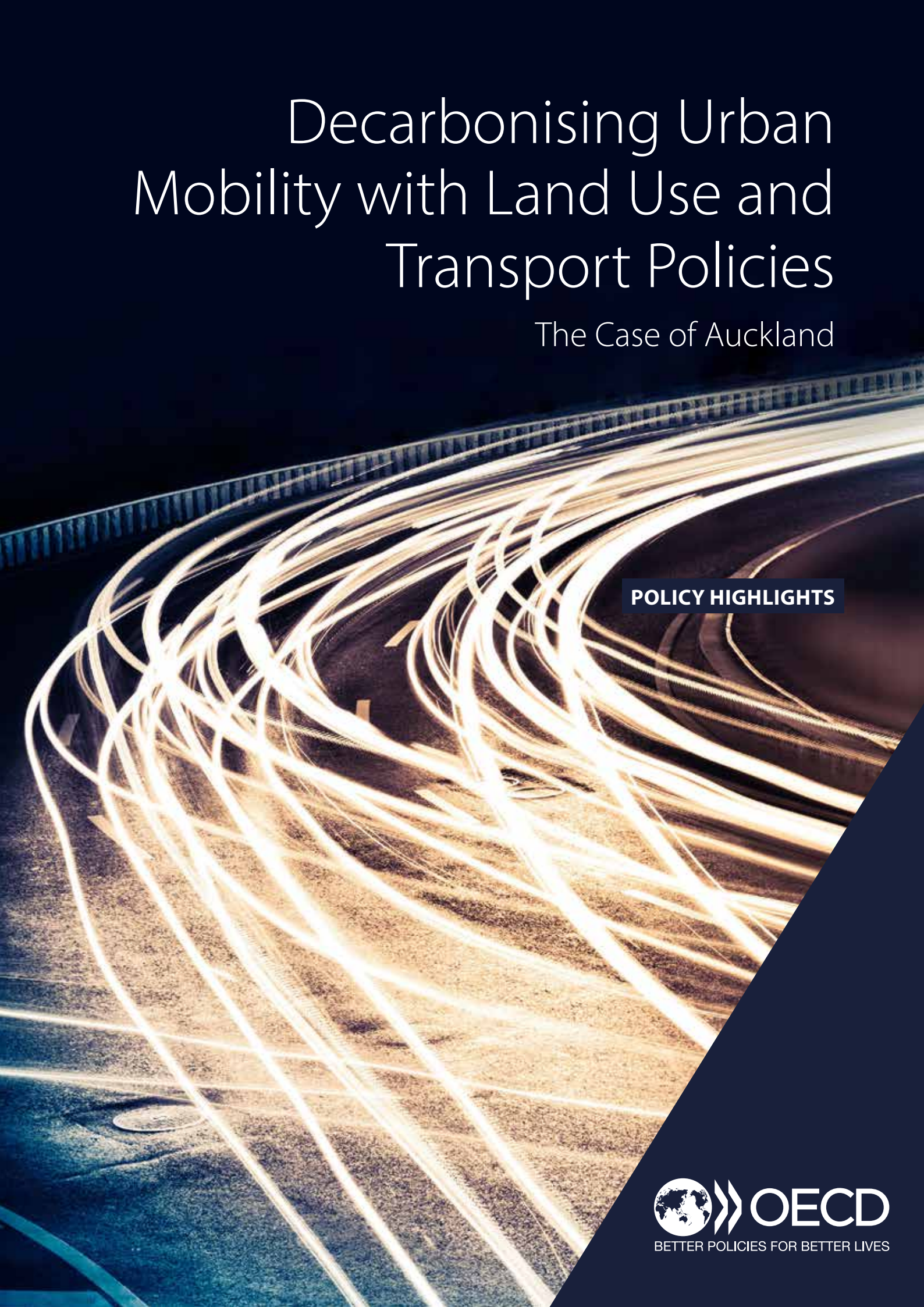
Decarbonising Urban Mobility with Land Use and Transport Policies

The Case of Auckland



POLICY HIGHLIGHTS

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BETTER POLICIES FOR BETTER LIVES

Decarbonising Urban Mobility with Land Use and Transport Policies

The Case of Auckland

Decarbonising urban mobility must be placed at the core of climate change mitigation efforts. We are at a critical juncture, as cities continue to grow and people remain largely dependent on polluting private vehicles.

Rodolfo Lacy – OECD Environment Director

OECD

BETTER POLICIES FOR BETTER LIVES

Key messages

- Cities are responsible for 70% of global greenhouse gas emissions. One third of greenhouse gas emissions in major cities is generated by transport. This makes policies aimed at reducing emissions from urban transport critical to climate change mitigation.

- Coherent and targeted policy action is needed to reduce total emissions from urban transport and achieve the targets set out in the Paris Climate Agreement and the UN Sustainable Development Goals. The report finds that total greenhouse gas emissions from urban road transport in Auckland, New Zealand will continue to increase in the absence of major policy changes.

- While total greenhouse gas emissions from urban transport are projected to rise, the study finds that annual *per capita* emissions in Auckland fall by 40% between 2018 and 2050 due to technological progress.

- Policy action is necessary to achieve further emission reductions. Policymakers have a number of tools available to target reductions in greenhouse gas emissions from urban transport:

    - The report examines a package of policies that promote public transport over private vehicles through road pricing and a horizontal subsidy to bus and train fares. This package is found to reduce total emissions by 40% in 2050 in Auckland, relative to the reference case in which these policies are not implemented.

    - The report examines a policy package that promotes a shift to electric vehicles through substantial subsidies and tax exemptions for electric vehicles. The fixed and operating cost of conventional vehicles is also increased. The report finds that these measures increase the share of households that own an electric vehicle only moderately but reduces total emissions by 30% in 2050, relative to the reference case.

    - Finally, the report finds that a general relaxation of density regulations in Auckland would substantially limit the growth in housing prices by increasing housing supply. If implemented in combination with the policy packages that promote public transport and electric vehicles, the reform of existing land use policies can reduce emissions by an additional 10%.

- Although there is potential for significant emission reductions in urban transport over the next thirty years, urban structure changes slowly and vehicle lifetimes are long. Rapid policy action should therefore be prioritised if the targeted reductions are to be achieved. With 7 in 10 people forecast to live in cities by 2050, we must act today to build better cities for better lives.

1 Why is urban transport important in tackling climate change?

33%

of total urban GHG emissions in major cities are generated by transport (C40, 2019[1]).

70%

of the world's population is expected to live in urban areas by 2050.

Cities are growing and contribute significantly to global greenhouse gas emissions.

- Cities are currently home to 50% of world's population but are responsible for 70% of global CO_2 emissions (C40, 2019[2]).
- By 2050, about 70% of the world's population is expected to live in urban areas and global urban land-cover is projected to increase five-fold.

Emissions from transport are rising and almost all transport activity remains reliant on fossil-fuel powered internal combustion engines.

- Emissions from transport are rising faster than in any other sector: between 1990 and 2016, global emissions from road transport alone increased by 77% (IEA, 2018[2]).
- One third of total urban greenhouse gas emissions in major cities is generated by transport.
- Sales of alternative fuel vehicles remain low.

Road travel in urban areas often entails additional social costs, such as congestion, pollution, noise and accidents. This strengthens the rationale for policy action.

2 Objective of this report

Auckland is a representative example of a medium-sized city characterised by a growing population, low density and high levels of car dependency. The findings of this report are relevant not only to the city of Auckland, but more broadly for the assessment of different pathways to reduce emissions from urban transport in similar contexts.

The report addresses three overarching questions:

Technology		Will technological change in the electric vehicle industry lead to significant reductions in emissions from urban transport?
Policies		What is the role of transport and land use policies in reducing urban greenhouse gas emissions?
Impact		Are these policies welfare-improving, once their wider impact on the economy and society is taken into account?

The report answers these questions through the case-study of Auckland using the OECD integrated land-use and transport model, MOLES. This enables an evaluation of:

The effect of policy inaction across a range of indicators.	The environmental effects of land use and transport policies in the mid-term (2018-2030) and in the long run (2018-2050).
The wider consequences of land use and transport policies for tax revenue, housing prices and net aggregate welfare.	Possible trade-offs and synergies between the environmental performance and the economic impact of tested policies.

3 Policy interventions to reduce emissions from urban transport

The starting point of the analysis is the reference case scenario in which current policies are kept fixed. The results in this scenario are used to evaluate the consequences of policy inaction.

Three different types of "policy packages" are used in different combinations to explore possible synergies between different types of transport and land use policies. The outcomes under each scenario are evaluated relative to the reference case scenario. The components of each set of policies are presented below.

Reference case

Policies are evaluated relative to a reference case scenario, which represents a continuation of business as usual. This includes the following components:

- Current policies are kept fixed.
- Announced policies are implemented.

Promote Public Transport (PT)

The PT package entails policy changes designed to promote public transport over private vehicles. It includes the following components:

- An increase in the gasoline price.
- A significant increase in the distance-based private vehicle tax.
- The introduction of a system of two cordon tolls, which surround the Central Business District and the isthmus area.
- A reduction of public transport fares.

Promote Electric Vehicles (EV)

The EV policy package is designed to promote electric vehicles over conventional private vehicles. It includes the following components:

- The introduction of subsidies to owners of electric vehicles.
- A significant increase in the distance based private vehicle tax on conventional vehicles.

Densification

Two sets of densification policy packages are tested: the widespread densification of the Auckland urban area and the targeted densification of particular sections of it. The wide-spread and targeted densification programmes involve different levels of relaxation of the existing density restrictions:

- A relaxation of maximum building height restrictions.
- A relaxation of the proportion of land plots covered by buildings.

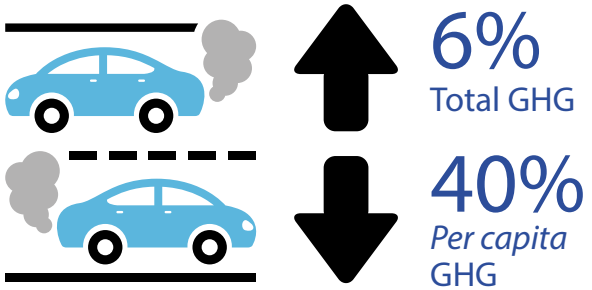
4 Reference case scenario: What are the consequences of policy inaction?

In the reference case scenario, in which current policies are kept fixed, total vehicle kilometres, greenhouse gas emissions and house prices increase by 2050. Technological improvements and a greener electricity grid are not sufficient to offset the increased demand for transportation driven by a rapidly growing population.

The consequences of keeping policies fixed on key indicators in 2050:

Total greenhouse gas emissions continue to rise

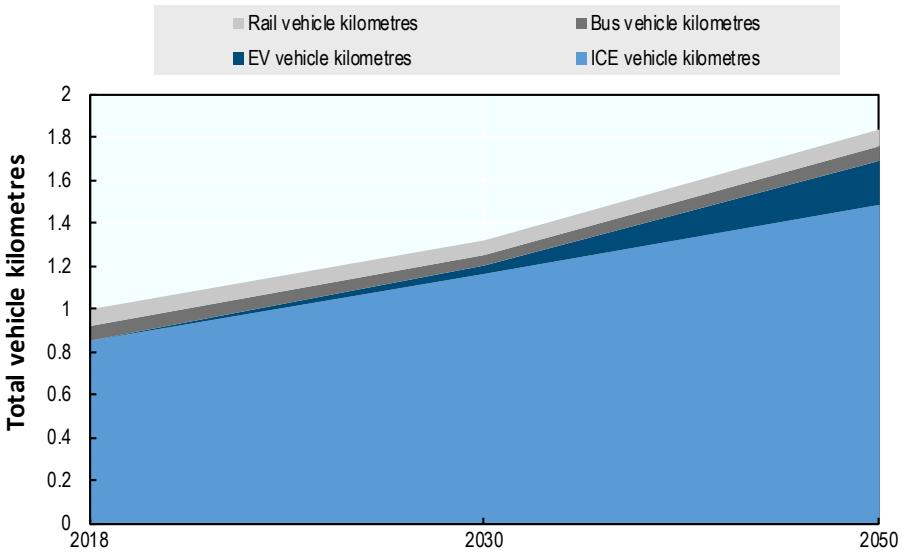
Annual total greenhouse gas emissions from urban transport increase by 6% in 2050 relative to the level in 2018. *Per capita* emissions fall by 40%.



Real house prices are projected to triple between 2018 and 2050

Housing supply is not able to meet rising demand resulting in a significant increase in house prices. This is driven by rising income levels and a growing population.

Total kilometres are projected to grow significantly



Total passenger kilometres will grow by 83% between 2018 and 2050. This is driven primarily by the projected population growth (75.6%). *Per capita* passenger kilometres increase by only 4% during the same period. The share of passenger kilometres travelled by electric vehicles grows from less than 1% in 2018 to 11% in 2050 while the share by public transport falls slightly.

5 Transport policy interventions I: Promote public transport

The study examines a package of policies that promotes public transport over private vehicles. This includes significant increases in gasoline and distance-based private vehicle taxes, the introduction of two cordon tolls in Central Auckland and a significant subsidy to public transport fares.

The "promote public transport" policy package is highly effective in reducing emissions and has positive welfare implications. Therefore, incentivising a switch to public transport, while ensuring that public transport is electrified, should be a priority.

The effect of implementing the promote public transport package on key indicators in 2050 relative to the reference case scenario:

Decrease in kilometres driven.

Total passenger kilometres travelled decline by 17% - a decline driven by the steep increase in taxes on private vehicle use.

Signicant decline in greenhouse gas emissions.

Total greenhouse gas emissions from urban transport falls by 40% - the outcome of fewer total kilometres travelled and a cleaner modal split.

Positive welfare implications.

Net welfare gain equivalent to 0.9% of net income - primarily a result of reduced road congestion, redistributed tax revenue and the social value of greenhouse gas reduction.

Increase in use of public transport.

Share of total passenger kilometres by public transport increases from 8% to 33% - incentivised by fare subsidies.

6 Transport policy interventions II: Promote electric vehicles

The study 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.

The policies to promote electric vehicles substantially increase the share of vehicle kilometres driven by electric vehicles and reduce aggregate emissions. The welfare implications of these policies are estimated to be positive and significant.

Reducing emissions by supporting the transition to electric vehicles could be particularly effective in New Zealand, where the share of renewable energy in the electricity grid is very high.

The effect of implementing the "promote electric vehicles" package on key indicators in 2050 relative to the reference case scenario:

Decline in greenhouse gas emissions.

Total GHG emissions from urban transport falls by 32% - the outcome of fewer total kilometres travelled and a shift towards electric vehicles.

Increase in use of electric vehicles.

Electric vehicles make up a larger part of the fleet and the share of total passenger kilometres driven by electric vehicles increases from 11% to 17.5%. This is driven by significant subsidies and tax exemptions to electric vehicle owners.

Decrease in kilometres driven.

Total passenger kilometres travelled decline by 12.5% - a decline driven by the steep increase in the fixed and operating costs of conventional vehicles.

Positive welfare implications.

Net welfare gain equivalent to 1.6% of net income - primarily a result of redistributed tax revenue and the social value of greenhouse gas reduction.

7 Land use policy reform: Widespread and targeted densification

Land use policies that affect the spatial structure of a city can play a substantial role in reducing vehicle kilometres travelled and entail further benefits by curbing the growth in the cost of housing.

The study tests two sets of densification policy packages: widespread densification (WD) of the entire Auckland urban area and targeted densification (TD) of a particular part of it. The widespread and targeted densification programmes involve different levels of relaxation of the existing density regulations.

Widespread densification entails that the the tripling of housing prices in Auckland projected in the reference case for the period 2018-2050 can be reduced to an increase of 57%. The associated welfare gain of such policies is substantial.

The four different targeted densification packages are:

TD1: densification of major employment hubs and public transit nodes

TD2: densification of central business district

TD3: densification of Auckland's isthmus

TD4: densification around major employment hubs

Note: zones in grey represent areas selected for targeted densification

The effect of implementing the various densification policy packages on key indicators in 2050 relative to the reference case scenario:

Minor decrease in kilometres driven

Total passenger kilometres travelled declines by 1-2% across the different densification packages relative to reference case, as travel distances become smaller.

Minor decline in greenhouse gas emissions

Total greenhouse gas emissions from urban transport fall by 1.5-3.5% depending on the type of densification implemented.

Substantial and positive welfare implications of widespread densification

Welfare gains are equivalent to more than 7% of net income for the widespread densification (WD) scenario – a result driven by the importance of housing affordability for overall welfare.

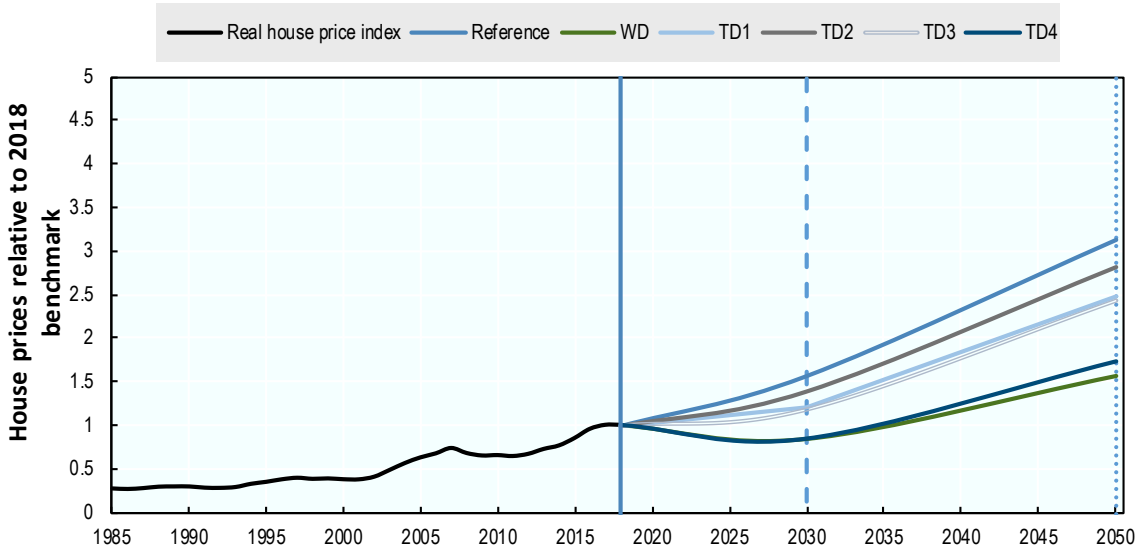
Highly effective in curbing growth in house prices

Under widespread densification house prices increase by 58% between 2018 and 2050 relative to 200% in the reference case scenario. The targeted densification policy packages also curb the growth in housing to varying degrees.

Not all targeted densification scenarios have a positive welfare impact

Only targeted densification packages 2 and 3 (TD2 and TD3) have positive welfare implications. Densification in areas that are already dense (i.e. TD1 and TD4) leads to decreases in welfare due to strong preferences for open space.

Evolution of house prices under different scenarios of policy intervention



House prices are projected to triple between 2018 and 2050 in the reference case scenario where no policy interventions are undertaken. Widespread densification (WD) and targeted densification (TD1-4) policies can curb this growth to varying extents.

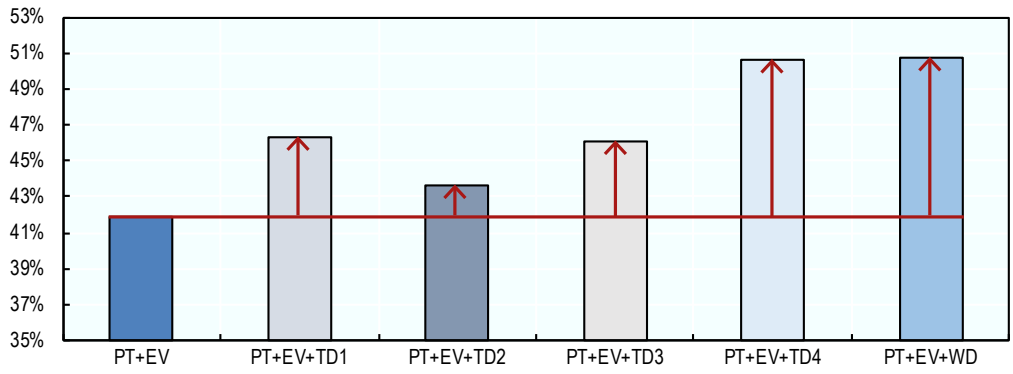
8 Combining transport and land use policies

The results of the study show that the use of transport policies that promote public transport and electric vehicles, combined with land use policies that foster a more compact urban form, can substantially reduce *per capita* greenhouse gas emissions.

The development of the appropriate policy mix requires *ex ante* evaluation of the likely outcomes of specific policies and the interactions between them. This report identifies substantial environmental and welfare benefits of integrating transport and land use policies.

Relaxing density regulations in Auckland can generate higher emission reductions when implemented in combination with transport policies than when implemented alone.

Greenhouse gas emission reductions from implementing transport and land use policies in 2050 relative to the reference case



Note: red arrows indicate the emission reductions from adding densification packages to transport policies.

A general relaxation of density regulations in Auckland under the widespread densification policy package can reduce emissions by an additional 10% if implemented in combination with the policy packages that promote public transport and electric vehicles.

9 Conclusions

This report helps decision makers understand the implications of policy inaction, as well as anticipate the potential impacts of land use and transport policies with regard to environmental effectiveness, economic efficiency and social welfare.

Implementing the policies assessed herein will require coordinated and targeted actions at both national and local levels. This report draws the following conclusions:

- A combination of policies, including densification programmes, distance-based taxes, public transport subsidies and a managed expansion of the urban area, are 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. This study underlines the benefit of designing policies in a holistic manner, so as to leverage their synergies and maximise their effectiveness over multiple domains.

The policy recommendations included in the report are also relevant 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 how the results of the analysis change when certain underlying assumptions are modified.

The OECD stands ready to assist governments in designing and delivering environmentally effective and economically efficient urban policies that will lead to a better quality of life in cities.

10 OECD SPINE project

The report *Decarbonising Urban Mobility with Land Use and Transport Policies: The Case of Auckland* is part of the OECD Spatial Planning Instruments and the Environment (SPINE) project.

Spatial planning and land use policies play a crucial role in managing the trade-offs between environmental, economic and social objectives. The importance of these policies is expected to increase in the future, as demand for housing, food, services and infrastructure grows. As spatial planning and land use policies have long-term impacts that will determine the economic and environmental outcomes of the future, it is essential to design and implement the right policies today.

Launched in 2015, the OECD SPINE project analyses the interactions among policy interventions, land use patterns, socio-economic and environmental processes. To this end, it uses refined geospatial data and a variety of analytical, empirical and modelling methods. In particular, SPINE analyses:

1. Urban sprawl and the effects of urban structure on the environment, the economy and well-being.
2. The environmental and economic effectiveness of existing urban policies
3. The long-term consequences of potential land use and transport policy choices

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The report presents an in-depth analysis of various policies that aim to reduce the greenhouse gas emissions of urban transport. Decarbonising transport lies at the core of efforts to mitigate climate change and has close links to urban sustainability and housing affordability. The report identifies the drivers of rising emissions in the urban transport sector and offers pathways to reduce them through a combination of transport and land use policies. The analysis yields a holistic welfare evaluation of these policies, assessing them according to their environmental effectiveness, their economic efficiency and their impact on fiscal balance and housing affordability. The report concludes that significant reductions in emissions from urban transport can be achieved through a careful alignment of transport policies designed to promote the use of public transit and electric vehicles, and land use policies, which foster a more compact urban form. The study is based on the case of Auckland, New Zealand, but the lessons drawn are relevant for institutions and governments working on issues relating to urban sustainability, transport, housing and climate change mitigation.

For further reading, please see the following publication on which these Policy Highlights are based: OECD (2020), *Decarbonising Urban Mobility with Land Use and Transport Policies: The Case of Auckland*, OECD Publishing, Paris.
https://doi.org/10.1787/095848a3-en

This report is part of the OECD SPINE project.
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