Climate policy: Are we going at the right speed and in the right direction?

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I was asked to respond to the question: "Are we going at the right speed and in the right direction?" The answer to this question depends on what we are trying to achieve. I have therefore organised my thoughts into three parts: where we are now, where we want to get to, and what types of policies might help us to get there.

So let me start with where we are now.

The concentration of carbon dioxide in the atmosphere continues to rise and shows no sign of slowing down. It is now above 407 parts per million. The last time it was this high was probably during the Pliocene Epoch around three million years ago, when trees were growing in Antarctica and sea levels were 10 to 20 metres higher than they are today.[1]

The concentrations of other greenhouse gases such as methane, nitrous oxide and industrial gases are also still increasing. In particular, the atmospheric concentration of methane is currently rising much faster than expected, following a plateau between 1999 and 2006. The cause of this sharp rise remains a mystery.[2]

The global average temperature has already increased by approximately one degree Celsius since pre-industrial times. March 2019 was the second warmest on record, after March 2016.[3]

The warming is not evenly distributed. Temperatures have already risen two or three times more than this in the Arctic. Just this week, scientists reported that parts of the Ross Ice Shelf in Antarctica are now melting 10 times faster than the overall ice sheet average.[4]

The impacts of climate change are not somewhere far off in the future. They are happening now and there is more to come.

Yet despite the clear message coming from the scientific community that urgent climate action is needed to curb these impacts, global emissions are still going in the wrong direction. Global carbon dioxide emissions from fuel combustion increased again last year, to an historic high of 33 gigatonnes.[5]

Roughly 40 per cent of global fossil carbon dioxide emissions came from burning coal to produce electricity and heat.[6] Since the year 2000, the world has

doubled its coal-fired electricity generation capacity from around 1,000 gigawatts to around 2,000 gigawatts in 2018.[7]

Global investment patterns *have* started to shift away from fossil fuels towards low-carbon energy sources. In 2017, more new solar power was installed worldwide than coal, natural gas and nuclear power combined.[8] The global installed capacity of wind power is also growing steadily, reaching around 600 gigawatts in 2018.[9]

But most of this progress has occurred in the electricity sector. Much less progress has been made in the transport, heating and cooling sectors, which currently account for the bulk of global energy demand.

Current climate action is uneven across countries and across sectors. There is still often a lack of alignment between climate policies and policies in other domains.

Examples of policy misalignment are rife everywhere. Let me just give you one – from Germany, the country that enabled solar photovoltaics to break out. The very same Germany is pushing to expand its domestic coal mines.[10]

Ironically, the United States is something of a bright spot despite the current Administration's decision to quit the Paris Agreement. Emissions continue to decline as coal-fired power plants are retired at record pace. However, the Administration's seeming determination to roll back anything that looks like an environmental regulation seems likely to lead in due course to a reversal of promising trends.

Media attention in New Zealand has mostly centred on agriculture's role in climate mitigation policy. But in the meantime, our gross carbon dioxide emissions have increased by 42 per cent between 1990 and 2017. The main drivers of this were increased emissions from road transport and the chemical and food processing industries.

The emissions intensity of New Zealand's electricity production was 105 kilograms of carbon dioxide per kilowatt-hour in 2016, well below the OECD average of 392 kilograms per kilowatt-hour. This is good.

But New Zealand's greenhouse gas emissions per capita were around 17 tonnes per person in 2016, well above the OECD average of 12 tonnes. This is partly due to our significant biological emissions from agriculture. But it is also because, despite the high share of renewable energy sources in our electricity system, we are still heavily reliant on fossil fuels for our transport and heating needs.

So where do we want to get to?

In the 2015 Paris Agreement, all countries committed to hold the increase in global average temperature to "well below two degrees" above pre-industrial levels, and to "pursue efforts" to limit it to 1.5 degrees.

The Intergovernmental Panel on Climate Change released a report last year outlining what we can expect to happen if the global temperature rises by 1.5 or two degrees Celsius, as well as global emissions pathways that would be consistent with these goals.[11] Let me pluck just two data points from many:

- At 1.5 degrees we can expect coral reefs to decline by 70 to 90 per cent. This decline rises to over 99 per cent for a 2 degrees world.

- Six per cent of all insect species are expected to be at risk of extinction at 1.5 degrees, rising to 18 per cent at 2 degrees. Let's hope it doesn't include too many pollinators.

There will be very significant impacts in a 1.5 degree or 2 degree world. Achieving 1.5 degrees would lead to fewer impacts.

To have a 66 per cent chance of limiting warming to 1.5 degrees, the IPCC found that the remaining carbon budget is around 420 gigatonnes of carbon dioxide. This carbon budget was then translated into global emissions pathways. For the pathways consistent with 1.5 degrees, global carbon dioxide emissions need to reach net zero by around 2050, while heating from non-CO_2 gases peaks by 2030.

In pathways consistent with 2 degrees, global carbon dioxide emissions reach net zero by around 2070. These pathways heavily rely on reforestation as well as unproven carbon dioxide removal technologies such as bioenergy with carbon capture and storage, often referred to as BECCS.

Big changes will be needed to achieve either of these pathways. For example, the entire pipeline of planned coal plants needs to be cancelled and approximately 20 per cent of existing capacity needs to be closed early.[12] With that in mind, the financial sector has a key role to play in ensuring that climate risks are integrated into investment decisions, as highlighted by the recent report from the Bank of England, Banque de France and other members of the Network for Greening the Financial System.[13]

Recent evidence has emerged that the climate sensitivity, previously believed to be somewhere between 2 and 4.5 degrees Celsius for a doubling of carbon dioxide, might be higher than expected.[14] If true, this would mean we have even

less time than previously thought to keep global temperature rise below either 1.5 or 2 degrees.

The Paris Agreement established a process for communicating so-called "nationally determined contributions", or NDCs, to the international community on a regular basis. These NDCs outline the actions that each country is prepared to undertake to reduce its emissions.

The NDCs announced to date have been calculated to lead to global warming of about three degrees by 2100, with warming continuing afterwards. The level of ambition of NDCs needs to be roughly tripled for the two degrees scenario and increased around fivefold for the 1.5 degrees scenario. In the words of UNEP's *Emissions Gap* report, "if NDC ambitions are not increased before 2030, exceeding the 1.5 degrees goal can no longer be avoided [and] it is very plausible that the goal of a well-below two degrees temperature increase is also out of reach."[15]

The NDCs are starting to look threadbare already and it is becoming increasingly difficult to remain optimistic about our chances of managing what we have set in train.

To safeguard against dangerous climate change, we need to reduce carbon dioxide as our top priority. The Earth's average temperature will not stabilise at any level until carbon dioxide emissions reach zero. Progress on non-CO_2 gases can also help to reduce peak warming, but only if fossil carbon dioxide emissions are on a trajectory towards zero.

My recent *Farms, forests and fossil fuels* report explained the reasons for this. As some of you will be aware, in this report I came out against allowing forestry as an offset for fossil emissions.

In brief, this is because forest offsets delay gross emissions reductions and investment in renewable energy technologies, and because the time scales of the impacts of fossil carbon dioxide emissions and the life expectancy of carbon sequestration by forests are poorly aligned. To truly offset the impact of fossil carbon dioxide emissions, forest carbon pools would need to be effectively maintained in perpetuity. We have no way of knowing if we can do that. But we know for certain that the fossil carbon we emit will have a warming impact for centuries to millennia.

I also noted that no other emissions trading scheme fully covers the forestry sector. The EU for one has kept forestry at arm's length from the EU ETS.

For biological emissions I observed that there is a better alignment between the lifetime of the temperature effects of these gases and forest sinks. But the risks

of increased climate disturbances and delaying gross reductions are the same. For this reason, even in respect of biological emissions, a limit or discount factor for forest offsets should be considered.

Renewable energy sources will play a significant role in reducing carbon dioxide emissions from energy, transport and industry in New Zealand.

In the modelling we commissioned for the *Farms, forests and fossil fuels* report, total electricity generation increases from 43 terawatt-hours in 2018 to 93 terawatt-hours by 2075. The share of wind in total electricity generation increases from 5 per cent in 2018 to 25 per cent by 2075. This is a result of assumptions that consider sustained technological improvements and reduced capital costs to be plausible outcomes.

The modelling also indicates that the switch to electric vehicles will be rapid with over 70 per cent of New Zealand's light vehicle fleet being electric by 2050, and over 95 per cent by 2075, thereby all but removing our single biggest fossil emissions source.

There will be people who question this level of renewable penetration, particularly if it relies on intermittent sources. Imagining it relies on a future electricity generating system that no longer has baseload capacity that is expensive or impossible to turn off.

Instead it would be one in which wind and solar are the cheapest generators on the system. Michael Liebreich, founder of Bloomberg New Energy Finance, refers to these as "base-cost renewables." In his words, "baseload is to future grid design as fax machine is to WhatsApp".[16] I understand he is coming here later this year so we may have a chance to interrogate him on this.

So finally, what types of policies are needed to shift our economy – and indeed all economies – onto a low emissions trajectory?

Emissions pricing should be an indispensable element of climate policy packages. It is the most cost-effective way of incentivising people to make incremental changes in a way that favours technological innovation and experimentation.

Emissions pricing, whether emissions taxes or emissions trading schemes, are now in place or scheduled for implementation in over 50 regional, national, and subnational jurisdictions around the world.

Emissions pricing can work, provided the prices make a meaningful difference. Unfortunately they often don't. New Zealand is a case in point.

The emissions price created by the New Zealand Emissions Trading Scheme is currently around $25 per tonne of carbon dioxide. At that level, the price of a litre of petrol at the pump is about six cents higher than it would be without the emissions price. That's not really enough to change driver behaviour.

It has been estimated that in the short run, average global emissions prices would need to rise to between 40 and 80 US dollars per tonne of carbon dioxide by 2020 if we're to be on track to achieve the objectives of the Paris Agreement. And even higher prices will be needed beyond that.[17]

Not only are emissions prices currently too low in New Zealand and the rest of the world; the coverage of emissions pricing is often limited. Eighty five per cent of global emissions are not currently priced and about three quarters of the emissions that *are* covered by an emissions price are priced below ten US dollars per tonne of carbon dioxide.[18]

One source of optimism is the fact that the share of emissions covered by emissions pricing has increased threefold over the past decade, albeit from a very small base.

The modelling commissioned for *Farms, forests and fossil fuels* that I referred to earlier saw prices rising to $350 per tonne of carbon dioxide by 2075 to reach a zero fossil emissions goal.

Many opportunities to switch away from fossil fuel consumption will present themselves long before prices reach anything like $350 per tonne of carbon dioxide. The rapid pace of change in some technologies means that there is considerable uncertainty about the sort of prices that are needed to prompt a switch to low emissions technologies.

The real issue is how that price evolves from its current level. It needs to rise steadily and consistently to send an unequivocal signal that fossil emissions will only ever be more expensive.

The modelling I commissioned predicted large reductions in energy emissions on account of assumptions about the sustained momentum of technological change that is underway in power generation and parts of the transport sector. The technological drivers are now so strong that even when we reduced the emissions price from today's level to just $1 per tonne of carbon dioxide over time, energy sector emissions still plummeted.

Care should be taken not to interpret these trends as an argument for doing nothing on the basis that technology and business innovation will resolve the problem. There are other, more stubborn emissions in other sectors that will

need to fall as well and a steadily rising emissions price will be an essential element of changing those technologies too.

Putting a price on emissions requires complete transparency on the part of governments.

France is the only G20 country that currently has an explicit emissions price in that range of 40 to 80 US dollars. In 2018, it taxed fossil emissions at a rate of up to €44.6 per tonne of carbon dioxide on a range of sectors including the transport and industrial sectors.

This emissions price resulted in the diesel price increasing by €0.25 per litre. The price was supposed to jump another €0.06 per litre in January this year, but the French government cancelled that increase after significant resistance from the *gilets jaunes* protest movement.

Much ink will no doubt be spilt on this latest French failure to implement environmental taxes, but the case is by no means unique. One thing seems to be clear: emissions pricing and other environmental taxes stand little chance of being accepted if most of the revenue is disappearing into the Government's coffers, as was the case in France, which is struggling with chronic fiscal deficits.

A commitment to recycle any revenue from taxes or the auctioning of units back to citizens through lowering other taxes or charges seems a prudent way forward. The best example I am aware of was the introduction of a carbon tax in British Columbia that rose progressively from $10 to $30 per tonne of carbon dioxide and survived a change of government. This was largely because the carbon tax was combined with a lowering of other taxes.

A Canadian study found that other flanking policies including recycling revenue to lower corporate and income taxes and energy efficiency standards, can halve the explicit emissions price faced.[19]

In *Farms, forests and fossil fuels*, I promoted the idea of recycling revenue from the pricing of biological emissions from agriculture back to the landscapes and communities where it was levied. Returning funds to the landscape that generated them is likely to significantly improve the public acceptability of taking strong climate action, and would allow rural communities to work on the wide range of other environmental challenges they are being asked to respond to.

Revenue from emissions pricing, whether for fossil or biological emissions, could also support hastening needed technological innovation, especially for

emissions-intensive trade-exposed industries for which easy technological fixes are not readily available.

Obviously, many of the needed breakthroughs will be developed abroad. But there will also be opportunities for kiwi entrepreneurs to find innovative solutions to the challenges the transition will provide here in New Zealand.

Richard Layard, an economist at the London School of Economics, recently commented that it is barely believable that the world only spends two per cent of its research and development money on its most pressing problem: climate change and clean energy.

Emissions pricing, therefore, should be seen as a key element of the climate policy menu, but not the only one. Even the best framework in the world for developing carbon budgets and deploying emissions pricing will not be enough. Flanking policies are needed to smooth the transition and avoid disruptive costs both to citizens and businesses.

Everything I have said so far belongs in a highly technical world of climate, energy and industrial policy that is nurtured by specialists. It is light-years away from the preoccupations of long-suffering voters who have limited patience.

A recent nationwide climate survey showed that while there is concern about climate change, only 42 per cent of New Zealanders believe that their actions can make a difference. Given that decarbonising the economy means changing the way we do many things, there is an urgent need to engage with New Zealanders about how they can continue to enjoy everyday activities that are currently fossil-dependent.

One approach is to use information and public awareness campaigns like EECA's electric vehicle information campaign. Another is the development of useful tools like the Household Climate Action Tool, which draws on averages of annual spending and household purchases to help New Zealanders figure out their best choices to reduce their household emissions.

But I wonder whether something a bit less cerebral mightn't be in order? I have long wondered whether we shouldn't be reaching out to kiwis through their recreational pursuits and working with them to see what can be done to re-place the fossil technologies they often rely on. I'm thinking of things like outboard motors, chainsaws, quad bikes, ride-on mowers and even barbecues.

I'm not suggesting that the climate problem will be solved by decarbonising these technologies. Rather, I'm suggesting that we should avoid a situation where people feel as though they are the targets of an elite crusade to take away their pleasures. Why not work with them, instead, to find ways of inserting new

technical solutions into familiar pastimes. Drop-in batteries and biofuels could replace a lot of small fossil units. And the demonstration effect is potentially huge.

To conclude, let me return to the question posed: are we going at the right speed and in the right direction? From an environmental perspective the answer is unequivocally, ‘no’. Rising emissions and rising greenhouse gas concentrations mean that we are going way too slow and are way off course. On the policy side, it’s a mixed bag, more hopeful here in New Zealand than many countries but the rubber has yet to hit the road.

Deep decarbonisation of our energy, transport and industry sectors is necessary to mitigate the major risks that climate change poses to our environment, our financial systems and our communities. There is mounting scientific evidence that this transition needs to happen sooner rather than later.

How much this transition will cost depends on rates of technological change and innovation, as well as the expectations of investors regarding the speed of transition. These things are difficult to model.

But it seems clear that the transition is technically possible, and renewable energy sources such as wind power will play a critical role in making it happen. *If* they are asked to.

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