Decarbonising the public sector: Why a night train can be the start of a national public transport network

…big changes will be needed in the coming decades. There will be some hard choices to make, but it's obvious we can't continue with business as usual.

Ministry of Transport, 2021

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Introduction

In March 2021, as many New Zealanders were preparing their submissions to the Climate Change Commission, the government released the cabinet paper *Leading the way: Establishing a Carbon Neutral Government Programme*.[2] This action followed the declaration of a climate emergency in November 2020.

The paper states that the government "must show leadership to reduce its own emissions, in order to demonstrate what is possible to other sectors in the New Zealand economy." One key initiative is to establish *the Carbon Neutral Government Programme* (CNGP).

The aim is to set up be a long-term work programme for CNGP organisations with the following goals:

• measure, verify and report emissions annually.

• set gross emissions reductions targets and longer-term reduction plans for the next decade.

• introduce a phased work programme to reduce organisations' emissions, and

• offset after gross emissions reductions are made to achieve carbon neutrality.

Phase one of the work programme seeks to minimise emissions from:

• Fossil fuel boilers for heating – the aim is to phase out coal boilers, prioritising the largest and most active coal boilers by 2025, continuing to use the State Sector Decarbonisation (SSD) Fund to replace them with clean alternatives.

• Petrol and diesel cars by:

1. requiring mandated agencies to optimise their fleets with the aim of reducing the number of vehicles in the government fleet.

2. requiring mandated agencies to purchase battery electric vehicles (BEVs), or plug-in hybrid electric vehicles (PHEVs) if a BEV is not appropriate for the proposed use, unless their operational requirements or other circumstances require (following an approval process).

[2] https://www.mbie.govt.nz/dmsdocument/13508-leading-the-way-establishing-a-carbon-neutral-government-programme-proactiverelease-pdf

• Office space – the government aims to implement an energy efficiency building rating standard over five years from January 2021 for all mandated property agencies who occupy single tenanted, co-tenanted or co-located government office accommodation over 2,000m.

The Ministerial group governing the CNGP set a target to report back on an ongoing basis, with the first two reports already due in March 2021. These reports needed to include an operational plan for how the vehicle fleets would be reduced and electrified**,** and how the proposed CNGP organisations will measure emissions, manage and report on them, set gross emissions reduction targets and have credible reduction plans in place by December 2023.

The second, potentially more important, report is due in June 2021. This will be on how carbon neutrality for the CNGP organisations could be achieved by December 2025 following further work by officials on the opportunities, risks and constraints around offsetting.

The scope of organisations covered in this initiative is very wide. Most are 'directed' and some 'encouraged' to be involved. 'Directed' organisations include all the core public service, non-public service agencies including the police and defence force, New Zealand Blood Service and district health boards. Initially school boards were also included but there is on-going debate about this. Agencies 'encouraged' include universities and the Reserve Bank. Excluded are SOEs, such as KiwiRail and companies that the government has a shareholding in such as Air New Zealand. Through running an airline, Air New Zealand is one of New Zealand's highest GHG emitters.

Most of this sounds very positive in the fight to reduce emissions. However, surprisingly lacking in the body of the paper is an 'elephant in the room', that of aviation. Case studies of New Zealand Trade and Enterprise, Auckland District Health Board (Including Auckland City Hospital, Greenlane Clinical Centre and community sites), Massey University and the Energy Efficiency and Conservation Authority are given in the appendix. This is where it becomes apparent that aviation needs its own workstream and reporting procedures.

In April 2021, marking another important turning point in the fight against climate change, the Minister of Transport released the *Future of Rail* report. While short on detail, the overall thrust of the report was that the government wishes to turn around the long-term underinvestment in rail. The report sets out the clear climate change benefits of mode shift to rail especially for freight.

But it has little focus on improving regional passenger rail services. There seems to be a gap between the acknowledged need to decarbonise the public sector and a whole-of-government understanding of how rail might support this.

Following this in May 2021, the Minister of Transport Michael Wood released *Hīkina te Kohupara - Kia mauri ora ai te iwi - Transport Emissions: Pathways to Net Zero by 2050*, a Ministry of Transport report outlining potential policies and pathways to a net zero emission transport sector.[3] This discusses aviation, but excludes international flights. It does however briefly consider alternatives to aviation for domestic travel.

This working paper brings public sector aviation emissions to the fore. It then sets out some practical ways that the domestic emissions could be reduced. One is through re-introducing a night train between Auckland-Hamilton and Palmerston North-Wellington. Another is through developing a fast rail connection between Wellington and Palmerston North. But the paper then demonstrates that these could just be the first steps in recreating a low carbon national public transport network with benefits beyond the public service. It finishes with some consideration of the barriers to such change.

Why we need to reduce emissions

The draft Climate Change Commission report issued in early 2021, set a budget of reducing domestic transport emissions by 47% by 2035. The 1Point5 Project's conclusion has been even stronger. Their research suggests that mitigating the risk of a delay in the decarbonisation of farming requires transport to aim for almost full transport decarbonisation by 2030. [4] Many submitters to the CCC consultation recommended that their emission targets were conservative and much higher emission target reductions are needed. There is now increasing opposition being expressed for projects that will increase emissions. For example, there is a campaign to stop the expansion of Wellington airport.[5]

3 https://www.transport.govt.nz//assets/Uploads/Discussion/DiscussiondocumentHikinateKohuparaKiamaurioraaiteiwiTransportEmissionsPathwaystoNetZeroby2050.pdf

4 https://1point5.org.nz/

5 https://www.stuff.co.nz/dominion-post/news/wellington/125162829/wellington-airport-recently-acquired-half-a-golf-course--now-its-fighting-to-put-planes-on-it

New Zealand has also been criticised for inaction on climate change. The Climate Tracker states that 'New Zealand lacks strong policies, despite its Zero Carbon Act.'

To get the reductions we need within the short timeframe all areas of reduction potential need to be fully explored.

Why flying is an important contributor to New Zealand's emissions

In 1990 total domestic transport emissions were estimated to be 8,772 kilotonnes carbon dioxide equivalent (kt CO2-e). By 2019, these had increased by 85%, to reach 16,207 kt CO2-e. However, these data exclude international aviation which has also seen significant growth.

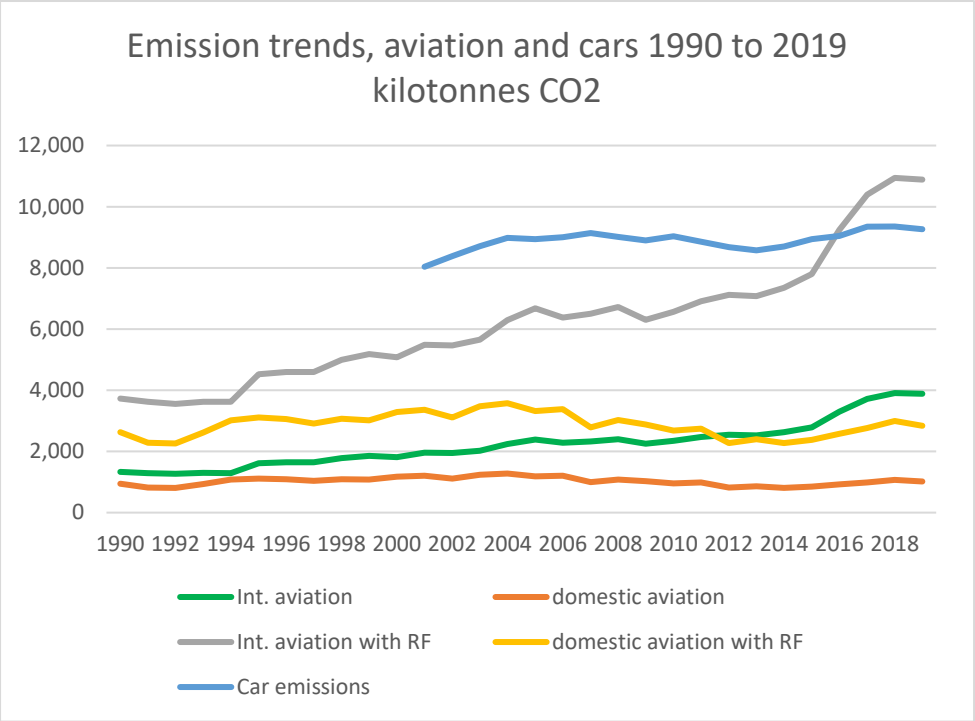
Official Ministry of the Environment data shows an upward trajectory of domestic and international aviation emissions in relation to just CO2 emissions. On this measure, aviation comprised 12% of New Zealand's CO2 emissions in 2019.

But these data do not include radiative forcing. Based on a growing research literature, estimates of emissions from both international and domestic aviation increasingly include a radiative forcing factor.[6] A 2021 study provides a median estimate of a 2.8 times amplification with 90% confidence intervals of 1.5 to 5.7 (log normal distributed).

Figure one shows aviation emissions with and without radiative forcing. It also shows estimated car emissions.

[6] Lee, D.S. et al (2021) 'The contribution of global aviation to anthropogenic climate forcing for 2000 to 2018', Atmospheric Environment, 244, https://doi.org/10.1016/j.atmosenv.2020.117834

Figure 1



Source: Ministry for the Environment, Emissions tracker

Car travel is clearly important and needs to be part of public sector emissions reductions. But there are pathways being suggested for this reduction within urban areas including higher use of public transport, more working from home and a switch to electric cars. While many of the emissions will come from urban based travel, a proportion will be generated by travel between regions, for example Wellington to Palmerston North or Auckland to Tauranga. As will be discussed, some of these car-related emissions could be reduced through the creation of an efficient regional public transport network.

Due primarily to the very rapid growth of tourism, international aviation emissions overtook cars in 2016 and, until Covid restrictions closed our borders, had been increasing rapidly. While domestic aviation had not seen any significant growth since 1990, it has had small growth and decline phases. The declines have been attributed primarily to efficiency gains, but strong passenger growth has prevented the desired reduction in emissions. Emissions were on an upward trend since 2012, despite the efficiency gains.

Until the public sector audits are completed it is difficult to estimate the contribution of public sector aviation emissions to these totals. But the case studies published in the cabinet paper show how aviation is important in four diverse organisations.

Figure 2: New Zealand Trade and Enterprise

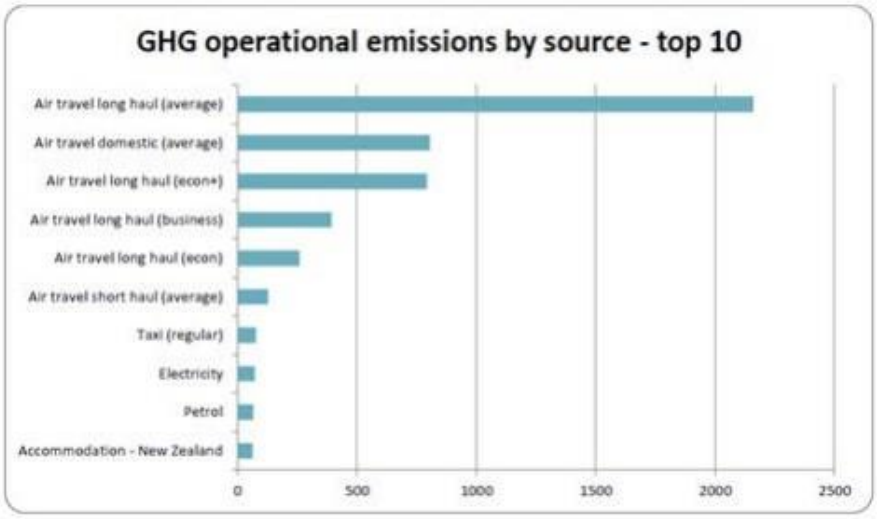


Figure 3: Auckland District Health Board (Including Auckland City Hospital, Greenlane Clinical Centre and community sites)

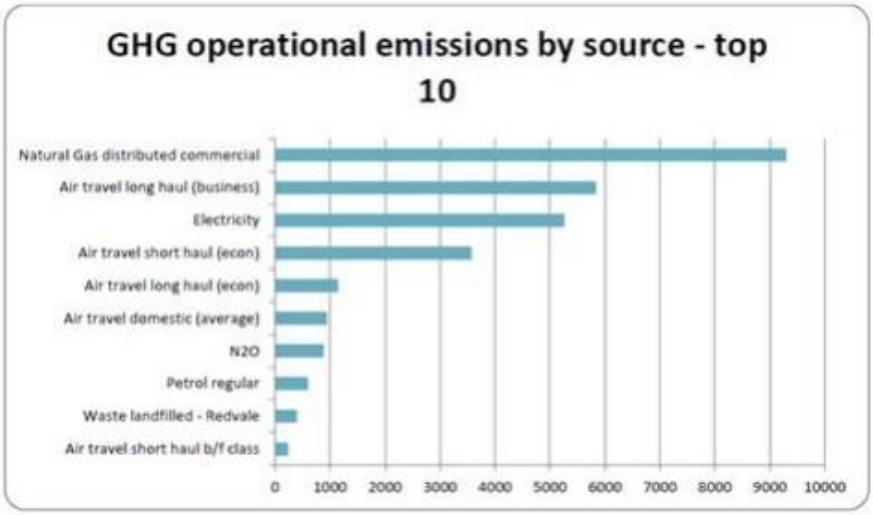


Figure 4: Massey University

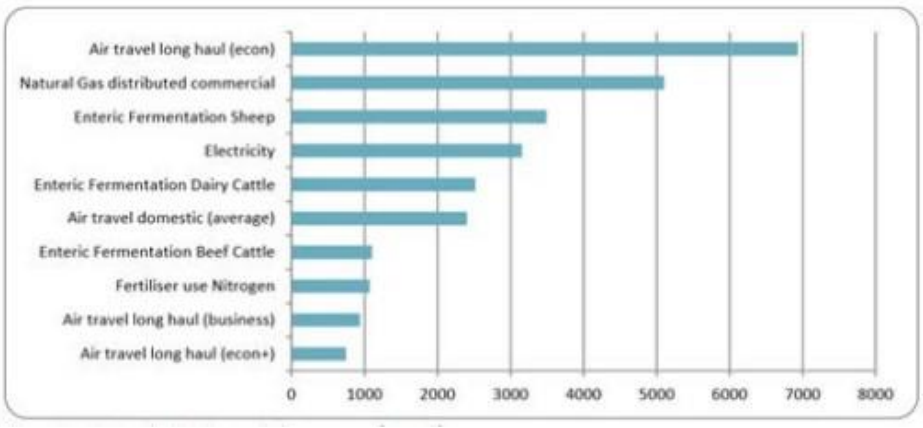
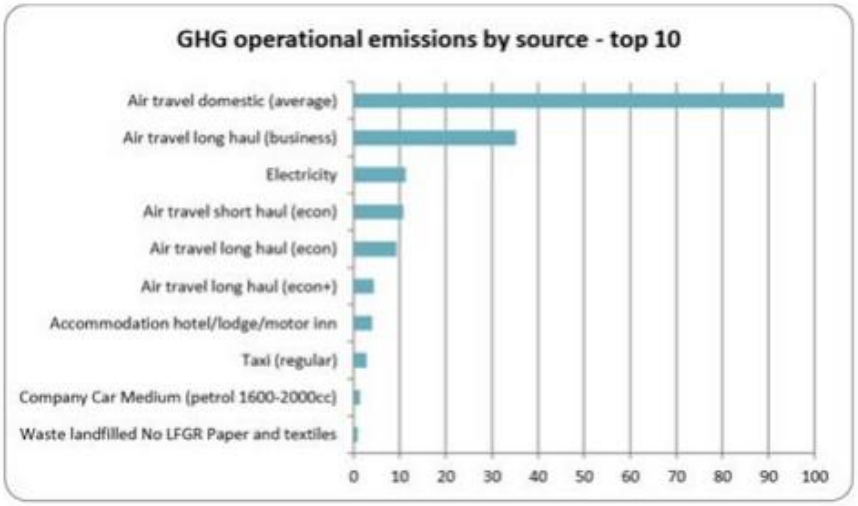


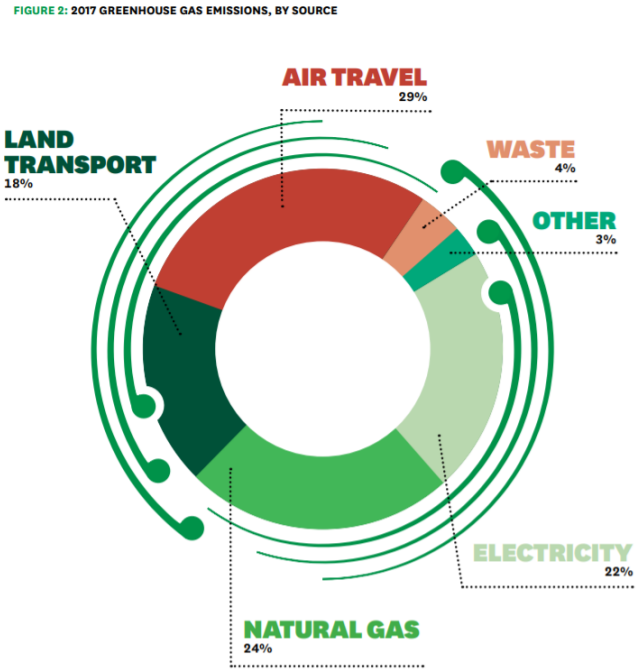
Figure 5: Energy Efficiency and Conservation Authority



All these examples show emissions from air travel are significant and will need to be reduced.

A study from another university, Victoria University of Wellington, also shows the importance of air travel emissions.[7]

Figure 6



[7] https://www.victoria.ac.nz/__data/assets/pdf_file/0008/1770785/Zero-carbon-plan.pdf

An OIA showed that in the 2014-2015 financial year NZTA staff used 23,065 internal flights. By 2018-2019 it had risen to 34,300. Many of those would have been between Auckland to Wellington.

It is good to see that the Department of Conservation is buying electric cars.[8] However, in an arrangement that is increasingly at odds with a vision of moving to a low emissions economy, the Department of Conservation has a partnership with Air New Zealand.

Figure 7

We cannot solve the problem with planting

Any public sector emissions that cannot be reduced will have to be offset within New Zealand.

The energy involved in aviation is very large, meaning there is a practical limit to offsetting. An article in The Conversation sets out the problems of offsetting globally through planting.[9]

In New Zealand, a study by the University of Otago's Inga Smith and Craig Rodger gives some idea of the scale of planting needed for aviation offsets.[10] Using a base of international aviation in 2005 and focussing on new native forests, an area equivalent to 15 Rakiura/Stewart Islands would need to be set aside. Including domestic aviation and the epic growth of international aviation seen in the 2010s takes it to 33 Rakiura islands.

Offsetting only gives some limited breathing space. But in itself it is not a feasible solution.

[8] https://www.doc.govt.nz/news/media-releases/2021-media-releases/hundreds-of-new-electric-cars-for-state-sector/
[9] https://theconversation.com/there-arent-enough-trees-in-the-world-to-offset-societys-carbon-emissions-and-there-never-will-be-158181?
[10] http://www2.physics.otago.ac.nz/space/jepo_personal_inpress_version_23Dec08.pdf

Why in the short to medium term new aviation technologies will be of little assistance

A paper prepared by Paul Callister and Wallace Rae for the Institute of Governance and Policy Studies sets out the challenges in decarbonising aviation.[11] These are not discussed in detail in this current paper but the main points are summarised below.

Hīkina te Kohupara - Kia mauri ora ai te iwi - Transport Emissions: Pathways to Net Zero by 2050, also discusses some options for decarbonising domestic aviation. These are also referred to in this summary.

Over a long period small technological changes have led to large increases in the efficiency of commercial aviation. It is likely these efficiency gains will continue. But historically these gains have been overwhelmed by price reductions for flights and expanding demand. Globally, projected increases in demand are well ahead of historic efficiency gains.

1. *Better air traffic control*

The Ministry of Transport 2021 emission reduction paper puts considerable weight on better air traffic control to reduce emissions.

2. *Switching to turboprops*

Switching back to seemingly older technology, that is turbo props rather than jets, can reduce emissions.

A 2019 article *Could Turboprops Be A CO2 Savior For Europe?* sets out the benefits.[12] They are more fuel efficient than jets and as they fly lower there is less radiative forcing.

They are however slower and the lower altitude flying means the ride can be more uncomfortable in bad weather. This is important as bad weather will increase as the planet warms.

Turboprops are also generally smaller than jets so more movements between airports would be needed.

[11] https://www.wgtn.ac.nz/__data/assets/pdf_file/0007/1772908/WP-19-02-can-we-keep-flying.pdf
[12] https://simpleflying.com/turboprops-co2-savior-europe/

Air New Zealand runs jets on its main domestic routes and turboprops on regional routes. New planes would need to be purchased if it was to switch to all domestic flights being turboprops.

The paper will return to the issue of turboprops versus trains.

3. Electric planes and hydrogen powered planes

There are many experiments being undertaken with small electric planes. Some are solely electric powered, some in research phase are fossil fuelled for take-off then powered by electric motors either powered directly by batteries or by hydrogen fuel cells. A major challenge for scaling up to large airliners is battery weight.

Optimistically, we may see some short flights by small aircraft being undertaken commercially in New Zealand in the next decade.

The world's major plane builders, notably Boeing and Airbus, are experimenting with hydrogen-powered flight. But there are major challenges in plane design in order to store and use hydrogen. It will mean a complete replacement of our current fleet of planes.

In a 2020 study of sustainable aviation options post-Covid for the World Economic Forum, McKinsey & Company state:

> *Hybrid-electric and hydrogen-powered aircraft could significantly help the industry reach the next efficiency horizon, but development and deployment at scale could take 10 to 20 years and the technology will be initially limited to smaller, shorter-range aircraft.*

An often-mentioned step to the use of electric planes in New Zealand is the Sounds Air agreement with Heart Aerospace to supply 19-seater electric planes by 2026.[13] While an important step, based on range information provided these would only be suitable for short trips in New Zealand such as Wellington to Nelson. They would not have the range to fly between Wellington and Auckland.

Given these challenges, such aircraft are highly unlikely to be a mainstay of New Zealand's aviation in the next couple of decades. However, the Ministry of

[13] https://www.rnz.co.nz/news/business/427098/sounds-air-aims-to-offer-first-regional-zero-emission-flights

Transport emission reduction paper places much hope in these technologies in the medium term.

4. Sustainable aviation fuels for the existing fleet

McKinsey & Company are more optimistic about the role of sustainable aviation fuels (SAFs) to help decarbonise aviation in the medium term. This view is shared by New Zealand's Ministry of Transport. It focuses on biofuels primarily produced from wood. The other main production method is Power to Fuel.

New Zealand could produce or potentially import SAFs. Such fuels are likely to be very important for international aviation and in the foreseeable future may be the only way to bring some element of sustainability to long haul travel.

However, whatever route is used to produce SAFs, their widespread availability will be quite distance away given the time needed to scale up production. They also do not solve the problem of radiative forcing, meaning that these fuel-powered planes continue to cause significant climate damage.

5. Switching to lower emission planes

New fleets are always more efficient than older planes. New Zealand's domestic fleet is relatively modern.

6. Reducing travel

Some technologies are already helping reduce business travel, in particular video conferencing apps such as Zoom. These technologies are likely to improve over time. Climate Minister James Shaw has stated that many agencies 'are investing quite heavily in distributed working technology to reduce the need to fly to meetings'.[14]

Potentially, a New Zealand version of 'flight shame' may emerge and have some impact on flying.

7. Energy requirements for electric or hydrogen powered planes are large

All alternative fuels, including SAFs, require large amounts of renewable electricity. The production of hydrogen in New Zealand provides an example.

[14] https://www.stuff.co.nz/environment/climate-news/125121276/674m-in-budget-to-help-public-sector-cut-carbon-from-cars-and-boilers-but-what-about-flying

One study[15] estimated the electricity that would be needed if 1. Hydrogen was produced by electrolysis 2. The liquid hydrogen was used to power all domestic and New Zealand's international aviation. Using a base of 2014 they found electrical energy requirements ranged from 28,555 GWh/y for the base scenario, to 46,555 GWh/y for a 2050 high demand scenario. This was equivalent to 67% to 110% of New Zealand's 2014 electricity generation. The authors note (pg 9):

> *The prospect of expanding electricity generation and transmission infrastructure to produce an additional 2 times the 2014 demand is certain to raise questions about whether this degree of expansion in generation and transmission infrastructure would be acceptable to society, even assuming that the energy resources were available. The policy and social implications of New Zealand producing all aviation fuel requirements as LH2, and whether this should take priority over electrification of other sectors, are therefore worthy of debate. Alternative options might include: a) importing all LH2 requirements; b) limiting LH2 production to domestic needs only; c) downsizing aviation and flying less.*

Currently New Zealand is facing electricity constraints and would need to build considerable new capacity.

In their report *Absolute Zero* Cambridge University researchers argue that the difficulties in curbing aviation emissions mean we should stop all unessential flying.[16] They leave open the possibility to start flying again if and when sustainable aviation becomes a reality. There are considerable equity arguments to support this path forwards, but stronger government direction would be required to overcome resistance, as political power tends to be held in New Zealand by the demographic who fly and pollute the most.

A case study of a night train between Auckland and Wellington points to one way to reduce flying. While public servants travel throughout New Zealand, a

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15 https://www.researchgate.net/publication/317886797_An_evaluation_of_electrolytic_hydrogen_as_an_aviation_fuel_for_New_Zealand

16 https://www.repository.cam.ac.uk/handle/1810/299414

key connection is between the seat of government in Wellington and our largest city, Auckland.

A night train between Auckland and Wellington

> *In rail's heyday, holiday times were hectic. On Christmas Eve in 1938, 16 express trains (including eight bound for Auckland) swept more than 11,000 travellers out of Wellington in a single day.*[17]

Those are significant numbers - fully 7% of the wider city's population, on a single day.[18] Leaving such a strong legacy, the people of 1938 would have expected New Zealand would have an advanced passenger rail network by 2020.

New Zealand once relied heavily on rail for long distance domestic travel. In a climate emergency New Zealand *can* resurrect regional passenger rail. With the resources available to us today (including cheap fossil carbon for a while yet) we have a short window of opportunity.

While many researchers and campaigners have promoted the restoration of passenger rail services within New Zealand, the only political party proposing a transformational staged rebuilding of a regional passenger train network at the 2020 election was the Green party.[19] These ideas were further developed for a post-Covid recovery package.

The Green's proposal would mean significant intercity rail investment over ten years to roll out fast electric passenger services connecting key provincial centres with Auckland, Wellington and Christchurch.

Over time this would see fast electric trains for passenger and freight connecting:

- Auckland to Hamilton, Tauranga and eventually Whangarei
- Wellington with Masterton, Palmerston North and eventually Whanganui
- Christchurch with Rangiora in the North, Ashburton in the south and eventually Timaru.

There would be two stages:

[17] https://teara.govt.nz/en/railways/page-7
[18] https://www3.stats.govt.nz/New_Zealand_Official_Yearbooks/1938/NZOYB_1938.html#idsect2_1_20495
[19] Green Party (undated) Future of Transport: Regional rail fact sheet, https://d3n8a8pro7vhmx.cloudfront.net/beachheroes/pages/14088/attachments/original/1601323836/Regional_Rail_-_Future_of_Transport.pdf?1601323836

Stage one:

- A major programme of work to electrify the rail lines between these centres
- Targeted improvements to the existing track to allow travel speeds to increase up to 110km/h.

Stage two:

- Building new higher-speed track to support “tilt-trains” capable of achieving speeds of 160km/h
- By-passes to create faster, more direct routes (e.g. around Whangamarino wetland north of Hamilton).

Included in this work would be re-instating the Wairoa to Gisborne rail line. However, the concept of a night train was not explored.

Figure 8: Green Party’s proposed rail network

The Climate Commission's draft report issued in February 2021 talked of getting more freight onto trains and supported further electrification of the network but was silent on re-establishing a long distance passenger network.[20] As mentioned, the *Future of Rail* report has little about re-establishing a regional passenger network.

The Ministry of Transport argue that "[a]voiding activities that produce emissions is, on balance, a more effective strategy than minimising the emissions from those activities". Hence the need to avoid the higher emissions from air travel.

Emission reductions from a night train

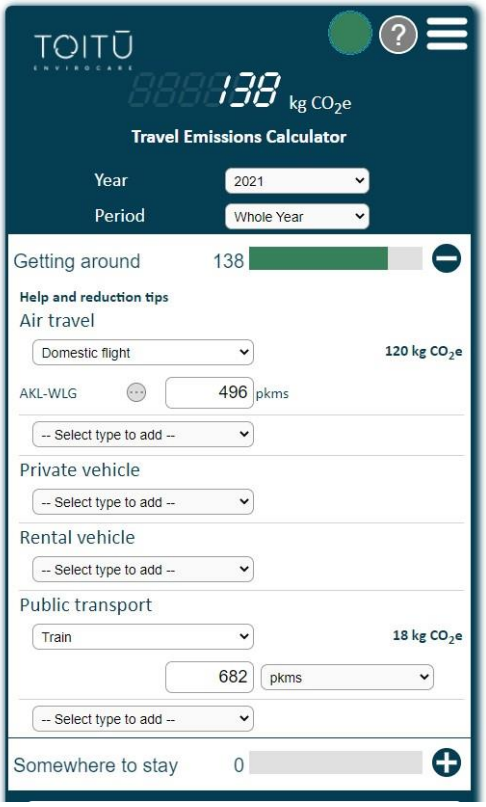
We need to have a reducing aviation carbon budget. But within this there is a need to seek out the optimal reduction strategies. Some flying will be hard to replace. Extremes include trips to the Chatham Islands. But even replacing flying between Auckland and Christchurch, spanning two islands, will be challenging. Luckily, most domestic flights take place between Auckland and Wellington. Also luckily, the distance is ideal for a night train.

In terms of re-establishing an overnight sleeper service between Wellington and Auckland, the distance of 682 km is within the range considered optimal for a sleeper service, as suggested in a *New York Times* article, *Once threatened, Europe's Night Trains Rebound*.[21]

The emission reduction benefits of using rail for the Auckland to Wellington trip can be calculated in a number of ways. The New Zealand Toitū calculator provides some estimates of emissions for various forms of travel. Here one way per-person plane and train travel between Auckland and Wellington are shown.

[20] While electrification is ideal in many countries hydrogen powered trains are also being introduced https://www.railjournal.com/fleet/first-french-region-signs-hydrogen-train-contract/
[21] https://www.nytimes.com/2019/06/11/travel/europe-overnight-trains.html

Figure 9



Using this calculator plane travel emits six times as much CO2e as a train trip. It is however difficult to know the assumptions underneath these calculations. It is likely that the train data are based on electric suburban trains. Until the full main trunk line is electrified, diesels are likely to be used to power an overnight train so the calculator will potentially be overstating the current benefits of rail.

Another way to calculate the emission differences between plane and train travel is to use official UK 'Greenhouse gas reporting conversion factors 2019.'[22] A further method is to use the *Atmosfair* calculator which allows aircraft type to be included.[23]

Table 1 shows the emission estimates of per person kilometre for each travel option using both the UK and *Atmosfair* data. Long distance coaches are also included.

[22] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2019
[23] https://www.atmosfair.de/en/offset/flight/

Table 1: KgCO2e per passenger kilometre

Mode	Type	Emissions per passenger km
UK Short haul flight*	Economy	0.15573
	Business	0.23360
UK Rail	National rail	0.04115
	International rail	0.00597
UK long distance coach		0.02779

*with an official estimate for radiative forcing

Table 2 uses the uses road, rail and air distance to calculate total per person emissions. If air traffic control is efficient, air travel covers a shorter distance.

Table 2: Auckland to Wellington travel using a variety of assumptions

Mode	Type	Emissions kg per person km	Km	KgCO2e/person
UK Short haul flight	Economy	0.15573	496	77
	Business	0.23360	496	116
Atmosfair A320				116
Atmosfair A320neo				93
Atmosfair ATR				50
UK Rail	National rail	0.04115	682	28
	International rail	0.00597	682	4
UK coach		0.02779	643	18

Like the Toitū calculations, calculations based on UK and *Atmosfair* data show that air travel creates significantly higher emissions than train or coach. Electric trains reduce emissions further and create a fraction of the air travel emissions whichever way they are calculated.

Coaches also create about a quarter of the emissions of jet air travel. Potentially as we switch to electric powered coaches the emissions will drop much further.

In the UK and Europe, some of the electricity that powers trains will be supplied by non-renewables. In the longer term, if the route from Auckland to Wellington can be fully electrified and, as planned by the government, 100% of

electricity comes from renewables, the emission footprint of rail travel will be even lower.

The night train's population catchment

A significant number of people live along this rail corridor. According to Statistics New Zealand data fifty seven percent of New Zealand's population lives along the route. (42% in Auckland and Wellington, 15% in between.) It also spans five universities, home to many thousands of frequent flyers: for example, Massey University's 3000+ staff flew an average of 18,000 km each in 2019.

How a night train might operate

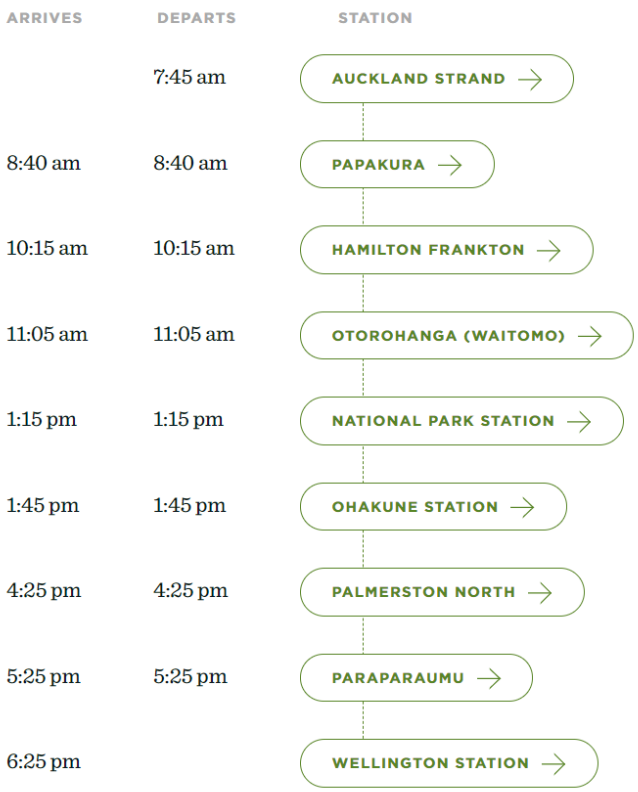
Between Auckland and Wellington today, we have the daytime Northern Explorer, which currently operates three times a week in each direction, and takes 10 hours and 40 minutes. There are on-board toilets and a café car. The ample leg room and tables mean one can work on a laptop if needed, albeit without on-board wifi. However, the very high cost, slow speed and infrequent schedule rules the option out for most travellers.[24] Most business travellers do not want to waste a full day travelling.

In New Zealand we do not have rapid rail. But this is not critical for a sleeper service. Track improvements, when they come, can provide faster and more reliable journey times, meaning a later evening departure time is possible, but that is not required to start the service.

Figure 10 shows the current day time schedule of the day train. In Auckland, the journey starts and finishes at the Strand Station not Britomart.

[24] Already the eighteen mayors and chairs of councils on the main trunk line, along with KiwiRail, are working on a business case for a regional passenger rail service - initially as a 'connector' between Hamilton and Palmerston North then joining up with regional trains.

Figure 10



Based on this schedule, a train leaving Auckland at 8pm could pick up passengers at Hamilton at around 10.30pm. Equally, a train leaving Wellington at 8pm could pick up Palmerston North passengers at around 10pm. When the last night train service operated it had a number of other stops along the route including Paraparaumu, Ohakune and National Park.

Depending on how fast the train travelled and the number of stops it could arrive in Wellington somewhere around 7am to 8am.

There are a variety of seating/sleeping configurations for a night train from basic sit up seats, through to couchettes and various full sleeper arrangements.[25] Couchettes have been popular in continental Europe but not the UK.

[25] https://en.wikipedia.org/wiki/Couchette_car

Figure 11: ÖBB couchette

Source: ÖBB website

Overseas night train trends

Continental Europe

Night trains were once common in Europe. A number of factors led to their demise. A key driver was the growth of low-cost airlines. These compete unfairly with the trains as they often fly from subsidised airports, pay no tax on kerosene, and do not face the real environment costs of their operations. But other factors also contributed to the decline. This included the lack of an integrated booking and ticketing system, the need for border crossings, differences in signalling and regulations by country, the failure to use dynamic pricing and the growth of rapid rail. The increase in fast trains undermined the advantage of using some night train services on some routes.

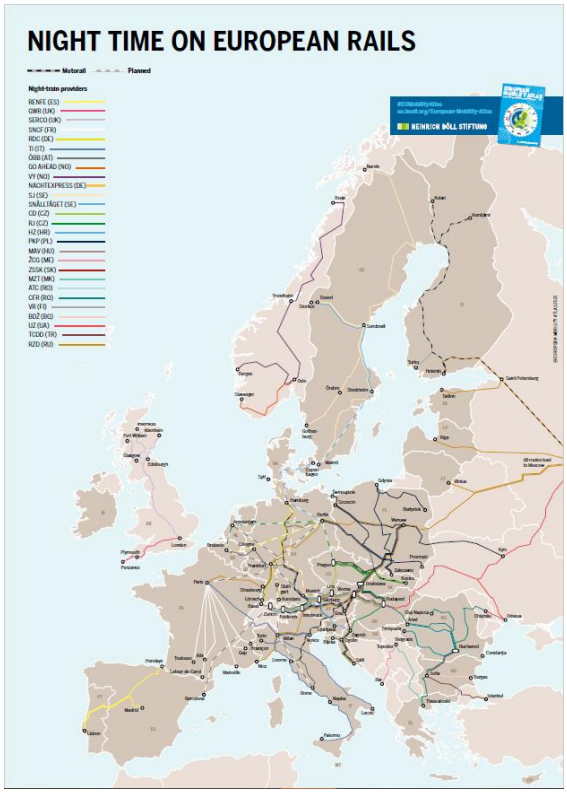
However, there is now a revival of night train services driven strongly by a concern for reducing travel-related emissions. Before Covid-19 paralysed Europe, night trains were making a comeback, and there are moves afoot to coordinate a night train network there.[26] [27]

[26] https://www.weforum.org/agenda/2021/01/night-train-carbon-climate-change/

[27] 'The Man in seat 61' website provides regular updates on trends in Europe and for much of the world https://www.seat61.com/news.htm

2021 has been designated as the European Year of Rail by the European Commission. A German study suggests that rail could play a key role in the future transport system because "it is clean, safe and reliable, and it could become a symbol for the European Green Deal".[28] It goes on to promote the idea that "a strengthened European rail system could (1) better connect people and businesses in Europe, (2) reduce transport emissions by creating alternative options to road transport and aviation, and (3) give a green boost to the European economy post-Covid-19."

Figure 12: European night trains



The Man in Seat 61 website sets out one example of how the turnaround of night trains in Europe took place.

> *Nightjet isn't just another train brand, it's a remarkable story. Prior to December 2016, ÖBB Austrian Railways operated a handful of good-quality sleeper trains out of Vienna, under the generic EuroNight brand. ÖBB believed in night trains, whilst other railways had lost faith. In 2015, Deutsche Bahn - the goliath that is German Railways - announced it was going to pull the plug on its entire City Night Line sleeper train network*

[28] Germanwatch (2020) Hop on the train: A Rail Renaissance for Europe How the 2021 European Year of Rail can support the European Green Deal and a sustainable recovery, December, https://germanwatch.org/sites/germanwatch.org/files/Hop%20on%20the%20Train.%20A%20Rail%20Renaissance%20for%20Europe_0.pdf

from December 2016. ÖBB took a big risk. They bought all 42 Comfortline sleeping-cars from DB along with many of DB's couchette cars, and took over most of the City Night Line routes, including a couple that don't even serve Austria (Berlin-Zurich & Zurich-Hamburg). The Nightjet brand was born!

ÖBB made the right decision. ÖBB have made the network a commercial success and they're now the largest operator of sleeper trains in central Europe, punching well above their weight. German travellers taking a sleeper train between Hamburg and Munich now travel on an Austrian train! They have started cautiously expanding, restoring a Vienna-Berlin sleeper (and in the process brokering the restoration of a Berlin-Budapest sleeper) as well as restoring sleeper trains to Brussels and Amsterdam. A Vienna-Paris sleeper is planned for December 2021, Zurich-Rome from December 2022, Berlin-Brussels and Berlin-Paris from December 2023, and even Zurich-Barcelona from December 2024.

Brand new sleeper trains are now under construction by Siemens, the first 13 7-car sets are due in service on routes from Vienna & Munich to Italy from December 2022 with another 20 7-car sets to be delivered for other routes after that. The new trains consist of 7 car sets: 2 sleepers (each with 10 compartments, all with en suite shower & toilet), 3 couchette cars (with 3 x 4-berth compartments and 28 x innovative sole-occupancy capsules or 'minisuites'), 1 multi-purpose car (with low-floor entry, an accessible couchette compartment & accessible toilet, some seating), and 1 seats car.

ÖBB is the Austrian state-owned railway company Austrian Federal Railways.

The ÖBB experience suggests that the price does not have to match a budget airline ticket, as (a) people know flying has extra costs such as getting to and from the airport and baggage fees, and (b) a hotel night is often saved, so is factored into the price.[29]

The shift to sole-occupancy capsules ('Minisuites') rather than shared couchettes, is designed to address a concern about sharing space with strangers.

In Europe, there are many night train operators including some from the private sector. This includes Transdev who also operate the passenger trains in

[29] Personal communication with Mark Smith, Man in Seat 61.

both Auckland and Wellington.[30] In 2020 Transdev first raised the possibility of operating a night train in New Zealand.[31] The private operators suggest competition is needed to improve services.

Flix, a company that is best known for operating long distance coaches in Europe and North America, has also joined those offering European night train services. Flix does not own buses or trains but owns the booking system and operates the services. [32] This would be equivalent to the InterCity bus group operating a New Zealand night train.

Figure 13

Snälltåget, from Sweden, is one of, if not the, longest-established open-access night train operator in Europe, and their night trains are fully made up of couchette carriages, rather than full sleepers and seat coaches. Transdev is their parent company.[33]

A new open access operator is AplenSylt.[34] Sylt is on the North Sea coast of Germany so this is a sea to Austrian alpine region night train.

More trains are planned. The Dutch company European Sleeper plans to introduce an overnight train from Brussels to Prague via Antwerp, Rotterdam,

[30] https://www.transdev.com/en/news-en/transdev-investment-night-trains-sweden-germany-2021/
[31] https://www.scoop.co.nz/stories/BU2009/S00515/transdev-new-zealand-endorses-concept-of-a-night-train-between-auckland-and-wellington.htm
[32] https://www.railjournal.com/passenger/main-line/flixtrain-to-launch-swedish-service-on-may-6/
[33] https://www.snalltaget.se/en https://en.wikipedia.org/wiki/Sn%C3%A4llt%C3%A5get
[34] https://www.nachtexpress.de/en/

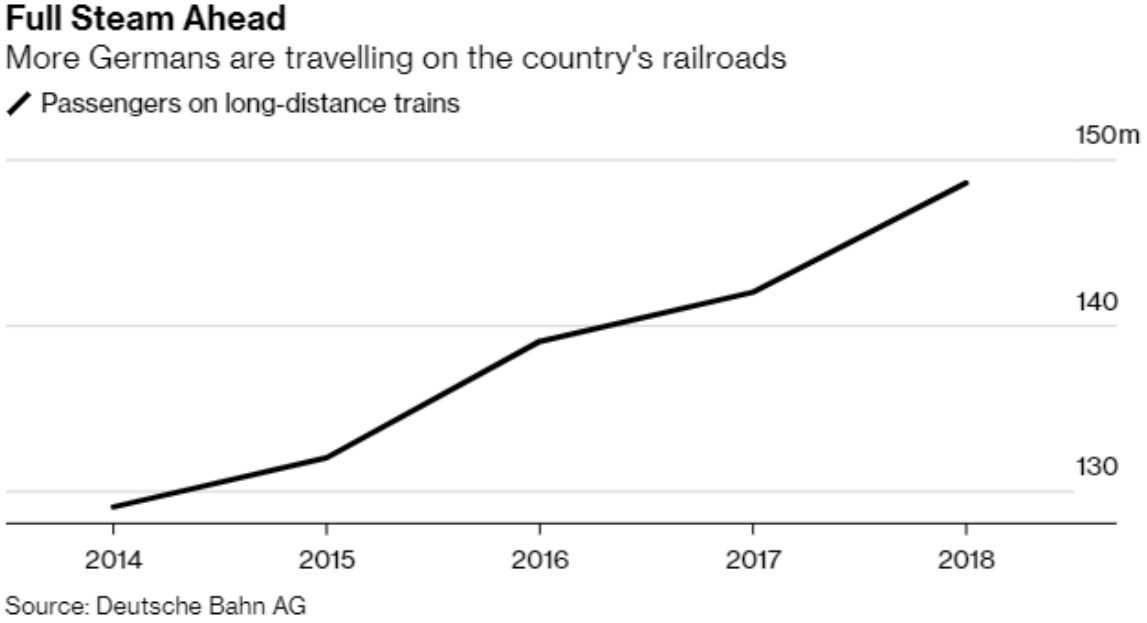
Amsterdam, Berlin and Dresden in April 2022 with a second night train to and from Belgium and the Netherlands planned for December 2022.

Moonlight Express, a Belgian company, has also confirmed its plans to launch a night train between Brussels, Liège and Berlin in April 2022.

In many European nations overall train passenger numbers were climbing pre-Covid and there has been much new investment in train services.[35] Such investment has been aided by very low interest rates.

In Germany, increased awareness of the emissions footprint of flying had resulted in a drop in domestic flying in 2019 and an increase in long distance train travel.[36]

Figure 14



The European network is forecast to grow further with new connections planned between cities such as Berlin, Barcelona, Amsterdam and Rome.[37]

In an overview article on European night trains published under the heading *Attractiveness and cost key to modal shift,* the writer notes*:*

> *While we might talk up green choices, most passengers will continue to make selections based on cost. Crucially, most prospective night train passengers want the ability to access a private berth, and if the EC is able*

[35] https://www.railjournal.com/passenger/main-line/ns-more-international-passengers-in-2019/
[36] https://www.bloomberg.com/news/articles/2019-12-19/german-air-travel-slump-points-to-spread-of-flight-shame
[37] https://www.timeout.com/news/europe-is-getting-a-ton-of-cool-new-sleeper-trains-120820

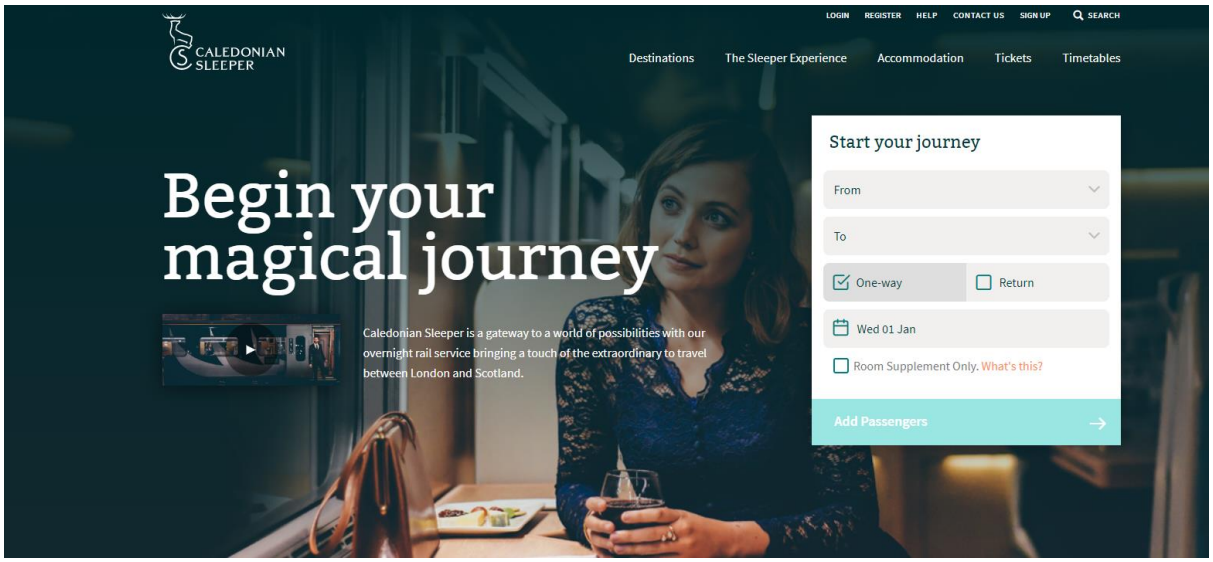
to level the playing field, this type of service could become affordable to a lot more people.

The rewards for railways and the environment of this outcome are potentially great. Rather than using a night train once a year for a holiday, they could become the mode of choice for business travellers and others who regularly criss-cross the continent, an exciting prospect for all involved.

United Kingdom

A service aimed more at the luxury tourism end of the market is the Caledonian sleeper train service in the UK.[38] It is run by Serco, the company that for one time ran some New Zealand prisons. The train leaves London just before midnight and arrives at Edinburgh at 7.30 in the morning. A twin en suite can be booked from £150 while a sit-up seat starts from £48. There are 'pet friendly' options and bikes are carried for free. The trains are also wheelchair-friendly.

Figure 15



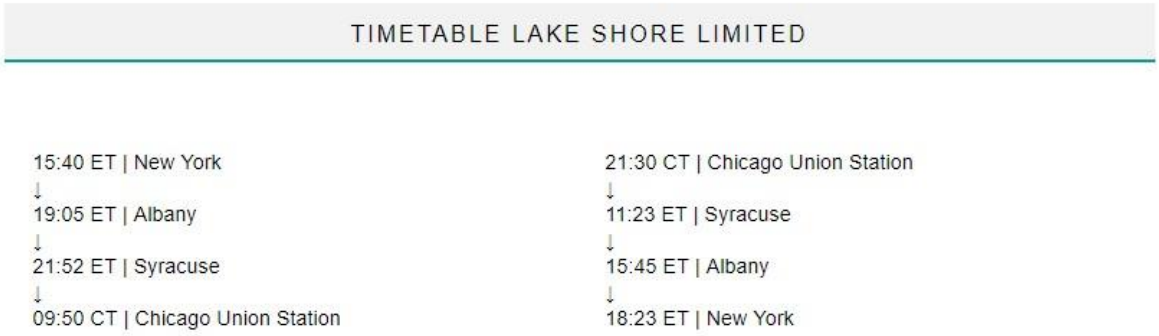
There is also the Great Western Railway Night Riviera Sleeper which operates between London and Penzance. On Sundays it departs London Paddington at 23:50 and arrives at Penzance at 08:59. Monday to Friday it departs London Paddington at 23:45 and arrives at Penzance at 08:00.

[38] https://www.sleeper.scot/timetable/london-edinburgh/

United States

The United States, a country often seen as being rail-unfriendly, also has night trains operated by Amtrak.[39] An example of a train aimed at the leisure market is the New York to Chicago service.

Figure 16: New York-Chicago night train



But in April 2021, a night train service between Boston and Washington was re-instated. This is aimed more at the business market. It departs Boston at 9.36pm and arrives in Washington at 7am.

Thailand

Thailand has an extensive night train network. Some of the trains use carriages re-purposed from other nations. For example, the former New Zealand *Silver Star* is operating in Thailand. [40]

In terms of new trains, Thailand has been buying carriages from China.

Australia

Closer to home in Australia – a sparsely populated country like New Zealand – there are a number of overnight trains. Most are focussed on the tourist market. Examples include the Ghan, operating between Adelaide and Darwin and the Spirit of Queensland, travelling between Brisbane and Cairns.[41]

There are however overnight trains that can be used also by business travellers such as those travelling from Sydney to both Brisbane and Melbourne. The

[39] https://www.youtube.com/watch?v=ymd3NKqK4I4

[40] https://www.seat61.com/Thailand.htm#On_board_Thai_trains
[41] http://night-trains.com/australia

Sydney to Melbourne train sets off at 8.42pm arriving in Melbourne at 7.30 the next morning. A standard adult fare costs A$94, First class $132, sleeper $235.

Would an Auckland to Wellington night train service be supported?

Back in October 2019, before Covid and before the declaration of a climate emergency, then newly-elected Wellington Regional Councillor Thomas Nash promoted the idea of bringing back a night train:[42]

> *With an increasing number of people wanting to travel with a lower carbon footprint, he believed a business case should be done to see if a regular night train was feasible.*

He also suggested on twitter[43]

> *if a bunch of employers publicly committed to making bulk purchases of train tickets for their employees that might be the kind of evidence needed to make the case*

At the same time Shaun Hendy suggested:[44]

> *that our universities get behind faster, more frequent train services between major centres*

Now potentially tipping the balance is the requirement for government to become carbon neutral by 2025. As *Stuff* suggests, although the public sector represents less than 1 per cent of New Zealand's emissions, the idea is that stimulating demand for EVs, green buildings and other lower-carbon goods and services – such as train travel – will make those things easier and cheaper to come by for everyone.[45]

In addition, private businesses are on notice to first report their emissions and then do something to reduce them.[46]

In addition to private businesses and government, there is also good potential for environmentally conscious NGOs to make some commitment to swapping planes for trains when travelling between Auckland and Wellington. This could include staff and supporters of Forest & Bird, WWF, Greenpeace, Oxfam, Generation Zero, Extinction Rebellion and School Strike.

[42] https://www.stuff.co.nz/dominion-post/news/116722778/bring-back-sleeper-train-to-auckland-says-councillor-thomas-nash
[43] https://twitter.com/nashthomas/status/1200957008444190720
[44] https://thespinoff.co.nz/science/16-12-2019/one-big-idea-to-transform-travel-in-new-zealand/
[45] https://www.stuff.co.nz/environment/climate-news/125121276/674m-in-budget-to-help-public-sector-cut-carbon-from-cars-and-boilers-but-what-about-flying
[46] https://www.newsroom.co.nz/climate-tipping-point-looms-for-business

The Federated Mountain Clubs are now suggesting that members focus on ways to reduce their emissions.[47] The North Island Main Trunk passes by one of our most popular national parks, Tongariro, for which the night train used to be an important travel link.

The Parliamentary Commissioner for the Environment, Simon Upton, also made reducing the carbon footprint of tourist travel one of his key recommendations.[48] All these factors should support the reintroduction of a night train.

Many older New Zealanders have experienced using night trains, either when they operated in New Zealand or while travelling overseas. Amongst some of this older generation there is some nostalgia for such travel.

In contrast, most middle class young New Zealanders have been brought up with easy access to cheap flying and may find it hard to imagine using a train for long distance travel. This is a barrier that needs to be overcome. For many, price will be a major decision tipping point. For others, a concern about climate change may change behaviour.

A revised cost benefit analysis?

Part of the reason the previous night train stopped running was that the cost of airline tickets became so low compared with the train. In addition, cars became cheaper and roads were improved. Neither driving nor aviation pay full environmental or social costs. But relative prices are starting to change. In particular, historically the price of carbon was not factored into analyses. Now, incorporating a rising price of carbon is also important. The New Zealand Infrastructure Commission notes: [49]

> *At present, market prices in New Zealand's Emissions Trading Scheme likely fall short of what is needed to reduce carbon emissions sufficiently and meet government targets. Under New Zealand's Emissions Trading Scheme, carbon emissions are currently priced at just under $40/tonne. Recent reforms have established a price floor of $20/tonne and a cost containment reserve that will be auctioned to cap prices at $50/tonne. According to recent Treasury estimates, a significantly higher price, as high as $232/tonne by 2050, would be needed to hold global warming at less than 2 degrees Celsius. Some international research indicates that*

[47] https://blog.planetaryecology.org/2021/04/07/recreation-transition-low-carbon-recreation-in-the-mountains/
[48] https://www.pce.parliament.nz/our-work/news-insights/media-release-not-100-but-four-steps-closer-to-sustainable-tourism
[49] New Zealand Infrastructure Commission (2021) He Tūāpapa ki te Ora Infrastructure for a Better Future Aotearoa New Zealand Infrastructure Strategy Consultation Document, May.

the true cost of carbon emissions could be nearer $400/tonne. Getting the price right is fundamental to driving infrastructure decisions that support a low-carbon economy.

The *Future of Rail* report, using a carbon price of $71.50 in 2019 values, shows there are multiple benefits to the use of rail.

Figure 17

A benefit-cost analysis of a revived overnight sleeper service needs to re-assess the environmental, access and safety benefits.[50] What is known is that the current government wishes to see the price of carbon increased, emissions reduced, and social and safety outcomes prioritised, meaning any previous cost benefit analysis is out of date. What needs to be investigated includes:[51]

- how many people would shift from flying to the train if aviation was fully user-pays?
- what level of support from individuals and businesses for the service will there be as climate awareness grows further?
- what social and environmental benefits would we see, particularly if establishing the service is seen as the first step to creating a comprehensive public transport network?
- while climate-aware citizens are frustrated by the pace of government climate action, what public engagement and mental health benefits would arise from seeing early, tangible action on transport's rapidly increasing emissions?

[50] https://www.greaterauckland.org.nz/2019/05/21/a-national-public-transport-network/
[51] https://www.greaterauckland.org.nz/2019/11/06/gathering-momentum-by-gathering-data/

The first point listed is important because flights are unnaturally cheap:

- aviation is not paying for its environmental damage (especially carbon emissions);
- passengers flying from Wellington to Auckland as part of an international flight pay no GST on the domestic leg of the trip, but would be charged if they used the train as the connection;
- government and local government have been subsidising many airports.[52] As an example, Kapiti District Council ratepayers have provided at least $150,000 of ratepayer support to a privately owned airline which flies from Paraparaumu (on the main trunk line) to Auckland;[53]
- land use and transport planning decisions in both Wellington and Auckland are often made to support aviation without a true understanding of how this negatively impacts other urban planning goals.

A study of the costs and benefits of subsidising the Kapiti airport showed most of the benefits went to individuals who had their travel time reduced. The authors of the study note '[i]t is important to note the benefits to the district we have identified in the report are likely to be attributable to a small segment of the local population (ie airport users, affected businesses). Therefore, we suggest that these distributional affects are considered when evaluating the equity of any future action'.[54]

Research across a range of countries shows that a small number of people fly the most. In additional, a significant part of the population rarely fly. It is the wealthier section of the community that are frequent fliers. As an example, in the United Kingdom data suggests that around 70% of flights are taken by 15% of the population.[55] On-going subsidies to aviation, either from ratepayers or taxpayers, are effectively a transfer from the wider community to a small group of the wealthier members of the community.

[52] https://www.stuff.co.nz/national/politics/114096731/taxpayerfunded-bailouts-on-the-cards-for-cashstrapped-regional-airports
[53] https://www.nzherald.co.nz/nz/kapiti-coast-district-council-votes-to-subsidise-air-chathams/XSHSLQSKP2QN7UXOPJ3BBLDYXI/
[54] TDB Advisory (2018) Kāpiti Airport: An estimation of its economic value to the Kāpiti District, Wellington.
[55] https://static1.squarespace.com/static/5d30896202a18c0001b49180/t/605a0951f9b7543b55bb003b/1616513362894/Elite+Status+Global+inequalities+in+flying.pdf

How quickly could a night train be re-introduced?

In an April 2021 radio interview, Greg Pollock, CEO of Transdev, discussed Transdev's interest in running a night train. As part of that interview Pollock was asked how quickly it could be running. He suggested that it could be operating within two to four years.

How would a night train be financed?

In Europe there is a mix of state-owned rail companies and private companies operating sleeper trains. Some trains are financed purely on a commercial basis.

There is potential to provide subsidies to either a private provider or KiwiRail. As an example, the New Zealand Emissions Trading Scheme is now in its fourteenth year of operation. Auctioning of emissions units began in March, and 2022 will see the introduction of a falling cap on net emissions of long-lived greenhouse gases. the carbon price could rise substantially. A key budget announcement is that all revenues from the auction – $3 billion over five years, according to Minister of Climate Change James Shaw, and potentially much more – will be dedicated to emissions reductions. Some could help establish the train.

There is strong global demand for new trains. While most operators are purchasing trains outright, it is possible leasing services will become widespread as in the airline industry. This would save on initial capital purchase costs.

A night train would link into existing rail services

A night train could quickly become part of our small existing rail network. As an example, a person could travel to Auckland in the morning on Te Huia, work all day in town, socialise in the early evening then catch the night train back to Hamilton. Equally, a traveller from Palmerston North could have a similar schedule taking the Capital Connection to Wellington in the morning and returning later in the evening.

But an expansion of efficient, regular regional rail would greatly improve the network.

Rapid rail as a key part of an expanded network

Rapid rail has been promoted by the Greater Auckland group between Auckland and Tauranga and between Auckland and Hamilton.

Figure 18

Greater Auckland is proud to present our proposal for Regional Rapid Rail – an Upper North Island Passenger Network.

In recent years, many other researchers and campaigners have promoted the restoration or improvement of passenger rail services within New Zealand. Some proposals call for simple improvements, such as upgrading existing services, including the trains linking Wellington and the Wairarapa and the Capital Connection linking Palmerston North and Wellington. This includes options to run the Capital Connection more frequently with return trips during the day and potentially services in the weekend.

But rapid rail is also being promoted.

As an example, in the lower North Island, Kapiti Coast District Council member Gywnn Compton has been running a campaign to bring better rail services to the Kapiti Coast through to Palmerston North. [56]

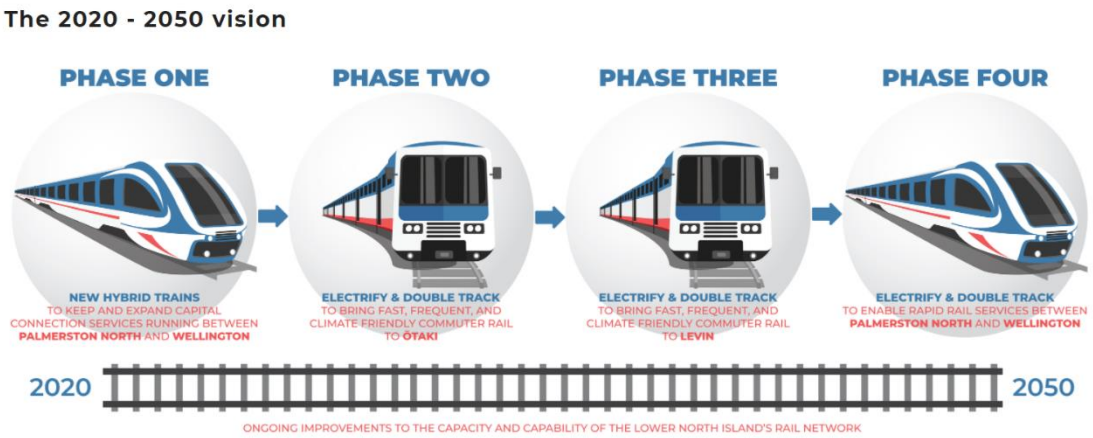
An end goal is fast rail. A simple first start would be double tracking from Waikanae to Otaki. The fast rail to Palmerston North could potentially link to

[56] https://www.gwynncompton.co.nz/kapitihorowhenuarail

Palmerston North airport. With the likely closure of Kapiti airport in order to build housing, Palmerston North airport provides a nearby alternative.

However, expressways are being built along this route instead. More to the north are proposed despite not representing a good return on investment.

Figure 19



Other regional services

Regional rail

In the meantime, with the support of councils along the route, KiwiRail is currently undertaking a feasibility assessment of a proposed day 'connector' passenger rail service between Wellington and Auckland.[57] This service would be different to the Northern Explorer service in that it incorporates more stops and operates as a connector service connecting people in more remote areas to health and employment. Horizons Regional Council notes that leading off this is the opportunity to consider a connector or passenger rail type service between Palmerston North and Whanganui offering an alternative transport mode for commuters between these two cities.

A more radical proposal has been put forward by students from Canterbury University under the guidance of Susan Krumdieck. This set out the costs and benefits of using power from a closed Tiwai Point Aluminium Smelter to run a greatly expanded South Island rail network.[58]

[57] https://www.horizons.govt.nz/HRC/media/Media/Draft-Regional-Land-Transport-Plan.pdf?ext=.pdf
[58] Davis, D., de Ridder and Greenhalgh, D. (undated) Electrified rail network for the South Island of New Zealand, Canterbury University.

Regional long-distance coaches

While rail is important, the role long distance coaches already play is often overlooked. For example, in Germany while regional rail services have declined, there has been strong growth in long distance coach travel since they were deregulated in 2013.

In New Zealand long distance coaches, most run by the privately owned InterCity company, already link all major urban areas with most small towns and rural areas. Where trains do not run, or planes do not fly, buses allow people to move within or between regions. There are also no train lines to the important tourist destinations of Nelson, Taupō and Queenstown.

Coaches are already a very low carbon form of travel. Using biodiesel is already feasible. And technology is advancing rapidly so they can further reduce emissions by turning to electricity. Already overseas bus companies are experimenting with long distance electric buses.[59]

However, key parts of the infrastructure supporting this bus network are very poor, examples being New Zealand's largest and most important coach station in central Auckland and the key tourist destination and interchange in Taupo. Coach passengers have to endure facilities which have long been deemed unacceptable for air travel. In addition, coaches often get caught in peak traffic coming in and out of cities. Bus lanes on motorways would help overcome this problem.

The actual coaches are also not keeping up with best practices overseas. While long distance coaches in most developed nations have on-board toilets, New Zealand's buses generally do not. Increasingly, overseas coaches are being designed to be easy for disabled people to use. Our coaches do not easily carry bikes, skis or surfboards. It should be easy to reach New Zealand's tourism focussed cycleways by coach (or train).[60]

Outside of the coach network there are also a range of smaller shuttle services, including health and tourism focussed shuttles.[61] Potentially, some rural mail and parcel delivery services could also be linked in and maybe even some

[59] https://shifting-gears.com/olectra-c9-a-long-distance-45-seater-intercity-electric-bus-for-india/
[60] https://www.greaterauckland.org.nz/2020/04/03/better-long-distance-coaches-design-regulation-and-community-public-health/
[61] https://www.greaterauckland.org.nz/2019/06/28/a-history-of-regional-and-long-distance-buses-in-new-zealand/

school bus services. What would be needed is a seamless booking and payment system which integrates all forms of low carbon travel.

Significantly upgrading and linking this whole network to make it more attractive would be relatively low cost and could occur quickly. An upgraded coach and shuttle network would build ridership for an upgraded rail network and has an intrinsic flexibility which can complement rail; route modifications to connect to each new or improved rail line as it comes on board are easily made. And even setting aside greenhouse gas reductions, an improved bus and train network will achieve a range of other social goals such as increasing mobility for those who cannot drive. It would be a contributor to a "just transition". And it would allow members of the public service to travel around New Zealand in a low carbon manner.

Good for public servants, good for wider society

In 2019 Heidi O'Callahan and I wrote:

Imagine a New Zealand where you can…

- *knock off work and escape the city for a long weekend, without having to drive on dangerous roads, bleary-eyed from a week at work…*
- *grow old in your hometown, knowing that even if you become too disabled to drive, heading to the nearest large centre for a doctor's visit isn't a transport hassle…*
- *travel to regional tournaments safely by public transport (while teammates are still gaining experience as drivers)…*
- *visit grandchildren in other regions travelling on high quality buses equipped with onboard toilets and fast wifi, enjoying vegan and gluten free options at refreshment stops…*
- *have seamless door to door travel between cities and small towns using a mix of trains, buses and electric vehicles, with the help of accessible technology…*

While an efficient joined-up low carbon regional transport network will help the public service meet its emission reduction goals, there are many other benefits in developing the network.

New Zealand has an ageing population particularly in small towns and rural areas. In addition, one of the side effects of unaffordable housing in larger cities is that there has been some movement to small towns, including by

those retired.[62] At some point those who are ageing cannot safely drive and so regional transport options become important.

Children, for example, have no choice about where to live, and in rural areas and small towns, have little transport independence. Children may need access to public transport simply to keep contact with both their parents, in the not-infrequent situation where one has moved to a different town. The lack of it may mean they are growing up with limited parental or wider whanau contact. Others may need to travel to and from boarding school, or to further an area of interest.

In the towns Ohai and Nightcaps, research found:[63]

> *Single women and the elderly are particularly disadvantaged in their access to private vehicles. Some older local people, especially women, do not have driver licences and are unable to drive even though they may own a serviceable vehicle.*

What is holding us back?

There are a number of barriers to re-establishing an efficient low carbon regional public transport network.

Lack of ambition in climate goals

A climate emergency has been declared but as many of the submissions to the Climate Change Commission pointed out, the follow-through to investment in low carbon transport options has been lacking. All levers need to be pulled to reach our emission reduction targets.

The Climate Commission's draft report talks of getting more freight onto trains and supports further electrification of the network but is silent on re-establishing a long-distance passenger network.[64]

The *Future of Rail* project also has little to say about re-establishing a passenger rail network.

[62] https://www.stuff.co.nz/national/125013645/live-like-a-king-down-country--buyers-head-to-te-kiti-to-escape-auckland-and-Covid19

[63] https://www.nzta.govt.nz/assets/resources/research/reports/484/docs/484.pdf

[64] While electrification is ideal in many countries hydrogen powered trains are also being introduced https://www.railjournal.com/fleet/first-french-region-signs-hydrogen-train-contract/

As in Europe, a clear vision is needed as to how rail can assist decarbonisation of passenger transport.

Poor state of NZ rail infrastructure and a gap in electrification.

The *Future of Rail* report argues that significant parts of the rail network have been in a state of managed decline. The new goal is to upgrade the network, primarily for improved freight handling. The 2021 Budget did allocate $1.3bn to rail improvements, including $449m to improve the 3,700km rail network. This seems a significant amount of money, but the total allocated to rail is similar to the amount spent of building just 27km of the Transmission Gully road project.

Still, many of the asset upgrades on the main trunk line will be of advantage in running a reliable night train.

One of the challenges in running a low emissions night train is the presence of two gaps in the electric network. According to Wikipedia, around 460 km (approximately 65%) of the line is electrified in three separate sections: one section at 1600 V DC between Wellington and Waikanae, and two sections at 25 kV AC: 412 km (256 mi) between Palmerston North and Te Rapa (Hamilton) and 34 km (21 mi) between Papakura and Auckland Britomart.[65]

The Climate Change Commission saw further electrification of rail as important, suggesting that most of this should take place between 2022-2025.

How to create a joined-up network of the two systems is beyond the scope of this paper but it is an issue that needs to be solved. Alternatively, there are now battery-powered and hydrogen-fuelled trains that bridge such gaps overseas. Solving this problem is especially important as diesel trains cannot go into Britomart.

A focus on roads and airports

In recent decades there has been a big focus at both the national and regional levels on road building and keeping regional airports open. Roading projects have been supported where there is little economic justification and often the projects have been subject to large cost blowouts. A recent example is Transmission Gully.[66]

[65] https://en.wikipedia.org/wiki/Railway_electrification_in_New_Zealand
[66] http://auckland.scoop.co.nz/2021/05/review-reveals-who-is-to-blame-for-transmission-gully-shambles/

In terms of regional airports, support has often been given by both ratepayers and taxpayers. International data shows that around two thirds of airports around the world make a loss, but with small airports being especially unprofitable.[67] Last year New Plymouth airport required a major ratepayer bailout, while Taupo airport received support from both ratepayers and taxpayers.[68] Kapiti Coast District Council has been lobbying for taxpayer support to keep the local airport open.[69]

In addition, the New Zealand government is a majority shareholder (52%) in Air New Zealand. The airline has received financial support from the government to aid its post-Covid recovery.[70] Potentially, the government would see a night train competing with this investment.

A view that we should not go backwards in technology

Opponents to rail in New Zealand sometimes say this is old technology and we should be investing in new technologies such as electric planes. However, just as aviation technology has been advancing so has rail. The new trains being established as night trains in Europe are quite different to trains such as the *Silver Star*. They are much more likely to be powered by electricity, they have high speed wifi meaning work or entertainment options while travelling have increased, they have improved disability access, and they can carry bikes. On some trains you can take pets.

They also have good quality on-board toilets.

[67] https://www.portcalls.com/66-worlds-airports-losing-moneyreport/
[68] https://www.stuff.co.nz/business/121952736/new-plymouth-airport-needs-a-multimillion-dollar-bailout
[69] https://www.stuff.co.nz/business/300178914/mayor-urges-pm-to-save-kpiti-airport-helen-clark-urges-careful-consideration
[70] https://www.newsroom.co.nz/air-nz-loan-extension-a-lost-opportunity-for-climate

Source: https://twitter.com/lennartnout/status/1393152810448039939?s=20

Electric, hydrogen and SAF powered planes may eventually be part of our overall transport mix. But their widespread use is decades away. A night train could be operating before 2025. Night trains can help reduce emissions in the short to medium term, regardless of what future innovation brings. Reducing emissions in the short to medium term is critical for pulling us back from irreversible climate damage.

Lack of separation between rail infrastructure and train operators

Some rail advocates suggest a major barrier to running regional passenger trains in New Zealand is the lack of separation between the owner of the rail network and those who wish to use it. Clearly in Europe and the UK much innovation has come from allowing private operators to use state-owned rail networks.

KiwiRail has not led innovation in the passenger rail network. While it operates a small number of day-tourist-oriented services, it has not actively tried to expand its market. This is in contrast to the airlines that aggressively market their products through special deals, offering frequent flyer schemes and being part of other loyalty schemes such as Flybuys and Airpoints. While carriages have been upgraded in recent years, neither the long-distance trains nor the Capital Connection offer on-board wifi.

No quality standards set for long distance coaches

While these services often depend on regional and local councils to supply off-bus infrastructure, the actual buses are operated by the private sector.

Minimum standards should apply to both off-bus infrastructure and the actual buses.[71] For example, if buses are offering trips longer than two hours on-board toilets such be mandatory as is common overseas.[72]

Lack of an integrated booking and ticketing system

We do not have an integrated booking system that allows easy planning of trips by rail, bus and ferry at both a national and regional level.

Another problem is that KiwiRail has not used dynamic pricing for selling tickets on its current long-distance trains. It seems to prefer to have empty seats rather than fill them with cheaper fares. In contrast airlines, and InterCity, use such pricing to maximise passenger numbers. This would need to change if a night train was operating as there will be seasonal and weekly peaks and troughs in travel demand.

Final thoughts

The longer New Zealand fails to address our heavy reliance on aviation, the more climate damage and inequity occurs. If all the public money used to subsidise airports, small airlines, Air New Zealand and potentially new aviation fuels, plus all the public and private money spent on research to reduce their emissions, was instead used on building a national public transport network of trains and buses, we would quickly have an excellent network.

And even if aviation could be electrified quickly, or electricity used to produce SAFs, two problems remain:

- reducing travel time induces trips; reducing travel time to the extent that aviation does, induces many trips, including many low value ones - which unhelpfully changes people's expectations of the geographic area they can work and play in within the time they have.
- the energy requirements will still be extremely high, displacing other uses for that energy - in regenerating urban and natural areas, improving biodiversity, and improving social and health outcomes.

This working paper highlights the benefits of a night train. It can contribute to establishing a low carbon national public transport network, which has safety,

[71] https://www.greaterauckland.org.nz/2020/02/25/aucklands-wonderful-long-distance-bus-terminal/
[72] https://www.greaterauckland.org.nz/2020/04/03/better-long-distance-coaches-design-regulation-and-community-public-health/

access and economic benefits beyond the environmental benefits of reducing carbon emissions.

Although aviation did not receive much focus in the *Carbon Neutral Government Programme* report, its emissions are not inevitable, they cannot be ignored and so they must be radically reduced. A night train would be a good contribution to this work.

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