ESR NEWSLETTER
May 2022

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1.New Zealand's 2020 Greenhouse Gas Emissions Report & Domestic Long-Term GHG Reduction Targets

NZ Gross Emissions by Sector in 2020[1]		
	Kt CO_2-e	%
Agriculture	39,425.5	50.0
Energy	31,461.4	39.9
IPPU	4,618.4	5.9
Waste	3,268.9	4.1

NZ Gross Emissions by Gas in 2020[1]		
	Kt CO_2-e	%
CO_2	34,456.8	43.7
CH_4	34,272.9	43.5
N_2O	8,463.8	10.7
F-gases	1,584.9	2.0

According to the latest GHG Emissions Report[1], between 2019 and 2020 New Zealand's gross emissions reduced by 3%, largely due to reduced fossil fuel use due to the Covid-19 restrictions.

In 2020, New Zealand's gross GHG emissions were 78,778.4 kt CO_2-e. This is an increase of 20.8% over the 1990 gross emissions of 65,197.0 kt CO_2-e. The 2020 net emissions were 55,465.1 kt CO_2-e. This is an increase of 26.1% over the 1990 net emissions of 43,967.8 kt CO_2-e.

New Zealand counts net removals from Afforestation and reforestation, Deforestation and Forest management (LULUCF activities) towards its emissions reduction targets.

The Energy sector produced 30,549.4 kt CO_2 or 88.7% of NZ's CO_2 emissions in 2020. Of this, Transport contributed 13,078.7 kt CO_2 and Manufacturing industries and construction contributed 6,595.2 kt CO_2. The contributions of the Agriculture sector to national emissions of CH_4 (methane) and N_2O (nitrous oxide) were 88.9% and 94.5% respectively. The Waste sector contributed 8.8% of gross methane emissions or 3,011.9 kt CO_2-e.

[1] Source: New Zealand National Inventory Report to UNFCCC, April 2022

In 2020 the LULUFC sector sequestered 23,666.2 kt CO_2 of New Zealand's CO_2 emissions. This resulted in net CO_2 emissions of 10,790.5 kt in 2020.

Kyoto Protocol

New Zealand's UNFCCC target is to reduce emissions to 5% below 1990 levels by 2020 for the period 2013 to 2020. The 2022 Inventory Report states that "Following the Kyoto Protocol rules, New Zealand's emissions budget for the period 2013 to 2020 is 509,774,982 tonnes CO_2-e. This is based on the gross emissions data for 1990 included in New Zealand's 2016 inventory calculation."

For the target period, New Zealand's gross emissions sum to 639,600.7 kt CO_2-e. However, by utilising accounting rules for the LULUCF activities in the Kyoto Protocol, New Zealand identifies a net removal from LULUCF activities of 123,281.1 kt CO_2-e over the 2013-2020 period. This reduces New Zealand's emissions to 516,319.6 kt CO_2-e which is only 6,544.62 kt CO_2-e (or 1.28%) over the target.

New Zealand's Domestic Long-Term GHG reduction targets

The recently announced national GHG reduction target is "net zero long-lived gases by 2050".

The targets are further stated as:

- net zero emissions of all greenhouse gases other than biogenic methane by 2050
- 24 to 47% below 2017 biogenic emissions by 2050 including 10% below 2017 biogenic emissions by 2030.

New Zealand has chosen to prioritise the reduction of long-lived GHG gases, namely CO_2 and N_2O, over biogenic methane (generated by the agricultural sector) largely on the grounds that long-lived gases continue to produce global heating over decades and substantially reducing biogenic methane is a relatively long-term process.

According to the April 2022 National Inventory Report, New Zealand's 2020 net CO_2 emissions were 10,790.5 kt. It follows that, based on the 2020 data, net zero carbon dioxide emissions would be achieved by reducing gross CO_2 emissions by 31.3% to 23,666.3 kt.

Applying the national targets above, CO_2 reductions beyond 31.3% would be required to offset any remaining N_2O emissions. Depending on the success in reducing N_2O by the agricultural sector, the required CO_2 reduction would range from 31.3% (if N_2O emissions are reduced to zero) to 44.1% (if there is no reduction in N_2O emissions).

Put another way, based on the 2020 data, the targets recently adopted by the New Zealand government:

1) are likely to result in New Zealand becoming a CO_2 sequester nation by 2050 (i.e. having negative net national CO_2 emissions by 2050).
2) would require the non-Agriculture sectors (primarily transport, manufacturing and construction, plus industrial processes) to reduce gross CO_2 emissions by up to 40.8% beyond the level required to achieve net zero CO_2 emissions by 2050.

2. Solid State Battery Development

From CBS News, 8 April 2022

Tokyo — Nissan is working with NASA on a new type of battery for electric vehicles that promises to charge more quickly and be lighter yet safe. The all-solid-state battery will replace the lithium-ion battery now in use for a 2028 product launch and a pilot plant launch in 2024, according to Nissan. When finished, it will be about half the size of the current battery and fully charge in 15 minutes instead of a few hours.

The collaboration with the U.S. space program, as well as the University of California San Diego, involves the testing of various materials, Corporate Vice President Kazuhiro Doi told reporters. Nissan and NASA are using what's called the "original material informatics platform," a computerized database, to test various combinations to see what works best among hundreds of thousands of materials, Doi said.

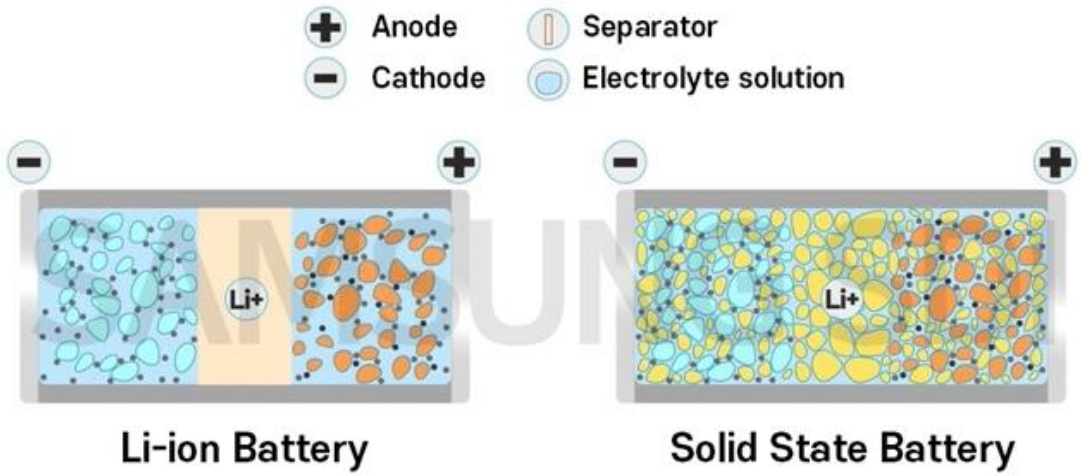
The goal is to avoid the use of expensive materials like rare metals needed for lithium-ion batteries.

Nissan is also counting on its historical experience with the Leaf electric car, which first hit the market in 2010 and has sold more than half a million units globally, although the battery technology is different, Doi and other company officials said. The Leaf battery hasn't had any major accidents on roads, and some parts of the technology remain common, such as the lamination of the battery cell, they said.

Other automakers, including Japanese rival Toyota Motor Corp., as well as Volkswagen of Germany and U.S. automakers Ford Motor Co. and General Motors Co., are working on all-solid-state batteries. Recently, General Motors and Japanese automaker Honda Motor Co. said they were working together on next-generation electric vehicles.

What is a Solid-state Battery? - From Samsung web site

A lithium-ion battery is composed of cathode, anode, separator and electrolyte. A lithium-ion battery applied at smartphones, power tools and EVs uses liquid electrolyte solution. On the other hand, a solid-state battery uses solid electrolyte, not liquid.



[Structure of Li-ion battery(left) and solid-state battery(right)]

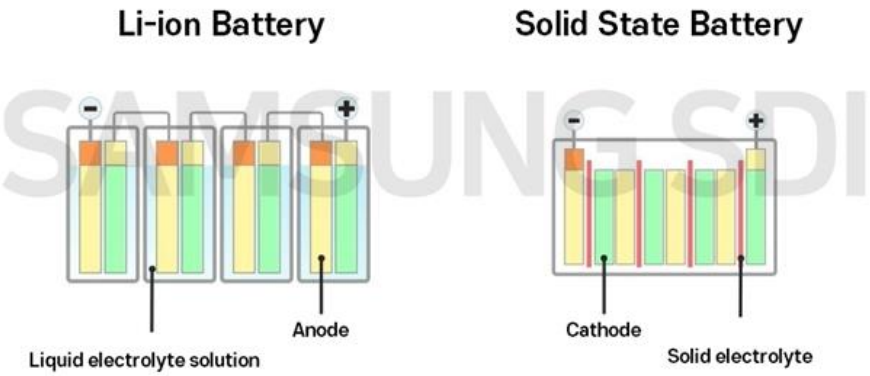
The Li-ion battery, which is commercially used, has a separator that keeps cathode and anode apart, with liquid electrolyte solution. On the other hand, the solid-state battery uses solid electrolyte, and the solid electrolyte plays a role of a separator as well.

The current Li-ion battery has a risk of battery damage such as swelling caused by temperature change or leakage caused by external force since it uses liquid electrolyte solution. A solid-state battery with solid electrolyte shows improved stability with a solid structure, and increased safety since it maintains the form even if the electrolyte is damaged.

Market research companies expect that EVs will replace ICEVs (internal combustion engine vehicles), and become the mainstream in the auto industry. To become the unarguable leader in the industry, EV should have the similar level of mileage as the current ICEV, and it is important to increase the battery capacity of an EV battery to do so.

A solid-state battery has higher energy density than a Li-ion battery that uses liquid electrolyte solution. It doesn't have a risk of explosion or fire, so there is no need to have components for safety, thus saving more space. Then there is more space to put more active materials which increase battery capacity in the battery.

A solid-state battery can increase energy density per unit area since only a small number of batteries are needed.



[A downsized solid-state battery(right) with the same capacity as the Li-ion battery(left)]

In March, the Samsung Advanced Institute of Technology showed the research result of a solid-state battery that can be charged/discharged over 1,000 times with 800km of mileage on a single charge. The study about the technology that increases life cycle and safety, and reduces the size of a solid-state battery in half was published in the 'Nature Energy', a global scientific journal.

3. Six things you should know about the new IPCC report (AR6)

From a report by Adam Currie, Greenpeace website, 1 March 2022 •

1. There is still hope

There's no denying that the report makes for grim reading, and some of the damage is already done. But time after time, we have seen that big – unimaginably big – change can happen when we stand together and build unstoppable people-power. There's absolutely no reason we can't do that now with climate change.

2. Climate risks are appearing faster and will get more severe sooner.

This really nails it. Climate change is already causing widespread losses and damages to nature and people, destroying lives, homes, livelihoods and culture. And it will get worse. Scientists have now updated their overall assessment on Reasons For Concern for future warming levels, and concluded that risks will increase to high and very high levels at lower global warming levels than previously assessed (in AR5). Already now, warming effects on ecosystems have been experienced earlier, are more widespread and with further-reaching consequences than anticipated.

3. The world is not prepared, even for the current impacts, and it is costing lives.

While attempts to adapt to the worsening climate hazards have increased globally, with benefits, most of it is still too little, too late, and not reaching those most in

need. As a result, the number of people and assets exposed to climate hazards has been increasing, not declining.

Lives and homes have been lost around the world, but in highly vulnerable countries mortality from floods, drought and storms was a whopping 15 times higher in the past decade, compared to countries with very low vulnerability.

It didn't need to be this way. Inclusive, equitable, sufficiently resourced and adequately implemented plans on adaptation and climate resilient development, that meet the needs of the most vulnerable, would save lives, homes and futures.

4. More warming brings more problems.

Limiting warming to 1.5°C would substantially reduce projected losses and damages, but cannot eliminate them.

Every increment of further warming is making the situation worse, pushing more people and species to their limits and beyond. Near-term actions that limit global warming to close to 1.5°C (the Paris Climate Agreement warming limit) would substantially reduce projected losses and damages to humans and ecosystems, but cannot eliminate them. Those losses and damages are unequally distributed and are not comprehensively addressed by current financial, governance and institutional arrangements, particularly in vulnerable developing countries.

5. We must restore nature and protect at least 30% of the Earth for it to protect us.

Safeguarding planetary health is fundamental for human and societal health and a precondition for climate resilient development. Diverse, self-sustaining ecosystems with healthy biodiversity provide multiple essential contributions for tackling climate change. That's why the IPCC puts strong emphasis on the potential and needs of ecosystem-based adaptation and mitigation. Importantly, scientists emphasise that maintaining the resilience of biodiversity and ecosystem services depends on effective conservation of approximately 30% to 50% of Earth's land, freshwater and ocean areas, including currently near-natural ecosystems.

6. This is the critical decade for securing a liveable, equitable and sustainable future. Governments must move from incremental to transformational, inclusive change.

Climate change impacts and risks are becoming increasingly complex and more difficult to manage, as different hazards occur simultaneously and interact with multiple risks created by unsustainable development models and social injustice. Hence, what's needed is not more incremental steps, but comprehensive and inclusive transformations of energy, food, industrial, urban and societal systems that deliver climate resilient, equitable development. Without any delay.

As the IPCC concludes:

"The cumulative scientific evidence is unequivocal: Climate change is a threat to human well-being and planetary health. Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all. (very high confidence)"

4. UN says up to 40% of world's land now degraded

Fiona Harvey *Environment correspondent, Guardian website, 27 April 2022*

Human damage to the planet's land is accelerating, with up to 40% now classed as degraded, while half of the world's people are suffering the impacts, UN data has shown. The world's ability to feed a growing population is being put at risk by the rising damage, most of which is caused by food production. Women in the developing world are particularly badly affected as they often lack legal titles to land and can be thrown off it if conditions are tough.

Degraded land – which has been depleted of natural resources, soil fertility, water, biodiversity, trees or native vegetation – is found all over our planet. Many people think of degraded land as arid desert, rainforests maimed by loggers or areas covered in urban sprawl, but it also includes apparently "green" areas that are intensely farmed or stripped of natural vegetation.

Growing food on degraded land becomes progressively harder as soils rapidly reach exhaustion and water resources are depleted. Degradation also contributes to the loss of plant and animal species and can exacerbate the climate crisis by reducing the Earth's ability to absorb and store carbon.

Most of the damage by people has come from food production, but consumption of other goods such as clothes also makes a big contribution. Much of the degradation is most visible in developing countries, but the root cause of overconsumption happens in the rich world, for instance in the increasing consumption of meat, which takes far more resources than growing vegetables, and fast fashion, which is worn briefly then thrown away.

Without urgent action, degradation will spread further. By 2050, an area the size of South America will be added to the toll if current rates of harm continue, according to the Global Land Outlook 2 report. The Global Land Outlook 2 report, only the second such report published, has taken the UN five years to compile with 21 partner organisations and represents the most comprehensive database of knowledge of the planet's land yet.

Restoring degraded land can be as simple as changing farming methods to terrace and contour farming, leaving land fallow or planting nourishing cover crops, practising rainwater harvesting and storage or regrowing trees to prevent soil erosion. Many farmers fail to take these steps owing to pressure to produce, lack of knowledge, poor local governance or lack of access to resources. Yet for every $1 spent on restoration, the UN calculates a return of between $7 and $30 in increased production and other benefits.

5.Sharp cut in methane now could help avoid worst of climate crisis

Fiona Harvey *Environment correspondent, Guardian website, 23 May 2022*

Cutting methane sharply now is crucial, as focusing on carbon dioxide alone will not be enough to keep rising temperatures within livable limits, scientists have warned.

CO_2 is the greenhouse gas most responsible for heating the planet, with most of it coming from the burning of fossil fuels. As a result, it has been the major focus of international efforts to prevent climate breakdown. However, other greenhouse gases also have a sizeable warming effect, and if we ignore them we will fail to keep temperatures within globally accepted limits, according to research published on 23 May 2022[2].

The study found that cuts to CO_2 alone could not achieve the reductions needed to stay within 1.5C of pre-industrial temperatures. But cutting methane and other "short-lived climate pollutants" (SLCPs) such as soot would reduce the global heating effect in the near term, thus giving the world "a fighting chance" of staving off climate catastrophe, the scientists said. Methane warming effect is as much as 80 times that of Co_2, although it quickly degrades in the atmosphere.

Emissions of methane have been soaring in recent years, the result of leaks and venting from oil and gas exploration, and shale gas wells, and from the intensive rearing of livestock for food. Earlier this year, the International Energy Agency said many countries were drastically under-reporting their emissions of methane, and that the global problem was far worse than previously thought.

Plugging the methane leaks from oil and gas operations, including shale wells, and stopping harmful practices such as venting or flaring the gas, is not only technically feasible but can also be highly profitable at today's gas prices.

The IGSD paper, which was published in the Proceedings of the National Academy of Sciences, showed the huge potential for "buying time" to change the world's energy systems by concentrating on cutting methane, and other SLCPs including soot, hydrofluorocarbons, ground-level ozone and nitrous oxide.

These substances contribute almost as much to global heating as CO_2, according to the study, though most of them last only a short time in the atmosphere. Cutting CO_2 is still essential for the long term, but must be accompanied by strategies to reduce the levels of SLCPs. If not, then temperatures are likely to exceed 2C above pre-industrial levels, the upper limit set in the 2015 Paris climate agreement, even if there are stiff cuts to CO_2 emissions.

The paper found the importance of "non-carbon dioxide pollutants" had been "underappreciated by scientists and policymakers alike and largely neglected in efforts to combat climate change".

[2] PNAS, Volume 119 No.22, May 23, 2022

Last year, before the Cop26 climate summit, the US and the EU launched a global pledge to cut methane emissions by 30% by 2030, to which more than 100 governments responsible for more than half of those emissions are now committed. However, Russia – which has some of the world's highest methane emissions, owing to its leaky oil and gas infrastructure – is not among them.

Ross Rutherford

ESR Newsletter Editor

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