

# How to decarbonise New Zealand's transport sector

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# Decarbonising New Zealand's transport sector: How to do it and what is stopping us

*New Zealand can deliver on a 1.5°C future*

*To achieve this, transportation in New Zealand must be largely decarbonised by 2030.*

*Our current transport system no longer meets our needs.*

*By 2030 our transport system will be safe, healthy, accessible to all, resilient and decarbonised.*

*Paul Winton, 1point5 Project*

## Introduction

Emissions from transport are a major part of New Zealand's climate challenge, as highlighted by the Climate Change Commission in February 2021. While transport emissions have been rising in most of the world, New Zealand's increase in road transportation emissions by 101.6% from 1990 to 2018 has been remarkable.<sup>1</sup> New Zealand is also unusual among advanced industrialised economies with farming creating around half of our total greenhouse gas emissions. This has implications for the transport sector.

Both transport and farming have enormous emission reduction possibilities. The co-benefits of decarbonising transport will improve lives throughout society, which can be communicated relatively quickly. The co-benefits of decarbonising farming are extensive, but because farming is an important export industry this may cause a delay to action. Regardless, we must meet our international commitments and decide as a country how we split the emissions reductions between sectors.

We have produced this working paper in response to the publication of the Climate Change Commission's first report and the Parliamentary Commissioner for the Environment's second report on sustainable tourism.<sup>2 3</sup>

## The problem

The Climate Change Commission's draft report sets a budget of reducing domestic transport emissions by 47% by 2035. The 1Point5 Project's conclusion is stronger. Their research suggests mitigating the risk of a delay in the decarbonisation of farming requires transport to aim for almost full decarbonisation by 2030.<sup>4</sup>

We take this as our starting point. How do we achieve this, and what are the barriers to change?

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<sup>1</sup> <https://www.mfe.govt.nz/sites/default/files/media/Climate%20Change/new-zealands-greenhouse-gas-inventory-1990-2018-vol-1.pdf>

<sup>2</sup> <https://www.climatecommission.govt.nz/get-involved/our-advice-and-evidence/>

<sup>3</sup> <https://www.pce.parliament.nz/publications/not-100-but-four-steps-closer-to-sustainable-tourism>

<sup>4</sup> <https://1point5.org.nz/>

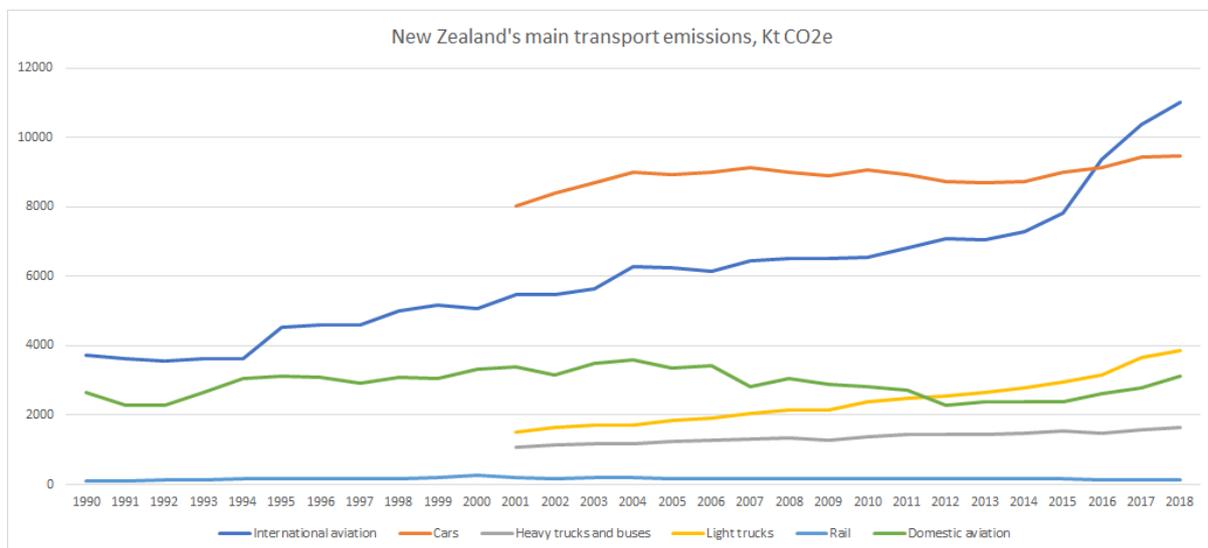
While it has been known for quite some time that we need to reduce transport emissions, New Zealand has been heading in the opposite direction. The problem we face, essentially, is that these increases have happened for systemic reasons; and those systems are still in place.

## Our historical emissions from transport

In 1990 domestic transport emissions were estimated to be 8,765 kilotonnes carbon dioxide equivalent (kt CO<sub>2</sub>-e). This represented 14% of gross emissions in that year. By 2018, these had increased by 90%, to reach 16,625 kt CO<sub>2</sub>-e, representing 21% of total emissions. Road transportation increased over the same period by 101.6%.

Figure 1 shows the trajectory of the main domestic transport emissions. Due to its significance and growth path, international aviation is also included. Based on a growing research literature, both international and domestic aviation emissions lines used here include a radiative forcing factor.<sup>5</sup> In its February 2021 draft report the Climate Change Commission did not factor in radiative forcing. Nor did the Parliamentary Commissioner for the Environment report on tourism.

**Figure 1**



Source: <https://www.mfe.govt.nz/publications/climate-change/new-zealands-greenhouse-gas-inventory-1990-2018>

Cars, and increasingly those SUVs defined as 'light trucks', had until recently been by far the largest contributor to transport emissions.<sup>6</sup> In briefings to the incoming government in 2020 officials made it clear that not enough was being done to curb these emissions.<sup>7</sup> The Climate Change Commission also concentrates heavily on private car emissions and the need to reduce these.

However, due to the very rapid growth of tourism, international aviation emissions overtook cars in 2016 and, until Covid-19 restrictions closed our borders, had been increasing rapidly. Domestic aviation had not seen any significant growth since 1990, but has had small growth and decline phases. The declines have been attributed primarily to efficiency gains, but strong passenger growth

<sup>5</sup> Research indicates that radiative forcing amplifies aviation emissions. 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). 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>

<sup>6</sup> Canadian research indicates cars have been getting bigger, heavier and more powerful reducing any efficiency gains. [https://twitter.com/brent\\_bellamy/status/1371991786889961474?s=19](https://twitter.com/brent_bellamy/status/1371991786889961474?s=19)

<sup>7</sup> <https://www.stuff.co.nz/national/politics/300184111/government-policy-not-enough-to-curb-rising-transport-emissions-officials-say>

has prevented the desired reduction in emissions. Emissions were on an upward trend between 2012 and 2020, despite the efficiency gains.

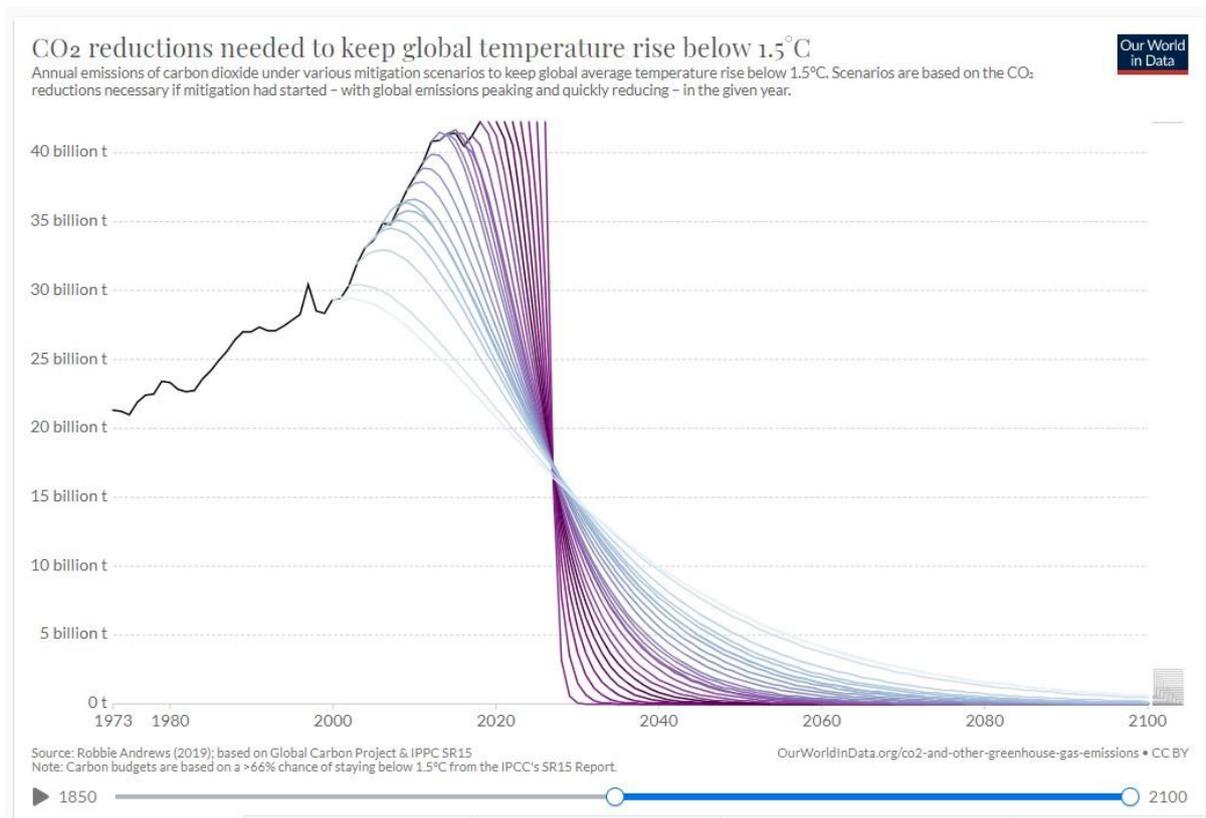
Rail emissions (primarily freight) have been very low throughout the whole period. As an indicator of the efficiency of rail, 7% of all passengers and 11% of all goods movements in the European Union are by rail but rail is responsible for less than 0.5% of the European Union's transport-related greenhouse gas emissions.<sup>8</sup>

We focus on passenger transport rather than freight.

## Pathways to 1.5 degrees warming

The decline in overall emissions has to be dramatic if we are to stay under 1.5 degrees warming. As Figure 2 indicates, unless our actions lead to very rapid decarbonisation of transport, the challenge only gets harder and harder each year.<sup>9</sup> There is on-going debate as to whether the overall targets set out in the draft Climate Change Commission advice are strong enough.<sup>10 11</sup>

Figure 2



<sup>8</sup> 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](https://germanwatch.org/sites/germanwatch.org/files/Hop%20on%20the%20Train.%20A%20Rail%20Renaissance%20for%20Europe_0.pdf)

<sup>9</sup> <https://ourworldindata.org/grapher/co2-mitigation-15c?time=1973..2100>

<sup>10</sup> <https://www.stuff.co.nz/environment/climate-news/124520105/why-the-climate-change-commissions-targets-are-so-weak>

<sup>11</sup> <https://www.lawyersforclimateaction.nz/news-events/zoom-on-ccc-draft-advice>

# Electrification of the car fleet on its own is not an economical approach to decarbonisation

Until recently, the approach of both our major political parties to reducing the emissions from transport has been to rely on the development and uptake of low emissions vehicles. The Climate Change Commission also focuses on expanding the EV fleet.

Yet while electrification of the car fleet is important, it can only be one strand of policy, for a number of reasons.<sup>12</sup>

New Zealand's car ownership rate is 86%<sup>13</sup> - amongst the highest in the world<sup>14</sup>. The required number of electric vehicles to provide full decarbonisation would be nearly 4.7 million vehicles<sup>15</sup> by 2030. If all cars were new the cost to the public would be well over \$230 billion. Even if costs could be substantially reduced by half by drawing on second-hand cars, the figure is still extraordinarily high. Accommodating these vehicles, with road-building and parking provision, is also very costly.<sup>16</sup>

The Climate Change Commission believes the minimum cost will drop but it is speculation as to whether the average price paid would be much below this. An Otago University survey suggests most people do not spend much at all on their vehicles, even those on higher incomes. The majority of the survey participants reported they were unlikely to spend more than \$20,000 on a new vehicle.<sup>17</sup>

There is also a danger that plug in hybrid electric vehicles (PHEVs) will be seen as of similar value to full electric vehicles.<sup>18</sup> PHEVs generally have a small battery which will degrade over time so potentially become predominantly fossil fuelled. PHEVs may become very popular in New Zealand because:

- They generally come in the large SUV format, which are currently popular with New Zealand drivers.
- PHEVs do not have the range anxiety, journey logistical planning, or battery ageing issues of 100% EVs because the associated petrol drive system just seamlessly takes over as needed.
- Categorisation of PHEVs as electric cars gives the owner the feel-good factor of doing their bit to help combat climate change, even if that is primarily an illusion.
- The PHEV user may be able to take advantage of incentives given to encourage the uptake of electric vehicles.

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<sup>12</sup> We consider electric bikes later in the paper.

<sup>13</sup> Vehicle fleet was 4,346,294 in 2019. (<https://www.transport.govt.nz/statistics-and-insights/fleet-statistics/vehicle-fleet/>) Population in December 2019 was 5,042,000 (<https://www.stats.govt.nz/topics/population>)

<sup>14</sup> ([https://en.wikipedia.org/wiki/List\\_of\\_countries\\_by\\_vehicles\\_per\\_capita](https://en.wikipedia.org/wiki/List_of_countries_by_vehicles_per_capita))

<sup>15</sup> assuming the car ownership rate remains at 86% and population rises to 5.5 million (Vehicle fleet was 4,346,294 in 2019. (<https://www.transport.govt.nz/statistics-and-insights/fleet-statistics/vehicle-fleet/>) Population in December 2019 was 5,042,000 (<https://www.stats.govt.nz/topics/population>))

<sup>16</sup> There are also those who argue that the mining and other resource use cannot support the worldwide growth of EVs. In addition, those promoting this view often argue that due to poor energy returns on investment as well as the resources required we cannot provide enough renewable energy to power these vehicles.

<sup>17</sup> <https://www.newsroom.co.nz/ideasroom/what-kiwis-really-think-about-evs>

<sup>18</sup> Personal comment from Steve Goldthorpe.

- Given the bulk of everyday vehicles feeding the New Zealand fleet are second-hand imports (primarily from Japan), good quality used PHEVs (with ageing batteries) may flood the New Zealand market at attractive prices.

Developed countries with lower car ownership rates (eg Norway at 51%) can consider relying heavily on electrification of the fleet because they have fewer vehicles to replace and the cost per capita will be lower to do so. They have also already started reaping the benefits of investment in safety improvements that enable an uptake in sustainable, active travel - an investment New Zealand still faces.

For New Zealand, if policy can succeed at substantially reducing driving and car ownership, our fleet can shrink. This can in turn reduce the mammoth task of electrification to an affordable level. As an effective alternative to electric cars, vastly expanding the fleet of e-bikes has significant co-benefits, and is far cheaper.

Decarbonisation via fleet electrification, without serious systems change, also leaves future generations with a transport network similar to the one we have at present - car dependent, expensive to maintain, and accompanied by poor safety, health, access and local environment outcomes. Also, electrification actually increases vehicle travel<sup>19</sup>:

*Because cleaner vehicles generally have lower operating costs than conventional vehicles, they tend to increase total vehicle travel and associated costs. For example, electric vehicles typically cost about half as much to operate as fossil fuel vehicles, which typically increases annual vehicle-miles by 10-30%.*

Policy needs to harness as many benefits from our investment in decarbonisation, and electrification delivers very few<sup>20</sup>:

*There are two general approaches to reducing transportation emissions: cleaner vehicles strategies that reduce per mile emission rates, and vehicle travel reduction strategies that reduce total vehicle mileage.*

**Table 1: Comparing Emissions Reductions Strategies**

Community Goals	Cleaner Vehicles	Vehicle Travel Reductions
Total Vehicle Travel	Increased	Reduced
Congestion reduction	Worse	<b>Better</b>
Roadway cost savings	Worse	<b>Better</b>
Parking cost savings	Worse	<b>Better</b>
Consumer savings and affordability	Mixed	<b>Better</b>
Traffic safety	Worse	<b>Better</b>
Mobility options for non-drivers	Worse	<b>Better</b>
Energy conservation	<b>Better</b>	<b>Better</b>
Pollution reduction	<b>Better</b>	<b>Better</b>
Physical fitness and health	Worse	<b>Better</b>
More compact development	Worse	<b>Better</b>

*By reducing vehicle operating costs, Cleaner Vehicle strategies increase total vehicle travel, sprawl, and associated costs. Vehicle travel reduction strategies help achieve many multiple goals.*

<sup>19</sup> <https://www.vtpe.org/wwclimate.pdf>

<sup>20</sup> *ibid*

# Decarbonising our decisions

As outlined by the Climate Change Commission, transport and land use are intricately connected. Our multiple crises in safety, climate, public health, transport poverty, lack of access to opportunities and to some extent, the housing crisis - have been created by flaws in our methods for:

- planning,
- transport modelling and
- investment evaluation methods.

Our development plans have assumed that a level of sprawl and region-wide road building is necessary. Yet this core assumption is flawed because our cities and towns have plenty of room for quality intensification. Sprawl and road building reduce our longer-term resilience, push our emissions up, and cost billions of dollars in public money. The alternative to sprawl - intensification - is a key decarbonisation element<sup>21</sup>, reducing emissions initially by at least 9%<sup>22</sup>, and significantly more over the long term.

Unfortunately, our transport modelling methodology then takes these poor planning assumptions, and introduces further, substantial, inaccuracies.<sup>23</sup> The modelling incorrectly flags the road networks as being impossibly congested in scenarios without new roads, and magically uncongested in scenarios with the new roads.

Neither is true. Without the road - and *with* the proximity offered by intensification instead of the sprawl assumed in the planning - traffic levels would not rise as the base models assume. Conversely, in the scenario with the new road, the initial lower levels of congestion after opening would actually induce traffic until the improvements in travel time are swallowed up. The inaccuracy is fundamental; it comes from an assumption that both scenarios - although having different levels of road capacity, and vastly different patterns of development - would see the same land use patterns and number of "person trips".<sup>24</sup>

Our investment evaluation methods then amplify the problems further. **Travel time savings** for drivers, and lower congestion levels, are considered "benefits" in the business cases for new roads; in reality these benefits quickly disappear as induced traffic - those "person-trips" that are ignored in the modelling - eventuates. **Safety** seems like an obvious benefit but in fact is spurious because the induced traffic increases traffic conflicts throughout the city or region - not just on the road itself. "**Lower emissions**" are often attributed to new roading - but this is a benefit which relies on the (fanciful) belief that congestion will be lower. The evidence instead is that new roads increase emissions. And "**agglomeration**" benefits are assumed to accrue to drivers due to the travel time benefits; in fact agglomeration is about density and walkability, something these new road projects worsen.

In summary, how we plan, model and evaluate transport projects continues to bias investment towards road building and widening. This happens at council and Waka Kotahi level, and is why Cabinet received poor advice from officials for deciding on the NZUP and the Covid Recovery

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<sup>21</sup> <https://smartgrowthamerica.org/resources/driving-down-emissions/>

<sup>22</sup> <https://link.springer.com/article/10.1007/s13280-019-01290-y>

<sup>23</sup> <https://research-repository.griffith.edu.au/handle/10072/17993>

<sup>24</sup> <https://www.semanticscholar.org/paper/The-%E2%80%99fundamental-law-of-highway-congestion%E2%80%99-and-air-Garcia-L%C3%B3pez/5d106760830ccaef92ac1008dc091404b7fd309>

packages. These packages brought forward projects that should never have been in the longer term plans.

The sector is also bogged down by over-use of the “business case” process, which is intended as a useful aid to decision-making. For smaller projects, such as many of the placemaking and active travel projects, the business case costs are onerous. This skews investment towards larger projects which can swallow the cost of the business case more easily. Also, the quality of the business case results vary entirely with the assumptions within them, but the significance of the numerical results has been elevated above their accuracy. This has seen them replace leadership and strategic decision-making. Furthermore, there is a temptation to use biased assumptions within the business cases to manipulate investment decisions.

Professionals in the sector need to refresh themselves on their codes of ethics<sup>25</sup>, paying particular attention to the need to update their skills with international best practice, and to avoid environmental harm.

The investment decisions made on the basis of these poor processes are a core reason for the country’s rising emissions and level of car dependence. The implications for climate change are enormous. Unfortunately, there are many vested interests in the political economy of car dependence<sup>26</sup> which will resist the reform to these methodologies. Strong, informed leadership has never been more critical.

To break through these multiple problems, some new tools will be needed. The Cycling and Walking Plan for England<sup>27</sup> provides a useful governance measure:

*To receive Government funding for local highways investment where the main element is not cycling or walking improvements, there will be a presumption that all new schemes will deliver or improve cycling infrastructure to the new standards laid down...*

In a similar way, Government and councils should consider making the funding for any roading projects, including maintenance and renewals, contingent on a requirement to roll out cycling and walking improvements across the network, and to reduce “vehicle km travelled” (vkt) annually by, say, 7% per annum.

The agencies would very quickly discover the many big and small decisions they can change to achieve this, if they want to continue to receive funding.

Another important adjustment to how the funding is allocated, is to adjust the assistance rate for public and active transport projects and road projects to ensure the right incentives are in place for Councils to advocate for public and active transport, and not for roading.

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<sup>25</sup> <https://www.engineeringnz.org/engineer-tools/ethics-rules-standards/code-ethical-conduct/>

<sup>26</sup> <https://www.sciencedirect.com/science/article/pii/S2214629620300633>

<sup>27</sup> [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/904146/gear-change-a-bold-vision-for-cycling-and-walking.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904146/gear-change-a-bold-vision-for-cycling-and-walking.pdf)

# Decarbonising Auckland/Tāmaki Makaurau, our largest city

Most of New Zealand's population live in the large cities of Auckland, Hamilton, Wellington, Christchurch and Dunedin. However, it is beyond the scope of this paper to consider them in the detail that is necessary to set a path for decarbonisation. Auckland is considered here primarily as an illustrative example.

Car dependence - including high car ownership, biased regulations, unhealthy streets prioritised for vehicles, and sprawling development patterns - is at the root of Auckland's high transport emissions:

*Car-dependent transport systems are an important component of 'carbon lock-in', i.e. "the interlocking technological, institutional and social forces that can create policy inertia towards the mitigation of global climate change"...*

*suburban sprawl can be seen as the effect of state capture by the car-dependent transport system, rather than an outcome of citizen preferences...<sup>28</sup>*

The strength of this state capture is evident in the recent update to the Auckland Transport Alignment Project<sup>29</sup>. With a budget of \$31.4 billion, ATAP 2021 is the largest investment in business-as-usual car dependent planning the city has seen. The 10-year programme puts the city on track to increase transport emissions by 6% over the decade.

The programme ignores the Council's commitment to C40 "innovative city" membership, which requires innovation and leadership to inspire other cities. The Auckland Climate Plan's target of reducing transport emissions by 64% over the decade, and various specific targets, such as increasing cycling modeshare to 7%, were ignored.

Here are some illustrative examples on how to reduce emissions: halting sprawl, improving safety and amenity for active travel, a city-wide low traffic neighbourhood plan, reducing vehicle travel, and improving public transport.

## ***Auckland's sprawl***

Sprawl - with its effect on population density and longer travel distances - is often cited as the reason better public transport is too expensive to provide here, and why longer distances mean cycling modeshare will always be insignificant. In fact, Auckland is like any car-dependent city; improvements to public transport and cycling infrastructure can result in significant modeshift.

Yet the transport challenges presented by sprawl are indeed obvious, and Auckland's first task for decarbonisation is to reverse its plans for continuing to exacerbate this problem. The city must stop developing into greenfields areas.

Moreover, the growing population means Auckland's urban form can be changed quite swiftly. Intensification brings amenities to areas that are currently lacking them, vastly improving access and proximity for existing residents living nearby. This steadily reduces average trip distances, enabling

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<sup>28</sup> <https://www.sciencedirect.com/science/article/pii/S2214629620300633>

<sup>29</sup> <https://ourauckland.aucklandcouncil.govt.nz/media/39069/atap-project-breakdown-and-qa.pdf>

modeshift to walking, cycling and public transport. Intensification also supports better levels of public transport ridership and provides a higher revenue (from rates) to maintain infrastructure.

So although Auckland has chosen to continue to sprawl in recent years, the opportunity to harness projected population growth to reshape Auckland's urban form remains.

Currently, the Auckland Development Strategy allows for Auckland's size to increase by 25% in three decades, and with private plan changes being approved, this number may be even higher. This will hinder our climate response and set future transport planners up for ongoing failure. The Auckland Climate Plan calls for a review of the development strategy. We believe the new strategy should include zero greenfields development.

To overhaul the development strategy as we suggest will require challenging economists on the relevance of "the law of supply and demand." This theory is used to claim that drip-feeding a supply of land to the construction sector will keep housing prices down. In fact, there are too many other factors involved for this theory to dominate the equation, and the opposite is true. As the OECD study<sup>30</sup> into decarbonising Auckland's land and transport system found:

*In addition to reducing emissions, policies that increase population density may entail further social benefits by curbing growth in the cost of housing. Auckland house prices are expected to triple over the period 2018-2050 on current trends and by implementing a set of land-use policies that enable widespread densification this could be reduced to a 57% increase.*

Sprawl is unpopular because it is visibly destructive, converting land from productive farmland, trees, or from marginal land that could otherwise be planted in carbon-sequestering native forest. The cost of providing the infrastructure for this sprawl is very high and is robbing the city of funding to provide the regeneration and repair of our existing transport network to provide a more liveable city and more sustainable travel outcomes. And housing will be much cheaper through intensification.

There are few, if any, benefits from sprawl for Aucklanders, and many disadvantages. Good leadership should not find it too politically difficult to rewrite the development strategy in an environmentally responsible way, with no greenfields expansion.

## ***Improving safety and amenity for active travel***

Walking, cycling and micromobility are very low - or no - emissions transport modes. The latent demand for being able to walk and cycle safely is huge - as shown by the response to the Level 4 lockdown and to any new infrastructure with a modicum of connectivity.

But Auckland has a safety crisis. When people do not feel safe cycling, or walking to the bus or train, driving becomes the preferred mode, with obvious effects on Auckland's transport emissions.

The United Nations recommends investing 20% of all transport funding<sup>31</sup> in walking and cycling, at both the national and regional levels. New Zealand has a lot of catch up work to do. Since 2018, funding has been increased but is still less than a quarter of the UN recommendation. ATAP 2021 provides 4.7% of the budget for active modes and local board activities, and a lot of that is for just one project.

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<sup>30</sup> <http://www.oecd.org/publications/decarbonising-urban-mobility-with-land-use-and-transport-policies-the-case-of-auckland-new-zealand-095848a3-en.htm>

<sup>31</sup> <https://www.unep.org/resources/report/share-road-global-outlook-walking-and-cycling-october-2016>

Creating a safe and attractive system for walking and cycling will allow our transport emissions to drop in four ways:

- People choosing to walk or bike a trip they previously would have driven.
- People choosing to replace long vehicle journeys to distant activities or retailers with short active journeys to local activities and retailers,
- People choosing to replace long vehicle journeys with public transport journeys because the first and last legs by walking or cycling are now possible.
- People not having to travel at all because the people they needed to chauffeur can now travel actively themselves.

**Figure 3: Throughout New Zealand the bike shed has been replaced by free car parks for students**



Source: Historic photo Palmerston North library bike display

The transport emissions modelling undertaken by the Auckland Forecasting Centre and Auckland Transport only acknowledged the first of these pathways to lower emissions, which is why their decarbonisation plans have not focused on emissions reductions through active travel:

*The problem with considering walking for emissions reductions is that their contribution to mode share of distance travelled is so small that even doubling the amount that's walked has negligible effect on emissions.<sup>32</sup>*

Correcting this misconception would allow a different investment programme to be explored in Auckland. As Phil Goodwin<sup>33</sup> has noted<sup>34</sup>

*A frequent criticism is that the aim of reducing car use by increasing walking and cycling will bear most on shorter trips, with therefore inadequate reductions in mileage. This is where the deeper commitment to 'taking the targets seriously' becomes important. Superficial analyses typically assume (though they rarely make this explicit) that the number and distribution of journey lengths stays constant. But entirely orthodox modelling indicates that if all travel is becoming more expensive, there will be more short trips and fewer long ones. What this should mean is that the policy interventions necessary to increase the walking share of trips will also, at the same time, increase the number of journeys to nearby*

<sup>32</sup> Auckland Transport (2020, December 10). Personal communication.

<sup>33</sup> <https://scholar.google.co.uk/citations?user=3hF5I4oAAAAJ&hl=en>

<sup>34</sup> <https://www.transportxtra.com/publications/local-transport-today/news/68068/taking-grant-shapps-walking-and-cycling-targets-seriously/>

*destinations and reduce those to distant destinations, which can have the desired effect of reducing overall mileage more than any reduction in the number of trips – addressing the criticism above.*

Auckland can see significant modeshift through fixing its many safety deficiencies simply because the deficiencies are so widespread and egregious that fixing them will transform the system.

Can we do this quickly enough to impact our transport emissions by 2030? Yes. Cities can change their infrastructure quickly, as the world discovered during 2020<sup>35</sup>.

Auckland can learn from a smaller city, Seville<sup>36</sup>:

*In just two years, we transformed a city with almost no cyclists and seven miles of bike lanes, to a city where bikes have a central role in the urban mobility system... The result of this infrastructure building process was a parallel growth in cycling mobility. The number of cycling trips on a working day increased from approximately 13,000 to a peak of 72,000 — a 452% increase — in just three years. This came with a huge safety boon: Cycling in the city is twice as safe as it was when cycling infrastructure was nonexistent.*

**Figure 4: Cycling in Seville**



Source: The Guardian, <https://www.theguardian.com/cities/2015/jan/28/seville-cycling-capital-southern-europe-bike-lanes>

<sup>35</sup> <https://www.theguardian.com/lifeandstyle/2021/mar/12/europe-cycling-post-covid-recovery-plans>

<sup>36</sup> <https://usa.streetsblog.org/2020/10/13/best-practices-how-seville-became-a-city-of-cyclists/>

Or a large city, London<sup>37</sup>, which reallocated only 0.7% of its streetspace in less than a year, doubling or trebling its cycling numbers:

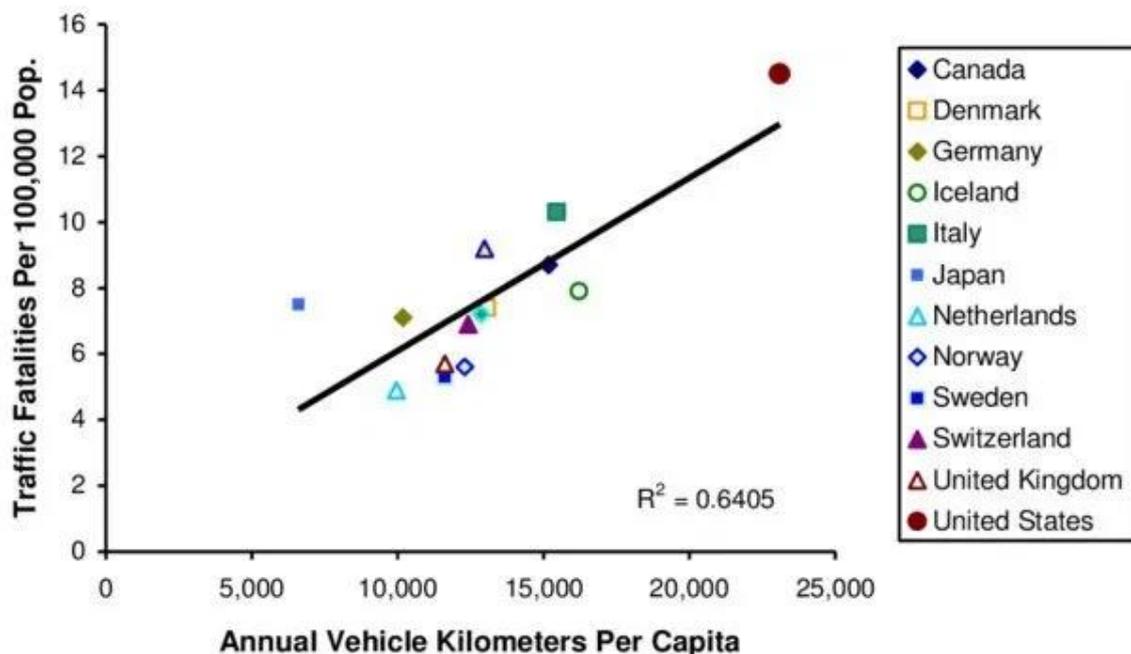
*In less than 12 months @MayorofLondon @tfl & @londoncouncils have built 100km of new cycle lanes & hundreds of km of quieter streets. The result? Last weekend we saw a 200%+ increase in cycling (300%+ in some places).*

The key is to use ideas from everywhere, to get Auckland’s cycling modeshare first to 5%, then 10%, then 15% and keep going. Similarly, with walking. Here are some ideas.

Auckland needs default speed limit changes, to bring our speed limits in line with Vision Zero, Austroads and the International Transport Forum. All urban areas - except where it can be demonstrated that higher speeds are safe - should be 30 km/hr. Making this change a default change is far cheaper than requiring signage for multiple different speeds and rolling it out in a piecemeal fashion. It is also easier for the public to adjust to when it is one comprehensive change.

Auckland needs to comprehensively reduce vehicle travel, because in general, a system with reduced vehicle travel reduces the number of conflicts between vehicles and other road users<sup>38</sup>. A later section of this paper details how this can be achieved.

Figure 5



The amenity and safety of people walking and cycling needs to be prioritised in every decision. Although this is already the stated policy, decisions in actual projects claim improvements cannot be undertaken due to “the impacts on the network.” Indeed, another reason for stopping sprawl is that a spreading, low density city influences transport planners to prioritise traffic flow for longer vehicle journeys, inconveniencing and endangering people walking and cycling.

Auckland needs to focus on connecting as much of a network of safe and attractive walking and cycling routes as possible within the decade. All arterials should be included because they are

<sup>37</sup> [https://twitter.com/martin\\_mckee/status/1365330192126853121?s=09](https://twitter.com/martin_mckee/status/1365330192126853121?s=09)

<sup>38</sup> <https://www.planetizen.com/blogs/108401-vision-zero-meet-vmt-reductions>

generally the most direct route and have the most amenities along them. People travelling by bike need access to all properties, which means safe all-ages, protected cycling lanes. This will generally mean reallocating parking lanes or repurposing the flush median. The intersections need particular attention to make them suitable for all-ages cycling, with a reduction in the number of traffic lanes.

Walking requires safe, level footpaths, frequent pedestrian crossings, shorter wait times at traffic signals and legislative changes to provide priority at intersections. Footpaths also need to be sufficiently wide, and for multiple ecological reasons, we need large street trees throughout the city. Unfortunately, many footpaths and verges have been narrowed uncomfortably in the last few decades, often involving the removal or compromise of the street trees.

Parking management must be overhauled to make both walking and cycling much safer. Parked vehicles detract from both safety and amenity by dominating the public realm, in parking lanes, off street parks or illegally parked on footpaths and squares. Both effective enforcement and reallocation of parking lanes is needed. Also, in many areas walking and cycling are dangerous due to wide vehicle crossings, sometimes taking up the entire property frontage, requiring people walking and cycling to be in a heightened state of alert. These need reducing to single vehicle width crossings, and ideally, parking should be consolidated for several properties into one location and one vehicle crossing.

## ***A city-wide low traffic neighbourhood plan***

A city-wide, low traffic neighbourhood plan is one way to rapidly improve walking and cycling.<sup>39</sup> In the United Kingdom these plans have delivered multiple benefits<sup>40</sup>, including reduced injuries and deaths<sup>41</sup>, a far more pleasant environment, improved equity<sup>42</sup>, reduced car ownership<sup>43</sup>, significant modeshift from driving<sup>44</sup>, reduced vehicle travel both in and around each low traffic neighbourhood<sup>45</sup>, improved public health<sup>46</sup>, reduced crime<sup>47</sup>, and reduced emissions and pollution<sup>48</sup>. Through good coordination with “first responders”<sup>49</sup> they improve response times<sup>50</sup>. They also require and benefit from good engagement with local people with mobility issues<sup>51</sup>.

All precincts can benefit from these improvements, be they industrial areas, big box retail or recreational. The public policy think tank The Helen Clark Foundation and WSP have recommended them for Aotearoa<sup>52</sup>:

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<sup>39</sup> <https://www.greatauckland.org.nz/2020/03/16/aucklands-low-traffic-neighbourhood-plan>

<sup>40</sup> <https://www.sustrans.org.uk/for-professionals/infrastructure/an-introductory-guide-to-low-traffic-neighbourhood-design/an-introductory-guide-to-low-traffic-neighbourhood-design-contents/design-guide/all/5-a-guide-to-the-evidence-around-low-traffic-neighbourhoods/>

<sup>41</sup> <https://findingspress.org/article/18330-the-impact-of-introducing-low-traffic-neighbourhoods-on-road-traffic-injuries>

<sup>42</sup> <https://osf.io/preprints/socarxiv/q87fu/>

<sup>43</sup> <https://findingspress.org/article/18200-the-impact-of-low-traffic-neighbourhoods-and-other-active-travel-interventions-on-vehicle-ownership-findings-from-the-outer-london-mini-holland-programme>

<sup>44</sup> <http://rachelaldred.org/research/low-traffic-neighbourhoods-evidence/>

<sup>45</sup> <https://beta.lambeth.gov.uk/streets-roads-transport/railton-low-traffic-neighbourhood-stage-one-monitoring-report/methodology>

<sup>46</sup> <https://www.bmj.com/content/372/bmj.n443>

<sup>47</sup> <https://osf.io/preprints/socarxiv/ftm8d/>

<sup>48</sup> <https://www.udg.org.uk/publications/news/2020/low-traffic-neighbourhoods-major-research-report>

<sup>49</sup> [https://www.collegeofparamedics.co.uk/COP/Blog\\_Content/the\\_paramedic\\_case\\_for\\_safer\\_streets.aspx](https://www.collegeofparamedics.co.uk/COP/Blog_Content/the_paramedic_case_for_safer_streets.aspx)

<sup>50</sup> <https://twitter.com/susancashmere/status/1298252074732236803?s=09>

<sup>51</sup> <https://www.transportforall.org.uk/wp-content/uploads/2021/01/Pave-The-Way-full-report.pdf>

<sup>52</sup> <https://www.wsp.com/en-NZ/news/2020/people-not-cars-at-heart-of-communities>

*Councils should therefore develop high-level plans to create multiple, interlinked, low-traffic areas in parallel, while keeping the specific form and process highly responsive to local needs...*

*We recommend that central government:*

- *Make reducing VKT a road safety priority. When the Road to Zero action plan is next updated, make reducing the number of kilometres travelled in vehicles (VKT) one of the focus areas, with specific targets and actions including the reduction of traffic in urban areas.*
- *Increase Innovating Streets funding with specific provision for permanent low-traffic neighbourhood projects.*
- *Develop a specific legislative tool to enable the creation of low-traffic neighbourhoods modelled on the UK's Experimental Traffic Orders, but adapted for the Aotearoa context.*
- *Review existing legislation, especially s342 and schedule 10 of the Local Government Act, and the definition of 'traffic', with a view to how they could more easily enable low-traffic interventions.*

## ***Reducing vehicle travel***

Reducing vehicle travel also needs to be central to Auckland's plans to decarbonise transport. This is not a new concept in sustainable transport planning. Traffic reduction has been overt in some European cities' Sustainable Urban Mobility Plans (SUMP's) for years.

Yet Auckland's transport planning currently does the opposite. By "optimising the network", "minimising the impacts on the network" and "easing congestion" at each congestion hotspot in turn, current planning methods mean each project incrementally increases vehicle travel throughout the network. Ironically, this increase in travel worsens congestion throughout the network.

When the focus is put on reducing vehicle travel instead, improvements to sustainable travel infrastructure can be prioritised. Recognising that "network impacts" such as local congestion actually lead to network-wide reductions in congestion and vehicle travel opens up a swath of decarbonisation opportunities. Major projects, streetscape and safety projects, renewals, traffic management, bus network planning, the operations centre, enforcement, travel demand management, arterial road redesigns, and optimisation programmes would all start to contribute to Council's decarbonisation goals - and in a far more economical way.

Reallocating traffic lanes to active and public transport, for example, offers two major benefits: an increase in sustainable travel, and a decrease in driving. Together, these can create significant modeshift, with very little investment.

There are multiple levers that can be used to reduce vehicle travel:

Table 2

LEVERS for adjusting vehicle km travelled

<b>WRONG DIRECTION - INCREASES TRAFFIC</b>	<b>LEVER</b>	<b>RIGHT DIRECTION - DECREASES TRAFFIC</b>
Increase Road Capacity	Road Capacity	Decrease Road Capacity
Retain vehicle priority on all streets	Street Layout	Use Low-Traffic Neighbourhood layouts
Retain extensive general traffic amenity	Circulation Plan	Restrict general traffic as required to prioritise sustainable travel
Widen intersection space for vehicles	Intersections	Reduce intersection space for vehicles
W&C Budget Insufficient	Walking and Cycling	Invest in W&C Infrastructure
Decrease Safety	Safety	Increase Safety
Increase Parking Free or Cheap Parking	Parking	Reduce Parking Price Parking
Decrease Road Pricing	Road Pricing	Increase Road Pricing
Decrease Public Transport Infrastructure	Public Transport Infrastructure	Increase Public Transport Infrastructure
Increase Public Transport Fares	Public Transport Fares	Decrease Public Transport Fares
Decrease Public Transport Quality	Public Transport Quality	Increase Public Transport Quality
Sprawl	Land Use	Intensify
Decrease vehicle costs, or hold them steady in the face of steady car advertising	Vehicle Costs such as registration fees	Increase vehicle costs
Evaluation Methods Using Old Models	Land Use and Transport Evaluation Methods	Evaluation Methods Best Practice



If the transport plans include activities from both the left and right columns, they will waste money and undermine each other. Reducing traffic consistently will orient urban transport policy to the objectives of health, such as safety, air quality, physical activity, well-being, accessibility, and fairness, as well as to reducing carbon emissions:

*reducing car use contributes to all these objectives, therefore potentially reducing the difficulty of controversial trade-offs between competing objectives.*<sup>53</sup>

Any decarbonisation that is not achieved through reducing vehicle travel must be achieved through electrification, at great cost. The target for travel reduction needs to be significant. A reduction of 7% in vehicle km per annum would still require electrification of half the fleet, by 2030, so this would be a bare minimum. Yet it would require a rapid shift in culture, approach and programme activities at both Waka Kotahi and Auckland Transport.

## ***Improving public transport***

The OECD's study, Decarbonising Urban Mobility with Land Use and Transport Policy - The Case of Auckland<sup>54</sup>, includes a public transport improvements scenario that suggests a 40% drop in emissions by 2050 is possible. This latter modelling was undertaken before the climate emergency was declared and before Covid, so the conventional economic approach used did not estimate the impact of some of the more recent tactical interventions seen overseas. The modelling also did not delve deeply into transport-specific details like improved customer experience and advanced network design. Due to the conservative nature of the modelling, we believe much of this 40% drop in emissions could be brought forward to 2030.

Improvements to public transport to achieve this reduction in emissions would include:

- Widescale bus priority in the form of bus lanes, bus priority in the give way laws, and bus-triggered traffic signals. Where bus lanes cannot fit, actively manage the general traffic volumes to ensure the bus is not held up due to congestion.
- Rapidly expanding the frequent bus network to cover the existing urban area and any new growth areas under construction;
- Low Traffic Neighbourhoods, which will reduce traffic congestion on the bus routes and improve the first and last legs of passenger journeys;
- A full focus on passenger safety, including near bus stops and train stations, and on passenger experience, including quality information and wayfinding that does not rely on having a functioning smartphone.
- Parking management to encourage modeshift from driving to public transport (eg significant removal of parking, parking levies, the removal of residential parking zones, higher prices for parking, parking management to reduce the supply of illegal parking spaces)
- Completing Auckland's Congestion Free Network<sup>55</sup>;
- Replacing the farebox recovery policy to allow for greater funding from central government for operational expenses of public transport;
- Introducing new fare schemes such as free travel for community service card holders and daily/weekly fare caps<sup>56</sup>;

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<sup>53</sup> <https://www.itf-oecd.org/trends-car-use-travel-demand-and-policy-thinking>

<sup>54</sup> <http://www.oecd.org/publications/decarbonising-urban-mobility-with-land-use-and-transport-policies-the-case-of-auckland-new-zealand-095848a3-en.htm>

<sup>55</sup> <https://www.greaterauckland.org.nz/congestion-free-network-2/>

<sup>56</sup> <https://freezethefares-generationzero.nationbuilder.com/>

- Making public transport attractive for people to use off peak, late night, cross town and counter-peak services.

This last point needs some illustration. Public transport management in Auckland is still overly focused on serving commuters on the main flows in and out of the city. This is because the rationale for investing in public transport has been to try to encourage modeshift during the heavily congested peaks in order to improve the driving experience for other drivers.

A focus on public transport users - of any time of day - requires giving just as much priority to other services. Users may only actually use an off peak, late night, cross town or counter-peak service irregularly, but its existence allows them to treat public transport the way drivers treat the road network - as a system that extends everywhere, any time. In any eventuality, they are secure knowing they can get wherever they need by public transport. This approach radically shifts mindsets and reduces car ownership and driving.

The value of an individual service cannot be calculated on a spreadsheet based on the number of people using it - the effect on customer experience and ridership is not captured there.

Good frequencies are critical and reduced off peak fares can make the services more attractive too.

Attractive off-peak services and cheaper fares also spread the ridership away from the peak hours, improving the return on investment and the ridership / emissions ratio.

Unfortunately, this approach to public transport investment has not been accepted in the recent emissions modelling by Auckland Transport, which explains why the scenario in which “public transport was improved so that fare, frequency and access barriers were removed” didn’t show significant reduction of emissions.<sup>57</sup> They concluded that a larger emissions reduction from public transport improvements than what the model showed is not pragmatically possible.

Furthermore, simple public transport improvements to help bring emissions were rejected on the basis that:

*the 70% driving modeshare means it is difficult to get public sentiment to change rapidly*

The modelling has not been used to find a technical solution to our problems, it has simply reflected the status quo, and is really a measure of the organisation’s unwillingness to change.

## Decarbonising our smaller cities and towns

In most small cities and towns, residents also depend heavily on cars for transport - if they can drive and can afford a car - while those who do not drive are not well catered for. Census data indicate many small centres are deprived areas. As a result, residents have, on average, older less reliable cars.

As already discussed, cars can potentially be electrified but this does not improve access for people who do not drive. Purchasing new electric cars is also beyond the means of many residents of small cities and towns so many people in smaller towns will wait for second hand EVs to become available. For EV uptake to be significant in the next decade substantial government support is required.

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<sup>57</sup> Auckland Transport (2020, December 10). Personal communication.

Significant modeshift could be encouraged instead. Distances within towns and smaller cities are shorter than in NZ's large cities, making these locations better suited to walking and cycling. The price of land for off-road shared paths is also considerably cheaper than in cities. This would allow the creation of long-distance connections to households, workplaces, amenities, local attractions, and neighbouring towns. A quality solution-finding process with landowners, similar to the Twin Streams Project in Waitākere City<sup>58</sup>, could enable the creation of networks. Engagement would include discussion about the long-term benefits to the region of taking cars off the roads, and of ensuring visitors and locals alike have full, active access.

Electric bikes offer an opportunity to transform transport in small cities and towns.<sup>59 60</sup> They are much cheaper than electric cars and have lower energy requirements, and there are bikes to meet the needs of all people - cargo bikes, bikes for people with disabilities, bikes with covers, bike buses for groups of young children. In Lithuania, a scheme where old cars can be traded in for subsidised electric bikes has been very successful.<sup>61</sup> Other governments are subsidising, or considering subsidising, e-bikes.<sup>62 63</sup>

To enable this, however, safe infrastructure is required. E-bikes overcome the problem of distance and hills, but in many smaller towns, these problems do not exist. In Palmerston North, Hastings, Gisborne, towns in the Wairarapa and the Kāpiti/Horowhenua Coast, and elsewhere, what is keeping the lid on the latent demand for cycling is the lack of safe infrastructure and the ease of driving that roading investment and ample free parking have provided. With main regional highways often running through the centre of these towns, safe walking and cycling will need the introduction of enforced, systematically safe speed limits, road environments that support the low speeds, and a new approach to freight, making far better use of rail, and smaller, safer trucks.

However, with an ageing population not all people will be able to walk or bike. Creating safe walking and cycling infrastructure will help those who need to use mobility scooters. Innovative mobility schemes are also needed to provide transport for non-drivers for activities such as shopping and medical appointments.

And of course, public transport is important. Over 26% of the New Zealand population do not have a driving licence - a figure set to rise as driving becomes both less affordable and less socially acceptable. Taking the bus can be made far more attractive by reducing traffic volumes so buses are not delayed. Some small urban areas, for example Queenstown and Waiheke Island, demonstrate that a frequent bus service can attract customers.<sup>64</sup>

To help pay for the costs of public transport and the physical work of reallocating road space to buses and cycle lanes, councils can introduce paid parking for all public car parks, raise prices where they already exist, and levy all private carparks. As in large cities, schools and universities in smaller centres should not provide free, or very cheap, parking for students. For example, in the past most students bused or biked to the Massey University campus in Palmerston North. Now, with vast low cost parking on campus, cheap cars, and drivers not required to pay the full cost of their

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<sup>58</sup> <https://www.mfe.govt.nz/sites/default/files/large-scale-property-purchase-without-recourse-to-compulsory-purchase.pdf>

<sup>59</sup> Philips, I., Anable, J. and Chatterton, T. (2020) E-bike carbon savings – how much and where?, CREDS Policy brief 011, Centre for Research into Energy Demand Solutions, Oxford, <https://www.creds.ac.uk/publications/e-bike-carbon-savings-how-much-and-where/>.

<sup>60</sup> McQueen, M., MacArthur, J. and Cherry, C. (2020) The E-Bike Potential: Estimating regional e-bike impacts on greenhouse gas emissions, Transportation Research Part D: Transport and Environment, Volume 87, <https://doi.org/10.1016/j.trd.2020.102482>.

<sup>61</sup> <https://electrek.co/2020/11/01/lithuania-trade-in-old-cars-for-electric-bikes-scooters/>

<sup>62</sup> <https://slate-com.cdn.ampproject.org/c/s/slate.com/technology/2021/02/e-bikes-act-electric-bicycles-subsidy.amp>

<sup>63</sup> <https://www.congress.gov/bill/117th-congress/house-bill/1019/text?r=1&s=1>

<sup>64</sup> <https://www.nzherald.co.nz/travel/nzs-most-beautiful-public-transport-rides/>

environmental impact, most people drive. This creates a downward spiral for the provision of bus services.

Charging for parking helps ensure drivers pay all the externalities of driving (including environmental, land use and health costs), preventing them from feeling financially obligated to take the less socially responsible option.

Urban form is also vital in smaller cities and towns. Towns throughout the country have empty shops and decaying main streets while subsidised sprawl continues into the rural hinterland. For example, on the Kāpiti/Horowhenua Coast, small towns are expanding in response to the stimulus provided by new motorways. An illustration is a new development on the edge of Levin.<sup>65</sup> Not only is this development on prime farmland, it is promoted on the idea that new roading will bring it within easy car-based commuting range of both Palmerston North and Wellington.

This is the pattern of development that has driven up New Zealand's high transport emissions.

Kāpiti provides case studies that illustrate this problem. At the same time as developing housing in Levin, in central Paraparaumu there is an uneconomic airport. The location offers huge potential for creating medium to high density affordable housing, perhaps mixed with amenities and suitable commercial uses, close to public transport, shops, schools and civic amenities. Instead, the council has provided ratepayer support for the airport, and is now arguing for taxpayer subsidies.<sup>66</sup>

The transport plans that smaller cities and towns have adopted in recent times tend to focus on a 'business as usual' concept rather than supporting the decarbonisation pathway called for by the Climate Change Commission.

On 25 May 2019, the Kāpiti Coast District Council declared a climate emergency. Yet, on 28 January 2021, the same council adopted a 'Sustainable' Transport strategy - which was completely at odds with the proposed national carbon budgets. This was just three days before the Climate Commission released its draft advice on emission reductions.<sup>67</sup>

This was especially disappointing, because the Kāpiti council does understand climate: in 2019 they won a nationwide "Excellence in Climate Action" award. Earning this award - by reducing their own in-house emissions 76% in just 10 years - the council had learnt through experience that sustainable action also brings substantial cost savings.

Within a week of the release of the Climate Change Commission report, the neighbouring regional council, Horizons (Manawatū/Whanganui), released their draft plan. Despite increased spending on walking and cycleways and a useful discussion of regional rail, the single two largest spending items are new highways, one being a continuation of the expressways currently under construction between Wellington and north of Levin. This is despite research indicating a poor business case for this road.<sup>68</sup> In the Horizons region, the proposed spending mix is 4% walking & cycling, 4% public transport, 36% road maintenance, 56% new roads.

Many local authorities will need to rework their transport plans. Hopefully, they will do so with more guidance and assistance from the central government to meet emission reduction targets.

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<sup>65</sup> <https://www.stuff.co.nz/national/rnz/300160417/major-new-housing-development-may-expand-levin-by-a-quarter>

<sup>66</sup> <https://www.stuff.co.nz/environment/climate-news/123742011/in-a-climate-emergency-kpiti-mayor-wants-to-save-airport>

<sup>67</sup> <https://www.newsroom.co.nz/comment/flawed-transport-strategy-a-tick-box-exercise>

<sup>68</sup> <https://www.newsroom.co.nz/build-homes-not-airports-and-expressways>

## A low carbon regional transport network

While decarbonising transport within cities and towns is vital, so too is developing ways of reducing transport emissions within regions and between regions. This primarily involves reducing and eventually replacing trips by fossil-fuelled cars and planes.<sup>69</sup>

Regional travel can take many forms, both within and between individual regions. Some people wish to travel long distance, such as from Auckland to Queenstown. Within-region travel might be from Ōtaki to Wellington, while an example of inter-regional travel would be Hamilton to Taupō. At times, within region travel will involve leaving the mainland and visiting islands, such as Great Barrier Island in the Hauraki Gulf.

Some regional travel will be for work, or education, or for engaging in a pursuit or holiday, while sometimes it will involve visiting friends and families. Many Māori will wish to visit their Marae, sometimes quite distant from their current homes and often in remote rural locations.<sup>70</sup> Other travel arises from the need to attend specialist medical appointments. Then there are the many holiday trips taken by domestic and foreign tourists.

Regional transport policy debates often pit technological market-driven optimists against those who argue for a need to support significant mode shift. Under the first option, the main tools would involve a major shift to electric cars, perhaps eventually self-driving, and a rapid move by all domestic airlines to, as yet commercially unproven, electric or hydrogen powered planes. This seems to be the model promoted by the Climate Change Commission. Some promoters of this vision support further road building and, sometimes, subsidies to airlines and airports.

Some changes are already being planned. An example is continuing the installation of fast chargers for electric vehicles throughout New Zealand, especially in areas where there are gaps such as the West Coast of the South Island. Lower cost slow chargers should also be available at all places of accommodation, in car parks next to walking tracks and other places where people stop for long periods. This is already being rolled out by companies such as Meridian.<sup>71</sup>

But more important, although currently not receiving attention, is the need for a shift to far more travel by train, bus and ferry. This is the model being pursued by many European nations and is primarily the model we, the authors, favour. Not only does this have emission reduction benefits, but more ably fits the goal of a socially just transition as it provides more affordable travel while also reaching more areas of New Zealand.<sup>72</sup>

Research clearly shows that by far the lowest carbon forms of travel are trains and buses.<sup>73</sup> Shipping will also have a place, especially if powered by electricity or low carbon fuels such as green ammonia.<sup>74</sup>

It is perhaps not surprising that neither long distance trains nor buses - or ferries - are central to the Climate Change Commission recommendations, given that no groups or businesses advocating for these modes of travel were included among their main set of advisors. But the Climate Change

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<sup>69</sup> Both authors have discussed this topic via a number of articles published in a variety of forums but in particular the Greater Auckland website. Links to many of these articles are to be found in <https://www.greatauckland.org.nz/2020/04/29/the-tourism-taskforce/>

<sup>70</sup> Te Puni Kōkiri (2017) Kōkiri 31 – Taku Marae E: Connecting to Marae, <https://www.tpk.govt.nz/en/mo-te-puni-kokiri/kokiri-magazine/kokiri-31-2015/taku-marae-e-connecting-to-marae>

<sup>71</sup> <https://www.stuff.co.nz/motoring/EVs/124340492/meridian-to-launch-nationwide-ev-charging-network>

<sup>72</sup> <https://www.wgtn.ac.nz/igps>

<sup>73</sup> <https://ourworldindata.org/travel-carbon-footprint>

<sup>74</sup> <https://www.bbc.com/news/business-54511743>

Commission is not the only group with a blind spot. Transport in general, and aviation in particular, are often ignored by New Zealand environmental groups, and despite campaigns for better urban public transport, few of our country's environmental groups specifically promote long distance rail or buses.<sup>75</sup> In contrast, a study of youth climate protesters in Switzerland shows they regard air travel, especially short-haul, as problematic, with demands made for air travel reduction, the promotion of trains, and the favouring of monetary incentives and behaviour change as solutions. Air travellers are also held responsible for their own behaviour<sup>76</sup>.

A behavioural shift by New Zealanders who want to reduce their emissions by using these forms of travel is currently very difficult. Through a combination of changing consumer demand, policy shifts, including shifting subsidies from rail to road and airports, New Zealand's once extensive regional train network has been destroyed. There was also the overnight ferry between Wellington and Christchurch. A regional bus network still exists, but it is of poor quality and is currently not an attractive form of travel for most New Zealanders.

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.<sup>77</sup> 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.<sup>78</sup>

2021 is 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".<sup>79</sup> 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."

The German study suggests the biggest rail-related gains can be made by focussing first on areas with the largest populations. This supports the need to develop fast rail between Auckland, Hamilton and Tauranga, an idea originally promoted by the urban blog Greater Auckland in 2017.<sup>80</sup> There has also been much discussion about better rail services between Wellington and Palmerston North, between Wellington and the Wairarapa and connecting Christchurch to nearby urban areas. Creating this network will be slow and expensive but will have long term benefits. However, some rail projects could be developed quickly and at relatively low cost. For example, a night train between Auckland and Wellington does not depend on significant upgrades to the rail network.<sup>81</sup> Before

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[https://docs.google.com/document/d/1T7Qnre8vuMModx2b3QOm\\_1d286QxAevaeSCth8Q6At0/edit?fbclid=IwAR3n07Ib27amBra4xNcv3Go5q1P\\_pZLo3IVWT1dBS7FAn6g8sMXX-C5I2zs](https://docs.google.com/document/d/1T7Qnre8vuMModx2b3QOm_1d286QxAevaeSCth8Q6At0/edit?fbclid=IwAR3n07Ib27amBra4xNcv3Go5q1P_pZLo3IVWT1dBS7FAn6g8sMXX-C5I2zs)

<sup>76</sup> Kreil, A. S. (2021) Visual protest discourses on aviation and climate change, *Annals of Tourism Research Empirical Insights*, Volume 2, Issue 1, <https://doi.org/10.1016/j.annale.2021.100015>.

<sup>77</sup> 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](https://d3n8a8pro7vhmx.cloudfront.net/beachheroes/pages/14088/attachments/original/1601323836/Regional_Rail_-_Future_of_Transport.pdf?1601323836)

<sup>78</sup> 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/>

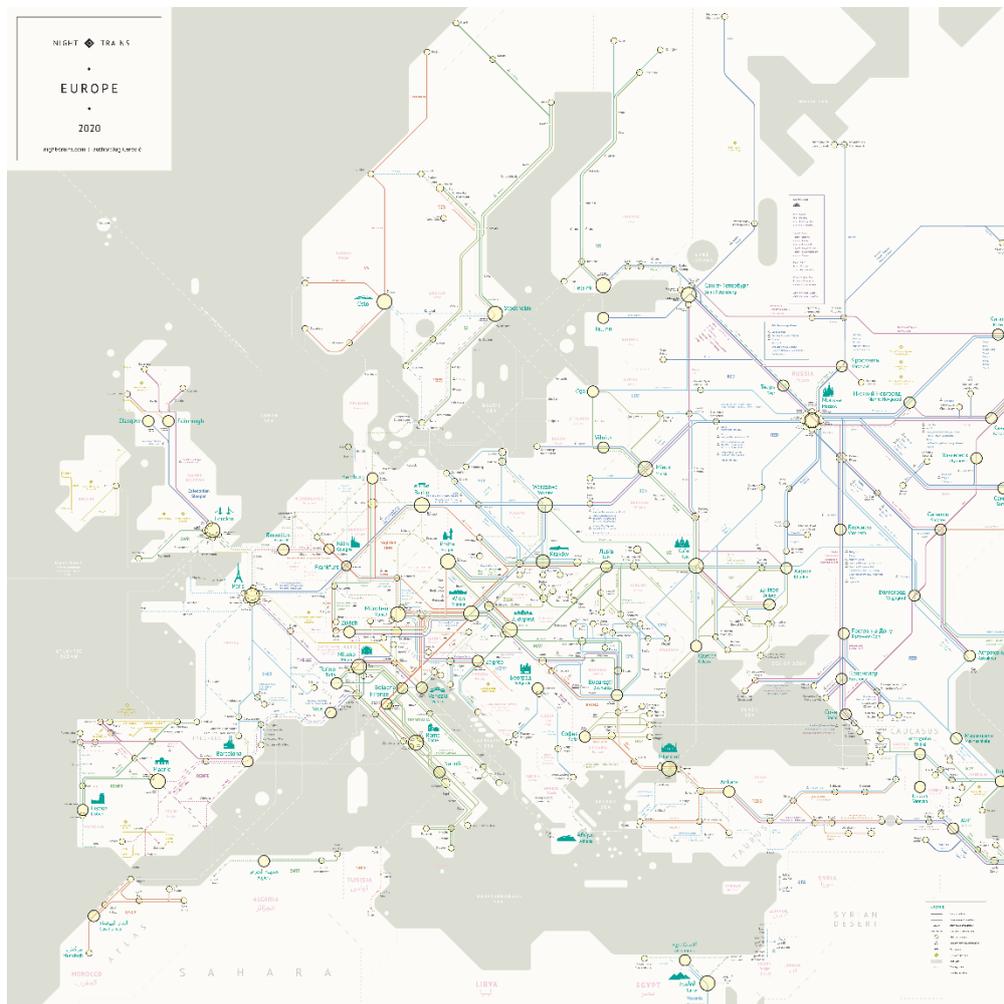
<sup>79</sup> Germanwatch (2020) Hop on the train: A Rail Renaissance for Europe How the 2021 European Year of Rail can support the European Green Deal and a sustainable recovery, December, [https://germanwatch.org/sites/germanwatch.org/files/Hop%20on%20the%20Train.%20A%20Rail%20Renaissance%20for%20Europe\\_0.pdf](https://germanwatch.org/sites/germanwatch.org/files/Hop%20on%20the%20Train.%20A%20Rail%20Renaissance%20for%20Europe_0.pdf)

<sup>80</sup> <https://www.greatauckland.org.nz/regional-rapid-rail/>

<sup>81</sup> <https://www.greatauckland.org.nz/2020/02/12/night-train/>

Covid-19 paralysed Europe, night trains were making a comeback, and there are moves afoot to coordinate a night train network there.<sup>82</sup>

**Figure 6: European night trains**



Source: <http://night-trains.com/europe>

Some simple changes would begin to rebuild regional rail in New Zealand. Currently, the Northern Explorer runs only every second day and is price pitched at international tourists rather than commuters. As mentioned in the draft Horizons transport plan, North Island mayors and regional council chairs have been collectively advocating for a change to make it more commuter-friendly.

If the Northern Explorer operated every day and had lower cost options for travel it would supplement the daily Monday to Friday Capital Connection run between Palmerston North and Wellington and the twice daily Te Huia which starts running between Hamilton and Auckland in April 2021.<sup>83</sup> With a night train as well, travel options would be further increased, allowing for the start of a rebuild of an efficient rail network.

According to Horizons, KiwiRail is also currently undertaking a feasibility assessment of a proposed 'connector' passenger rail service between Wellington and Auckland.<sup>84</sup> This service would be different to the Northern Explorer service in that it would incorporate more stops and operate as a

<sup>82</sup> <https://www.weforum.org/agenda/2021/01/night-train-carbon-climate-change/>

<sup>83</sup> <https://www.tehuiatrain.co.nz/travel-with-us/>

<sup>84</sup> <https://www.horizons.govt.nz/HRC/media/Media/Draft-Regional-Land-Transport-Plan.pdf?ext=.pdf>

connector service linking people in more remote areas to health and employment. Horizons 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.<sup>85</sup>

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. However, long distance coaches were not mentioned in the draft Climate Commission report.

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 or hydrogen. Already overseas bus companies are experimenting with long distance electric buses.<sup>86</sup>

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).<sup>87</sup>

Outside of the coach network there are also a range of smaller shuttle services, including health and tourism focussed shuttles.<sup>88</sup> Potentially, some rural mail and parcel delivery services could also be linked in and maybe even some 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".

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<sup>85</sup> Davis, D., de Ridder and Greenhalgh, D. (undated) Electrified rail network for the South Island of New Zealand, Canterbury University.

<sup>86</sup> <https://shifting-gears.com/oletra-c9-a-long-distance-45-seater-intercity-electric-bus-for-india/>

<sup>87</sup> <https://www.greaterauckland.org.nz/2020/04/03/better-long-distance-coaches-design-regulation-and-community-public-health/>

<sup>88</sup> <https://www.greaterauckland.org.nz/2019/06/28/a-history-of-regional-and-long-distance-buses-in-new-zealand/>

How realistic is the ideal that a significant number of people will shift back to domestic rail and coaches? Hopefully, the provision of good quality low carbon means of travel will be enough to convince some people to change their behaviour. But there are a number of levers that can be used to encourage this modeshift. One is price. On a level playing field, lower emissions travel would be cheaper than higher emissions travel. Through realistic carbon prices, removing the considerable subsidies for air travel, and introducing sensible road pricing, travel by rail and bus will become cheaper than flying or driving.

Government and private businesses are under increasing pressure to reduce their footprints and cannot rely solely on offsets. Low emission travel will be an attractive way to fulfil their sustainability policies. Where quality of service is comparable with, or better than driving or flying, many businesses are likely to support such travel. Examples would include fast rail between Auckland, Hamilton and Tauranga as well as fast rail between Wellington and Palmerston North. A night train between Auckland and Wellington, also linking Palmerston North and Hamilton, would suit some business and leisure travellers.

However, attitudes to domestic leisure travel may also have to change to encourage such a shift. Long distance 'mini-breaks' will be hard to justify, and at the same time, more small towns will reap benefits from focusing on becoming the walkable destinations people seek when having a break away. Auckland residents, for example, may seek weekends away in Te Aroha rather than Queenstown, keeping the South Island destinations for those special holidays to savour when they have a couple of weeks to enjoy.

## **Tourism, international family links and foreign students**

Creating a high-quality, low carbon rail and bus network would greatly assist the decarbonisation of travel within New Zealand. But the elephant in the room is international aviation. As we have seen with the Covid-19 pandemic, New Zealand tourism depends heavily on flying. Aviation has also allowed many New Zealanders to travel the world as tourists, for business and to visit friends and family living overseas. Low-cost aviation has also allowed the growth of the international student industry.<sup>89</sup>

Professor Susanne Becken, at Australia's Griffith University, has analysed air traffic based on total distance flown from the country of departure. Most of the very high per capita emitters are tiny tourist focused island economies. But when compared with countries with populations one million or more, New Zealand ranked number five on a per capita basis, well ahead of countries such as the United Kingdom, Sweden and Germany. In 2018, aviation was responsible for 13 % of New Zealand's CO2 emissions and internationally had been projected to triple by 2050. If that happens, it will be consuming the entire remaining carbon budget of the earth.

Emission reduction budgets prepared by the Climate Change Commission do not directly include international aviation. They will be in the next round in 2024.

While international aviation is not part of the current target setting, we still need to be urgently working on decarbonisation strategies. It is clear there is no easy way to reduce emissions from long-distance international flights. Recognising this, Allwood et al in their report "Absolute Zero"

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<sup>89</sup> Equally, organised overseas trips were becoming more common in New Zealand schools.

argue that most flying has to stop.<sup>90</sup> In a United Kingdom context, they advise the need for airports to start closing and that it will be only 2050 and beyond that we can consider using electricity fuelled planes, but only if there are enough non-emitting electricity supplies available.

The second PCE report on sustainable tourism focuses on aviation as one of the four areas for recommendations. But like the CCC, the main organisations consulted are those who benefit from current systems and subsidies. While Auckland Airport, Air NZ and Tourism Holdings were included, KiwiRail and Entrada - the group who run most long-distance coaches in New Zealand - were not.

The PCE report recommends that the Government considers introducing a distance-based departure tax that reflects the cost of greenhouse gas emissions generated by passengers flying from New Zealand. They suggest the revenue generated by the tax should be ring-fenced to support research efforts to reduce emissions from the aviation sector and provide a source of climate finance for Pacific Island nations.

But the PCE's own report advises this will not cut emissions. Research cited suggests that international tourist arrivals are not particularly responsive to changes in the price of airfares. They argue that, for many potential visitors, New Zealand is something of a 'bucket list' destination, where fluctuations in prices make little difference to individual travel decisions.

Other commentators within the industry generally focus on yet-to-be-realised technology. Some rely on behavioural change or offsetting.<sup>91</sup>

As a behavioural shift, "flight shame" appeared to be having some impact in Europe and may well have some influence on this source of New Zealand bound tourists. New Zealand has its own, small 'fly less' movement.

There are a multitude of measures proposed by ICAO, IATA and ICCAIA (the organization of aircraft manufacturers) in terms of higher fuel efficiency, more efficient air traffic control, the CORSIA offsetting scheme, the ICAO fuel efficiency standard, a few potential taxes, and electric planes. But research by Paul Peeters suggests that while many are important none of these individual measures, nor the combination of them, will enable zero emissions from aviation in 2050.<sup>92</sup> Peeters focuses on producing 'sustainable aviation fuels' (SAFs) as a key strategy.

In considering SAFs it needs to be kept in mind that they still contribute to radiative forcing, so even the most sustainably produced fuel still has two thirds of the impact of a fossil fuel. Reducing the impact by one third is considerable, but it is still not a fully sustainable solution.

In terms of allowing much of the current fleet to keep flying until the end of its life cycle, the production of synthetic kerosene is technically feasible. There are two main routes. One is the potentially problematic biofuel option.<sup>93</sup> This seems to be the main option promoted in New Zealand. If produced from feedstocks, such as palm oil, this will be an environmental disaster. Potentially, it could be produced from plantation forests or crops, but this would require large areas

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<sup>90</sup> Allwood, J., al. (2019). Absolute Zero. <https://doi.org/10.17863/CAM.46075>

<sup>91</sup> Not discussed is whether some regional Pacific trips could be replaced by passenger ships using low carbon fuels. Much travel to and from New Zealand is to visit friends and relatives in nearby Australia and the Pacific Islands. It is a paradox that many Pacific nations fear the impact of climate change but depend on, and often promote, aviation.

<sup>92</sup> Peeters, P. (2015) Tourism's impact on climate change and its mitigation challenges: How can tourism become 'climatically sustainable'?, Doctoral thesis Delft University of Technology

<sup>93</sup> Scion (2018) New Zealand Biofuels Roadmap Technical Report, February, [https://www.scionresearch.com/\\_data/assets/pdf\\_file/0017/63332/Biofuels\\_TechnicalReport.pdf](https://www.scionresearch.com/_data/assets/pdf_file/0017/63332/Biofuels_TechnicalReport.pdf)

of land. If grown on prime land it would be competing with food production. There is also an option to create a small amount from waste streams, including municipal waste.

A February 2021 joint statement by Transport Canada and the U.S. Department of Transportation demonstrates a commitment to reducing emissions from aviation, primarily based around 'high integrity' SAFs.<sup>94</sup> There is also much discussion of SAFs in Europe with a consensus statement on guiding principles for supporting the deployment of sustainable aviation fuels in the EU being issued in January 2021.<sup>95</sup> Two of the points made in the EU statement are to exclude biofuels produced from dedicated cropland and to prioritise fuels made from wastes and residues.

There is the already proven "Power to Fuel" (P2F) and a more experimental process turning carbon and hydrogen into jet fuel. Potentially, P2F can involve carbon capture technology as part of the process. A study by one of us (Paul Callister), together with industrial chemist Wallace Rae, concluded that sustainable aviation fuel, produced by a "Power to Fuel" process, was the only realistic path if flying was to continue at pre-Covid-19 levels.<sup>96</sup>

These fuels depend on the availability of huge amounts of renewable electricity, a point we will return to.

The PCE report suggests these technologies are 'immature' and more research is needed. This is not correct for some of the technologies. There is already one Power-to-Fuel plant under construction in Norway (Norsk E-fuel, fuelled by plentiful hydropower) and a much larger one proposed in Chile (Haru Oni, to be fuelled by the plentiful wind at the Straits of Magellan).<sup>97</sup>

But New Zealand already has experience in producing synthetic fuels. The hydrogenation of CO<sub>2</sub> to methanol is a proven technology beginning with the commissioning of the Motunui synthetic petrol plant in 1987, the first of its kind in the world. Methanol to hydrocarbons was practised in New Zealand until 1997 when Motunui closed and switched to just methanol production. New Zealand is already extracting CO<sub>2</sub> from Kapuni gas and venting it to the atmosphere.

The production of small amounts of biodiesel - which can be further refined - has also been proven in New Zealand with the opening of Z Energy's tallow to fuel plan in 2018. However, that plant is currently in hibernation due to an international bidding war for tallow.<sup>98</sup>

Estimates of the current cost of sustainable aviation fuels vary considerably. A German study suggests the costs could be five to eight times the cost of fossil fuels.<sup>99</sup> However, with fuel only being about a quarter of the operating costs of airlines the final cost to consumers would not be prohibitive, especially if the initial 'drop in' amounts are relatively small.

How would airlines be encouraged to use such fuels? The easiest way is a mandate to use them, flagged early by the government, to allow the industry to plan. For example, it could require that half of all aviation fuel sold in New Zealand by some target date be SAFs, rising over time to 100%. It could also require all airlines flying into New Zealand to use SAFs.

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<sup>94</sup> Joint Statement by Transport Canada and the U.S. Department of Transportation on the Nexus between Transportation and Climate Change - Canada.ca

<sup>95</sup> <https://europeanclimate.org/wp-content/uploads/2021/03/aviation-paper.pdf>

<sup>96</sup> [https://www.wgtn.ac.nz/\\_\\_data/assets/pdf\\_file/0007/1772908/WP-19-02-can-we-keep-flying.pdf](https://www.wgtn.ac.nz/__data/assets/pdf_file/0007/1772908/WP-19-02-can-we-keep-flying.pdf)

<sup>97</sup> <https://www.norsk-e-fuel.com/en/>

<sup>98</sup> <https://z.co.nz/keeping-business-on-the-move/fuels/z-biodiesel/>

<sup>99</sup> <https://mavt.ethz.ch/news-and-events/d-mavt-news/2021/03/CO2-every-kilogram-counts.html>

All domestic aviation companies would not need to meet this minimum but could trade obligations as long as the total target was met. The challenge will be to source such fuels, either internationally or locally. But demand will stimulate supply.

In the longer term, there may be long haul planes powered by hydrogen.<sup>100</sup> Again, this will depend on producing large amounts of hydrogen using renewable sources of electricity.

A study estimated the amount of renewable electricity that would be needed if 1, hydrogen was produced by electrolysis, or 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):<sup>101</sup>

*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.*

Transpower's 2018 white paper considered energy futures and mentions aviation.<sup>102</sup> But it does not include such large increases in renewable energy in its scenarios. An updated report released in early 2021 mentions aviation and through graphical presentations suggests domestic flying will be powered by a mix of electricity, biofuel and hydrogen.<sup>103</sup> But the report does not consider the bigger task of producing alternative fuels for international aviation.

If it is simply the market that determines use of electricity, a model may emerge whereby scarce renewable electricity will be used to support leisure travel by a small group of wealthy New Zealanders, while many more people will suffer from energy poverty.

It is clear that in a climate emergency the time of very cheap flying should be over. Through removing subsidies to aviation, increasing the price of carbon, and using more expensive SAFs, the cost of air travel will more fully reflect the impact on the environment and on global population health. A higher price may curb some demand. But, in the absence of some technological miracle that allows vast amounts of cheap renewable electricity to be produced, other mechanisms will also need to be in place to reduce flying. This includes rebuilding New Zealand's low carbon land-based transport network.

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<sup>100</sup> <https://www.stuff.co.nz/travel/green-travel/300175953/airbus-bets-on-hydrogen-to-deliver-zeroemission-jets?>

<sup>101</sup>

[https://www.researchgate.net/publication/317886797\\_An\\_evaluation\\_of\\_electrolytic\\_hydrogen\\_as\\_an\\_aviation\\_fuel\\_for\\_New\\_Zealand](https://www.researchgate.net/publication/317886797_An_evaluation_of_electrolytic_hydrogen_as_an_aviation_fuel_for_New_Zealand)

<sup>102</sup> Transpower (2018) Te Mauri Hiko - Energy Futures, Transpower White paper,

<https://www.transpower.co.nz/sites/default/files/publications/resources/TP%20Energy%20Futures%20-%20Te%20Mauri%20Hiko%2011%20June%2718.pdf>

<sup>103</sup> [https://www.transpower.co.nz/sites/default/files/publications/resources/Transpower\\_Electrification%20Roadmap\\_SCREEN3\\_LR.pdf](https://www.transpower.co.nz/sites/default/files/publications/resources/Transpower_Electrification%20Roadmap_SCREEN3_LR.pdf)

## Equity

At a global level, emission inequality closely mirrors income inequality.<sup>104</sup>

**Figure 7: Per capita and absolute CO<sub>2</sub> consumption emissions by four global income groups in 2015**



Lord Deben, chair of the United Kingdom's Climate Change Committee, suggests that New Zealand has a unique opportunity to lead the world on reducing emissions and we need to do this as part of our 'fair share'.<sup>105</sup>

*We are rich nations and we are using a lot more of the world's resources than the poor nations. And if we're going to ask the poor nations to do the very difficult thing of jumping the dirty part and getting to a better position, we've all got to do it. You just can't ask Burkina Faso or Malaysia to do things if you don't do it at all.*

Inequality issues are also important within New Zealand. In making the large required emission reductions, we are also concerned about not placing additional burdens on those already facing economic and social disadvantages. One of the arguments for a small relatively rich country, such as New Zealand, to make a significant contribution to reducing greenhouse gases is that of a 'fair share'.

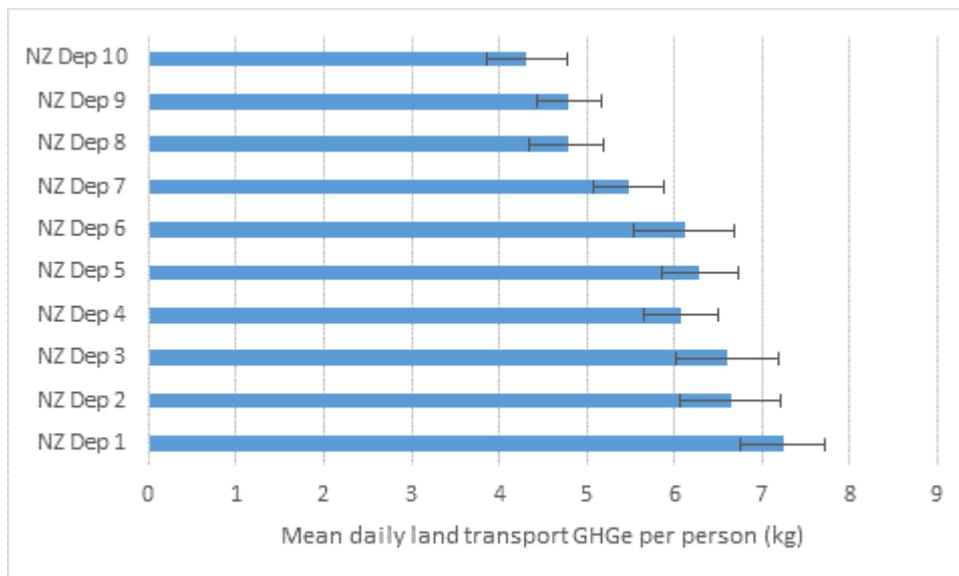
Within New Zealand, research shows that there is a gradient among households in terms of emissions from transport. Research by Caroline Shaw on land-based travel indicates that it is the

<sup>104</sup> <https://www.unenvironment.org/emissions-gap-report-2020>

<sup>105</sup> <https://www.newsroom.co.nz/climate-emergency/uk-climate-advisor-nz-can-lead-the-world>

higher income households that, on average, have the highest emissions. An equitable regime of reductions requires the largest declines to come from these higher income, higher emitting, households.

**Figure 8: Transport emissions by area of geographic deprivation**



Source: Caroline Shaw, personal communication

The systems that have prioritised freight and people moving at speed and over long distances need to be overhauled. The needs of people, of future generations, of the environment, and of lowering the overall cost of the transport network, must be prioritised. In the street network, once it is clear that road reallocation is a way to reduce emissions, options for improving public transport and cycling become much cheaper. Overall equity benefits are enormous because the cost of the whole transport system drops, including for ongoing maintenance costs, making mobility affordable, and giving new transport options for all the people who do not drive.

Aviation in particular raises equity concerns. As Figure 1 indicated, emissions from car travel and from international aviation were similar. However, the number of trips contributing to those emissions differ by orders of magnitude. Viewing emissions as a cost, the benefit/cost ratio of aviation needs scrutiny through an equity lens, as a small number of New Zealanders and tourists are responsible for the majority of these aviation trips. While research has not been undertaken in New Zealand, research in the United Kingdom suggests that around 70% of flights are taken by 15% of the population. United States research also confirms that it is higher income households that fly more. Among the global population, only about a fifth of people have ever flown.<sup>106</sup>

Already the aviation industry is endeavouring to use an equity argument to push back against changes that might increase the cost of flying. They argue that cheap fares allow a broad range of people to travel by air.<sup>107</sup> Yet, providing high-quality low-cost alternatives to flying would, at least domestically, allow a greater range of individuals and families to travel but at a lower environmental cost.

But there are more subtle effects. Technology to decarbonise land travel exists - our action is largely awaiting good policy. Some of the technology required to decarbonise air travel, particular the use

<sup>106</sup> [https://www.wgtn.ac.nz/\\_\\_data/assets/pdf\\_file/0007/1772908/WP-19-02-can-we-keep-flying.pdf](https://www.wgtn.ac.nz/__data/assets/pdf_file/0007/1772908/WP-19-02-can-we-keep-flying.pdf)

<sup>107</sup> <https://aviationweek.com/air-transport/editorial-europe-must-avoid-air-travel-regentrification>

of batteries in large planes and using hydrogen, is still in its infancy. Research and development are hugely expensive, and even the funding of research introduces questions of equity.

Currently, the two main sources of funding for research and development into how to decarbonise aviation are tax, which supports funding for research grants, and industry research development funding. This latter money comes from 'profits' made within the industry. However, any profits made by the industry are heavily subsidised: the carbon used and its effect on climate is not sufficiently taxed, while airports and airlines receive public money in the form of bailouts and 'investment'.

If the aviation sector was not subsidised, ticket prices would rise, reducing ridership. With fewer passengers, efficiencies would drop, and costs would go up further. A cycle of falling ridership and rising costs would follow, resulting in a limited service and route model with lower profits than the industry has enjoyed in recent decades. The costs of decarbonising this highly emitting sector must be calculated using an unsubsidised - and therefore low volume, low profit - industry model as the 'baseline'.

Who should pay for the research into decarbonising aviation and for the subsidy required to keep aviation functioning while the research is undertaken? It should not be poorer people who cannot afford to fly. Nor should it be future-focused industries trying to operate within a low carbon model, nor people consciously taking steps to reduce their carbon emissions in terms of how they work, holiday and shop.

The industries that benefit from aviation can pay the full costs of the necessary research and development. If they become uneconomic in the process, they are not important industries - which by definition, economically support the country rather than act as a drain on our economy.

With climate change and large social issues to resolve, the competing needs for public money are too many, and too urgent, to continue expecting decarbonisation research can continue in such a subsidised and inequitable way.

## Conclusion

In order to decarbonise transport by 2030 we need to act with urgency and clarity. The solutions are not complex, but they require system change. Achieving this goal will necessitate a wide range of short- and long-term measures. Change needs to occur at many levels, including by individuals, businesses, iwi, local authorities and central government. Hopefully, both the Climate Change Commission's draft report and the Parliamentary Commissioner for the Environment's sustainable tourism report will stimulate discussion and, more importantly, action. However, we consider both reports to be too cautious in their suggested changes and, in this paper, have set out a range of transport related actions we consider would speed up the transition to a low carbon economy.