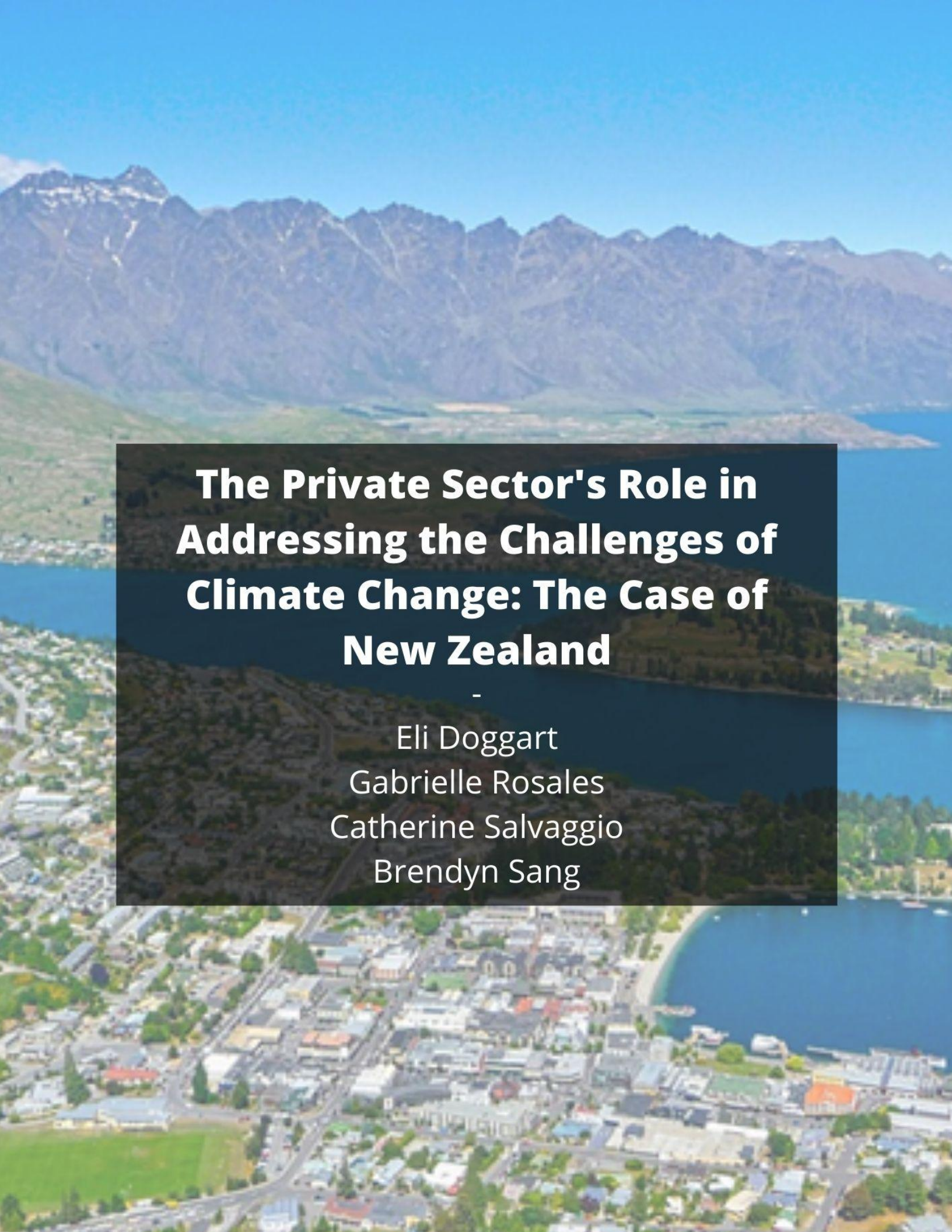

The Private Sector's Role in Addressing the Challenges of Climate Change: The Case of New Zealand

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Abstract

As climate change is an increasingly serious global problem, the goal of our project was to document response strategies in New Zealand. We conducted 14 interviews with decision makers in critical economic sectors to gather these strategies and assess their impacts. Our findings were categorized into governmental policies and actions, and technical solutions implemented by companies within different sectors. Based on these interview results, we recommended a series of solutions to the United States based on current greenhouse gas emissions by economic sectors.

Executive Summary

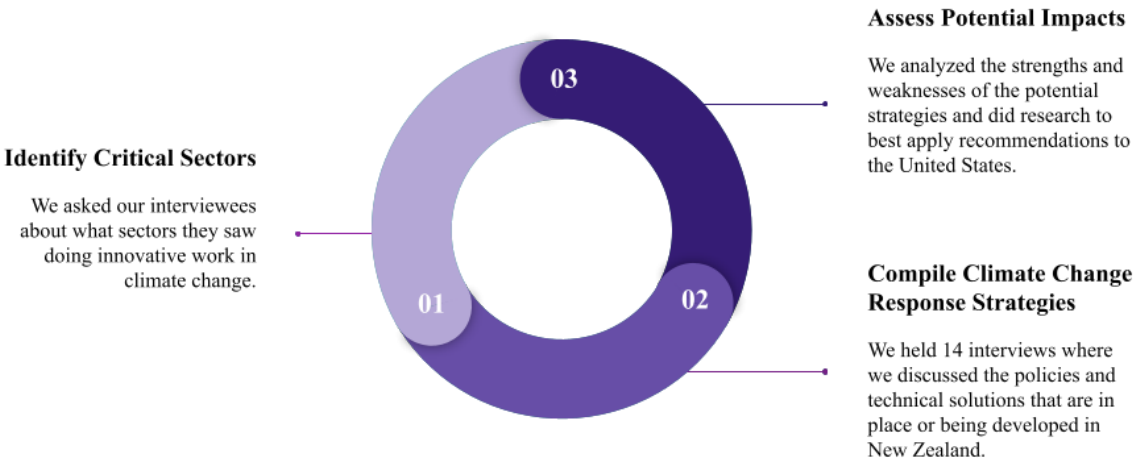
Introduction

With the increase of greenhouse gasses in the atmosphere, the Earth's climate has become less predictable, creating more hostile environments that affect a range of day-to-day operations (Perlwitz et al., 2017). Coastal floods have forced communities to implement adaptation measures or relocate (Jackson, n.d.). Farmers have had to adjust to wildly varying weather conditions such as drought and flooding. Torrential downpour has placed highways at risk of landslides, impacting transportation lines. For the private sector and industry, these impacts have had major consequences for how we do business around the world, creating an urgency to respond. The goal of this project was to document climate change response strategies in the private sector of New Zealand that can be shared globally. This project is meant to serve as a step towards sharing global approaches to reducing climate change and addressing its effects.

The realization that climate change will impact all aspects of our future has become increasingly apparent. Climate change will have many lasting effects on not only the physical environment, but also on how we conduct business, and how industries can operate. For the private sector, the threat can be met through strategic decisions about how materials are produced, how products are moved, and even changes to the site of the operations.

With the increase in climate-related events, the need to document the private sector's climate change strategies has become more critical to create climate-resilient communities. Although there are plans to implement climate resilience in the private sector, more collaboration needs to be done to minimize the effects of climate change. Therefore, business practices in New Zealand may apply to businesses in the United States to better progress towards the target of the Glasgow Climate Pact, a global initiative to reduce the effects of climate change.

Methodology



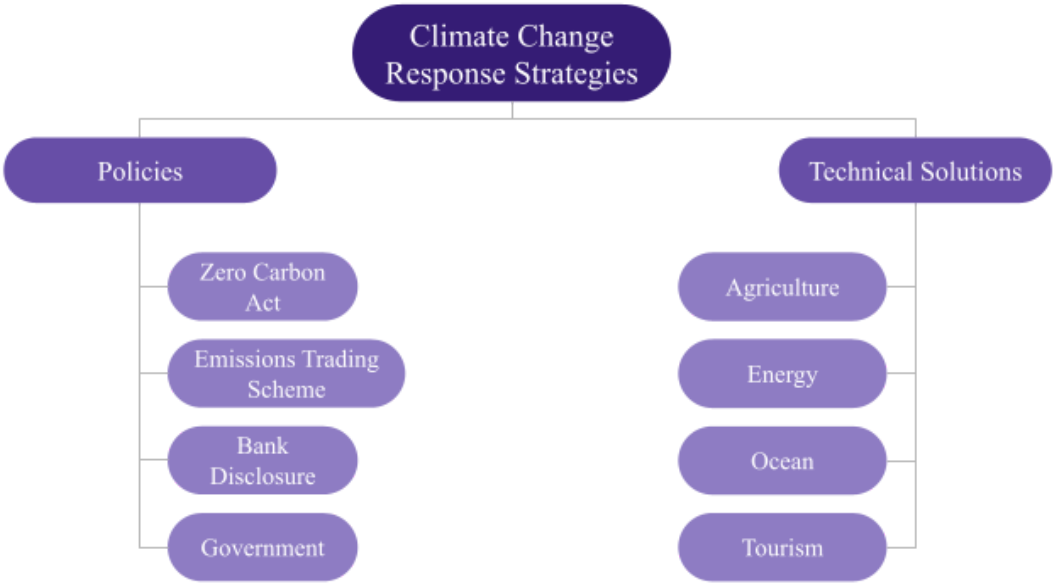
The goal of our project was to document climate change response strategies in the private sector of New Zealand that could be shared globally. Our team accomplished this goal through the three objectives: identify a sample of critical sectors that are reacting to climate change,

compile current or planned climate change response strategies, and assess potential impacts and promises of the strategies identified. These three objectives were applied to each interview, following a circular methodology to allow for additional data to be collected.

Results/Findings

Critical sectors fall into two key categories: sectors requiring the most improvements and sectors containing many innovative solutions. Based on our interviews, we identified the agriculture, government, and energy sectors as needing the most improvement. Among these critical sectors, the agriculture and energy sectors stood out as having innovative solutions in reducing greenhouse gas emissions.

Based on our interviews, we also determined two distinct angles from which New Zealanders approach climate change: the creation of policies and the implementation of technical solutions or actions from businesses. Our team gained insights on New Zealand decision makers' opinions of these response strategies, allowing us to determine the strengths and weaknesses of the response strategies.



Through different policies, the New Zealand government has laid the foundation for the implementation of key technologies to reduce the emissions of different sectors. Since industries currently have a lot of ambitions to implement climate change responses, these policies will aid in turning these ambitions into real action for the long term. In New Zealand, Māori have influenced nearly every policy made, and since they highly value long-term solutions, Māori ensure that these policies consider factors that may occur hundreds of years in the future (Interview 14, February 16, 2022)

In addition to policies, we have also learned about ways businesses in New Zealand respond to climate change using different key technologies within each sector. From the

foundation created by research and advising organizations and the government, these technical solutions accelerate the process of decarbonizing the economy to make tangible differences.

Conclusion

Although all political parties in the United States do not completely agree on the issues related to climate change, businesses and certain parts of the government have implemented climate change solutions. Many businesses are making big strides to reduce the country's greenhouse gas emissions. However, in order to make serious changes and achieve climate-related goals, the mindset and behavior of citizens need to start changing to realize that climate change will not simply resolve itself. Encouraging businesses to make long-term investments and getting people to start taking actions to reduce their emissions takes time since people tend to not make radical changes to their lifestyle. In conclusion, countries like the United States that contribute a significant portion of the global emissions must implement systematic changes to reduce greenhouse gas emissions now without simply delaying the problems another decade into the future generations.

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Chapter 1. Introduction

With the increase of greenhouse gasses in the atmosphere, the Earth's climate has become less predictable, creating more hostile environments that affect a range of day-to-day operations (Perlwitz et al., 2017). Coastal floods have forced communities to implement adaptation measures or relocate (Jackson, n.d.). Farmers have had to adjust to wildly varying weather conditions such as drought and flooding. Torrential downpour has placed highways at risk of landslides, impacting transportation lines. For the private sector and industry, these impacts have had consequences on how we do business around the world. According to an article in Forbes, three out of ten companies have reported operational disruptions due to climate change such as damage to facilities (Deloitte Contributor, 2021). Therefore, it has become increasingly important for the private sector to respond.

Industrial practices have been tied to climate change, with byproducts that affect the health and wellbeing of countries. Since the industrial revolution, the amount of carbon dioxide in the atmosphere has increased drastically around the globe (*Climate Change Evidence*, 2021; Lindsey, 2020). This is largely due to the burning of fossil fuels and emissions from the farming of animals. Once these greenhouse gasses are in the atmosphere, they lock in the thermal energy from the sun and increase the global average temperature. In the last 115 years, the global temperature has increased by 1.0 degrees Celsius (Wuebbles et al., 2017). This increase, while it may seem small, has greatly destabilized weather patterns globally (Perlwitz et al., 2017).

Among the countries pushing to address climate change, Aotearoa (colonially known as New Zealand) could be a model for other nations. As an island nation with a strong economy largely dependent on agriculture and tourism, the business sector in Aotearoa was particularly concerned with climate change response. In turn, the government has led a push for climate change policies such as the Climate Change Response Amendment Act in which the net carbon emissions in Aotearoa reach zero by 2050 (*Climate Change Response (Zero Carbon) Amendment Act 2019*, 2021).

The goal of this project was to document climate change response strategies in the private sector of New Zealand that can be shared globally. To meet that goal, we identified three objectives. First, we identified a sample of critical sectors that were reacting to climate change. Second, we compiled current and planned climate change response strategies. Finally, we assessed the potential impacts and promises of the strategies identified to determine the potential

global application. This project was meant to serve as a step towards sharing global approaches to reducing climate change and addressing its effects.

Chapter 2. Literature Review

In this chapter, we describe the greater context of our project. We summarize and explore academic research and case studies to better understand the interconnected relationships between the private sector and climate change in New Zealand. We begin with some fundamental concerns about climate change in general.

2.1 Effects of Climate Change

The realization that climate change will impact all aspects of our future has become increasingly visible. Climate change will have many lasting effects on not only the physical environment, but also on how we conduct business, and how industries can operate. Resilience means adapting across the economy, society, and landscape to prepare for widespread disruption. For the private sector, the threat can be met through strategic decisions about how materials are produced, how products are moved, and even changes to the site of the operations.

Depending on the sector, this response action has indefinite variations. Climate change-related disasters can easily affect productivity. As noted in a recent report, "Drought can harm food production and human health. Flooding can lead to disease spread and damages to ecosystems and infrastructure. Human health issues can increase mortality, impact food availability, and limit worker productivity" (*Climate Change Impacts | National Oceanic and Atmospheric Administration*, n.d.). This chain of events clearly shows the grave impact that climate change has on global socioeconomics.

Some sectors may face earlier adaptation needs. Food and agriculture production is an example of a sector significantly affected by climate change already. Farmers have been challenged by climate conditions like increased temperatures, drought, weather extremes, etc. (*Climate Change Impacts | National Oceanic and Atmospheric Administration*, n.d.). Food industries are directly affected by aspects of climate change such as the sea-level rise and change in weather patterns. In New Zealand, regional case studies have shown that ecological responses to Marine Heatwaves (MHWs), the excessive absorption of heat on the top layers of the ocean, and a direct effect of climate change, can have socioeconomic implications. Agriculture has directly suffered because of the oxygen reduction as water temperature rises, directly resulting in the decrease of the quality of aquatic life. The socioeconomic implications due to this include loss of fisheries income, erosion of essential ecosystem services, mass mortalities of iconic

species, and conflict (Smith et al., 2021). Similarly, New Zealand, being an island nation, experiences the impact of these effects more drastically. For example, in 2016-2017 there were mass mortalities of farmed salmon in the South Pacific Ocean (Smith et al., 2021).

Private sectors around the world will need to react quickly to maintain quality, distribution, and compliance with new environmental standards. Climate change has created an increasing sense of urgency in the case of resilience and the impact it is having on industries across the globe. Ideals of climate resilience and decarbonization are key factors in making a necessary change for the world.

2.2 Climate Resilience

Climate resilience is a term used to describe how communities or sectors plan and prepare for climate-related disasters. Climate resilience is composed of two main parts: resistance and recovery. Resistance is how entities perform while under the stress of a climate disturbance, whereas recovery is how well and how fast they can return to their state before the disaster (Hodgson et al., 2015). Part of resilience also means being flexible as new policies are implemented by communities, businesses, and governments to help protect the environment. This capacity to react in the private sector contributes to more resilient communities that can focus on resistance and recovery due to climate change (Bates et al., 2019).

Much of climate resilience is initiated through policy. First, climate change events and disasters "directly affect[s] the living conditions of most of the people in developing countries" (Cannon & Müller-Mahn, 2010). Given the potential impacts on the economy, infrastructure, and housing, climate-related events are a threat to global operations. Furthermore, climate-related events are especially devastating to the more vulnerable populations and unprepared private-sector economies. Climate impacts can reduce economic productivity and set off local or widespread climate mitigation (Palmer, 2020). The future of land use may stress areas near unlivable regions causing competition for resources, increasing the spread of diseases, and the potential for major conflict (Harvey, 2016). By promoting early climate resilience within communities, they can adapt better to climate change and work to prevent these negative effects from happening.

There have been a few controversies associated with the idea of planned climate resilience. First, with the increase in discussion and adoption of climate resilience, there has been a "loss of nuance." Specifically, the goal becomes returning to a normal state after a disaster,

rather than progressing forwards to a better state after a disaster (Wither et al., 2021). This has a significant effect since there is less of a focus on the long-term impacts that climate change policies can have. Also, a problem is that resilience in policy is "difficult to integrate into existing governance mechanisms," because governments rely heavily on quantifiable metrics, whereas there are many "intangibles such as trust or sense of community" that are encompassed in climate resilience (Wither et al., 2021). Therefore, navigating the scale of climate resilience will be a work in progress and one that will benefit from shared innovation.

2.3 Decarbonization as a Foundation for Resilience

Decarbonization is the movement to reduce the economy's dependence on processes that release carbon dioxide. Ever since the Industrial Revolution, captured carbon in the form of coal, oil, and natural gas has been used as the main source of energy for many different utilities (REN21, n.d.). The incredible energy density and ease of access to these resources made them the ideal source of energy for machines during this time. Unfortunately, this carbon, which has been trapped in the ground for millions of years, can lead to a destabilized climate when released into the atmosphere as quickly as it has been over the last 200 years (Felder & Kumar, 2021).

One major sector for decarbonization is the electricity production sector. Making up a third of energy production globally, renewable energy sources such as wind, solar, geothermal, and others already make a significant contribution to the world's energy production (Gupta et al., 2021). By 2050 in the United States, it is possible to decrease the greenhouse gas emissions in this sector by 80% given significant investment of low carbon infrastructure (Victor et al., 2018).

Another major sector for decarbonization is transportation. Making up approximately a quarter of greenhouse gas emissions on the planet, transportation is also a major contributor to climate change. The current solution to this issue is electric cars since this can account for an 84% decrease in air quality-related emissions. However, this is also heavily reliant on improvements in the energy production sector. Another approach is to alleviate the need for many passenger vehicles to be on the road. A shift to working and shopping from home, as well as using public transportation and carpooling services could lead to a 44% reduction in CO2 emission by 2060 (Zhang & Zhang, 2021).

Industry also has a large impact on carbon dioxide (CO_2) output (US EPA, 2015). One unexpected emitter of CO_2 is cement, which itself is responsible for almost 10% of the global CO_2 emissions. With rates of new construction increasing, the amount of carbon dioxide released

by cement will play a larger role in climate change as time passes. One simple answer to this issue is to simply use less cement in buildings. However, the issue is that cement is an incredibly useful building material that is necessary for pouring concrete (Habert et al., 2020). To solve this problem, low cement concretes have been developed that can reduce CO_2 emissions by 25%. Many possible substitutions to concrete exist, but it is very difficult to scale up their production to meet the construction needs of the world (Soldado et al., 2021).

2.4 Understanding the Regional Baseline for Climate Change Resilience in Wellington

New Zealand is expected to face a significant threat from sea-level rise, changing weather events, and even secondary impacts from climate migration. The city is taking climate action seriously. The Wellington regional council declared their goal to be carbon neutral by 2030 in 2019 (*Regional Climate Plan*, n.d.).

Therefore, sea-level rise, as well as other factors that can displace people, have created an even higher level of threat (*Why Climate Change Matters to Māori*, 2020). Industrial sectors such as Computer Services, which alone makes up nearly 4% of Wellington jobs, are affected by climate change. Agriculture makes up approximately 6% of New Zealand's economy with wine, sheep, and dairy as their most well-known exports. Each of these sectors is sensitive to climate change and also has a role to play in mitigating impacts or innovating adaptation (*New Zealand GDP Share of Agriculture - Data, Chart*, 2018). For example, climate change affecting the amount of rain in the region can easily affect crop growth and viable crops. On the other side, livestock is responsible for 14.5 of global greenhouse gas emissions (Grossi et al., 2019)

2.5 Partners and Changemakers

The future of climate change resilience is in shared knowledge and innovation. Therefore, the project is the foundation for a partnership between private sector leaders who are working with local governmental agencies, environmental organizations, and activists. From the sharing effectiveness of policies and actions put into place in New Zealand and elsewhere, we can build resources that can be implemented into climate change policies in the United States. These responses could inspire private sector leaders in the United States who share similar threats to their business. These policies could impact future business models in the United States and push companies to consider climate change when planning actions and procedures. On a greater scale, actions taken by governments and businesses have the potential to make a big impact on limiting

and lessening further climate change-caused disasters and events, which in turn impacts individuals in countries around the world.

As part of a grant from the Department of Education, Dr. Michael Elmes, Worcester Polytechnic Institute (WPI) professor of business is interested in understanding how we can learn from climate change response in New Zealand. More specifically he wants to take a deeper look into the private sector's role and progress in addressing climate resilience to identify and share successful and applicable practices.

Networks between industry and academic research are critical because they allow for a better understanding of resiliency within the business world. Academic research can influence developing methods of different resiliency techniques that can have benefits for not only the industry but for the environment encircling it as well. This can allow the opportunity for people to take the time to propose deliberate actions for obstacles that industries may face. Academic research can enable opportunities for researchers to analyze the bigger picture to ensure it is in the best interest of all stakeholders.

2.6 Industry Sustainability Models and Climate Change Policies

As evident in the increase of extreme weather variations and disasters caused by increasing temperatures, the need to make serious changes in how we preserve natural resources and live a sustainable life becomes prevalent. In November of 2021, COP26 took place, hosting people from about 200 countries. After these talks concluded, the president of the conference made some final remarks about the results of their talks. He said that "[the Glasgow Climate Pact] emphasizes the urgent need to accelerate our efforts to turn targets into action to keep 1.5 within reach. That work must start now" (*COP26 President Remarks at Closing Plenary*, 2021). When mentioning "1.5 within reach", he is referring to the global average temperature increase in the best-case scenario of greenhouse gas emissions in 2050. However, for this scenario to become a reality, he emphasized that world leaders would have to start taking action immediately. One of the biggest differences between this conference and the previous climate conference is that nearly 90%, rather than 30%, of the world, has set goals to reach the net-zero target (*COP26 Keeps 1.5C Alive and Finalises Paris Agreement*, 2021).

Although there have been many conferences that have resulted in plans to reduce the effects of climate change, the timeline of these plans is still too slow to reach the 1.5℃ temperature increase goal, and some seem to only be temporary solutions. As part of the Paris

Agreement, each country submitted its nationally determined contribution (NDC) to the overall goal of reducing greenhouse gas emissions to net-zero (*The Paris Agreement | UNFCCC*, n.d.). For this project, we are focusing on the shared knowledge between the United States of America and New Zealand. When comparing the two NDCs, both countries pledged to reduce their total emissions by 50% of their 2005 emissions (UNFCCC, 2021a, 2021b). The United States included general plans to reduce the emissions produced by different sectors of the country including industries(UNFCCC, 2021a). Their general focus was to phase out emissions by supporting research on renewable energy and "zero-carbon industrial processes and products." Economically, they also planned to use government resources to assist in early market support of "zero-carbon industrial goods." On the other hand, New Zealand's NDC had a series of policies being worked on, as well as current policies being enforced like the Climate Change Response Amendment Act, which pushes legislation to assist in reducing greenhouse gas emissions, similar to the United States' plans (*Climate Change Response (Zero Carbon) Amendment Act 2019*, 2021; UNFCCC, 2021b). However, New Zealand's NDC also emphasized synergistic research between conventional science and the co-governance strategies which incorporate Māori values to shape policies on the environment and economy. Due to Māori's unique culture like the belief of kaitiaki, New Zealand has a focus on creating a sustainable life for the current and future generations. It is their belief of being connected to everything that gives New Zealand a different way to view the world.

In our history, businesses have pushed to develop innovations to gain the most profit without much care about their impacts on the environment. With the dramatic increase of greenhouse gasses, the average temperature of the world has increased 1.02℃ since the beginning of the industrial revolution (Change, n.d.). Currently, industries only contribute about 22.4% of the world's greenhouse gas emissions, but can directly affect the sustainability of our lives (*Greenhouse Gas Emissions Worldwide*, n.d.). Although certain businesses may seem to be the main contributor to the emissions of greenhouse gases, they are also "...our best hope in reducing emissions through technological innovation" (Wright & Nyberg, 2015). Similar to the COP26 conferences, over 2,000 companies around the world have committed to reaching the 1.5 target with the Science Based Target initiative (*How It Works*, n.d.). Businesses like Tesla have joined this initiative, and according to Tesla's 2020 Impact Report, their vehicles have saved 5 million metric tons of greenhouse gasses by not only providing a zero-emission vehicle but also

by using renewable energy to power various infrastructures like factories and recharging stations (*Impact Report 2020*, 2020). As a result, their business becomes resilient to the changing regulations of climate change policies since their actions align with the global push to adapt to climate change (*How It Works*, n.d.). Joining this initiative also gives investors confidence in the company's success, as it shows that their business model follows global trends. These benefits are applied to every company in this initiative.

Although the initiative gives benefits to every committed company, they do not necessarily collaborate in reaching the 1.5 goal. In the United States, Tesla is one of the biggest electric vehicle companies which have pushed people to transition away from traditional vehicles. Their report mentions that they use the profits from selling products and emission credits to increase their vehicle production (*Impact Report 2020*, 2020). Also, their business model is becoming unsustainable due to legislative regulations around the world, which requires other companies to join the market, increasing competition. This essentially forces Tesla to focus on investing in itself rather than assisting other companies in order to stay competitive. Due to the nature of competition stimulating the United States economy, companies have not collaborated to push climate change actions. Although the United States Chamber of Commerce has been developing policies to push companies toward the 1.5 goal, each company develops its implementation rather than work together as a collective (*Climate Change*, n.d.). However, over 100 businesses in New Zealand have joined the Climate Leaders Coalition that essentially brings business leaders together to push climate change actions as a whole (*Home - Climate Leaders Coalition*, n.d.). When founding the coalition, Mike Bennett, the Convenor of the coalition, stated that:

> ...many businesses were making progress with their own company's response to climate change but that still left a gap around what we could be doing more of together to increase the pace and scale of impact from our collective efforts. So, it made sense to discuss those opportunities and commit to further action. At the very least that is a common commitment that we can all be held accountable for and provides other businesses with the confidence to lean into their own responses knowing they are not alone in doing that ("NZ's Leading Businesses Take up the Climate Change Challenge," 2018).

This pact pushes company leaders to work together to benefit the country as a whole, creating economic growth in New Zealand. When compared to the collaboration of companies in New Zealand, there seems to be room for companies in the United States to see collaboration as one of the catalysts for investment into innovation.

2.7 Relevant Case Studies in Resilience Planning

We have found institutions in Europe and New Zealand that have conducted similar research to our project and have presented their work in greater detail below.

Case 1. European Union

Research was completed to analyze local climate plans (LCPs) in over 800 cities across the European Union (Reckien et al., 2018). These LCPs were assessed using two dimensions: spatial alignment and level of integration. Spatial alignment refers to whether the LCP was aligned locally, nationally, or internationally, whereas the level of integration refers to how well LCPs worked together with other local policy documents. This research resulted in a few major discussion points. First, national legislation does not back many LCPs; however, among these countries, over two-thirds of cities have LCPs, meaning that some internal drivers in developing climate plans suggest a need for an investigation. Also, this research found that when national regulations support LCPs, both mitigation and adaptation plans create significant impacts. Overall, the research for the European cities analyzed the relationship and motivators of local climate plans in order to show their effectiveness, identify what impacts the planning process, and share these findings to help future climate change policies and plans to make further progress towards the overall goal set by the Paris Agreement.

Case 2. New Zealand

In New Zealand, The Aotearoa Circle is a group of public and private sector leaders that are committed to taking actions against climate change (*The Aotearoa Circle*, n.d.). Their website has listed notable participants, a timeline, and planned next steps for many different critical sectors of New Zealand. This research and data contributed to our research and provided valuable information for our project. The Aotearoa Circle's work helped our team document actions taken by businesses in New Zealand, assisting us to determine the relevant knowledge to share with the United States.

2.8 Summary

With the increase in climate-related events, the need to document the private sector's climate change strategies has become more important to create climate-resilient communities. Although there are plans to implement climate resilience in the private sector, more collaboration needs to be done to accomplish the 1.5 target goal. Therefore, practices done by New Zealand businesses may apply to businesses in the United States to better progress towards the target of the Glasgow Climate Pact.

Chapter 3. Methodology

The goal of our project was to document climate change response strategies in the private sector of New Zealand that could be shared globally. Our team accomplished this goal through the following three objectives:

1. Identified a sample of critical sectors that are reacting to climate change
2. Compiled current or planned climate change response strategies
3. Assessed potential impacts and promises of the strategies identified

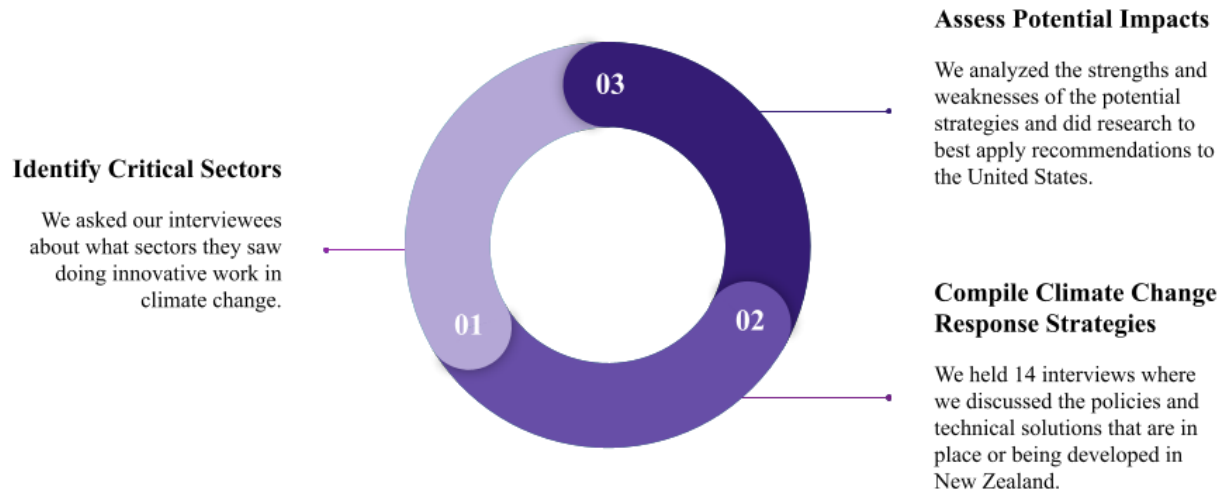

Figure 3.1 Overview of Methodology

3.1 Objective 1: Identified A Sample of the Critical Sectors That Are Reacting to Climate Change

The first objective for our project was to identify a sample of the critical sectors that were reacting to climate change. We accomplished this by first researching the different types of sectors that are mainly affected or are affiliated with climate change adaptation. Our team identified how these sectors are impacted by climate change and how they were responding.

Our sponsor, Dr. Michael Elmes, provided our team with initial contacts to interview. From these first interviews, we utilized a technique called, “snowball sampling” to solicit referrals to more experts to reach out and speak to next. In order to ensure good relations with the participants, we asked permission to use them as a reference.

Our interviews were semi-structured. This allowed the conversation to flow naturally while still hitting the key points through prepared interview questions (Cochrane, 2020).

Appendix A contains a list of questions that were used as a template for developing both broad questions about climate change and specific questions about the interviewee's background. As a result, each interview was tailored to each interviewee. Questions were selected depending on the individual or organization being interviewed. The interviews took place over Zoom or Microsoft Teams, allowing our team to better analyze responses carefully and use the recording feature that was given consent from the participant. In order to identify the most critical sectors, we asked each interviewee which sectors had the most room for improvement as well as which sectors had the most innovative ideas. We then used snowball sampling to find additional contacts that they may have from that sector.

3.2 Objective 2: Compiled Current or Planned Climate Change Response Strategies

After determining our sample of critical sectors, our next objective was to compile climate change response strategies that were in development or used in each of these sectors. To accomplish this objective, our team interviewed a variety of influential individuals which could include climate decision-makers such as environmental representatives as well as other experts in the sectors or even participants within local business profession organizations. This resulted in trends that were emerging from a broad perspective on climate change policies in New Zealand. Environmental representatives within specific sectors or businesses were able to provide specific details as to how climate change was being considered within individual companies and organizations.

Decision-makers and government officials provided a perspective on the "behind the scenes" aspects of policies and procedures, allowing us to assess how climate change was taken into consideration within their organization. Overall, the goal of these interviews was to gain insight into how businesses were responding to climate change, the degree to which responses were prioritized, and how quickly those responses were being enacted across sectors.

3.3 Objective 3: Assessed Potential Impacts and Promises of the Strategies Identified

Our third objective was to determine the qualities of each climate change response or innovation we collected based on the impact they have caused or by comparing it to similar policies made by other organizations. To accomplish this, we compiled recorded impacts of company policies and researched similar policies from other companies to compare potential impacts and sorted each strategy based on scale and type of response.

To assess the impacts of existing policies, we asked business leaders what they believe their policies have accomplished. We also researched media articles to assess how the general public views their impact. This allowed us to give a better understanding of the hypothetical impacts of these policies if they were implemented by companies in the United States. For policies that are planned to be implemented, we researched similar policies from other companies to base the potential impacts that could happen in the future. This allowed us to get an estimate on the impact of a company's policy. Some additional research about how companies can actually implement certain policies was also required.

Additionally, in order to develop the optimal recommendations for the United States, we researched greenhouse gas emissions by sector in the United States. This allowed us to focus the recommendations on the most impactful sectors, which would advance decarbonization in the United States most significantly.

Chapter 4. Results and Discussion

For this project, we conducted interviews with various decision-makers in New Zealand on the topic of climate change, including climate resilience and decarbonization. This chapter will identify and discuss key data that we gathered from these interviews.

4.1 Identification of Critical Sectors

Critical sectors fall into two key categories: sectors requiring the most improvements and sectors containing significant innovative solutions. We asked each interviewee to identify sectors that fit into these categories and pursued more interviews in those sectors. Based on our interviews, we identified agriculture, government, and energy sectors as needing the most improvement. Among these critical sectors, the agriculture and energy sectors stood out as having innovative solutions in reducing greenhouse gas emissions. This overlap means that New Zealand uses its climate change response resources effectively since the areas with the most room for improvement have the most attention.

4.2 Climate Change Response Strategies with Potential Impacts and Promises

We determined two distinct angles from which New Zealanders approach climate change: the creation of policies and the implementation of technical solutions or actions from businesses. These angles of approach interact with each other to allow New Zealand to start addressing the issue of climate change. Through the process of conducting interviews, our team gained insights on New Zealand decision makers' opinions of these response strategies, allowing us to determine the strengths and weaknesses of the response strategies discussed in more detail below. Figure 4.1 depicts an overview of the policies and technical solutions we identified.

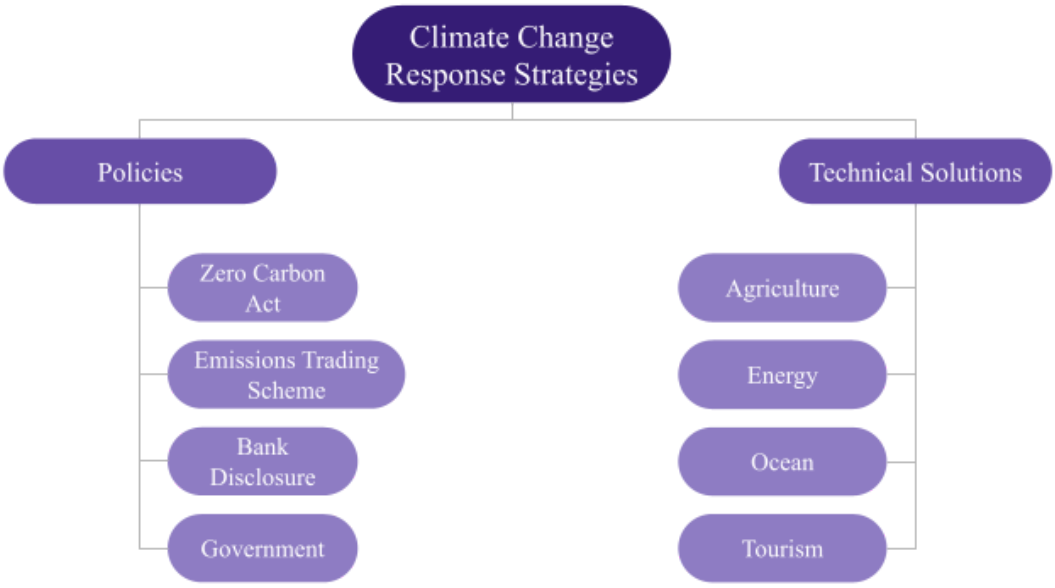

Figure 4.1. Breakdown of Climate Change Response Strategies

Policies

Through different policies, the New Zealand government has laid the foundation for the implementation of key technologies to reduce the emissions of different sectors. This was emphasized by Jo Hendy, the Chief Executive of the Climate Change Commission, who stated that climate change action is "a slow curve to begin with and then accelerates, and that is because of all the fundamentals, the policy work, the infrastructure that needs to be put in place, the capital investments need to be made, then decarbonization can accelerate" (Interview 6, January 31, 2022). Since industries currently have a lot of ambitions to implement climate change responses, these policies will aid in turning these ambitions into real action for the long-term. In New Zealand, Māori have influenced nearly every policy made, and since they highly value long-term solutions, Māori ensure that these policies consider factors that may occur hundreds of years in the future (Interview 14, February 16, 2022).

Zero Carbon Act

First devised by young professionals and university students of Generation Zero, the Zero Carbon Act implemented climate change policies to reach net-zero emissions by 2050 (*Climate change response (Zero carbon) amendment act 2019,* 2021). Through gaining support from the youth branches of each political party, as well as the Sustainable Business Council, Generation Zero brought the idea to Parliament and created an official act (Interview 7, February 1, 2022).

This act put in place strategies to contribute to the global efforts of the Paris Agreement and for New Zealand to mitigate the effects of climate change happening around them. The four main goals of the Zero Carbon Act were to:

1. Set a new target goal for greenhouse gas emissions
2. Establish a system of emission budgets
3. Require Government support to develop new policies for adaptation and mitigation of climate change
4. Establishment of the Climate Change Commission

With the successful establishment of the Climate Change Commission, the independent group guides New Zealand into taking action to address climate change. Comprised of skilled researchers, it guides climate change strategies and makes suggestions to New Zealand policymakers on how to best approach climate adaptation and mitigation. As an independent organization of the government, the purpose of the commission also included transparency of information to the public. Since it keeps the reports, data, and goals of New Zealand's climate change actions available to the public, the commission also allows the people to hold the government accountable.

Additionally, the different political parties in New Zealand unanimously agreed on taking action on climate change which brought them together to rectify the Zero Carbon Act. (Interview 7, February 1, 2022). Although this act pushed the whole country to start making serious changes to reduce emissions, it did not make any specific actions in the private sectors in New Zealand. As a result, many of our interviewees are worried about the time it takes to reach zero carbon by 2050. As Terry Paddy put it, "the thing that we try and point out at in group discussions and stuff with industry is it's not like these decisions are all about, 'oh, if we don't get to something by 2030, it's OK. We'll just spend more money, and we'll get there by 2040' or something along those lines. It's like, 'if we don't get to this point by 2030, the science says the temperature will spin out of control and we'll never get that back'" (Interview 2, January 19, 2022). Although the public worries about the effects of climate change, there is a lack of systematic changes being done. Many feel that the government needs to implement action now before they lose that time.

Emissions Trading Scheme

In 2008, the New Zealand government created the Emissions Trading Scheme with the purpose to ensure equity across all sectors and ensure each one contributes towards reducing

emissions. It works similarly to a carbon tax by putting a price on greenhouse gas emissions with the unique exception that it includes all sectors of the economy as well as all six greenhouse gases. (Interview 7, February 1, 2022).

One of the strengths of the ETS includes ensuring equity across sectors so that each sector contributes towards lowering emissions; however, several actions have weakened the effectiveness of the ETS. First, the government deferred the obligations of the agricultural sector indefinitely. This "watered down" the ETS as the agriculture sector makes up nearly 48% of the greenhouse gas emissions in New Zealand (Interview 7, February 1, 2022). Additionally, the ETS is linked to the international market prices, but the New Zealand ETS had a price cap of $25 per ton. Therefore, even if the international price rose higher than $25, the New Zealand price would not follow. Additionally, the ETS had a reduction of the unit obligation by half, meaning that one unit accounted for two tons and made the price ceiling $12.5 per ton. However, this price cap has not made a significant impact yet due to the linkage between the ETS and international emissions price. These prices also drastically fell, resulting in New Zealand's prices staying low with the international price. As a result, the public felt that New Zealand had no long-term decarbonization commitments. Since the price has stayed low for so long, they felt as though they wasted a decade trying to reduce carbon emissions (Interview 7, February 1, 2022).

Bank Climate Disclosures

The New Zealand government recently passed a unique law that requires banks with assets over one billion New Zealand dollars to disclose the climate impacts of their invested businesses. According to James Shaw, New Zealand's Minister for Climate Change, the goal in this disclosure policy was to make the financial sector aware of climate impacts to help achieve the overall goal of reaching net-zero carbon emissions by 2050 (*Mandatory climate-related disclosures,* 2021). Since this policy was introduced in late 2021, we cannot accurately evaluate the impacts of this policy, but based on our interviews, this policy did not take any tangible actions into addressing climate impacts, making it seem like "complete window dressing" (Interview 5, January 27, 2022).

Government

Our interviewees had different, and sometimes contrasting, opinions on the government actions, or lack thereof. We asked all of our interviewees, "How do you see businesses/industries working with the government?" with the follow-up of "What is going well?" and "What are the

challenges?" In addition, we asked broad questions about the most room for improvement in New Zealand and the greatest challenges to approaching climate change. From this, we gathered data on people's feelings on how the government addresses climate change adaptation and mitigation.

Some people believe the governmental policies work well and encourage businesses and industries to address climate change due to the threat of policy and mandatory restrictions should the government force businesses to take action (Interview 2, January 19, 2022). Additionally, some believe that the foundation set by the government is vital to accelerating action in technical solutions (Interview 6, January 31, 2022). The government has also funded many key research projects that help innovate new and creative ideas for decarbonization, which interviewees speak positively about.

On the other hand, many interviewees thought either the government does not take enough action or does not take action fast enough. While New Zealand has a small contribution to global emissions, they still export to large carbon emitters, so their efforts to make changes are still critical (Interview 7, February 1, 2022). Additionally, the government has had issues of staying on track to meet their reduced emissions goal by 2050, which much of their criticism stems from (Interview 6, January 31, 2022). To combat this problem some leaders like Lisa Tumahai think that older leaders should "move aside" to make room for younger more progressive people (Interview 14, February 16, 2022).

Technical Solutions and Actions

In addition to policies, we have also learned about ways businesses in New Zealand respond to climate change using different key technologies within each sector. From the foundation created by research and advising organizations and the government, these technical solutions accelerate the process of decarbonizing the economy to make tangible differences.

Agriculture Sector Solutions

Ruminant animals produce methane which contributes to over forty percent of New Zealand's emissions. Animals, such as cows and sheep, have stomachs that derive energy from plants by fermenting it in their stomachs. Methanogens, a particular group of bacteria, generally thrive in the stomachs of ruminant animals. They produce methane from CO2 and hydrogen floating around in the stomach. Preventing these animals from producing methane would make a

huge impact on New Zealand's emissions. One organization in New Zealand known as the Pastoral Greenhouse Gas Research Consortium (PGGRC) plans to reduce methane in ruminant animals with four main avenues of research.

The first method involves the artificial selection of desirable genetic traits to produce animals with drastically different physical and mental traits. One of the PGGRC's efforts is to breed sheep that produce less methane through a process of measuring the methane produced in a sample of genetically well-understood sheep to find sheep that produce the least amount of methane (Interview 3, January 21, 2022). This method successfully produced sheep that decreased emissions by about 1% per generation. Currently, the sheep in the test group have a 16% difference between the sheep producing the most and least methane from the 4% difference existent in the general population.

Figure 4.2. Respiratory Sheep Chamber for Measuring Methane Emissions

The second way involves feeding animals different feed to reduce the amount of methane that sheep produce. This method has yielded measurable, although small, changes in the amount of methane produced. However, since New Zealand farmers generally have their animals graze the fields, farmers who have more control over the types of food animals eat could utilize this method more effectively.

The third way involves the immunization of sheep. Scientists believe that methanogens do not serve any purpose to sheep and actually use up to 12% of the energy from the food.

Therefore, the PGGRC pursued research on using the sheep's immune system to eliminate methanogens with vaccines. This emerging technology could make ruminant animals more efficient and be the "Holy Grail" of agricultural innovations according to Mark Aspin, general manager of the PGGRC. Since it could increase profits, this method could provide a financial incentive for farmers to opt into the program (Interview 3, January 21, 2022).

Finally, the fourth way involves putting additives in the sheep's feed in order to decrease the amount of methane produced. The PGGRC claims, "Two-day respiration chamber trials in sheep helped to refine the selection even further and have identified five substances that showed methane inhibition of 30 percent without affecting general rumen function" (Pastoral, 2017). This emerging method can greatly benefit regions where ruminant animals are grain-fed instead of pasture-fed.

When it comes to methane produced by ruminant animals, reducing emissions of animals has lots of limitations due to the way animals are farmed. In New Zealand, most sheep are pasture-raised, meaning that manipulating the feed is rarely a viable solution. When tested, planting low methane crops in pasture land only reduced the methane production by half a percent. Other challenges come from the commercial viability of solutions, meaning farmers need to have a financial incentive to change their processes. Since methanogens use up some of the energy the animal requires, this financial incentive may come in the form of more efficient animals that have to eat less feed per unit of wool, milk, or meat output.

Energy Sector Solutions

One of the major steps for New Zealand to reach the zero-carbon goal is the electrification of the country in order to reduce the use of fossil fuels. The government has made big pushes for industries, especially the transportation sector, to completely phase out fossil fuel power and transition to electricity. Currently, the country has made developments in creating electric vehicles like an electric ferry to move between the North and South Islands. Industries also have discussions on how to encourage people to trade in their traditional cars for electric vehicles. However, due to the convenience and cheap cost of gasoline cars, people do not want to make the transition because of the lack of pressure to do so. Besides the transportation sector, industries in the forestry sector have also started to transition to using electricity by using electric heaters instead of coal to dry out any wood chips. Although these plans to use electricity more than fossil fuels would greatly push the country to produce almost zero carbon from the

consumer level, the electrical grid would also need to have an increased capacity to power everything.

Currently, many New Zealanders working in the energy sector worry that if everyone transitioned to electricity, the electrical grid could not support the demand. Traditionally, in order to increase capacity, companies could simply build another substation and increase the price of energy to fund the construction. However, in New Zealand, companies do not want to simply increase prices as that would cause economic strain to everyone, especially people in the vulnerable population. One of our interviewees, Terry Paddy, participated in discussions with other energy companies and spoke about how they want to resolve this issue, “we've got this problem. We need to spend $100 million to build a new substation unless someone out there in the wider industry, solar company, whatever, can come up with a non-wires solution that we can integrate with our network and use distributed energy to solve that problem.” (Interview 2, January 19, 2022). This calls for a complete transformation of the electrical distribution which companies like Our Energy strives to achieve.

As one of the people trying to make this change to the traditional electricity system, John Campbell, CEO of Our Energy, talked about their plans to create a decentralized electrical system where energy is distributed more locally rather than from one large central station. This would mean that homeowners would install some kind of renewable source, typically solar panels, and allow communities to participate in the energy sector. Although other sources of energy like hydroelectric dams are still needed to subsidize any shortages, the overall strain on the existing grid would decrease.

In the energy sector, another issue with the increased demand for electricity is the actual generation. Currently, New Zealand has the capacity to generate 85% of its energy from renewable sources like hydroelectric dams, solar energy, offshore wind turbines, and biofuels. However, cultural issues have prevented additional construction of some of these sources. In many of our interviews, people reported that they did not want to have additional hydroelectric dams because of how much it ruins the landscape. Offshore wind turbines disrupt the view and landscape of many places. On the other hand, there are also great innovations in using biofuels instead of coal by using wood chips.

In terms of electrifying the country, certain issues arise with the implementation. For example, New Zealand has a relatively high cost of living and electric cars generally cost much

more than gasoline cars. Even though, systematically, carbon emissions would decrease across the whole nation with electric cars, citizens don't have any incentive to change.

We found out that companies can implement additional energy capacity in two ways: constructing additional power substations or transitioning to a decentralized system. With the traditional way of installing more substations, people would have to pay more for their energy in order for companies to fund construction projects. On a national level, constructing additional substations would put a high economic strain on people, especially people in poverty as studies have shown that they spend a lot on energy (Interview 5, January 22, 2022). On the other hand, a decentralized system would require individual buildings to contribute to the grid. Not only would the country benefit from transitioning to renewable energy but individuals could take an active role in transitioning to a zero-carbon country. By giving people the power to contribute to the community, they might change their usage of energy since they could easily monitor their energy usage in real-time. In our interview with Terry Paddy, providing customers with real-time data would make a big difference between actively thinking about one's energy usage and having no motivation at all to look at their own energy usage (Interview 2, January 19, 2022). However, the main challenge revolves around the idea that it requires everyone to participate which is difficult to encourage without full systematic changes from both government and private sectors. On the other hand, building additional substations does not have this issue since it mainly falls on company resources.

Issues with generation may also arise due to the increased demand for electricity, but adding additional sources of renewable energy may not optimally support electrification. During multiple interviews, people generally did not like the idea of constructing additional hydroelectric dams and wind turbines as it would potentially disrupt existing ecosystems. With solar panels, issues come up with the land to build on as it would either require taking up large areas of open land, which can also disrupt ecosystems, or encourage citizens to build solar panels on their property, requiring government action. Another option to generate clean energy includes building nuclear power plants, but since New Zealand does not have any existing plants and is susceptible to frequent earthquakes, people have issues with accepting the construction of one. In one of our interviews, Lisa Tumahai, Chairperson of Te Rūnanga o Ngāi Tahu, talked about how building infrastructure for additional energy generation in Māori lands on the South Island could

be considered only if the need arose as a long-term solution (Interview 14, February 16, 2022). However, since many iwis focus on agriculture currently, construction is not necessary.

Tourism Sector Solutions

Tourism makes up a significant portion of the New Zealand economy. From our interviews, people have reported that their country is advertised as "clean, green New Zealand" and have also said that this is not the case anymore. Ewan Mackie, the Sustainability Leader in RealNZ, discussed that "[the clean, green New Zealand motto] was good marketing ten years ago. [But] I think we're moving away from that." (Interview 13, February 9, 2022)

RealNZ has started to move away from the "high volume, low value" tourism and focused more on trying to share a high-value experience that allows people to not only see the nice parts of New Zealand but also start realizing the cost it takes to maintain their pristine lands. For example, when flying to New Zealand, the plane releases lots of CO2 emissions directly into the atmosphere, contributing to the issues of climate change. Therefore, for people to still enjoy the land, New Zealand must reduce its domestic emissions even further. As Mackie has told us, "if we are decarbonizing, we want to share that with our guests. We want the decarbonization to have, result number one, producing less carbon, but result number two, to being an advocacy model and to say 'look what we're doing. This is how we do it. We're prioritizing it. You could consider that in your own life too'" (Interview 13, February 9, 2022). RealNZ's new mission does not simply revolve around changing the mindset of its customers. They want to encourage other tourism companies to start taking on this mission as well to make a real difference in the world. They have already collaborated with other ski companies on decarbonization plans even though it does not help their own profit margins. Due to the general mindset of New Zealanders that encourage actions that maintain their land, many businesses are more concerned about the bigger picture of climate change rather than increasing their profit margins. Although some tourism companies collaborate, additional companies need to also implement the concept of making changes to a person's behavior through shared experiences, so people can start to change their lifestyle for the betterment of the world.

Ocean Sector Solutions

As their territory consists of 95% open ocean, New Zealand has a large seafood industry. According to Volker Kuntzsch, CEO of Cawthron Institute and past international career in the seafood industry, climate change has hit this industry the hardest, forcing them to adapt to an

environment which is susceptible to large spikes in ocean temperature. He believes that "The ocean is our solution to our climate change problem" (Interview 9a, February 7, 2022). Even though New Zealand focuses many of its solutions on agriculture, collaboration on finding innovative methods using the ocean could present some great solutions. For example, seaweed has many uses, but one of the most recent innovative solutions involves using it within the feed of ruminant animals to reduce methane emissions. Kuntzsch also suggested that "We can reduce our dependency on land-based proteins or the way to carbon sequestration by planting seaweed forests that sequester carbon" (Interview 9a, February 7, 2022). The reduction of dependency on land-based protein could help reduce the production of methane emissions. The seaweed forests could also provide an alternative to pine and other tree forests to reduce carbon emissions. In another aspect, due to ocean acidification, mussels cannot create a hard shell when hatching which makes them unable to reproduce and increases the possibility of extinction. Therefore, the seafood industry has recently teamed up with the agriculture sector to develop hatcheries for oysters.

These collaborative solutions of climate change action have the potential for great changes; however, the push for collaboration may not benefit companies financially. New Zealanders worry about the drastic changes within the oceanic ecosystem. With the rise in ocean temperatures and changes in weather patterns, different species and predators have migrated to different areas. Salmon has had such high mortality rates that the seafood industry has decreased fishing in order to help the population grow. The drastic changes have called for a sense of urgency in the climate change response category, yet it has not had the publicity or attention to make the necessary changes for the environment.

Chapter 5. Recommendations

In this chapter, we will describe and discuss New Zealand's climate change resilience strategies that would be beneficial to implement in the United States. These recommendations and suggestions include what New Zealand has seen as successful responses to climate change which can help the United States prioritize its response strategies.

5.1 United States Climate Emissions

In order to make the best recommendations for the United States, we researched the emissions for Unite States industries. Figure 5.1 below was created with data from the Environmental Protection Agency (EPA) and shows the greenhouse gas emissions by economic sectors in 2019 (Environmental Protection Agency, 2021).

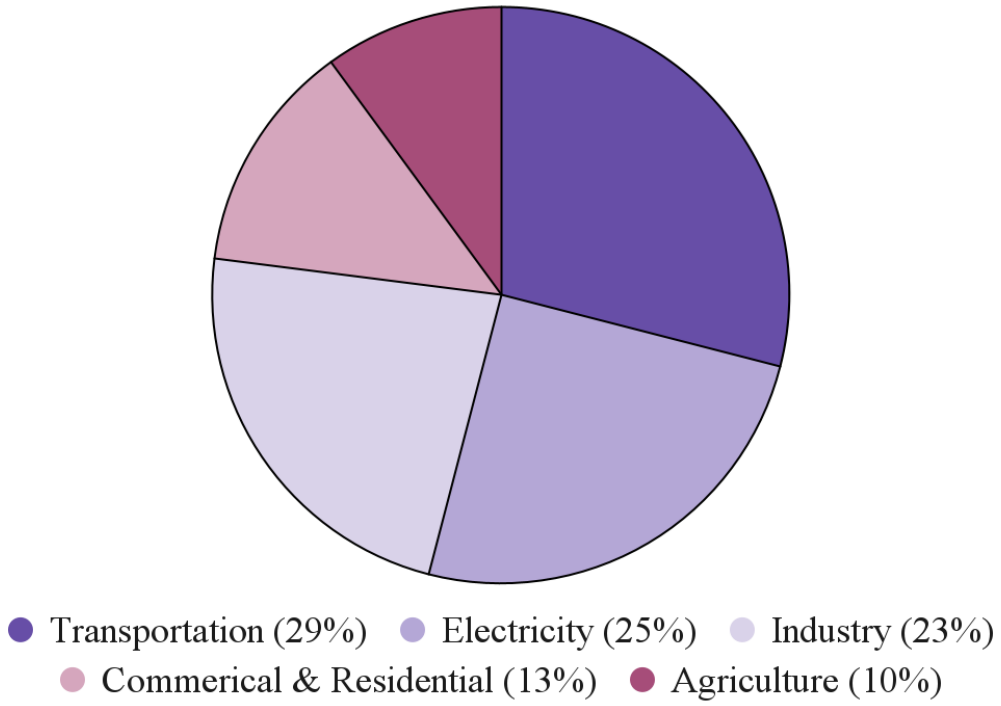

Figure 5.1. United States Greenhouse Gas Emissions by Sector

5.2 Recommendations

Transportation

There are many options for decreasing greenhouse gas emissions in the transportation sector, one of the largest contributors to greenhouse gas emissions. Transitioning to electric

vehicles can greatly reduce emissions, which have already started growing in use in the United States, and research in hydrogen-fueled vehicles have benefitted heavier vehicles. The suggestion from one interviewee in New Zealand was that it is "best use case," meaning that either option should be used wherever it makes the most sense rather than it being a black and white case of electric vehicles versus hydrogen-fueled vehicles (Interview 1, December 21, 2021). In addition, personal transportation makes up a large portion of the sector. Many households have multiple vehicles, which all contribute to carbon emissions. Either encouraging the use of electric vehicles or creating infrastructure where cars are not necessary are methods that could be utilized to reduce emissions. This can be done by encouraging other modes of transportation through improving and increasing public transportation and creating infrastructure for biking and walking paths.

Electricity

New Zealand has the ability to generate up to 85% of its energy from renewable sources, which comes in many forms such as solar, hydro, and wind energy. New Zealand also has the goal of being 100% renewable by 2050. By contrast, the United States is at just under 20% renewable (Energy Information Administration, 2021). Energy from coal is almost equivalent to all renewable energy sources in the United States. Figure 5.2 below shows the United States' sources of energy generation created with data from the Energy Information Administration.

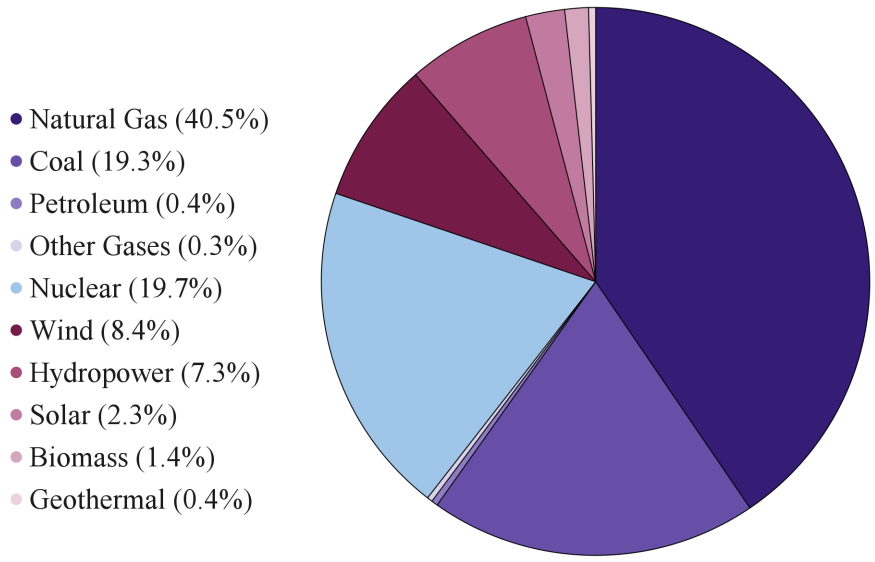

Figure 5.2. United States' Energy Generation by Source

We recommend that the United States take steps to increase energy from renewable sources. There is no one right path to do this, and in fact, it would be best for the United States to diversify the renewable energy sources since certain weather conditions can make sources less efficient than other sources. Currently, President Biden has pledged to cut emissions in half by 2030, yet in 2021 greenhouse gas emissions increased by over 6% (B. Dennis & M. Joselow, 2022). Either the government or an independent advising organization, similar to the Climate Change Commission, should create a detailed plan on how to achieve that goal. However, the government cannot achieve these goals if the deadline gets pushed back and, in the case of climate change, spending more money will not resolve the issue.

Agriculture

The way in which ruminant animals are farmed is a solution that New Zealand has valued to decrease methane emissions which the United States could utilize as well. Despite making up a smaller fraction of the county's emissions, ruminant animals in the United States still produce a significant amount of emissions. There are a few factors that are different in the states that should be considered when evaluating solutions. For instance, many of the farm animals in the United States are grain-fed as opposed to pasture-fed, meaning that farmers have much more control over what they eat. Changing the animals' diet to foods that prevent methane production may therefore be a more viable strategy in the United States than it is in New Zealand. Also, vaccinating the animals to lower their methane emissions has been a viable solution. Breeding them in a particular manner afterwards so there is a greater population of methane-reduced animals is a potential solution that New Zealand is looking towards which the United States could adopt. Another factor in the United States is the political nature of climate change discussion. Passing climate change legislation in the United States that pressures the agriculture sector to be more climate-conscious may be even more difficult than it has been in New Zealand.

Emissions Trading Scheme

In order to encourage climate change resilience, a policy similar to New Zealand's Emissions Trading Scheme should be implemented. There should be a price on greenhouse gas emissions, not limited to carbon dioxide. The price should also have a price cap, so the cost doesn't inflate too high. In order to assist small businesses, there needs to be government assistance like tax reliefs, so businesses still have the opportunity to grow. For bigger companies,

since they have the resources but do not have much motivation to change their practices, not only do they need policies like the Emissions Trading Scheme, but also a guarantee if their plan does not work. Bigger companies would be able to make serious progress in reducing emissions and maintain or increase their profit margins. In terms of implementing a policy like the Emissions Trading Scheme, the government would need to ensure two aspects. The first is that the policy is simple to understand. The second is that the enforcement needs to be consistent without loosening the restrictions too much. This ensures the steady progress of climate change actions and also provides revenue that can then be invested in innovative projects. Through long-term investments and emission taxes, the Emissions Trading Scheme can encourage the much needed systematic change to reduce greenhouse gas emissions in the United States.

5.3 Limitations

The issue of climate change has many different technical and political solutions. However, in terms of implementation, there are many limitations with applying the technical solutions of New Zealand to the United States. The agriculture sector, one of the greatest producers of methane, makes a much greater impact on greenhouse gas emissions in New Zealand than within the United States, making it seem less critical for the United States to focus its attention on that sector. In terms of societal norms, people in New Zealand have very different perspectives than people in the United States. The people of New Zealand take pride in their land and want to help make change. They will sometimes make decisions to improve climate change rather than increase the profits of their business. On the other hand, businesses in the United States tend to focus on their profits rather than the well-being of the planet. This thought process makes a huge difference in efforts to make a change, making the startup and priority for technical solutions to stay low in the United States. Additionally, based on our interviews, cultural and perspective changes will make the most significant impact, but will take time to implement because it is not a clear and direct change like a policy. However, even policies have many obstacles in the United States. The current political parties in the United States have disagreements on the issues of climate change, including its existence. In order to start making real changes to reduce emissions, the political parties and businesses in the United States must come to terms with the global problem of climate change.

This project, specifically, was also limited by the scope of our interviews and the allotted time. We could not talk to all of the sectors we would have liked, including the forest industry

and Māori businesses. The ability to speak to these sectors could have provided more insight and recommendations for the United States climate change response and resilience which could be an avenue for future research.

Chapter 6. Conclusions

Although all political parties in the United States do not completely agree on the issues related to climate change, businesses and certain parts of the government have implemented climate change solutions. Many businesses are making big strides to reduce the country's greenhouse gas emissions. However, in order to make serious changes and achieve climate-related goals, the mindset and behavior of citizens need to start changing to realize that climate change will not simply resolve itself and allow people to maintain their current lifestyle. Large systematic pushes need to be implemented now in order to start encouraging people to change their lifestyles. Like Jo Hendy said, “people are tricky” so encouraging businesses to make long-term investments and getting people to start taking actions to reduce their emissions takes time (Interview 6, January 31, 2022). Climate change leaders in New Zealand wished that they could have implemented actions earlier. One of our interviewees even said, “we've basically lost a decade of domestic progress because of this dumb system, and we can't get that decade back,” talking about New Zealand’s efforts in the early 2010s (Interview 7, February 1, 2022). This issue of losing time can also be seen in the United States as local governments can easily recommend certain actions like installing solar panels, but when passing a national bill to add regulations on industries, many officials will dispute the issue for months or years, yielding no results. In conclusion, countries like the United States that contribute a significant portion of the global emissions must implement systematic changes to reduce greenhouse gas emissions now without simply delaying the problems another decade into the future generations.

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Appendix A: Interview Questions

Here is a list of questions that can be asked in an interview. Questions would be divided into 3 categories, specific, broad, and ending. Specific questions would be tailored to each individual interviewee, followed by broad questions that we asked everyone, followed by the ending questions that would lend to our snowball sampling and make sure we didn't miss anything.

Specific questions:

- Varied by interview
    - Related to the person's specific role as a decision maker and their own personal work.

Broad Questions:

- How do you see other businesses/industries working with the government?
    - What is going well?
    - What are the challenges?
- Besides the work that you are involved in, where else do you know of any innovative climate change responses?
    - Within the _____ sector?
    - Outside of the _____ sector?
- Where do you see the biggest challenges within approaching climate change in New Zealand?
    - Collaboration?
    - Funding?
- Where do you see the _____ sector in X number of years in terms of dealing with climate change and resilience?

End Questions:

- Is there anything you think is important that we did not touch upon?
- Do you know of any people or companies that you believe are doing a lot of work in terms of decarbonization and climate change response that would be willing to let us know about?
    - If we contacted them, would you be willing for us to use your name as a reference?
- Would you like us to send you a copy of our full report?

Appendix B. Interview Table

Interview Number	Name	Date
1	Robert Holt	12/21/2021
2	Terry Paddy	1/19/2022
3	Mark Aspin	1/24/2022
4	Jamie Kerr	1/25/2022
5	Arthur Grimes	1/27/2022
6	Jo Hendy	1/31/2022
7	Anonymous	2/1/2022
8	John Campbell	2/1/2022
9a	Volker Kuntzsch	2/7/2022
9b	Jodie Kuntzsch	2/7/2022
10	Christiano Marantes	2/7/2022
11	Amelia Sharman	2/8/2022
12	Mike Williams	2/9/2022
13	Ewan Mackie	2/9/2022
14	Lisa Tumahai	2/16/2022