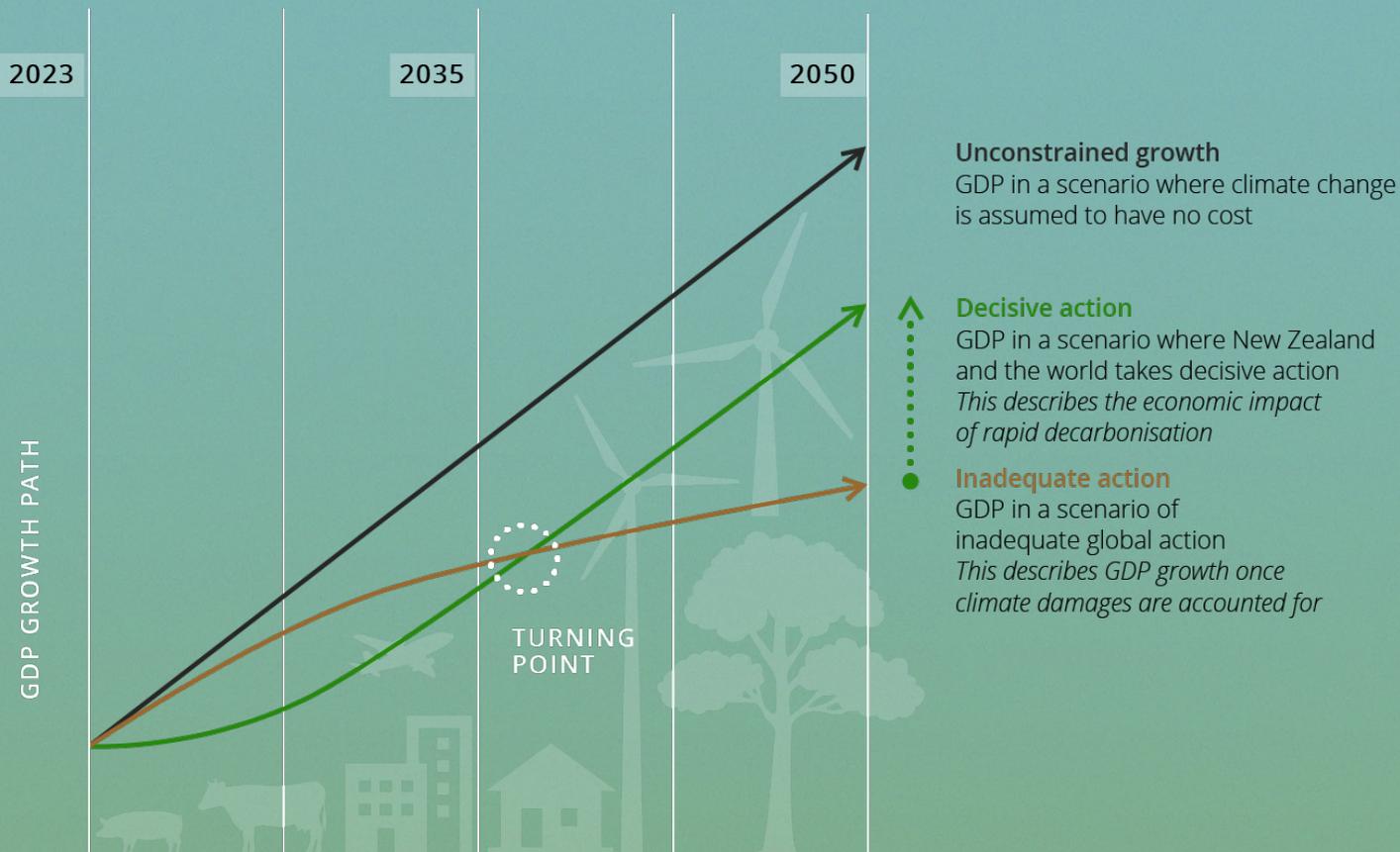
This scenario presents a future with a high rate of global GHG emissions, where current technologies and strategies reduce GHG emissions and stabilise the temperature increase at around 2°C by 2050 and 3°C by 2100. The modelling for this scenario reflects a widely adopted set of emissions, economic and population assumptions, referred to as SSP2-4.5. The results of inadequate global action (the orange line in the diagram) are presented as a deviation, a comparison to a world where the impacts of climate change are assumed to have no cost (the black line).



# Economics for a new climate

## Decisive action

This scenario presents a future where governments, businesses and citizens around the world take decisive action to limit global warming to as close to 1.5°C above pre-industrial levels as possible. The results of decisive global action are presented as a deviation (the green line), a comparison to a world where inadequate climate action allows the world to warm by around 3°C. Decisive action reflects a widely adopted set of emissions, economic and population assumptions, referred to as SSP1-1.9.



# Economics for a new climate

## The benefits of decarbonisation outweigh upfront costs

### Upfront costs

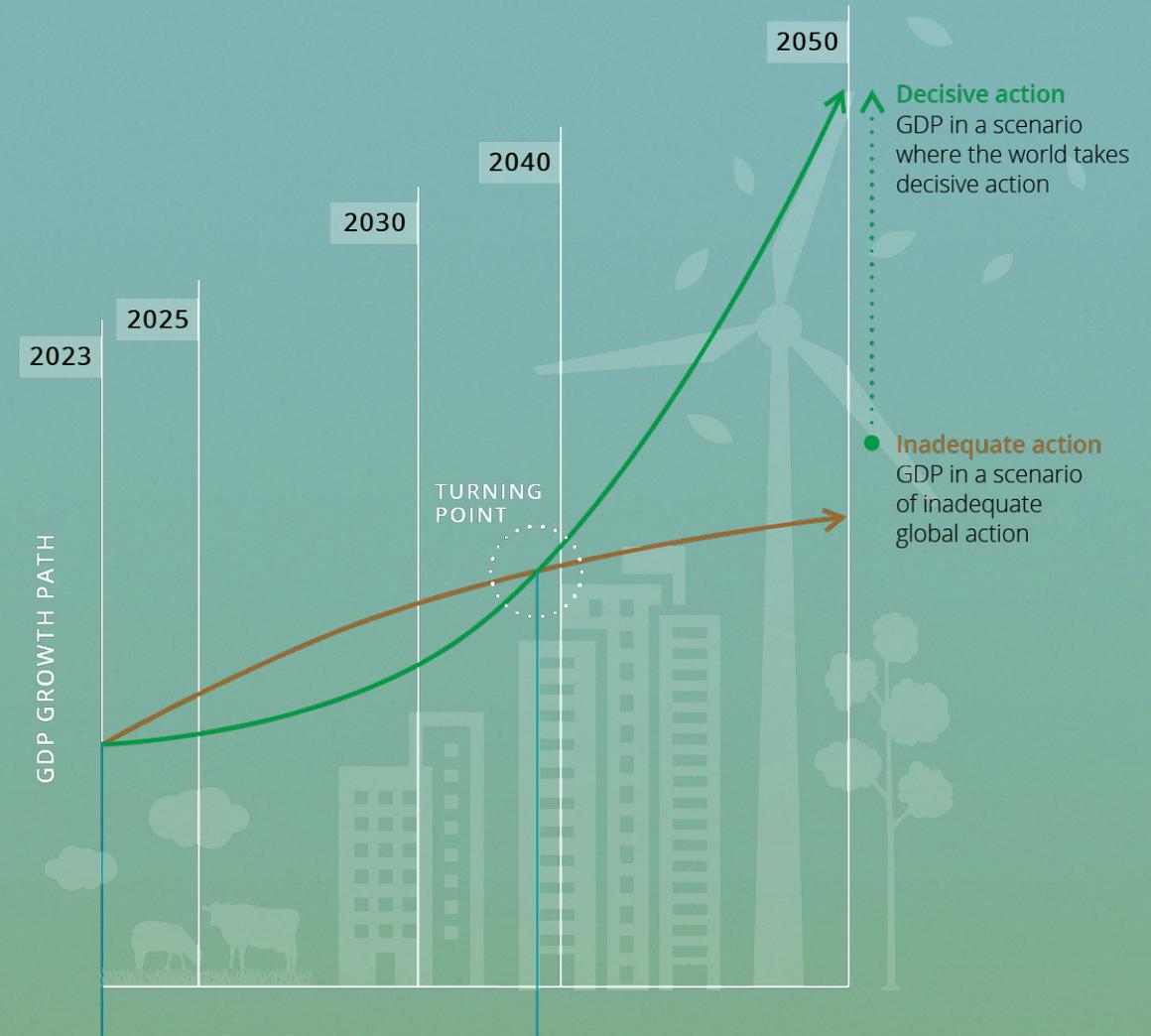
Decisive action to limit global warming to as close to 1.5°C above pre-industrial levels as possible, would create fundamental changes to the structure of economies across the world, including New Zealand's. As New Zealand invests in initiatives to reduce its biogenic methane emissions and switch its reliance on fossil fuels for transport needs, there will be upfront costs. The costs of upfront investments associated with decarbonisation, coupled with the already locked-in damages of climate change, would temporarily lower economic activity compared to the current emissions-intensive path.

### The "turning point"

As New Zealand's economy transitions to a low-emissions future, the country will see the benefits of avoiding more climate damage. The economy will also benefit from the emergence of new sectors that drive increased growth and employment.

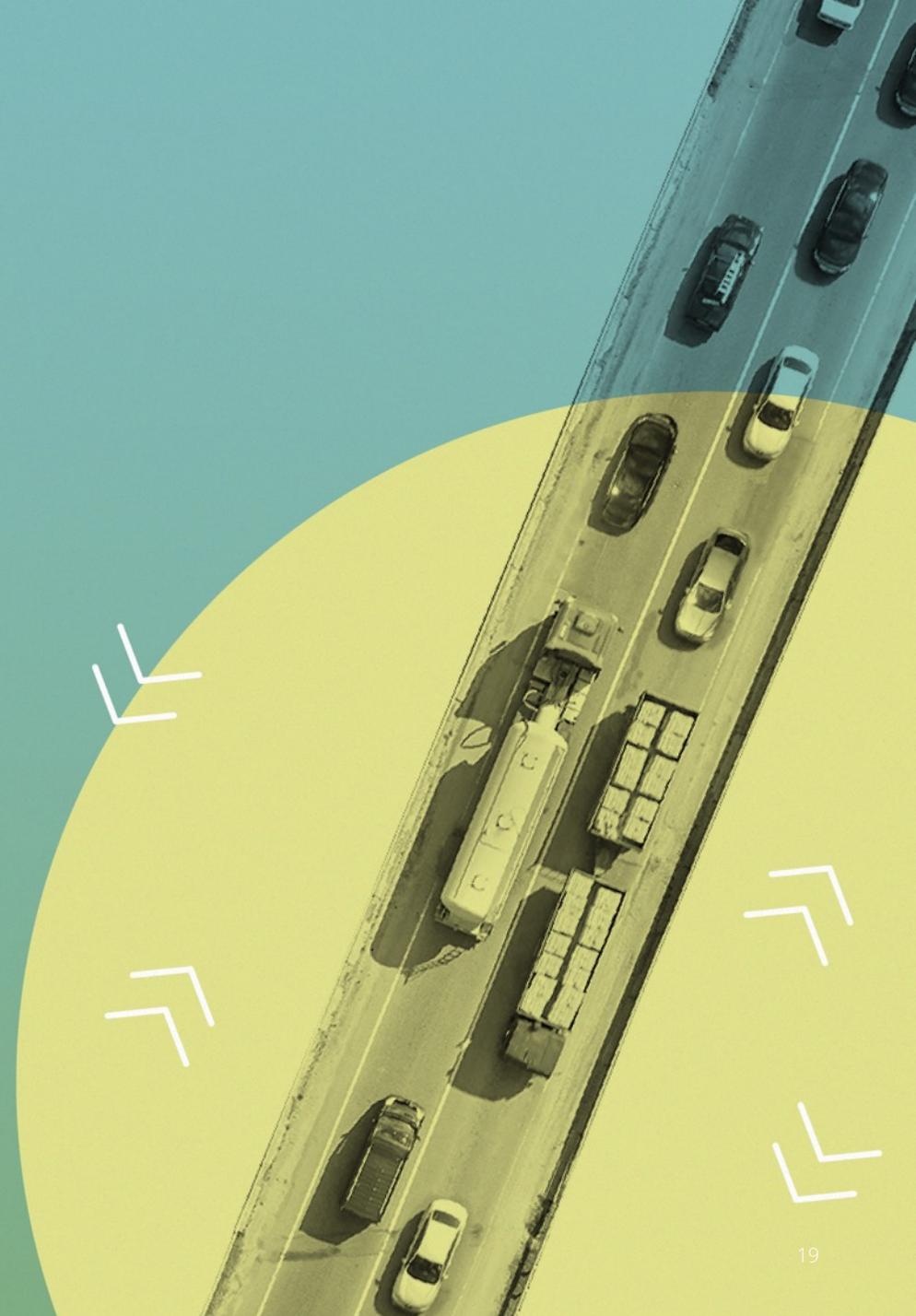
However, our modelling suggests more is needed to outweigh the initial costs of rapid decarbonisation. The Government has a crucial role to play. It will need to support sectors that face the most significant costs associated with rapid decarbonisation and assist them with transitioning to a low-emissions future.

The combination of avoided climate damage, the emergence of new sectors and transition support from both the public and private sectors means benefits of transitioning New Zealand's economy to a low-emissions future will start to outweigh the initial costs. At this moment, which we refer to as the "turning point", New Zealand's economy will be able to grow more significantly than if the country, and the globe, take inadequate action to address climate change.



Period where investments in decarbonisation in the decisive action scenario create temporary losses relative to the inadequate action scenario

# The costs of inadequate climate action



# The costs of inadequate climate action

## The economic costs of inadequate action are substantial

### Inadequate climate action could come at a cost for New Zealand

If New Zealand and the world do not take decisive action against climate change, the country's economy could lose nearly \$4.4 billion of GDP, between 2023 and 2050. By 2070, the losses could escalate to \$48 billion.

At the same time, there could be nearly 3,000 fewer job opportunities by 2050 due to the economic impacts of climate change. These negative impacts are in comparison to a world where the impacts of climate change are assumed to have no cost.

The estimates described here are conservative. There are a range of impacts we have not explicitly modelled, such as the impact of individual natural disasters and extreme events, water availability and ocean acidification.

### Some sectors are more insulated from the negative effects of climate change

In a world with inadequate action and rising global temperatures, New Zealand's relatively temperate climate means some industries will be relatively

insulated while others bear the costs of inadequate action more acutely.

For example, trade, manufacturing, and services will be worse off, reflecting the toll increasing temperatures have on people, land and physical infrastructure in New Zealand and across the world. Overall, the broader New Zealand economy will suffer as a result of inadequate action.

No action is not a choice for New Zealand. If no change is made and New Zealand falls behind, key exports could be impacted as trading partners commit to net zero targets and start to focus on the sustainability of their imports.

Loss to 2050 on a path to a 3°C world, compared to traditional projections



# New Zealand's turning point



# New Zealand's turning point

## New Zealand's turning point will occur around 2036

It gets tough before it gets better. Transitioning the economy off fossil fuel sources of energy and reducing biogenic methane emissions in agriculture is costly, and GDP will be lower during this transition when compared to 'inadequate action'. At the most costly point of New Zealand's transition, which would occur in 2031, GDP growth is 1.3% lower with 'decisive action' when compared to the 'inadequate action' scenario.

However, if New Zealand stays on track, and picks up the pace of decarbonisation, it would be one of the first countries to reap the benefits. Even better, our modelling shows that after 2036, New Zealand's economy could grow even more than if there is inadequate action on climate change. By 2050, New Zealand's GDP could be 2.4% greater and \$64 billion higher overall over 2023 to 2050 than a scenario of 'inadequate' action on climate change.

New Zealand's relatively large mix of pre-existing renewable energy means, in a scenario of global decisive action, it is one of the first economies to reach its turning point. This means that many sectors could transition off fossil fuel sources of energy faster than their international counterparts, thus avoiding the increasing cost of emissions these sources of energy attract. This gives these sectors an advantage and could boost their contribution to

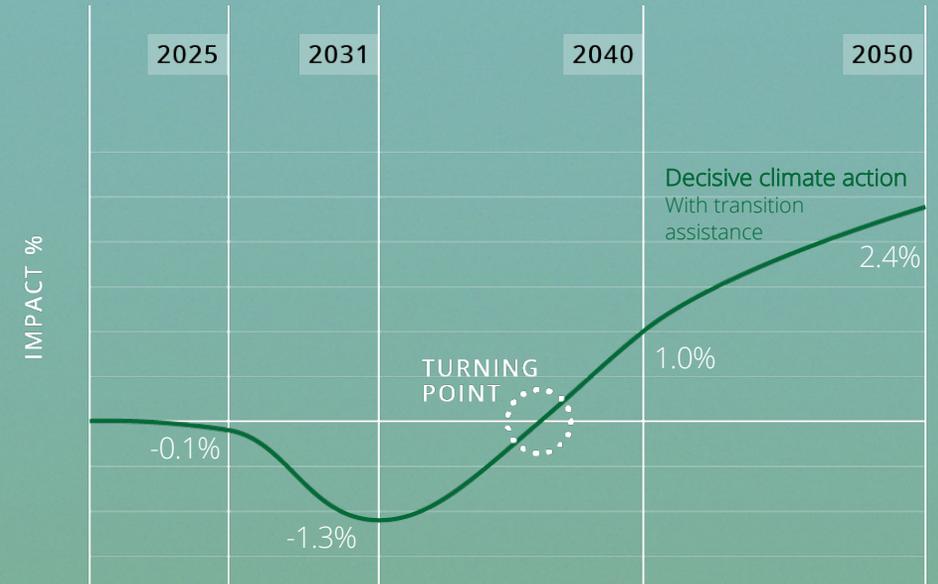
GDP and employment while the rest of the world continues to decarbonise.

The reduction of biogenic methane emissions is a fundamental driver of New Zealand's decarbonisation in this scenario. Under 'decisive action', New Zealand's greenhouse gas emissions reduce by 75% in total by 2050 compared to 2022. This reduction depends on the successful adoption of new and emerging technologies.

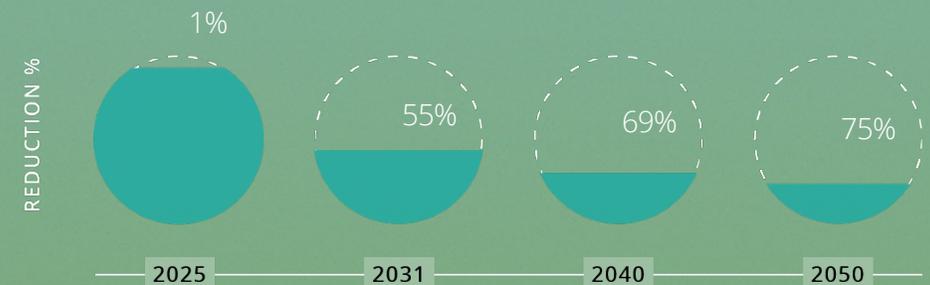
New Zealand's turning point is not only an opportunity to contribute to global emissions reductions; it is also an opportunity to set the economy on a higher growth trajectory. Doing so will require coordination and collaboration between government, industry and all New Zealanders – 'decisive action' is an extraordinary opportunity for the country.

## Change in GDP, 2023 to 2050 (constant prices)

The % deviation is relative to a scenario with 'inadequate' action on climate change



## Total emissions reduction compared to 2022



# The opportunity for New Zealand in a net-zero future

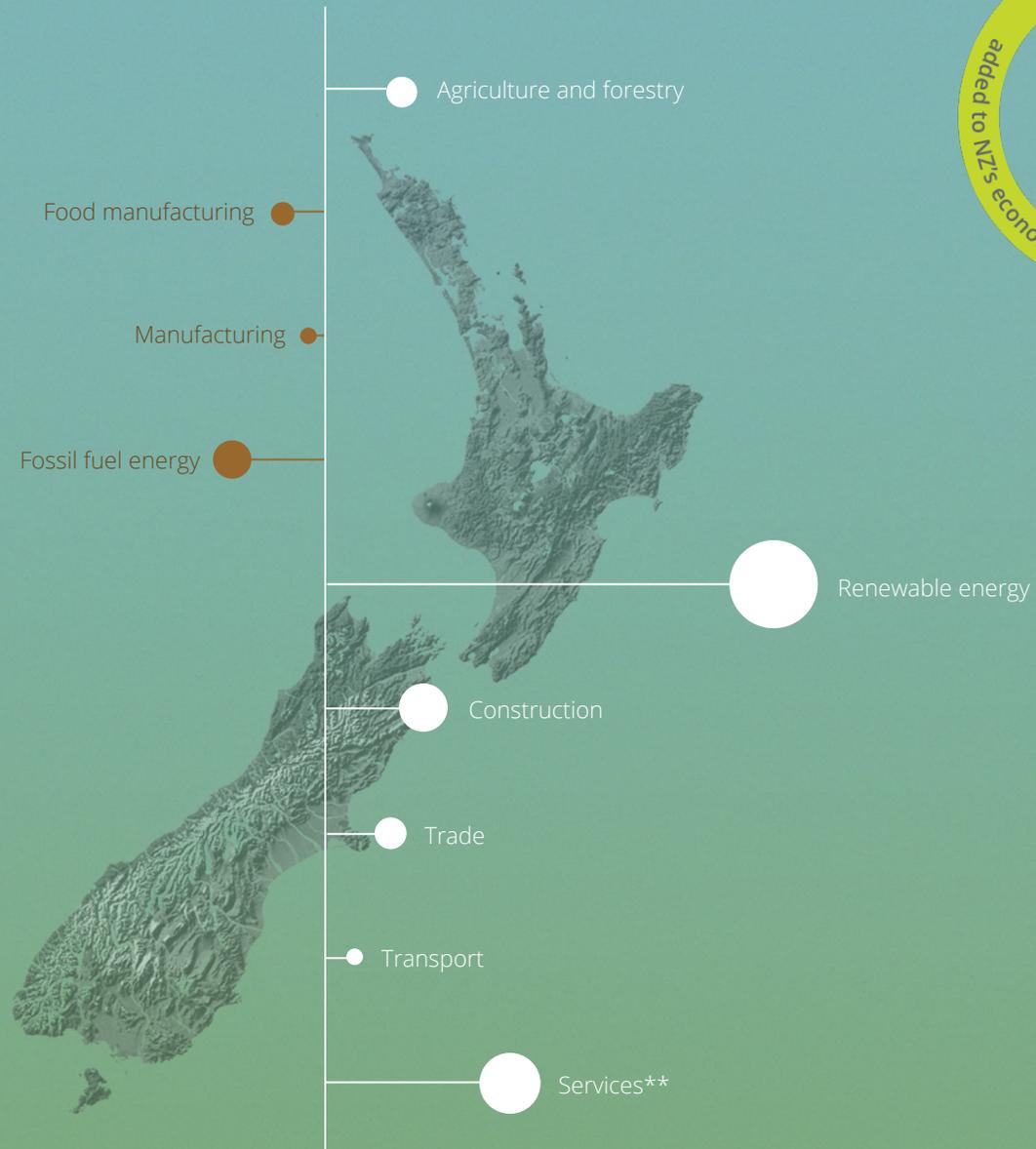
Sector gain to 2050, on a decisive action path to a 1.5°C world, compared to a scenario of inadequate action

The composition of the benefits of decisive action by 2050 differ by sector:

- The renewable energy, services and construction sectors are the key contributors to the benefits of decisive action by 2050 in value added terms.
- Agriculture and forestry, trade and transport also contribute to the positive benefits of decisive action by 2050 in value added terms, although to a smaller extent.
- As a result of decisive action, the fossil fuel sector is worse off, reflecting the increasing use of renewable energy sources as a result of decisive action.
- The food manufacturing and manufacturing sectors also add less value, relative to inadequate action. This is not to say these sectors have negative growth. Rather, they grow slower relative to the other expanding sectors.

These differing sector impacts demonstrate the inherent trade-offs that New Zealand needs to be aware of with decisive action on climate change.

Value added impact by 2050 (\$million, 2022)\*



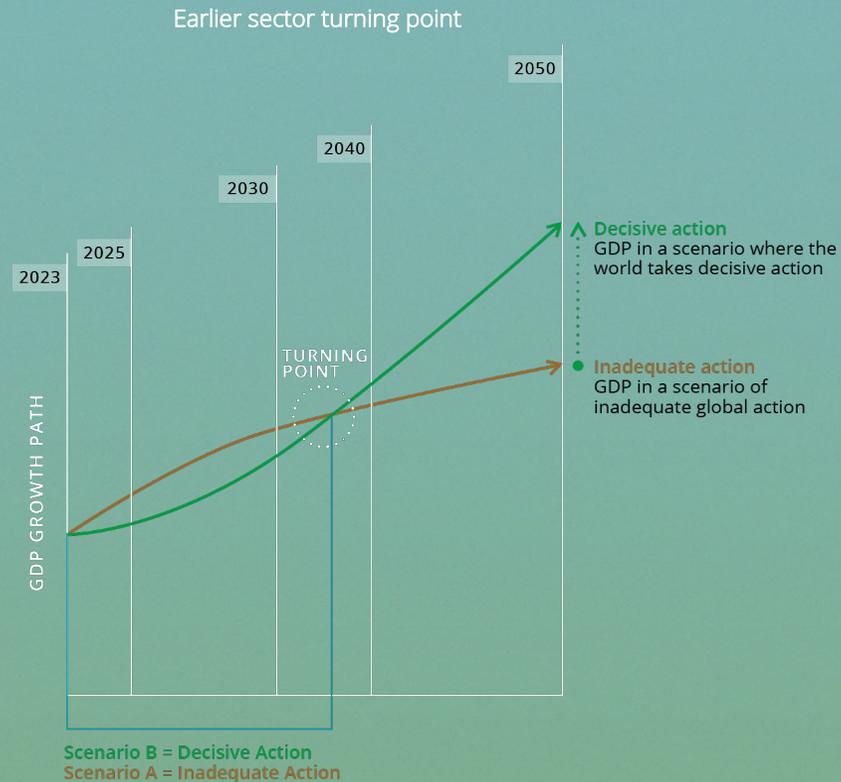
**\$64 billion**  
added to NZ's economy by 2050 if warming is limited to 1.5°C

\* D.Climate models 27 detailed sectors. This chart presents an aggregated version of this sectoral breakdown.

\*\* Services comprises of communication, financial services, insurance, real estate activities, business services, recreational and other services, dwellings, public administration and defence, education and human health and social work activities.

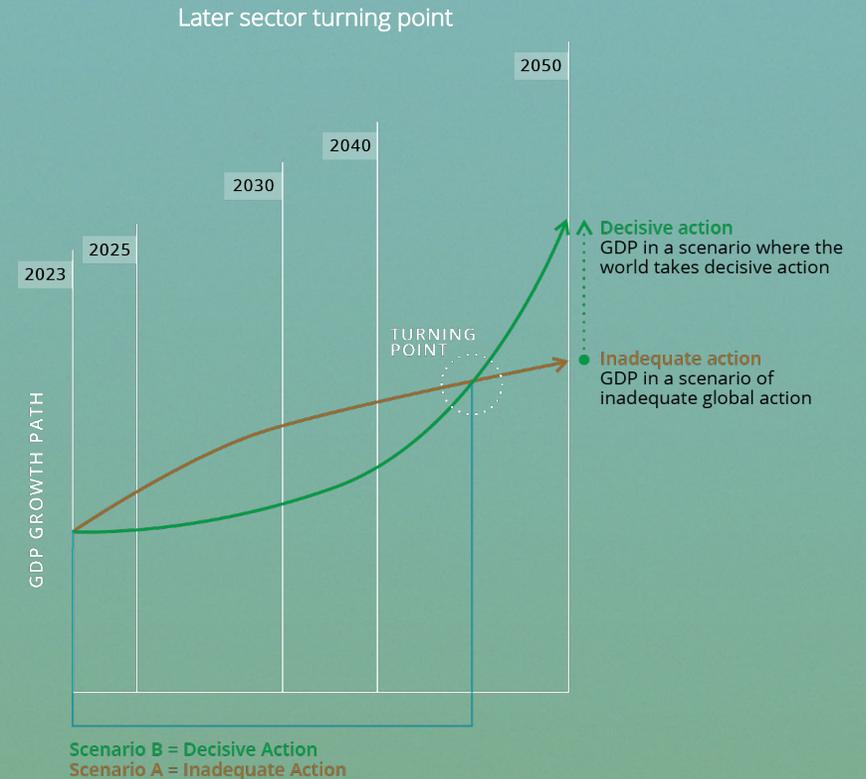
# The opportunity for New Zealand in a net-zero future

Different sectors have different turning points



While New Zealand will benefit overall from decisive action on climate change, the sectoral impacts differ. The differences, in turn, reflect differing transition costs and the degree of flow-on impacts seen from a growing renewable energy sector.

Some sectors may face fewer transition costs and will benefit from an expanding renewable energy sector. For instance, in terms of the value it adds to New Zealand's economy, the construction sector could reach its turning point as early as 2031, benefiting from an expanding renewable energy sector. Similarly, the services sector will transition relatively early, reaching its turning point in 2039.



Other sectors, however, face more upfront costs of transitioning or could be crowded out by a growing renewable energy sector.

For example, the transition costs of the agriculture sector are higher. This is not to say growth will be negative. Rather, our modelling shows it is lower for a time, compared to 'inadequate action'. This means the agriculture sector could reach its turning point later in 2047. By 2050, the sector adds more value to the New Zealand economy when compared to the inadequate action scenario.

# New Zealand's turning point

## Bold plays will set the economy up for rapid decarbonisation

### Phase One: Bold Plays

New Zealand is in many respects a world leader in its commitments to reducing emissions. However, it has not pulled all the potential levers available. Bold plays are required in New Zealand and across the world to limit warming to 1.5°C by the end of the century. Delaying this will only increase the cost of transitioning and risks not meeting targets and so, the time for action is now. Many of the bold plays noted below have come directly from New Zealand's industry leaders we have spoken to.

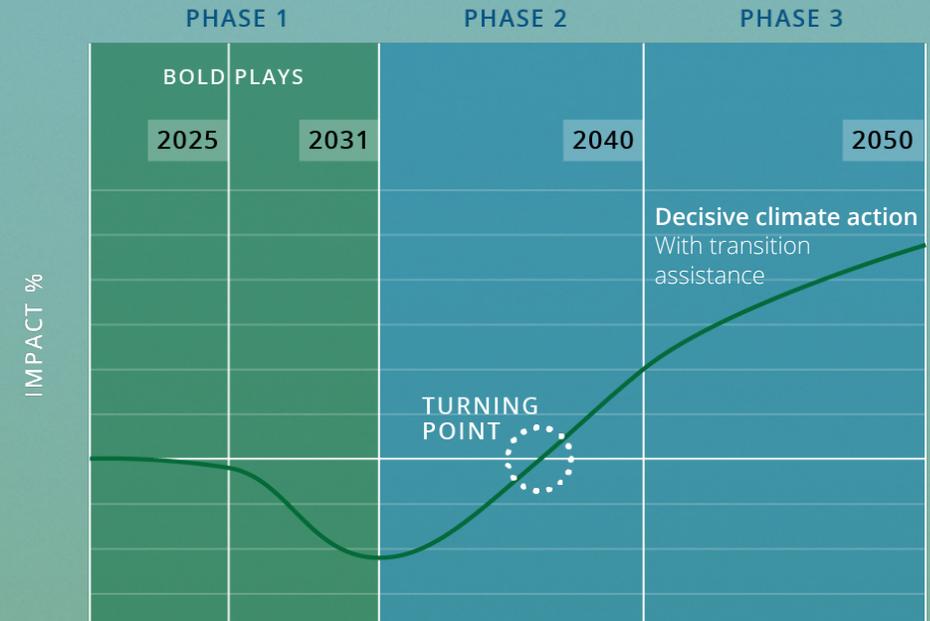
**Clear and consistent policy direction** is needed from government to take action on climate change. Action and investment in industry can be stalled in the absence of the clarity, certainty and predictability that clear and consistent policy can provide. Any government needs to ensure market mechanisms and regulations result in the price of emissions increasing significantly over the next few years. This clear price signal is crucial in driving behaviour and investments towards renewable energy sources and solutions to reduce emissions. Erratic or inconsistent changes in policy direction and settings could inhibit behaviour change and investments towards decarbonisation now.

**Respecting Te Ao Māori.** The country must value and respect the role Māori and iwi have to play, particularly in relation to farming, fisheries, forestry and geothermal holdings – in addition to understanding the impact of climate action on communities. This could involve investing in decarbonisation in ways which enable iwi to leverage existing resources to create economic prosperity, such as enabling Māori enterprises to create new low-emissions services and products or improving existing ones.

**The role of extractive industries** in enabling new technology and innovation will be an important consideration. Clean energy technologies are more mineral intensive than fossil fuel-based alternatives.<sup>25</sup> Therefore transitioning to clean technology requires awareness of the resources used to create these technologies and their impact on carbon emissions.

### Change in GDP, 2023 to 2050 (constant prices)

The % deviation is relative to a scenario with 'inadequate' action on climate change



### Bold plays

- Governments in New Zealand and across the world set clear policy direction that has the effect of raising the price of carbon, methane and nitrous oxide emissions. This imposes a cost on the economy. Fossil fuel energy sources and process emissions become increasingly expensive. Costs of production are higher and GDP and employment growth are lower.
- However, the increasing cost of emissions drives businesses and consumers purchases and investment towards renewable sources of energy and further incentivises research and investment to finding solutions to abating biogenic methane and nitrous oxide emissions.

# New Zealand's turning point

## Bold plays will set the economy up for rapid decarbonisation

### Phase One: Bold Plays

The finance sector has a crucial role to play. The finance sector to date has played an important role in directing investment towards decarbonisation and climate innovation. To further this, financial markets need clear, comprehensive, and high-quality information on the impacts of climate change, including the risks and opportunities presented by rising temperatures, climate-related policy, and emerging technologies in the changing world. TCFD disclosures will therefore have a crucial role in facilitating the required investment needed for rapid decarbonisation but more could be contemplated, such as creating incentives for the finance sector to deploy capital into decarbonisation initiatives.

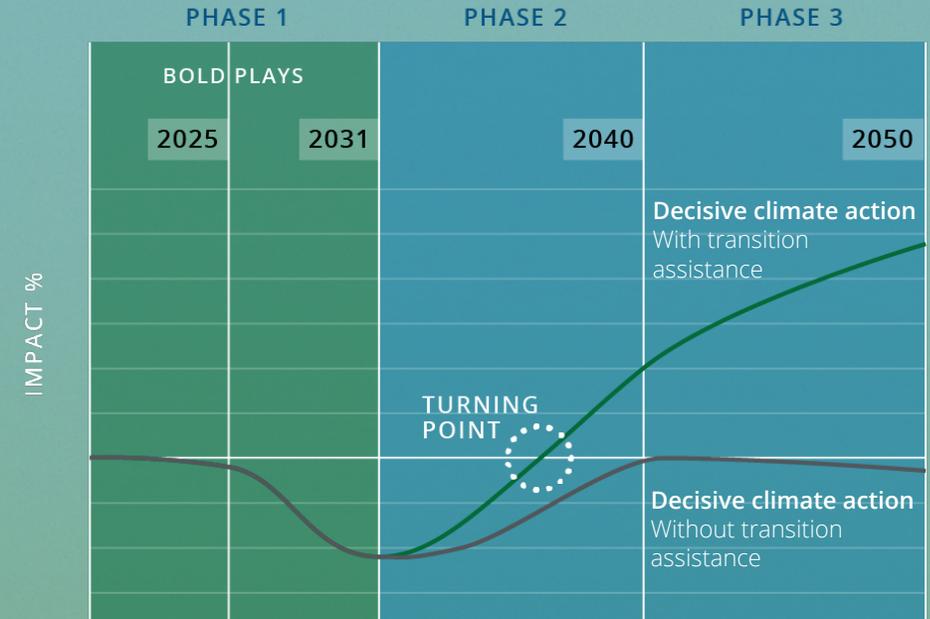
Consents for investments aimed at decarbonisation should be prioritised and, if appropriate, sped up.

This would enable New Zealand businesses to decarbonise faster and reach targets within the specified time frames.

Transition assistance is crucial. The modelling results show that, with targeted assistance from the government and the private sector, New Zealand faces fewer upfront costs, reaches its turning point sooner and maintains higher growth in the longer term. Efforts to incentivise *investment in decarbonisation in key areas will be needed to reduce biogenic methane, set up new markets and infrastructure for renewable energy (e.g. hydrogen), and meet the needs of an increasingly electric fleet (e.g., transmission and rapid charge infrastructure).*

### Change in GDP, 2023 to 2050 (constant prices)

The % deviation is relative to a scenario with 'inadequate' action on climate change



### Bold plays

- Transition assistance softens the upfront cost. Targeted assistance from government and the private sector softens the cost of switching to renewable sources of energy and assists with research and investment in commercialising solutions to abating process emissions. This assistance means transition costs are lower and employment growth is higher than would be the case otherwise.

# New Zealand's turning point

## Accelerating to zero

### Phase two: Accelerating to zero

At this point, New Zealand has largely decarbonised and energy consumption has shifted towards renewable sources. This has occurred across the economy reflecting the coordination and collaboration across government, industry and all New Zealanders.

A key driver of transition has been the solutions found to reduce on-farm emissions. This reflects the increasing price of agricultural emissions and the significant investment and effort from both the private and public sectors to commercialise solutions for reducing biogenic methane and nitrous oxide emissions.

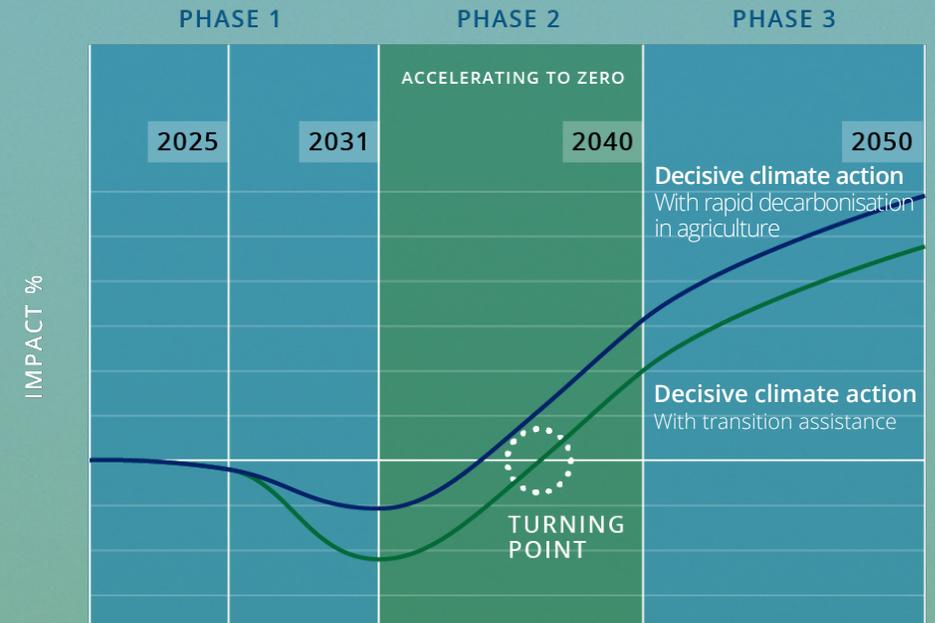
In addition to the ongoing investment in research and development that has made New Zealand the world's most carbon-efficient producer of meat and dairy<sup>26</sup>, new initiatives and efforts, such as the Global Research Alliance, the Centre for Climate Action on Agricultural Emissions, and joint ventures with MPI and industry to accelerate the development of tools to help farmers, have worked. New Zealand has found solutions to reducing and capturing on-farm emissions suited to its pasture-based production methods.

Solutions have focused on reducing emissions without significantly sacrificing production. Being the most carbon-efficient producer of meat and dairy in the world, reducing emissions by reducing production would only shift production to more carbon-intensive producers, increasing overall emissions. Knowledge and solutions to reducing emissions based on pasture-based production methods already exist, but by Phase Two they have become commercially viable and scalable.

**If New Zealand is able to lead the world in the reduction of biogenic methane, it has the potential to add a further ~\$50 billion to the economy by 2050.** In reducing biogenic emissions quickly and effectively, New Zealand's agricultural sector reduces its exposure to the increasing price of emissions faster, giving its exports a comparative advantage over other countries in the midst of their decarbonisation journeys.

## Change in GDP, 2023 to 2050 (constant prices)

The % deviation is relative to a scenario with 'inadequate' action on climate change



### Accelerating to zero

- The economy at this phase has rapidly decarbonised.
- Clear policy direction from the government and the rising price of emissions has led to significant investment in renewable sources of energy, with this sector now significantly contributing to New Zealand's GDP. The construction sector also benefits from this substantial investment in new infrastructure and is larger and employs more people by this phase compared to a scenario of inadequate action.
- The services sector sees an increase in employment and overall output as workers shift with the structural change and higher growth trajectory.
- Solutions to biogenic methane and nitrous oxide emissions have been found by this phase, driven by an increasing price on these emissions as well as targeted investment from the government and the private sector to find solutions. While solutions to biogenic methane and nitrous oxide emissions have been found, the transition remains costly and the agriculture sector's GDP and employment growth remain lower than in the scenario of inadequate action in this phase.

# New Zealand's turning point

## A low-emissions future

### Phase three: A low-emissions future

New Zealand is well on its way to achieving its net-zero targets.

By limiting temperature increases to 1.5°C by the end of the century, the worst effects of climate change on human and physical capital have been avoided. New Zealand has prevented most of the negative impacts on economic output and employment from changing schedules and shut-downs of shifts, managed retreat and investment towards fixing damage from weather events.

The energy system has been transformed. The renewable energy sector is crucial to the economy, contributing significantly to New Zealand's GDP. Importantly, the economy is set up for more inclusive and sustainable growth into the future.

**Bold plays have been crucial in getting the New Zealand economy to this stage.** Clear and consistent policy from the government has been crucial in driving change in consumer behaviour and directing investment towards renewable sources of energy and innovation in decarbonisation.

**Transition assistance has been key.** Direct assistance from the government and the private

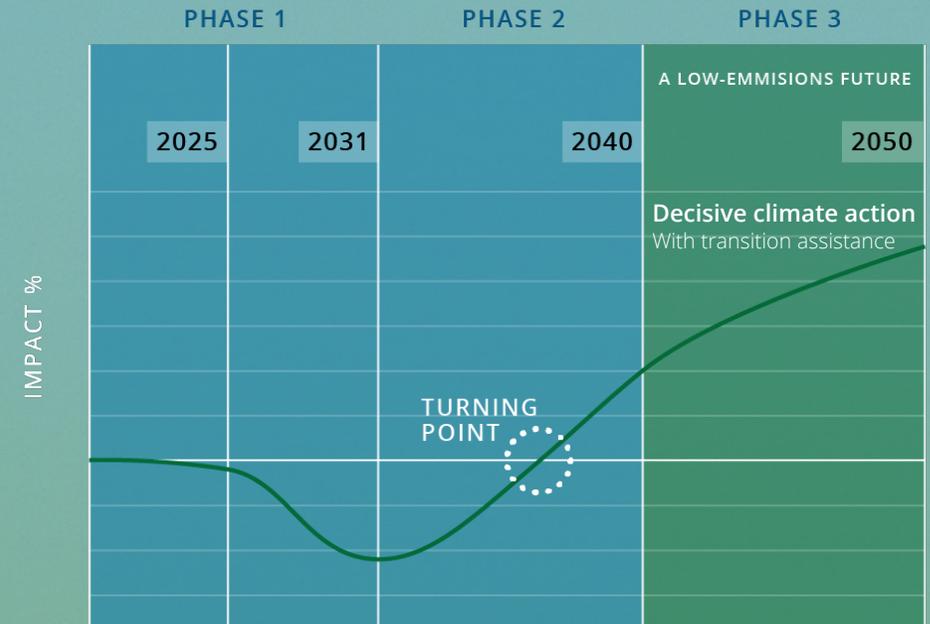
sector have helped mitigate the structural disruption of decarbonisation and boosted job creation early on. Without transition assistance, the costs of rapid decarbonisation would be higher and New Zealand's turning point would be reached later. Importantly, additional economic growth without transition assistance is not durable nor sustained.

### New Zealand needs to stay the course.

New Zealand is on the right track. The scenarios presented here demonstrate the importance of staying the course, engaging in bold plays now and the economic opportunity for New Zealand if it successfully transitions to a low-emissions future.

## Change in GDP, 2023 to 2050 (constant prices)

The % deviation is relative to a scenario with 'inadequate' action on climate change



### A low-emissions future

- New Zealand's economy has completed its transition by this point. The worst effects of rising temperatures are avoided, meaning GDP growth and employment at an economy-wide level are higher than in the scenario of inadequate action.
- Most sectors of the economy have now completed their transitions, meaning they have shifted away from sources of fossil fuel energy attracting a high emissions price to cheaper renewable energy sources. GDP and employment growth in sectors such as agriculture, construction, services and trade are larger by this point compared to inadequate action.
- As expected, the renewable energy sector is a significant contributor to the GDP of the economy. Conversely, the fossil fuel sector is smaller and employs fewer workers when compared to a scenario of inadequate action, reflecting the fundamental structural change the economy has gone through.

# Appendix

# End notes

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26. [Beef + Lamb New Zealand \(2022\) \*New Zealand beef and lamb among the most carbon efficient in the world\*](#)



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Incorporation

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Beef & Lamb NZ Limited

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Raglan Land Company

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Fletcher Building  
Limited

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Fonterra Co-operative  
Group Limited

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IAG New Zealand

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Ministry for Primary  
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