Transforming transport and cities in NZ: a note for the Climate Change Commission's engagements on transport and urban form

26 August 2020

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About the New Zealand Centre for Sustainable Cities

The New Zealand Centre for Sustainable Cities is an interdisciplinary research centre dedicated to providing the research base for innovative solutions to the economic, social, environmental and cultural challenges facing our urban centres. We undertake a range of research, published as journal articles, policy papers, working papers, and blogs, as well as making submissions from time to time to central government and councils on a range of issues relevant to cities, from climate change policy to compact urban development. See http://sustainablecities.org.nz/ and http://resilienturbanfutures.org.nz/

Key points

1) The IPCC has said a "**fundamental transformation"** of energy systems is needed by 2030 (IPCC, 2018) or the targets set in Paris will slip through our grasp. By "fundamental transformation," it meant a 45-50 percent reduction in emissions by 2030. As Bill McKibben puts it, 'the period in which we retain the most leverage to really affect the outcome may be measured in years that correspond to the digits on your two hands.' (McKibben, 2020).

2) So a clear, explicit, and urgent **plan** is needed for New Zealand to achieve this. The Paris goals (especially the goal of 1.5C, explicitly set down in New Zealand's legislation[1]) will not be attained unless significant and trendsetter countries, including New Zealand, plan for the 45-50% reduction goal. There is no reason why New Zealand should not be contributing to this goal, and no reason why transport should be exempted. As the OECD notes, emissions from road transport in New Zealand make up '39% of all carbon dioxide emissions… significantly higher than in many other developed countries' (OECD, 2020). New Zealand's transport system needs to be **transformed fast,** even if this will be difficult.

3) New Zealand's transport emissions goal would do well to start with this **endpoint** in mind – about 50% less carbon being emitted by 2030 than in 2020 – and **work back from that**, to assess what policies are required. This does not mean a vague 'low emissions' target for 2050. (Some limited flexibility might be permitted by greater reductions in sectors such as electricity, assuming emission reductions are of lower cost per tonne in those sectors, but since transport emissions are already large and have been growing, it would be unwise to try

[1] Climate Change Response (Zero Carbon) Act 2019 s.5Q specifies net zero by 2050 for GHGs other than biogenic methane. The s.4 purpose of the Act relating to mitigation is to 'develop and implement clear and stable climate change policies that (i) contribute to the global effort under the Paris Agreement to limit the global average temperature increase to 1.5° Celsius above pre-industrial levels;…'

to avoid major reductions in the sector). Adopting and implementing policy measures should have **a high likelihood of getting us near the target**. This means a few policies by themselves will not be enough. What is needed is a coherent package (including complementary measures for freight transport), assessed against achievability, timing and equity goals.

4) In overall outline, an ambitious target and approach necessitates a **three-decade vision** for sustainable transport and sustainable cities. In our view, this vision entails a **major shift to greener transport modes** and **more compact cities and towns**, emphasising public transport, car sharing, cycling/e-bikes and walking. It adds up to a different, much less car-centred vision of urban life. We recognise that while some mode shift can be rapid, for most people the shift cannot be realised overnight. In the short term, then, complementary runs on the board could be achieved by accelerating the switching of ICEVs to EVs. But we do not see an EV-centred approach as a long-term, complete or sustainable solution.

5) The longer-term mode-shift emphasis is likely to be more **equitable** (Henderson, 2020), in terms of affordable access by most residents of cities and towns to jobs and facilities, but would require more public expenditure (e.g. for lower public transport fares) and investment in mass transit and supporting infrastructure (rail lines and bus lanes) in the bigger cities to generate a large momentum of change. The mode shift strategy would need to be reinforced by complementary policies on congestion pricing, carpark pricing, car share support, etc. In our view, as well as being more equitable across income groups, the mode shift approach may also entail fewer resource demands overall (including for road construction; new vehicles) than widespread switching to EVs, which would be accompanied by a continued demand for road construction and suburban sprawl.

6) Both approaches would need to include rapid switching of public sector car fleets to EVs. Under the EV-switching approach, significant investment cost for e-vehicle charging systems would fall to (local) government. Also, electric vehicles embody substantial emissions from their manufacturing and recycling stages, which counts against them if wider sustainability is to be attained. If commercial and political pressures pushed in favour of the EV switching approach rather than supporting a shift to other modes, it is possible that as many as **30%** of New Zealand's fossil light duty fleet might be replaced by e-vehicles by 2030; in that case, light duty fleet carbon emissions could be around **20% less** than today's.[2]

7) To drive either transformation would probably require a **ban** on fossil vehicle imports signalled early as coming into effect by 2030 at the latest, incentivising people to switch modes or vehicles **before** then, when reviewing their transport options. An additional incentive would be a steep **increase in the ETS price** (to NZ$ 200/tonne or so), in line with historic petrol price shocks (Hasan, Frame, Chapman, & Archie, 2020). To minimise impacts on household budgets, and equity implications, this could be phased in over several years.

8) The mode shift approach would be much better aligned with a decisive **shift in the form and design of cities.** The EV-switch approach would tend to increase congestion and use of space for vehicles (Henderson, 2020). By contrast, the second option could save space for

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[2] In terms of CO_2 emissions over the **life cycle** (i.e. including manufacturing plus recycling, as well as use), e-vehicles enable a 'disappointing' 62% (approx.) saving relative to fossil cars (Hasan & Chapman, 2019). (Governments in consumer countries tend to ignore manufacturing/recycling emissions, but this is not ethically defensible.) For a simple model supporting the analysis of carbon savings, and some variations in assumptions, see the Annex to this note.

housing/green space and would fit well with more urban residents living in compact housing closer to transport nodes with easier access to jobs, schools and shops by active travel or public transport. Urban intensification also tends to be less costly than greenfield development (Adams & Chapman, 2016), although both entail infrastructure investment. More compact cities also have major health co-benefits (Chapman, 2019, p.16, 18; Howden-Chapman, Keall, Conlon, & Chapman, 2015; Howden-Chapman, Keall, Whitwell, & Chapman, 2020). However, most of the carbon savings from such a shift would take longer than 10 years to be visible: the percentage effect by 2030 might be in low single figures.

9) Modal shift would be assisted by **shifting most of our land transport investment** away from road building towards mass transit, cycle paths and better footpaths. This reorientation of investment has begun (MOT, 2020), but needs to be accelerated and in any case will take 10-30 years to take full effect. The impact by 2030 would probably be only a few percentage points reduction in transport CO_2 emissions.

10) It is impossible to estimate with confidence the overall CO_2 savings which could be achieved by either policy package, as policies are not independent, and policy design (e.g. ETS price; government investment levels) remains to be determined. On the positive side, some measures would be mutually reinforcing, building momentum in transport behaviour change. Various international studies suggest a package of measures could yield major changes: e.g. Creutzig finds that 'a combination of pricing, non-motorized and public transport investment, and compactification, could enable up to 50% reduction in urban transport GHG emissions from 2010 until 2040.' (Creutzig, 2016, p.348). In larger, faster-growing New Zealand cities with the possible exception of Wellington (where emissions per capita already reflect high levels of active travel) an ambitious package of policy measures, if complemented by assertive freight transport measures, might generate **30% reductions** or more in road transport carbon emissions by 2030. Clearly, this would not achieve the 50% desired, but would represent a hugely valuable start.

11) A recent OECD study of Auckland's transport and urban form (OECD, 2020) modelled coordinated regional and local transport and land use (urban form) policies. They found that road transport CO_2 emissions could be cut **70% *per capita*** (p.23) and overall by around **30%** (p.12), **by 2050** (significantly less than a target of 50% by **2030**, but a major contribution), and broadly in line with the estimates above. Such reductions would require:

    a. Policies to promote public transport, biking and walking. and discourage private vehicles by "drastically increasing the cost of private vehicle ownership" (p.12)
    b. Substantial subsidies and tax exemptions for EVs, and faster innovation in the EV sector
    c. Land use policies to reduce kilometres travelled, by altering the spatial structure of Auckland over time, and enabling widespread densification. The OECD note that 'Policies that promote a more compact urban form are fundamental in the long-run success of urban transport decarbonisation strategies.' (p.18).

12) To achieve political legitimacy, policies will need to address equity issues. Some authors (e.g. Henderson, 2020) argue that an EV-oriented policy approach would present a major affordability problem for low-income groups, while redistributing public resources towards middle and upper-income groups (the 'kinetic elite'). Conversely, a mode shift approach could be combined with public transport and active travel subsidies (e.g. e-bike support) to make the transport and urban form transformation much more palatable to lower income groups, as long as public transport system expansion was adequate. It would certainly be necessary to examine impacts on mobility costs for different income and other social groups, during the process of developing detailed packages of policies, before they are implemented. At the same time, explaining the overwhelming case for strong policy measures will require a major social marketing process.

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Annex: a simplified model of car fleet emissions reductions

This model explores reductions under an EV-switch approach. It excludes freight vehicle emissions. It assumes that the switch in the fleet towards EVs is driven exogenously, e.g. by a high ETS price, or by an impending fossil vehicle import ban, or government subsidies, or all of these. The model ignores mode shifts towards other forms of transport such as bus or cycle transport, or increased walking. To the extent that such shifts take place, E30 will be lower.

E20 = Carbon dioxide emissions of the light duty vehicle fleet in 2020.
E30 = Emissions of car fleet in 2030, after allowance for conversions to EVs and some fleet growth

Assume initially:

30% of the fleet is converted to EVs by 2030; no fleet growth; no vkt growth per vehicle.
EVs have life cycle emissions which are ~62% lower than (i.e. 38% of) ICEVs (Hasan & Chapman, 2019).

Then $E30 = 0.3*E20*0.38 + 0.7*E20 = 0.81\ E20$ ….this implies a **19%** emissions reduction below BAU

Now, assume also:

Car fleet grows marginally but all the growth occurs in the EV fleet (e.g. 5% growth in EV fleet; zero growth in non-EV numbers).

Then $E30 = 0.3*E20*0.38*1.05 + 0.7*E20 = 0.82\ E20$ …this implies an 18% reduction below BAU

Lastly, assume also that there is 5% growth in vkt per vehicle among those which are converted to EVs, due to the ‘rebound’ effect (the magnitude of which is uncertain):

Then $E30 = 0.3*E20*0.38*1.05*1.05 + 0.7*E20 = 0.83\ E20$ …this implies a 17% reduction below BAU

Conclusion: based upon these assumptions – especially the assumption of very rapid growth in EV numbers as ICEV owners switch to EVs -- carbon dioxide emissions from light duty vehicles might fall by about 20% by 2030. Modest additional fleet growth or rebound effects would have little effect on this outcome. This simple model result does not imply that government policies to induce such a switch to EVs are necessarily desirable; it simply illustrates the scale of emission reductions which might be ‘delivered’.