Executive summary

Cities are home to over half the world's population and their rapid growth is projected to continue. Currently, cities are responsible for 70% of global greenhouse gas emissions and this share will increase as the world becomes increasingly urban (C40, 2019[1]). This makes climate action at the city-level critical to limiting the rise in global average temperature.

Reducing greenhouse gas emissions will require "rapid and far-reaching" changes to consumption and mobility patterns and to the structure of modern economies (IPCC, 2018[1]). The transport sector represents a particular challenge for emission reductions. As incomes and population have grown, emissions from transport have risen faster than in any other sector. Global emissions from road transport alone increased by 77% between 1990 and 2016 (IEA, 2018[2]). Despite rising sales of electric vehicles in recent years, almost all transport activity remains reliant on fossil-fuel powered internal combustion engines. This also holds true in urban environments, where one third of total emissions in major cities is generated by transport (C40, 2019[3]). In the face of growing urban populations, reducing emissions from transport represents a formidable challenge for cities.

This report assesses the impact of demographic and technological changes on emissions from urban transport in Auckland, New Zealand by 2050. The study uses the OECD's integrated land use and transport model, MOLES, to evaluate different land use and transport policies. This modelling framework allows the identification of possible trade-offs between the environmental performance and welfare effects of these policies. Moreover, the model addresses synergies between land use and transport policy instruments.

Auckland is a representative example of a medium-sized city facing challenges in reducing emission from urban transport due to a growing population, low density and high levels of car dependency. The findings are therefore relevant not only to the city of Auckland and New Zealand, but more broadly for the assessment of different pathways to reduce emissions from urban transport in similar contexts.

The report assesses how policies can reduce emissions from the transport sector through three channels:

1. Increasing the share of cleaner forms of transport by encouraging a shift from private vehicles to public transport, biking or walking. Policy options to shift mobility towards cleaner modes include road pricing, per-kilometre taxes and public transport subsidies.
2. Reducing the emissions intensity per kilometre travelled through measures that encourage shifts from fossil-fuel powered cars to electric vehicles. Such measures include incentives and tax exemptions, which favour electric vehicles.
3. Reducing the total number of kilometres travelled by encouraging fewer and shorter trips. Adjusting land use policies, such as maximum density restrictions, can be key to reducing total distances travelled.

Key findings:

- **In the reference scenario, total annual CO_2 emissions from road transport in Auckland are projected to increase by 7% in 2050, relative to 2018 emissions.** This increase will take place despite a number of trends that will reduce *per capita* CO_2 emissions from urban transport in Auckland by 40% over the same time period. These trends include projected improvements in the energy efficiency of vehicles, declining costs of electric vehicles and accompanying increase in EV ownership, a less carbon-intensive electricity sector and the electrification of public transport. Therefore, in the presence of a growing population, technological and other developments will be insufficient to reduce emissions from urban transport in the absence of additional policies. This underlines the scale of the challenge of decarbonising urban transport in Auckland.
- **Increasing the use of public transport while imposing higher taxes on private vehicles offers one pathway to emission reductions.** The report examines a package of policies that promotes public transport over private vehicles. This package drastically increases the cost of private vehicle ownership while channelling a large subsidy to public transport fares. This policy package targets a modal shift to public transport and reduces aggregate emissions by 40% in 2050, relative to the reference case in which these policies are not implemented. Further, the public transport policy package yields a welfare gain equivalent to 0.9% of net income in 2050. Therefore, incentivising a switch to public transport, while ensuring that public transport is electrified should be a priority.
- **Promoting the use of electric vehicles over conventional and hybrid vehicles offers another path to large reductions in emissions from urban transport.** The report also examines a policy package that promotes a shift to electric vehicles. The considered policies channel substantial subsidies and tax exemptions to electric vehicles while significantly increasing the fixed and operating cost of conventional vehicles. This effectively increases the use of electric vehicles. The report finds that these measures increase the share of households that own an electric vehicle to 13.5% and reduce aggregate emissions by 30% in 2050, relative to the reference case. The associated welfare gain is estimated to be 1.6% of net income in 2050. Reducing emissions by supporting the transition to electric vehicles is particularly effective in New Zealand where the share of renewable energy in the electricity grid is very high.
- **Land use policies that affect the spatial structure of a city can play a substantial role in reducing vehicle kilometres travelled.** A general relaxation of density regulations in Auckland can reduce emissions by an additional 10% if implemented in combination with the policy packages that promote public transport and electric vehicles. This reduction in emissions could potentially be even greater if urban densification is combined with a delay in the development of remote suburban areas.
- **In addition to reducing emissions, policies that increase population density may entail further social benefits by curbing the growth in the cost of housing.** By implementing a set of land use policies that enable widespread densification, the tripling of housing prices in Auckland projected in the period 2018-2050 can be reduced to an increase of 57%. The associated welfare gain of such policies is substantial. The report finds that this gain exceeds 7% of net income in 2050.

- **A faster rate of innovation in the electric vehicle industry will increase the penetration rate of electric vehicles and lower transport sector emissions.** Adopting a more optimistic view of the pace of technological change than the one used in the main results leads to a drastic increase in the share of households that own an electric vehicle by 2050. In turn, a higher share of passenger kilometres travelled using electric vehicles reduces aggregate emissions by 30% between 2018 and 2050. More rapid technological development also enhances the effectiveness of transport policies that support the penetration of these vehicles.

Implementing the policies assessed in the report will require co-ordinated and targeted action at both national and local levels. Reducing emissions from urban transport is most effective when transport and land use policies are integrated. A combination of policies is required to incentivise modal shifts, reduce emissions intensity per kilometre travelled and reduce total distances travelled. Trade-offs between environmental and welfare outcomes should be considered in order to ensure cost-efficient policies. Moreover, it can take time for land use and transport policies to affect the urban structure of a city and the composition of its vehicle fleet. The report highlights the areas in which there is a need for rapid policy action if the targeted reductions are to be achieved.

The policy recommendations included in the report also holds relevance to contexts beyond Auckland, particularly to urban areas characterised by low population density and car dependency. However, the design of these policies should be adapted to the local characteristics of each specific area. To achieve this objective, the report examines the extent to which the results of the analysis change when certain underlying assumptions are modified.

References

C40 (2019), *Transportation and urban planning initiative: Mass Transit*, C40 Cities, https://www.c40.org/networks/mass-transit. [3]

IEA (2018), *CO2 Emissions from Fuel Combustion 2018*. [2]

IPCC (2018), "Summary for Policymakers", in Masson-Delmotte, V. et al. (eds.), *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways*, World Meteorological Organization, Geneva. [1]