Submission on whether emissions from international shipping and aviation should be included in the emissions reduction target ('the 2050 target')

Don't Burn Our Future

21 June 2023

Background

Don't Burn Our Future is a group of New Zealanders who came together to oppose the proposed biofuels obligation which the government planned to use to put biofuels in cars, trucks, trains and ships in Aotearoa NZ. Our core members are:

1. Jake Roos, a climate change mitigation expert and professional consultant with 20 years' experience in the field. He has a Masters of Applied Science from the University of Otago.
2. David Keat, an engineer and was formerly a senior executive in the NZ and International oil industry. He lived for five years in Borneo and West Malaysia and witnessed first-hand massive rain forest clear felling for palm oil and the annual dry season burning.
3. Dr Paul Callister, an economist whose research focuses on low emission transport options for New Zealand. Paul has undertaken research on alternative fuels for aviation.
4. Robert McLachlan, a Distinguished Professor in Applied Mathematics at Massey University. Robert writes on climate and environmental issues, including aviation, at planetaryecology.org

Our opposition to the biofuel mandate for land-based transport came from overwhelming evidence that:

- Similar biofuel directives around the world have caused massive net increases in greenhouse gas (GHG) emissions compared to using regular fuel,
- Growing the feedstocks for biofuel drives tropical deforestation, destroying biodiversity, depriving indigenous people of their land and livelihoods and increases net emissions.
- It drives up food prices, as biofuels are derived from food crops. Food price increases cause material hardship for the most vulnerable people around the world.
- Non-food 'second generation' biofuels, or those derived from waste are not available in the necessary volumes, or at all.

- Electrifying ground transport rather than using biofuels, or equally problematic hydrogen, is by far the best policy for energy use, emissions and for the wider environment.

Our full submission can be found here
https://lowcarbonkapiti.org.nz/wp-content/uploads/2022/12/DBOF-biofuels-Environment-Select-Committee-Submission-20-12-22.pdf

International Aviation and Shipping

We agree that emissions from shipping and aviation to and from Aotearoa New Zealand need to be included in our 2050 targets. Climate change is agnostic to the source of greenhouse gases. Therefore, all sectors must be accounted for. Ideally all sectors would reduce their GHG emissions, but if a sector underperforms in this regard, it needs to be compensated for by deeper cuts in other sectors. We also recognise that both shipping and aviation are especially important to Aotearoa New Zealand given our geographic isolation.

The evidence that international aviation and shipping should be included in our climate targets is:

1. They are already included in the Paris Agreement via Article 2.1(a) ("Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels"), Article 4.4 ("Developed country Parties should continue taking the lead by undertaking economy-wide absolute emission reduction targets") and Article 4.3 ("Each Party's successive nationally determined contribution will represent a progression beyond the Party's then current nationally determined contribution and reflect its highest possible ambition").
2. The legal argument is developed more fully in Dejon, E. 2021. Inclusion of emissions from international aviation and shipping in Nationally Determined Contributions: Legal advice.
https://www.transportenvironment.org/wp-content/uploads/2021/10/Re-Aviation-Shipping-NDC-UPDATED-Legal-Advice-Final-3-5-21-corr-1.pdf
3. The main reason they are not already included generally is that their accounting has been deferred by the UNFCCC to the International Marine Organization (IMO) and International Civil Aviation Organization (ICAO) where they have been subject to notorious delay. ICAO, in particular, has been resolutely focussed on growth and, despite its official role as a standards setting body, in 25 years of discussions has not set any CO_2 emission standards for aviation. However, both the IMO and ICAO have now set voluntary, aspirational targets for net zero by 2050 for both aviation and shipping. How to achieve this is left up to the nation states.
4. New Zealand is a founding signatory of the International Aviation High Ambition Coalition (IAHAC), signed at COP26 in 2021. However, we have not yet fulfilled our obligations under this agreement, particularly Article 6 ("Preparing up-to-date state action plans detailing ambitious and concrete national action to reduce aviation emissions and submitting these plans to ICAO well in advance of the 41st ICAO Assembly") – that plan should have been lodged by September 2022.

5. One motivation for the formation of the IAHAC was to increase pressure on ICAO to adopt a net zero goal, which has now been achieved, albeit in a very soft form.
6. The EU and UK are now moving on specific mitigation actions for international aviation and shipping.
7. The growth plans of the aviation industry, both globally and in New Zealand – roughly for a doubling of traffic by 2050 – threaten to overwhelm any plausible technological mitigation options. Regulation, including regulation of growth and capacity, is needed urgently, including clear signalling of the future direction.
8. Successful regulation of these industries is essential to their continued viability. For aviation, we envisage a steadily falling cap on emissions, combined with steady passenger numbers (and possibly decreasing total passenger kilometres). But parts of the industry remain in denial, and prefer to spread scare stories about "a New Zealand without aviation" (Ward, 2022, Submission on developing the Aotearoa New Zealand Aerospace Strategy, New Zealand Airports Association, https://www.mbie.govt.nz/dmsdocument/25983-nz-airports-aotearoa-new-zealand-aerospace-strategy-submission-pdf)
9. Preventing a global rise in aviation emissions is critical to achieving global climate goals. High emitting countries will be expected to play a leading role. Technological mitigation measures are uncertain, but should not prevent action. The uncertainty creates a risk of delay, in which the aviation sector claims a larger share of the remaining carbon budget while also investing for growth. Therefore, early, clear signals are important.
10. It is sometimes argued that New Zealand is too small, and international aviation and shipping too important to us, for us to move on these issues. We argue that these factors make mitigating international aviation and shipping more, not less, important.
11. Shipping is highly essential, is smaller than aviation, has a more certain pathway to decarbonisation, and is also relatively smaller for NZ. (Global average 0.13 tCO_2/person; NZ 0.2 tCO_2/person; EU-27 0.33 tCO_2/person). These factors point to it being relatively easier to handle than aviation, perhaps via a mechanism like that in the EU where international shipping will enter the ETS at a 50% discount from 2024.
12. Taking everything together, the arguments that countries like New Zealand should reduce their emissions apply even more strongly to the international aviation and shipping sectors. Failure to act risks malinvestment.

Aviation

Individually and together Robert McLachlan and Paul Callister have written extensively about aviation. Key articles are:

Callister, P. and McLachlan, R. (2023) Decarbonising Aotearoa New Zealand's aviation sector: Hard to abate, but even harder to govern. Policy Quarterly, 19(2): 9-18. (online)

Callister, P. and McLachlan, R (2023) Managing Aotearoa New Zealand's greenhouse gas emissions from aviation, Journal of the Royal Society of New Zealand, DOI: 10.1080/03036758.2023.2212174 (open access)

Pre covid, total domestic and international aviation emissions were estimated to make up 12% of total CO_2 emissions. Until covid, growth of international emissions had been growing especially fast. And it seems international flights are now ramping up quickly again.

Traditionally, one way of reducing aviation emissions has been through efficiency gains such as improved engines, better aircraft design and better air traffic control. We expect these small gains to continue. But these depend heavily on rapid renewal of the fleet and, more importantly, have historically been swamped by growth in miles flown.

Judging by proposed airport expansions, Aotearoa New Zealand is on the verge of a major expansion of aviation.

Our largest airport Auckland has plans to increase passenger traffic from around 20 million per year pre covid to around 40 million by 2044.

Current passenger numbers for Wellington airport are around 6 million per year. By 2040, Wellington airport expects to double this to 12 million passengers. This represents a growth rate of 2.9% per year.

At the other end of the country, the masterplan released by Queenstown airport in May 2023 suggests passenger numbers will increase by one third from 2023 to 2033, with many of these coming internationally.

Nelson airport also plans expansion. They plan to also double their passenger numbers by 2050.

In Aotearoa New Zealand it is hard to think of any other large area of fossil fuel emissions that is planning to grow. Land transport emissions have peaked and the market share of electric alternatives is accelerating steadily. Aviation is the exception in that it is planning to grow in volume, has very questionable technology options, and is largely unregulated.

While powering long distance flights using hydrogen is frequently discussed, our view is that (a) there are huge, likely insurmountable, technical challenges to overcome and (b) even if these are overcome, the impact of such technologies will be very slow as it will require new aircraft specifically designed around the use of hydrogen plus a new world-wide production and distribution network.

From a technical perspective, the energy density per kilogram of hydrogen, even at high pressures, is about 7 times lower than kerosene. This will likely prove insurmountable in making hydrogen a viable fuel for wide body aircraft.

While electric flight has already been demonstrated with small planes over short distances, battery technology is nowhere near good enough to power long distance flights. Even with major advances in battery density and weight, electric planes are unlikely to have any real impact on international aviation in the foreseeable decades.

International consultancies such as Bain also project that new technology will have little impact on emissions, even out as far as 2050. They place most hope on Sustainable Aviation Fuels (SAF)s

The existing kerosene-based aviation fleet will be flying for many years and climate change remediation needs to happen urgently. Therefore, there are only four ways of reducing emissions from international aviation in the short to medium term. These are:

1. Ongoing efficiency gains in areas such as air traffic control.
2. Using biofuels either as a drop in or fully powering planes.
3. Using Power to Fuel (PtF) either as a drop in or fully powering planes.
4. Putting in place demand management strategies.

Biofuels for Aviation

"Sustainable" Aviation Fuel (SAF) biofuels are made from the same set of feedstocks used for biodiesel. Therefore, for the same set of reasons we opposed the NZ and EU biofuel mandates for land transport, we oppose using first generation biofuels to power aircraft.

In addition, the international aviation growth strategies noted above will make it impossible to match ongoing supply with growing demand.

We do, however, support further research into second generation biofuels, particularly forestry-based fuels. We note the recent announcement by Air New Zealand/the government to fund research into this source of SAF. However, our research strongly suggests that such fuels are still many years away from being viable on a large scale and without increased net emissions, if ever. There are many technical challenges to overcome in producing fuel from trees and local and international research is still in its infancy. Furthermore, a conventional oil refinery is required to process forestry based biocrude into SAF, which New Zealand no longer has.

As was well established during the land transport biofuels discussions, NZ will need to import any SAFs. For the foreseeable future SAFs will be expensive and the available supply of used cooking oil (UCO) and non-food biomass feedstocks will be less than the EU mandated volumes. New Zealand will compete with the EU and others inevitably resulting in fraudulent fuels , a problem the EU acknowledges exists now. There is even a court case pending in New Zealand where biofuel feedstocks may have been deliberately mislabeled.

Palm oil and all its by-products are banned by the EU as contributing to deforestation, species decline and dramatically increasing greenhouse emissions. Approximately 5% of raw palm oil is a soapy byproduct called PFAD (Palm oil Fatty Acid Distillate) which has a number of industrial uses and usually commands a higher price than palm oil itself. In 2009 Finland reclassified PFAD as a waste product, allowing it to be used as a feedstock for biofuels. The Finnish National oil company Neste, which until then had been running conventional fossil fuel oil refineries, seized the marketing opportunity to process PAFD into Jet Fuel, which they have since marketed as Sustainable Aviation Fuel (SAF).

PFAD does not meet any reasonable definition of "waste", so the PFAD based SAF Neste promotes in fact has the same disastrous environmental consequences the EU is trying to avoid with all non waste-based biofuels. For this reason Neste is opposed by all European and international environmental groups; Greenpeace, Friends of the Earth etc. Neste's PFAD absolutely should not be accepted in New Zealand.

Power to Fuel (PtF) for Aviation

Although aviation biofuel and PtF are chemically very similar to fossil fuel kerosene, potentially PtF is less environmentally damaging. But it is at present only available in very small pilot plants. Our view is that PtF may have a role in the far future, but for our climate challenge it is a mirage and distracts from meaningful action. We strongly concur with a recent EECA Report on Innovation and the Transition to a Low Carbon Future which states "The clear implication of this is that New Zealand's emissions reductions commitments in 2030 and 2050 will mostly have to be met by technologies that are in-use today". pg2

To produce a truly carbon neutral PtF process requires huge quantities of renewable electricity to split water to hydrogen and "sustainable" CO_2 to carbon monoxide. This then feeds a Fischer Tropsch process followed by processing through a conventional oil refinery to convert the resulting hydrocarbon mixture to aviation fuel. The oil industry worldwide operates only six large Fischer Tropsch plants as they cost USD 20-30 billion for one about the size of Marsden Point refinery. The technical challenges took decades to overcome and the processes are heavily patented.

There is recent industrial experience on developing and scaling electrolysis of water to hydrogen, but electrolysis of carbon dioxide is so far only demonstrated in laboratories and small pilot plants. The timeline for developing and scaling such technologies is typically 5 to 10 years or more, making the EU mandated targets and timelines very optimistic.

Lastly, a key problem is the huge requirement for renewable electricity, which is in short supply in New Zealand. Furthermore, surely the renewable electricity we do have should be used as effectively as possible – displacing fossil fuel motors in land transport with electric motors is many times more effective in reducing emissions than a PtF process.

Airline Miles Demand Management Strategies

In the short to medium term, the only way to reduce New Zealand's aviation emissions is to halt expansion and ideally reduce the amount of flying.

This could be achieved in a number of ways including a moratorium on airport expansions, apply GST to international aviation and/or applying carbon taxes to international aviation.

Shipping

Although shipping can operate using diesel, at present most shipping fuels are much heavier, giving rise to significant emissions. Recent legislation changes have reduced sulphur dioxide

emissions to low levels, but CO_2 and NOx emissions remain high. To date the industry has proposed or identified several solutions;

1. Diesel replacing heavier fuels to reduce emissions
2. LNG to further reduce emissions
3. Biofuels or PtF
4. Renewable hydrogen in the form of ammonia
5. Other efficiency measures such as slower steaming speeds, sails, low viscosity paint etc.

From a climate change perspective, solutions 1 and 2 are at best short-term transition measures but are no lasting solution. We oppose the biofuel and PfF solutions as they have the same problems as using them for aviation, as discussed earlier. Obviously, any efficiency and conservation measures (point 5) are desirable for many reasons and should be implemented, but will not be enough on their own.

Use of truly renewable, low-emissions fuels in concert with efficiency and conservation measures offers a potential solution in the long term. Use of green hydrogen fuel - in the form of ammonia - for shipping appears more promising and sensible than using it for aviation.

It could be implemented more quickly (existing ships could be modified, rather than requiring an entirely new generation of vehicles to be developed and built, as would be the case with hydrogen planes) and the amount of mass that can be moved per unit of energy invested is vastly higher for shipping than for aviation.

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