

THRIVING WITHIN PLANETARY BOUNDARIES

A FRAMEWORK FOR NZ/AOTEAROA

NET ZERO EMISSIONS BY 2030

KEY MESSAGES

- Humanity is in ecological/planetary overshoot. It is critical to understand that climate change is but one of many symptoms of a wider ecological overshoot manifested in biodiversity loss, collapse of ecosystems, pollution, resource depletion, and soil depletion. We have already exceeded Earth's carrying capacity and our current ecological footprint exceeds our global bio-capacity by at least 56%. We are rapidly eroding our own ecosphere, the life-support system upon which we all depend. We have already crossed several critical thresholds, and are dangerously close to many others (Rockström 2009; Wackernagel et al. 2021).
- The dominant ethos of our Western culture over the past 200 years has been economic growth made possible by fossil fuels, a convenient and energy dense form of energy. Abundant and cheap fossil fuels have enabled exponential growth in world population and economies as measured by GDP – see Figures 1, 2, and 3.

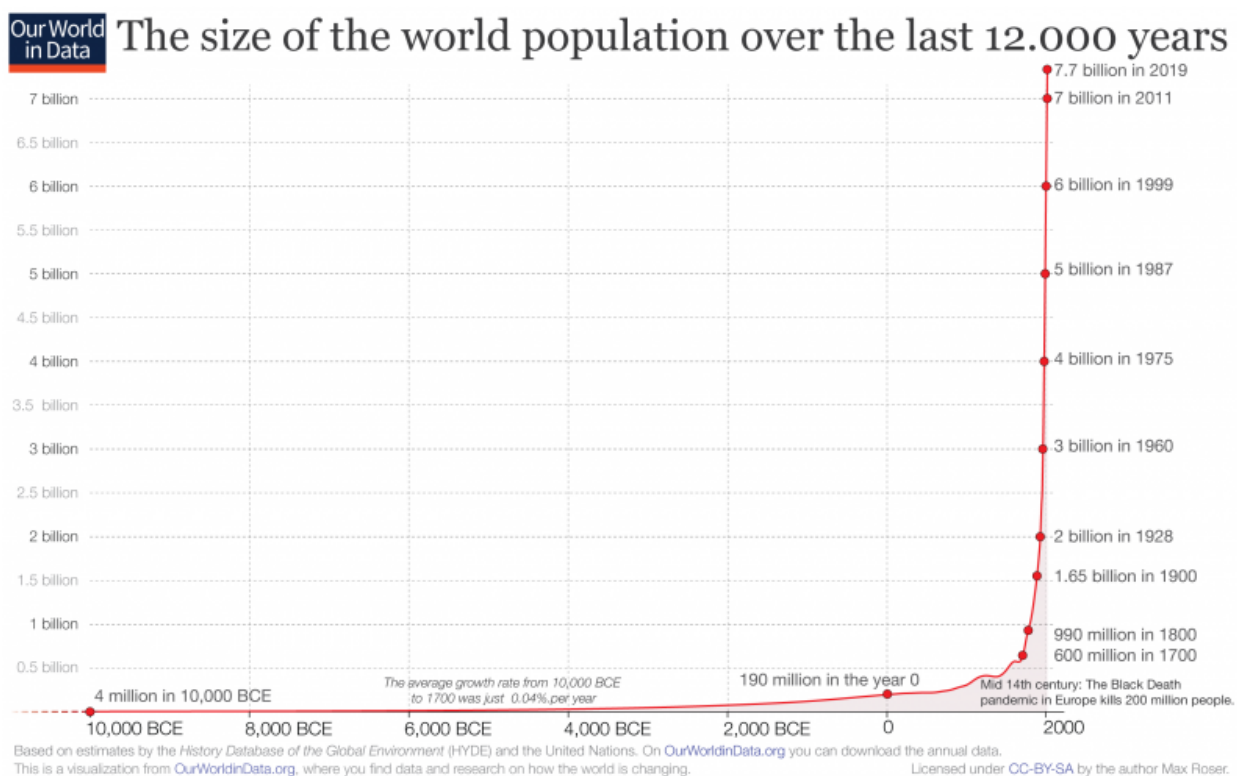
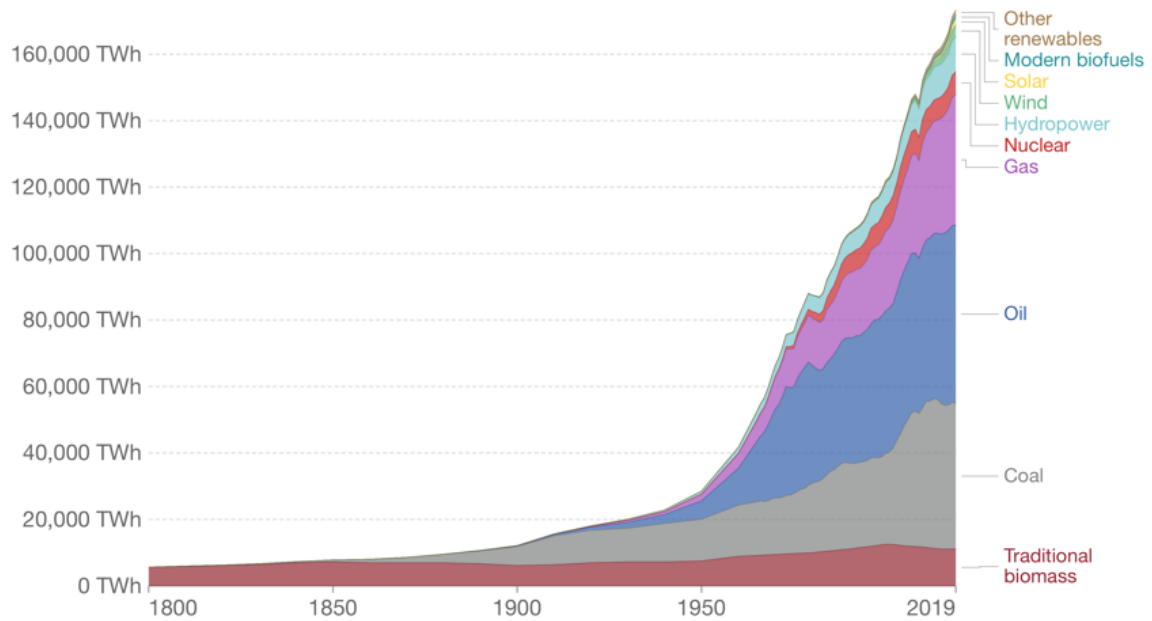


Figure 1: Human population over the past 10,000 years. *Our World in Data*, (2021)

Global primary energy consumption by source

Our World
in Data

Primary energy is calculated based on the 'substitution method' which takes account of the inefficiencies in fossil fuel production by converting non-fossil energy into the energy inputs required if they had the same conversion losses as fossil fuels.



Source: Vaclav Smil (2017) & BP Statistical Review of World Energy

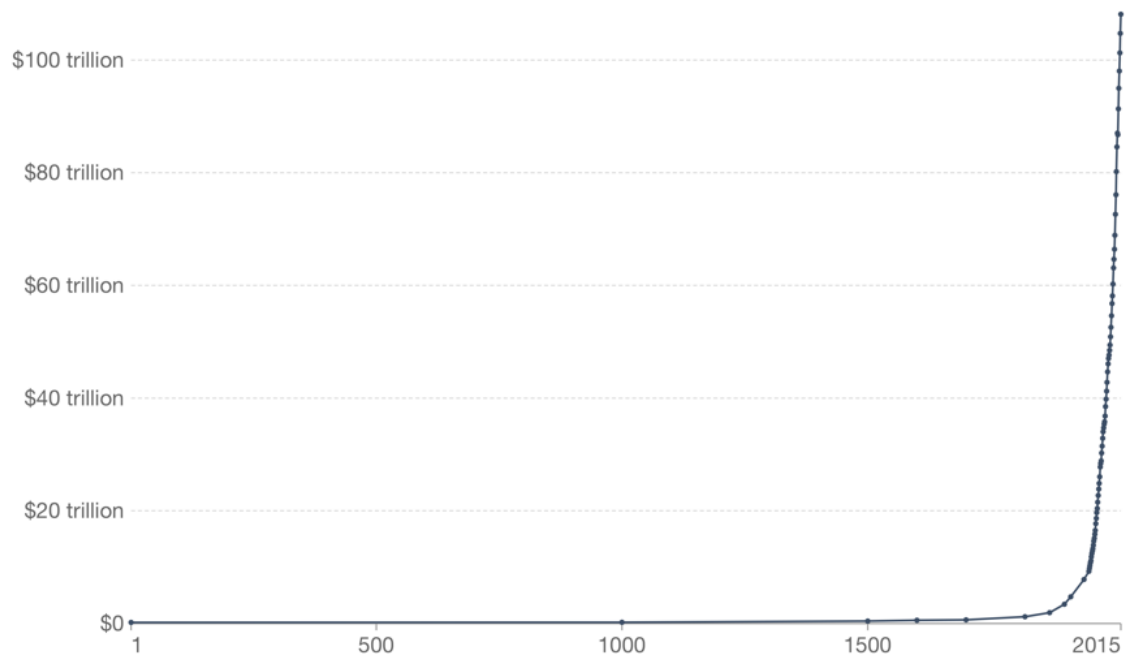
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Figure 2: Global Primary Energy Consumption by Source. *Our World In Data* (2021)

World GDP over the last two millennia

Our World
in Data

Total output of the world economy; adjusted for inflation and expressed in international-\$ in 2011 prices.



Source: World GDP - Our World In Data based on World Bank & Maddison (2017)

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Figure 3: World GDP over the last two millennia. *Our World In Data* (2021)

- The burning of fossil fuels and emissions of greenhouse gases has resulted in human-induced climate change. We must reduce fossil fuel consumption to put a brake on the already disastrous impacts of climate change, which if left unaddressed, is an existential threat to all forms of life on Earth (Lenton et al. 2008; Steffen et al. 2018).
- Renewable energy (non-fossil fuel energy such as wind and solar) cannot bootstrap the formation of renewable energy infrastructure by itself. Continued use of fossil fuels is required to enable a transition at the very same time we need to immediately reduce consumption of fossil fuels. The carbon emissions generated by building and implementing the renewable energy infrastructure needed to replace total current energy consumption from fossil fuels, and to do it soon enough, would massively exceed any remaining planetary carbon budget (Bihouix 2021).
- Furthermore, the energy returned on energy invested (EROI) to extract fossil fuels from the ground is declining (Hall et al 2014). There are strong indications that conventional oil has already peaked and the maximum rate of extraction has plateaued (Chapman 2014; Bihouix 2021). Peaking will inevitably occur for all forms of fossil fuels. Declines in EROI can only but accelerate. Ultimately, there will still be fossil fuels in the ground, but it will take one unit of fossil fuel energy to extract one unit. There is no advantage in doing that.
- Renewable energy has a much lower EROI than conventional oil had in the Twentieth century, a period when the EROIs of fossil fuels was much higher than it is now. Aside from the carbon emissions involved, it is impossible to scale up renewable energy to current energy per-capita levels because renewable energy is critically dependent on the use of scarce and rare minerals (Michaux 2021; Bihouix 2021). Furthermore, battery storage of renewable energy is less energy dense and portable for transport purposes than fossil fuels (Seibert & Rees 2021). In sum, we cannot quantitatively replace current usage of energy from fossil fuels with energy from renewables (Krumdieck 2021; Seibert & Rees 2021; Bihouix 2021).
- High EROIs of fossil fuels enabled exponential growth in populations and economies in the Twentieth Century. In the Twenty First Century, we now face a future where there will be fewer ‘energy slaves’ to work for us (quantities of energy which, when used to construct and drive non-human infrastructure, replace units of actual human labour). In a ‘green’ economy based on renewable energy, priority of energy use will have to be given to maintaining our economies. There will be no place for continued expansion in consumption and economic activity on limited energy per-capita.
- Even if it were possible, any attempts to continue business-as-usual economic growth and avoid climate change through a transition from fossil fuels to renewables will only but lead towards increasing ecological overshoot and collapse through biodiversity loss, ecosystems breakdown, soil depletion, resource depletion and all the other symptoms of overshoot. Whether it is powered by fossil fuels or renewable energy, continued economic growth – the expansion of the human enterprise in a finite world - can only lead to ecological and social decline and collapse (Demaria 2018; Herrington 2021).

We need to reduce our emissions of greenhouse gases and we need to continue using fossil fuels to enable a transition. The only way to satisfy both needs is to radically reduce our current levels of consumption and divert the use of fossil fuels away from extravagant and unnecessary consumption to that of investment in renewable energy and infrastructure. We need to keep most of our fossil fuel reserves in the ground to avoid a critical climate change threshold (McGlade & Ekins 2014). If we squander our limited budget of fossil fuels on frivolous consumption, then we will lose our last chance to make a global transition to renewable energy and infrastructure.

In summary, it is logically impossible for perpetual economic and population growth to occur on a finite planet. Sustainable economic growth is an oxymoron and empirical evidence on resource use and carbon emissions does not support green growth theory (Hickel & Kallis 2020). Either we have a planned, orderly contraction (de-growth) of our economy or else a far more chaotic contraction will be forced upon us by nature, likely within a decade from now (Herrington 2020).

We can only address climate change by addressing ecological overshoot (Heinberg 2017; Herrington 2020).

Rees (2021) stresses that the following actions must therefore be taken:

- Acknowledge that the economy is not separate from, and cannot function independently of, the biophysical environment.
- Explicitly acknowledge the end of material growth and the need to reduce the human ecological footprint.
- Acknowledge that so long as we remain in overshoot, sustainable production/consumption means *less* production/consumption.
- Admit that modern renewables – wind turbines and solar panels – are themselves dependent on fossil fuels and have no possibility of scaling up to replace current levels of fossil fuels.
- Recognise that equitable sustainability requires an economic levelling. Fiscal and other regulatory mechanisms are required to ensure redistribution of income, wealth, and opportunity among and within countries. Greater equality is better for everyone.
- Enact policies such as education, access to birth control, and economic independence for women which will lead fairly and without coercion to a smaller global population. The challenge is great, given that models show about two billion people could live comfortably and indefinitely within the biophysical means of nature.
- Implement measures including pollution and resource depletion taxes to internalise costs and move society closer to full social cost pricing. This would blunt current steeply rising levels of consumption in the developed world, the greatest contributor to overshoot.
- Start to create national subsystems of self-reliant bio-regions with productive ecosystems.

“Like it or not, there only remains the very rational option to apply the brakes: reduce, as quickly and as drastically as possible, the average consumption of resources per person ... The choice is not between growth and de-growth, but between imposed de-growth – because the resource issue will catch up with us in due course – or elective de-growth.” (Bihouix 2021, 50)

It is within this context we provide recommendations for various sectors below, a framework of solutions to achieve a thriving NZ/Aotearoa based on social foundations working within planetary boundaries by 2030.

FRAMEWORK OF SOLUTIONS FOR THRIVING WITHIN PLANETARY BOUNDARIES

Economic Approach and Policy

Politicians and citizens must recognise that continuing to pursue continual growth (including 'green' growth) is literally a dead end – it will deplete resources, drive further consumption and inequality, ever more carbon emissions and the destruction of the very environment our economy is based on. We have to radically reduce demand rather than supply and ask ourselves: how could one live as well, under certain conditions, without this or that need or desire (or chimera of 'green growth')? (Bihouix 2021)

Recalling Rees's points:

- Leaders and citizens must explicitly acknowledge the end of material growth and the need to reduce the human ecological footprint.
- We must acknowledge that so long as we remain in overshoot, sustainable production/consumption means *less* production/consumption.

A fundamental shift in policy is needed. We must move away from GDP growth as the target of our economy, and shift the economic paradigm to de-growth (Kallis 2015) or whatever is needed to fit our ecological carrying capacity. Our resources are finite and we are wholly dependent on a stable climate system.

We need to manage the necessary energy-descent while maintaining a fair distribution of the energy on which we all depend, and work on solutions and alternatives as we go.

This is a communal and national effort which must be built on acceptance of the limits of planetary resources and be a fair and just transition, as described in Kate Raworth's Doughnut Economics (Raworth & Hens 2019).

For this transition we urge a war-footing response, an organisational effort that our government is demonstrating admirably with the pandemic. In WWII, rationing of fossil fuels was the tool used to divert energy to the war effort. This tool could again be employed to direct the down-shift in energy consumption and emissions.

Given that reducing energy production and consumption is a difficult political challenge, the NZ Government must take responsibility in leading the country and achieve public buy-in to make real progress on both energy and emissions reductions. Support is only likely if there is widespread understanding of the reasons behind it. A public dialogue on this topic is urgently needed. Enlightened, decisive leadership action on energy and emission reduction will allay the anxiety about climate change already present in the population and strengthen belief in the government and democracy itself.

A transition to lean energy does not mean our quality of life will be diminished. It simply means we must reorganise our lives so that they function on less energy (Krumdieck 2021). We will be far healthier and

more comfortable and creative for it. There is strong evidence that high energy consumption does not equate to higher well-being (Millward-Hopkins et al. 2020). McLachlan (2021) estimates that a decent living standard can be had at less than a tenth of energy consumption of what New Zealanders currently use, based on data provided by Millward-Hopkins (2020).

Critical: This is a change to current business as usual – and must be accompanied with redistribution of wealth to offset impacts of this de-growth on the lower-income population, the sector which is the most affected.

Therefore, as Rees points out:

- Equitable sustainability requires fiscal mechanisms for income/wealth redistribution.
- Communities, families, and individuals need assistance to facilitate adoption of sustainable lifestyles.

De-growth means equitable redistribution of resources that we can use within planetary limits and within a certain budget or ration over time. This redistribution should be built on an orderly access to energy in the long-term descent. To achieve this, consider employing a flexible instrument such as Trading Energy Quotas (TEQs); its strength being that it involves all energy users directly and equitably – a fair, simple and more practical framework than either green taxation or ETS schemes. It guarantees achieving national carbon reduction targets by uniting the nation in a common purpose (Fleming 2016).

- End debt-based, growth-based money and for-profit banking systems. This will reduce the need for ever-greater consumption. Shift to co-op/not-for-profit banking.
- Remove requirement on corporations to place shareholder profit above all else.
- Implement various policy measures such as Universal Basic Income and reduced/shared working hours (Bihouix 2021).

PŪNGAO - ENERGY: zero emissions by 2030

Reduce emissions as rapidly and equitably as humanly possible by downshifting consumption and energy needs.

The current target of 2050 for net zero emissions is neither rational nor safe: We are already way beyond historic safe levels of atmospheric concentrations of greenhouse gases. The rate of temperature rise is increasing (Xu et al. 2018); 1.5C will be reached before 2030. The severe impacts of extreme weather events we are now experiencing at 1.2C of global heating will be very dangerous at 1.5° C, and disastrous at 2.9 C, the level that current climate policies are committing us to (Climate Action Tracker 2021; Monbiot 2021).

Long-term targets are an excuse for procrastination. What we do in the short term, over the next 3-4 years, matters most. It is vital to immediately reduce the impact of climate change and protect the most vulnerable ecosystems. Failure to do so right now may make long-term targets irrelevant if cascades of system-level changes are triggered (National Centre for Climate Restoration 2021). We therefore

propose an urgent shift to a much-accelerated time line – *net zero emissions by 2030* – in line with Kalmus (2021).

The UN says that to limit temperature change to 1.5° C, new or updated NDCs (nationally determined contributions) must be collectively increased fivefold this year (World Meteorological Organization 2021). However, if the countries that submitted NDCs to date continue to fall short of that benchmark, then the countries which have not yet submitted NDCs would have to make even deeper cuts to make up lost ground. In our view, all countries, and especially a rich economy like ours which emits very high levels of emissions per capita, must summon all the ambition that can be mustered and act much more urgently.

We are acutely aware of the pressing need to act immediately to reach the necessary targets to limit further warming of the atmosphere and address both the immediate and underlying drivers. We urge the Government to be bold and facilitate the rapidly needed downshift in energy consumption and emissions.

To meet the 2030 goal, significant changes are called for, especially in the areas of energy and trade, agriculture, and transport. Given the already existing loading of the atmosphere with greenhouse gases, it is necessary to front load many of the changes (both reductions in some areas and the underpinning increases in activity in other areas) by having the higher rate of change over the next 5 years. We therefore propose 50% reductions by 2025 and 75% reductions by 2027 in most areas with only some exceptions.

The proximity of these dates emphasises the extreme urgent need for action now. We ask for government to pass laws to set in place a pandemic-like mobilisation, a ‘go hard and go early’ approach with clearly communicated goals and expectations based on the most updated scientific advice. These laws should also include a requirement that the government publicly report each month’s progress against the goals with quantitative estimates of downward trends of energy consumption and emissions.

Energy actions:

- Measure and monitor all energy use.
- Set and adhere to a national energy budget to halt the rise in emissions and control an equitable down-shift in energy consumption and needs.
- Reduce energy use by:
 - Organising/designing compact community/town/city-living where all amenities are reachable in 20 minutes by active/public transport.
 - Setting up energy efficiency regulations to conserve all energy – in building, manufacturing, food production, transport, heating/cooling etc.
 - Rewarding those that most successfully reduce their energy use.
 - Introducing border tariffs on imported items which use fossil fuels.
 - Continuing focus on NZ’s existing ‘green’ production sites that already deliver the highest energy returns on energy investment (EROI) - hydro and geothermal (Krumdieck 2021). Making do with

what we already have: one of the world's highest percentages of renewable electricity generation.

Reserving energy for maintenance of these systems.

- Nationalisation of production, distribution, and retail of large-scale electricity generation.
- Setting true charges for electricity transmission to incentivise local production for local use, thus reducing transmission losses.
- Repurpose, renovating, and building new houses to high energy efficiency/passive standards.
- Do *not* fund large scale development of:
 - Hydrogen, because more energy is required to produce and compress the product than it can later generate (Seibert and Rees 2021).
 - Biofuel, because it has low EROI & degrades soil due to biomass depletion and uses land needed for food supply and restoration of ecosystems.
- Immediately divert funds from planned large scale energy projects to set up local communities with suitable small scale local energy production, such as micro-hydro (Heinberg 2021), mechanical wind and water, passive solar, animal and human labour (Seibert & Rees 2021).
- Prioritise use of available electricity for:
 - Electrification of public transport including NZ railway system.
 - Production of electric active/public transport vehicles – bicycles, cargo carts, trams, buses, trains.
 - Local manufacture and production of basic goods and tools needed in communities.

HOKO -TRADE:

Shift from globalised 'free' trade to self-reliant eco-centric local trade to reduce emissions resulting from resource over-exploitation, global pollution, and population growth.

Measure, report on, and reduce emissions from trade of goods and services in all economic sectors.

Reconsider the NZ Emission Trading Scheme (NZ ETS) as a tool to reduce emissions. It is subject to both political whim and corporate tactics that have the potential to nullify its effectiveness. Instead, implement measures that address the root causes, together with legislation for immediate steep reductions in emissions this year and every year after without exceptions.

Incentivise:

- Strengthening local businesses trading within local communities to reduce transport emissions.
- Manufacturing of local carbon neutral products and services needed in the community:
 - Food – seasonal products from gardens, communal gardens, urban farms, farms etc.
 - Clothing and shoes – products made from wool, linen, hemp, leather, felt, etc.
 - Transport – products for movement of goods and people: bicycles, carts, trains, draft animals etc.
 - Energy – small scale energy production generated by water, wind and geothermal.
 - Housing – constructions made of wood, stone, earth, repurposed materials.
- Small/medium enterprises and cooperatives – employees own enterprise shares.
- Community markets within 20-minute reach in all areas.
- All the above facilitated by local currencies with community support (alongside national currency) and community owned banks - loans at zero interest.

Reduce emissions from waste of goods:

- Incentivise local businesses to provide for local needs on demand with less waste emissions.
- Regulate for:
 - Product stewardship by producers.
 - Durability and repairability ratings on goods.
 - Mandatory reuse/recycling e.g. redeemable deposits paid at purchase, refills, etc.
 - Food share initiatives, composting, etc.
 - Free recycling, fees for landfill use.

ONE me AHUWHENUA - SOIL and AGRICULTURE

Shift away from resource heavy agricultural production and global transportation of food and turn all agricultural soils into effective carbon sinks.

Measure and report agricultural emissions. Ensure fast reductions of all agricultural emissions (methane – reduction is urgent to offset the warming effect from declining aerosol pollution (Shindell & Smith 2019) and increasing carbon dioxide equivalents, including methane (UNEP 2022). Immediately legislate to:

- Prioritise health of soils and atmosphere over profits to agricultural industry.
 - Phase out synthetic nitrogen fertilisers by 2023.
 - Phase out imported animal feedstock by 2023.
 - Reduce ruminant herd numbers (dairy, sheep, and beef cattle) to 1990 levels by 2030 (NZ Greenhouse Gas inventory 2021).
 - Set safe upper limits of nitrogen levels in all waters.
- Shift to farm management methods that increase soil organic matter, carbon sequestration and water holding capacity. Specifically reduce tilling or use no tilling, lower stock numbers, diversify crops, retain stubble/crop residue, grow perennial instead of annual crops, add compost, mix animal/crop farming, improve rotational grazing techniques. To achieve this:
 - Immediately subsidise:
 - Nationwide transition to regenerative mixed farming practices.
 - De-stocking of dairy/beef cattle herds.
 - Agroforestry - diversity of crops/tree cover combined with animal husbandry.
 - Restoration of native forests and wetlands on private and communal land.
 - Re-wilding of all degraded, eroding, steep private and communal land.
 - Incentivise:
 - Mainly plant-based diets.
 - Small scale organic local/urban food production.
 - For all green and food waste to be recycled/composted and distributed.
 - Immediately protect:
 - All prime soils for food growing.
 - Local markets - including tariffs on imports produced using fossil fuels.

KOTI PĀPORI - TRANSPORT:

Facilitate ways of living that reduce the need for transport and rapidly maximise active and public transport.

Measure and report all transport emissions.

Reduce transport emissions through structural changes by:

- Designing compact communities/housing so that all amenities are consistent with 20 - minute community living.
- Organising economic activities based on local needs met in, and by, local communities.
- Providing active, public, and shared/pooled transit infrastructure.
- Implementing use of communication technologies instead of travel.

Plan for NZ wide tree-lined walking & cycling networks linking areas, towns, suburbs, and central cities, and encourage use of e-cargo bikes:

- Separate pedestrians and cyclists from heavy, fast traffic.
- Provide safe crossings and access points.
- Vary routes connecting points of interest.
- Provide connectivity to public transport system.
- Locate infrastructure – toilets, drinking fountains, signage, electric bike charging/repair stations, lights where needed.
- Provide well-designed points of access, intersections, and roundabouts where cars and bikes meet.
- Ensure strict liability protection laws for cyclists – motorists are financially liable for collisions with cyclists.
- Provide connectivity to public transport system.
- Provide access to bike share programs.
- Provide nationwide cycling education.
- Provide infrastructure for toilet stations.
- Extend limits of 300 watts on electric bikes to 1kW for better handling of hills & cargo.

Plan for a NZ wide emission-free public transport network – electrified trams, buses, trains, ferries on basic arterial network connecting the country:

- Increase subsidies for public transport.
- Build stations/hubs/stops within communities.
- Ensure suitable timetables/regularly updated signage
- Build park and ride facilities – bike parking.
- Improve connections of public transport to cycle- and walkways.
- Integrate with mobility sharing and car-pooling systems.
- Facilitate 20 min communities/towns/cities.
- Public transport and car-pooling priority lanes.
- Prioritise shared transport parking.

- Incentivise NZ production of electric bikes, golf cart type cargo vehicles, trams, and trains.

Reduce all car and roading infrastructure emissions:

- Phase out imports of new, second hand and hybrid ICE vehicles by 2023 (in conjunction with public transport development).
- Replace electric car subsidies with funding for electric bikes, buses/trams/trains for connected communities.
- Incentivise Mobility Sharing and car-pooling – access to transportation on an as-need basis.
- No new road building - funds diverted to active (bike, walk) and public transport.
- Implement fuel/Road tax on all vehicles (incl. EVs) to build active and public transport infrastructure.
- Expand Clean Car Standard legislation to achieve more stringent fuel efficiency and emissions standards.

Reduce Freight emissions:

- Maximise carriage of heavy loads by electric rail, ship.
- Transport light freight by electric vans, cargo carts, bikes and horse power.

Reduce machinery emissions:

- Restrict fossil fuel use to heavy machinery for clearing slips, river beds etc.
- Shift light machinery to electricity.

Impose tax on fossil-fuel based shipping - cruise and freight ships, fishing boats, yachts etc.

Aviation:

- Tax long and short haul flights to cover true cost of emissions.
- Tax international passengers on arrival & departure to pay for local infrastructure and emissions.

TE TAIAO – NATURE:

Protect and increase natural carbon sinks: foster the long-term carbon sequestration capabilities of natural spaces.

Measure and report on greenhouse gas sequestration by significant natural areas.

Survey all NZ public and private land and identify steep and erodible land suitable for re-wilding.

Continue survey of land significant for conservation and protection of biodiversity in both private and public ownership (forests, grass/wetlands, sub- and alpine areas, lakes, rivers, streams, oceans under NZ jurisdiction).

Government legislation to protect biodiversity:

- Continue and expand protection of significant natural habitats on privately and communally owned land.
- Expand protected NZ ocean habitats – declare 50% of all NZ waters as marine reserves.
- Ban seabed mining/bottom trawling.
- End subsidies for all fisheries.

Nationwide shift to land management practices that sequester carbon long term and increase biodiversity:

- Acquire land of natural significance as Commons and/or build green areas in cities.
- Increase funding to landowners, councils, community groups, and the Department of Conservation for regeneration, conservation, and management of naturally significant habitats on privately and communally owned land.
- Re-wild through large-scale native tree planting programs and active management of naturally regenerating marginal land.
- Integrate agriculture and tree/shrub cover on farms based on agro-ecological principles (Agroforestry).
- Diversify native forests for long term carbon sequestration not for harvesting.
- Use appropriate fast growing native trees instead of planned pine monocultures as nursery crops for native forest establishment to avoid wilding-pine problem, degraded soils and erosion of felled slopes, increased fire and disease risk. Increase habitats for native species.
- Further enhance the predator-free NZ programme to protect living trees and birds for seed dispersal (e.g. consider cat control legislation).

Legislate prohibition of dumping of waste into earth and waters to stop pollution and contribute to reduction of consumption and therefore emissions:

- No new landfills.
- Adopt a 'No Waste' policy – products are reused and repaired (longevity and repairability ratings).
- Produce local goods for local markets to enable on-demand production with less waste.
- Implement product stewardship/kaitiakitanga (producers are responsible for reusing/recycling).
- Phase out unnecessary use of plastics, replacing them with biodegradable alternatives - fibre, wood, wool etc. Use of plastics limited to essentials such as certain medical products.

Reduce emissions from nature tourism:

- Prioritise healthy management of natural areas over profits to tourism, and local over international visitors to reduce transport emissions.
- Incentivise emission-free active/public transport and activities, and tourist activities that assist wildlife, pest control, plantings, walkway construction, etc.
- Introduce caps on visitor/tourist numbers and introduce tourist surcharges on nightly stays that are passed to local councils to offset costs of environment impacts & infrastructure.

Reduce loss of habitat and carbon-sequestering green space, by strict planning to limit urban sprawl. See also Transport.

HAPORI - COMMUNITY:

Strong community engagement, support and cohesion is necessary to enable the downshift of energy and resource use and emissions without social upheaval.

To build cohesive communities:

- Design local 20-minute communities with active public or shared transport, schools, medical care, markets, composting facilities, playgrounds, meeting places, repair workshops, community gardens, urban farms, natural spaces, and small-scale energy production etc. (see also Transport).
- Foster self-reliance, resilience, and stability of communities.
- Diversify local economies to ensure future security of goods and services in communities.
- Hold hui, meetings, and events by working together on communal projects e.g. planting and preserving food, restoring natural habitats, restoring and constructing communal housing and infrastructure, up-skilling etc. See also Just Transition Assemblies, following section.
- Emphasise and celebrate diversity and inclusion of all cultures with festivals and holidays.
- Disseminate Tangata Whenua local histories information.
- Teach Te Reo as national language in communities at all levels.
- Deliver wealth distribution through a fair tax system, Living Wage scheme and equitable energy rationing.

Provide subsidies for:

- Networks of local growers and community markets to underpin 20-minute communities.
- Community skill development (training, Repair Cafes/People Sheds/repurposing/recycling. re-establish courses at local learning centres to build diverse practical and communication skills).
- Health care for everyone.

Quantify NZ's human ecological carrying capacity (human ecological footprint) to inform the design of policies for national, regional and community population planning (family planning & migration).

- Fair resettlement, immigration, and refugee policies:
 - Plan for intake of Pacific Island Nations and NZ internally displaced climate refugees affected by rising sea levels and weather events.
 - Settlement of other new citizens based on the carrying capacity of the country's resources.

RANGIMÁRIE, MANATIKA, MARUTAU PEACE/JUSTICE/SAFETY:

Climate and Resource Justice is vital in achieving an equitable energy down-shift with peaceful and thriving communities and nations.

Foster safe communities without crime by rationing energy use to allow a basic living standard for all. Reduce police/military emissions by preventing social conflicts and wars over resources:

- Recognise climate change as social as well as environmental issue.
- Reconsider structural issues of inequities.
- Immediately collaborate with Treaty partners to find solutions that uphold Te Tiriti and which are co-designed with diverse representation from the local communities, iwi and hapu.
- Require people on higher incomes to lower their energy and resource use and emissions substantially more and faster than people on low incomes, who are struggling to cover even their basic needs.

- Reduce NZ's emissions much faster than required of low emitting nations. They have not been responsible for the historical emissions generated in the first place.
- Provide transition assistance to low-emitting nations and nations who are still industrialising. Direct aid to diversify nations away from oil and gas, but not in form of NZ corporate offsets to avoid reducing emissions in Aotearoa.
- Establish regular Citizens' Assemblies on Just Transition at local and national level to ensure solutions reflect public engagement.

Measure and report on basic needs and wellbeing of all citizens:

- Local and national food security.
- Local and national clean water security.
- Local and national housing security.
- Access to healthcare/dental care/birth control.
- Local and national safety.
- Sense of belonging, esteem, self-actualization/realization through:
 - Building community and creation of transition employment.
 - Shared participation (paid or volunteered).
 - Skill development.
 - Access to and immersion in natural environments.
 - Living wage / universal basic income for all.

KĀTAO - WATER:

Clean and adequate water is the basis for healthy communities and thriving economies.

Measure and report regularly on the state of water supplies.

Reduce all emissions steeply to prevent ocean acidification and protect ocean biodiversity.

Lower the need for resource-heavy water infrastructure (extensively piped, dammed, channelled, and treated water) to limit carbon emissions from construction and release funds for other purposes by a series of legislation and funding actions on fresh water, storm water, and sewage:

- **Wai – Fresh Water**
 - Value and conserve clean water.
 - Establish Kaitiakitanga - Personification/Protection of lakes, aquifers, rivers, streams (e.g., Whanganui River).
 - Legislate to preserve water as common good and be managed equitably.
 - Prohibit overseas trade in fresh water.
 - Legislate for pollution protection of rivers, lakes, aquifers, streams for safe upper limit for nitrogen runoff that guarantees healthy fresh water.
 - Fund the conservation of natural water systems of soils, forests, grass and wetlands, lakes, aquifers, streams, and rivers through Department of Conservation.

- Re-establish natural water systems (key streams above ground, natural water channels and river beds).
 - Support restoration of fresh water aquifers, lakes, rivers, and streams by urban and rural communities (e.g. Raglan community – 10-year recovery effort needed to restore streams and harbour).
 - Require rain water harvesting from building structures for drinking water.
- **Pókáká - Stormwater**
 - Incentivise natural water filtration systems in urban areas instead of resource-heavy infrastructure:
 - Swales, not gutters; streams, not channels.
 - Wetlands and riparian plantings.
 - Increase of permeable surfaces in urban areas.
 - Reduce impermeable surfaces (paved roadways and paths) to decrease water and pollutant run off.
 - Phase out all harmful pollutants (including herbicides) which enter into storm water or are deposited on land where they enter water (including nitrogen).
- **Paru – Sewage**
 - Reuse all grey water from households, manufacturers, in dense urban housing developments (shape landscapes to allow water to infiltrate soils using gravity).
 - Regulate for management of grey water and sewage infrastructure including recycling of nutrients.
 - Consider introduction of and regulations for composting toilets in new and repurposed buildings to achieve:
 - Water savings.
 - Circulation of nutrients for soil health, biodiversity, and food production.
 - Emission savings on fertilisers.

ĀNGI - AIR

Clean air is vital for thriving communities.

Measure, record, and report regularly on national and local air pollution levels (transport, industry, heating of all fuel burners etc.) as part of monitoring emissions reductions.

Reduce the need for activities that pollute the air e.g. regenerative land use does not promote burn-offs, passive buildings do not burn fuel for heating, and 20-minute communities avoid petrol/diesel fumes by using active and electric public transport.

Legislate and regulate elimination of all air pollution.

Subsidies and incentives for air pollution reduction in all sectors are another tool for emissions reduction and for preservation and regeneration of natural habitats – see ‘Nature’.

KAI - FOOD:

Reduce food emissions by phasing out synthetic fertilisers, inefficient supply chains (global food trade/meat/dairy), and food waste.

Measure and report regularly on emissions from food production and distribution, and on food security of communities.

Immediately incentivise:

- Climate friendly food production and consumption.
- Regenerative food growing methods used in all home and community gardens, urban and horticulture farms.
- Communities to grow food for local communities on communally owned land such as community gardens, allotments, park edges, berms etc.
- Local farmer's markets in every area consistent with 20-minute communities.
- Increases in local, seasonal, and plant-based produce consumption.
- Decreases in imported food, meat, and dairy products (high supply chain emissions).
- Transition from intensive monocultures to regenerative/permaculture farming methods based on agro-economy and agro-forestry.
- Increased production and diversity of locally grown food crops to reduce food miles, and enhance self-sufficiency and resilience.

Legislate to protect existing prime fertile soils for climate-friendly local food production:

- Survey and test soils to identify best places for:
 - Community gardens, urban farms in and around populated areas.
 - Mixed farming - horticulture/animal husbandry/crops.
- Protect growers through:
 - Levies on imported food.
 - Grants to access land and training.
- Reduce wastage of food to landfills by:
 - Food waste collection, composting and distribution of compost.
 - Food sharing projects.
 - Recycling of by-products from food production.

WHARE - BUILDINGS & HOUSING:

A smaller, yet highly energy efficient housing footprint allows for expansion of natural habitats and carbon sinks.

Measure and regularly report on emissions from buildings and their construction.

Incentivise and legislate for:

- Compact housing to prevent sprawl and achieve energy efficiency, while ensuring liveability of dense housing by regulating for access to light, amenities, natural and food growing spaces, public transport etc.
- Design of energy efficient upgrades of older buildings (retrofitting, insulation etc).
- Repurposing of old buildings instead of making way for new builds.
- Recycling and repurposing of demolition materials.
- Design of energy efficient/passive heat new builds to achieve warm/cool dry shelters for all people in Aotearoa, without exceeding emissions targets.
 - Development and use of locally produced materials for local construction: stone, wood, straw, flax, hemp, earth, wool, reclaimed, 'green' roofing etc.
- Easy access to loans and consents for energy efficient co-operative housing models and long-term diverse community and social rental housing.
- Levies on empty homes/buildings to minimise non-permanently occupied houses to reduce emissions from unnecessary new builds.

Fund initiatives through tax on capital gains on housing sales.

HAUORA - HEALTH:

Healthy environments are the basis of healthy communities, resulting in less emissions from health care.

Measure & report the health-cost impact of all emissions, and make clear that reductions in these costs will help offset the cost of transition to net zero carbon.

Ensure maintenance and improvement in population health while reducing emissions from health provision:

- Design the health system for distributed (local) rather than distant care. Enable access for all to medical/health care (preventative, dental, mental, emergency, pre-birth/birth care, paediatric, optical, hearing and maintenance etc.) within 20 minutes using active or public transport.
- Reduce emissions from the use of disposables such as surgical supplies, masks, baby nappies, etc.

Prevention/health promotion: Many of the actions described in other sections will promote health through disease prevention by mitigating emissions and climate change, for example:

- Buildings and housing – warm, dry, energy efficient homes.
- Water - guaranteed access to clean ample supplies of drinking water and prevention of flooding.
- Food – ensured security of supply of high-quality nutritious foods – retention of prime soils and improvement of soil quality while, at same time, reducing emissions from food production (see Food).
- Transport – urban design for 20-minute access to work and leisure, plus active and public transport to lower transport emissions thus reducing air pollution & traffic accidents. Improved access to healthy pursuits: swimming, walking, biking to increase physical exercise.
- Community – improvement in community engagement and social cohesion.

- Peace/Justice – elimination of inequality of access to health care.
- Air – reductions in air pollution from heating and transport improve health.

MĀTAURANGA - EDUCATION:

Access to evidence based scientific knowledge, awareness of Kaitiakitanga, and the need for stewardship of the environment as expressed by Maori and other indigenous cultures of society is key to understanding the need for de-growth and downshift in consumption of energy.

Measure and report on emissions from education.

Reduce emissions from education by incentivising locally based and nature centred learning:

- Introduce 20-minute communities/towns/cities with schools within 20-minute radius – School Zoning.
- Repurpose, renovate, and build schools and other learning centres to high energy efficiency/passive standard.
- Phase out:
 - Fossil fuel and biomass heating.
 - Teaching of growth-based economy model.

Incentivise a shift to teaching material at Pre-School/Primary/Secondary/Tertiary/citizen education level based on and emphasising:

- Interconnection/interdependency of physical/biological systems of which humans are a part.
- Knowledge of planetary boundaries including:
 - Necessity of change from growth-based economy to no growth/steady state economy.
 - How local communities of diverse life forms can live within physical limits.
 - The importance of no waste simple living.
 - Skills to fulfil basic human needs (community, warmth, shelter, clean air, water, and food production) within planetary limits.

References

- Bihouix, P. (2021), *The Age of Low Tech: Towards a Technologically Sustainable Civilization*, Bristol University Press.
- Chapman, I. (2014). *The end of Peak Oil? Why this topic is still relevant despite recent denials*. Energy Policy 64, 93– 101, <https://doi.org/10.1016/j.enpol.2013.05.010>
- Climate Action Tracker (2021), Warming Projections Global Update, May 2021 https://climateactiontracker.org/documents/853/CAT_2021-05-04_Briefing_Global-Update_Climate-Summit-Momentum.pdf
- Demaria, F. (2018), *Why economic growth is not compatible with environmental sustainability*, The Ecologist, 22 February 2018, <https://theecologist.org/2018/feb/22/why-economic-growth-not-compatible-environmental-sustainability>
- Fleming, D. (2016), *Lean Logic - A DICTIONARY for the FUTURE and HOW to SURVIVE IT*, Chelsea Green Publishing (see entry on TEQs -Tradeable Energy Quotas), <https://leanlogic.online/>
- Hall, C.A.S., Lambert, J.G., Balogh, S.B., (2014), 'EROI of different fuels and the implications for society'. Energy Policy 64, 141–152, <https://doi.org/10.1016/j.enpol.2013.05.049>
- Heinberg, R. (2017), *Why Climate Change isn't our biggest environmental problem, and why technology won't save us*, Resource Crisis, 19 August 2017, <https://countercurrents.org/2017/08/why-climate-change-isnt-our-biggest-environmental-problem-and-why-technology-wont-save-us/>
- Heinberg, R. (2021), *Questions to Richard Heinberg from a 15-Year-Old Student*, <https://www.postcarbon.org/questions-to-richard-heinberg-from-a-15-year-old-student/>
- Herrington, G. (2021), *Update to limits to growth: Comparing the World3 model with empirical data*, Journal of Industrial Ecology, 25(3): 614-626, <https://advisory.kpmg.us/content/dam/advisory/en/pdfs/2021/yale-publication.pdf>
- Hickel, J., Kallis, G., (2020), *Is Green Growth Possible?* New Political Economy 25, 469–486. <https://doi.org/10.1080/13563467.2019.1598964>
- Kallis, Gi. (2015), *The Degrowth Alternative', Great Transition Initiative – Toward a Transformative Vision and Praxis*, <https://greattransition.org/publication/the-degrowth-alternative>
- Kalmus, P. (2021), *Forget plans to lower emissions by 2050 – this is deadly procrastination*, The Guardian: Covering Climate Crime, <https://www.theguardian.com/commentisfree/2021/sep/10/net-zero-2050-deadly-procrastination-fossil-fuels>

- Krumdieck, S. (2021), *Sustainability is wishful thinking': get ready for the energy downshift*, Stuff, <https://www.stuff.co.nz/environment/climate-news/122689734/sustainability-is-wishful-thinking-get-ready-for-the-energy-downshift>
- Lenton, T.M., Held, H., Kriegler, E., Hall, J.W., Lucht, W., Rahmstorf, S., Schellnhuber, H. (2008), *Tipping elements in the Earth's climate system*, Proceedings of the National Academy of Sciences, v.105, 2008, pp. 1786–93. <https://doi.org/10.1073/pnas.0705414105>
- McGlade, C., Ekins, P., (2014). *Un-burnable oil: An examination of oil resource utilisation in a decarbonised energy system*, Energy Policy 64, 102–112. <https://doi.org/10.1016/j.enpol.2013.09.042>
- McLachlan, R. (2021), *Climate explained: How much of the world's energy comes from fossil fuels and could we replace it all with renewables?*, Stuff, <https://www.stuff.co.nz/environment/climate-news/300407084/climate-explained-how-much-of-the-worlds-energy-comes-from-fossil-fuels-and-could-we-replace-it-all-with-renewables>
- Michaux, S. (2021), *Assessment of the Extra Capacity required of Alternative Energy Electrical Power systems to Completely Replace Fossil Fuels*, GTK: Geological Survey of Finland, 20 August 2021, https://www.researchgate.net/profile/Simon-Michaux-2/publication/354067356_Assessment_of_the_Extra_Capacity_Required_of_Alternative_Energy_Electrical_Power_Systems_to_Completely_Replace_Fossil_Fuels/links/61236e890c2bfa282a63400a/Assessment-of-the-Extra-Capacity-Required-of-Alternative-Energy-Electrical-Power-Systems-to-Completely-Replace-Fossil-Fuels.pdf?origin=publication_detail
- Millward-Hopkins, J., Steinberger, J.K., Rao, N.D., and Oswald, Y. (2020) *Providing decent living with minimum energy: A Global scenario*. Global Environmental Change, Volume 65. <https://doi.org/10.1016/j.gloenvcha.2020.102168>
- Monbiot, G. (2021), *Earth's tipping points could be closer than we think. Our current plans won't work*, https://www.theguardian.com/commentisfree/2021/sep/09/earths-tipping-points-closer-current-climate-plans-wont-work-global-heating?CMP=Share_iOSApp_Other
- New Zealand's Greenhouse Gas Inventory, 1990-2019 Snapshot - Emissions trends by sector, at <https://environment.govt.nz/publications/new-zealands-greenhouse-gas-inventory-1990-2019-snapshot/emissions-trends-by-sector/>
- Our World in Data (2021), <https://ourworldindata.org/#entries>
- Raworth, K. & Hens, T. (2019), *Doughnut Economics for a Thriving 21st Century*, Green European Journal: 2049 Open Future, <https://www.greeneuropeanjournal.eu/doughnut-economics-for-a-thriving-21st-century/>
- Rees, W. (2021). *To Save Ourselves, We'll Need a Very Different Economy*, TheTyee, <https://thetyee.ca/Analysis/2021/08/10/Save-Ourselves-Need-Very-Different-Economy/>

Rockström, J. et al. (2009), *A safe operating space for humanity*. Nature 461, 472–475.

<https://doi.org/10.1038/461472a>

Seibert, M., and Rees, W. (2021), *Through the Eye of a Needle: An Eco-Heterodox Perspective on the Renewable Energy Transition*, Energies 14, no. 15: 4508, <https://doi.org/10.3390/en14154508>

Shindell, D., Smith, C.J. (2019), *Climate and air-quality benefits of a realistic phase-out of fossil fuels*. Nature 573, 408–411. <https://doi.org/10.1038/s41586-019-1554-z>

Steffen, W., Rockström, J., Richardson, K., Lenton, T.M., Folke, C., Liverman, D., Summerhayes, C.P., Barnosky, A.D., Cornell, S.E., Crucifix, M., Donges, J.F., Fetzer, I., Lade, S.J., Scheffer, M., Winkelmann, R., Schellnhuber, H.J., (2018), *Trajectories of the Earth System in the Anthropocene*, Proc Natl Acad Sci USA 115, 8252–8259, <https://doi.org/10.1073/pnas.1810141115>

United Nations Environment Programme and Climate and Clean Air Coalition (2021). *Global Methane Assessment: Benefits and Costs of Mitigating Methane Emissions*. Nairobi: United Nations Environment Programme. 173 pp.

Wackernagel, M., Hanscom, L. Jayasinghe, P., Lin. D., Murthy, A., Neil, E., Raven, P. (2021), *The importance of resource security for poverty eradication*, Nature Sustainability volume 4, pages 731–738, 26 April 2021, <https://www.nature.com/articles/s41893-021-00708-4#Fig1>

World Meteorological Organization (2021), *Five years after the adoption of the Paris Agreement, the emissions gap is as large as ever*, United in Science 2021, https://public.wmo.int/en/resources/united_in_science

Xu, Y., Ramanathan, V., & Victor, D.G. (2018), *Global warming will happen faster than we think*, Nature, 564 30-32, 5 December 2018, <https://www.nature.com/articles/d41586-018-07586-5>