

## Science 1.1 Report

### Issue:

Heat is being trapped on Earth because of the human induced greenhouse gases. This temperature rise is causing global disruption to the Earth's natural climates and eco systems. Some problems include the melting of glaciers, animal loss of habitat, impacts on the health of Earth's plants and wildlife, and extreme weather, potentially causing irreversible damage.

### The Science Ideas Relating to the Issue:

The cause of climate change comes from human influence on gases in the atmosphere called greenhouse gases. Greenhouse gases are a collective of gases primarily consisting of carbon dioxide and methane. These gases absorb heat and re-radiate it back onto the planet, preventing heat from escaping so the Earth stays at a regular temperature and doesn't freeze. The name "greenhouse" comes from the fact that it operates similar to a greenhouse, letting in the sun's rays and holding the heat inside like an invisible glass dome. The influence of humans on the natural greenhouse effect is causing Earth's global temperatures to rise at unprecedented rates. The main source of this influence is the mass production of carbon dioxide being released into the air, trapping too much heat onto our planet and irregularly warming the climate.

Over the long term, the Earth has a natural cycle and balance at which carbon is produced, stored and dispersed. This balance must be maintained to prevent too much carbon being released into the air or too much carbon being stored into the Earth. There are many methods used to keep this balance. For example, carbon is released into the atmosphere by the respiration of animals and the evaporation of sediments inside oceans. On the contrary, carbon is absorbed by plants and trees, stored within rocks and deceased organisms. This is a process managed over a long period of time to keep Earth's temperature relatively stable, but because of humans, the amount of carbon being released and absorbed are equal. This creates an imbalance in the Earth's natural carbon cycle, trapping too much heat on earth and causing global warming.

Some of the main factors of many being the combustion of fossil fuels and forests. Fossil fuels are a natural fuel formed over millions of years, this long period of time is why fossil fuels are considered a non-renewable source. Fossil fuels consist of oil, coal, natural gasses, and the carbon of decomposed plants and animals. When burned, it becomes a resource for heat and energy. The energy of these fuels supply an estimated 80% of the world's energy needs, hence the high value and importance of it to humans.

The combustion of fossil fuels is releasing the carbon stored inside, becoming the primary contributor to the build-up of gases in the atmosphere. In addition, the combustion of forests causes even more carbon dioxide to be released into the air. When the remaining parts of a tree decompose after death or burn during fire, the carbon stored inside is then released into the atmosphere, contributing to the Earth's rapidly expanding greenhouse gases. At the increased build-up of greenhouse gases, not enough heat is being released from Earth and too much heat is being trapped inside, globally causing the Earth's climates to drastically increase in temperature over recent years.

This temperature increase is detrimental because of the problems being inflicted on the Earth's ecosystems and the inability for the environment and animals to adapt to the rapid changes. An example of the problems within climate change taking effect are the melting of ice glaciers, ice sheets, and sea ice. This affects all arctic wildlife from beluga whales in the arctic ocean to polar bears on the ice. Polar bears are among the species most affected by the melting of sea ice, because it makes up 96% of critical polar bear habitat. At the melting of sea ice, polar bears face various challenges like reduced hunting success, longer fasting periods, and limits their areas to find a den, negatively impacting their reproductive success and overall survival rates. Along with various other arctic wildlife, polar bears are at risk of

extinction primarily due to the problems of climate change, and if not stopped soon the damage could be irreversible.

### **Science-uninformed Response to the Issue:**

A science-informed response to the issue of climate change brought up in New Zealand is introducing the opportunities to reduce and delay the effects of climate change within transport. The goal is to lessen the reliance on burning fossil fuels as an energy source for transport, and decrease the amount of carbon emissions from vehicles. Some standards set by the government include: "Reaching net zero emissions by 2050, reducing the emissions intensity of transport fuel by 10% by 2035, and increasing zero-emissions vehicles to 30% by 2035." This means the government wants to lower the amount of diesel and petrol cars to decrease the amount of carbon dioxide being released into the atmosphere. Some ideas proposed to minimise the production of carbon emissions and use of fossil fuels is by increasing the use of low-carbon travel choices and new technologies. This includes more fuel-efficient vehicles, improving public transport like buses and light rails, and encouraging cycling and walking by improving urban design. The reasoning behind these objectives is the high rates of vehicle ownership and 99% of transport in New Zealand being dependent on fossil fuels, causing an unhealthy amount of carbon emissions to be released.

### **Science Ideas That Were Behind the Response:**

The transport sector produces about 17% of New Zealand's total greenhouse gas emissions. This is due to the current dependence on gasoline and diesel light duty vehicles for mobility. According to data from the Ministry of Transport in 2022, New Zealand has one of the world's highest rates of motor vehicle ownership with a number of 661 to 817 vehicles per 1 000 people. Only 3.8% of the total vehicle fleet being petrol hybrids, while pure electric vehicles and plug in hybrid electric vehicles combined only making up 1.6%. This proves the heavy reliance on gasoline and diesel vehicles in New Zealand, which is a concern for the use of fossil fuels and greenhouse gas emissions. Research from 2022 says the diesel and petrol car produces between 170-173 grams of CO<sub>2</sub> per km, which is notably a large amount compared to freight movement and electric vehicles. The electric car produces around 47 grams of emissions per km which is on par with the coal powered train at 49 grams per km, but the electric train produces an even lesser amount at 35 grams. The alternatives are significantly more sustainable compared to petrol and diesel cars that produce almost five times the CO<sub>2</sub>. The uptake of electric vehicles will need to be increased in New Zealand to meet the government's standard of zero-emission vehicles making up 30% of vehicles by 2035. To further support the decreasing of emissions and fossil fuel use, urban design that would prioritise convenient walking and cycling are being explored, along with the focus on convenient and comfortable freight movement. Emissions from transport continue to rise annually but could be reduced by at least 60% by 2050 if the ideas of mitigation are encouraged.

### **Ministry of Transport Perspective on the Science-Informed Response:**

The Ministry of Transport agrees with the government's response to reduce climate change by increasing the use of more sustainable transport options, but want to lower the amount because they can't supply enough and would be charged with hundreds of millions of dollars in fines. Car importers expressed their opinions, deeming the task of sourcing enough electric and low emission vehicles unachievable. This conclusion was collectively directed by the Motor Industry Association the Imported Motor Vehicle Industry Association, the Motor Trade Association, and the Ministry of Transport.

### **Ideas Behind the Ministry of Transport's Perspective:**

Within the manufacturing of electric vehicles, there are many scientific, technological and economical challenges car importers have to worry about that could make it difficult to bring electric cars to New Zealand, especially with tight deadlines and penalty fines an estimated total of \$800million. The primary problem is because electric vehicles are finite due to how

limited the materials to make an electric battery are. Electric vehicle batteries require rare minerals like lithium, cobalt, nickel and graphite.

These resources are hard to get a hold of because they are limited in availability and shared between countries. New Zealand is low priority in the supply chain due to having a smaller population and smaller economy in comparison to larger countries like USA and Japan. For example, according to 2024 data New Zealand has a population of 5.1 6million while Japan has a population of 1 23million, the USA has a larger population of both countries combined with a population oof 342million. This shows the major size difference in markets, proving New Zealand to be very small market in competition with other countries. This affects New Zealand because countries with larger markets and manufacturing bases get first access to the limited supplies needed to produce the electric battery within electric vehicles. Because of the challenges in constructing electric vehicles, New Zealand relies heavily on Japan's used vehicle market, receiving most of their electric vehicle imports from there.

### **How does the Response to the Issue Demonstrate Tiakitanga?**

The response to the issue of gross greenhouse gas emissions demonstrates tiakitanga because it responds to climate change in a way that upkeeps the people while simultaneously making the effort to protect our climate. For example, rather than just getting rid of vehicles overall, the idea of transitioning to electric cars develops an alternative option to using petrol and diesel cars. This means efficient travel is still here to upkeep the people of New Zealand without leaving toxic carbon footprints in the Earth's atmosphere. Because if the government just got rid of petrol and diesel cars, it would demonstrate tiakitanga and care for the climate but would sacrifice the tiakitanga of the population, hindering the efficiency of transportation which would create a mass of travel problems for the population. This shows that the current response to issue demonstrates tiakitanga for both the people of New Zealand without destructively contributing to the issue of climate change.

### **Sources**

#### **Climate Change/GHG/Carbon**

[What Are Greenhouse Gases and Why Do They Matter | NOAA Climate.gov The Carbon Cycle](#)

[The Impact of Melting Arctic Sea Ice on Wildlife - Arctic Ice Project](#)

#### **Transport Information/Gov Perspective**

[Transport](#)

[Transition to a low-carbon economy for New Zealand National Taxonomic Collections in New Zealand 2015 NumberOfVehicles24.pdf AnnualFleetStatistics.pdf](#)

[Sources of greenhouse gas emissions from transport | NZ Transport Agency. Walā Kotahi](#)

[Which form of transport has the smallest carbon footprint? - Our World in Data](#)

[Emissions from train travel](#)

#### **Car Company Perspective**

[The Impact of Climate Policies on the NZ Car Industry New Zealand's Automotive Industry And The Impact Of Climate Change —The Broadmind Blog REL-EECA-EV-Supply-constraints-report.pdf](#)