SLOCAT Transport and Climate Change Global Status Report

2nd edition

Tracking Trends in a Time of Change: The Need for Radical Action Towards Sustainable Transport Decarbonisation

SLOCAT
Partnership on Sustainable, Low Carbon Transport

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About the SLOCAT Partnership

SLOCAT is the international multi-stakeholder partnership that enables collaborative knowledge and action for sustainable, low carbon transport and brings the voice of the movement into international climate change and sustainability processes. With a primary focus on land transport, and a geographic footprint targeted at the Global South; we deliver on our mission through three mutually-reinforcing work streams; namely knowledge and policy analysis; advocacy and engagement, and dialogue and networking. Our Partnership engages a vibrant international, multi-stakeholder ecosystem of over 90 entities across transport sectors associations, knowledge and academia, governments, multilateral organisations, NGOs, philanthropy and industry; as well as a large community of world-class experts and change-makers. By going there where others do not or cannot go individually, our inclusive, multi-stakeholder Partnership is leveraged to set ambitious global agendas and catalyse new thinking and solutions for the urgent transformation of mobility systems.

Values

Recognised leading convener and voice of an inclusive, multi-stakeholder community of change-makers.

Experienced ambitious thought leader for urgent transformation, with positive impact on people and planet.

Credible on integrated, inter-modal, multi-sectoral, multi-stakeholder approaches for cost-efficient solutions, adapted to different socio-economic realities.

Skilled in collaboration within and beyond the transport community for long-term legacy.

Acknowledged as a reputable, trustworthy, competent partner, with nimble and flexible procedures.

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www.slocat.net | secretariat@slocatpartnership.org

Transport Actions for Achieving the Sustainable Development Goals

SLOCAT is committed to articulate the breadth of positive interactions between sustainable, low carbon transport and mobility and the United Nations 2030 Agenda for Sustainable Development.

Sustainable, low carbon mobility is a powerful driver for positive, systemic transformation of our societies. While sustainable, low carbon transport and mobility is not represented by a stand-alone Sustainable Development Goal (SDG), its successful implementation supports the achievement of almost every SDG.

www.slocat.net/transport-sdgs

About the Report

The SLOCAT *Transport and Climate Change Global Status Report – 2nd edition* tells the global and regional stories of where we are and where we need to get to urgently on climate action in the transport sector. With contributions from more than 150 world-class experts and organisations, it is a one-stop shop for the latest available data, targets and developments on transport demand, emissions, policies and measures – showing that it is imperative to accelerate radical action for sustainable transport and climate in this time of unprecedented global change.

This report, launched in June 2021, aims to capture data and trends from the period between 2018 and early 2021. Throughout the analysis, the most recent publicly accessible data were used. These data are also provided in the Transport and Knowledge Base (TraKB), an open-source database that has been curated by SLOCAT over the years and that has been updated in conjunction with this second edition of the report.

The report intends to provide a balanced perspective and examples of policy measures, targets, etc. across both the Global North and South. Illustrative measures and case studies from different geographies are provided, with the aim of emphasising new activities in developing and emerging economies where possible.

This edition of the report was guided by a global strategy team consisting of 20 experts from development agencies, intergovernmental organisations, multilateral development banks, multi-stakeholder partnerships, non-governmental organisations, United Nations regional commissions and research organisations. The creation of this report also has relied on the expertise of more than 100 individual contributors as special advisors, section authors, feedback team members and peer reviewers, among other roles *(see detailed list in Acknowledgements)*.

The report has been made possible thanks to financial support from Agence Française de Développement (AFD) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

How to navigate this report

Modular approach: While the report can be downloaded as a single file and read from start to finish, sections of interest can also be accessed individually via the website at tcc-gsr.com.

Structure: The report is divided into **five main sections. Sources for the information provided** are listed at the end of each section, and cross-references among sections are included where relevant. The five main sections are as follows (and described in detail below):

- Executive Summary
- 1 Section 1: Global Overview
- 2 Section 2: Transport Demand, Emissions and Targets
- 3 Section 3: Responses to Address Climate Change in the Transport Sector
- 4 Section 4: Financing Climate Action in Transport

The ***Executive Summary*** summarises the trends and conclusions of the report and highlights threats, opportunities and uncertainties for climate action in the transport sector. The Summary describes escalating transport demand and emission trends through 2019 as well as the temporary disruption to these trends following the onset of the COVID-19 pandemic in 2020. The Summary presents three scenarios for climate action in the transport sector: 1) following a *business-as-usual approach* to mobility patterns and investments; 2) continuing *incremental progress* on mitigation and increasing adaptation measures; and 3) creating a *radical change* in transport behaviour and investment. The Summary underscores the imperative of radical action to put transport decarbonisation on the right track.

The remaining sections are divided into relevant sub-sections, each of which highlights key findings on transport demand, emissions, policy measures and the impacts of the COVID-19 pandemic.

Section 1 - Global Overview examines progress towards decarbonising transport on a global scale and includes sub-sections on each of the six global regions as defined by United Nations classification: Africa, Asia, Europe, Latin America and the Caribbean, North America and Oceania.

Section 2 - Transport Demand, Emissions and Targets assesses transport demand and emission trends in more detail and showcases low carbon pathways for 2050, with a focus on the various transport modes and their impact on emissions. The sub-sections outline the trends in demand and emissions for key areas such as urbanisation, infrastructure development, the carbon efficiency of transport modes, and the decoupling of economic prosperity and emissions.

***Section 3 - Responses to Address Climate Change** in the Transport Sector* details transport decarbonisation within climate and development plans such as the Nationally Determined Contributions and Long-Term Strategies under the Paris Agreement. It then outlines climate mitigation and resilience actions across 10 major thematic areas: sustainable mobility planning and transport demand management, walking and cycling, urban passenger and freight transport, passenger and freight railways, shared mobility services, fuel economy, electric mobility, renewable energy in transport, aviation and shipping.

Section 4 - Financing Climate Action in Transport provides an overview of the current investment landscape, showing how climate finance and national investments for sustainable transport modes have developed in recent years.

Additionally, ***seven Focus Features*** put a spotlight on important cross-cutting issues: improving access to opportunities, adaptation policy measures in the transport sector, behavioural change in transport as a result of the COVID-19 pandemic, gender and sustainable mobility, the health impacts of transport, paratransit as a complement to formal transport networks, and multistakeholder mobilisation for climate action.

Moreover, ***31 Country Fact Sheets*** were developed for countries that had the highest absolute transport carbon dioxide (CO_2) emissions in 2019. These fact sheets present data on transport demand, emission trends and measures taken at the national level towards achieving a decarbonised, sustainable transport system. Of the 31 countries covered, 8 are in Africa (Algeria, Angola, Egypt, Ghana, Kenya, Morocco, Nigeria and South Africa), 8 are in Latin America and the Caribbean (Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico and Peru), 6 are in Asia (China, India, Indonesia, Iran, Japan and Saudi Arabia), 5 are in Europe (France, Germany, Italy, the Russian Federation and the United Kingdom), 2 are in North America (Canada and the United States) and 2 are in Oceania (Australia and New Zealand).

Disclaimer

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Our warm thanks to the many SLOCAT partners and experts from the wider transport community who have shaped this report. A significant share of the research for this report was conducted on a voluntary basis.

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Foreword

While the world continues to recover from the losses, hardships and disruptions of the COVID-19 pandemic, we are in a critical moment to collectively reflect on the future that we want and how we can achieve it.

With emissions from the transport sector growing faster than those from any other major economic sector, action in transport is needed urgently to deliver on the sustainable, low carbon future outlined in the goals of the Paris Agreement on climate change and of the 2030 Agenda for Sustainable Development.

The SLOCAT *Transport and Climate Change Global Status Report – 2nd edition* continues the legacy of the report's inaugural edition to tell the global and regional stories of where we are and where we need to get to urgently on climate action in the transport sector. With contributions from more than 150 world-class experts and organisations, it is a one-stop shop for the latest available data, targets and developments on transport demand, emissions, policies and measures – showing that it is imperative to accelerate radical action for sustainable transport and climate in this time of unprecedented global change.

We hope this report helps identify some of the key levers of change in this uncertain time, and we look forward to continuing to track the latest developments in sustainable, low carbon transport for the next editions.

We warmly invite colleagues to continue to contribute more current and comprehensive data, amplify the analysis of this report, and use it to help reach our collective goal of mobility for an equitable world that is able to keep planetary warming below 1.5 degrees Celsius.

Bronwen Thornton
Chair, SLOCAT Board of Directors
Chief Executive Officer, Walk21

We are excited to launch this second edition of the SLOCAT *Transport and Climate Change Global Status Report,* which introduces several new elements compared to the report's inaugural edition. These include seven "Focus Features" highlighting interlinkages of sustainable transport with broader sustainability themes, 31 country fact sheets taking a deep dive into progress at the national level, and an interactive website at www.tcc-gsr.com.

In addition, the Executive Summary summarises the trends and conclusions of the report and highlights threats, opportunities and uncertainties for climate action in the transport sector, illustrating the imperative for accelerating radical action. An updated version of the open-source SLOCAT Transport Knowledge Base that forms the basis of the report is also being released.

Driven by our passion for open-source data and knowledge, one of the aims of the SLOCAT *Transport and Climate Change Global Status Report* is to leverage the collective knowledge of the sustainable, low carbon transport community. Data are important to provide a comprehensive picture of the status of this field, and in this time of change they are essential for policy and investment decision making. We hope that this report can be a useful resource for the SLOCAT Partnership and beyond.

Our warmest gratitude goes to all the colleagues who have helped shape this report. It has been truly our honour to work with more than 150 world-class experts across transport sector associations, knowledge and academia, governments, multilateral organisations, non-governmental organisations, philanthropy and industry. A special thanks to the financial supporters of this edition, Agence Française de Développement (AFD) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

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Table of Contents

List of Figures

Walking and Cycling

Urban Passenger and Freight Transport

Passenger and Freight Railways

Shared Mobility Services

Fuel Economy

Electric Mobility

Renewable Energy in Transport

Aviation

Shipping

4 Financing Climate Action in Transport

Addressing Climate Change and Improving Access to Opportunities

Health Impacts of Transport

Paratransit as a Complement to Formal Transport Networks

List of Tables

National Policy Frameworks for Transport and Climate Change

Sustainable Mobility Planning and Transport Demand Management

List of Abbreviations

°C
Degrees Celsius

A-S-I
Avoid-Shift-Improve

ACT
Action towards Climate-friendly Transport

ADB
Asian Development Bank

AFD
French Development Agency (*Agence française de développement*)

ALICE
Alliance for Logistics Innovation and Collaboration in Europe

AIIB
Asian Infrastructure Investment Bank

APEC
Asia-Pacific Economic Cooperation

ASEAN
Association of Southeast Asian Nations

ATM
Air traffic management

B10
10% biodiesel blend in diesel

B30
30% biodiesel blend in diesel

B100
100% biodiesel

BAIC
Beijing Automotive Industry Holding Company

BAU
Business-as-usual

BGD
Bangladesh

BTS
Bureau of Transportation Statistics

BRT
Bus rapid transit

CAD
Canadian dollar

CAEP
Committee on Aviation Environmental Protection

CAF
Development Bank of Latin America

CAT
Climate Action Tracker

CCAFS
Climate Change, Agriculture and Food Security

CDM
Clean Development Mechanism

CDP
Carbon Disclosure Project

CNG
Compressed natural gas

COACCH
CO-designing the Assessment of Climate Change Costs

CO_2
Carbon dioxide

CO_{2e}
Carbon dioxide equivalent

COP
Conference of the parties (United Nations Climate Change Conference)

CORSIA
Carbon Offsetting and Reduction Scheme for International Aviation

CPI
Change Partners International

CRC
Costa Rican Colón

CTF
Climate Technology Fund

E-bike
Electric bike

E-scooter
Electric scooter

EBRD
European Bank for Reconstruction and Development

EC
European Commission

ECF
European Cyclists' Federation

ECLAC
United Nations Economic Commissions for Latin America and the Caribbean

ECOWAS
Economic Community of West African States

EDGAR
Emissions Database for Global Atmospheric Research

EEA
European Environmental Agency

EIA
US Energy Information Administration

EIB
European Investment Bank

EPA
Environmental Protection Agency

ESG
Environmental, social, and corporate governance

EU
European Union

EUR
Euro

EV
Electric vehicle

FAME
Faster Adoption and Manufacture of Electric and Hybrid Vehicles

FAME (biodiesel)
Fatty acid methyl esters

FTA
Federal Transit Administration

GAD
Decentralised autonomous government (Gobierno autónomo descentralizado)

G (CO_2)
Grams

GBP
British pound sterling

GCF
Green Climate Fund

GDCI
Global Designing Cities Initiative

GDP
Gross domestic product

GHG
Greenhouse gas

GEF
Global Environment Facility

GFEI
Global Fuel Economy Initiative

GIZ
Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH

Gt
Gigatonnes

GPS
Global positioning system

HAC
High Ambition Coalition

HDV
Heavy-duty vehicle

HEV
Hybrid electric vehicle

HGV
Heavy goods vehicle

Hr
Hour

HVO
Hydrotreated vegetable oil

IATA
International Air Transport Association

ICAO
International Civil Aviation Organization

ICCT
International Council on Clean Transportation

ICE
Internal combustion engine

ICLEI
Local Governments for Sustainability

IDB
Inter-American Development Bank

IEA
International Energy Agency

IFRN
Federal Institute of Rio Grande do Norte (Instituto Federal de Rio Grande do Norte)

IISD
International Institute for Sustainable Development

IKI
International Climate Initiative

IMF
International Monetary Fund

INDC
Intended Nationally Determined Contributions

Incl.
Including

Intl.
International

IMO
International Maritime Organization

IPCC
Intergovernmental Panel on Climate Change

IRENA
International Renewable Energy Agency

IRF
International Road Federation

IsDB
Islamic Development Bank

ITDP
Institute for Transportation and Development Policy

ITF
International Transport Forum

IRF
International Road Federation

JCM
Joint Crediting Mechanism

JI
Joint Implementation

JR
Japan Railway

KCCA
Kampala Capital City Authority

KES
Kenyan Shilling

Kg
Kilogram

Km
Kilometre

kW
Kilowatt

kWh
Kilowatt-hour

L
Litre

Lge
Litres of gasoline-equivalent

LAC
Latin America and the Caribbean

LDV
Light-duty vehicle

LEDS
Low Emissions Development Strategies

LEZ
Low-emissions zone

LNG
Liquefied natural gas

LRT
Light rail transit

LT-LEDS
Long-Term Low Emission Development Strategy

M
Metres

MaaS
Mobility as a Service

Mboe/d
Million barrels of oil equivalent per day

MDB
Multilateral development bank

MJ
Megajoule

MPGCA
Marrakech Partnership for Global Climate Action

Mt
Metric ton

$MtCO_2e$
Metric tonnes of carbon dioxide equivalent

Mtonnes
Megatonnes

N/A
Not available

NACTO
National Association of City Transportation Officials

NAMA
Nationally Appropriate Mitigation Actions

NAP
National Adaptation Plan

NAPA
National Adaptation Programmes of Action

NCCETC
North Carolina Clean Energy Technology Center

NDC
Nationally Determined Contributions

NDF
Nordic Development Fund

NEDC
New European Driving Cycle

NGO
Non-governmental organisation

NUMO
New Urban Mobility Alliance

NUMP
National urban mobility plan

ODF
Official development finance

OECD
Organisation for Economic Co-operation and Development

OEM
Original equipment manufacturer

OICA
Organisation Internationale des Constructeurs d'Automobiles

PBSP
Pacific Blue Shipping Partnership

PHEV
Plug-in hybrid electric vehicle

Pkm
Passenger kilometre

$PM_{2.5}$
Fine particulate matter

ppm
Parts per Million

PPMC
Paris Process on Mobility and Climate

PSI
Private sector involvement

RED
Renewable Energy Directive

REN21
Renewable Energy Policy Network for the 21st Century

RNG
Renewable natural gas

RPI
Rensselaer Polytechnic Institute

RPK
Revenue passenger kilometre

SAATM
Single African Air Transport Market

SIDS
Small island developing states

SDG
UN Sustainable Development Goal

SLOCAT
SLOCAT Partnership on Sustainable, Low Carbon Transport

SMP
Shared mobility principles

SSATP
Africa Transport Policy Programme

SuM4All
Sustainable Mobility for All

SUMC
Shared-Use Mobility Center

SUMP
Sustainable urban mobility plan

SUV
Sport utility vehicle

TEU
Twenty-foot Equivalent Unit

THB
Thai baht

TDA
Transport Decarbonisation Alliance

T&E
Transport & Environment

TOD
Transit-oriented development

TNC
Transport network company

TUMI
Transformative Urban Mobility Initiative

UC
University of California

UEMI
Urban Electric Mobility Initiative

UIC
International Union of Railways

UITP
International Association of Public Transport

UK
United Kingdom

UK PACT
United Kingdom Partnering for Accelerated Climate Transitions

ULEZ
Ultra-low-emission zone

UN-Habitat
United Nations Human Settlements Programme

UN
United Nations

UNCTAD
United Nations Conference on Trade and Development

UNDRR
United Nations Office for Disaster Risk Reduction

UNECOSOC
United Nations Economic and Social Council

UNEP
United Nations Environment Programme

UNESCAP
United Nations Economic and Social Commission for Asia and the Pacific

UNESCWA
United Nations Economic and Social Commission for Western Asia

UNFCCC
United Nations Framework Convention on Climate Change

USA
United States of America

USD
United States Dollar

VAT
Value-added tax

VNR
Voluntary National Review

VOC
Volatile organic compounds

WEF
World Economic Forum

WGST
Working group on sustainable transport

WHO
World Health Organization

WLTP
Worldwide harmonised light vehicles test procedure

WRI
World Resources Institute

WTW
Well-to-wheel

WWF
World Wildlife Fund

ZEV
Zero-emission vehicle

ZEZ
Zero-emission zone

Executive Summary for Decision Makers

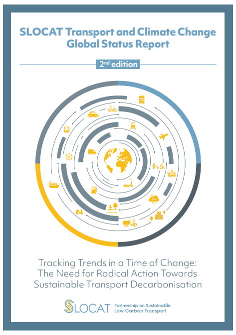
Tracking Trends in a Time of Change: The Need for Radical Action Towards Sustainable Transport Decarbonisation

SLOCAT Transport and Climate Change Global Status Report – 2nd edition

The SLOCAT Transport and Climate Change Global Status Report – 2nd edition tells the global and regional stories of where we are and where we need to get to urgently on climate action in the transport sector. With contributions from more than 150 world-class experts and organisations, it is a one-stop shop for the latest available data, targets and developments on transport demand, emissions, policies and measures – showing that it is imperative to accelerate radical action for sustainable transport and climate in this time of unprecedented global change.

This Executive Summary summarises the trends and conclusions of the report and highlights threats, opportunities and uncertainties for climate action in the transport sector. The Summary describes escalating transport demand and emission trends through 2019 as well as the temporary disruption to these trends following the onset of the COVID-19 pandemic in 2020. The Summary underscores the imperative of radical action to put sustainable transport decarbonisation on the right track.

Please see the full *Transport and Climate Change Global Status Report – 2nd edition* for a more detailed analysis of the topics introduced in this Summary, and the "About the Report" section for more on the development of this report.



What is at stake for climate action in the transport sector in a post-pandemic world?

The years 2019 and 2020 have left an indelible mark on human and planetary history. They were two of the three hottest years ever recorded, with atmospheric levels of carbon dioxide (CO_2) reaching their highest point in more than 800,000 years in March 2019 and rising nearly 50% over pre-industrial levels.[1] Within this context, a global pandemic was declared in March 2020, resulting in extensive loss of life and economic hardship that increased social divides both within and between countries. The pandemic has dominated policy and funding discussions, delaying urgent global action on a growing climate crisis and widening inequalities that the United Nations 2030 Agenda on Sustainable Development seeks to address.

The COVID-19 pandemic has transformed transport and mobility patterns in every part of the world. The health crisis brought transport demand to a temporary standstill in much of the world due to lockdowns and distancing measures. While a significant population shifted to work from home, many of those who were required to commute faced reduced transport options. Demand for public transport and air travel plunged, while walking and cycling rates surged on reconfigured streets. Global maritime trade dropped around 4% in 2020, with about 12% of the container fleet idled at the peak of initial lockdowns.[2] These trends caused oil demand to plummet temporarily, brought transport emissions to a near halt, and cleared some urban skies for the first time in memory. While global CO_2 emissions dropped an estimated 5% overall in 2020, emissions from transport fell nearly 20%, more than any other sector.[3]

Despite the pandemic's impact on transport demand, transport emissions are still not on the right track. The transport sector was the fastest growing fossil fuel combustion sector worldwide from 2010 to 2019, with sectoral emissions rising more than 17% during this period.[4] In absolute terms, transport was the second-highest emitting sector (along with industrial emissions) in 2019.[5] Increases in road, aviation and shipping activity (both passenger and freight) were leading factors behind global growth in transport CO_2 emissions from 2000 to 2019.[6]

In order to meet Paris Agreement targets and to keep the rise in the average global temperature below 1.5 degrees Celsius (°C), transport emissions will need to drop two-thirds below 2019

levels (or by 8 gigatonnes (Gt) of CO_2) by 2050.[7] Therefore, the temporary reduction in transport emissions experienced during the pandemic in 2020 is roughly equal to the reductions needed *annually* to meet 2050 targets and to close the transport emissions gap.[8] However, as of May 2021, only 15% of the 54 second-generation Nationally Determined Contributions submitted by countries under the framework of the Paris Agreement included a specific target for reducing transport emissions, showing limited progress towards meeting key goals.[9]

The pandemic has underscored the need for policy makers to take bold steps to address catastrophic impacts to transport and mobility systems. However, while some leaders and practitioners – often at the local level – have demonstrated willingness to take short-term action on mobility to increase access and well-being (e.g., by reallocating road space and supporting public transport), others have hesitated to take bold steps. These mixed responses have catalysed renewed commitments from policy makers and activists to stabilise the climate while increasing equity, inclusion and social justice, through climate strikes and other actions.

Pandemic recovery packages so far have proven a mixed bag for climate action in the transport sector. While a number of national recovery packages have firmly embraced a goal to "build back better" (e.g., by promoting electric vehicles or shifting from air travel to rail), many have upheld the status quo (e.g., by backtracking on fossil fuel subsidy reform or providing unconditional airline bailouts) rather than adopting green and equitable recovery strategies for transport systems. The pandemic has also led to severe budget cuts in some national aid programmes, threatening to widen social and economic divides between the Global North and South and to push meaningful climate action even further into the future (*see Section 4 on Financing Climate Action in Transport*).[10]

In a time of global uncertainty, we face three divergent scenarios for climate action in the transport sector:

Scenario 1

Abandon meaningful climate action in the transport sector and follow a ***business-as-usual*** approach to mobility patterns and investment trends (projected to yield a scenario of a 4+ °C increase);

Scenario 2

Continue ***incremental progress*** on transport mitigation and increase the focus on adaptation, despite limited progress over the past 40 years amidst economic booms and rapid growth (3-4 °C scenario);

Scenario 3

Accelerate ***radical action*** on transport behaviour and investments, while prioritising the triple impacts of transport decarbonisation, job creation and equitable accessibility (1.5-2 °C scenario).[11]

Only radical action will contribute to meeting ambitious Paris Agreement targets and achieving the Sustainable Development Goals. Only radical action will guarantee the balanced *Avoid-Shift-Improve* approach that is needed: to ***Avoid*** unnecessary motorised trips based on proximity and accessibility; ***Shift*** to less carbon-intensive transport modes; and ***Improve*** vehicle design, energy efficiency and clean energy sources (*see Section 1.1 on Global Transport and Climate Change*). Only radical action will ensure that sustainable, low carbon transport and mobility is a vital component of an equitable, healthy, green and resilient pandemic recovery.[12]

Threats, opportunities and uncertainties for transport climate action

As the world continues to take initial steps to address a pandemic that is still well under way, climate action in the transport sector is faced with a number of threats, opportunities and uncertainties.

Threats

Transport CO_2 emission trends – in most countries and regions – are not moving in the right direction. In 2019, transport was the top or second-highest CO_2-emitting sector in more than three-quarters of the world's countries, and from 2010 to 2019, total transport emissions decreased in only a fifth of countries.[13] High-income countries contributed half of transport emissions during this time, with per capita emissions nearly 15 times above 2050 Paris Agreement targets.[14] Rising transport emissions have been driven by rising automobile use and plummeting public transport ridership due to the pandemic. (See Section 1: Global and Regional Overview.)

Transport emission trends have progressed unevenly across regions, sectors and income groups. Europe was the only world region that stabilised its transport CO_2 emissions over the past decade, while transport emissions surged more than 20% in other regions.[15] International aviation and shipping grew 37% and 10%, respectively, over the decade, yet these sources remain uncounted in most national emission inventories (outside of the European Union, EU).[16] Member countries of the Organisation for Economic Co-operation and Development (OECD) and non-OECD countries currently contribute roughly equal shares of transport CO_2 emissions, reflecting the approximate split of global GDP.[17] However, between 2010 and 2019, transport CO_2 emissions grew 4% in OECD member countries and 34% in non-OECD countries, suggesting a growing divergence.[18] (*See Section 2 on Transport Demand, Emissions and Targets.*)

In the face of this growth, the ambition to mitigate transport emissions in countries' Nationally Determined Contributions (NDCs) is falling short. The United Nations Framework Convention on Climate Change extended the timeline for countries to submit second-generation NDCs until 9 to 12 months before the 2021 UN Climate Change Conference (COP26, postponed to November 2021).[19] However, the sector is not on track to meet emission reduction targets for 2050.

Under a business-as-usual pathway, transport CO_2 emissions could increase from 8 Gt in 2019 to 14.5 Gt in 2050.[20] Yet, as of May 2021, only 15% of NDC submissions (representing 7 countries and the EU-27, out of 54 total submissions) had set transport mitigation targets in revised NDCs.[21] Long-term low emissions development strategies (LT-LEDS) focus strongly on *Improve* measures (more than half of all measures), whereas *Shift* and *Avoid* measures (7% each) are less well-represented.[22] (*See Section 3 on Responses to Address Climate Change in the Transport Sector*.)

Accelerating action on transport sector resilience to climate change impacts is falling short in country plans. Although adaptation strategies are a required element of NDCs, only 28% of submissions (15 total) as of May 2021 included specific transport adaptation measures.[23] Most National Adaptation Plans (NAPs) and National Adaptation Programmes of Action (NAPAs) offer few details on transport measures, and only 50% of submissions (11 total) since 2015 have specifically included them.[24] With no new NAPAs submitted in the last four years, the adaptation gap in least-developed countries is growing wider.

Financing has not kept pace with growing needs for sustainable, low carbon transport in most cities and countries. Climate-focused transport spending has been overshadowed by "brown investments" in highways and other carbon-intensive transport infrastructure, with two-thirds of infrastructure investments (totalling USD 586 billion per year in the 50 largest economies) in 2015 going to road transport.[25] Fossil fuel subsidies continue to outpace renewable energy spending in transport budgets by orders of magnitude. Similarly, many COVID-19 recovery packages and bailout programmes have invested more heavily in fossil fuel-related companies than in clean energy, a trend that is likely to drive transport emissions upward.[26] (*See Section 4 on Financing Climate Action in Transport.*)

Electric mobility is not a silver bullet for transport decarbonisation and requires a holistic notion of sustainable mobility. Most policy attention is focused on private vehicles, and much current dialogue fails to consider realities in the Global South (including the widespread import of used vehicles).[27] Electric vehicles accounted for around 25% of motorised two- and three-wheelers and 18% of public buses, but only 1% of private passenger cars in 2020.[28] Electric mobility has limited potential in aviation, shipping and heavy-duty trucking, and it will only fully decarbonise transport if it is powered with renewable energy. Electric mobility requires differentiated strategies by region and a greater focus on shared fleets (including electric buses, mini-buses, and two- and three-wheelers); otherwise, its expansion will simply lead to cleaner congestion. (*See Section 3.8 on Electric Mobility.*)

Opportunities

Commitments to phase out internal combustion engines are driving more sustainable emission trajectories. Low carbon transport measures are becoming increasingly efficient and leading to more positive trends than were previously projected. Whereas in 2017 the emission gap between the projected business-as-usual and low carbon transport emission levels was estimated to reach 16 gigatonnes of CO_2 by 2050, newer estimates (based on studies up to 2019) show a smaller gap of around 12 gigatonnes.[29]

Targets for phasing out the use of internal combustion engines (and for phasing in electric vehicles) are accelerating the pace of transport decarbonisation. So far, 19 countries, at least 11 cities and regions, and a number of automobile manufacturers have announced phase-out commitments.[30] Accelerated uptake of electric mobility has been coupled with halting progress towards divestment from fossil fuels – including recent rulings against Chevron, Exxon and Royal Dutch Shell for dragging their feet on climate action – and some oil companies endorsing carbon pricing.[31]

Technological advances are reshaping the landscape, as plunging battery prices are making electric vehicles more affordable for many users, especially in the Global South.[32] More-affordable batteries are facilitating the rapid scale-up of electric bicycles in Europe, North America and South Asia, and of electric bus fleets in leading e-bus countries such as China, Chile and Colombia.[33] While tested solutions are plentiful, there is a need for more dedicated champions and more sustained financing to make them the rule rather than the exception.

Established emission reduction measures are complementing emerging technological advances. Increasing fuel economy and quality standards for light- and heavy-duty vehicles continues apace, with 30 countries actively improving fuel economy-related policies since 2018, and nearly 80% of all light-duty vehicles sold as of 2017 subject to such regulations.[34] Limiting imports of polluting used vehicles in the Global South is progressing, as reflected in the recent commitments of 18 countries in Africa, Asia and Latin America.[35]

Many low-carbon transport measures can be implemented quickly and inexpensively with sufficient political will. Many short-term policy measures have been implemented during the pandemic, which saw "tactical urbanism" measures – such as the deployment of open streets in more than 194 cities globally as of October 2020 – that allow millions of people to reimagine their daily mobility needs.[36] Active transport (walking and cycling) has increased in many cities, and Europe quickly built 1,500 kilometres of bicycle lanes, allocating EUR 1.7 billion (USD 2 billion) for cycling promotion.[37]

Uncertainties

A number of uncertainties – many of them heightened by the pandemic – have the potential to enhance, accelerate or reverse the positive impacts of climate action in the transport sector. Anticipating and addressing such uncertainties, while capitalising on emerging opportunities and addressing looming threats, can maximise positive outcomes for sustainable, low carbon transport. Important questions remain in a diverse range of issue areas, as outlined below.

Sustainable mobility in cities

- Will public transport systems struggle due to underinvestment, dwindling revenues and remote work? Or will they recover ridership in the short term and regain public trust?
- Will tactical urbanism and improved spaces for walking and cycling become default strategies? Or will car traffic surge back on reconfigured streets along with growing economic activity?
- Will ride-hailing continue to revolutionise urban and suburban mobility markets while increasing traffic? Or will these services be deployed more efficiently to support accessible, low-carbon transport?

Inter-urban and international transport and mobility

- Will global supply chains be diminished by the pandemic, with manufacturing relocating to regional and national centres? Or will supply chains innovate and adapt to current challenges?
- Will aviation demand trends be permanently reshaped by behavioural change and reorientation of economic activity? Or will future travel and tourism adopt new patterns and protocols?
- Will land-based freight transport shift more broadly from road to rail and inland waterways (e.g., with fossil fuel phase-outs)? Or will high-carbon investments and operations remain the rule?

Effects of pandemic recovery responses

- Will recovery packages, the largest historical global mobilisation of public funds, yield unintended consequences? Or will there be accountability in how public funds are deployed in practice?
- Will massive post-pandemic government debt mean less money for sustainable, low carbon transport in the future? Or will recovery packages accelerate an irreversible transformation to sustainable, low carbon transport through innovative measures (e.g., shifting from air to rail travel)?

Anticipating and monitoring such uncertainties, while capitalising on emerging opportunities and addressing looming threats, will maximise positive outcomes for climate action in the transport sector.

Sustainable transport decarbonisation trends in thematic areas, from A to Z

Following on the threats, opportunities and uncertainties covered above, we investigate here a number of promising and challenging trends over the past two years – in areas from Aviation to Zero-emission vehicles – that will establish the direction of sustainable, low carbon transport for years to come. (*Note: these are selected highlights from the full* SLOCAT Transport and Climate Change Global Status Report – 2nd edition*; see cross-referenced sections for more detail.*)

A

Access to sustainable transport is critical for climate action; yet in many cities, more than half of residents lack access to opportunities within 60 minutes' travel time.[38] For example, in **Mexico City** and **Johannesburg**, South Africa, 56% and 42% of urbanites, respectively, are under-served in their ability to reach job locations.[39] Much of the world's rural population lacks adequate transport access: in rural sub-Saharan Africa, 65% of people live more than 2 kilometres from a weatherised road, stranding many from life-saving healthcare and market opportunities that improve farming productivity and earnings.[40] Increasing access for urban and rural residents requires improving conditions for walking and bicycling, developing better inter-city bus or other shared transport routes, and creating proximity-based transport planning approaches (e.g., 15-minute cities) in cities across both the Global North and South.

Aviation has received insufficient climate policy attention, despite a nearly 40% increase in emissions between 2010 and 2019.[41] Passenger and freight aviation were responsible for around 10% of global transport CO_2 emissions in 2018.[42] The aviation sector is challenging to decarbonise due to high energy requirements, constraints to the scale-up of biofuels and challenges with electrification. The ambition of international bodies fall well short of Paris Agreement targets, and the International Civil Aviation Organization's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) has set a weak baseline, which at best would only stall emission growth, which is projected to increase 290% by 2050.[43] While industry commitments to reducing emissions are a step in the right direction, meaningful impacts are decades off.[44] Aviation provisions in pandemic recovery packages generally prioritise economic health over environmental well-being, delaying climate action further. (See Section 3.10 on Aviation.)

B

Behavioural change is an essential element of climate action, and policy makers will need to enforce safety measures in public transport to regain trust. During the pandemic, many essential workers and those with low-income jobs (especially in the informal sector) have not had the option to shift to teleworking, and many have had to maintain existing travel patterns. Evidence indicates that people have changed their attitudes towards transport, and the current scenario favours the development of new and sustainable social norms (e.g., the public bike-sharing system in **Seoul**, Republic of Korea recorded more than 2.7 million rides during June 2020, compared to 1.2 million rides in June 2019).[45] Trying new ways of travelling during the pandemic and having positive experiences may trigger new behaviours in the future. New policies and investments in infrastructure and enforcing safety measures in public transport will help increase citizens' trust in less carbon-intensive transport options and will nudge behaviours. (See Focus Feature: Impact of COVID-19 on Travel Behaviour.)

C

Cycling is a near zero-emission transport mode that has gained momentum during the pandemic, yet further investment is needed to maintain increased demand.[46] Cycling activity and investment have surged during the COVID-19 pandemic (e.g., the cycling mode share in Bogotá, Colombia increased from 23% to 37% pre- and post-pandemic, and more than 2,300 kilometres of new cycling lanes were announced in 37 of the 94 biggest European cities as of December 2020).[47] Electric bicycle sales increased 120% globally in 2019 and surpassed a 50% market share in the Netherlands.[48] More than 150 million e-bikes were in use in 2019, a total that is projected to double by 2023.[49] Despite positive trends, cycling's share of transport trips remains low in most cities and regions. Optimising cycling's potential to mitigate transport emissions will require investing in bike lanes and parking, planning and institutional capacity, and increasing the affordability of e-bikes across regions. (See Section 3.3 on Walking and Cycling.)

F

Freight transport accounts for around 40% of transport emissions globally, yet green freight measures are not proportionally reflected among policy priorities.[50] Road freight accounts for a large share of freight impacts (as heavy-duty trucking is difficult to decarbonise), although some multilateral solutions are emerging.[51] Rail, maritime and inland waterway transport can help offset road freight impacts, but investment trends are still insufficient to rein in freight emissions, which are projected to nearly triple between 2015 and 2050.[52] Electrified and human-powered two- and three-wheelers are reducing urban freight emissions, and corporate actions are driving low-carbon solutions that leapfrog local and national policies.[53] The COVID-19 pandemic increased the demand for home deliveries, with some countries seeing a more than 20% increase in e-commerce between 2019 and 2020.[54] At the same time, the disruption of global supply chains led to a sharp decline in seaborne trade and has challenged equitable access to goods and services.[55] While "green" logistics strategies have emerged, more must be done to stem rising freight emissions (e.g., investments in freight rail and inland waterways, emission standards for heavy-duty vehicles). (See Section 3.4 on Urban Passenger and Freight Transport, and Section 3.11 on Shipping.)

G

Gender-sensitive sustainable mobility planning is critical to increasing access to essential opportunities for girls and women, while advancing transport decarbonisation.[56] Limited access to transport in developing countries is the greatest obstacle to women's participation in the labour market, reducing their probability of participation by 15.5%.[57] Recognising the crucial role of sustainable infrastructure in advancing gender equality, the 2019 session of the United Nations Commission on the Status of Women recommended the creation of inclusive transport.[58] To capitalise on the untapped potential to transform gender inequalities, mobility and urban planning must take into account the different needs of girls, women, boys and men (e.g., in many cities, women take public transport and walk with greater frequency than men).[59] This also requires removing barriers to girls' and women's access to sustainable mobility (e.g., by establishing safe physical distance on public transport).

I

Inter-city passenger transport demand has been steady in recent years, driven largely by fossil fuel subsidies and car-friendly measures in pandemic recovery packages. Inter-city passenger transport accounts for roughly a third of total transport emissions due to longer distances and fewer public transport options.[60] Demand has surged due in part to rising car ownership and use in both the Global North and South. At the same time, inter-city railway development has been concentrated in only a handful of countries (e.g., half of the global high-speed rail network is in China).[61] Rural roadways are a lifeline for roughly 45% of the world's population, yet they account for a disproportionate share of road crashes, with inefficient and unsafe vehicles travelling on under-maintained infrastructure (e.g., in Africa, road fatalities are nearly 50% higher than the global average).[62] Reducing emissions and casualties from inter-city passenger transport will require shifting demand to lower-carbon rail and bus travel. (See Section 3.5 on Passenger and Freight Railways.)

M

Maritime shipping emissions could be reduced more than 75% by 2050 by adopting sustainable biofuels, better utilising capacity and optimising vessel speeds.[63] Shipping accounted for more than 80% of trade by volume and 11% of global CO_2 emissions in 2019.[64] International maritime transport is challenging to decarbonise due to high initial investment costs and the long life spans of vessels.[65] Despite limited policy action, the shipping industry appears to have attained its 2030 target for improving carbon intensity, even before the onset of the pandemic; however, the industry is far from meeting its 2050 emission reduction target (which is rated "insufficient").[66] Progress in reducing emissionswill require stronger policy support and increased public-private co-operation. (See Section 3.11 on Shipping.)

P

Public transport is a key strategy for decarbonisation, yet the world's public transport systems require far greater investment to recover from the pandemic-driven loss in ridership. Although metros, trams and bus systems are a backbone of low carbon transport in many cities, they have not gained ground over private vehicle use, and investment in and repair of public transport systems continues to lag in many cities. Urban rail is seven times more energy efficient per passenger-kilometre than urban car trips, and electric city buses are up to ten times more efficient.[67] Urban rail development has grown steadily since 2010, with numerous new systems emerging in the Global South, and systems expanding in many countries, led by Asia.[68] However, bus rapid transit has fallen short of its initial promise, with only nine cities adding new systems globally between 2019 and 2020.[69] **Paratransit** (also called "informal transport") is a critical service in the Global South, with minibuses and motorcycle taxis carrying 80% of riders in some cities.[70] Decarbonising public transport requires increasing investments to address pandemic ridership loss, generating new funding streams, increasing electrification and properly pricing high-carbon transport modes. (See Section 3.4 on Urban Passenger and Freight Transport.)

Renewable energy is a crucial component of transport decarbonisation, yet renewables accounted for less than 4% of energy use in the sector in 2018.[71] Key conduits for greater integration of renewable energy are railways, which account for the highest share of renewables in the sector, and two, three- and four-wheeled electric vehicles.[72] However, policies to scale up vehicle electrification and renewable energy remain largely unconnected. Whereas aviation faces obstacles to broad integration of renewables, shipping holds greater potential through the use of hydrogen and ammonia fuels generated from surplus wind and solar energy.[73] Moving the needle on renewables for transport requires reducing the cost of advanced fuels; strengthening policy and technical linkages between electric vehicle development and renewable energy generation; and using electric vehicles as energy storage devices though consumer and utility incentives. (See Section 3.9 on Renewable Energy in Transport.)

Shared mobility services will need to be more integrated and electrified to achieve largely untapped decarbonisation potential. Shared mobility services (e.g., shared two-, three- and four-wheelers, and ride-hailing services) have expanded globally following their initial roll-out in Asia, Europe and North America. In the past decade, car-sharing membership in Asia increased nearly 20 times (to more than 22 million members); bike sharing systems in Europe increased four-fold (to around 1,000 systems); and Africa launched more than 180 app-based motorcycle services.[74] The COVID-19 pandemic has reshaped the shared mobility landscape, with demand for shared bikes, e-bikes and scooters soaring, and with some ride-hailing companies shifting from passenger transport to food delivery due to falling demand.[75] Electric scooter and bike-sharing services have helped to reduce emissions by shifting trips from polluting modes, whereas ride-hailing services increase the vehicle-kilometres travelled and result in more emissions.[76] To optimise the potential for shared mobility to reduce emissions, these services need to be made available in poorer and more remote neighborhoods and to bridge the needs of public and private actors. (See Section 3.6 on Shared Mobility Services.)

Sustainable urban mobility plans (SUMPs) offer significant low carbon benefits but require more substantial funding to translate plans to action. SUMPs have expanded as a strategy to meet urban mobility needs through a collaboration of public and private sector actors, citizens and other key stakeholders.[77] While SUMPs focus on mobility in cities, national urban mobility policies (NUMPs) provide enabling frameworks for local-level planning. During 2019 and 2020, the number of SUMPs and NUMPs increased 6% globally, and growth has been particularly strong in the Global South, with Latin America accounting for 16% of the more than 1,600 global SUMPs as of 2020.[78] SUMPs are strengthened by measures aimed at transport demand management, such as low-emission zones, which have surged alongside demand for improved urban air quality. As SUMPs reach critical mass in the Global South, peer countries can emulate successful policies and learn from key lessons. (See Section 3.2 on Sustainable Urban Mobility Planning and Transport Demand Management.)

Walking is the dominant (zero-emission) transport mode in much of the Global South, yet a significant investment gap remains between walking and motorised transport infrastructure.[79] Walking accounts for 70% of trips globally and is a component of nearly every trip taken.[80] Walking and cycling can substitute for more than 40% of short car trips; this could save nearly 5% of CO_2 emissions from car travel on top of the existing estimated 5% of "avoided" emissions from walking and cycling trips.[81] Nevertheless, walking shares are declining in many parts of the world, and 21% of road traffic crashes involve pedestrians.[82] In response to the COVID-19 pandemic, nearly 200 cities globally have created pedestrian-only spaces and/or protected bike lanes.[83] It remains to be seen how many temporary measures will be translated to long-term policies and infrastructure investments. (See Section 3.3 on Walking and Cycling.)

Zero-emission vehicles (ZEVs) have gained momentum globally; however, maximising their benefits will require increasing affordability and mobilising dedicated champions. ZEVs (e.g., electric vehicles, fuel cell electric vehicles, solar vehicles) are often misperceived as a silver bullet for transport decarbonisation. Electric vehicles produce around 20% fewer CO_2 emissions than internal combustion engines even when the electricity for charging is generated from fossil fuels.[84] In 2020, sales of plug-in hybrid and electric vehicles increased 70% to reach 4.6% of total new vehicle sales, and roughly 350 million electric vehicles made up 25% of the global motorised two- and three-wheeler stock.[85] However, ZEVs remain a small fraction of global fleets, and sales of oversized vehicles (particularly sport utility vehicles, or SUVs) outweigh the emission benefits of ZEVs. Increased fuel economy standards are a crucial complement to ZEVs, and restrictions on the import of used vehicles are reducing emissions and improving air quality in Asia, Africa and Latin America.[86] Although electric vehicles are more efficient than conventional vehicles, they offer far greater potential for reducing emissions if powered by clean, renewable energy. (See Section 3.7 on Fuel Economy, and Section 3.8 on Electric Mobility.)

Where do we go from here to achieve more equitable transport trajectories?

This A-to-Z overview of trends in selected thematic areas raises several key questions: How can we accelerate climate action to move transport emissions in the right direction? Can we get there in time to prevent the most severe climate impacts? And, amidst the lingering pandemic, are we building back better? So far, these questions have all been met with a resounding "No… or at least not yet."[87]

Radical action is needed to deliver on Paris Agreement targets and Sustainable Development Goals to achieve an equitable 1.5 °C world and to adopt more sustainable development pathways. However, it will take concerted efforts and dedicated resources to stabilise accelerating climate change. To keep global temperature rise below 1.5 °C, annual transport CO_2 emissions must drop to 2-3 Gt, which means reducing per capita transport emissions from 0.88 tonnes in 2019 to 0.2 tonnes in 2050.[88] This will require strong policy support, financial incentives and more equitable mobility options worldwide.

Radical action will necessitate taking unprecedented risks and creating positive disruptions. It is critical to anticipate and embrace short-term turbulence to ensure a more just transition in the long term. We see four primary building blocks to harness momentum on climate action for transport and to enable the radical action needed to decarbonise the sector:

Tackling major threats

Reversing ongoing threats to climate action in the transport sector will require raising the ambition on mitigation and adaptation in NDCs and LT-LEDS and delivering on that ambition. However, while 13 of the 54 second-generation NDCs submitted as of May 2021 set higher targets for reducing economy-wide emissions, current pledges would still lead to warming of 2.6 °C by 2100, far exceeding Paris Agreement targets.[89] Aligning NDC and LT-LEDS processes with national transport policies and investment strategies remains a critical need.[90]

- Raising mitigation ambition will require demonstrating that making systemic changes to reduce transport emissions can enhance rather than diminish quality of life – i.e., sustainable urban mobility plans can lead to economic prosperity, personal well-being and decoupling of transport emissions.
- Increasing attention to adaptation will require leveraging the power of reverse linkages (i.e., South-North exchanges), as many successful adaptation solutions are emerging under the most vulnerable conditions (e.g., more resilient pavements, distributed solar energy to avoid electric grid outages).
- Reversing emission trends will require capitalising on proven solutions. In many cases, it will simply require doing less of what has not been working (e.g., phasing out fossil fuel subsidies) and more of what has been working (e.g., improving fuel economy standards and walking/cycling infrastructure).

Expanding and scaling up opportunities

Scaling up opportunities towards lower transport emission trajectories will require significant financing. Globally, achieving low carbon transport pathways will require investments of USD 2.7 trillion per year between 2016 and 2030 (or USD 40.5 trillion in total), with 60-70% of these investments in emerging economies.[91] Achieving this level of investment necessitates leveraging private capital as well as support from high-income countries (through direct assistance) and multilateral development banks (through funding frameworks aligned to the Paris Agreement).

- Leveraging COVID-19 recovery packages towards green and equitable transport financing will require building on successful trends during the pandemic (e.g., tactical urbanism measures) and ensuring that positive changes become permanent (e.g., less congestion, improved urban air quality).
- Expanding opportunities for sustainable, low carbon transport will require adopting measures that support the Sustainable Development Goals, such as decent work and economic prosperity, and affordable and clean energy (e.g., electric freight vehicles powered by small-scale renewables).
- Disseminating proven low carbon transport solutions that pay off quickly on social, economic and environmental dimensions (e.g., limiting passenger and freight vehicle imports to reduce operating costs and improve air quality) will require expanding capacity building and education programmes.
- Filling funding gaps will require shifting resources from less efficient to more efficient transport measures that balance incentives and disincentives and drive substantive behaviour change (e.g., expanded road and parking pricing, pay-as-you-drive insurance, incentives for car-free living).
- Expanding lending criteria compatible with Paris Agreement targets will require broader commitments from international financial institutions to incorporate fossil-free financing as a core business practice (e.g., European Investment Bank alignment of transport lending criteria with 1.5 °C targets).

Responding to and managing uncertainties

Pandemic recovery packages, which exceeded USD 12 trillion as of October 2020, dwarf existing low carbon investments. A fraction of the investment in these packages could put the world on track to decarbonisation by 2050.[92] Building a more stable future for transport systems and societies requires learning and applying lessons from the pandemic involving policy responses and funding mobilisation and increasing investments in low carbon transport to address the umbrella issue of climate change.

- Building more resilient societies will require building transport systems that can adapt to rapid climate impacts and be resilient to shocks, in order to maintain social, physical and mental health (e.g., active and shared mobility systems) under all environmental conditions.
- Recovering from the pandemic and building resilience will require strengthening public transport as a backbone of equitable mobility systems (e.g., for essential workers) and leveraging sustainable freight railways as a critical means of conveyance for personnel and goods (e.g., medical supplies).
- Navigating changing economic conditions will require maintaining accessible and affordable transport systems that facilitate and maintain economic growth and drive more predictable investment patterns (e.g., reduced congestion, increased economic activity in commercial centres).

Strengthening and expanding the transport dialogue and community

Establishing strategic collaborations beyond the transport community can help deliver on the Paris Agreement and Sustainable Development Goals. An analysis of personal consumption options has identified low carbon transport choices as the most effective area for reducing emissions, well above shifts in food, housing and other sectors.[93] Thus, stakeholders from across many sectors have a common interest in supporting efforts to transform transport and mobility systems, and in turn the social and economic systems they underlie.

- Enhancing the transport community will require strengthening linkages among action by multilateral country groupings (e.g., large and small polluters, the Global North and South), small non-governmental organisations and large corporations (e.g., bringing Google, Apple, Amazon and the transport industry to the same table) and leveraging emerging financing sources (e.g., Bezos Earth Fund supporting electric school bus fleets).
- Broadening the transport community will require engaging additional stakeholders in energy (e.g., planning renewable electricity generation in concert with ZEV demand), the just transition (e.g., enabling cycling jobs that benefit local economies and offer a variety of jobs for a skilled workforce) and social services (e.g., ensuring equitable access to low carbon transport for all ages, genders and abilities).[94]
- Strengthening the transport community will require demonstrating that radical action can benefit all parties at some level. For instance, ZEV roll-out can benefit producers and consumers (e.g., in manufacturing efficiencies combined with purchase incentives) and government and utilities (e.g., in improved healthcare outcomes combined with energy storage to reduce infrastructure costs).

These building blocks demonstrate that radical action in the transport sector is both an imperative and a possibility. Radical action means empowering both large and small carbon emitters to collaborate in shared solutions and to move beyond more calls for action on transport and climate change. It means moving on to scaling up and accelerating actual on-the-ground actions, which translate to positive impacts for access and mobility that help bridge divides among global regions and income groupings.

Through data-driven analysis, the *SLOCAT Transport and Climate Change Global Status Report – 2nd edition* demonstrates that rising transport demand and emission trends are avoidable and not inevitable. While 2019 and 2020 have revealed substantive threats to the world in general and to the transport sector in particular, the report shows that these years set the stage to transform a time of uncertainty into a moment of opportunity. Capitalising on this opportunity will create a lasting positive transformation of transport and mobility for the benefit of the climate, people and the planet.

Global Overview

1

This section provides an overview of global progress towards decarbonising transport and examines the six major world regions through an assessment of overall transport demand, emissions and policy measures.

1.1

Global Transport and Climate Change

As global emissions from the transport sector continue to rise, gaining a better understanding of the specific sources of these emissions, and how to address them, is critical. Which sub-sectors, regions and actions are leading to the increase in emissions? And where is progress being made towards decarbonisation? This section highlights global transport demand and emission trends, comparing them broadly across regions and framing the policy responses through the *"Avoid-Shift-Improve"* framework. The subsequent section dives deeper into the demand, emissions and policies of each region. *(For detailed information by transport sub-sector, see Section 2 of this report.)*

Key findings

Demand trends

- Global passenger transport demand remained at similar levels between 2015 and 2017. Road transport accounted for 78% of this demand in 2017.
- More goods than ever before are being transported on trucks as freight activity has continued to grow, surpassing 120 trillion tonne-kilometres in 2017.

Emission trends

- Increases in road vehicles (both passenger and freight), aviation and shipping were the leading factors behind the global growth in transport carbon dioxide (CO_2) emissions between 2000 and 2018.
- Transport accounted for 14% of total global greenhouse gas emissions in 2018.
- Asia experienced the highest increase in transport CO_2 emissions among world regions from 2010 to 2019, at 41%, while Europe's emissions fell 2% during this period.
- International aviation and shipping emissions both recorded double-digit growth between 2010 and 2019.
- Between 2010 and 2019, annual growth in gross domestic product (GDP) averaged 2.9%, while transport CO_2 emissions increased only 2.0%.

Policy measures

- Growing evidence shows that Avoid and Shift strategies can account for 40-60% of transport emission reductions, at lower costs than Improve strategies.
- Countries' updated Nationally Determined Contributions (NDCs) under the Paris Agreement continue to focus strongly on Improve measures, which represent 52% of all measures, whereas Shift measures account for 38% and Avoid measures for only 10%.

Impacts of the COVID-19 pandemic

- In total, transport emissions declined by 1.5 gigatonnes of CO_2 in 2020.
- For the transport sector, CO_2 emissions in 2020 fell 19.4% below 2019 levels, with emissions dropping 56.4% in international aviation, 31.9% in domestic aviation, 24.8% in international shipping and 14.6% in ground transport (road and railways).
- Sales of new vehicles dropped 14.5% below 2019 levels in 2020.

Overview

The transport sector contributes a growing share of the world's greenhouse gas emissions. During the period from 2010 to 2019, it was the fastest growing combustion (fossil fuel-burning) sector globally. In 2019, transport was the second largest source of CO_2 emissions after the power sector (on par with "other industrial combustion" for manufacturing and fuel production).[1] Transport was responsible for 30% of global final energy demand and for 23% of global direct CO_2 emissions from the energy sector that year.[2]

In 2020, the worldwide impacts of the COVID-19 pandemic reduced global energy demand by a projected 4%, and total global CO_2 emissions fell an estimated 5.4% (with 1.9 billion fewer tonnes of CO_2 released than in 2019).[3] CO_2 emissions from transport plunged 19% for the year, due mainly to rapid emission reductions during the early months of the pandemic; overall, international aviation emissions were down 56%, international shipping down 25%, and ground transport down nearly 15% in 2020, compared to 2019.[4] *(For more on the impacts of COVID-19, see Box 1 in this section.)*

Demand trends

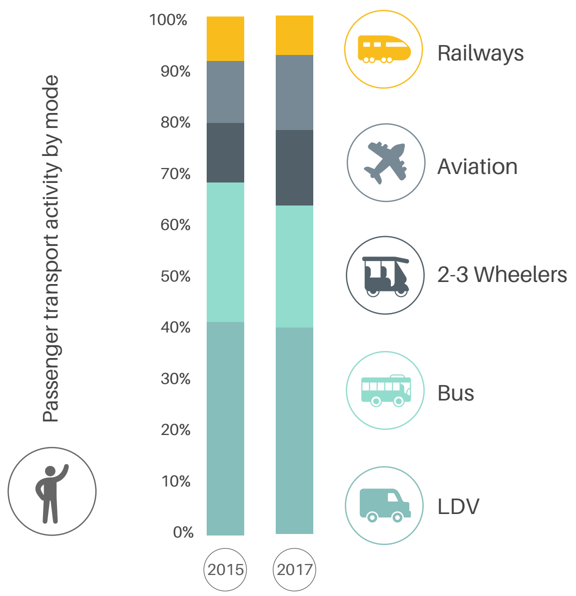
Road transport (both passenger and freight) accounts for the largest portion of global transport, and its growth is closely related to trends in new vehicle purchases. Sales of new passenger cars (road motor vehicles other than motorcycles) and commercial vehicles (light trucks, heavy trucks and buses) continued to increase up to 2017, with a record 95 million vehicles sold that year.[5] Sales then declined over the subsequent two years, to 91 million new vehicles sold in 2019.[6]

Growth in commercial vehicle sales is driven mainly by the demand for road freight transport.[7] In 2019, more than 26 million new commercial vehicles were sold, driven by strong demand in high-income countries.[8] By 2050, the global fleet of passenger and commercial vehicles is expected to more than double, including many older, polluting vehicles that will likely remain in circulation in Africa, Central Asia and Latin America.[9]

Global passenger transport demand

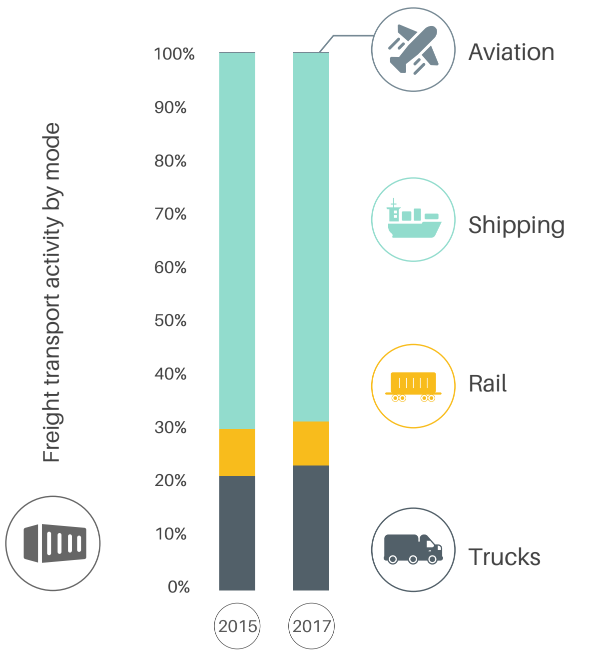
Global passenger transport demand remained at similar levels between 2015 and 2017. In 2017, global passenger transport activity totalled 55 trillion passenger-kilometres, of which 78% was from road transport.[10] Although rail is by far the most carbon-efficient transport mode, with the lowest CO_2 emissions per passenger, it represented less than 8% of passenger activity that year.[11] Motorised two- and three-wheelers and aviation accounted for the largest growth in passenger transport activity between 2015 and 2017, a combined increase of around 25% *(see Figure 1)*.[12] In many developing countries, two- and three-wheelers are the fastest growing mode of motorised mobility.[13]

Figure 1. Share of passenger transport activity (passenger-kilometres) by mode, 2015 and 2017



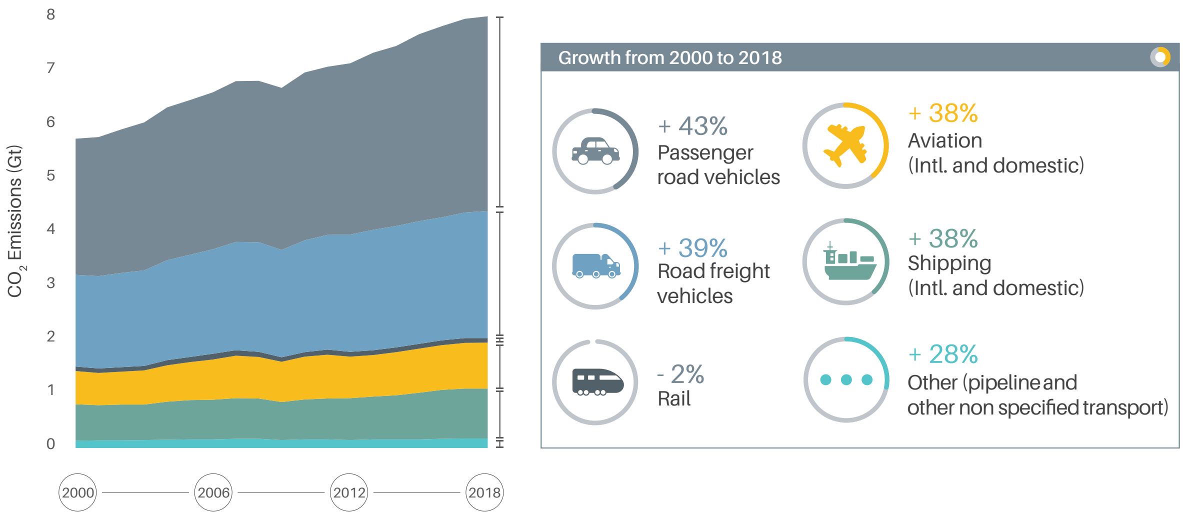
Source: See endnote 12 for this section.

Figure 2. Share of freight transport activity (tonne-kilometres) by mode, 2015 and 2017



Source: See endnote 14 for this section.

Figure 3. Transport CO_2 emissions by mode, 2000-2018



Source: See endnote 16 for this section.

Global freight transport demand

More goods than ever before are being transported on trucks as freight activity has continued to grow, surpassing 120 trillion tonne-kilometres in 2017 *(see Figure 2)*.[14] This increase is attributed mainly to the rising demand for consumer goods being transported by road freight and maritime shipping.

The freight sector is widely seen as the most challenging transport segment to decarbonise, due in part to a lack of comprehensive policies and mature technology options. Key barriers to decarbonising road freight include the low supply of zero-emission freight vehicles, the ageing and non-adaptable existing freight fleet, and the lack of resources in under-developed and developing countries to acquire new vehicle fleets.[15]

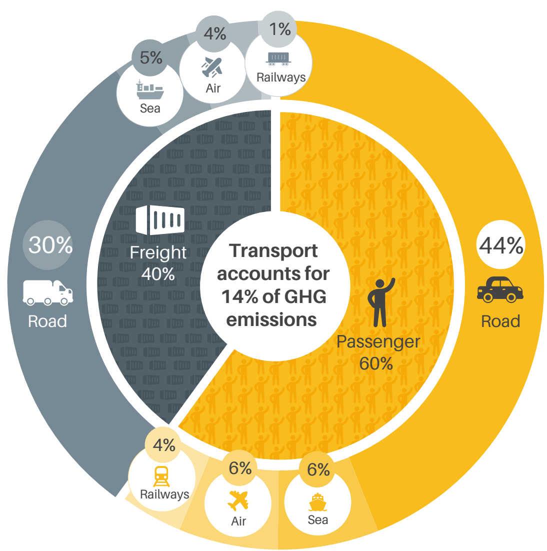
Emission trends

Global emission trends

Increases in road vehicles (both passenger and freight), aviation and shipping were the leading factors behind the global growth in transport CO_2 emissions between 2000 and 2018 *(see Figure 3)*.[16] Improvements in fuel economy for road transport were outpaced by the increased sales of larger, heavier vehicles *(see Transport Demand section in Section 2.1)*. In contrast, CO_2 emissions from railways declined between 2000 and 2018, due mainly to the electrification of major rail corridors and to further efficiency improvements.[17]

Transport accounted for 14% of total global greenhouse gas emissions in 2018.[18] Road transport (both passenger and freight) contributed nearly three-quarters (74%) of transport greenhouse gas emissions that year, while rail represented only 5% *(see Figure 4)*.[19] Around 36% of transport CO_2 emissions occur in urban areas, with 31.6% coming from passenger transport and 4.7% from freight.[20]

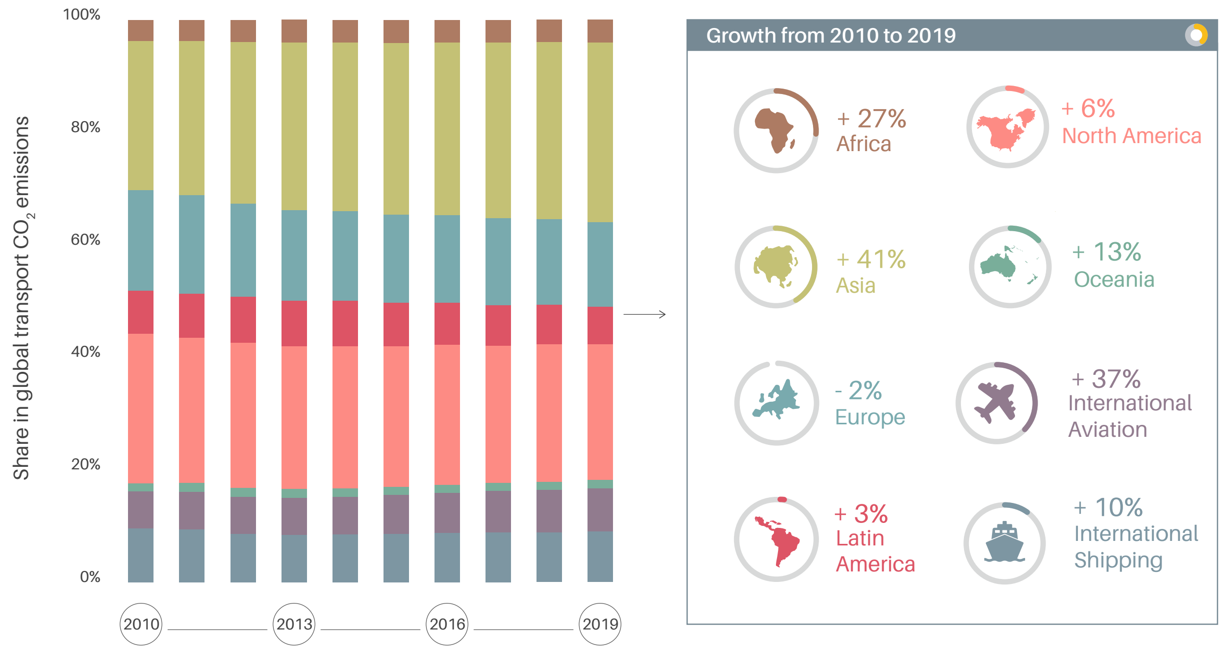
Figure 4. Greenhouse gas emissions from transport, by mode, 2018



Source: See endnote 19 for this section.

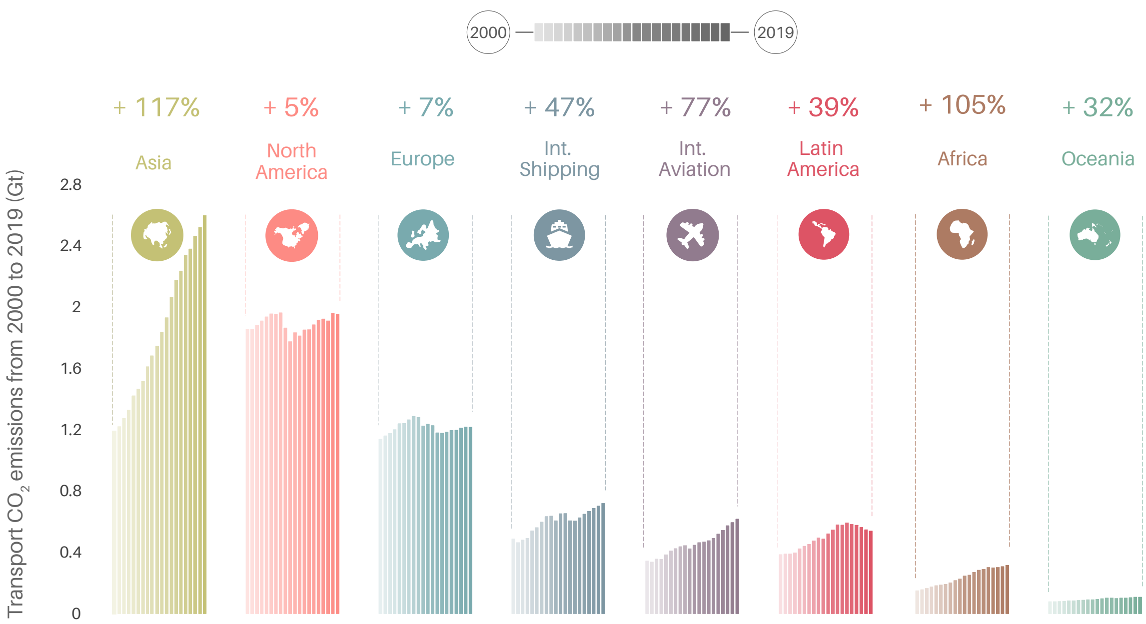
Black carbon – a short-lived climate pollutant emitted into the air as a result of incomplete fuel combustion – is both a major contributor

Figure 5. Share of transport emissions by region and in international aviation and shipping, 2010-2019



Source: See endnote 24 for this section.

Figure 6. Growth in transport emissions by region and in international aviation and shipping, 2000-2019



Source: See endnote 29 for this section.

to climate change and a growing public health concern. Black carbon is a key component in fine particulate matter (PM2.5), which can penetrate deep inside the lungs, contributing to premature mortality and a range of cardiovascular and respiratory diseases.[21] In 2015, around 4,770 gigatonnes of black carbon were emitted worldwide, of which 11% were from road transport and 3.5% from all other transport modes combined.[22] Road transport accounts for an estimated 30% of global urban emissions of ambient particulate matter (less than 2.5 micrometres in size).[23]

Regional emission trends

Between 2010 and 2019, transport CO_2 emissions rose in all regions except Europe, where they fell 2% *(see Figure 5)*.[24] The emission improvement in Europe is attributed to advanced fuel economy regulations and strong sustainable urban mobility planning frameworks, among other factors. **Asia**, which in 2011 became the top regional emitter of transport CO_2 due to its large population and strong economic growth, continued to lead in 2019 and experienced the highest growth in transport CO_2 emissions among regions from 2010 to 2019, at 41%.[25] In **Latin America and the Caribbean**, transport CO_2 emissions increased 3% overall during 2010-2019, but the growth in emissions has declined year-on-year since 2015.[26] *(For more on emissions by region, see Sections 1.2 to 1.7.)*

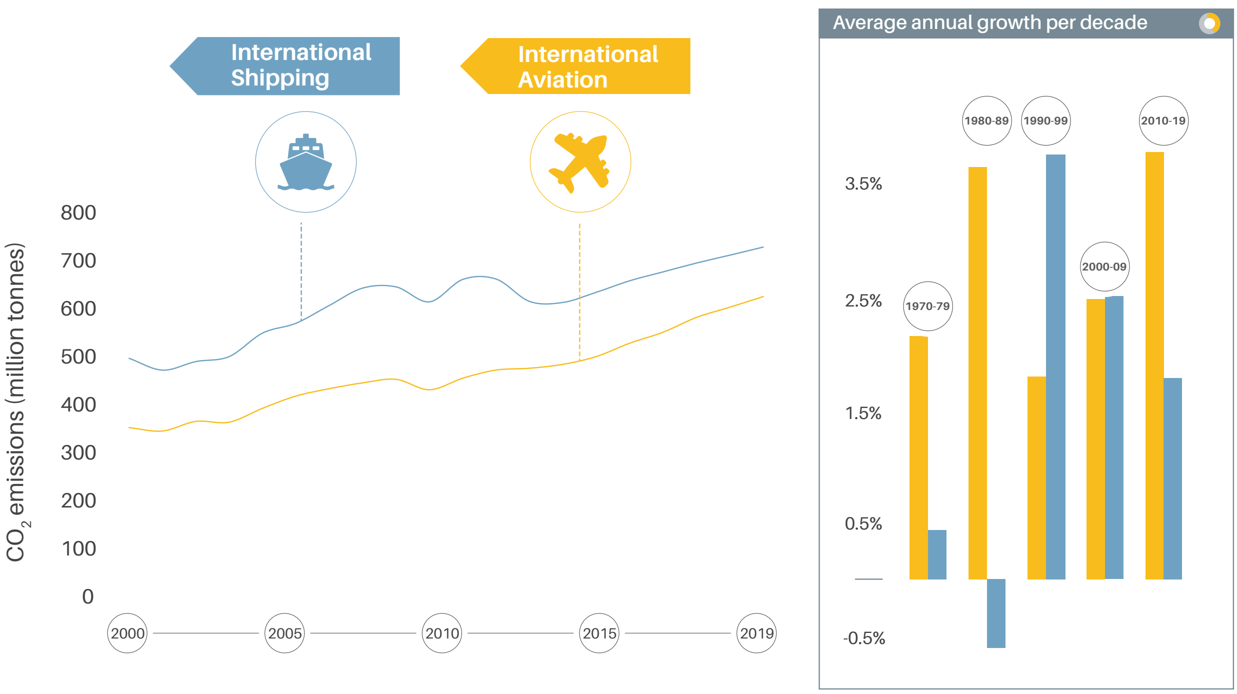
International aviation and shipping emissions both recorded double-digit growth between 2010 and 2019.[27] These two transport modes each emit more CO_2 annually than the entire regions of Latin America and the Caribbean, Africa and Oceania *(see Figure 6)*.[28]

International aviation activity grew 7.1% between 2017 and 2018, from 7,699 billion passenger-kilometres to 8,258 billion passenger-kilometres.[29] With the worldwide growth in air travel, CO_2 emissions from international flights increased 3.8% annually between 2010 and 2019, reaching 627 million tonnes.[30]

Whereas international aviation is focused largely on passenger travel, international maritime transport caters almost exclusively to freight. Maritime shipping is the backbone of global trade. In 2018, 11 billion tonnes of goods were transported over a total distance of 85,864 billion cargo tonne-kilometres.[31] As international maritime shipping has increased, so too have related CO_2 emissions, totalling 730 million tonnes in 2019.[32] However, emissions from maritime shipping have risen more slowly than those from aviation: between 2015 and 2019, average annual emission growth in shipping stayed between 2.4% and 2.8%, and this growth decreased overall in the decades between 1990 and 2019 *(see Figure 7)*.[33]

Between 2010 and 2019, annual GDP growth averaged 2.9%, while transport CO2 emissions increased only 2.0%.[34] This trend is especially apparent in member countries of the Organisation for Economic Co-operation and Development (OECD), where strong fuel economy regulations and other measures have supported efficiency gains.[35] Even as global transport emissions have risen, especially in rapidly developing regions such as Asia, the growth in GDP (historically the main driver of transport CO_2 emissions) has continued to outpace the growth in emissions. This observed decoupling has become more pronounced since 2004, indicating that implementing low carbon solutions in transport likely does not have a negative impact on economic growth.[36]

Figure 7. Emission growth in international aviation versus shipping



Source: See endnote 33 for this section.

Policy measures

Applying *Avoid-Shift-Improve (A-S-I)* measures through integrated, inter-modal and balanced approaches is critical to unleashing the full benefits of sustainable, low carbon transport. The *A-S-I* framework has been central to sustainable, low carbon transport for more than a decade *(see Figure 8)*.[37]

The *A-S-I* approach follows an implicit hierarchy, with appropriate and context-sensitive *Avoid* measures intended to be implemented first, followed by *Shift* measures and finally by *Improve* measures.[38] This prioritisation can help reduce environmental impact, improve access to socio-economic opportunities, increase logistics efficiency, reduce congestion, improve air quality and increase road safety. The *A-S-I* framework calls for:

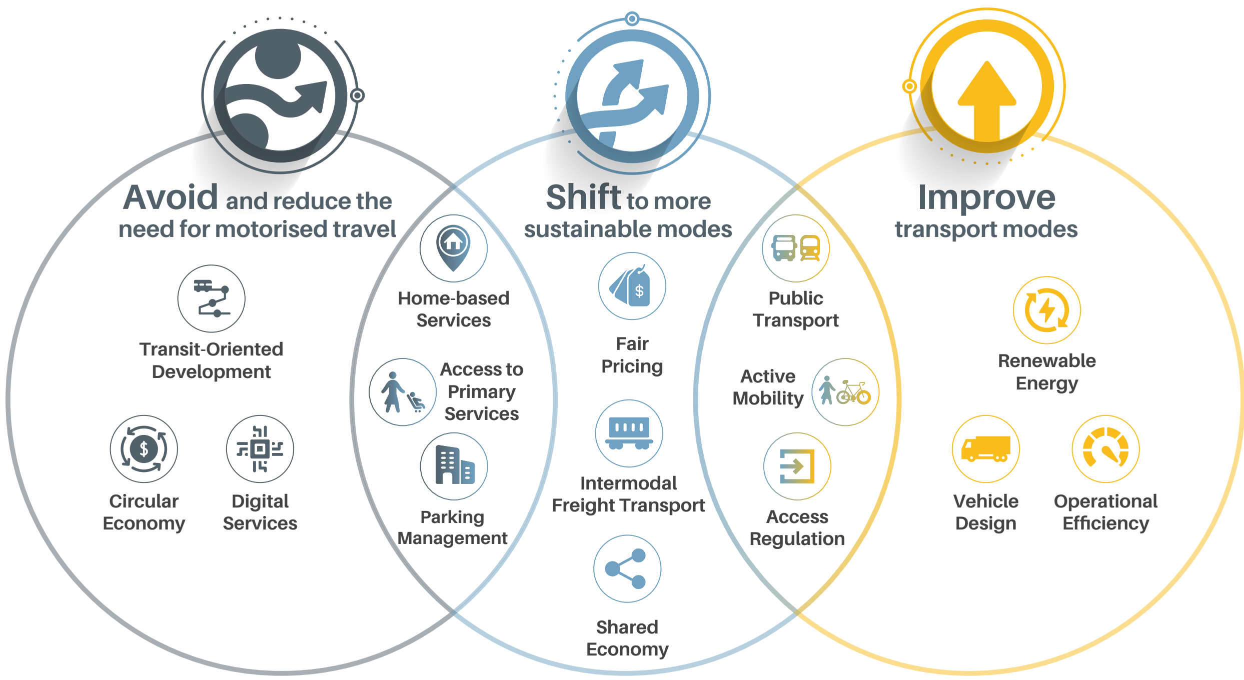
- *Avoiding* unnecessary motorised trips based on proximity and accessibility;
- *Shifting* to less carbon-intensive modes – that is, from private vehicles to public transport, shared mobility, walking and cycling, water-based freight, electrified road-rail freight, and cargo bikes for last-mile deliveries, among others; and
- *Improving* vehicle design, energy efficiency and clean energy sources for different types of freight and passenger vehicles.

Growing evidence shows that *Avoid* and *Shift* strategies can account for 40-60% of transport emission reductions, at lower costs than *Improve* strategies *(see Figure 9)*.[39] There is wide recognition that current policies are over-reliant on technology-focused Improve strategies, and thus are insufficient to achieve the systemic and rapid transformation that is needed to meet global climate and equity goals.

Avoid and *Shift* measures (for example, allocating road space for dedicated bus lanes) may be far less costly for improving transport access than many Improve measures, particularly in rapidly urbanising developing countries. However, more research is needed to assess the long-term cost effectiveness.

The narrative of sustainable mobility has evolved over the decade since the creation of the *A-S-I* concept; in response, a number of stakeholders are engaging in a process to refocus the framework, integrating decades of experience and harnessing momentum on green, equitable pandemic recovery and an unprecedented disbursement of funds through recovery packages. A renewed focus on the framework presents an opportunity to optimise *A-S-I* strategies through novel lenses, including gender and geographic equity; freight transport; and renewable energy.

Figure 8. *Avoid-Shift-Improve* Framework



**The A-S-I diagramme presents a non-exhaustive list of measures for illustrative purposes only.*

Source: See endnote 37 for this section.

An enhanced focus on *Avoid* and *Shift* is of particular relevance to fast-growing, middle-income and low-income economies working to increase access in response to development demands.

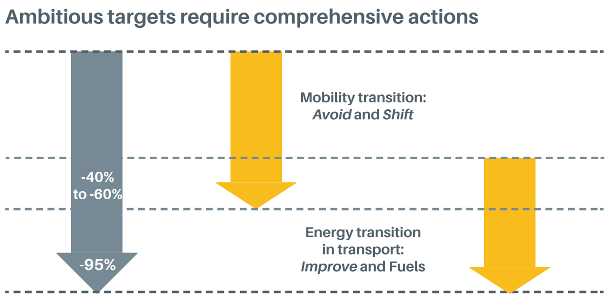
However, *Avoid* is often subject to political resistance, especially in the Global South, where a key priority is to maintain an already robust walking and cycling mode share. In areas where the majority of the workforce needs to travel for livelihoods, the call is to *Shift* to more sustainable modes; however, travel alternatives are often limited, especially for lower-income riders. An intended outcome of the refocusing process is to build upon the strengths of the framework to achieve systemic shifts through a more balanced and cost-effective application of *A-S-I* measures.

Countries' updated Nationally Determined Contributions (NDCs) towards reducing emissions under the Paris Agreement continue to focus strongly on Improve measures, which represent 52% of all measures, whereas *Shift* measures account for 38% and Avoid measures for only 10%.[40] Given the long-term impacts of some *Avoid* and *Shift* policy measures, it is important that countries' NDCs and Long-Term Climate Strategies include a balanced *A-S-I* approach. However, the over-focus on *Improve* measures, particularly the electrification of vehicles, risks distracting attention from necessary long-term structural changes in business models, supply chains, city planning and behaviour.[41] *(see Section 3: Responses to Address Climate Change in the Transport Sector)*

Shift and *Improve* measures – and the overall decarbonisation of the transport sector – are most effective when combined with *Avoid* measures. *Avoid* measures allow cities to limit vehicle traffic to within the capacity of roadways, and they reward travellers who use transport modes that are resource, space and energy efficient. Many *Avoid* measures aim to actively manage transport demand, with approaches such as congestion charging, carbon pricing for all transport modes, and incentives for behavioural modifications leading to wide-scale changes.

Specific policy measures by region are detailed in Section 2, and sub-sectoral responses are detailed in Section 3.

Figure 9. Potential emission reductions resulting from actions in the A-S-I framework



Source: See endnote 39 for this section.

Box 1. Impacts of the COVID-19 pandemic on global transport demand and emissions

In total, transport emissions declined by 1.5 gigatonnes of CO_2 in 2020. As a result of the COVID-19 pandemic, global energy demand fell a projected 4%, and total global CO_2 emissions dropped an estimated 5.4%. The decline in emissions is attributed mainly to the rapid reductions in aviation and road transport activity in the early months of the pandemic. Despite the emission drop, the total amount of CO_2 in the earth's atmosphere was expected to increase 0.6% in 2020, just below the 0.68% rise projected in pre-COVID scenarios.

For the transport sector overall, CO_2 emissions in 2020 fell 19.4% below 2019 levels, with emissions dropping 56.4% in international aviation, 31.9% in domestic aviation, 24.8% in international shipping and 14.6% in ground transport (road and railways). Total emissions from ground transport fell by around 947 million tonnes of CO_2, and from domestic and international aviation by around 466 million tonnes of CO_2 *(see Figure 10)*.

The COVID-19 pandemic led to a 14.5% drop in new vehicle sales, from 91 million new vehicles sold in 2019 to 78 million sold in 2020.

The impact of the COVID-19 pandemic on freight transport has highlighted the interconnectedness of the global economy and revealed underlying vulnerabilities in international supply chains and transport of goods. While initial projections estimated substantial reductions in freight transport volumes, data from the International Transport Forum's forthcoming 2021 Transport Outlook reveal a roughly 4% decline between 2019 and 2020, attributable in part to the decrease in the consumption and trade of fossil fuels as overall energy demand fell.

In international aviation, the number of seats offered by airlines, as well as the total number of domestic and international flights, each fell 61% in 2020, with an estimated 8.2 million fewer international flights during the year. As airlines sought alternative revenue streams, cargo aviation was up 6.6%, growing by 25,000 flights. In total, emissions from international aviation declined by 354 million tonnes of CO_2.

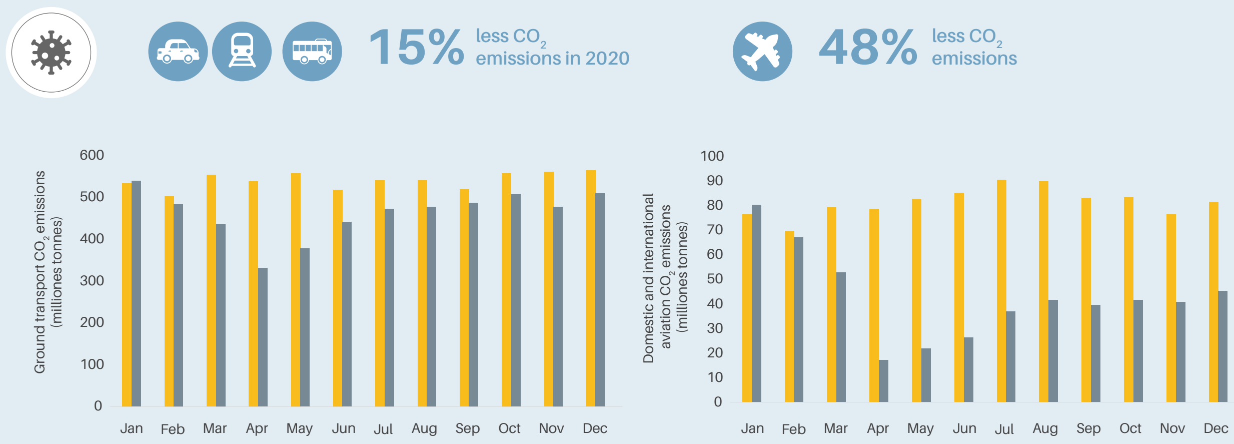
In general, the COVID-19 pandemic has laid bare the weaknesses of the transport sector's preparedness for disasters and global shocks. In many cities, public transport systems were pressured to the verge of collapse in 2020, following significant declines in ridership, revenue and passenger trust. Many people returned to private vehicles as their first choice of mobility, while others, lacking access to safe and reliable transport services, were stranded by lockdowns and deprived of work to maintain their livelihoods, resulting in greater impoverishment among the most vulnerable groups.

At the same time, COVID-19 has pushed us to reflect on how we move both people and goods, and what the pandemic will mean for the future of transport. During early lockdowns, many urban dwellers appreciated the cleaner air and reduced noise pollution due to less traffic. Cities around the world reclaimed streets for pedestrians and cyclists, adopted cost-efficient "tactical urbanism" measures that enable active mobility, and depended more on freight and logistics as residents turned to online deliveries at an unprecedented pace.

The decisions that governments and multilateral entities make to support economic recovery from the pandemic will determine the degree of transformation that will be achieved through the next decade and beyond. The urgency of these decisions must not derail efforts to achieve universal equitable access to mobility, or the push for ambitious, systemic decarbonisation across all transport modes, whether on land, air or sea.

For more on the Impacts of the COVID-19 pandemic on specific transport modes, see *Box 1 in Section 2*.

Figure 10. COVID-19 impacts on CO_2 emissions from land transport and domestic aviation



Source: See endnote 4 for this section.

The next section examines transport demand and emissions in each world region, helping to illuminate the global trends and figures by narrowing in on the major developments, trends and policy measures that are shaping the transport landscape regionally.

Africa Regional Overview

Demographics

Population size:	Population growth:	Urban population share:	Urban population growth:	GDP per capita:	Urban population growth:
1,338 million	+29%	44%	+44%	USD 1,969	+31%
(2020)	(2010-2020)	(2020)	(2010-2020)	(2019)	(2010-2019)

Sources: See endnote 1 for this section.

Key findings

Demand trends

- Motorised transport volumes in Africa are the lowest among world regions; however, car ownership rates are rising, with some countries experiencing growth of 250% or more between 2005 and 2015.
- Increased car ownership in Africa is driven largely by imports of used vehicles from other regions, which account for up to 95% of vehicle registrations in some African countries.
- The African region has seen a rapid increase in motorcycles, which are used as taxis in both urban and rural areas and transport 80% of passengers and goods on rural roads.
- More than one-third of all trips globally are made on foot or by bicycle; in some African cities, walking and cycling account for more than 70% of all personal trips.
- Africa has the highest rate of road fatalities, with nearly 40% of these deaths involving pedestrians and another 4% involving cyclists – together accounting for nearly half of the region's road fatalities.
- In some African cities, up to 80% of the population relies on paratransit (sometimes called "informal transport"), and some minibus taxi fleets have grown more than 5% annually.
- Freight transport in Africa faces significant infrastructure gaps, resulting in relatively low levels of intra-regional trade.

Emission trends

- Africa had the lowest transport CO_2 levels among all regions in 2019 (at 0.25 tonnes per capita), contributing only 5% of total global transport CO_2 emissions that year.
- Transport emissions in the region are growing rapidly from a low baseline. Africa's transport emissions increased 27% between 2010 and 2019, the second highest regional growth rate after Asia (41%).
- Only 15% of African countries exceeded global average per capita transport emissions during 2010-2019; however, nearly three-quarters of African countries reported above-average emission growth.

Policy measures

- Walking and cycling infrastructure improvements are expanding the options for safe, low carbon mobility, accounting for up to 20% of overall transport budgets in some African cities.
- Broader adoption of sustainable urban mobility plans (SUMPs) reflects more comprehensive planning approaches; however, SUMPs in Africa trail other regions relative to population share.
- Despite recent improvements, only 35% of residents in Sub-Saharan Africa live within 500 metres of access to public transport, the lowest rate in the world and well below the global average of 49%.
- Enhancements to paratransit services – including increased regulation, fleet renewals and digital technologies – are increasing access to mobility across Africa.
- Actions aimed at regulating vehicle and fuel quality standards are increasing and include bans on used vehicle imports as well as national and regional fuel economy roadmaps.

Impacts of the COVID-19 pandemic

- Paratransit services have been particularly vulnerable to the COVID-19 pandemic, due to travel restrictions, reduced capacities and rising costs.
- A number of African cities have expanded walking and cycling measures in response to COVID-19 to allow for physical distancing while commuting and recreating.

Overview

Rapid urbanisation trends in Africa continued in 2019 and 2020, and the region's megacities (many in **West Africa**) are expected to represent all of the world's 10 fastest growing cities (and 21 of the top 30) from 2018 to 2035.[2] Car ownership has remained low by global standards, with only 38 cars per 1,000 people in 2015, but is rising rapidly in many countries including **Ghana, Madagascar** and **Tanzania** *(see Figures 1 and 2)*.[3] African populations rely heavily on imported used vehicles and on paratransit as a primary source of mobility *(see Focus Feature 6: Paratransit as a Complement to Formal Transport Networks)*.[4]

Historically, regional transport investments have been focused mainly on developing infrastructure for private vehicles, although most of the African population does not have access to this form of transport. Walking is a dominant mode of travel in the region, but fewer resources have been allocated to pedestrian and cycling infrastructure, exacerbating issues of social inequity and access to transport.[5] Overall, a lack of robust data on urban and rural transport in Africa makes quantifying trends and calculating emissions difficult, although efforts are being made to fill in critical data and information gaps.[6] The COVID-19 pandemic has created additional challenges for transport systems in Africa *(see Box 1)*.[7]

Demand trends

Motorised transport volumes in Africa are the lowest among world regions; however, car ownership rates are rising, with some countries experiencing growth of 250% or more between 2005 and 2015 *(see Figures 1 and 2)*.[8] Despite relatively low vehicle ownership, Africa has the world's highest mortality rate from road traffic accidents (at 32.2 deaths per 100,000 inhabitants), nearly three times that of Europe.[9] Africa (along with the Middle East) is an emerging hub for automobile manufacturing, led by several new plants being opened in recent years in Morocco.[10]

- **Morocco** has become Africa's leading auto manufacturer, producing 345,000 passenger vehicles in 2017 to surpass South Africa's total (331,000).[11] Morocco has also become a key supplier of parts for European auto factories and is expected to soon produce more cars annually than Italy.[12]
- **South Africa** is Africa's largest commercial vehicle market; however, the shift in demand for domestic and continental freight during the COVID-19 pandemic greatly impacted new commercial vehicle sales.[13]

New vehicle sales in Africa:

- **7% decrease** in total new vehicle sales (2010-2019)
- **5% decrease** in new passenger car sales (2010-2019)
- **841,000** new passenger cars sold (2019)
- **11% decrease** in new commercial vehicle sales (2010-2019)
- **302,000** new commercial vehicles sold (2019)

Sources: See endnote 14 for this section.

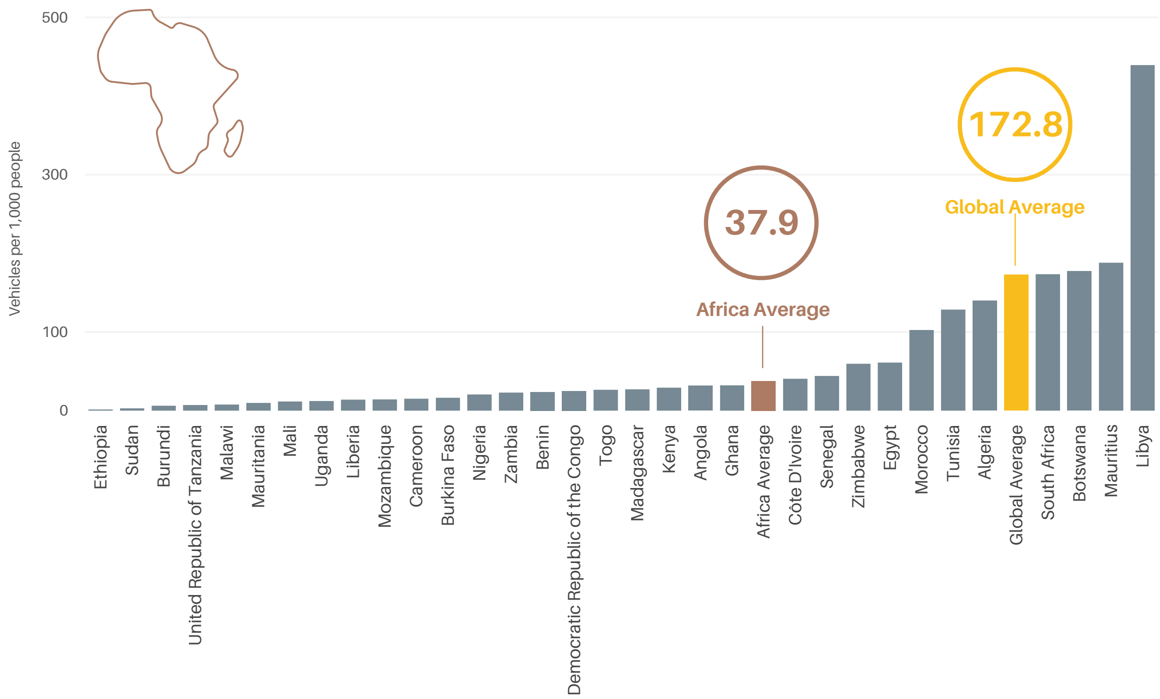
Increased car ownership in Africa is driven largely by imports of used vehicles from other regions, which account for up to 95% of vehicle registrations in some African countries.[15] Used car imports from Europe and Japan make up a large portion of light-duty vehicle fleets in many African countries.

- In **Kenya**, **Rwanda** and **Uganda**, up to 95% of vehicles being added to light-duty vehicle fleets are imported from Japan.[16]
- From 2017 to 2018, the **Netherlands** exported 35,000 light-duty vehicles to **Africa**, with roughly two-thirds of these going to Libya, Nigeria and Ghana.[17] More than 80% of the vehicles did not meet Euro 4 emission standards.[18]

The African region has seen a rapid increase in motorcycles, which are used as taxis in both urban and rural areas and transport 80% of passengers and goods on rural roads.[19]

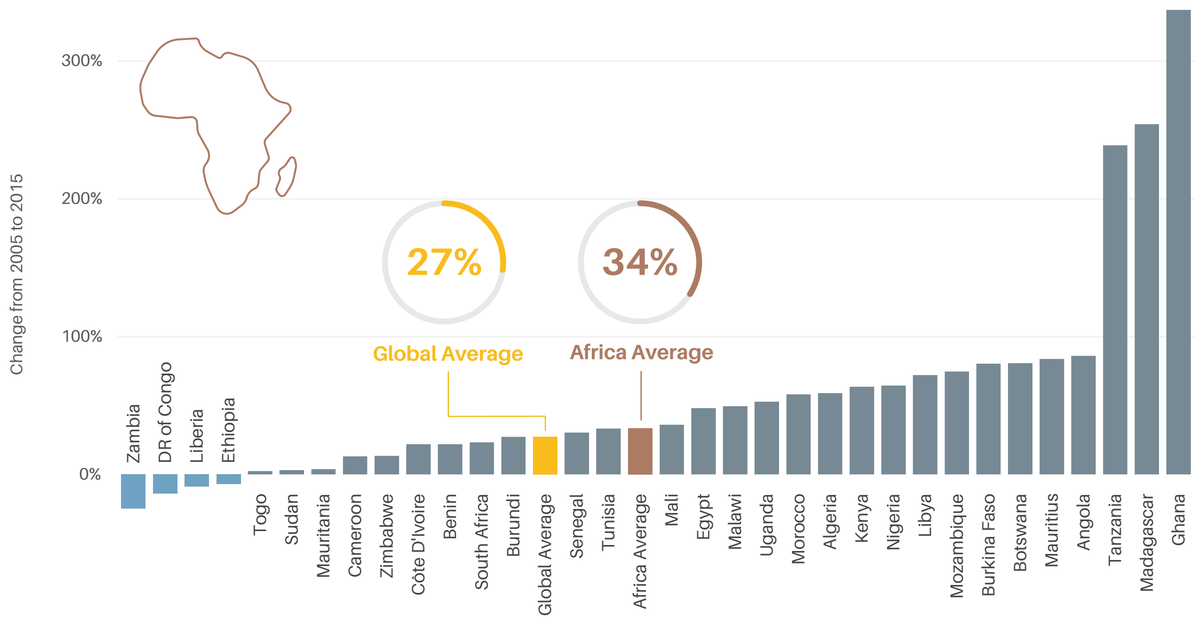
- The African two-wheeler market is predicted to grow 12% annually until 2025.[20]
- Motorcycle numbers in **Rwanda** increased 8.5% annually between 2004 and 2017.[21]

Figure 1. Car ownership rates per 1,000 people in Africa, 2015



Source: See endnote 3 for this section.

Figure 2. Growth in car ownership in Africa, 2005-2015



Source: See endnote 3 for this section.

More than one-third of all trips globally are made on foot or by bicycle; in some African cities, walking and cycling account for more than 70% of all personal trips.[22] However, more than 9 out of 10 of the streets in the region that are walked and cycled do not meet minimum levels of service.[23]

- African cities where pedestrian travel exceeds 30% of all trips include **Dar es Salaam**, Tanzania; **Kampala**, Uganda; **Nairobi**, Kenya; and **Quelimane**, Mozambique.[24]

Africa has the highest rate of road fatalities, with nearly 40% of these deaths involving pedestrians and another 4% involving cyclists – together accounting for nearly half of the region's road fatalities.[25] Globally, some vehicle manufacturers have begun implementing safety standards to protect people who are outside the vehicle, but these standards typically are targeted at high-income countries.[26]

- Traffic death rates generally go up as incomes decrease; in **Africa**, the fatality rate for middle-income countries is 23.6 per 100,000 but for low-income countries is 29.3 per 100,000.[27]
- Of the more than 90,000 walking and cycling deaths recorded in **Africa** in 2019, 93% involved pedestrians.[28]
- **Africa** is home to only 2% of the countries globally where drunk-driving laws meet best practices, compared to 60% in Europe.[29]

In some African cities, up to 80% of the population relies on paratransit, and some minibus taxi fleets have grown more than 5% annually.[30] Paratransit contributes to urban air pollution because the vehicles are often old and poorly maintained.[31] A lack of formal scheduling can lead to higher global emissions due to frequent start-and-stop patterns and rapid acceleration and deceleration cycles *(see Focus Feature 6: Paratransit as a Complement to Formal Transport Networks)*.[32]

- In **Kampala, Uganda**, a fleet of 16,000 private minibus taxis carried 82.6% of commuters in 2015, and this fleet has grown 5.4% annually in recent years.[33]
- Shares of minibus taxi use in **South Africa's** provinces reached 45.7% in Gauteng and 38.3% in the Eastern Cape and Mpumalanga in 2019.[34]
- Paratransit services directly employed around 100,000 people in **Kampala, Uganda** in 2015.[35]

Freight transport in Africa faces significant infrastructure gaps, resulting in relatively low levels of intra-regional trade.

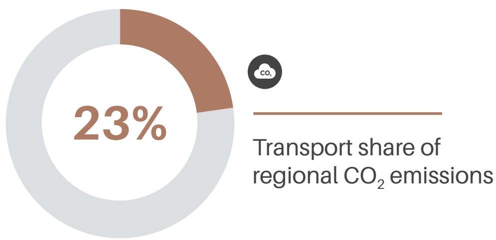
- Transport infrastructure in **South Africa** is rated on par with **India** and slightly better than **Indonesia**.[36] Many African countries face a continuing need for improvements in road, rail, air and port networks.[37]
- **Sub-Saharan Africa** scored 45 out of 100 points for regional infrastructure performance in the World Economic Forum's 2019 Global Competitiveness Report, down nearly three percentage points from 2018.[38]
- The quality of **Africa's** transport infrastructure declined 6% between 2015 and 2017, compared with a 7% average improvement in countries in the Association of Southeast Asian Nations (ASEAN) region.[39] During this period, only **Botswana** and **South Africa** narrowed transport infrastructure gaps relative to more advanced economies.[40]

Emission trends

Africa had the lowest transport CO_2 levels among all world regions in 2019 (at 0.25 tonnes per capita), contributing only 5% of total global transport CO_2 emissions that year.[41] This is due in part to the region's still large rural population share, whereas in urban areas transport emissions are growing rapidly.[42]

Regional CO_2 emissions

- Total transport CO_2 emissions (2019): **326.8 million tonnes**
- Share of global transport CO_2 emissions (2019): **5%**
- Per capita transport CO_2 emissions (2019): **0.25 tonnes**
- Transport CO_2 emissions per USD 10,000 GDP (2019): **1.31 tonnes**



Sources: See endnote 43 for this section.

Transport emissions in the region are growing rapidly from a low baseline. Africa's transport emissions increased 27% between 2010 and 2019, the second highest regional growth rate after Asia (41%).[44] The rise in emissions is driven by factors such as increasing urbanisation, growing demand for consumer goods, widespread import of inefficient used vehicles and a lack of fuel economy standards.

Only 15% of African countries exceeded global average per capita transport emissions during 2010-2019; however, nearly three-quarters of African countries reported above-average emission growth *(see Figures 3 and 4)*.[45] Trends in transport emissions ranged from 198% growth in Cabo Verde to a 16% decline in Djibouti.[46] Only 2 out of 53 African countries reduced transport emissions during the period.[47]

Policy measures

Africa has continued to experience high urbanisation rates and increasing pressure to accommodate economic activity and population growth. This has resulted in a growing need for sustainable mobility options. Improving access to low carbon transport in Africa will continue to depend on national and private actions, due to a general lack of regional co-operation enabling sustainable planning modes.

Given the relatively small share of investment in transport in Africa (only 5.6% of the region's foreign direct investment portfolio), the strongest opportunities to improve sustainable transport are likely low-cost, innovative, sustainable transport approaches that focus on planning, regulation and small-scale information technology solutions.[48]

Transport policy measures enacted since 2018 include an increase in comprehensive transport planning, growing (but still insufficient) attention to walking and cycling, expansion of bus rapid transit systems, the integration of digital technologies in transport, and efforts to map and improve the routing of paratransit services. Additionally, public transport reforms in recent years contributed to making formalised transport more viable in several African cities.

Walking and cycling infrastructure improvements are expanding the options for safe, low carbon mobility, accounting for up to 20% of overall transport budgets in some African cities.[49] Walking is a dominant mode of transport in the region but receives little attention from dedicated infrastructure and policies, which continue to invest heavily in urban highways and flyovers. African cities have faced challenges in expanding cycling due to a lack of dedicated bicycle infrastructure; they also have a unique opportunity to maintain the share of pedestrian travel by improving the walkability of streets.

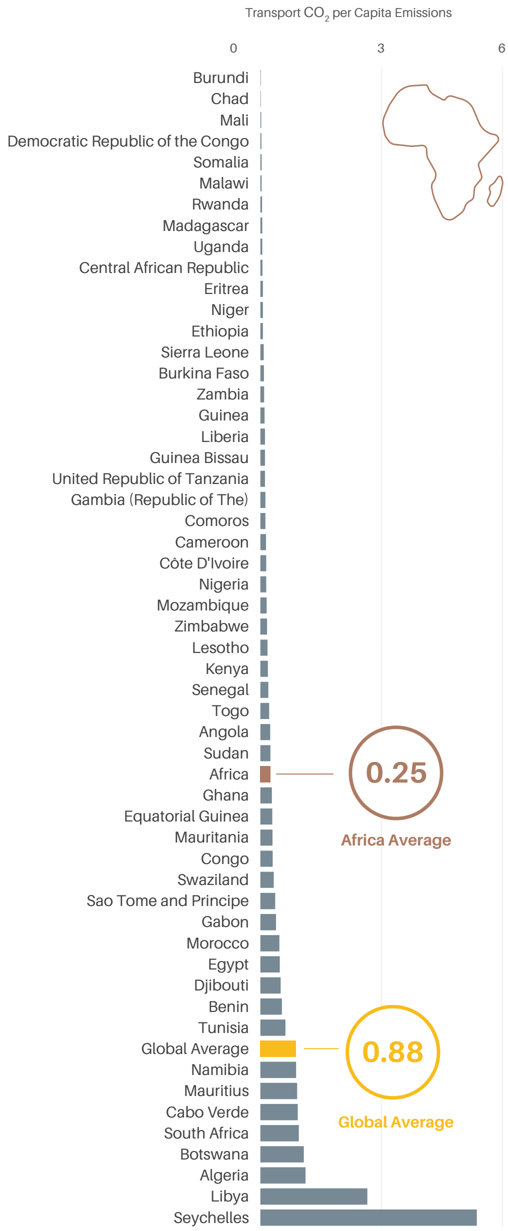
- Strategies to increase walking and cycling have been implemented in **Ethiopia**, **Kenya** (including Mombasa and Nairobi) and **Zambia**.[50] Nairobi has earmarked 20% of its transport budget towards development of these modes.[51]
- "Open Streets" events have become increasingly popular in several major cities, including Addis Ababa, **Ethiopia** and Kigali, **Rwanda**.[52] Since 2018, Menged Le Sew (Streets for People) has organised monthly car-free days in Addis Ababa and other **Ethiopian** cities.[53]
- Infrastructure improvements and Open Streets activities in Kampala, **Uganda** have been aimed at advancing the uptake of cycling.[54]

Broader adoption of sustainable urban mobility plans (SUMPs) reflects more comprehensive planning approaches; however, SUMPs in Africa continue to trail other regions relative to population share. Efforts have been made in several African countries to support more comprehensive transport planning that enables public transport, more walking and cycling, and improved paratransit services.

The increased focus on SUMPs and on national urban mobility plans (NUMPs) with wide-ranging transport options provides opportunities to address social inequalities through enhanced accessibility. It can also help maintain Africa's relatively low levels of transport CO_2 emissions, especially given rapid growth in the region's megacities. However, the increased adoption of NUMPs and SUMPs in Africa will only bring about emission reductions and improvements in mobility access if they are soundly implemented.

- Since 2018, **Burkina Faso**, **Cameroon** and **South Africa** have all adopted NUMPs.[55] At the local level, Douala and Yaounde (**Cameroon**) and Kisumu (**Kenya**) offer examples of advanced sustainable urban mobility planning.[56] The MobiliseYourCity

Figure 3. Per capita transport CO_2 emissions in Africa, 2019

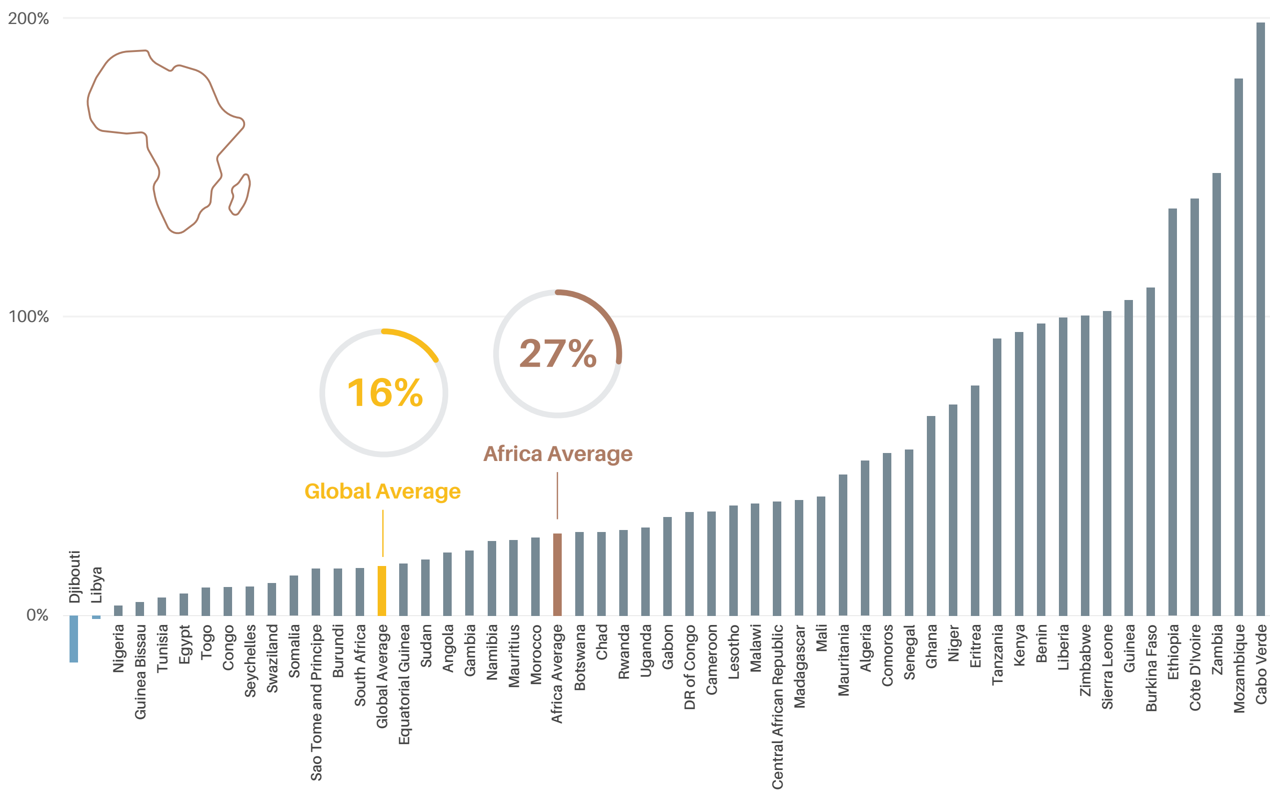


Source: See endnote 45 for this section.

Partnership is expected to provide ongoing support to cities in **Côte d'Ivoire**, **Ethiopia**, **Ghana**, **Morocco**, **Mozambique** and **Senegal**, among others.[57]

- Diagnostic studies on sustainable urban mobility were conducted in 2020 in **Benin**, **Burkina Faso**, **Côte d'Ivoire**, **Ethiopia**, **Ghana**, **Guinea**, **Kenya**, **Mali**, **Nigeria**, **Rwanda**, **Senegal** and **Togo**, facilitated by the Africa Transport Policy Program (SSATP).[58]

Figure 4. Change in transport CO_2 emissions in Africa, 2010-2019



Source: See endnote 45 for this section.

- In 2020, GoMetro and Ascendal initiated the **Africa Urban Mobility Observatory** to collect urban mobility data on 10 African cities, which can support the formulation of SUMPs and other sustainable transport policy measures; these cities are: **Addis Ababa** (Ethiopia), **Blantyre** (Malawi), **Dar es Salaam** (Tanzania), **Gaborone** (Botswana), **Johannesburg** (South Africa), **Kigali** (Rwanda), **Kinshasa** (Democratic Republic of the Congo), **Lagos** (Nigeria), **Maseru** (Lesotho) and **Mwanza** (Tanzania).[59]

Despite recent improvements, only 35% of residents in Sub-Saharan Africa live within 500 metres of access to public transport, the lowest rate in the world and well below the global average of 49%.[60] While bus rapid transit and light-rail systems are being launched or expanded in some African cities, greater investment is required to provide needed urban mobility options across the continent.

- **Abuja**, Nigeria inaugurated the country's first light-rail Phase 1 project in 2018, extending 24 kilometres from the city's central business district to the Murtala Mohammed International Airport.[61]
- **Lagos**, Nigeria inaugurated a 13.6-kilometre bus rapid transit extension in 2020 from Oshodi to Abule Egba, with 550 new buses.[62]
- In March 2020, **Dakar**, Senegal started building the first phase of its bus rapid transit system.[63] The first section of the city's Train Express Régional, a 55-kilometre commuter rail, was completed in 2019.[64]
- **Dar es Salaam**, Tanzania started implementing its second and third bus rapid transit lines in 2019, which aim to eventually cover 130 kilometres, and launched a smartphone app for trip planning on the system.[65]

Enhancements to paratransit services – including increased regulation, fleet renewals and digital technologies – are increasing access to mobility across Africa. The paratransit sector, comprising minibuses, taxis and motorcycles, has filled in the gap left by limited public transport options in African cities.[66] Improvements in the services have been pursued by civil society, company, government and non-governmental entities in many cities across the region (e.g., **Accra**, **Addis Ababa**, **Cairo**, **Dar es Salaam**, **Kampala**, **Kisumu**, **Lusaka** and **Mombasa**).[67] However, the challenge of quantifying the emissions from these services makes it difficult to evaluate policy impacts.[68]

- African cities have increasingly sought to improve the efficiency of paratransit through regulations (e.g., minibus taxi licencing in **Kampala**, Uganda), support for fleet renewal (e.g., in

Burkina Faso) and integration with formal public transport services *(see Focus Feature 6: Paratransit as a Complement to Formal Transport Networks)*.[69]

- App-based ride-hailing services have expanded quickly in many countries in the region (such as **Kenya** and **Nigeria**) and have pulled away ridership from traditional taxis and collective transport.[70]
- Digital technologies such as smart phone apps have improved paratransit mapping, route planning and user experience by increasing the predictability of service frequency and wait times; examples include the DAR City Navigator app in Dar es Salaam, **Tanzania**; the Google Maps paratransit feature in Lagos, **Nigeria**; and DigitalTransport4Africa mapping of public/paratransit services across **Africa**.[71]

Actions aimed at regulating vehicle and fuel quality standards are increasing and include bans on used vehicle imports as well as national and regional fuel economy roadmaps. Africa imports the largest share of used passenger cars (40%) of any region, and many of the vehicles have high fuel usage and CO_2 emissions and low safety conditions.[72] The lack of regulations in many African countries results in lower efficiency levels than in any other region.[73] Imports of vehicles that meet minimum emission standards in exporting markets can help lower the pollution impacts of road transport and improve human and environmental health.[74]

- African countries that have imposed total bans on used vehicle imports include **Egypt, Morocco, South Africa** and **Sudan.**[75]
- The first-ever regional fuel economy roadmap, introduced through the **Economic Community of West African States** (**ECOWAS**), aims to improve the average fuel economy in the 15 member countries 34% over 2015 levels by 2025, with an average target of 5 litres per 100 kilometres by that year.[76]
- **Namibia** and **Nigeria** are among the countries using fiscal measures or tougher fuel economy measures in an effort to reduce fuel consumption.[77]

Box 1. Impacts of the COVID-19 pandemic on transport in Africa

Major COVID-19 impacts:

- 53% decrease in trips to public transport stations (at lowest point in 2020 versus January 2020 average)
- 32% to 50% decline in freight transport activity (below 2019 levels)
- 60% decline in international aviation activity (below 2019 levels)
- 53% decline in domestic aviation (below 2019 levels)

Mobility in most African countries has been heavily impacted by COVID-19. **South Africa** experienced a significant drop in transport demand for several months in 2020. Whereas global public transport ridership levels dropped 60-80%, ridership in South Africa fell 78-100%.

In **Kenya**, the government halved the capacity of collective transport providers, causing transport costs to rise and leading 27% of transport users to travel less often, and 17% to be unable to travel. Whereas 62% of users shifted to walking as a primary means of transport, only 6% shifted to private vehicles.

In **Nigeria**, due to the drop in oil prices (to which the local currency is pegged), public transport fares increased 100% or more (and in some cases 200% or more for paratransit, which provides the majority of services).

Relief funds for increased transport services (including those that are less formal) have not been proportional to needs in many African countries. In **Cairo**, Egypt, the local government has supported bus companies by restructuring loan agreements and service fees to maintain the viability of public transport operations.

Paratransit services have been particularly vulnerable to the COVID-19 pandemic, due to travel restrictions, reduced capacities and rising costs.

- In **Kampala**, Uganda and elsewhere, travel restrictions and lockdowns led to a temporary halt of all boda boda and minibus services.
- In **Kinshasa**, Democratic Republic of the Congo, social distancing requirements for public and private transport decreased the number of passengers per vehicle, leading to higher fares, lower revenues and vehicle delays due to lack of resources.

A number of African cities expanded walking and cycling measures in response to COVID-19 to allow for physical distancing while commuting and recreating. COVID-19 has underscored the need for improved walking and cycling infrastructure, which are being implemented in cities such as **Addis Ababa** and **Kampala.**

- **Cape Town**, South Africa has constructed 17 kilometres of new walkways for pedestrians and cyclists.
- **Mombasa**, Kenya has converted a major road into a temporary pedestrian zone to minimise contact while reducing traffic volumes.
- **Nairobi**, Kenya has widened footpaths and sidewalks to promote walking as a response to the pandemic.

Source: See endnote 7 for this section.

In Practice: Additional Policy Responses

Avoid measures

Sustainable mobility planning

- **Burkina Faso** adopted a national urban mobility policy (NUMP) in 2020 that aims to improve governance in the urban mobility sector; improve safe and equitable access to essential service; promote development of public transport; and drive a shift from private motorised vehicles.[78]
- **Cameroon** enacted a NUMP in 2019 that in turn enabled the creation of sustainable urban mobility plans (SUMPs) in Douala and Yaounde.[79]
- Kenya's third largest city, **Kisumu**, introduced a SUMP in 2020 with 10-year goals, such as keeping the share of walking and cycling above 55% and lowering greenhouse gas emissions.[80]
- **South Africa** launched its Green Transport Strategy in 2018, with a time frame up to 2050 in support of national climate plans.[81]

Shift measures

Public transport

- **Kigali**, Rwanda completed full adoption of electronic fare collection on the city bus system, revolutionising local transport by allowing real-time updates of public transit routes; the city also launched the re-tendering of city bus services.[82]

Paratransit

- Civil society, non-governmental and governmental partners have documented existing paratransit routes in Accra, Addis Ababa, Cairo, Dar es Salaam, Kampala, Kisumu, Lusaka and Mombasa, among others.[83]
- **Burkina Faso** plans to regulate paratransit taxi services by 2025 by renewing fleets, increasing the share of drivers with health insurance and implementing a fare collection system in all vehicles.[84]
- By the end of 2019, the Digital Matatus project had mapped 140 routes for paratransit in **Nairobi, Kenya**, covering more than 3,000 kilometres and 4,000 stops.[85]
- Google officially launched its Maps feature for paratransit in **Lagos**, Nigeria in 2019.[86] In February 2020, the city enacted a ban on motorcycle-based ride-hailing due to safety concerns.[87]
- **Kampala, Uganda** launched a licencing programme for minibus taxis in June 2020 in an effort to better regulate the network and routes.[88]

Walking and cycling

- The African Road Safety Observatory was launched in 2018 to improve safety for road users in the region, which has the world's highest rate of road traffic fatalities at 26.6 deaths per 100,000 people.[89]
- **Ethiopia** launched a national Non-Motorised Transport Strategy in 2020, preceded by the **Addis Ababa** Non-Motorised Transport Strategy of 2019. The national strategy includes targets to increase the share of walking, cycling and public transport, reduce personal vehicle use, improve road safety and improve air quality over a 10-year period.[90]
- The "red carpet" project in **Mombasa**, Kenya expanded walkways in the city centre by nine kilometres.[91] In **Nairobi**, the first car-free day was held in the city centre in 2019, and the city has begun implementing its 2015 Non-Motorised Transport strategy.[92]

Improve measures

E-mobility

- **Egypt** started operating its first electric buses, with a fleet of 15 buses in **Alexandria** in 2018 and **Cairo** in 2019.[93]
- Kenya reduced excise duties on electric vehicles from 20% to 10% in 2019, while increasing fees for conventional vehicles.[94]
- In 2020, **Morocco** launched several hundred electric scooters in Marrakech and its first electric car charging station in Rabat.[95]
- In 2019, **Rwanda** announced a national mobility policy to replace all motorcycles with electric motorcycles, as well as plans to launch a national electric bike sharing system.[96]
- South Africa's uYilo eMobility Programme, which enables connectivity between electric vehicles and smart grid infrastructure, was named a UK PACT implementation partner in February 2021.[97]
- **Kampala, Uganda** began pilot operations of two electric buses in 2020.[98]

Asia Regional Overview

Demographics

Population size:	Population growth:	Urban population share:	Urban population growth:	GDP per capita:	Urban population growth:
4,609 million	+10%	51%	+26%	USD 6,505	+35%
(2020)	(2010-2020)	(2020)	(2010-2020)	(2019)	(2010-2019)

Sources: See endnote 1 for this section.

Key findings

Demand trends

- Asia's car ownership rate increased 87% from 2005 to 2015 (latest available data), more than three times the global average.
- Four of the world's five most congested cities in 2019 were in Asia (Bengaluru, Mumbai and Pune, India; and Manila, the Philippines), due to increased ownership of motorised two-, three- and four-wheeled passenger and freight vehicles.
- Asian countries are ramping up motor vehicle production and accounted for 95% of motorised and electric two-wheelers globally, while also increasing commitments to phase out internal combustion engines.
- Electric two- and three-wheelers are being scaled up rapidly in Asia, with annual e-bike sales in China alone increasing from nearly 12 million in 2010 to 16 million in 2020.
- Asia was the epicentre of dockless bike-sharing systems in 2019 and 2020, but Asian cities accounted for only 8% of e-scooter services worldwide in early 2020, far fewer than the United States (39%) and Europe (37%).
- Asia continued to dominate global maritime trade in 2019, accounting for more than 50% of global trade volume, more than 40% of goods loaded and more than 60% of goods unloaded.

Emission trends

- Transport CO_2 emissions in Asia grew 41% between 2010 and 2019, the highest growth among global regions.
- Two-thirds of Asian countries exceeded the global average for transport emissions growth (16%) between 2010 and 2019.
- Road freight transport increased more than 9% each in China and India from 2016 to 2017 (latest available data).

Policy measures

- Metro rail construction and expansion in Asian cities is outpacing other regions. The Asia-Pacific region continues to invest heavily in urban rail systems and in 2018 overtook Europe in the number of new light rail projects for the first time.
- China introduced up to half a million electric buses in its cities between 2015 and 2019, nearing scale, and the buses are also taking hold in neighbouring regions.
- Fuel economy improvements have progressed in China, India, Japan and Saudi Arabia. Average fuel economy improved at least 3% in major Asian countries (China, India, Indonesia, Japan, Malaysia, the Philippines and Thailand) in 2017 – more than twice the global average.
- Asian countries such as Indonesia, the Philippines and Singapore have introduced walking and cycling campaigns, policies and infrastructure improvements in an attempt to counteract the decline in walking and cycling in rapidly motorising countries and cities in the region.
- Asian countries are advancing policy measures on low carbon freight transport, including efforts in sustainable logistics, electric freight vehicles, eco-driving (i.e., driving techniques to maximise fuel efficiency) and freight exchange platforms.
- In Asia, most policies to increase the share of renewables in transport are related to biofuels, and most efforts to scale up electric vehicle uptake are not directly linked to the use of renewable energy.

Impacts of the COVID-19 pandemic

- Public transport impacts due to the COVID-19 pandemic were less drastic in Asia compared to other world regions, and some countries witnessed rapid recoveries in demand.
- Demand for shared mobility services in Asia was heavily impacted by the pandemic, resulting in reduced revenues and employment while triggering new strategies and innovation.

Overview

Asia accounts for most of the growth in global transport demand since 2000.[2] The region's transport CO_2 emissions also increased rapidly during this period, representing nearly 40% of the global total in 2019.[3] Yet **Asia** (led by **China**) also has witnessed some of the strongest emission mitigation responses, leading global growth in high-speed rail, urban public transport (especially metro and bus rapid transit), fuel economy standards and bike sharing. The share of paratransit (sometimes called "informal transport") is high in many cities, contributing to increased mobility but also greater congestion. Overall, Asia is poised to set the pace for new sustainable transport models that can be replicated across both developed and developing countries.

The needed investment in transport infrastructure to drive economic growth in Asia is an estimated USD 500 billion to USD 900 billion annually.[4] With the demand for private transport rising, finding a balance between economic growth and mobility has proven a challenge. Opportunities in the region are mainly focused on efforts to "*Improve*" vehicle technologies; however, economic growth strategies in Asia must also align with "*Avoid*" and "*Shift*" measures to prevent lock-in effects.

Demand trends

Transport demand has continued to rise in most of Asia in line with economic growth. While the COVID-19 crisis led overall demand for transport to plunge in many Asian countries in 2020, demand was more stable in countries that implemented early virus containment policies and that offered more sustainable transport options *(see Box 1)*.[5]

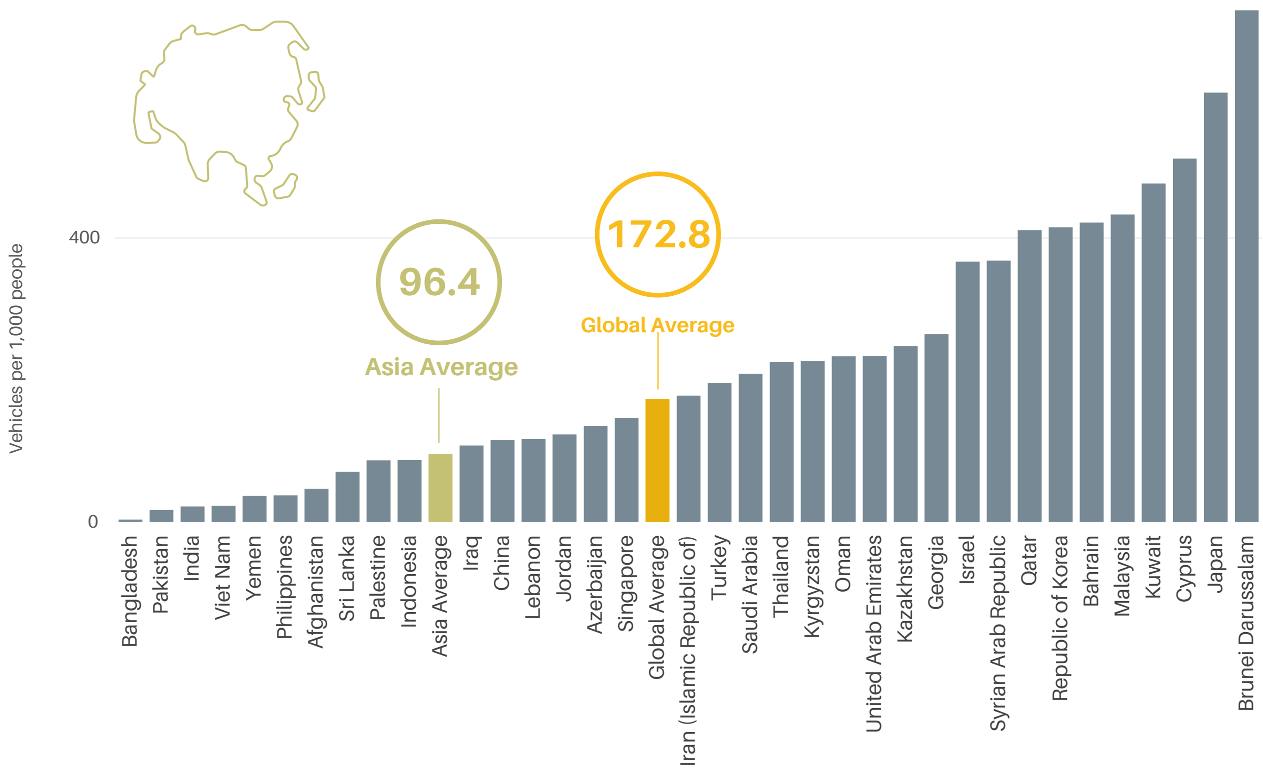
Asia's car ownership rate increased 87% from 2005 to 2015 (latest available data), more than three times the global average *(see Figures 1 and 2)*.[6] Imported used vehicles account for a high share of car ownership in Asian countries (including Bangladesh, Cambodia, Myanmar, Pakistan and Sri Lanka), contributing to declining air quality and increasing congestion. New passenger car sales in the region remained brisk from 2010 to 2019 (up 33%), while demand for new commercial vehicles declined.[7]

- **25% increase** in total new vehicle sales (2010-2019)
- **33% increase** in new passenger car sales (2010-2019)
- **Over 35 million** new passenger cars sold (2019)
- **1% decrease** in new commercial vehicle sales (2010-2019)
- **7.8 million** new commercial vehicles sold (2019)

Sources: See endnote 8 for this section.

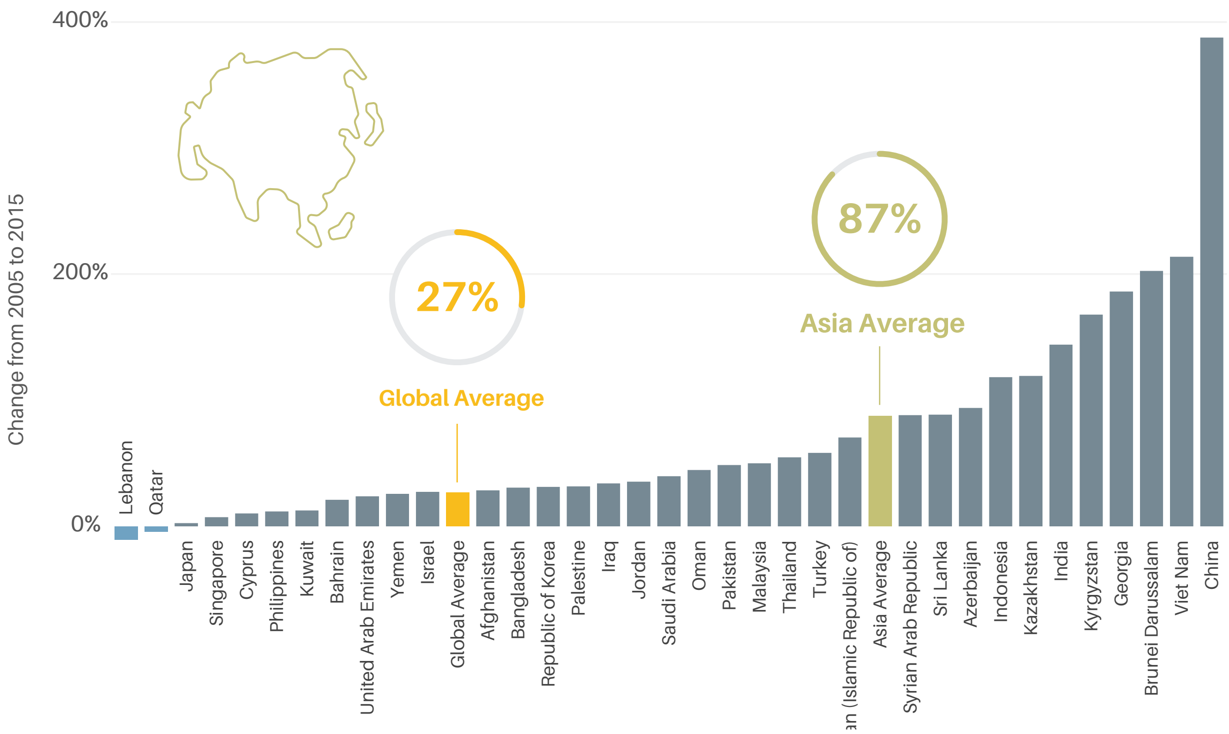
Four of the world's five most congested cities in 2019 were in Asia (Bengaluru, Mumbai and Pune, India; and Manila, the Philippines), due to increased ownership and use of two-, three- and four-wheeled passenger and freight vehicles.[9] Paratransit in Asia includes national services such as ankhot (Indonesia), jeepneys (Philippines) and si-lor (Thailand), which serve as feeders to public

Figure 1 Car ownership rates per 1,000 people in Asia, 2015



Source: See endnote 6 for this section.

Figure 2. Growth in car ownership in Asia, 2005-2015



Source: See endnote 6 for this section.

transport systems. The paratransit share is high in many Asian cities (e.g., Dhaka 54%, Jakarta 50%, Khulna 58%), contributing to increased mobility but also rising congestion.[10]

- Passenger transport demand in China: up 27% during 2010-2019, to 3,534,920 million passenger-kilometres[11]
- Freight transport demand in China: up 49% during 2010-2019, to 13,998,760 million tonne-kilometres[12]

Asian countries are ramping up motor vehicle production and accounted for 95% of motorised and electric two-wheelers globally, while also increasing commitments to phase out internal combustion engines.[13] The region dominates the market for electric passenger cars and buses. As countries like **China**, **India** and the **Republic of Korea** increase vehicle manufacturing, there are opportunities to replace polluting internal combustion engines with more efficient, regionally produced low carbon vehicles.

- In 2019, the **Republic of Korea** announced a goal to produce 6.2 million hydrogen cars by 2040.[14] The country aims to shift all commercial vehicles, including trucks and construction machinery, to fuel cells by 2035 and to have 2,000 hydrogen fuel cell electric buses by 2022.[15]
- Hainan Province, **China** announced in 2019 that it will ban sales of diesel and petrol cars by 2030.[16]
- Hong Kong, **China** announced plans in 2019 to phase out internal combustion engine vehicles and to go fully electric over the next 20 years.[17]
- Several Asian auto manufacturers plan to phase out production of cars with internal combustion engines, including two of **China**'s five biggest automakers (Changan Automobile and the BAIC Group) by 2025.[18] The Korean automaker Hyundai halted development of diesel engines in 2020.[19]
- In 2020, **Singapore** announced that it would phase out petrol and diesel vehicles by 2040.[20]

Electric two- and three-wheelers are being scaled up rapidly in Asia, with annual e-bike sales in China alone increasing from nearly 12 million in 2010 to 16 million in 2020.[21] Middle and low-income countries in Asia have the world's highest density of two- and three-wheelers, both in absolute terms and as a fraction of the overall fleet.[22] Implementing policies to ensure that these vehicles are powered by renewable electricity can reduce global greenhouse gas emissions and improve local air quality.

- In 2020, Delhi Metro Rail Corporation in **India** added electric rickshaw services to 12 more metro stations, bringing the total to more than 1,000 e-rickshaws at 29 stations.[23]
- Solar rickshaws in **India** debuted on the IIT-Delhi campus in 2019, followed by an expansion of more than 1.5 million solar rickshaws throughout New Delhi in 2020.[24]
- Bicycle exports from **Chinese Taipei** included 410,000 electric bicycles in 2020, up 21% from 2019.[25]
- In **Vietnam**, the transition to electric two-wheelers was found to have the highest potential to reduce transport CO_2 emissions by 2030.[26] One local producer was able to increase production from 50,000 units in 2019 to 112,000 in 2020.[27]

Asia was the epicentre of dockless bike-sharing systems in 2019 and 2020, but Asian cities accounted for only 8% of e-scooter services worldwide in early 2020, far fewer than the United States (39%) and Europe (37%).[28] This could be attributed to the lack of a cohesive regulatory framework for introducing and integrating e-scooter services into existing public transport systems.

- China's initial boom in dockless bike sharing crashed in 2019, with more than 40 private companies competing for limited urban space.[29] Cities including Hangzhou and Shanghai later created local guidelines aimed at reducing theft, vandalism and disposal of shared bicycles.[30]
- Life-cycle emissions of shared bikes in China are significant, with an estimated two years of use required to achieve net carbon savings.[31]

Asia continued to dominate global maritime trade in 2019, accounting for more than 50% of global trade volume, more than 40% of goods loaded and more than 60% of goods unloaded.[32] Trade tensions between China and the United States greatly affected maritime trade patterns in 2019, contributing to increased maritime activity in Vietnam and to smaller increases in Cambodia, Indonesia, Malaysia, the Philippines, Singapore and Thailand.[33]

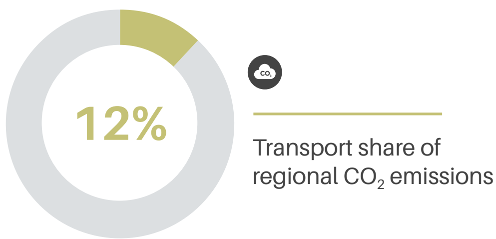
- In 2019, Asia remained home to 16 of the world's top 20 container ports.[34]
- Intraregional (within Asia) and South-South trade accounted for around 40% of total container-based trade in 2019.[35]

Emission trends

Transport CO_2 emissions in Asia grew 41% between 2010 and 2019, the highest growth among global regions.[36] Asia is the largest regional contributor to transport CO_2 emissions, as strong population growth has led to increased demand for passenger and freight transport, and because of limited progress in decoupling economic growth from growth in transport emissions. Per capita transport CO_2 emissions in 2019 in Asia are close to the global average *(see Figure 3)*.[37]

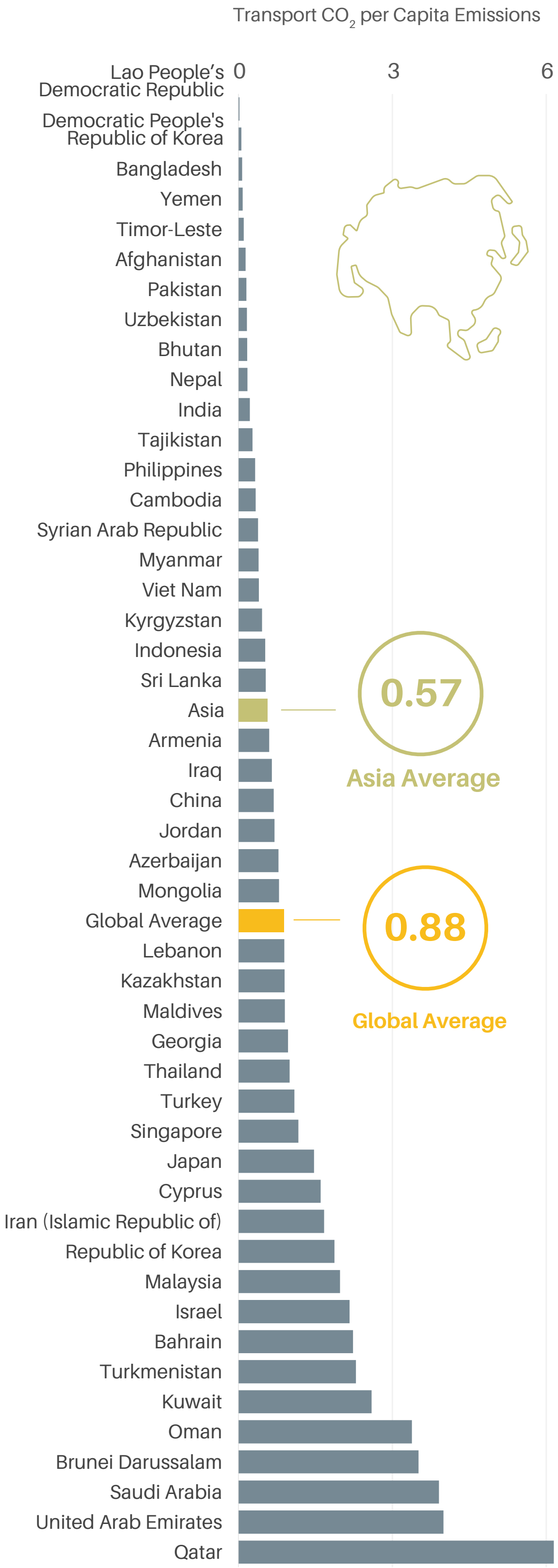
Regional CO_2 emissions

- Total transport CO_2 emissions (2019): **2,606 million tonnes**
- Share of global transport CO_2 emissions (2019): **38%**
- Per capita transport CO_2 emissions (2019): **0.57 tonnes**
- Transport CO_2 emissions per USD 10,000 GDP (2019): **0.88 tonnes**



Sources: See endnote 38 for this section.

Figure 3. Per capita transport CO_2 emissions in Asia, 2019



Source: See endnote 37 for this section.

Two-thirds of Asian countries exceeded the global average for transport emissions growth (16%) between 2010 and 2019 *(see Figure 4)*.[39] Only 20% of Asian countries reduced their transport CO_2 emissions during this period (in some cases due to political conflicts).[40]

Road freight transport increased more than 9% each in China and India from 2016 to 2017 (latest available data).[41] Road freight transport produces higher emissions than rail, aviation and maritime transport combined.[42] CO_2 emissions from freight transport in Asia are projected to grow more than 300% from 2010 to 2050.[43]

Policy measures

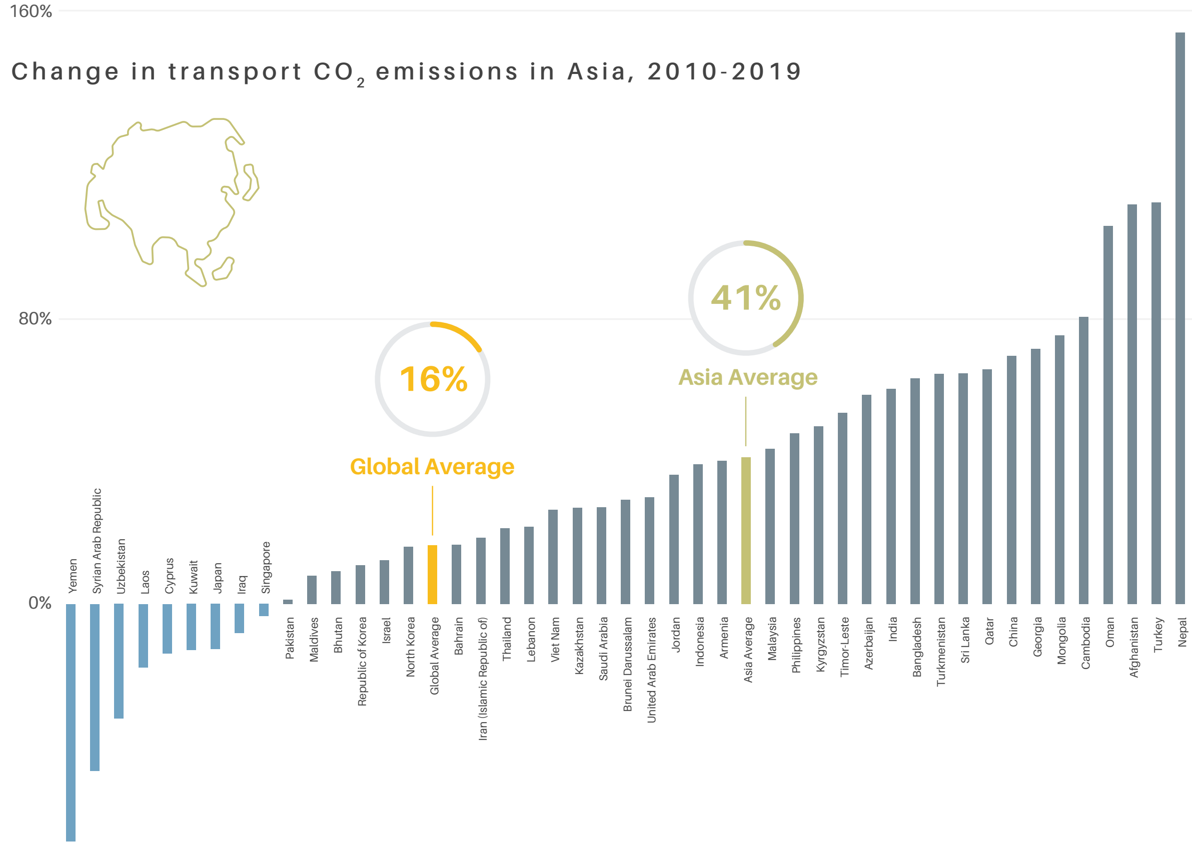
Sustainable transport policy measures continued to expand in Asia, offering best practices in electric mobility, shared mobility, urban rail and renewable energy. Densely populated Asian cities have significant potential to expand sustainable mobility planning, including walking and cycling facilities, and more countries in the region are developing policy frameworks supporting low carbon urban mobility.

Metro rail construction and expansion in Asian cities is outpacing other regions.[44] **The Asia-Pacific region continues to invest heavily in urban rail systems and in 2018 overtook Europe in the number of new light rail projects for the first time.**[45] Major metropolitan areas launched and extended light and heavy rail systems, a key opportunity to reduce transport emissions. However, little action was recorded on bus rapid transit systems in the region during 2019 and 2020, with only one new system opening (in Peshawar, Pakistan). Other examples of rail construction and expansion in Asian cities include the following:

- In 2019, cities in **China** expanded their subway systems by a combined 877 kilometres from the previous year, for a total length of 6,172 kilometres.[46]
- The first metro line in **Pakistan** opened in **Lahore** in October 2020, aiming to serve 250,000 passengers daily along its 27-kilometre route.[47]
- The first subway system in **Jakarta, Indonesia** entered operation in 2019, with the opening of a metro line in March 2019 and a light rail line in December.[48]
- **Nagpur, India** opened its first subway line in March 2019, followed by second line in January 2020.[49] **Doha, Qatar** introduced three subway lines in 2019 with a total length of 76 kilometres.[50]
- The urban rail network in **Bangkok, Thailand** was expanded in 2018 with a 13-kilometre southern extension of the elevated BTS with nine new stations, followed in 2019 by a 10-kilometre northern extension and an extension of the blue line, completing the loop around the city and enabling capacity of 500,000 passengers per day.[51]

China introduced up to half a million electric buses in its cities between 2015 and 2019, nearing scale, and the buses are also taking hold in neighbouring regions.[52] As local governments

Figure 4. Change in transport CO_2 emissions in Asia, 2010-2019



Source: See endnote 39 for this section.

across Asia replace older buses with new electric versions, there is an opportunity for formalised public transport systems to provide both cleaner and more equitable access. Tendering and contracting of public transport services to acquire electric vehicles could also include stipulations to make vehicles safer for riders and pedestrians and more accessible for persons with disabilities.

- In **China**, subsidies for electric vehicles (also called "new energy vehicles") were extended in 2020 through the end of 2022.[53]
- In **Singapore**, 60 electric buses began operating as part of a trial in early 2020 and are expected to reduce around 7,840 tonnes of CO_2 annually, equivalent to the emissions of 1,700 passenger cars.[54]

Fuel economy improvements have progressed in China, India, Japan and Saudi Arabia. Average fuel economy improved at least 3% in major Asian countries (China, India, Indonesia, Japan, Malaysia, the Philippines and Thailand) in 2017 – more than twice the global average.[55]

- The **ASEAN** Fuel Economy Roadmap 2018-2025, released in 2019, contains a target to reduce the average fuel consumption of new light-duty vehicles sold in the Association of Southeast Asian Nations (ASEAN) region by 26% between 2015 and 2025, reaching 5.3 litres of petrol equivalent per 100 kilometres by 2025.[56]
- In 2018, the **Bangladesh** Road Transport Authority initiated efforts to improve the fuel economy of light-duty vehicles. Between 2005 and 2017, the country's average fuel economy improved 23% (from 8.98 litres per 100 kilometres to 6.9 litres), and transport CO_2 emissions fell 24%.[57]
- **Malaysia** aims to reduce carbon emissions by improving the overall fuel consumption of vehicles to 5.3 litres per 100 kilometres, in line with the ASEAN Fuel Economy Roadmap.[58]
- A new fuel economy labelling guideline in the **Philippines'** Energy Standards and Labeling Program was to be implemented on a voluntary basis for one to two years starting in 2019.[59]
- **Vietnam** began regulating newly assembled and imported four-wheel vehicles to Euro 4 emission standards in 2018 and is targeting the higher Euro 5 standards from 2022.[60]

Asian countries such as Indonesia, the Philippines and Singapore have introduced walking and cycling campaigns, policies and infrastructure improvements in an attempt to counteract the decline in walking and cycling in rapidly motorising countries and cities in the region. In **Beijing**, China, cycling's share of transport fell from 39% in 2000 to 17% in 2010, and similar declines have occurred in many Chinese cities.[61]

- A guidebook for reallocating rights-of-way to prioritise walking and cycling in Indian cities was released in 2020, with case studies from **Coimbatore, Mumbai, Ranchi, Rohtak** and **Udaipur**.[62]
- In 2019, **Jakarta**, Indonesia built 63 kilometres of dedicated bike lanes to encourage active commuting and reduce congestion.[63] In September 2020, the Ministry of Transport in **Indonesia** published a regulation for cyclist safety that mandated every city and regency to provide cycling facilities, such as bike lanes and bike parking; by December, **Jakarta** was among several cities with newly painted bike lanes.[64] Until 2020, there had been no regulation to improve cycling conditions in Indonesia, and the new regulation was foundational for the development of cycling policies across the country.[65]
- A National Bicycle Act introduced in the **Philippines** in 2019 mandated the development of policies, infrastructure and facilities to integrate bicycles into the public transport system.[66] The country's Urban Mobility Plan, approved in 2020, outlines investments in non-motorised transport infrastructure.[67]
- **Singapore** announced in 2020 that it would double the length of its cycling paths to 800 kilometres by 2023.[68]

Asian countries are advancing policy measures on low carbon freight transport, including efforts in sustainable logistics, electric freight vehicles, eco-driving (i.e., driving techniques to maximise fuel efficiency) and freight exchange platforms.[69] Rising shares of road freight in Asian countries present a challenge for efforts to reduce transport emissions.

- In 2019, **China** introduced zero- or low-emission zones for freight vehicles in at least 10 cities, resulting in strong uptake of electric freight vehicles.[70]
- INGKA Group, an IKEA franchisee that provides last-mile delivery services, achieved 100% electric home delivery in **Shanghai** in 2019, a year ahead of its 2020 target.[71]
- In 2020, **Clean Air Asia** concluded a five-year eco-driving programme in **Indonesia**, with private sector companies and other stakeholders seeking to reduce freight emissions.[72]

In Asia, most policies to increase the share of renewables in transport are related to biofuels, and most efforts to scale up electric vehicle uptake are not directly linked to the use of renewable energy. Nine Asian countries produce transport biofuels, and **China, Indonesia, Thailand** and **India** rank among the world's top producers.[73] Biofuel production in the region increased more than 25% between 2017 and 2018, to 12 million tonnes.[74] Electrification of vehicles coupled with renewable energy can help reduce transport emissions, and pilots are under way to integrate hydrogen, solar and geothermal resources.

- **Indonesia** trialled 30% biodiesel blending – the most ambition target in the region – in 2019 and was aiming for 40% blending in 2020.[75]
- Under a hydrogen pilot project in Foshan, **China**, 70 hydrogen buses were in operation by the end of 2018.[76]
- Vehicle-to-grid integration pilots using solar energy in **China** included Hanergy Glory Solar Technology's test to run an electric vehicle for 30 consecutive days solely on solar power, without plug-in charging.[77]
- In 2019, an urban rail network in **Tokyo, Japan** was converted to being powered entirely by geothermal power and hydropower.[78]

Box 1. Impacts of the COVID-19 pandemic on transport in Asia

Major COVID-19 impacts:

- 59% decrease in trips to public transport stations (at lowest point in 2020 versus January 2020 average)
- 27% to 53% decline in freight transport activity (below 2019 levels)
- 71% decline in international aviation activity (to and from Asia; below 2019 levels)
- 37% decline in domestic aviation activity (below 2019 levels)

Following the onset of the COVID-19 pandemic, transport emissions in Asia dropped along with the decline in transport demand.

Public transport impacts due to the COVID-19 pandemic were less drastic in Asia compared to other world regions, and some countries witnessed rapid recoveries in demand. By late May 2020, the number of people accessing public transport stations in **Mongolia**, the **Republic of Korea** and **Vietnam** had returned to pre-COVID-19 levels of January 2020 (following sharp declines in April). Rail freight flows along the Trans-Asian Railway network avoided major restrictions during the pandemic in 2020.

Demand for shared mobility services in Asia was heavily impacted by the pandemic, resulting in reduced revenues and employment while triggering new strategies and innovation. The Indian ride-hailing company **Ola** saw a 95% drop in revenue in April and May 2020 and fired 1,400 employees to cut costs, while shifting resources to research and development. In December 2020, Indonesia-based **Gojek**, a platform providing transport, logistics and food delivery services, began a collaboration with the Asian Development Bank to research the impacts of COVID-19 and digitalisation on micro, small and medium-sized enterprises.

Source: See endnote 5 for this section.

In Practice: Additional Policy Responses

Avoid measures

Sustainable mobility planning and transport demand management

- One of nine key tasks in **China's** 2019 Long-Term Transport Development Plan is to promote green, low carbon, resource- and energy-efficient, low-polluting and eco-friendly transport systems.[79]
- **Malaysia's** National Transport Policy 2019-2030 includes actions on green transport, such as prioritising public transport networks in urban structures and accelerating the implementation of low carbon mobility initiatives.[80]
- In 2019, after extensive public consultation, **Singapore** released its Land Transport Master Plan 2040, which includes the goal of a 45-minute city with 20-minute towns and 100% zero-emission buses and taxis by 2040.[81]
- National strategies to accelerate sustainable mobility were implemented in **Turkey**, aimed at higher fuel efficiency, introducing more transport services and reducing private vehicles in cities.[82]

Shift measures

Public transport

- In **China**, recent additions to bus rapid transit systems included a 13-kilometre line in Fuzhou (Jiangxi Province), a 38-kilometre line in Tengzhou (Shandong Province) and a 35-kilometre line in Yongzhou (Hunan Province) in 2019, as well as extensions in Nanchang and Shanghai.[83]
- The only new bus rapid transit system in Asia in 2020 opened in **Peshawar, Pakistan** with 32 stops, allowing a ridership of 500,000 people.[84]
- **TransJakarta**, the bus rapid transit system in Jakarta, Indonesia, set an ambitious target in 2019 to shift to a 100% zero-emission fleet by 2030.[85]

Shared mobility services

- In 2019, motorcycle taxis were allowed to legally operate in the **Philippines** for the first time.[86] In an attempt to regulate the industry, the number of such taxis was restricted in Metro Manila and Cebu to 45,000 riders, divided equally among three operators.[87]
- Uber began using boats to alleviate road congestion on roads in Mumbai, **India** and partnered with the e-mobility start-up SUN Mobility to deploy electric three-wheelers in selected Indian cities in 2019.[88]
- In early 2020, Grab introduced 20 electric cars to its ride-hailing fleet in Jakarta, **Indonesia**.[89]

Improve measures

Vehicle emissions

- **Bangladesh** announced plans to introduce Euro 6 emission standards in 2025.[90]
- In 2018, the government of **Indonesia** introduced the Euro 4 standard for all vehicles that have two or more wheels.[91]
- In **Malaysia**, tentatively, the Euro 4 standard took effect for new models after 1 April 2020, and for existing models after 1 October 2020.[92]
- In 2019, **Turkey** adopted legislation to improve energy efficiency in the transport sector through the implementation of vehicle efficiency and environmentally friendly alternative fuels.[93]
- **Sarawak**, Malaysia started using hydrogen-fuelled buses in 2020.[94]
- **JR East Group**, a major passenger railway company in Japan, committed in May 2020 to achieving net-zero CO_2 emissions by 2051.[95]
- **Indian Railways** is on track to be 100% electrified by the end of 2022 and has committed to being carbon neutral by 2030.[96]
- **India's** National Electric Mobility Mission Plan has the ambitious target of achieving 7 million hybrid and electric vehicles from 2020 onwards, and in 2019 the government implemented the Faster Adoption and Manufacturing of Electric Vehicles in India (FAME) Phase II scheme, allocating USD 1.4 billion in rebates over three years to reduce the purchase price of hybrid and electric vehicles.[97] The scheme also targets 2,700 electric vehicle charging stations in cities above 4 million inhabitants as well as fast and ultra-fast charging stations along major highways.[98]
- In 2019, a decree in **Indonesia** outlined government support for efforts to build an industry around the production and purchasing of electric vehicles.[99]

Europe Regional Overview

Demographics

Population size:	Population growth:	Urban population share:	Urban population growth:	GDP per capita:	Urban population growth:
747 million	+2%	74%	+4%	USD 30,496	+13%
(2020)	(2010-2020)	(2020)	(2010-2020)	(2019)	(2010-2019)

Sources: See endnote 1 for this section.

Key findings

Demand trends

- In two-thirds of European countries, the growth in car ownership between 2005 and 2015 was below the global average; however, average rates of car ownership in 2015 were nearly three times the global average.
- The share of electric vehicles among new car registrations in Europe increased from 2% in 2018 to 3.5% in 2019, but market penetration remains relatively low.
- Passenger transport demand in the European Union (EU) reached a record high in 2018, with car travel accounting for more than 70% of passenger demand, and rail travel for nearly 7%.
- Freight transport demand increased 11% from 2010 to 2018, with road transport accounting for 73% of this demand, rail for 17% and inland waterways for 6%.
- Tram and metro usage reached an all-time high in the EU-27 in 2018, with growth of more than 10% since 2010. Demand for urban and inter-city buses remained stable during this period.

Emission trends

- Transport is responsible for nearly a quarter of EU greenhouse gas emissions and is the region's only sector without significant emission reductions since 2018.
- Transport CO_2 emissions in Europe remained roughly stable between 2010 and 2019 and accounted for around 18% of global transport CO_2 emissions in 2019.
- Half of all European countries reduced their transport CO_2 emissions between 2010 and 2019, but more than 20% of countries exceeded the global average growth in transport emissions.
- Europe has the cleanest vehicle fleet among world regions; however, average CO_2 emissions from new cars and vans increased between 2017 and 2019, exceeding the 2021 emission standards for passenger cars by more than 25%.

Policy measures

- Individual European countries and the EU have established ambitious transport decarbonisation roadmaps to address rising transport emissions, with the aim of achieving climate neutrality by 2050.
- Many European countries have embraced integrated mobility planning to reduce urban transport emissions, and in 2020 the region accounted for 68% of global sustainable urban mobility plans (SUMPs).
- Electric mobility is a key target of EU policies for a "green transition" and post-pandemic recovery, and several European countries have announced progressive bans on sales of fossil fuel vehicles.
- Europe has emerged as a frontrunner in implementing low-emission zones as an effective strategy to tackle climate change and improve air quality; as of 2020, these zones were present in at least 261 European cities.
- With road freight movement in the region expected to grow steadily, low carbon freight and logistics strategies are emerging to help reduce greenhouse gas emissions and to incorporate the emission goals of the European Green Deal.
- Mobility as a Service (MaaS), which originated in Europe, is more advanced in the region than elsewhere globally; however, it is still transitioning towards broad market integration and remains far from achieving maximum emission reductions.
- The European Investment Bank adopted its Climate Bank Roadmap 2021-2025 to make all of its activities Paris Agreement compatible, and is reviewing its transport lending criteria to align with the Roadmap.

Impacts of the COVID-19 pandemic

- Prolonged lockdowns and travel restrictions due to COVID-19 contributed to a 61% reduction in public transport demand in Europe in 2020, although the region also experienced a swift shift to active mobility.
- By March 2020, most European countries had experienced declines in air passenger transport of 50-70% compared to 2019 levels, with Italy registering the largest drop of 85%.
- COVID-19-related declines in daily EU greenhouse gas emissions (compared to business as usual) began in early March 2020 but had almost returned to pre-lockdown levels by the end of July.
- Investments have been made in Europe to encourage active modes of transport (walking and cycling) as an effective means to guarantee social distance and promote active lifestyles.

Overview

Demand for freight and passenger transport in Europe grew at relatively low rates (1-2%) in 2018, but the region's per capita transport emissions remained high (although still well below North America's).[2] Europe's transport networks are well developed, with a rich set of public transport systems, walking and cycling infrastructure, and demand management policies. Transport policies aimed at climate change adaptation are also taking shape.

The European Green Deal, which aims to align **EU** policies with the region's objective to achieve climate neutrality by 2050, includes the goal of "accelerating the shift to sustainable and smart mobility".[3] This led to the adoption in 2020 of a strategy and action plan that aims to provide more affordable, safe, competitive, accessible, healthier and cleaner mobility options, with the goal of cutting EU emissions from road, rail, aviation, and waterborne transport 90% by 2050.[4] Despite the significant effort within Europe to implement planning approaches to ambitiously reduce transport-related emissions, the region has demonstrated few achievements in effective climate change mitigation.

The COVID-19 pandemic has impacted European transport in numerous ways. In the early months of 2020, most European countries experienced sharp declines in air passenger transport, and the region's long-distance, regional and international passenger rail services also plummeted *(see Box 1)*.[5]

Demand trends

In two-thirds of European countries, the growth in car ownership between 2005 and 2015 was below the global average; however, average rates of car ownership in 2015 were nearly three times the global average *(see Figures 1 and 2)*.[6] For example, high car ownership in **Luxembourg** is driven by low taxation of transport fuels, a large number of company cars and high housing prices (which has led to greater numbers of cross-border workers).[7] Government policies, such as the removal of parking spaces in **Amsterdam**, reflect efforts to reduce car ownership and ease congestion in rapidly motorising cities and regions.[8]

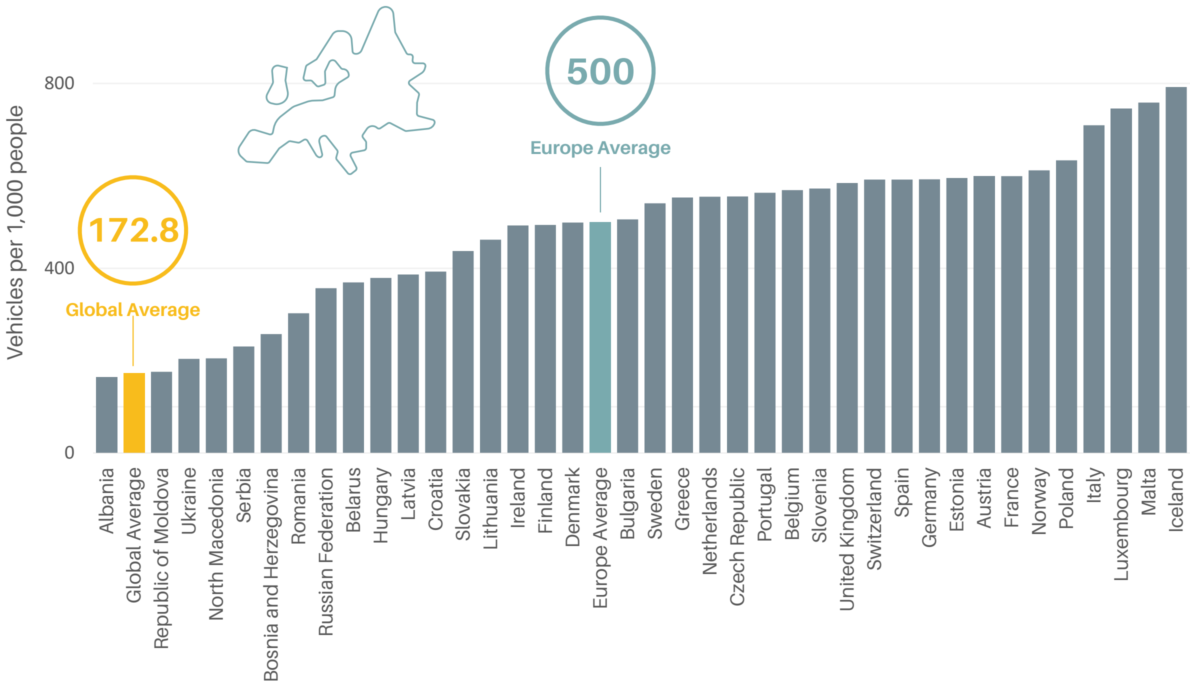
- In 2019, automobile production in **Germany** fell to its lowest level since 2010, coinciding with rapidly evolving vehicle technologies (e.g., electric and autonomous vehicles) and tighter emission restrictions.[9]
- A 2019 survey in **Finland** found that nearly 20% of citizens plan to give up their cars by 2024 in favour of public transport, shared bicycles or carpooling.[10]

New vehicle sales

- **13% increase** in total new vehicle sales (2010-2019)
- **10% increase** in new passenger car sales (2010-2019)
- **Over 17.5 million** passenger cars sold (2019)
- **33% increase** in new commercial vehicle sales (2010-2019)
- **2.7 million** new commercial vehicles sold (2019)

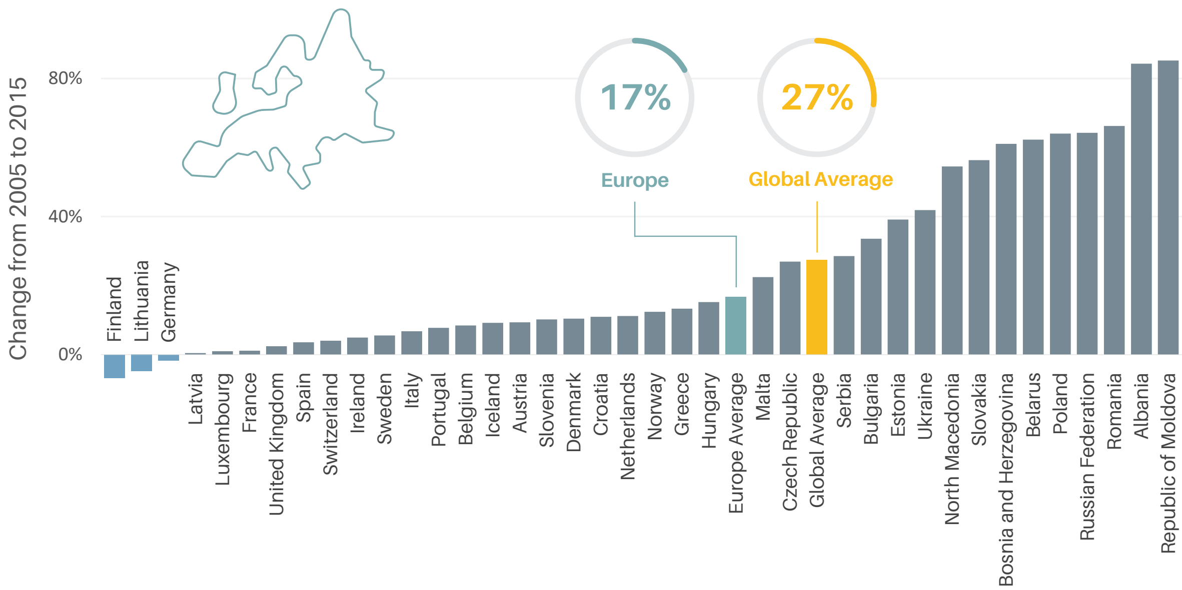
Source: See endnote 11 for this section.

Figure 1. Car ownership rates per 1000 people in Europe, 2015



Source: See endnote 6 for this section.

Figure 2. Growth in car ownership in Europe, 2005-2015



Source: See endnote [6] for this section.

The share of electric vehicles among new car registrations in Europe increased from 2% in 2018 to 3.5% in 2019, but market penetration remains relatively low.[12] Electric vehicle registration shares were highest in **Norway** (56%), **Iceland** (19%), the **Netherlands** (16%), **Sweden** (12%) and **Switzerland** (11%).[13] The demand for electric vans increased from 0.8% of total vehicle registrations in 2018 to 1.3% in 2019.[14]

Passenger transport demand in the EU reached a record high in 2018, with car travel accounting for more than 70% of passenger demand, and rail travel for nearly 7%.[15] Car travel grew 6.7% between 2010 and 2018, while rail travel increased at more than twice that rate (13.6%).[16] Demand for passenger rail varied among Member States, with increases of up to 30% reported in the **Czech Republic**, **Luxembourg**, the **Slovak Republic** and the **United Kingdom**, while **Bulgaria**, **Croatia**, **Greece** and **Slovenia** reported stable or declining ridership.[17] In 2017, high-speed rail accounted for 27% of passenger rail transport in the EU overall, and for more than half in both France and Spain.[18]

Freight transport demand increased 11% from 2010 to 2018, with road transport accounting for 73% of this demand, rail for 17% and inland waterways for 6%.[19] The main contributors to the increase in demand between 2010 and 2018 were road freight (up 9.7%) and rail freight (up 12.9%), while inland waterway freight fell 13.1%.[20]

- Passenger transport activity: up 9% during 2010-2018, to 5,916 billion passenger-kilometres[21]
- Freight transport activity: up 11% during 2010-2018, to 3,353 billion tonne-kilometres[22]

Tram and metro usage reached an all-time high in the EU-27 in 2018, with growth of more than 10% since 2010.[23] **Demand for urban and inter-city buses remained stable during this period.**[24] Overall, however, tram and metro usage accounted for just 1.7% of total passenger-kilometres in 2018, while buses accounted for 8.5%.[25]

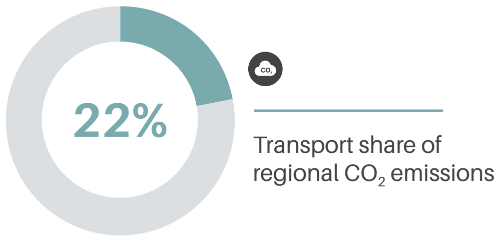
- Cities in **Germany** pursued various measures to improve public transport networks in 2019: **Berlin** announced that it would spend EUR 28 billion (USD 33 billion) on improving public transport until 2035, and **Augsburg** introduced the country's first "mobility flat rate", enabling local consumers to enjoy bus, car sharing, bicycles, etc. for a set monthly rate of EUR 79 (USD 95).[26]
- In 2018, **Estonia** became the world's first country to make all public transport free in an effort to reduce car traffic, followed by **Luxembourg** in 2020.[27]

Emission trends

Transport is responsible for nearly a quarter of EU greenhouse gas emissions and is the region's only sector without significant emission reductions since 2018.[28] The EU must reduce transport emissions 90% by 2050 to achieve climate neutrality as targeted under the European Green Deal.[29]

Regional CO_2 emissions

- Total transport CO_2 emissions (2019): **1,226 million tonnes**
- Share of global transport CO_2 emissions (2019): **18%**
- Per capita transport CO_2 emissions (2019): **1.64 tonnes**
- Transport CO_2 emissions per USD 10,000 GDP (2019): **0.54 tonnes**



Source: See endnote 30 for this section.

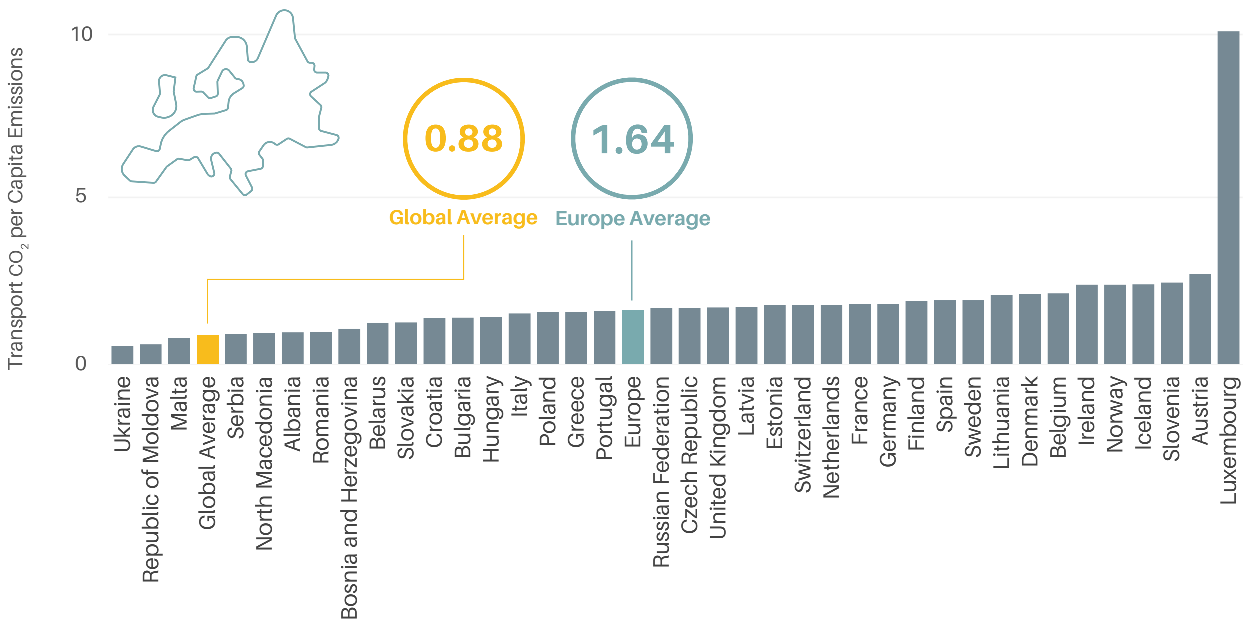
Transport CO_2 emissions in Europe remained roughly stable between 2010 and 2019 and accounted for around 18% of global transport CO_2 emissions in 2019.[31] Although transport CO_2 emissions in Europe have not grown considerably, they remain far from the substantive reductions required to achieve the region's 2050 target for carbon neutrality.[32] The per capita transport CO_2 emissions of nearly every European country are above the global average *(see Figure 3)*.[33] Luxembourg is shown as an outlier as data is based on fuel consumption, which is extremely high due to the low fuel prices that attract citizens from neighbouring countries.[34]

Half of all European countries reduced their transport CO_2 emissions between 2010 and 2019, but more than 20% of countries exceeded the global average growth in transport emissions *(see Figure 4)*.[35] The region includes examples of both rapid growth and sharp declines in transport CO_2 emissions during this period.

- Transport emissions in **North Macedonia** have surged mainly because of rising car ownership. This has led to a very high carbon intensity in transport, especially considering the prevalence of old vehicles with low or no emission controls, and the limited provision of public transport.[36]
- In contrast, the sharp decline in transport emissions in **Greece** is explained by the economic crisis and subsequent drop in fuel consumption during 2009-2012; since 2013, however, emissions have been continually increasing at a low rate (not including 2020).[37]

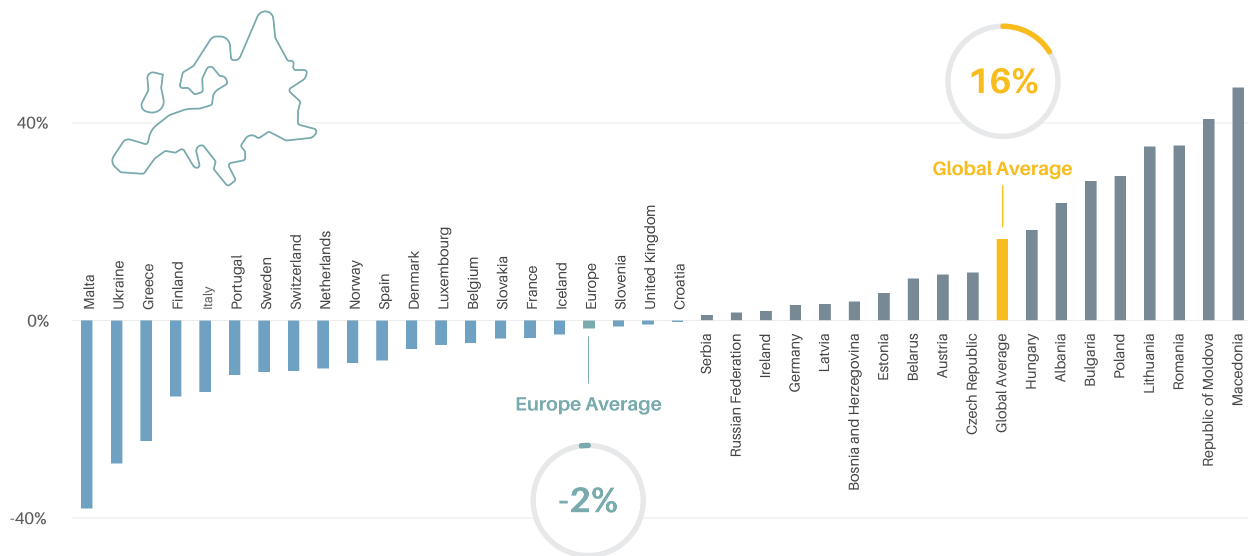
Europe has the cleanest vehicle fleet among world regions; however, average CO_2 emissions from new cars and vans increased between 2017 and 2019, exceeding the 2021 emission standards for passenger cars by more than 25%.[38] Sport utility vehicles (SUVs) accounted for nearly 40% of new car sales in Europe in 2019, while electric vehicles accounted for only 2.3%.[39] European car industry sales increased in 2019, unlike industry sales in both **China** and the **United States**.[40]

Figure 3. Per capita transport CO_2 emissions in Europe, 2019



Source: See endnote 33 for this section.

Figure 4. Change in transport CO_2 emissions in Europe, 2010-2019



Source: See endnote 31 for this section.

- Average emissions of new cars registered in the EU totalled 122.4 grams of CO_2 per kilometre in 2019, well above the target of 95 grams for 2021 and higher than the 2018 average.[41]
- Sales of diesel vehicles as a share of total vehicles sold in the EU fell from 36% in 2018 to 31% in 2019.[42]
- The **EU** adopted new CO_2 emission performance standards for cars and vans in 2019 and set a target for 35% zero- and low-emission vehicles in new registrations by 2030 – measures that are projected to reduce the region's CO_2 emissions from road transport 23% by 2030 (compared to 2005 levels).[43]

Policy measures

Strong political will in the region has paved the way for Europe to be an influential leader in global action on transport and climate change. The EU encourages strict fuel economy requirements and the use of advanced biofuels. At a national level, the majority of countries aim to increase investments in public transport, walking and cycling infrastructure.

Europe offers many tested transport solutions (including trams, high-speed rail, shared mobility systems, low-emission zones, etc.) that can be and have been replicated by peers in other regions and adapted by countries and cities across geographies in different socio-economic realities.

Individual European countries and the EU have established ambitious transport decarbonisation roadmaps to address rising transport emissions, with the aim of achieving climate neutrality by 2050. The EU played a key role in negotiating the Paris Agreement and offers examples of ambitious climate change policies. The region is uniquely positioned to influence climate action in other countries because of its economic weight, ability to craft common legislation among 27 Member States and role as the world's largest provider of international development assistance.[44]

- The **European** Green Deal proposes actions for sustainable, low carbon transport with key priorities including increasing multimodal passenger and freight transport efficiency, fostering automated and smart mobility, ending fossil fuel subsidies, extending emission trading to shipping and ramping up sustainable fuels.[45]
- Many cities in **Europe** have joined the Global Covenant of Majors for Climate and Energy to jointly tackle both climate change mitigation and adaptation and to support implementation of the EU target to cut greenhouse gases 40% by 2030.[46] The Covenant commits more than 10,000 cities worldwide to submitting concrete action plans as well as strategies to track their implementation.[47]
- **Scotland's** Green New Deal of 2019 included GBP 500 million (USD 700 million) for improved bus priority lanes to tackle congestion and increase usage.[48] In 2020, the **UK** Government announced a GBP 5 billion (USD 7 billion) boost for greener transport, transforming bus services across the country with simpler fares, bus fleet modernisation, improved routes and higher frequencies.[49]
- The EU's Long-Term Strategy for implementation of the Paris Agreement offers transport innovations by using "alternative means of transport, connected and automated driving combined with the roll-out of electric vehicles and enhanced use of alternative fuels".[50]
- A large share (83%) of international transport experts view the **EU** as the most influential major international organisation to help increase co-ordination and drive decarbonisation in the transport sector.[51]

Many European countries have embraced integrated mobility planning to reduce urban transport emissions, and in 2020 the region accounted for 68% of global sustainable urban mobility plans (SUMPs).[52] During the year, SUMPs expanded to seven cities in Ukraine.[53]

- In 2019, **Italy** launched an initiative to support the development of SUMPs in at least 64 municipalities.[54]
- Paris, **France** set several targets in 2019 aimed at establishing a "15-minute city", where all essential needs are within a short walk or bike ride.[55] Only battery electric and hydrogen fuel cell vehicles will be permitted to enter the city's low-emission zone by 2030.[56]
- **Ukraine**'s comprehensive package of mobility reform measures offers a model for other emerging and transitional economies and includes the expansion of SUMPs, targets for alternative fuels and electric vehicles, and tax waivers.[57]

Electric mobility is a key target of EU policies for a "green transition" and post-pandemic recovery, and several European countries have announced progressive bans on sales of fossil fuel vehicles.[58] Although electric vehicle sales are increasing rapidly in the region, market penetration remains low at 3.5% in 2019.[59] Initiatives to boost electric mobility have focused mainly on technological optimisation and market development of battery-powered vehicles.

- Bans on sales of fossil fuel vehicles will enter into force in **Norway** by 2025; in **Denmark**, **Iceland**, **Ireland**, the **Netherlands**, **Slovenia**, **Sweden** and the **United Kingdom** by 2030; and in **France**, **Portugal** and **Spain** by 2040.[60]
- **Volkswagen** announced that it would launch its final generation of internal combustion engine vehicles in 2026, and Volvo pledged to manufacture only electric vehicles by 2030.[61] Europe's seven largest truckmakers have agreed to phase out the use of traditional internal combustion engines.[62]
- In 2019, **France** launched a massive fleet of 10,000 electric bicycles in Paris, along with 800 new electric buses to help reduce smog.[63]
- **Portugal** developed an electric bike subsidy scheme in 2019, supporting the purchase of 1,000 e-bikes.[64] In the **Netherlands**, e-bike sales grew roughly 35% in 2019, while sales of regular city bikes fell 4.1% in the first half of the year.[65] Across the EU, 3.7 million e-bikes were sold in 2019, far outpacing the half-million electric vehicles sold that year.[66]

Europe has emerged as a frontrunner in implementing low-emission zones as an effective strategy to tackle climate change and improve air quality; as of 2020, these zones were present in at least 261 European cities.[67] In a 2020 UK poll, 74% of respondents said they want businesses to "do more to cut pollution and traffic after the lock down so that neighbourhoods don't go back to the way they were".[68] *(See Section 3.2 Sustainable Mobility and Transport Demand Management.)*

- In 2019, Paris, **France** banned the use of all diesel cars manufactured before 2006, and by 2030 only zero-emission vehicles will be allowed to enter the city's low-emission zone.[69]
- In 2020, Krakow became the first city in **Poland** with a low-emission zone.[70]
- London, **UK** implemented an ultra-low emission zone in April 2019, charging polluting cars and trucks an additional fee for entering the already existing congestion zone.[71]
- **Spain** enacted a law in 2020 to implement low-emission zones in all urban areas with populations larger than 50,000.[72] Barcelona, which created a low-emission zone that includes neighbouring communities, aims to cut the number of cars in the city by 125,000 within three years, and air pollution by 20% within four years.[73]
- Under the umbrella of the Dutch National Climate Agreement, Rotterdam adopted its Roadmap Zero-Emission City Logistics strategy in 2019 and is required to implement a zero-emission zone by 2025 (along with the 30 largest cities in the **Netherlands**).[74]

With road freight movement in Europe expected to grow steadily, low carbon freight and logistics strategies are emerging to help reduce greenhouse gas emissions and to incorporate the emission goals of the European Green Deal.[75] Shifting road freight to rail and inland waterways can help cut emissions, pending measures to increase the capacity and improve management of these more efficient freight modes.[76] Two-thirds of freight companies consider decarbonisation to be a priority for the sector, and many shippers and logistics service providers have begun setting mitigation goals.[77]

- In 2019, the Alliance for Logistics Innovation and Collaboration in **Europe** (ALICE) developed the Roadmap Towards Zero Emissions Logistics 2050, aimed at decarbonising the logistic sector by defining specific stakeholder roles while promoting cleaner vehicles, trains, barges, ships and planes.[78]
- In the **Netherlands**, in 2019, the Dutch company GoodFuels and partner Reinplus Fiwado Bunker launched the country's first inland vessel that runs on 100% sustainable biofuels.[79]
- A pilot to employ a shared passenger-cargo tram to deliver goods was announced in Frankfurt, **Germany** in 2018.[80] Similar schemes have been implemented in Dresden, Germany to supply materials to the Volkswagen factory, in **Switzerland** to transport garbage and in **France** to transport goods to supermarkets.[81]
- Chronopost has used cargo bikes for last-mile delivery in Lisbon, **Portugal**, where the municipal light-duty fleet is also 100% electric.[82]

Mobility as a Service (MaaS), which originated in Europe, is more advanced in the region than elsewhere globally; however, it is still transitioning towards broad market integration and remains far from achieving maximum emission reductions.[83] Innovative mobility solutions and the use of information technologies have moved transport services towards a more user-centred paradigm. MaaS aims to make travel by private car less attractive than using collective, shared or active transport modes by integrating different fares and modes in a unified online platform, and has the potential to reduce transport CO_2 emissions up to 50%.[84]

Despite many European initiatives to deploy MaaS at a large scale, few systems are fully operational.[85] Regulation has been identified as the last resort for MaaS, including complex interlinks between different sectors. In turn, co-ordination across different levels of government is key for its spread.[86]

- In **Spain**, Bilbao's 2019 declaration "Towards a more sustainable urban mobility" encourages transport, automotive and technology companies to direct their research and development processes and new technologies towards the service of sustainable urban mobility.[87]
- European cities with either pilot or fully developed MaaS strategies include Amsterdam, Antwerp, Birmingham, Ghent, Gothenburg, Hannover, Helsinki, Mulhouse, Stuttgart and Vienna – although operation and commercialisation remain limited.[88]
- In 2019, the Nordic countries created the Nordic Mobility Innovations Platform, aiming to spread MaaS across the Nordic region, open a pan-Nordic market, and share knowledge and collaboration.[89]
- The world's first full MaaS solution, Whim, is available in Helsinki, **Finland**, allowing users to access public transport, taxis, car rentals, bicycles and e-scooters through a single app and payment system.[90]
- In Barcelona, **Spain**, a pilot of demand-responsive public transport services was implemented in areas of low population density to increase efficiency.[91]

The European Investment Bank (EIB) adopted its Climate Bank Roadmap 2021-2025 to make all of its activities Paris Agreement compatible, and is reviewing its transport lending criteria to align with the Roadmap.[92] Although only 10% of EIB activities are outside the EU, the Bank is among the world's biggest lenders on climate action, and transport is its largest area of activity.[93] The EIB's discussion and conclusions on the transport lending criteria will have global implications, due to both the sheer scale of the Bank's activities and because it is the multilateral development bank with the most ambitious climate policy.

- In 2019, the EIB announced that it would end fossil fuel financing for energy projects by 2021.[94]
- The EIB committed to unlocking EUR 1 trillion (USD 1.2 trillion) for climate action and environmental sustainable investment from 2021-2030.[95]

Box 1. Impacts of the COVID-19 pandemic on transport in Europe

Major COVID-19 impacts:

- 61% decrease in trips to public transport stations (at lowest point in 2020 versus average between 3 January and 6 February)
- 40% decline in freight transport activity (below 2019 levels)
- 60% decline in international aviation activity (below 2019 levels)
- 37% decline in domestic aviation activity (below 2019 levels)

Prolonged lockdowns and travel restrictions due to COVID-19 contributed to a 61% reduction in public transport demand in Europe in 2020, although the region also experienced a swift shift to active mobility. The largest declines in trips to public transport stations occurred during the first wave of the pandemic in March/April and the second wave in October. Meanwhile, steep increases in cycling were recorded in many cities around Europe.

- A study of temporary cycling measures adopted in 106 **European** cities showed a 7% increase in cycling on average during the first three months after opening a temporary bike lane compared to the average of 12 months before the opening, with an estimated EUR 3 billion (USD 3.5 billion) in annual health benefits due to the implementation of pop-up bike lanes.
- The **UK's** strict lockdown imposed in March 2020 triggered a 95% decrease in subway trips in London.
- In Barcelona, **Spain**, public transport use fell 50% and car use fell 10%, whereas walking and cycling have risen to 10% above pre-pandemic levels. Other cities with significant increases in walking and cycling include Milan, **Italy**; Paris, **France**; Lisbon, **Portugal**; London, **UK**; Brussels, **Belgium**; and Krakow, **Poland**.
- A survey in 21 European cities in June 2020 found that 21% of respondents planned to cycle more and 35% planned to walk more once lockdowns were fully lifted.

By March 2020, most European countries had experienced declines in air passenger transport of 50-70% compared to 2019 levels, with Italy registering the largest drop of 85%. The region's long-distance, regional and international passenger rail services also plummeted. The demand for passenger transport fell because of both travel restrictions and reduced commuting, tourism and business travel. The dramatic decline in transport activity during lockdowns may have reduced CO_2 emissions in Europe, but these impacts were expected to be temporary. The overall decline in the region's CO_2 emissions may also be related to the contraction in Europe's GDP.

COVID-19-related declines in daily EU greenhouse gas emissions (compared to business as usual) began in early March 2020 but had almost returned to pre-lockdown levels by the end of July. An estimated 54% of the CO_2 emission reductions came from the transport sector, with the largest declines from aviation and road transport. The most affected activities during the pandemic were wholesale, retail trade, transport, accommodation and food service activities, together with the manufacturing sector. Collectively, these activities accounted for around 62% of the overall reduction in GDP and contributed to more than 93.7% of the total CO_2 emissions reduction due to their traditional high carbon intensity.

Investments have been made in Europe to encourage active modes of transport (walking and cycling) as an effective means to guarantee social distance and promote active lifestyles. As of May 2021, more than 2,500 kilometres of new cycling lanes had been announced, and more than 1,400 kilometres had been implemented, in 42 of the 94 biggest European cities.

The EU's COVID-19 recovery plan focuses on implementation of the European Green Deal to provide safe and healthy conditions and to restore economic growth in a sustainable, fair, strong and inclusive manner. The plan includes NextGenerationEU, an emergency allocation of EUR 750 billion (USD 900 billion) to help repair the immediate economic and social damage from the pandemic, including by boosting rail travel and clean mobility in cities and regions. Together with other targeted funding for 2021-2027, NextGenerationEU will bring the total financial firepower of the EU budget to EUR 1.85 trillion.

At the country level, **Austria**, **France**, **Germany**, **Italy** and **Spain** all announced financial measures to advance the deployment of electric vehicles and charging infrastructure during the post-pandemic period. Principles for recovery have focused on safety guidelines and integrating technology in transport to prioritise the health of workers and riders.

Source: See endnote 5 for this section.

In Practice: Additional Policy Responses

Avoid measures

Sustainable mobility planning

Europe leads in the development of sustainable urban mobility plans (SUMPs), as the European Commission encourages Member States to develop such action frameworks.[96]

- In 2020, **the Netherlands** lowered its speed limit from 130 to 100 kilometres per hour to reduce emissions, and **Amsterdam** plans to strip its city centre of parking spaces (removing 10,000 in total) over the coming years, making way for bike lanes, sidewalks and more trees.[97]
- In Ukraine, the cities of **Chernivtsi, Poltava, Vinnytsia and Zhytomyr,** and **Podil District of Kyiv,** developed SUMPs in 2019, and **Mykolayiv** and **Lviv** approved such plans in 2020.98 In Serbia, **Kruševacte** was the first town to develop a SUMP, forming the basis for developing others in Belgrade, Pirot and Ŝabac.[99]
- **Helsinki** and **Turku** in **Finland** aim to become carbon neutral by 2035, which will have strong implications for transport systems.[100]

Shift measures

Public transport

European cities and countries have extensive public transport systems that are undergoing continuous innovations and improvements.

- **Barcelona**, Spain introduced a new travel card in 2020 offering unlimited public transport trips within the metropolitan area for EUR 40 (USD 48) a month.[101]
- A recent report concludes that reviving European international rail connections is a key measure to cut greenhouse gas emissions, as a flight from Paris to Berlin contributes six times the CO_2 emissions of train travel.[102] Night-train routes are re-emerging across Europe to replace flights, including possible connections from Stockholm to Berlin and from Brussels to Vienna.[103] *(See Section 3.10 on Aviation.)*

Shared mobility services

Dockless e-scooters are highly popular in Europe, surpassed only by **North America.** Also, many pilot projects have been launched related to autonomous vehicles (collective and individual transport).

- In **Paris**, Lime e-scooters replaced 1.2 million motor vehicle trips and avoided more than 330 tonnes of CO_2 in 2019.[104] By 2030, the increasing adoption of e-scooters in **Paris** could prevent over 10,000 tonnes of CO_2 emissions and 300 kilograms of local particulate pollution annually.[105]
- **Germany** passed a law in May 2019 permitting e-scooters only on bicycle lanes and requiring vehicle registrations.[106] Also that year, tests of fully electric, autonomous collective passenger vehicles on public roads took place in Frankfurt.[107]
- In 2020, **Bird** announced a partnership with an independent green supplier to offset the company's energy consumption in **Paris**; for every kilowatt-hour consumed, Bird will finance select green energy producers throughout France.[108]

Walking and cycling

As part of their urban planning, many European cities have prioritised the need for better walking and cycling infrastructure. As a "tactical urbanism" response to the pandemic, more than 2,500 kilometres of new cycling infrastructure were implemented in cities across the region since March 2020.[109]

- **Germany** pursued a pedestrian policy that aimed to increase the share of walking trips in big cities to 41%, and in rural areas to 35%, by 2020.[110]
- In 2019, **Italy's** Ministry of Environment announced an investment of EUR 500 million (USD 600 million) to expand urban and interurban cycling paths and to promote bike sharing services.[111]
- In a push for improved walking and cycling, **Scotland** banned parking on pedestrian walkways in 2019 and allocated GBP 80 million (USD 110 million) for active travel in 2019-2020 as part of a climate change bill.[112]
- **France** plans to spend EUR 350 million (USD 420 million) from 2019 to 2025 to boost cycling through better bike lanes and tax incentives.[113]

Improve measures

Fuel economy and quality

Throughout Europe, policies to enhance the efficiency of both passenger and freight vehicles have been put in place.

- Under new European fuel economy standards that are focused on heavy-duty vehicles, manufacturers will have to reduce emissions from large trucks 30% by 2030. In parallel, the EU has provided incentives for zero-emission and low-emission vehicles.[114]
- Starting in January 2020, **France** lowered the CO_2 emissions threshold for new cars to 110 grams of CO_2 per kilometre, above which vehicles are subjected to a penalty; this is 7 grams lower than the previous threshold implemented in January 2019.[115]
- As part of its 2019 Climate Programme, **Germany** linked a vehicle's tax outlay to its emissions level; the tax is incremental and depends on the vehicle's carbon output.[116]

E-mobility

Europe was home to 20% of the sales of new electric passenger cars worldwide in 2019.[117]

- In **Norway**, which leads globally in the share of electric vehicles among new car sales, 69% of new vehicles sold in the first half of 2020 were either fully electric or plug-in hybrid electric cars.[118]
- In 2018, **Ukraine** announced a target of 75% electric personal vehicles by 2030. In 2019, the country extended its zero-tax benefit for purchasing an electric car (new or second-hand).[119]
- **Serbia** introduced a tax exemption for electric and fuel cell vehicles in January 2020 and was considering more subsidies in response to rising air pollution in the country.[120]
- Public electric vehicle charging points are widely available in France, Germany, the Netherlands and the United Kingdom, and the EU has encouraged Member States to boost these numbers. **Estonia** fostered the installation of a nationwide fast-charging network, ensuring a recharging point every 40-60 kilometres in dense traffic areas, and **Sweden** offers a tax break to individuals who install a charging point at home.[121]
- In **Malta**, financial incentives for electric and hybrid cars and two-wheelers (including pedelecs) were successfully implemented, and the government is moving forward national regulations for electric scooter use.[122]

Renewable energy

The **EU** is the only international organisation that aims to introduce advanced biofuels, based on new sustainability criteria decided in 2018.[123]

- **Finland** adopted a law in 2019 to gradually increase the share of biofuels for road traffic to 30% by 2029, with advanced biofuels accounting for 10%.[124]
- **France** launched the world's first hydrogen-powered bus rapid transit system in Pau in 2019.[125] The French government raised the mandatory minimum biofuel blend in motor fuel to 7.9% in 2019 and 8.2% in 2020.[126] The company Hype rolled out 100 hydrogen fuel cell taxis in Paris in early 2019 and was targeting 600 by the end of 2020.[127]
- In 2018, **Ukraine** set a target for 50% alternative fuels by 2030.[128]
- In the **United Kingdom**, Chester Council approved plans in 2019 to build a biogas plant that will generate enough fuel to power up to 1,000 low carbon heavy-duty vehicles and buses per year.[129] In a UK trial of a heavy goods vehicle fuelled with biomethane, some 1,400 tonnes of CO_2 emissions were saved.[130]

Latin America and the Caribbean Regional Overview

Demographics

Population size:	Population growth:	Urban population share:	Urban population growth:	GDP per capita:	Urban population growth:
649 million	+11%	82%	+15%	USD 8,653	+6%
(2020)	(2010-2020)	(2020)	(2010-2020)	(2019)	(2010-2019)

Source: See endnote 1 for this section.

Key findings

Demand trends

- The LAC region is experiencing the highest growth in car ownership in the world – up 58% between 2005 and 2015, or more than twice the global average of 27%.
- The majority of passenger travel in the region occurs via public transport (averaging 68% of all trips). LAC has the world's highest per capita bus use and also leads in the implementation of bus rapid transit, with systems present in 54 cities as of 2019.
- Around 70% of freight transport in the LAC region is by truck, and regional freight demand (on land and sea) is expected to more than double between 2015 and 2050.

Emission trends

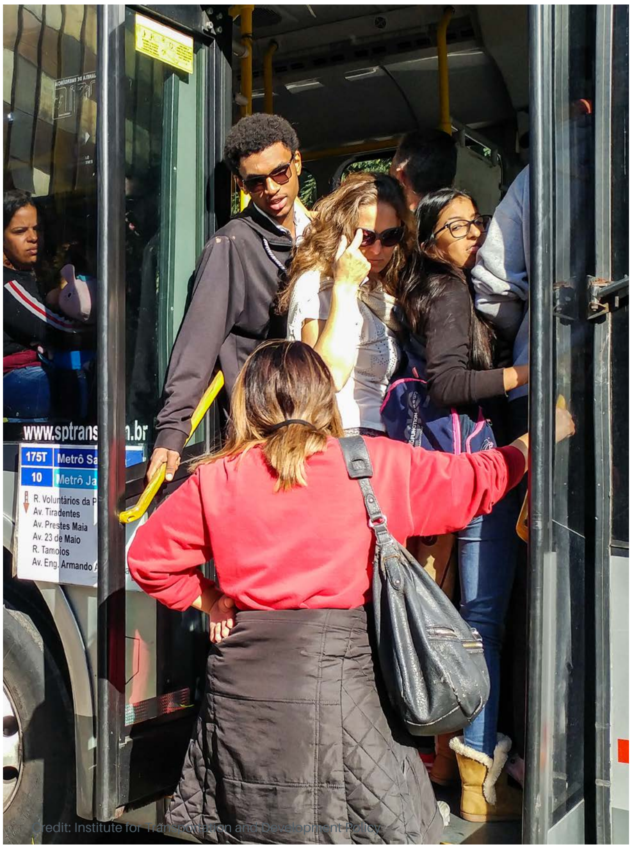
- Transport carbon dioxide (CO_2) emissions in the LAC region increased 3% from 2010 to 2019, and accounted for 8% of total global emissions in 2019.
- Per capita transport CO_2 emissions in the region (0.85 tonnes) track closely to the global average (0.88 tonnes).
- Transport emissions relative to economic output are higher in LAC than in any other region except Africa, at 0.98 tonnes of CO_2 per USD 10,000 in 2019.
- The LAC region has lower vehicle emission standards than Asia and Europe, but emerging programmes in Argentina, Brazil, Chile and Costa Rica are contributing to more stringent standards.

Policy measures

- Strategic plans, enabling policies and incentives are emerging across the region to help accelerate the uptake and manufacturing of electric vehicles.
- The LAC region boasts the world's highest shares of renewable energy, including in electricity grids, allowing greater potential to decarbonise transport through electrification.
- The region has the world's second highest number of implemented sustainable urban mobility plans (SUMPs) after Europe, and national urban mobility plans (NUMPs) are growing in prominence (although not yet widespread).
- Cities in the region continued to invest in cycling infrastructure, supported by strategies and incentives to increase active mobility; however, investments in pedestrian infrastructure have been insufficient, considering that walking constitutes as much as 54% of all trips.
- Shared mobility has become a prominent mode in the region, but further expansion is hindered by insufficient regulatory frameworks and a lack of integration with existing transport modes.

Impacts of the COVID-19 pandemic

- Mobility reductions accelerated starting in mid-March 2020, and by the end of that month passenger travel demand in the region had dropped nearly 80% and stayed roughly the same through late 2020.
- Public transport systems in the region are financed through a mix of user fees and government subsidies, both of which have been greatly impacted by the pandemic, with decreases in ridership and economic downturns.
- Cities across the LAC region responded by adding temporary bicycle lanes to promote socially distant transport options, including in Bogotá, Buenos Aires, Cuenca (Ecuador), Lima and Mexico City, among others.
- Paratransit (sometimes called "informal transport") has been an essential supplier of transport services in the LAC region, especially during the COVID-19 pandemic, providing access to mobility for millions of people, filling in gaps left by formal transport systems by quickly adapting and responding to changes in demand, and generating significant employment opportunities.



Overview

Latin America and the Caribbean is the second most urbanised region in the world after Asia, with 81% of the population living in urban areas in 2019.[2] This high urbanisation rate has led to rising demand for transport and, in many cases, to an increase in private vehicle trips, resulting in congestion, bad air quality and growing CO_2 emissions.

The region has a high share of urban bus use as well as broad roll-out of bus rapid transit systems. In many cities, efforts are being made to improve walking and cycling infrastructure. However, the region also has the highest global growth in private vehicles, with projections of a three-fold increase by 2050, to exceed 200 million.[3] Freight in the LAC region represents 40% of global transport CO_2 emissions, and 70% of surface freight is delivered via road (trucks), contributing greatly to regional transport emissions.[4]

COVID-19 has profoundly impacted transport in the LAC region, with sharp decreases in trips to public transport stations, freight transport and aviation activity. Demand levels stayed roughly the same through late 2020, although they showed slight increases each month. In addition, several major cities had announced plans to expand bicycle lanes before the onset of COVID-19, and the pandemic may have accelerated implementation *(see Box 1)*.[5]

Demand trends

The LAC region is experiencing the highest growth in car ownership in the world – up 58% between 2005 and 2015, or more than twice the global average of 27% *(see Figure 1)*.[6] While public transport use remains high, people in the region rely increasingly on private vehicles, leading to high congestion levels in cities. Regionally, more than 30% of the traffic in large cities is from vehicles looking for parking spots, and major cities such as Bogotá, Mexico City and São Paulo are considered among the most congested in the world.[7] As of 2015 (latest data available), nearly one-third of countries in the LAC region had car ownership rates above the global average of 173 vehicles per 1,000 people *(see Figure 2)*.[8]

Personal use of both private cars and motorcycles has grown in the region due to a mix of factors, including greater affordability of vehicles and rising incomes; convenience and accessibility when compared to public transport or active modes; and the perception of increased safety associated with private vehicles. The out-of-pocket costs of traveling by different modes vary widely in Latin American cities, with the costs of public transport being relatively high in many cities *(see Figure 3)*.[9] In São Paulo, Brazil, for example, the cost to take a bus 7 kilometres in 2014 was higher than the cost of fuel to drive a private vehicle the same distance.[10] In almost every city analysed, it is cheaper to travel by motorcycle than by bus or private vehicle.[11]

New vehicle sales

- **9% increase** in total new vehicle sales (2010-2019)
- **11% growth** in new passenger car sales (2010-2019)
- **Over 4.2 million** new passenger cars sold (2019)
- **2% growth** in new commercial vehicle sales (2010-2019)
- **1.5 million** new commercial vehicles sold (2019)

Sources: See endnote 12 for this section.

In addition to new vehicle sales, a large number of vehicles sold in the LAC region are used vehicles, which are not reflected in the numbers above.

The majority of passenger travel in the region occurs via public transport (averaging 68% of all trips).[13] **LAC has the world's highest per capita bus use and also leads in the implementation of bus rapid transit, with systems present in 54 cities as of 2019.**[14] Metro projects also have increased in recent years. Given the region's high urbanisation rates, there is further potential to expand on existing high levels of public transport and paratransit.

- In **Mexico**, passenger transport activity has grown 40.7% since 2010, to 537,270 million passenger-kilometres in 2019.[15]
- In **Bogotá**, **Lima**, **Medellín** and **Quito**, people use public transport for more than half of daily trips.[16] In **Mexico City** and **Panama City**, public transport accounts for more than 70% of daily trips.[17]

Around 70% of freight transport in the LAC region is by truck, and regional freight demand (on land and sea) is expected to more than double between 2015 and 2050.[18] As the demand for freight deliveries increases, fleet renewal will be needed to replace the region's ageing vehicles. This presents a challenge for freight companies, which operate in a decentralised ecosystem and without centralised smart freight systems to help alleviate negative impacts in the region.

- In **Mexico**, freight transport activity has grown 43.5% since 2010, to 347,733 million tonne-kilometres in 2019.[19]
- **Brazil** launched an extensive effort to increase the use of railways for cargo transport, investing around USD 4.5 billion between 2019 and 2020 to expand its network more than 4,000 kilometres.[20]

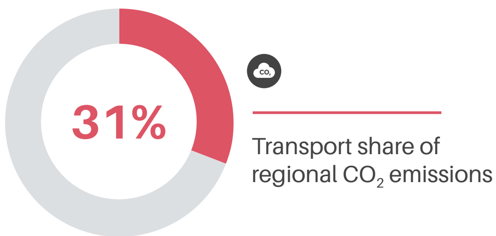
Emission trends

Transport CO_2 emissions in the LAC region increased 3% from 2010 to 2019, and accounted for 8% of total global emissions in 2019.[21] Transport contributed nearly a third of the region's total CO_2 emissions (31%) in 2019, a higher share than in peer regions such as Africa (23%) and Asia (12%).[22]

Per capita transport CO_2 emissions in the region (0.85 tonnes) track closely to the global average (0.88 tonnes) *(see Figure 4)*.[23] This is likely due to the mix of high public transport use and the simultaneous growth in car ownership rates alongside limited vehicle emission standards. In two-thirds of LAC countries, the growth in transport CO_2 emissions exceeded the global average of 16% (with Barbados and Bolivia exceeding this rate by more than five times) *(see Figure 5)*.[24]

Regional CO_2 trends:

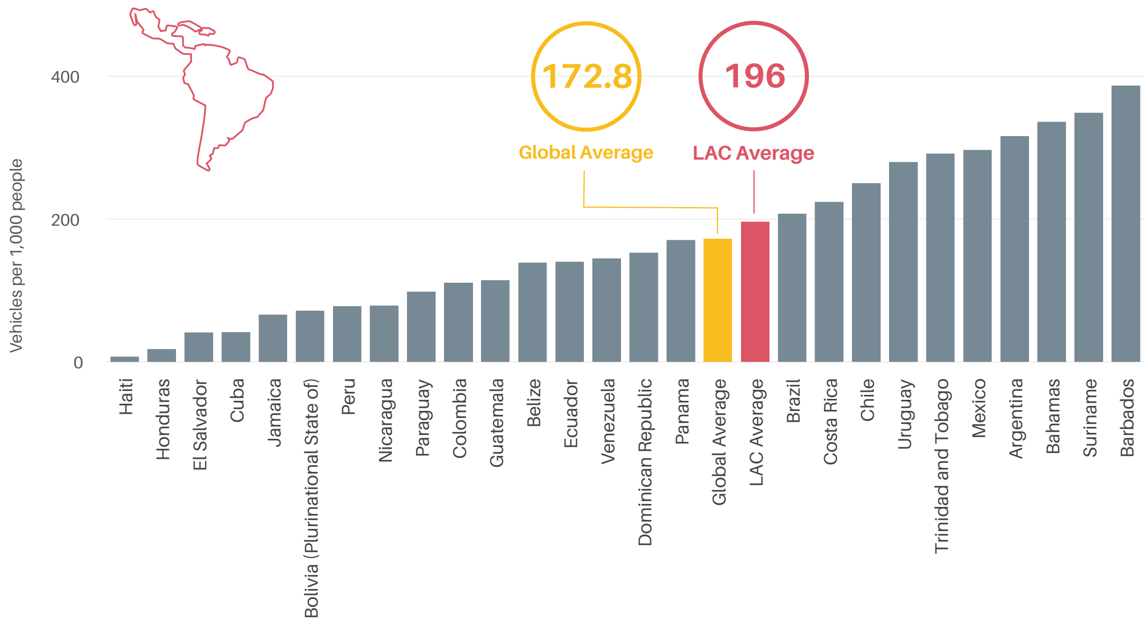
- Total transport CO_2 emissions (2019): **549 million tonnes**
- Share of global transport CO_2 emissions (2019): **8%**
- Per capita transport CO_2 emissions (2019): **0.85 tonnes**
- Transport CO_2 emissions per USD 10,000 GDP (2019): **0.99 tonnes**



Sources: See endnote 25 for this section.

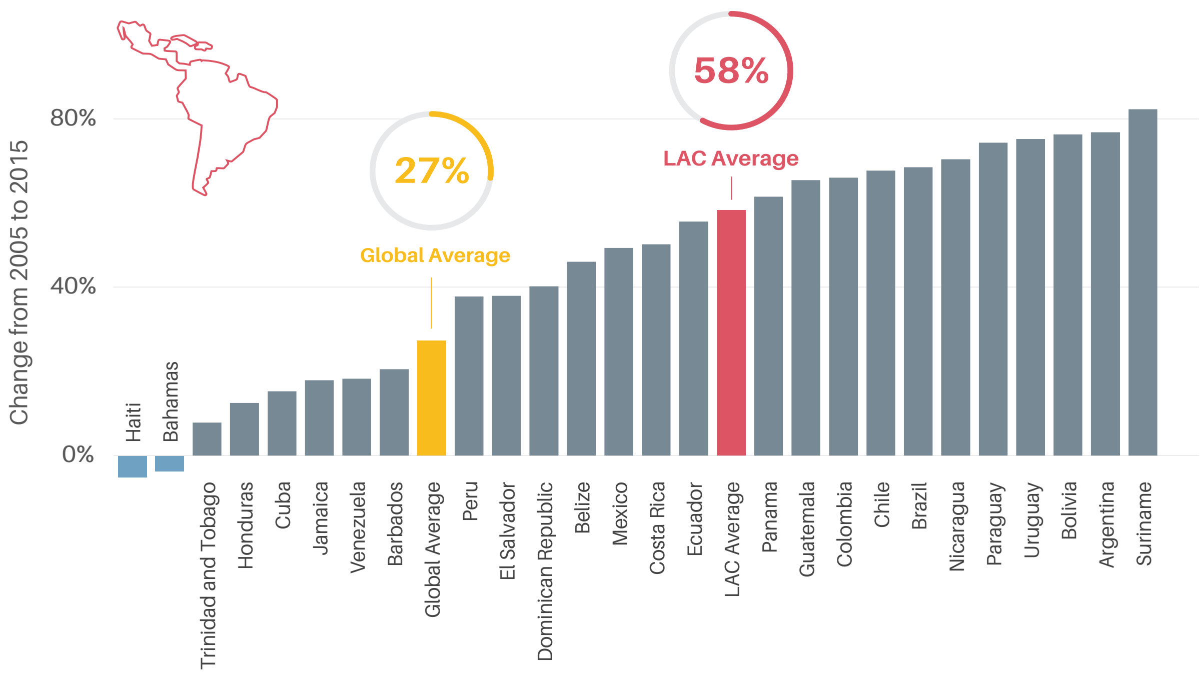
Transport emissions relative to economic output are higher in LAC than in any other region except Africa, at 0.99 tonnes of CO_2 per USD 10,000 in 2019.[26] This may be due to the dominance of road freight transport, as alternative modes such as rail and shipping, which are more cost effective and energy efficient, are relevant only in a few LAC countries.[27] Increased economic activity and export demand from international and domestic markets has also driven

Figure 1. Car ownership rates per 1,000 people in Latin America and the Caribbean, 2015



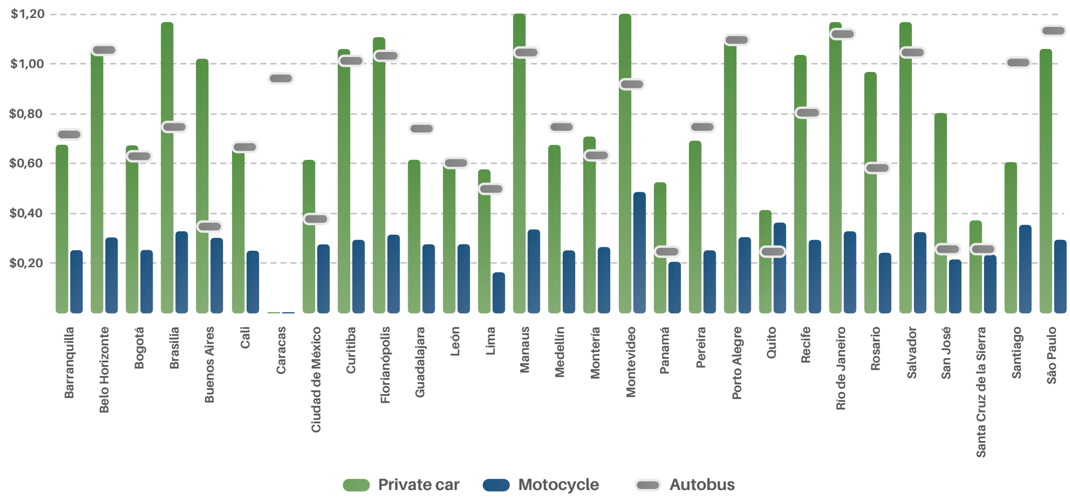
Source: See endnote 6 for this section.

Figure 2. Growth in car ownership in Latin America and the Caribbean, 2005-2015



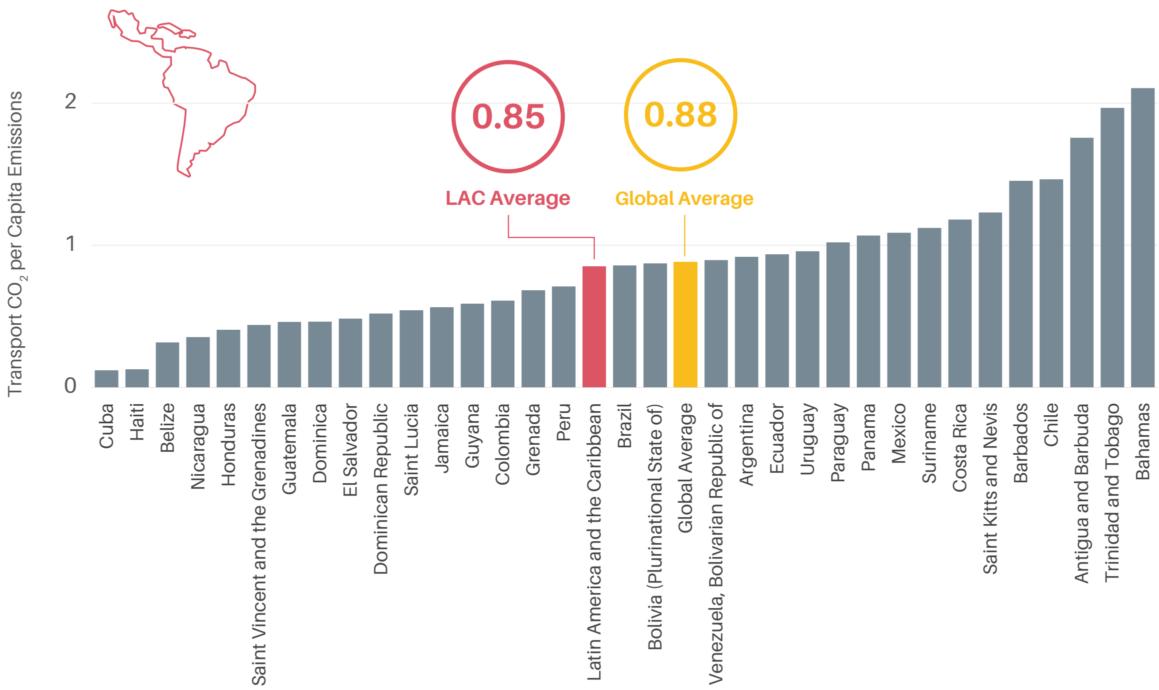
Source: See endnote 8 for this section.

Figure 3. Out-of-pocket costs to travel 7 kilometres, by transport mode, in selected cities in Latin America and the Caribbean, 2014



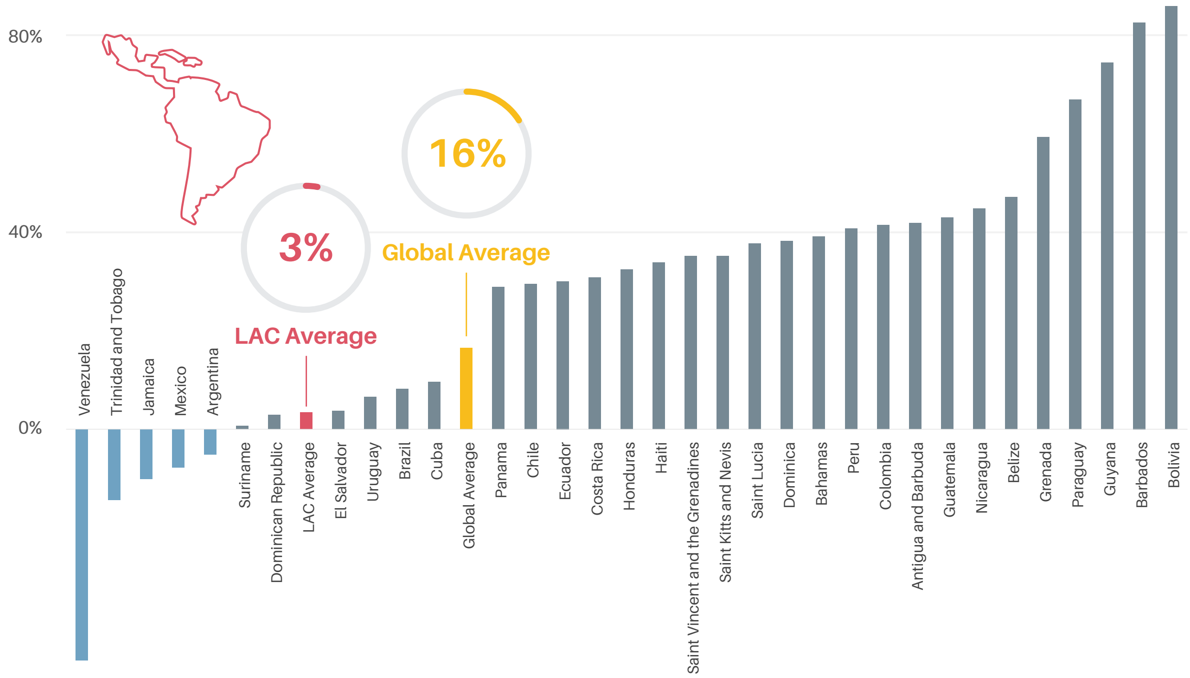
Source: See endnote 9 for this section.

Figure 4. Per capita transport CO_2 emissions in Latin America and the Caribbean, 2019



Source: See endnote 23 for this section.

Figure 5. Change in transport CO_2 emissions in Latin America and the Caribbean, 2010-2019



Source: See endnote 24 for this section.

growth in the region's trucking fleet (and in turn road-kilometres travelled), adding to the challenge of decoupling transport emissions from economic growth.[28]

The LAC region has lower vehicle emission standards than Asia and Europe, but emerging programmes in Argentina, Brazil, Chile and Costa Rica are contributing to more stringent standards.[29] The efficiency of road vehicles in LAC lags behind peer regions, and only a few countries have introduced vehicle emission standards.[30] In Central America and the Caribbean, which have large second-hand vehicle markets, a lack of harmonised standards on imported used vehicles is a significant barrier to decarbonising transport.[31] Greater regional and international co-operation could help promote stricter standards.

- **Argentina's** new intelligent transport programme aims for fuel savings and efficiency improvements in the freight sector by pioneering new technologies and management systems for companies – with the goal of reducing total transport emissions 8.4% by 2030.[32]
- In 2019, **Brazil** adopted P-8 standards (equivalent to the European Union's Euro VI standards[i]) to control emissions from heavy-duty vehicles. The standards are planned to take effect in 2022 and are expected to yield an estimated USD 11 in health benefits for each dollar invested in emission-control technologies.[33]
- **Chile** in 2018 implemented Giro Limpio, a voluntary programme that seeks to certify and recognise the efforts made by transport companies to improve their energy and environmental performance.[34] In 2019, the country issued its 2050 Energy Strategy, which includes long-term transport targets, among them higher energy efficiency standards for road transport, light-duty vehicle fuel economy standards and a target for 100% of new buses to include energy efficiency criteria.[35]
- **Santiago, Chile** has set maximum pollutant emission levels for public buses since 2017. Under this legal framework, the city's public transport system has evolved towards a cleaner fleet, with 996 zero- or low-emission buses circulating by the end of 2019 (comprising 14% of the system's fleet).[36]
- **Costa Rica** adopted Euro 4 vehicle emission standards for light-duty vehicles in 2018 and intends to move to Euro 6 standards[ii] in 2021.[37]

i For a heavy-duty diesel vehicle to be Euro VI-compliant, it cannot emit more than 0.4 grams per kilometre (g/km) of nitrogen oxide (NO_X) gases in steady-state testing. See https://theicct.org/sites/default/files/publications/ICCT_Euro6-VI_briefing_jun2016.pdf.

ii For a light-duty diesel vehicle to be Euro 6-compliant, it cannot emit more than 0.08 g/km of NO_X, while a petrol-fuelled vehicle can emit no more than 0.06 g/km of NO_X. See https://theicct.org/sites/default/files/publications/ICCT_Euro6-VI_briefing_jun2016.pdf.

Policy measures

The LAC region's current transport demand trajectory points towards rising emissions, worsening congestion and greater pollution. However, significant economic, social and environmental opportunities are available to help meet increasing demand through sustainable, low carbon transport measures.[38] Promising developments include policies to support investments in public transport and bus rapid transit systems, as well as increased cycling infrastructure in many cities. The electrification of transport, particularly buses, is growing, with significant opportunities to drive decarbonisation based on the region's high share of renewable energy.

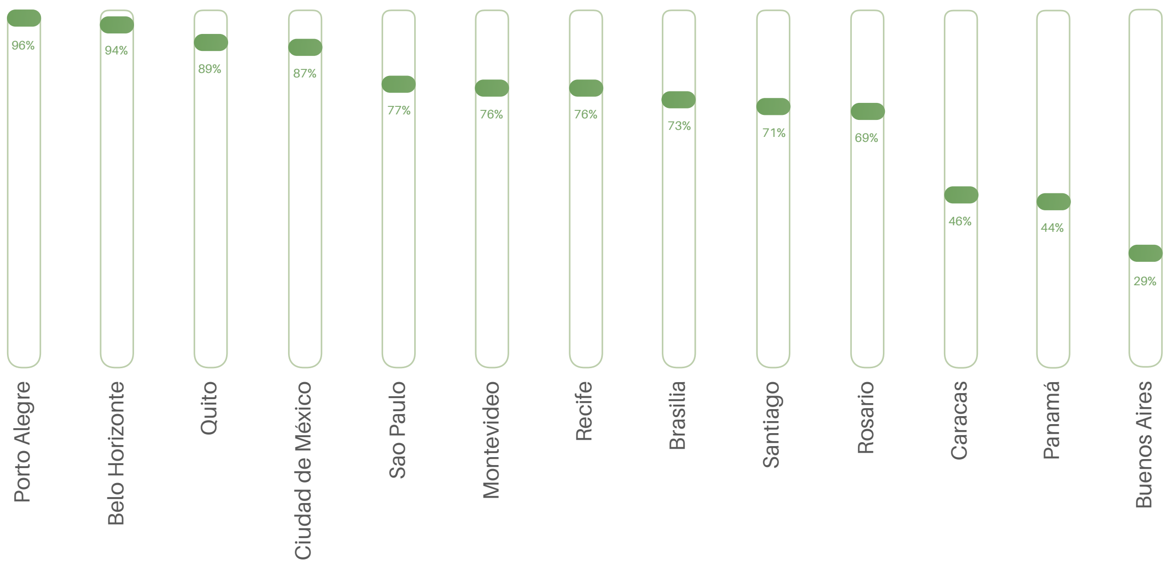
Strategic plans, enabling policies and incentives are emerging across the region to help accelerate the uptake and manufacturing of electric vehicles. Several electric vehicle manufacturing facilities exist in Brazil, and additional facilities are planned to produce electric trucks.[39] The replacement of bus fleets with electric buses also creates opportunities to increase regional manufacturing of these vehicles.

As of March 2021, nearly 3,000 electric buses were operating across the LAC region, most introduced in the past several years.[40] Chile and Colombia are rolling out electric buses at scale, with Bogotá's TransMilenio operating 1,485 of the buses as of early 2021.[41] This can create economies of scale for other regional neighbours to operate electric buses, which can be further supported through regulations on the pricing of electricity for charging electric vehicles.

- **Colombia** passed a new law establishing incentives for electric vehicles, including discounts on insurance premiums, exemptions on vehicle traffic restriction measures and preferential parking.[42]
- **Costa Rica** launched a National Electric Transport Plan with new laws and incentives to promote electric vehicles.[43]
- **Ecuador**, through its Energy Efficiency Law, set a target to electrify all buses by 2025 and eliminated import taxes on electric cars and buses as well as on charging stations and vehicle batteries. This has spurred the development of municipal regulations to support electric vehicle deployment.[44]
- **Mexico's** Alliance for Electromobility, which comprises governments, companies and civil society organisations, launched a 2019-2022 Strategic Plan for Electromobility and aims to promote policies, laws, regulations and an overall cultural shift towards electric vehicles.[45]

New financing streams will be needed to achieve an effective and quick transition towards electric fleets. In many cities in the LAC region, a high percentage of the operation costs for public transport are covered by ticket fares *(see Figure 6)*.[46] As more cities transition to electric buses, it will be important to find new ways to finance these

Figure 6. Percentage of operation costs covered by ticket fares, selected cities in Latin America and the Caribbean, 2014



Source: See endnote 45 for this section.

vehicle acquisitions, so that the costs are not passed down to users, potentially leading to declines in ridership. Electric shared mobility, including e-bicycles and scooters, is also a growing regional trend.

The LAC region boasts the world's highest shares of renewable energy, including in electricity grids, allowing greater potential to decarbonise transport through electrification.[47] Nearly every country in the region also has blending mandates for biofuels, although these are not always enforced.[48]

The region's high renewable energy share provides an opportunity to rapidly scale up the electrification of both passenger and freight transport. For example, the subway system in **Santiago**, Chile is powered largely by wind and solar energy and can serve as a model for peer cities and countries in the region.[49] However, a key barrier to scaling up electric mobility is the lack of regulation in regional electricity markets, impeding differentiated tariff rate designs and infrastructure investments in this area.

Recent efforts to reduce fossil fuel subsidies in the LAC region have been largely unsuccessful, adding to the challenge of decarbonising the transport sector. In 2019, an attempt to remove fossil fuel subsidies in Ecuador resulted in country-wide protests.[50] Similar responses occurred in **Argentina**, **Mexico** and **Brazil**, where a reduction in diesel subsidies in 2018 led truck drivers to hold a week-long strike.[51]

The LAC region has the world's second highest number of implemented sustainable urban mobility plans (SUMPs) after Europe, and national urban mobility plans (NUMPs) are growing in prominence (although not yet widespread).[52] In **Brazil**, where such plans are mandatory for cities with more than 200,000 citizens, over 200 Sustainable Urban Mobility Plans had been finalised by 2020, and at least 100 additional plans were being prepared for future years.[53]

- **MobiliseYourCity** and the **EUROCLIMA+ programme** supported the development of SUMPs in eight LAC cities, as well as NUMPs in five countries (Chile, Colombia, Ecuador, Peru and Uruguay), from 2015 to 2020.[54]
- In 2019, **Feira de Santana**, **Brazil** launched a new SUMP that commits USD 26 million to reclaim public spaces for walking and cycling infrastructure and to improve public transport and traffic safety.[55]
- **Peru**'s national sustainable urban transport programme (Promovilidad), developed in 2019, promotes sustainable urban mobility and co-ordinated public transport systems in 30 cities. It focuses on improving mobility services by providing technical and financial support to municipalities.[56]

Cities in the region continued to invest in cycling infrastructure, supported by strategies and incentives to increase active mobility; however, investments in pedestrian infrastructure have been insufficient, considering that walking constitutes as much as 54% of all trips.[57] Pedestrians, cyclists and motorcyclists still account for more than half of regional road fatalities.[58] If these modes are to be supported, more emphasis needs to be placed on improving the safety of users by reducing road injuries and fatalities.[59]

- Campaigns to implement safe and level pedestrian crossings have succeeded in cities across **Mexico** as well as in Medellín, **Colombia**, replacing pedestrian bridges that were inaccessible to many.[60]

Cycling infrastructure has expanded greatly in urban areas.

- **Bogotá**, **Colombia** had 580 kilometres of bicycle lanes as of 2019, and in February 2020 it announced plans for an additional 280 kilometres; the city accelerated this plan in the early months of COVID-19 by adding 84 kilometres in March.[61]
- **Costa Rica** announced that it would offer tax incentives to companies promoting bicycle use among employees.[62] The government also passed a law to prioritise cycling, introducing an active mobility unit, a technical design guide for cycling infrastructure, public bike-sharing and financing for cycling.[63]
- **Mexico City**, **Mexico** introduced a new strategy in 2019 that aims to integrate fares among the various public transport services and to develop more bike infrastructure.[64]
- As part of its COVID-19 response, **Lima**, **Peru** implemented 50 kilometres of emergency cycling infrastructure measures, including bike lanes and parking spots. This is expected to connect with the existing 227 kilometres of cycling facilities that integrate with health and other services.[65]

Shared mobility has become a prominent travel mode in the region, but further expansion is hindered by insufficient regulatory frameworks and a lack of integration with existing transport modes. The recent rapid deployment of car-sharing and electric scooter rental (both for passenger transport and for last-mile logistics) in some cities shows promise of expanding transport options. However, a lack of strong regulation related to safety, pricing and integration of shared mobility with existing transport modes poses barriers to expansion. Many of the service providers supporting the delivery and maintenance of shared mobility lack formal employment contracts, with no access to occupational health insurance or pensions.

- A new e-scooter service in **Quito**, **Ecuador** began operating 75 of the scooters at 32 stations in November 2019, avoiding 4 tonnes of transport CO_2 emissions during the first week of operation.[66]
- In 2019, 30% of riders in **Chile** were replacing car trips with scooters, as the number of trips via Lime scooters exceeded 1 million.[67]
- In January 2020, **Lime** announced plans to cease operations in Bogotá, Buenos Aires, Lima, Montevideo and Puerto Vallarta due to low interest in its services.[68]

Box 1. Impacts of the COVID-19 pandemic on transport in Latin America and the Caribbean

Major COVID-19 impacts:

- 72% decrease in trips to public transport stations (at lowest point in 2020 versus January 2020 average)
- 37% to 42% decline in freight transport activity (below 2019 levels)
- 60% decline in international aviation activity (below 2019 levels)
- 54% decline in domestic aviation activity (below 2019 levels)

COVID-19 has profoundly impacted transport in the LAC region. **Mobility reductions accelerated starting in mid-March 2020, and by the end of that month passenger travel demand in the region had dropped nearly 80%.** Demand levels stayed roughly the same through late 2020, although they showed slight increases each month. Traffic volume dropped 88% in **Buenos Aires**, and at their lowest levels (in mid-April 2020) public transport trips fell 97% in **Lima**, 96% in **Cuenca** (Ecuador), 92% in **Bogotá**, 86% in **São Paulo** and 75% in **Quito**.

The use of telework services in the region increased more than 300% in the first half of the year, and new orders through the e-commerce site Mercado Libre increased more than 100% in Chile, Colombia and Mexico compared to 2019, greatly impacting passenger and freight demand.

Public transport systems in the region are financed through a mix of user fees and government subsidies, both of which have been greatly impacted by the pandemic, with decreases in ridership and economic downturns. Alternative financing schemes are key to ensuring that these systems are financially sustainable.

- Between March and April 2020, demand fell 93% for buses, subways, trains, minibuses and combis in **Lima, Peru**. Over the following year, public transport companies were forced to cut services due to economic losses from the pandemic, with calls for government subsidies to support their continued operation.
- In **Costa Rica**, public transport operators reported 80% revenue loss during April 2020, totalling CRC 14,000 million (around USD 23 million). The drop in ridership during 2020 overall averaged more than 60%.

The COVID-19 Observatory, established by the United Nations Economic Commission for Latin America and the Caribbean, tracked responses to the pandemic in the region, with countries such as Belize, Brazil, Chile, Costa Rica and El Salvador introducing stringent lockdown measures. **Cities across the region responded by adding temporary bicycle lanes to promote socially distant transport options, including in Bogotá, Buenos Aires, Cuenca (Ecuador), Lima and Mexico City, among others.** It remains unclear whether these measures will be temporary or permanent. In addition, several major cities had announced plans to expand bicycle lanes before the onset of COVID-19, and the pandemic may have accelerated implementation.

COVID-19 has brought attention to the critical role that paratransit plays in moving people and goods in many low- and middle-income countries. **Paratransit has been an essential supplier of transport services in the LAC region, especially during the COVID-19 pandemic, providing access to mobility for millions of people, filling in gaps left by formal transport systems by quickly adapting and responding to changes in demand, and generating significant employment opportunities.** Groups like the Inter-American Development Bank, the Centro para la Sostenibilidad Urbana and Agile City Partners have published reports providing more insight into these practices. Universities have also conducted research to inform decision makers on how to support and formalise paratransit systems and how to best integrate them into climate change, energy and transport agendas at the city, regional and national levels, including as part of COVID-19 recovery measures. *(For more on paratransit, see Focus Feature 6.)*

Source: See endnote 5 for this section.

In Practice: Additional Policy Responses

Avoid measures

Sustainable mobility planning

- In 2020, **Colombia** developed a new national policy for urban and regional mobility, with guidelines for the comprehensive management of mobility in order to contribute to social welfare, environmental protection and economic growth in cities.[69]
- Integrated mobility plans were established in four districts of San José, **Costa Rica** in 2018.[70]
- Buenos Aires, **Argentina** developed a Clean Mobility Plan in 2017 that includes measures such as shared mobility for private trips, Euro VI standards for trucking and a higher share of biofuel use.[71]

Shift measures

Public transport

- **Brazil's** bus rapid transit system expanded in 2019 with the Transoceânica corridor in Niterói, Rio de Janeiro.[72] The cities of Campinas and Salvador were adding bus rapid transit as of 2020.[73]
- **Brazil** announced plans in 2020 to finance improvements in urban mobility, with a strong focus on urban rail and active mobility.[74] The city of **São Paulo** has extended its subway system nearly 50 kilometres in recent years.[75]
- **San Pedro,** Costa Rica implemented five corridors of additional exclusive bus lanes in 2019 and 2020.[76]
- **Panama** inaugurated Metro Line 2 in 2019, with 14 stations spanning 22 kilometres, and is planning a network of five metro lines by 2040.[77]
- **Cuenca,** Ecuador began the commercial operation of a tram system with a 20.4 kilometre network in September 2020.[78]
- In Quito, **Ecuador** a metro system extending 22 kilometres is under construction.[79]
- In **Mexico City,** a 34-kilometre cable car system, Cablebus, was inaugurated in March 2021 to supplement the public transport network.[80]
- Several cities were undertaking expansions of existing public transport systems, including the TransMilenio in **Bogotá**, the Metrobús in **Buenos Aires** and the Metrobús in **México City.**[81]

Shared mobility services

- Ride-hailing services in Latin America generated USD 518 million in revenue in 2018, an amount projected to reach USD 1,017 million by 2023.[82]
- **Brasília,** Brazil, in co-operation with major development agencies and power companies, launched a pioneering electric vehicle car-sharing project in October 2019 that offers 16 vehicles for use by local civil servants.[83]

Cycling

- In 2019, 1.2 million daily cycling trips were taken in Santiago, **Chile**, and the total length of cycling lanes increased 12% from 2017, to 408 kilometres.[84]
- In **Lima**, Peru, the Ciclovías X 3 initiative, developed by WWF-Peru together with Actibícimo and the Pontifical Catholic University of Peru, tripled the length of cycling paths to more than 450 kilometres.[85]
- In 2019, **Buenos Aires** committed to improving pedestrian conditions in five designated areas, including by implementing stricter speed limits, improving pedestrian and cycling infrastructure, and reconfiguring the spaces to accommodate pedestrian traffic.[86] The city also has an extensive network of more than 260 kilometres of protected cycling lanes.[87]
- **Mexico City** had more than 200 kilometres of cycling lanes as of 2019 and announced plans to expand the network to 600 kilometres by 2024 in an effort to reduce transport-related emissions.[88]
- In April 2020, the first phase of **Quito's** Emergent Cycle Path Plan was launched with the aim of creating 62.7 kilometres of cycling paths around the city. The plan, presented by the local Ministry of Mobility, was created in conjunction with public entities, universities and citizen groups in favour of sustainable mobility.[89]

Improve measures

Electric mobility

- Several states in **Brazil**, including Mato Grosso do Sul, Rio de Janeiro and São Paulo, have implemented a 50% vehicle tax discount on purchases of zero-emission vehicles.[90]
- In **Bogotá**, Colombia, a fleet of 1,485 electric buses was in operation as of 2021.[91]
- In **Santiago,** Chile the fleet of electric buses is envisioned to grow from 973 as of 2021 to 5,300 by 2022, with a goal of 100% electric public transport in the city by 2040.[92]
- At least eight cities in the LAC region received their first electric buses in 2019 and 2020, including **Buenos Aires, Guayaquil, Lima, Mendoza, Mexico City, Montevideo, Panama City** and **São Paulo.**[93]

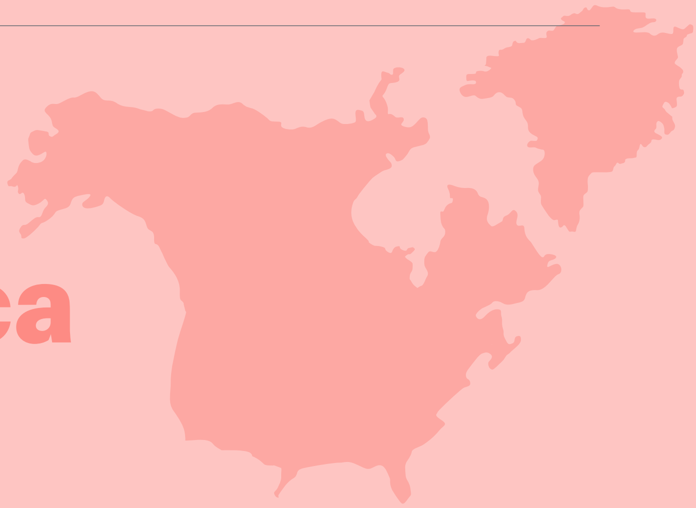
Renewable energy and alternative fuels

- In 2020, the local legislature in **Santa Fe,** Argentina proposed a shift to biodiesel for public transport, following the 2018 launch of B100 (100% biodiesel) buses in **Buenos Aires.**[94]
- The bus fleet in **Rosario,** Argentina has been fully operating with B100 buses since 2019.[95]
- **Bolivia** began producing biofuels in 2018, making 80 million litres of ethanol from sugar cane with plans to increase this to 350 million litres by 2025.[96]

The Ministry of Hydrocarbon Policies in **Ecuador** committed in 2019 to policies and actions to guarantee the quality of fuels, encourage the use of alternative fuels and promote electric mobility.[97]

Brazil's Biofuels National Policy (RenovaBio) became official in December 2019, establishing annual compulsory goals for reducing greenhouse gas emissions in the commercialisation of fuels and creating a voluntary carbon credit market based on the volume of fossil fuel transactions from each biofuel distributor.[98] The programme aims to boost the biofuel share of the energy mix, and Brazil hopes to reduce the carbon intensity of the fuel mix 10.1% by 2028.[99] Preliminary targets for greenhouse gas reductions in 2021 were released for all fuel distributers.[100]

In November 2020, **Chile**'s Ministry of Energy presented a National Strategy for Green Hydrogen with three main objectives: to develop 5 gigawatts of electrolysis capacity by 2025, to produce the cheapest green hydrogen in the world by 2030 and to be among the top three hydrogen exporters by 2040.[101]



North America Regional Overview

Demographics

Population size:	Population growth:	Urban population share:	Urban population growth:	GDP per capita:	Urban population growth:
747 million	+7%	83%	+10%	USD 55,153	+22%
(2020)	(2010-2020)	(2020)	(2010-2020)	(2019)	(2010-2019)

Sources: See endnote 1 for this section.

Key findings

Demand trends

- In the United States of America (USA) in 2019, single-occupancy vehicles accounted for more than 75% of work commute trips, whereas public transport accounted for less than 5%, with little change from 2018.
- Rail accounted for roughly one-third of all freight transport in Canada in 2011, and in the USA in 2019, exceeded only by pipelines in Canada (40%) and trucking in the USA (39%).
- Car ownership levels in North America were nearly five times the global average in 2015; however, the average growth in car ownership between 2005 and 2015 was nine times greater globally than in North America.
- Total new vehicle sales in North America grew 46% in 2019, the highest increase among global regions and nearly 3.5 times the increase in Europe (13%).
- The USA is the world's second largest national market for electric and plug-in hybrid cars (after China), with nearly 1.5 million units sold in 2019; however, in the USA electric vehicles accounted for only around 2% of new car sales that year.

Emission trends

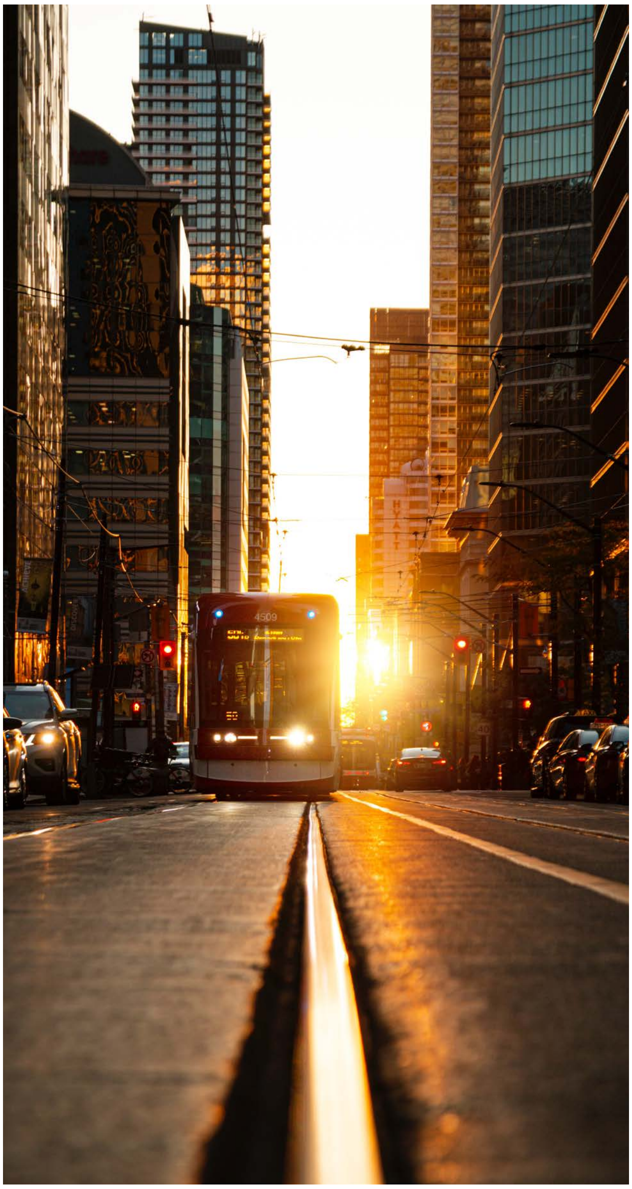
- Transport carbon dioxide (CO_2) emissions in North America grew 6% from 2010 to 2019, less than half the global average rate.
- Transport CO_2 emissions in the USA in 2014 were dominated by internal combustion engines, led by passenger cars (42%), freight trucks (23%) and light-duty trucks (18%).
- Transport emissions in North America are being decoupled from economic activity (decreasing 12-14% per unit of GDP from 2010 to 2019), while absolute transport emissions continued to rise through 2019.
- In the USA, domestic aviation accounted for nearly 7% of transport CO_2 emissions in 2014; however, much of the country's aviation emissions remain unaccounted for, as international flights represent the majority of air travel miles.

Policy measures

- At least 43 **USA states** and the **District of Columbia** took policy actions in 2019 related to electric vehicles and charging infrastructure.
- In 2019, **Canada** adopted a target for 100% zero-emission passenger vehicles by 2040, and in 2020, **15 USA states** and the **District of Columbia** collectively pledged to sell only electric medium- and heavy-duty vehicles by 2050.
- Sustainable freight measures in **North America** focused on zero-emission vehicle targets and efforts to shift delivery patterns.
- In 2019, nearly 140 million trips were taken on shared bicycles and scooters in the **USA**, up 60% from 2018. Shared scooter use grew more than 100%, while shared bike use increased around 10%.
- Active commuting rates in much of the **USA** remained low in 2017, with walking declining and cycling remaining level, while walking was the fastest growing mode in Vancouver, **Canada** in 2018.

Impacts of the COVID-19 pandemic

- In April 2020, after the onset of the pandemic, trans-border road and rail freight between the USA and neighbouring Canada and Mexico dropped nearly 45% from a year earlier, to its lowest level since 2009.
- Cities across **Canada** and the **USA** re-allocated road space to pedestrians and cyclists to encourage physical distancing and active transport in response to the pandemic.



Overview

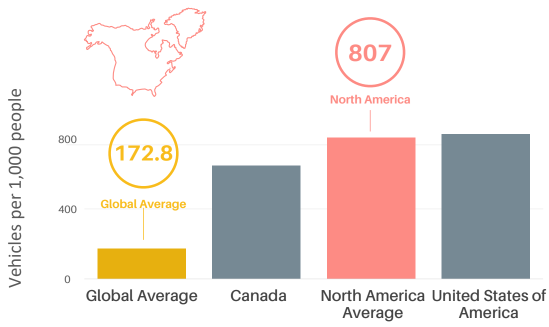
North America[i] – comprising Bermuda (territory of the United Kingdom), Canada, Greenland (Denmark), Saint Pierre and Miquelon (France) and the USA – contributed the second highest regional share of transport CO_2 emissions in 2019 after Asia, at 29%.[2] This reflects the continued use of private vehicles in countries that have limited fuel economy standards (especially the USA), as well as the temporary USA withdrawal from the Paris Agreement. Both the USA and Canadian Nationally Determined Contributions towards reducing emissions under the Paris Agreement have been deemed "critically insufficient" or "insufficient" to meet targets.[3]

Steps towards decarbonisation of the region's transport sector included growing local, state and provincial leadership on transport climate action, increased momentum towards the electrification of medium- and heavy-duty vehicles, and innovations in shared mobility. In June 2020, the INVEST in America Act was proposed to improve infrastructure in the USA, including in the transport sector *(see Box 1)*.[4]

The COVID-19 pandemic led to sharp declines in public transport demand across the region.[5] *(See Box 2)* In March 2020, a recovery package announced in the USA allocated USD 25 billion in federal aid to public transport, and a Canadian recovery plan provided significant funding to the country's airports but few incentives for sustainable transport.

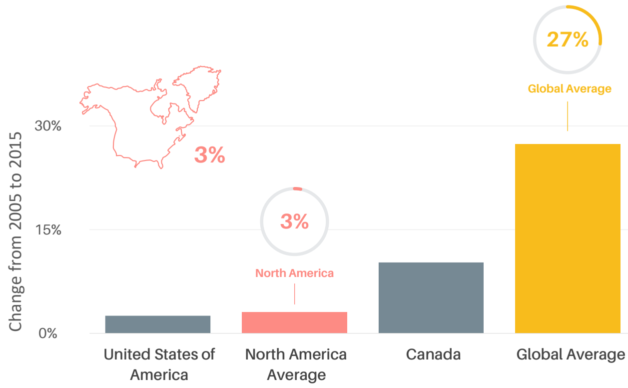
i While "North America" technically includes all five countries and territories listed here, in this section it is generally used to refer to only Canada and the United States unless otherwise specified.

Figure 1. Car ownership rates per 1,000 people in North America, 2015



Source: See endnote 16 for this section.

Figure 2. Growth in car ownership in North America, 2005-2015



Source: See endnote 16 for this section.

Box 1. The INVEST in America Act

In July 2020, the US House of Representatives passed the Investing in a New Vision for the Environment and Surface Transportation in America Act (INVEST in America Act). This comprehensive legislation authorises nearly USD 500 billion over five years to address some of the country's most urgent transport infrastructure needs, including repairing and replacing a backlog of roads, bridges and public transport systems.

In addition, the Act has a complementary objective to drive greener response and recovery to COVID-19. For example, it allocates funding for building more resilient transport infrastructure, designing safer streets for all road users (including pedestrians and cyclists), putting the US on a zero-transport-emissions trajectory, and boosting public transport options in urban, suburban and rural areas.

Source: See endnote 4 for this section.

Demand trends

In the USA in 2019, single-occupancy vehicles accounted for more than 75% of work commute trips, whereas public transport accounted for less than 5%, with little change from 2018.[6] In 2017, ride-hailing services in the country contributed to an estimated 8-22% increase in vehicle trips (compared to a lack of ride-hailing services).[7]

- In **Canada**, ridership on passenger railways grew 13% from 2018 to 2019, to 1.73 trillion passenger-kilometres travelled.[8]
- Ridership on the **USA** passenger railway Amtrak increased 2.5% in fiscal year 2018-19, to 32.5 million passenger-journeys, and capital investment in the railway jumped 9.4%, to USD 1.6 billion.[9]
- **USA** domestic air travel increased 5.6% from 2017 to 2018 but then fell 41% from 2019 to 2020 due to the COVID-19 pandemic, to the lowest level since 1987.[10]
- Passenger transport activity:
  - Canada: down 2% during 2000-2009, to 449,413 million passenger-kilometres[11]
  - USA: up 12% during 2010-2018, to 10,281 billion passenger-kilometres[12]

Rail accounted for roughly one-third of all freight transport in Canada in 2011, and in the US in 2019, exceeded only by pipelines in Canada (40%) and trucking in the US (39%).[13] Greater demand for real-time delivery has increased urban freight activity and impacts.

- Freight transport activity:
  - Canada: up 29% during 2010-2015 to 903,981 million tonne-kilometres[14]
  - USA: down 10% during 2010-2017 to 7,422 billion tonne-kilometres[15]

Car ownership levels in North America were nearly five times the global average in 2015; however, the average growth in car ownership between 2005 and 2005 was nine times greater globally than in North America *(see Figures 1 and 2)*.[16]

Total new vehicle sales in North America grew 46% in 2019, the highest increase among global regions and nearly 3.5 times the increase in Europe (13%).[17] Most of the newly purchased vehicles in the region were for commercial purposes, with the USA being the largest commercial vehicle market.

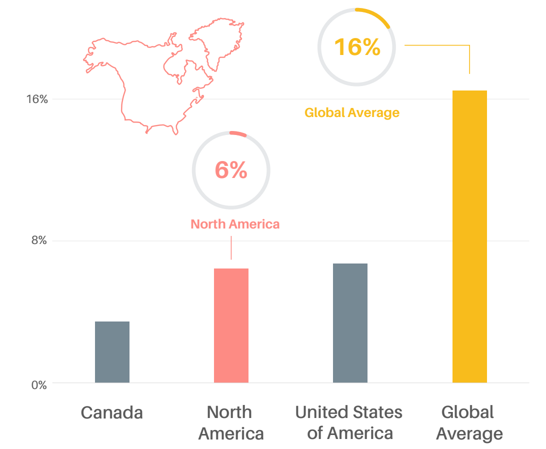
New vehicle sales

- **46% increase** in total new vehicle sales (2010-2019)
- **18% decline** in new passenger car sales (2010-2019)
- Over **5.2 million** new passenger cars sold (2019)
- **103% increase** in new commercial vehicle sales (2010-2019)
- **14.2 million** new commercial vehicles sold (2019)

Sources: See endnote 18 for this section.

The USA is the world's second largest national market for electric and plug-in hybrid cars (after China), with nearly 1.5 million units sold in 2019; however, electric vehicles accounted for only around 2% of US new car sales that year.[19] Electric car sales accounted for nearly 3% of new car sales in Canada in 2019.[20]

Figure 3. Change in transport CO_2 emissions in North America, 2010-2019

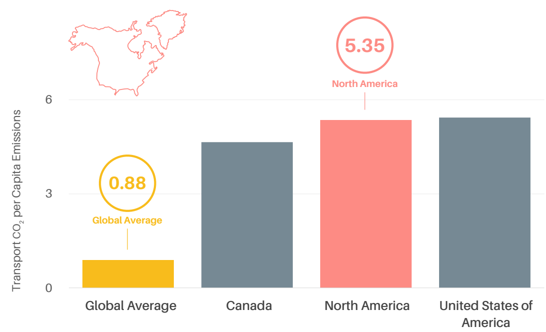


Source: See endnote 21 for this section.

Emission trends

Transport CO_2 emissions in North America grew 6% from 2010 to 2019, less than half the global average rate *(see Figure 3)*.[21] In 2018, transport accounted for the largest share of greenhouse gas emissions in the USA, at 28%, and for the second largest share of Canadian emissions (after oil and gas), at 25%.[22] Per capita transport emissions in North America are more than five times the global average due to the higher rate of motor vehicle use in the region *(see Figure 4)*.[23]

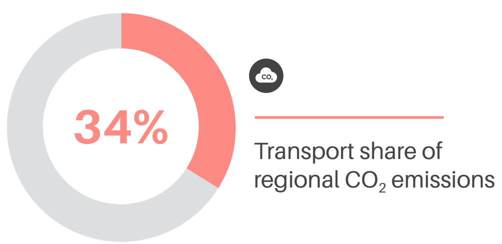
Figure 4. Per capita transport CO_2 emissions in North America, 2019



Source: See endnote 23 for this section.

Regional CO_2 trends

- Total transport CO_2 emissions (2019): **1,962 million tonnes**
- Share of global transport CO_2 emissions (2019): **29%**
- Per capita transport CO_2 emissions (2019): **5.35 tonnes**
- Transport CO_2 emissions per USD 10,000 GDP (2019): **0.97 tonnes**



Sources: See endnote 24 for this section.

US transport CO_2 emissions in 2014 were dominated by internal combustion engines, led by passenger cars (42%), freight trucks (23%) and light-duty trucks (18%).[25] In Canada, freight trucks and passenger light trucks contributed the most to transport emission growth during 2010-2019.[26]

Transport emissions in North America are being decoupled from economic activity (decreasing 12-14% per unit of GDP from 2010 to 2019), while absolute transport emissions continued to rise through 2019.[27]

Aviation saw an overall decline in contributions to CO_2 emissions. Flights within North America accounted for 16% of global passenger CO_2 emissions in 2019, down 3% from 2013.[28] **In the USA, domestic aviation accounted for nearly 7% of transport CO_2 emissions in 2014.**[29] **However, much of the country's aviation emissions remain unaccounted for, as international flights represent the majority of air travel miles.**[30]

Policy measures

In addition to withdrawing from the Paris Agreement, the US government weakened transport efficiency measures for 2025 that had been adopted in 2012. The roll-back of fuel economy and air quality standards meant that passenger cars were allowed to emit nearly 1 billion more tonnes of CO_2 over their useful life.[31] Despite these reversals at the federal level, state and local actors, as well as private companies, continued to influence the policy landscape for sustainable, low carbon transport (including through the We Are Still In coalition).[32]

The USA state of **California** expanded its climate leadership through initiatives including the 2020 Advanced Clean Trucks regulation.[33] **California** further demonstrated its leading role in transport and climate action in the USA by collaborating with auto and truck manufacturers to raise fuel economy standards (despite federal roll-backs) and by becoming the first USA member of the Transport Decarbonisation Alliance.[34]

In Canada, **British Columbia** amended its greenhouse gas reduction regulations in June 2020 to provide financial incentives for alternative fuel vehicles.[35] Local-level actions included more than 30 new bus and light rail projects in the **USA** and **Canada**, scheduled to begin operation in 2020 and 2021.[36]

At least 43 USA states and the District of Columbia took policy actions in 2019 related to electric vehicles and charging infrastructure.[37] Many of these actions focused on the electrification of buses and other heavy-duty vehicles, an essential strategy for decarbonising the transport sector. State policy measures, often supported by utilities and cities, provide critical footholds for federal action to follow.[38]

- **New Jersey** announced plans in 2020 to make the New Jersey Transit bus fleet 100% electric by 2040.[39]
- School districts across the **USA** have purchased electric school buses, in some cases funded through the Volkswagen settlement that was agreed to after the company violated emission standards and the US Clean Air Act.[40]
- Both **Maryland** and **Nevada** passed enabling legislation in 2019 to support school districts in the transition to electric school buses.[41]

In 2019, Canada adopted a target for 100% zero-emission passenger vehicles by 2040, and in 2020, 15 USA states and the District of Columbia collectively pledged to sell only electric medium- and heavy-duty vehicles by 2050.[42] Both the demand and market for electric mobility are strong, mainly for passenger vehicles and buses, and are supported by robust targets and expanding charging infrastructure. Electrification also offers opportunities for the uptake of renewable energy in transport through solar- and wind-powered charging of electric bicycles, cars and buses.

- **Canada** allocated funding for electric vehicle charging infrastructure in 2019 and launched a programme to help raise awareness of electric vehicle use in 2020.[43]
- In 2019, the state of **New York** (USA) provided USD 31.6 million to its regulated utilities to build up to 1,075 fast-charging stations to expand electric vehicle use.[44] In 2018, New York, as well as **Maryland's** public utility commission, authorised utilities to recover the cost of electric vehicle charging infrastructure from ratepayers and introduced a time-of-use rate for residential charging.[45]
- **California** will replace more than 200 diesel school buses with all-electric versions between 2020 and 2025 and pledged to transition to only electric buses by 2040.[46]

Sustainable freight measures in North America focused on zero-emission vehicle targets and efforts to shift delivery patterns. Electric freight vehicles and off-peak freight delivery offer potential to increase efficiency and reduce urban emissions.[47] However, continued support for fossil fuels at the national level in both the USA and Canada has reduced incentives for cleaner freight vehicles.

- **California's** Advanced Clean Trucks regulation, passed in 2020, aims for 55% of light-truck sales and 75% of medium- and heavy-truck sales to be zero emission by 2035.[48]
- **New York City** (USA) implemented an off-hour deliveries programme in 2018 to combat congestion and improve the productivity of shippers.[49]
- In 2019, **Canada** was the first country to join the Drive to Zero Pledge, which calls for most new commercial vehicles to be zero emission by 2040.[50]

In 2019, nearly 140 million trips were taken on shared bicycles and scooters in the USA, up 60% from 2018.[51] **Shared scooter use grew more than 100%, while shared bike use increased around 10%.**[52] These two modes accounted for over 350 million trips in the USA between 2010 and 2019.[53] In cities across North America, the increase in shared mobility services is reshaping the transport landscape.

- **New York City** (USA) has legalised electric scooters and bikes, and scooter ridership outpaced docked bicycle ridership for the first time in 2020.[54]
- A 2018 electric scooter pilot in **Portland, Oregon** (USA) is estimated to have replaced car trips that would have produced 122 metric tonnes of CO_2, equivalent to the yearly emissions of 27 passenger cars.[55] Other studies take a more nuanced view of the potential of e-scooters to reduce emissions.[56]
- By April 2021, **Vancouver's** bike share system Mobi, launched in 2016, had grown to more than 2,000 bicycles housed at more than 200 solar-powered stations, serving 75,000 users.[57]

Active commuting rates in much of the USA remained low in 2017, with walking declining and cycling remaining level, while walking was the fastest growing mode in Vancouver, Canada in 2018.[58]

- An analysis of national commuting surveys in the **USA** conducted between 2006 and 2017 shows a significant decrease in walking in many states, with cycling staying at similar levels.[59]
- Walking accounted for 29% percent of trips in **Vancouver, Canada** in 2018, the highest share among sustainable transport modes including cycling and public transport.[60]
- **Canada** does not currently conduct a national household travel survey, which has created a data gap on walking and cycling activity.[61]

Box 2. Impacts of the COVID-19 pandemic on transport in North America

Major COVID-19 impacts:

- 60% decrease in trips to public transport stations (at lowest point in 2020 versus January 2020 average)
- 37% decline in freight transport activity (below 2019 levels)
- 62% decline in international aviation activity (below 2019 levels)
- 41% decline in domestic aviation activity (below 2019 levels)

In the early months of COVID-19, commercial transport activity in both **Canada** and the **USA** declined sharply, operating at around 84% and 85% (respectively) of normal volume as of mid-March 2020. Major cities with the largest public transit systems issued strict disinfection guidelines for their subway cars, buses, turnstiles, handrails and related facilities in an effort to keep ridership safe.

In April 2020, after the onset of the pandemic, trans-border road and rail freight between the USA and neighbouring Canada and Mexico dropped nearly 45% from a year earlier, to its lowest level since 2009. Truck freight declined more than 40%, while rail freight fell more than 60%.

Cities across Canada and the USA re-allocated road space to pedestrians and cyclists to encourage physical distancing and active transport in response to the pandemic. Examples in the **USA** include Chicago (Illinois), Cleveland (Ohio) and Portland (Oregon), and examples in **Canada** include Montreal (Quebec), Toronto (Ontario) and Vancouver (British Columbia).

- **Calgary**, Alberta (Canada) converted six roadways to pedestrian zones to facilitate safe active transport during the pandemic.
- **Madison**, Wisconsin (USA) has designated a number of "shared streets" to provide safer travel options for cyclists and pedestrians.

Source: See endnote 5 for this section.

In Practice: Additional Policy Responses

Avoid measures

Sustainable mobility planning and transport demand management

- **Transport Canada** released a 2019-2020 update to its 2017-2020 Departmental Sustainable Development Strategy, committing to action on climate change; healthy coasts, oceans, lakes and rivers; safe and healthy communities; and clean growth.[62]
- In the first such move for a **Canadian** city, Edmonton decided in 2020 to eliminate minimum parking space requirements, allowing for less car-dependent development.[63]
- In 2018, the **US** Department of Transportation issued a Strategic Plan for fiscal years 2018-2022 that prioritises the goals of safety, investment in infrastructure, innovation and accountability.[64]
- New York in 2019 became the first city in the **USA** to approve congestion pricing, but implementation of the measure was delayed due to the COVID-19 pandemic.[65]

Walking and cycling

- Advocates have pushed for **Canada** to develop a national cycling strategy, building on provincial strategies to expand protection for cyclists (e.g., through **Nova Scotia's** revised Motor Vehicle Act).[66]
- In 2020, **San Jose, California** (US) created the Better Bike Plan 2025, which includes a goal to expand cycling infrastructure and sets targets for 5% of all trips to occur via bike by 2020 and 15% by 2040; the city is also building a 640-kilometre on-street bikeway network.[67]
- In 2019, **New York City** (USA) agreed to invest USD 1.7 billion in road infrastructure over 10 years to dramatically improve safety for cyclists and pedestrians.[68]

Shift measures

Public transport

- Expansions of light rail transit in **Canada** occurred in Ontario (18 kilometres) and Ottawa (12.5 kilometres) in 2019.69
- In **Connecticut** (USA), a USD 21 million investment to improve transport, CT2030, includes mass transit as one of four key areas and outlines plans for new bus corridors and electric buses.[70]
- The light rail service in the **USA** city of Minneapolis, Minnesota recorded its highest-ever ridership in 2018, with more than 80 million rides.[71]

Shared mobility services

- As of January 2018, **Canada** had 18 car sharing services in operation, with 8,052 vehicles.[72]
- Ride-hailing services were available in 14 regions of **Canada** in 2018, mainly urban areas including Calgary, Montreal,

Ottawa and Toronto.[73] Revenue from these services totalled USD 829 million in 2018 and was projected to reach USD 1,067 million by 2023.[74]

- As of January 2018, the car-sharing services BlueIndy (Bolloré), car2go (Daimler), Maven (General Motors) and ReachNow (BMW) were operating in 12 markets in the **USA**, and two services (car2go and a Maven pilot programme) were operating in 4 cities in **Canada.**[75] In November 2019, Hyundai launched Mocean Carshare in Los Angeles, using electric vehicles.[76]
- **Ottawa,** Canada launched its first peer-to-peer, eco-friendly ride-sharing app in 2020, enabling consumers to request rides in electric, hybrid or petrol-powered vehicles.[77]
- In the **USA**, the ride-hailing service Lyft began offering wheelchair-accessible vehicles in San Francisco and Los Angeles in 2019, with plans for further expansion.[78]
- In 2019, the self-driving car service Waymo gained permission to transport passengers in **California** and Uber entered into the urban air mobility market by launching a helicopter service in **New York City**.[79]

Improve measures

Fuel economy

- In a 2018 evaluation of **Canada's** Passenger Automobile and Light Truck Greenhouse Gas Emissions Regulations, only 1% of commenters felt that the existing standards for 2022-2025 model years should be made less stringent.[80]
- Challenges to fuel economy developments in the **USA** in 2018 included the freezing of stricter standards developed for 2022-2025 and the roll-back of previously established clean car rules.[81]
- Despite the national freeze on fuel economy standards, the **US** state of California collaborated with four automakers to raise state efficiency and emission standards, aiming for 36 miles per gallon by 2026.[82]
- In 2020, the **US** rolled back previous plans for CO_2 emission standards and set the new target to 40.4 miles per gallon by 2026, requiring an annual improvement of 1.5% until then.[83]

Electric mobility

- In 2020, **Los Angeles** (USA) set targets for 155 electric buses and a 100% zero-emission bus fleet by 2028.84 The city aims to increase the share of electric or zero-emission vehicles to 25% by 2025, 80% by 2035 and 100% by 2050 for all transport modes.[85]
- Among other **USA** electric mobility developments in 2019, the state of Colorado adopted a requirement for electric cars to comprise 5% of an automaker's line-up by 2023; New York City set targets for 500 electric buses by 2024 and a zero-emission fleet by 2040; and Virginia allocated USD 20 million for electric buses.[86]
- In 2019, **San Francisco** set a target to ban the sale of new petrol and diesel vehicles by 2030 and to achieve emission-free transport by 2040.[87]

Renewable energy

- In 2019, **Santa Barbara, California** (USA) replaced petroleum diesel with renewable diesel in its bus fleet, and the state of Minnesota enacted a grant programme to fund biofuel blending infrastructure.[88]
- In 2019, the **US** government extended its biodiesel tax credit of USD 1 per gallon retroactively until 2022.[89]
- The **US** carrier Delta Air Lines announced in 2019 that it was investing USD 2 million to partner with Northwest Advanced Biofuels on a feasibility study to produce sustainable aviation fuel and other biofuel products.[90]
- In 2019, Enel X launched a pilot project in **Hawaii** (USA) to maximise electric vehicle charging at times when solar electricity generation is highest.[91]
- **New York City** (USA) added 50 self-contained, solar-powered electric vehicle charging stations In 2019.[92]
- **Portland, Oregon** (USA) pledged in 2019 to have a non-diesel public bus fleet by 2040, with new electric buses to be 100% wind powered.[93]

Oceania Regional Overview

Demographics

Population size:	Population growth:	Urban population share:	Urban population growth:	GDP per capita:	Urban population growth:
41 million	+16%	68%	+16%	USD 40,428	+27%
(2020)	(2010-2020)	(2020)	(2010-2020)	(2019)	(2010-2019)

Sources: See endnote 1 for this section.

Key findings

Demand trends

- Car ownership rates in Australia and New Zealand exceeded the global average by more than four times in 2015, while growth in car ownership in New Zealand between 2005 and 2015 was four times greater than in Australia.
- Between 2005 and 2015, passenger cars accounted for roughly two-thirds of passenger transport activity in the region, while bus and rail accounted for less than 10%. During this period, road freight activity increased 25%, while rail freight activity more than doubled, and coastal shipping fell 10%.
- Electric vehicle uptake has progressed unevenly across Oceania, with the market share of the vehicles lagging behind peer countries and regions.
- For shipping, container port activity fell 2.2% in Oceania in 2019 due to a slowdown in the Australian economy and declining consumer confidence.

Emission trends

- Transport carbon dioxide (CO_2) emissions grew strongly in Oceania in 2019, but overall the region contributes just 2% of global transport emissions.
- Countries in the region showed large variations in transport CO_2 emission trends, with several recording significant increases and others significant reductions.
- Currently 75% of the fossil fuels imported into the Pacific region are for land and maritime transport, underscoring challenges to decarbonising these sub-sectors.

Policy measures

- Major cities in the Oceania region are prioritising renewed investments in urban transport systems.
- Adaptation and resilience measures are increasingly important for transport planning and policy making due to the region's climate vulnerabilities, which range from extreme heat, flooding and high winds in Australia to sea-level rise in small island developing states (SIDS) and other countries.
- Some countries have set ambitious decarbonisation targets in their Long-Term Strategies and Nationally Determined Contributions to implement the Paris Agreement, while other plans remain insufficient.
- In 2019, energy and transport ministers from the Pacific region committed to boosting renewable energy use and decreasing reliance on fossil fuels.
- Six SIDS established the Pacific Blue Shipping Partnership in 2019, setting targets to reduce emissions from shipping 40% by 2030 and to reach full decarbonisation by 2050.
- New walking and cycling measures were adopted and implemented in the region as non-motorised transport activities increased; for example, cycling activity in Auckland, New Zealand grew 8.9% in 2019.

Impacts of the COVID-19 pandemic

- In April 2020, **Australia** reported an 80% decline in daily usage of public transport compared to January of that year.
- Container shipping in the region was hit hard as demand dropped more than 10% in the first half of 2020 due to the pandemic, a sharper decline than in many global regions.

Overview

Oceania's contribution to global transport demand and transport emission growth has remained low compared to other regions.[2] Aviation and shipping are important drivers of transport demand and emissions because the region comprises many dispersed small island nations; as a result, it has been heavily dependent on fossil fuels and is taking steps to reduce this reliance.

Small island developing states (SIDS) across the Pacific region have experienced increasing climate impacts to infrastructure due to rising emissions, with transport assets being among the most valuable and vulnerable. Strategies to decarbonise transport in Oceania involve expanding sustainable aviation and shipping solutions and scaling up electric mobility, with high potential to be powered by ample renewable energy resources.

The COVID-19 pandemic has had severe socio-economic impacts on Oceania. Australia saw strong declines in public transport ridership in the early months of 2020, and SIDS suffered greatly from the collapse of fisheries and tourism *(see Box 1)*.[3]

Demand trends

Car ownership rates in Australia and New Zealand exceeded the global average by more than four times in 2015, while growth in car ownership in New Zealand between 2005 and 2015 was four times greater than in Australia *(see Figures 1 and 2)*.[4]

Following 28% growth in car ownership within a decade, **New Zealand** in 2015 had the second-highest rate of car ownership in the world (after the United States), with cars outnumbering adults.[5] New car sales in **Australia** experienced 31 consecutive months of decline (through August 2020) and were down 18.8% from January to October 2020, compared with 2019.[6]

New vehicle sales

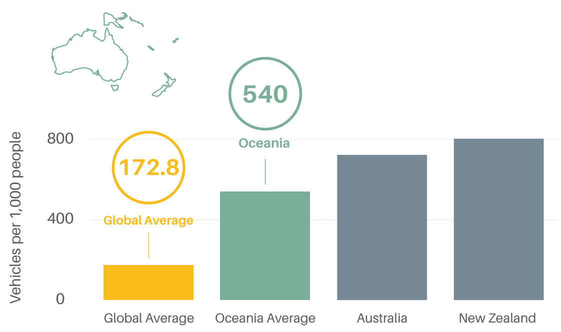
- **6% increase** in total new vehicle sales (2010-2019)
- **2% increase** in new passenger car sales (2010-2019)
- **0.9 million** new passenger cars sold (2019)
- **24% increase** in new commercial vehicle sales (2010-2019)
- **285,000** new commercial vehicles sold (2019)

Sources: See endnote 7 for this section.

Between 2005 and 2015, passenger cars accounted for roughly two-thirds of passenger transport activity in the region, while bus and rail accounted for less than 10%.[8] During this period, road freight activity increased by 25%, while rail freight activity more than doubled, and coastal shipping fell 10%.[9]

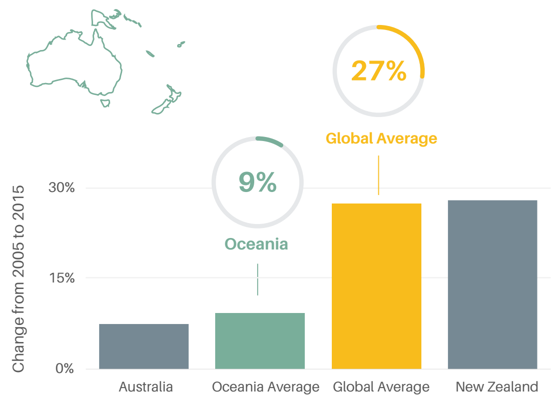
- Passenger transport activity in Australia: up 12% during 2010-2017, to 452.65 billion passenger-kilometres[10]
- Freight transport activity in Australia: up 28% during 2010-2015, to 727.7 billion tonne-kilometres[11]

Figure 1. Car ownership rates per 1,000 people in Oceania, 2015



Source: See endnote 4 for this section.

Figure 2. Growth in car ownership in Oceania, 2005-2015



Source: See endnote 4 for this section.

Electric vehicle uptake has progressed unevenly across Oceania, with the market share of the vehicles lagging behind peer countries and regions. Electrification of transport is at an early stage in the region, and only initial projects and incentives have been introduced. **Pacific Island nations** remain dependent on fossil fuel vehicles but have high potential for rapid electric vehicle uptake due to falling technology costs and growing renewable energy generation.[12]

- Electric vehicle sales in **Australia** tripled in 2019 despite a lack of policy support; however, electric vehicles still only accounted for 0.6% of new vehicle sales that year (compared to a global average of 4.2%), due to a lack of vehicle emission standards and a delayed national electric vehicle policy.[13]
- In **New Zealand**, electric vehicles represented 2.1% of all light-duty vehicle registrations in December 2019, a substantial improvement from just 0.03% in 2013.[14]
- In **Australia**, the first electric buses started operating in Canberra in 2019, as part of a plan to transition the Transport Canberra bus fleet to 100% zero-emission vehicles by 2040.[15]

For shipping, container port activity fell 2.2% in Oceania in 2019 due to a slowdown in the Australian economy and declining consumer confidence.[16] The liner shipping connectivity index (assessing the maritime connectivity for container shipping) also experienced a moderate decline prior to COVID-19.[17]

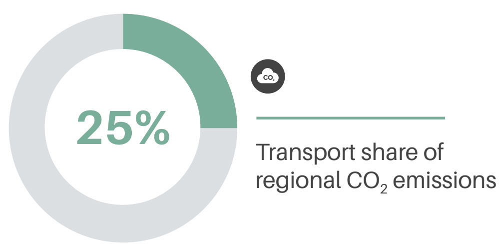
Emission trends

Transport CO_2 emissions grew strongly in Oceania in 2019, but overall the region contributes just 2% of global transport emissions.[18] Oceania has the lowest transport emissions of any global region, although its emissions share is nearly four times greater than its share of the global population (0.54%).[19] This is due in part to high rates of car ownership and use and to an abundance of larger vehicles with low fuel efficiency. In **New Zealand**, emissions of imported vehicles average 180 grams of CO_2 per kilometre, or 50% higher than European counterparts, driven in part by the lack of a national fuel efficiency standard.[20]

Countries in the region showed large variations in transport CO_2 emissions trends, with several recording significant increases and others significant reductions. In 2019, transport CO_2 emission increases in **Australia** and **New Zealand** were on par with the global average, but per capita transport CO_2 emissions in these countries were roughly three to four times the global average *(see Figures 3 and 4)*.[21] In **Papua New Guinea**, per capita transport CO_2 emissions were less than 25% of the global average in 2019, but during 2010-2019 overall transport CO_2 emissions increased at more than three times the global average.[22] Several SIDS (e.g., Kiribati, Solomon Islands, Vanuatu) decreased their transport emissions roughly 20-30% from already low baselines.[23]

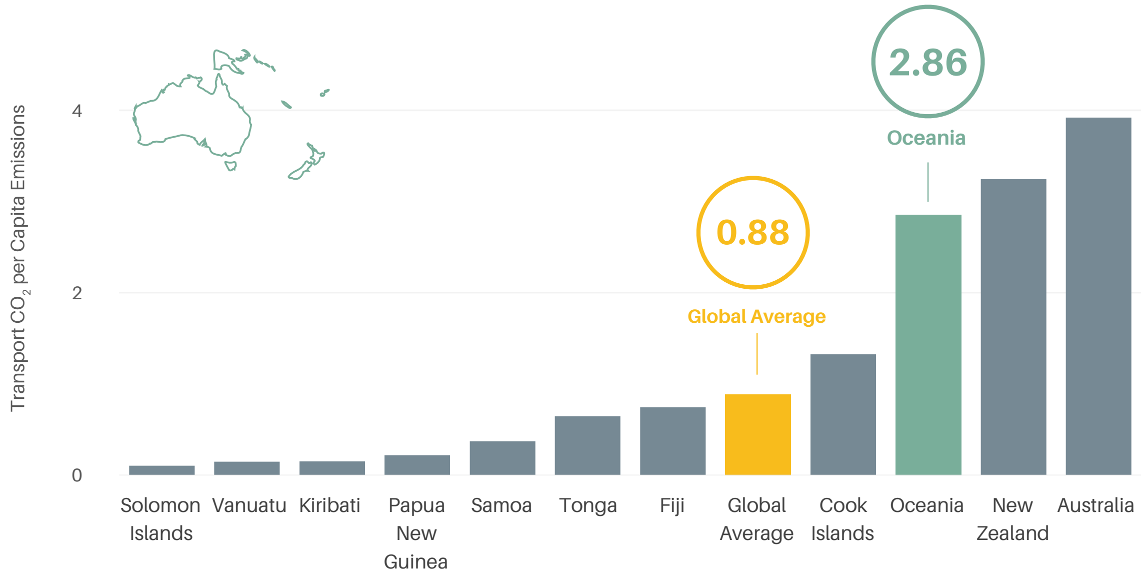
Regional CO_2 trends

- Total transport CO_2 emissions (2019): **117.9 million tonnes**
- Share of global transport CO_2 emissions (2019): **2%**
- Per capita transport CO_2 emissions (2019): **2.86 tonnes**
- Transport CO_2 emissions per USD 10,000 GDP (2019): **0.71 tonnes**



Source: See endnote 24 for this section.

Figure 3. Per capita transport CO_2 emissions in Oceania, 2019



Source: See endnote 21 for this section.

Currently 75% of the fossil fuels imported into the Pacific region are for land and maritime transport, underscoring challenges to decarbonising these sub-sectors.[25] A statement from regional energy and transport ministers in September 2019 affirmed a commitment to 100% renewable energy generation in the Pacific Islands to help counter this prevailing trend, aimed at including measures such as carbon pricing and creating a just transition from fossil fuels.[26]

Policy measures

Although transport emissions in Oceania are the lowest globally, the region's vast geography and multitude of island nations has created a high reliance on aviation and shipping for connectivity, which has translated to high transport costs and decarbonisation challenges. Transport policy measures in Oceania have focused on improving public transport, boosting resilience to climate change, and making shipping more sustainable, and are supported by ambitious emission reduction targets.

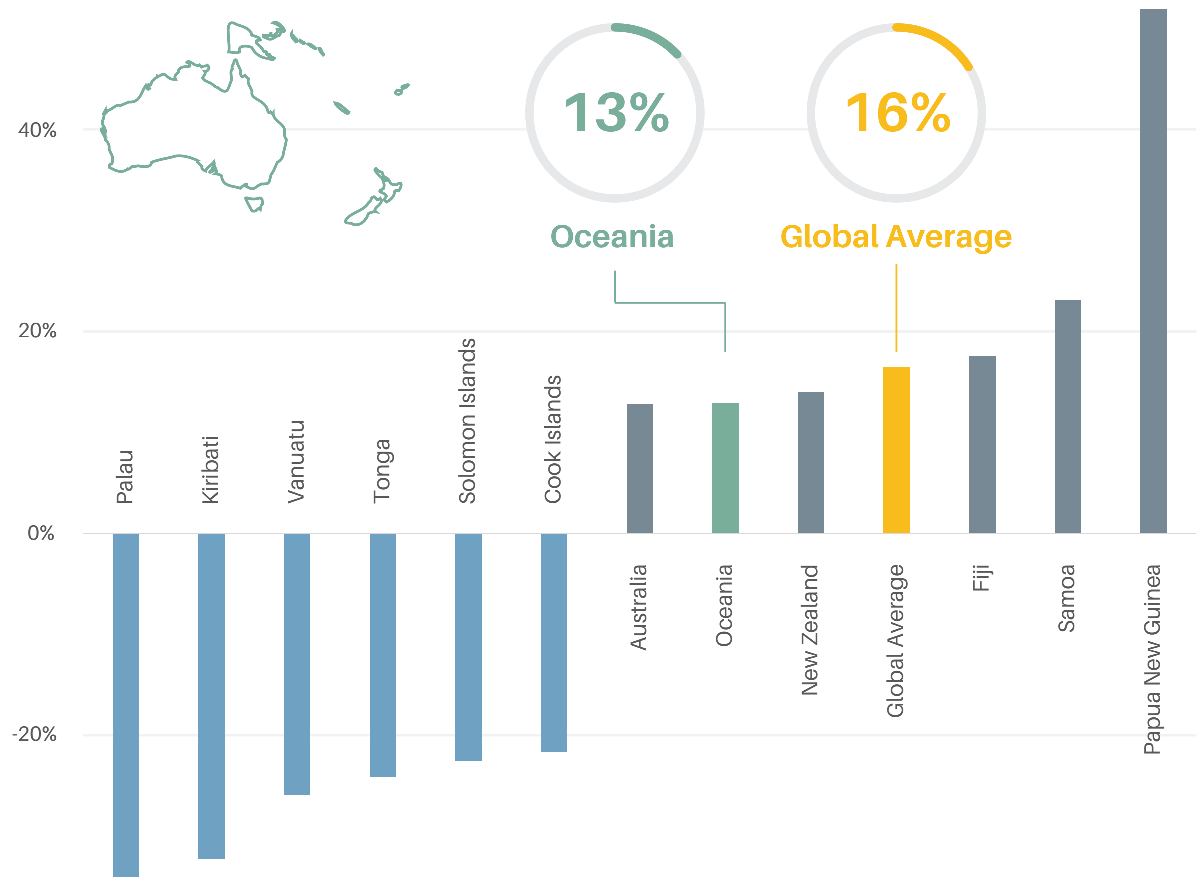
Major cities in the region have prioritised renewed investments in urban transport systems. Cities continued to pursue light rail systems and expand their bus services. **Australia** and **New Zealand** are the only countries in the region with extensive railway infrastructure. Brisbane, Melbourne and Sydney have made historic investments in public transport infrastructure to increase capacity in these metro areas.

- The first underground subway system in Oceania opened in **Sydney** in May 2019, and more lines are under construction, totalling USD 20.8 billion in investments.[27]
- In **Melbourne**, a proposed underground airport rail link would cost an estimated USD 15 billion.[28]
- In 2018, **New Zealand** announced a plan to invest NZD 16.9 billion (USD 12.2 billion) in land transport over three years, with the bulk of the funding marked for road construction, maintenance, and safety projects, and only a quarter dedicated to urban public transport and walking/cycling improvements.[29]

Adaption and resilience measures are increasingly important for transport planning and policy making due to the region's climate vulnerabilities, which range from extreme heat, flooding and high winds in Australia to sea-level rise in SIDS and other countries. The region is working simultaneously to increase the resilience of transport infrastructure while reducing emissions, as many transport networks have experienced disruptions due to storm damage and other impacts.

- In 2019, the World Bank launched the Pacific Climate-Resilient Transport Program, a series of projects focused on building resilient transport infrastructure; the programme focuses on four countries – **Samoa**, **Tonga**, **Tuvalu** and **Vanuatu** – with more expected to join in a second phase.[30]
- The **Asian Development Bank** has invested more than USD 2 billion in Pacific Islands, focusing on resilient transport.[31]

Figure 4. Change in transport CO_2 emissions in Oceania, 2010-2019



Source: See endnote 21 for this section.

Some countries have set ambitious decarbonisation targets in their Long-Term Strategies and Nationally Determined Contributions (NDCs) to implement the Paris Agreement, while other plans remain insufficient. In 2014, the **Marshall Islands** founded the High Ambition Coalition to ensure achievement of the Paris Agreement and has defined a long-term strategy for decarbonisation.[32] **New Zealand**'s target to achieve carbon neutrality by 2050 set the bar higher for the region, but early ambitions were slowed by the COVID-19 pandemic, and the country's NDC (along with that of Australia) has been rated "insufficient" to achieve Paris Agreement targets.[33]

- In 2018, **Fiji** published the Greater Suva Transportation Strategy 2015-2030, which aims to establish a comprehensive and integrated sustainable transport system.[34]
- **New Zealand's** Climate Change Response (Zero Carbon) Amendment Act, adopted in November 2019, established a new national emission reduction target for 2050; in December 2019, the country established an independent Climate Change Commission to monitor progress towards the 2050 target and emission budget.[35]
- The **Marshall Islands** was the only country to explicitly include a target to reduce shipping emissions in its first NDC; in its second NDC, submitted in December 2020, the country raised this target from 27% to 40% by 2030 (below 2010 levels).[36]

In 2019, energy and transport ministers from the Pacific region committed to boosting renewable energy use and decreasing reliance on fossil fuels.[37] Currently countries in Oceania are heavily reliant on imported fossil fuels. There are ample opportunities to increase the use of solar, wind and wave energy to power transport systems, and barriers to uptake are more institutional than technological.[38] However, total renewable power generation represents just 1% of the overall potential.[39]

- **Australia's** first public hydrogen station for charging fuel cell electric vehicles was installed in Canberra in June 2020, with additional stations planned for Melbourne in 2021 as part of the national hydrogen strategy.[40]
- The **Marshall Islands** set a target to reduce transport fuel use 20% by 2020 but did not reach the goal due in part to the lack of a dedicated regulatory body.[41] Overall, 13 SIDS have pledged to reduce transport fuel use 25% by 2033, although the commitment does not differentiate among transport sub-sectors (land, air, maritime).[42]

Six SIDS established the Pacific Blue Shipping Partnership (PBSP) in 2019, setting targets to reduce emissions from shipping 40% by 2030 and to reach full decarbonisation by 2050.[43] Maritime shipping is essential in the region for economic activity and to distribute goods, due to long distances between countries. The Oceania region is central to emerging efforts to reduce shipping impacts.

- Through the PBSP, the governments of **Fiji**, **Marshall Islands**, **Samoa**, **Solomon Islands**, **Tuvalu** and **Vanuatu** have joined forces to call for USD 500 million to increase the sustainable development of maritime transport.[44]
- **Nauru** aims to build a climate-resilient wharf that is expected to decrease wait times for vessels and reduce CO_2 emissions by an estimated 11,000 tonnes annually.[45]
- Several Pacific countries have submitted position papers to the International Maritime Organization to increase ambition in tackling carbon from the shipping sector.[46]

New walking and cycling measures were adopted and implemented in the region as non-motorised transport activities increased; for example, cycling activity in Auckland, New Zealand grew 8.9% in 2019.[47] Prioritisation of walking and cycling in national and city transport plans is facilitating a shift to active transport.

Austroads updated the Pedestrian Planning and Design Guidance for **Australia** and **New Zealand** in 2020 to align with national and international good practices.[48]

In 2019, technical guidelines for cycling infrastructure were adopted in **New Zealand**, and **Queensland**, Australia planned a state cycling network.[49]

Melbourne, Australia adopted restrictions or bans on cars in key streets or city centres to improve walking and cycling.[50]

Box 1. Impacts of the COVID-19 pandemic on transport in Oceania

Major COVID-19 impacts:

- 62% decrease in trips to public transport stations (at lowest point in 2020 versus January 2020 average)
- 42% decline in freight transport activity (below 2019 levels)

The pandemic caused a dramatic reduction in passenger transport demand in Oceania. **In April 2020, Australia reported an 80% decline in daily usage of public transport compared to January of that year.** In response to the pandemic, **Melbourne** fast-tracked 40 kilometres of cycling lanes, and **Sydney** and **Adelaide** disabled pedestrian push buttons and introduced automated pedestrian phases. By June 2020, **New Zealand** announced a full re-opening, including unrestricted public transport and travel across the country.

SIDS were at high risk of socio-economic impacts from the decline in travel and tourism, and they shifted the focus of their recovery efforts to resilience measures. Although road passenger rates had returned to pre-COVID levels as of early 2021, public transport growth is expected to take a number of years to return to previous levels.

Container shipping in the region was hit hard as demand dropped more than 10% in the first half of 2020 due to the pandemic, a sharper decline than in many global regions. Major ports in Oceania such as Melbourne and Sydney experienced more pronounced COVID-19 impacts than many Asian ports. From January to June 2020, global container ship calls were down 5.8% compared to 2019, and declines in Australasia (Australia, New Zealand and some neighbouring islands) and Oceania (down 12.4%) were exceeded only by those in Sub-Saharan Africa (down 12.7%). Passenger ship calls in Australasia and Oceania dropped 7% in the first quarter of 2020, and by the second quarter demand had fallen more than 35% in the region.

Source: See endnote 3 for this section.

In Practice: Additional Policy Responses

Shift measures

Public transport

- In 2019, **Sydney**, Australia added new light rail transit lines and extensions to its public transport service, and Canberra launched a 12-kilometre light rail line.[51]
- A new bus rapid transit system was launched in 2019 in Noumea, **New Caledonia** with a single 13.3-kilometre corridor.[52]

Railways

- In its 2020 budget, the **New Zealand** government allocated NZD 1.2 billion (USD 718 million) to rail in an effort to ease the recession brought by COVID-19; funding includes investment in new freight wagons and locomotives, track and support infrastructure, and portside infrastructure.[53]

Walking and cycling

- **Melbourne**, Australia implemented the pedestrianisation of two blocks in 2019 in an effort to curb cars in the city centre.[54]
- The Asian Development Bank is financing several road improvement projects – including a focus on increasing pedestrian and road passenger safety – in **Fiji**, **Papua New Guinea**, **Samoa**, **Solomon Islands**, **Timor-Leste**, **Tonga** and **Vanuatu**.[55]

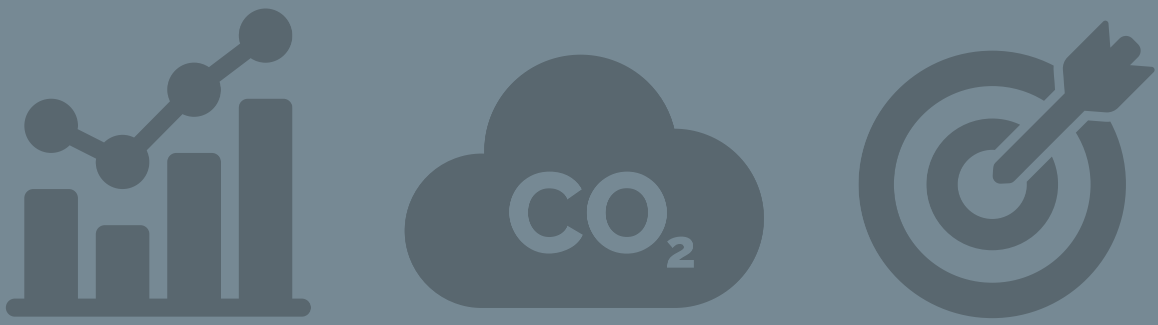
Improve measures

E-mobility

- In 2019, **New Zealand** announced subsidies and CO_2 tariffs in support of electric vehicles, to come into effect in 2021.[56]
- **Wellington**, New Zealand planned to expand its fleet of electric buses from 10 in 2020 to 108 by 2023.[57]
- In 2018, the Productivity Commission of **New Zealand** recommended a scheme in which vehicle importers would pay a fee or receive a rebate depending on the emission intensity of the vehicle.[58] The country also announced an exemption of electric vehicle owners from road user charges to support its electric vehicle target.[59]

Fuel economy

- The **New Zealand** Transport Ministry's proposed Clean Car Standard, introduced in 2021, is designed to lower the price of electric and other efficient vehicles, while raising fuel efficiency requirements for imported vehicles.[60]



Transport Demand, Emissions and Targets

2

This section covers three main areas:

Transport demand – the demographic and economic drivers of transport demand, trends in passenger and freight demand, and trends for existing and planned transport infrastructure.

Transport emissions – emissions from the transport sector, trends by different regions and transport modes, and tracking the carbon intensity of fuels.

Transport targets – countries' progress in meeting the 2020 targets for transport emission mitigation, and pathways needed to meet low carbon trajectories to avoid the worst effects of climate change.

2.1 Transport Demand

Key findings

Drivers of transport demand

- Global population increased 12% between 2010 and 2020, to an estimated 7.7 billion people, and the urban population grew nearly 20% over this period. As the population expands, more people worldwide need dependable transport services to access socio-economic activities and opportunities.
- Growth in global gross domestic product (GDP) has exceeded growth in transport energy use since 2010. Global GDP grew 27% between 2010 and 2019 (average annual rate of 3%) and 2.2% in 2019, but it fell an estimated 4.3% in 2020 due to the impacts of COVID-19.
- Global oil demand began declining in 2016, and this slide became a freefall in 2020 as the pandemic affected not only oil demand but also prices. The average price of West Texas Intermediate crude oil fell below USD 20 a barrel in 2020 (from USD 57 a barrel in 2019), as the reduction in travel led to a sharp drop in oil demand for transport.
- Battery prices – a major factor behind the cost of electric vehicles – dropped 89% between 2010 and 2020, from USD 1,183 per kilowatt-hour (kWh) to an estimated USD 135 per kWh.

Passenger transport supply and demand

- Global demand for public transport grew 4% per year between 2012 and 2017. Bus rapid transit, metro rail and light rail transit have expanded to varying degrees in nearly all regions, with bus rapid transit systems taking off in Europe and light rail becoming more prevalent in Oceania.
- The movement for better inter-city rail options is spreading not only in Europe, where more routes have been planned and upgraded, but also in Canada, China and Thailand. Heavy rail carries 8% of all passengers travelling between cities. Passenger rail transport activity is 75% electrified, and China and India are home to most of the existing track as well as future projected growth.
- Global air travel increased 4.2% from 2018 to 2019. In late July 2019, around 225,000 airplanes were active on a single day, the largest daily movement of aircraft ever recorded.
- The long-anticipated possibility of "peak car" may now be arriving, due to rising urban congestion as well as expanding shared mobility options. Between 2017 and 2019, total sales of passenger cars fell 7% in member countries of the Organisation for Economic Co-operation and Development (OECD) and 10% in non-OECD countries.

- Despite evidence of reduced car ownership in some cities, the growth in ridesharing appears to be correlated more strongly with a shift away from cycling, walking, taxis, and public transport, not necessarily car driving. A USA study found that the introduction of ridesharing services in a city leads to annual decreases in heavy rail ridership of 1.3% and in bus ridership of 1.7%.
- Motorised two-wheelers, such as mopeds and motorcycles, grew 149% in India and 80% in Vietnam between 2010 and 2019, and the world's largest motorcycle fleets are in China, India, Indonesia, Pakistan and Vietnam. These transport modes are most prevalent in Southeast Asia and have also increased in Latin America and Sub-Saharan Africa.

Freight transport supply and demand

- Although urban road freight accounted for only 1% of the total freight tonne-kilometres moved worldwide in 2015, it represented half of all road vehicle freight-kilometres, simply because urban loads are typically light but the travel is high frequency. Heavy rail carried 7% of all freight between cities in 2015.
- Global freight demand saw modest growth in maritime trade and declines in aviation due to the slow economic growth in 2018 and 2019.

Impacts of the COVID-19 pandemic

- Oil demand in 2020 was an estimated 8 million barrels per day lower than in 2019. Freight transport activity dropped an estimated 36% below projected levels, and carbon dioxide (CO_2) emissions from freight transport fell 30% in 2020.
- As the pandemic disrupted the supply chain, global vehicle production declined 14.5% in 2020, with 13 million fewer vehicles produced during the year. The drop was mostly in passenger car sales, whereas global sales of commercial vehicles fell by some 2.3 million. Only electric vehicles recorded strong growth, for a total of 11.2 million electric cars on the world's roads in 2020 (surpassing 2019 estimates by some 1.9 million cars).
- Bicycle sales in the USA increased 62% between January and October 2020 (compared to the same period in 2019), and e-bike sales increased 144%. Eleven European countries saw an average 8% increase in cycling during 2020.

Overview

Population growth and density, as well as economic growth and development, play an important role in driving transport activity. Urbanisation has had far-reaching effects on transport demand as well as on energy efficiency, economic development, social equity and paratransit (sometimes called "informal transport"). Additional factors influencing transport demand (and related emissions) include energy prices, policies related to transport and land use, as well as people's shifting behaviours and needs. Although comprehensive data for 2019 and 2020 are still emerging, various examples and indicators paint a picture of overall trends in the demand for both passenger and freight transport.

Drivers of transport demand

Population growth, urbanisation and density

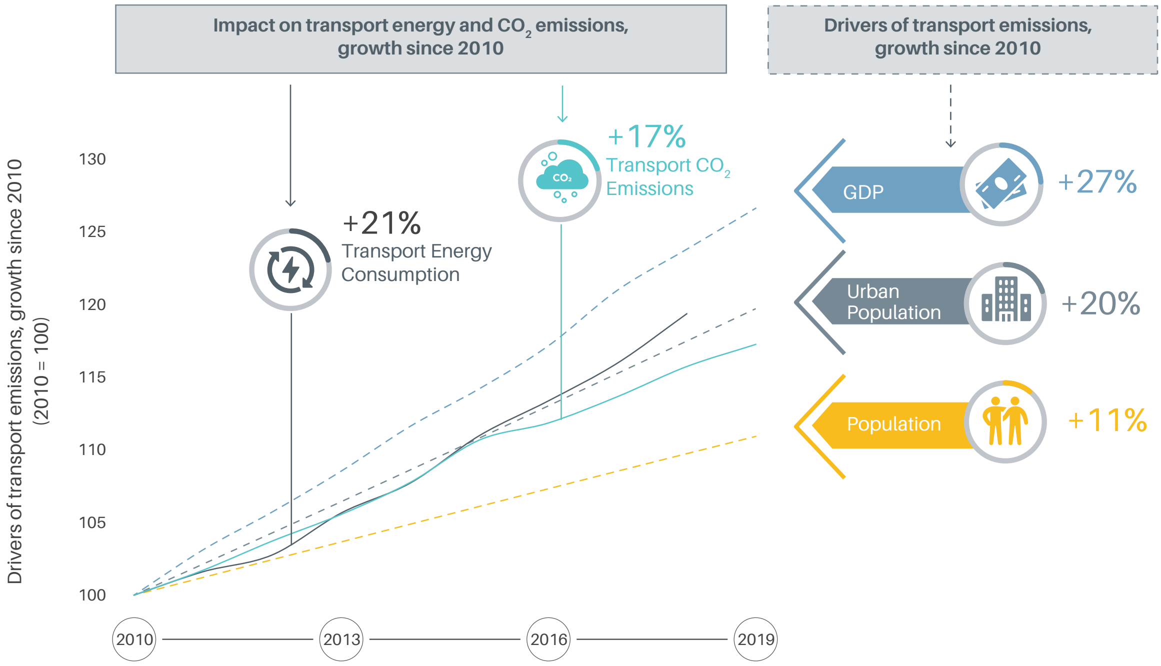
Global population increased 12% between 2010 and 2020, to an estimated 7.7 billion people, and the urban population grew nearly 20% over this period.[1] **As the population expands, more people worldwide need dependable transport services to access socio-economic activities and opportunities.** Africa's population grew fastest during the decade, at 29%, followed by Oceania (16%) and Latin America and the Caribbean (11%).[2] On average, the population in OECD member countries grew 6% over the decade, while the population in non-OECD countries grew 13%.[3]

The world's urban population increased at an average rate of 1.97% annually during 2010-2020, much faster than the rate of overall population growth (1.29%).[4] People are increasingly moving to cities to pursue economic, education, social and other opportunities. Small- to medium-sized urban areas are growing especially rapidly and are projected to account for rising shares of both population and economic growth, although they are often overshadowed by bigger, more visible cities.[5]

The links between population, economic growth, land use and the transport sector are diverse and interrelated. More densely populated areas tend to have higher urban GDP growth, whereas sprawling cities result in increased congestion and energy use. Urbanisation and higher population density can bring economies of scale and efficiency, helping to improve overall energy efficiency on a national level. However, with rising pressure on urban transport systems, cities can succumb to urban sprawl and long-term gridlock in the absence of proactive policies.[6]

Rising populations and consumer demand can make the movement of freight more challenging as the competition for road space increases. As of 2015, the global road network (excluding local urban roads) totalled around 14.5 million kilometres.[7] By 2050, it is expected to increase a further 3.0 to 4.7 million kilometres, especially in developing countries and in regions that are currently mainly wilderness, such as the **Amazon** and **Congo** basins.[8]

Figure 1. Drivers and impacts of transport demand, 2010-2019



Source: See endnote 11 for this section.

Demographic shifts also have implications for the planning of large infrastructure projects, as different age groups tend to have very different mobility patterns. For example, building a rail corridor to connect small- to medium-sized cities might make sense when accounting for projected population growth.

Policies related to the transport of passengers and goods, as well as to land use, play an essential role in ensuring that cities function efficiently for both human and socio-economic development.[9] However, a lack of integrated planning, and insufficient long-term investment in transport, can lead to unnecessary trips or congestion and to higher energy use in the sector.[10]

Economic trends

Growth in global GDP has exceeded growth in transport energy use since 2010. Global GDP grew 27% between 2010 and 2019 (average annual rate of 3%) and 2.2% in 2019 (*see Figure 1*), but it fell an estimated 4.3% in 2020 due to the impacts of COVID-19.[11] These economic trends impact both mobility and transport demand. Although GDP has grown faster than the population overall, the economic benefits have not been distributed equally. Based on most indices, the global economy today is less resilient than it was in 2007, in terms of both economic risks and their consequences, and how to mitigate them.[12] The main challenge for climate action will be decoupling economic growth from rising emissions, particularly in the transport sector.

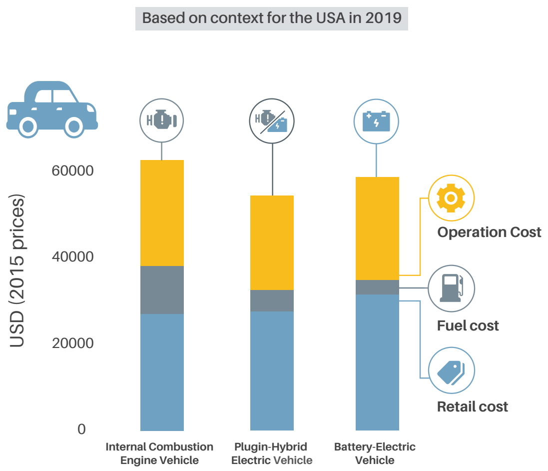
Providing more options to enable mobility can increase the resilience of both transport systems and the overall economy. This is one reason why both public transport and active modes of transport (cycling and walking) have attracted greater attention since the start of the COVID-19 pandemic (*see Box 1*).[13]

Energy consumption and prices

Global oil demand began declining in 2016, and this slide became a freefall in 2020 as the COVID-19 pandemic affected not only oil demand but also prices.[14] **The average price of West Texas Intermediate crude oil fell below USD 20 a barrel in 2020 (from USD 57 a barrel in 2019), as the reduction in travel led to a sharp drop in oil demand for transport.**[15] Energy prices can have a significant impact on both transport demand and related emissions.

The price of oil, which is highly susceptible to market forces, helps determine the financial competitiveness of electric vehicles (specifically those powered by renewable or other non-fossil fuel sources) compared to traditional internal combustion vehicles powered by fossil fuels. Even with the drop in oil prices, the payback period and total cost of ownership for electric cars and buses has become more competitive every year (*see Figure 2*), and electric buses have increasingly displaced diesel fuel use.[16] In 2019, 17% of the world's bus fleet was electric, and China was home to 98% of the global fleet, with its e-buses already displacing more oil than all of the world's electric passenger cars combined.[17]

Figure 2A. Total cost of ownership for cars



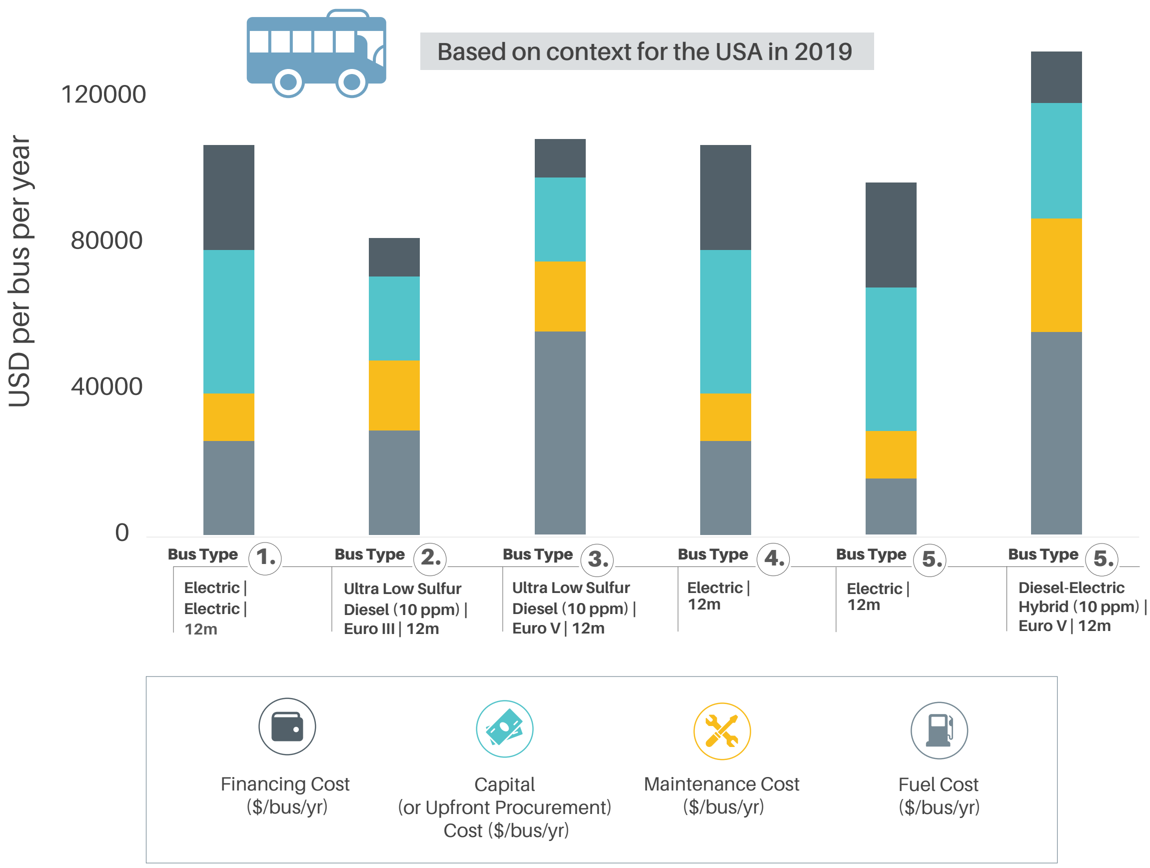
Source: See endnote 16 for this section.

Battery prices – a major factor behind the cost of electric vehicles – dropped 89% between 2010 and 2020, from USD 1,183 per kWh to an estimated USD 135 per kWh[i],[18] Even as oil prices have dipped to historic lows, lithium-ion batteries have become much less expensive and lack the price volatility of oil. The energy density of lithium-ion battery cells nearly tripled between 2010 and 2020, helping to extend the range of electric vehicles.[19]

However, cost comparisons between electric and fossil-fuelled vehicles fail to reflect the ongoing presence of fossil fuel subsidies. Despite progress with subsidy reform in the early 2010s, worldwide subsidies for fossil fuels still totalled USD 500 billion in 2019.[20] Many governments provide financial and non-financial incentives to support the initial uptake of electric vehicles, but these incentives are often designed to be phased out once a certain market share has been reached.[21]

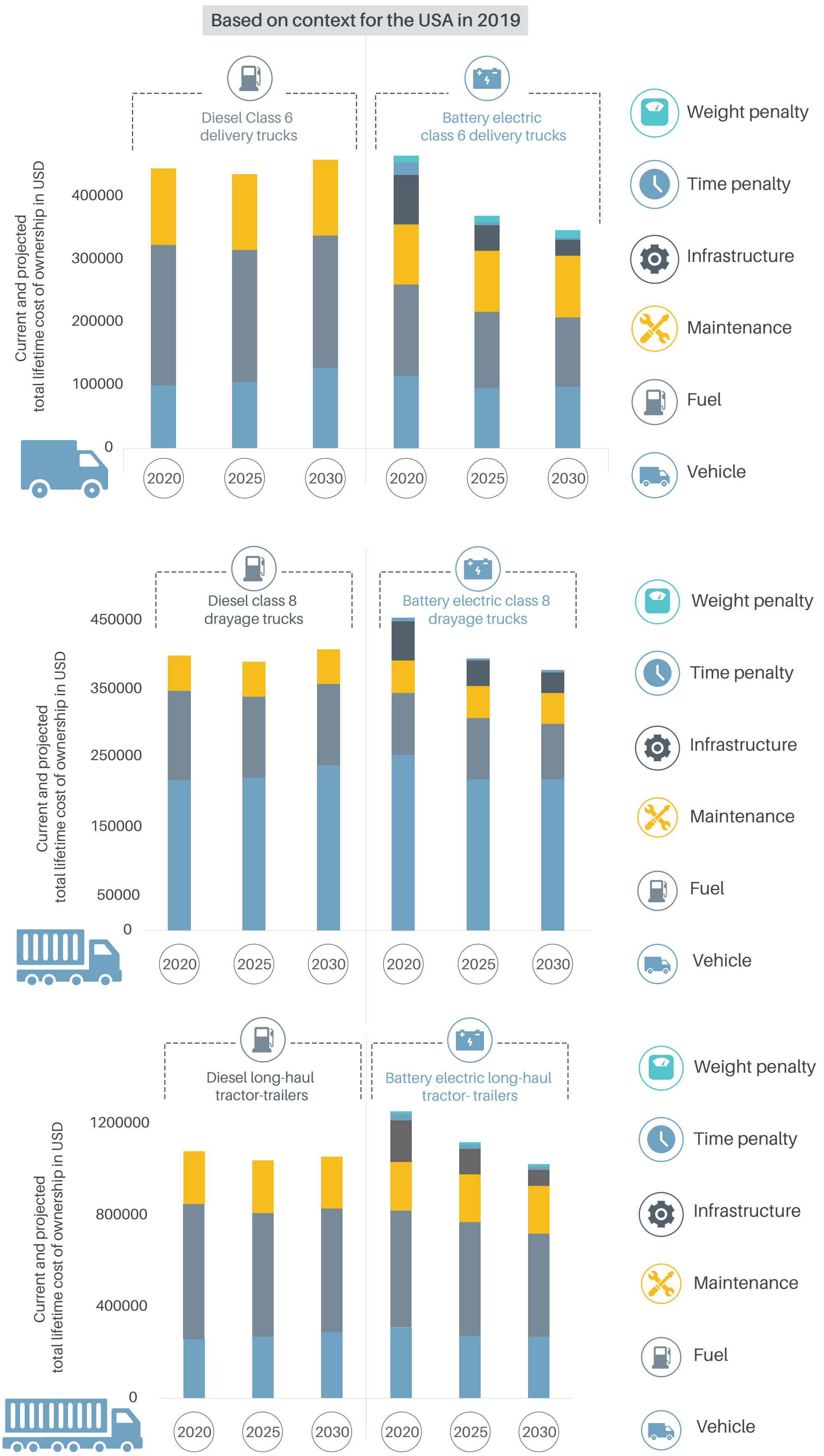
i Battery pack prices per kWh are higher for plug-in hybrid EVs, and vary by vehicle segment, but published figures refer to the volume-weighted industry average.

Figure 2B. Total cost of ownership for buses



Source: See endnote 16 for this section.

Figure 2C. Total cost of ownership for trucks



Source: See endnote [16] for this section.

Shifting behaviours, needs and policies

Additional drivers behind transport demand include people's shifting behaviours and needs, as well as changes in the supply of transport infrastructure. This includes the growing availability of data on the frequency and occupancy of buses and other transport modes, accessed via handheld devices and at public transport stops.

With rising urbanisation, cities have struggled to build adequate infrastructure to provide the needed mobility services for both passengers and freight. The quality of walking and cycling infrastructure in particular is not on par with the many benefits that these options offer to society and the environment.[22]

However, in recent years there has been a shift away from high-emitting modes of transport and towards non-motorised transport. In 2018 and 2019, the anti-flying movement known as *flygskam* or "flight shame" began sweeping across Europe.[23] A study also found that a majority of European urban residents support increased bans on diesel and petrol cars after 2030.[24] Globally, there was a positive correlation between the emergence of "pop-up" walking and cycling infrastructure during the pandemic in 2020, and the share of trips taken via these two modes, which neared 48% in some European cities.[25]

Policies and regulations shape and determine demand for transport in a variety of ways. Cities in particular serve as "laboratories" for testing the dynamic mix of urbanisation trends and evolving workplaces and delivery modes. For example, bicycle sharing schemes are using "nudging" to incentivise users to drop off their bikes at locations (such as transit stations) that are more useful to the operator. Meanwhile, many delivery companies now offer the option for customers to pick up parcels from a nearby shop at their convenience, instead of having to wait for the delivery and potentially miss it, which can increase energy use and emissions.

Passenger transport supply and demand

Mobility options both within and between cities have increased. However, investment in transport has not yet grown to levels that meet the burgeoning demand for mobility services (*see Section 4: Financing Climate Action in Transport*).

Public transport

Global demand for public transport grew 4% per year between 2012 and 2017.[26] Bus rapid transit, metro rail and light rail transit have expanded to varying degrees in nearly all regions, with bus rapid transit systems taking off in Europe and light rail becoming more prevalent in Oceania (*see Figure 3*).[27]

The number of cities with bus rapid transit systems increased from 169 in 2017 to 176 in 2020, and the total length of these lines grew from 5,000 kilometres to 5,282 kilometres during this period.[28] In 2020, bus rapid transit systems worldwide served nearly 34 million passengers per day.[29]

Metro rail grew 36% between 2014 and 2018, reaching a total of 178 metro systems worldwide with 642 lines and a combined length of 13,903 kilometres.[30] In 2019, **Indonesia** unveiled its first metro system, operating in Jakarta, and a new system also opened in **Doha**, Qatar.[31] The following year, the first metro in Pakistan went into operation in **Lahore**.[32]

Light rail and tram systems have experienced a renaissance, and in some cases systems were reinstalled in places where they had been stripped out decades before. Between 2015 and 2018, the length of light rail track added in Europe alone accounted for a third of the total track length worldwide.[33] However, the Asia-Pacific region had more new light rail projects than Europe for the first time as of 2017, and in 2015 Africa's first system was launched in **Addis Ababa**, Ethiopia.[34]

Even with the increase in public transport infrastructure and services, ridership has suffered in many places because public transport is a lower policy priority for many cities.[35] Best practices point to the importance of better route planning as a relatively cost-efficient measure to boost ridership, which in turn leads to greater revenue and potential for investments in improved bus services, especially as more fleets look to electrify.[36]

Heavy rail

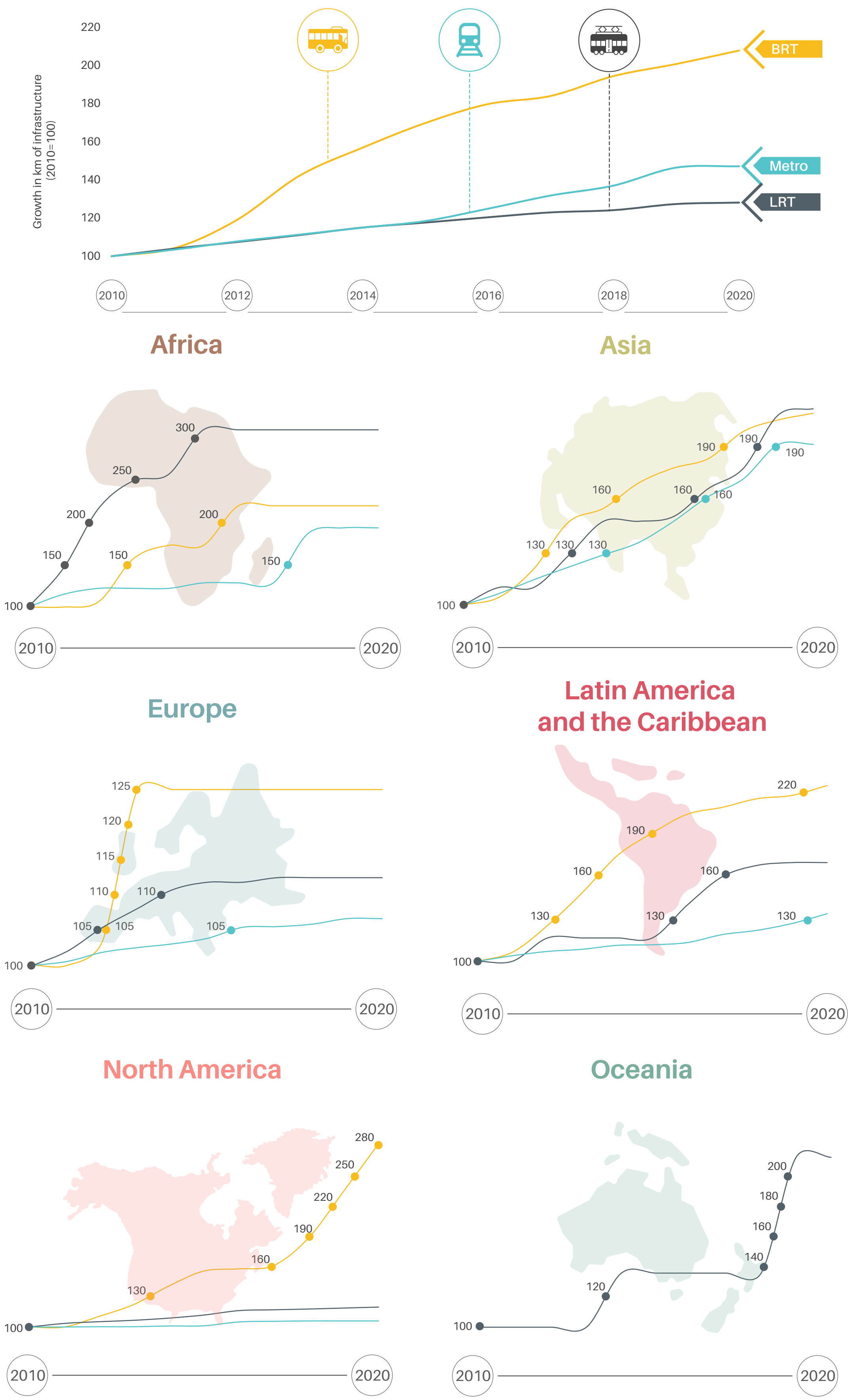
The movement for better inter-city rail options is spreading not only in Europe, where more routes have been planned and upgraded, but also in Canada, China and Thailand.[37] Heavy rail carries 8% of all passengers travelling between cities.[38] Passenger rail transport activity is 75% electrified, and China and India are home to most of the existing track as well as future projected growth.[39] Outside of these countries and Europe, construction of heavy rail lines is lagging, and most inter-city travel occurs via bus or airplane. High-speed rail is spearheading growth in heavy rail, and the total high-speed rail track length grew substantially in 2019 and increased in 2020 as well (*see Figure 4*).[40]

Interest in rail declined in many regions in recent decades as low-cost airlines captured a greater share of the market, expanding access to air travel worldwide. However, with increasing urbanisation (among other factors), the calculation is starting to lean more favourably towards high-speed rail corridors between cities, where previously a flight was the preferred mobility choice due to time savings (not taking into account environmental effects). In areas where high-speed rail systems exist, people tend to take trains instead of flights for trips under 500 kilometres.[41]

In **Europe**, inter-city rail travel – particularly the use of night trains with sleeper compartments – decreased between 2010 and 2018.[42] However, this trend has since reversed, in part because of rising environmental awareness, exemplified by the *flygskam* or "flight shame" movement that became prominent in **Sweden** in 2019.[43]

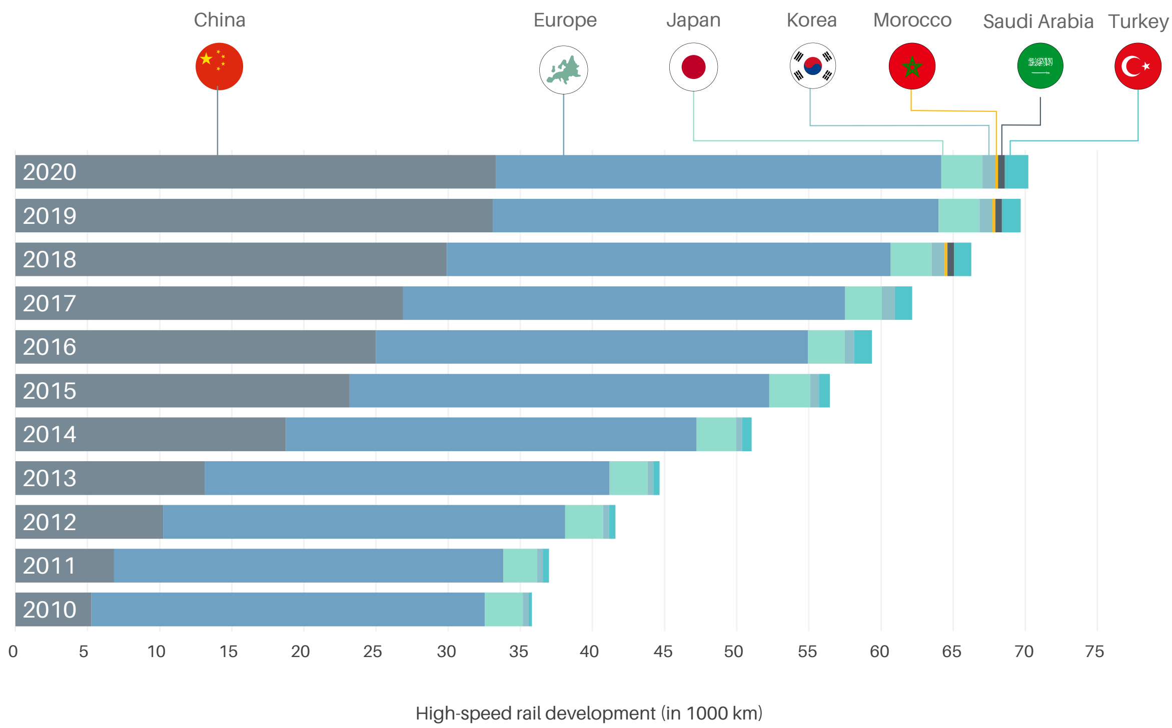
In 2019, international rail travel from the Netherlands went up 13%, while 500,000 fewer passengers flew out of **Amsterdam**'s Schiphol Airport.[44] Air travel in **Sweden** fell 4% in 2019, and night train travel in **Austria** doubled between 2016 and 2017, increasing a further 10% in 2018.[45] The Brussels-to-Vienna night train was reintroduced

Figure 3. Growth in bus rapid transit, metro systems and light rail transit, worldwide and by region, 2010-2020



Source: See endnote 27 for this section.

Figure 4. High-speed rail development by region, 2010-2020



Source: See endnote 40 for this section.

in 2020, nearly 16 years after it closed.[46] Despite integration efforts in the European Union (EU), many structural and technical issues related to inter-city rail have yet to be resolved, including different gauge widths and grid voltages among member countries.[47]

Air travel

Global air travel increased 4.2% from 2018 to 2019.[48] **In late July 2019, around 225,000 airplanes were active in a single day, the largest daily movement of aircraft ever recorded.**[49] While air travel is dominated by wealthier countries, the launch of the Single African Air Transport Market in 2018, covering 34 countries, will enable more air travel within **Africa**.[50] In **Europe**, aviation represented the second highest share of passenger transport volumes (after road transport) between 2010 and 2019.[51] **Europe** was the driving market for global air travel growth in 2019, with an 8.9% increase in domestic flights and a 6.3% increase in international flights.[52] Jet fuel remains untaxed globally, which amounts to an unequal subsidy.[53]

Air travel infrastructure has struggled to meet demand, and airports are being constructed or expanded in all regions to increase capacity.[54] In 2019, a new airport became operational in Istanbul, **Turkey**, and **China** also opened Beijing's second international airport, with the world's biggest terminal.[55] Despite these developments, total airport capacity grew only 3.4% in 2019, half the pace of the previous year.[56]

Passenger cars

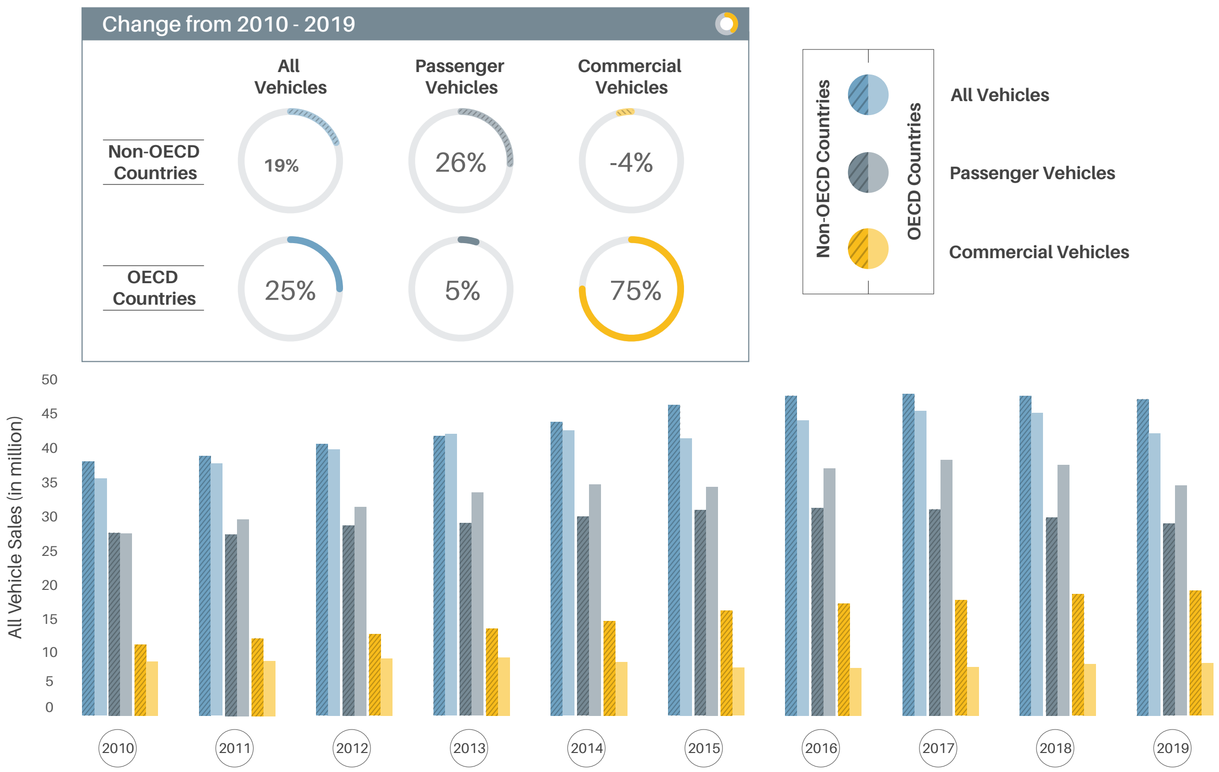
The long-anticipated possibility of "peak car" may now be arriving, due to rising urban congestion as well as expanding shared mobility options.[57] **Between 2017 and 2019, total sales of passenger cars fell 7% in OECD countries and 10% in non-OECD countries** (*see Figure 5*).[58] These declines occurred even as GDP per capita increased in both regions.[59] Overall, passenger car sales have plateaued since 2015 after expanding rapidly over the previous decade (from 45 million cars in 2005 to 65 million in 2015).[60] Despite declining sales in some developed countries, however, the total number of passenger and commercial vehicles worldwide has continued to increase, due to the continued circulation of older passenger cars.[61]

The three most-discussed car trends of recent years are electric, shared and automated vehicles.[62] Vehicle electrification has continued unabated, although the rate of uptake of electric vehicles remains too slow to meet climate targets (*see Section 3.8: E-mobility*). Meanwhile, shared and automated cars remain far from fulfilling their touted potential (*see Section 3.6: Shared Mobility Services*).

Ridesharing

Despite evidence of reduced car ownership in some cities, the growth in ridesharing appears to be correlated more strongly with a shift away from cycling, walking, taxis, and public transport, not necessarily car driving.[63] A USA study found that the introduction

Figure 5. Vehicle sales in OECD and non-OECD countries, 2010-2019



Source: See endnote 58 for this section.

of ridesharing services in a city leads to annual decreases in heavy rail ridership of 1.3% and in bus ridership of 1.7%.[64] In the USA, however, ridesharing still accounts for less than 1% of the total kilometres driven.[65] In some urban areas worldwide, ridesharing has been found to increase the total vehicle-kilometres travelled, with a 19% increase in New York City in 2016 and a 31.5% increase in Santiago, Chile.[66]

Motorised two- and three-wheelers

Motorised two-wheeler fleets, such as mopeds and motorcycles, grew 149% in India and 80% in Vietnam between 2010 and 2019 (*see Figure 6*), and the world's largest motorcycle fleets are in China, India, Indonesia, Pakistan and Vietnam.[67] These transport modes are most prevalent in Southeast Asia and have also increased in Latin America and Sub-Saharan Africa.[68]

The electric two-wheeler segment continued to grow in 2019, not only in China but also in Latin America and the Caribbean, Southeast Asia and Sub-Saharan Africa.[69] In India, the market grew 11% that year.[70] Three-wheelers, although more of a niche than two-wheelers, are particularly suited for passenger taxi trips and for the delivery of goods in congested cities, and their numbers are rising in China and India.[71]

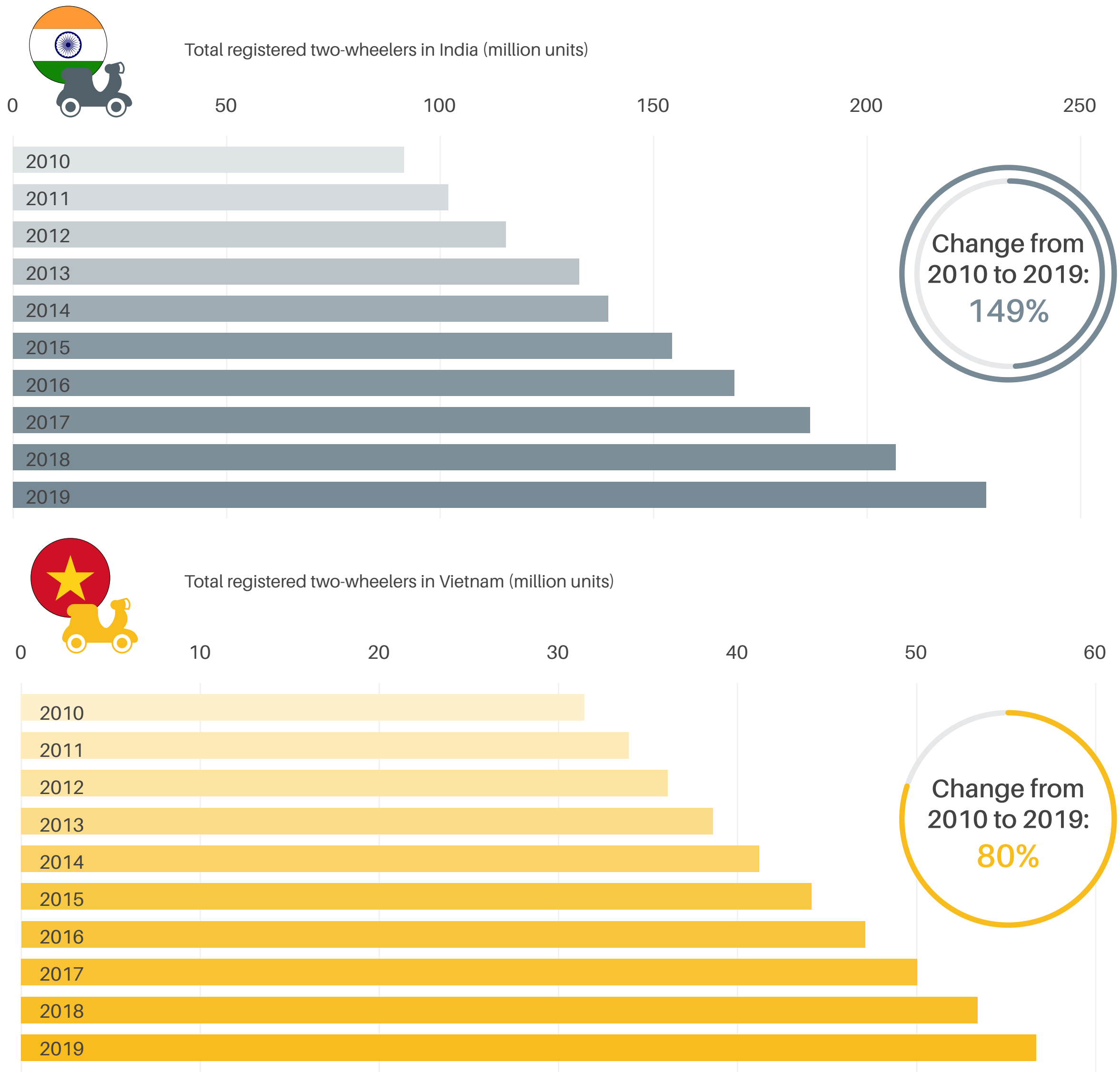
Two-wheelers have a much lower upfront cost than buying a passenger car and can potentially reduce inconveniences related to parking and congestion. Research on Indonesia's popular Gojek motorcycle rideshare service found that motorcycles can complement public transport by acting as feeder services to high-capacity public transport routes.[72]

Freight transport supply and demand

Although urban road freight accounted for only 1% of the total freight tonne-kilometres moved worldwide in 2015, it represented half of all road vehicle freight-kilometres, simply because urban loads are typically light but the travel is high frequency.[73] Heavy rail carried 7% of all freight between cities in 2015.[74] As freight demand has continued to grow, the total volume of freight tonne-kilometres moved has increased, with the biggest drivers in recent years being food delivery services and e-commerce.[75]

Increased urbanisation and the overall growth in GDP have contributed to the rise in urban freight demand. At the same time, a structural shift has occurred as more people order food and goods directly to their homes, and as both the availability of and demand for same-day deliveries have increased. Same-day delivery of goods

Figure 6. Change of motorcycle fleet in India and Vietnam, 2010-2019



Source: See endnote 67 for this section.

is especially prevalent in Chinese cities, which pioneered the trend (often on electric two- or three-wheelers); however, it is increasingly popular across all regions, particularly in tech-savvy cities in high-income countries and in emerging economies.[76]

Statistics tend to overlook many modes of urban freight transport, including the use of passenger cars for freight delivery or movement, the proliferation of motorcycle food and parcel deliveries, and the use of walking and cycling.[77] A case study in **London** found that up to 62% of a parcel carrier's round may include walking, and that the overall impacts of urban freight depend on a wide range of factors, including whether or not the first delivery attempt was successful.[78]

The order-return behaviour of consumers also influences freight transport, as purchase policies that enable easy returns can result in unnecessary trips.

Just as ridesharing is considered the marquee business model of the past decade in passenger mobility (upending taxi services around the world), innovation is also taking place in the freight sector. Both small and large companies have entered the sector in new ways. For example, **Uber** launched its Uber Freight service in the **USA**, **Netherlands** and **Germany** in 2017, then expanded it in 2019, and **Gojek** shifted in 2020 from just shuttling passengers to also delivering goods within and between cities.[79] **Doddle,** launched in several regions in 2015, seeks to avoid missed deliveries by providing physical drop-off locations that are not contingent on someone being home during daytime hours (also known as parcel consolidation).[80]

Amazon has entered the market with its Flex service, which invites eligible drivers with their own vehicles to deliver parcels as part of their daily routine, in an approach called "crowd shipping".[81] It expanded this service to India in 2020.[82] The company Lori has established a similar crowd shipping platform in Kenya.[83] Early indications suggest that this has the potential to help solve the last-mile problem but could also add considerably to emissions.[84] This issue is discussed further in *Section 2.2: Transport Emissions* and underscores the importance of tracking the movement of freight to gauge its current status.

Global freight demand saw modest growth in maritime trade and declines in aviation due to the slow economic growth in 2018 and 2019. Seaborne trade increased only 0.5% in 2019 (down from 2.8% growth in 2018), the lowest rate since the 2009 financial crisis.[85] Air freight represents a minimal share of global freight movement.[86] In 2019, air freight traffic fell 3.3% from the previous year, its first decline since 2012.[87]

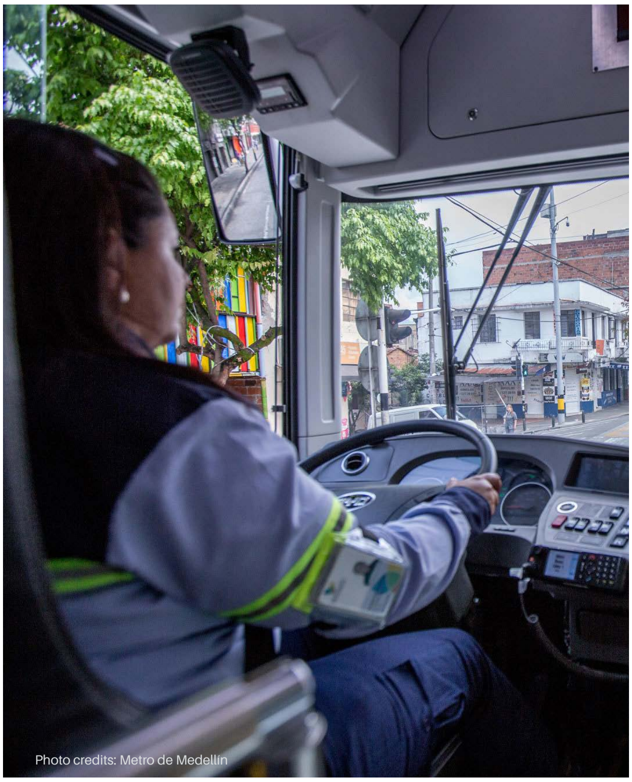


Photo credits: Metro de Medellin

Box 1. Impacts of the COVID-19 pandemic on transport demand

Total transport activity plummeted in early 2020 as countries enacted flight restrictions and issued stay-at-home mandates or guidelines due to the COVID-19 pandemic. Reductions in road transport and aviation, the world's two major oil consumers, led to a large drop in oil demand and prices. **Oil demand in 2020 was an estimated 8 million barrels per day lower than in 2019. Freight transport activity dropped an estimated 36% below projected levels, and CO_2 emissions from freight transport fell 30% in 2020.**

With the decline in air travel, the impacts of the pandemic led to rising interest in inter-city rail. Overall, the number of flights fell 33% in 2020, with 15 million fewer flights compared to 2019. The largest declines were in the **Middle East**, **Africa** and **Europe**. Air freight transport fell only 10.6% in 2020, and by December it was almost back to pre-COVID-19 levels from a year prior, as many flights were used to transport goods and medical supplies. Although home delivery services proved increasingly popular, the overall contraction of the world economy led total freight tonne-kilometres to fall for the year. World seaborne trade was down an estimated 4% in 2020.

As the pandemic disrupted the supply chain, global vehicle production declined 14.5% in 2020, with 13 million fewer vehicles produced during the year. The drop was mostly in passenger car sales, whereas global sales of commercial vehicles fell by some 2.3 million. Only electric vehicles recorded strong growth, for a total of 11.2 million electric cars on the world's roads in 2020 (surpassing 2019 estimates by some 1.9 million cars).

Walking and cycling attracted greater attention following the start of the pandemic. The need for social distancing contributed to accelerated implementation of temporary bike lanes, reallocation of street space and other responses (*see Section 3.2: Sustainable Mobility Planning and Transport Demand Management*). **Bicycle sales in the USA increased 62% between January and October 2020 (compared to the same period in 2019), and e-bike sales increased 144%. Eleven European countries saw an average 8% increase in cycling during 2020.** Walking declined sharply in March and April 2020 but recovered quickly to exceed pre-pandemic baseline levels by July.

A growing number of banks, financial and related stakeholders are considering ways to better manage both the pandemic and the climate crisis by linking COVID-19 recovery with investments in economic- and climate-resilient projects. For example, the World Economic Forum, among others, has explored how to "build back better".

The pandemic has had drastic impacts on travel behaviours *(see Focus Feature 6: Paratransit as a Complement to Formal Transport Networks)* and could have long-term impacts on people's perceptions and travel choices. Pandemic-induced conditions led to more trips within communities, remote working and an increase in health-related trips. However, the long-term direction of passenger and freight transport developments remains unclear, and decision makers must initiate and implement the shift to more sustainable, energy-efficient transport options.

Source: See endnote 13 for this section.

2.2 Transport Emissions

Key findings

Transport emission trends

- The transport sector was the fastest growing fossil fuel combustion sector worldwide from 2010 to 2019, with sectoral emissions rising 17.2% during this period. In absolute terms, transport (alongside "other industrial combustion") was the second highest emitting sector in 2019.
- Global transport emissions increased 1% in 2019, well below the 2% annual average growth rate for the decade.
- Between 2010 and 2019, transport carbon dioxide (CO_2) emissions grew 4% in member countries of the Organisation for Economic Co-operation and Development (OECD) and 34% in non-OECD countries.
- In 2019, transport CO_2 emissions fell more than 10% in some countries, but grew more than 5% in many countries, with growth exceeding 10% in some cases.

Transport emissions by mode and sub-sector

- In 2018, CO_2 emissions grew for all major transport modes and sub-sectors, except railways.
- Larger passenger vehicles – specifically sport utility vehicles (SUVs, including pickup trucks) – were the biggest driver of passenger transport emissions between 2010 and 2018, contributing 533 million tonnes of CO_2 during this period.
- Emissions from motorised two-wheelers accelerated; however, vehicle-level CO_2 emissions for two-wheelers are relatively low compared to larger vehicles.
- Ride-hailing services have increased rather than decreased CO_2 emissions in many regions and cities, resulting in an estimated 69% increase in climate pollution compared to the trips they displace, in part by increasing traffic congestion.
- Aviation emissions increased 32% between 2013 and 2018, exceeding projections for this period.
- Although freight transport accounted for only 5% of the vehicle fleet in 2017, it contributed 42% of total transport CO_2 emissions as well as disproportionately high levels of local air pollutants.
- Decarbonisation efforts have been slower for freight transport than for passenger transport, although some national and sub-national governments have increased funding commitments.
- As nearly zero emission modes of transport, walking and cycling contribute to Paris Agreement targets for reducing transport-related emissions, while moving 6-8 times more people per hour in the same space compared to higher-carbon, motorised personal vehicles.

Transport emissions and GDP growth

- Global gross domestic product (GDP) grew 2.9% annually on average between 2000 and 2019, while annual transport CO_2 emissions grew at a slower rate of 1.9% during 2000-2010 and 2.0% during 2010-2019; however, additional structural changes are needed to completely decouple economic growth and transport emissions.
- Since 2000, a strong decoupling of GDP and transport CO_2 emissions has been observed in OECD countries, with divergence beginning during the 2007 global financial crisis.
- Non-OECD countries have also experienced a decoupling of transport emissions and GDP growth, although at a lower intensity and a less rapid pace.

Transport energy intensity

- The energy intensity (total energy consumption per unit of GDP) of the transport sector continued to improve in 2018, decreasing 2.1% from the previous year, far faster than the 1.5% average annual decline for 2000-2017.
- The transport sector is 97% fossil fuel-powered and is the least diversified of all energy end-use sectors, remaining far from being fuelled primarily by renewable sources.
- As more electric vehicles enter the vehicle fleet, the carbon intensity of passenger transport has improved slightly.
- The carbon intensity of the shipping sector (CO_2 per deadweight tonne-nautical mile) improved 30% during the period from 2008 to 2018 – faster than the sector's stated target of 40% by 2030 – due to an increase in the average ship size.
- Between 2010 and 2018, the average carbon intensity of electricity generated globally improved 10%. As the market for electrified transport expands, it can leverage these cleaner grids to reduce overall transport emissions.

Other climate-related transport impacts

- As of June 2019, some 39 countries had adopted "soot-free" standards for heavier vehicles, helping to reduce black carbon emissions.
- A decoupling of economic growth and black carbon emissions for heavy-duty vehicles is under way, and accelerating this shift would result in an estimated USD 1 trillion in societal savings.

Impacts of the COVID-19 pandemic

- In 2020, global transport CO_2 emissions dropped 19.4% below 2019 levels due to the pandemic, the biggest decrease of any sector; however, this decline is projected to be short-lived.
- The USA saw the strongest decline in ground transport CO_2 emissions in 2020, down 24% from 2019 levels, followed by Brazil (down 15.3%).
- The impact of the COVID-19 pandemic on both GDP and transport CO_2 emissions may result in an equal or stronger decoupling of economic growth and emissions than seen in recent years.

Overview

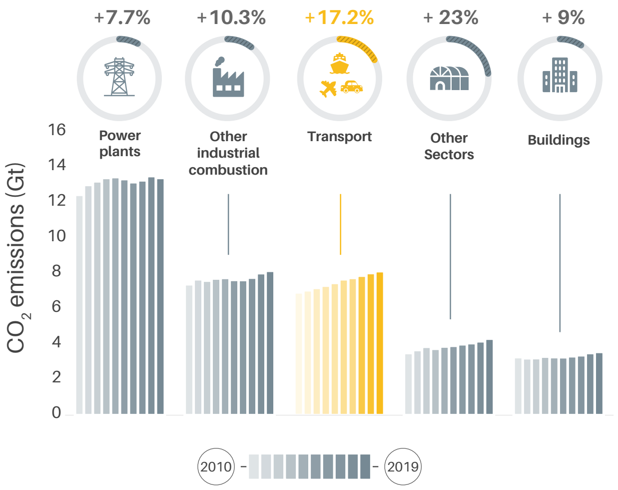
Rising global demand for mobility and goods has had a direct impact on emissions in the transport sector. Between 2010 and 2019, transport emissions grew in most countries, with higher growth recorded in developing countries. Strong emission increases occurred in road transport, driven by growing use of larger vehicles. Emissions from passenger aviation rose significantly before diving sharply in 2020 due to the COVID-19 pandemic, and shipping emissions experienced even more dramatic declines.

Efforts to decarbonise passenger transport outpaced action in freight transport, although some progress occurred on the latter. The decoupling of transport CO_2 emissions from GDP growth gained momentum – along with improvements in the energy intensity of transport – reflecting greater gains in developed countries. Reductions in black carbon yielded benefits for both transport emissions and local air quality. Although COVID-19 brought a temporary dip in transport emissions, this trend is projected to be short-lived (*see Box 1*).[1]

Transport emission trends

The transport sector was the fastest growing fossil fuel combustion sector worldwide from 2010 to 2019, with sectoral emissions rising 17.2% during this period (*see Figure 1*).[2] In absolute terms, transport (alongside "other industrial combustion") was the second highest emitting sector in 2019.[3]

Figure 1. Global CO_2 emissions by sector, 2010-2019



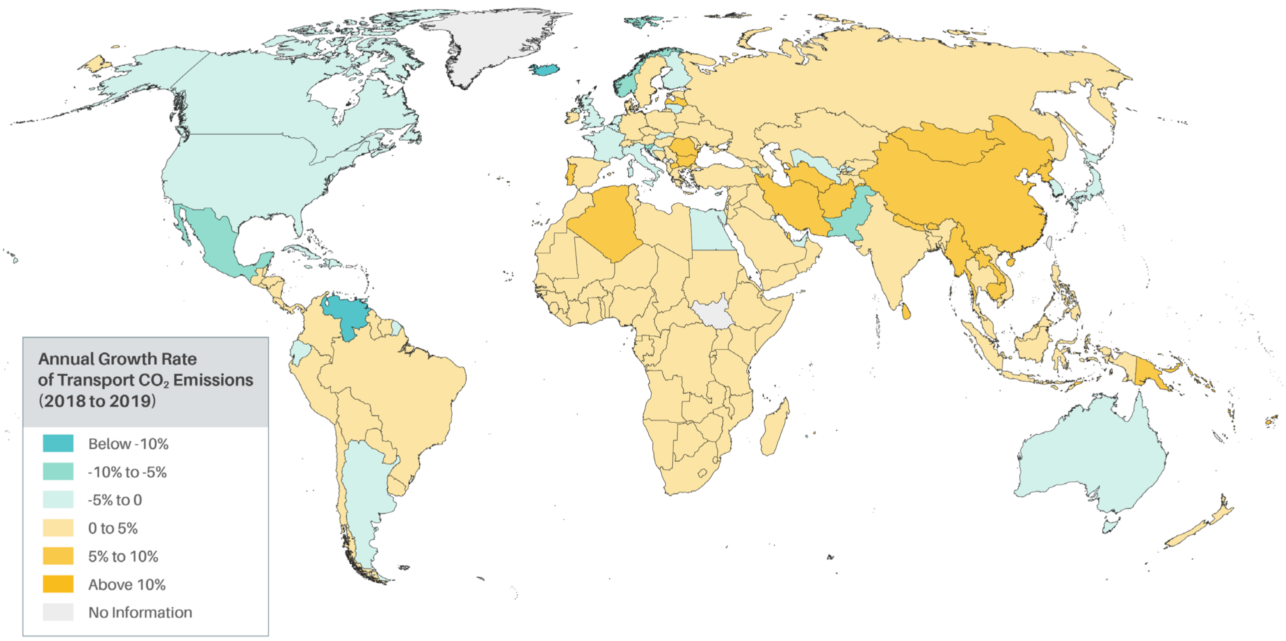
Source: See endnote 2 for this section.

Global transport emissions increased 1% in 2019, well below the 2% annual average growth rate for the decade.[4] As a whole, OECD countries and non-OECD countries contribute roughly equal shares of transport CO_2 emissions (similar to the split of global GDP).[5] However, this balance is likely to shift as the demand for transport grows in developing countries.

Between 2010 and 2019, transport CO_2 emissions grew 4% in OECD member countries and 34% in non-OECD countries.[6] The biggest emitters in 2019 were the **US** (1,788 million tonnes of CO_2), **China** (986 million tonnes), **India** (306 million tonnes), the **Russian Federation** (247 million tonnes), **Japan** (187 million tonnes) and **Brazil** (181 million tonnes).[7]

In 2019, transport CO_2 emissions fell more than 10% in some countries, but grew more than 5% in many countries, with growth exceeding 10% in some cases.[8] Globally, most countries experienced 1% to 5% growth in their transport emissions that year (*see Figure 2*).[9] Emissions fell more than 10% in **Iceland**, **Pakistan** and **Venezuela** (the latter an outlier due to economic and political factors).[10] Meanwhile, they grew 5% to 10% in many countries in **Asia** and **Oceania** (for example, **Brunei**, **China**, **Fiji**, **Iran** and **Sri Lanka**), and more than 10% in **Latvia**.[11]

Figure 2. Annual growth in transport CO_2 emissions, 2018-2019



Source: See endnote 9 for this section.

Transport emissions by mode and sub-sector

In 2018, CO_2 emissions grew for all major transport modes and sub-sectors, except railways. The emission growth was led by road freight (1.3% annual growth) and aviation (0.5%).[12] Despite recent efficiency gains, emissions from **passenger transport** increased as more people travelled by car and especially by aviation, both of which are high-emitting modes. As people move increasingly to cities, a decoupling of emissions from economic growth could occur as public transport networks develop in tandem with urban growth; however, this is not a given because urbanisation can lead to sprawl and congestion if not soundly managed.

Larger passenger vehicles – specifically SUVs (including pickup trucks) – were the biggest driver of passenger transport emissions between 2010 and 2018, contributing 533 million tonnes of CO_2 during this period.[13] The share of SUVs in passenger car sales increased from 17% in 2010 to 41% in 2019 (*see Figure 3*).[14] In some countries, the way that trucks and larger passenger cars are classified has undermined emission reduction efforts. For example, **Thailand**, despite a promising carbon-based excise tax on personal cars, gives preferential tax treatment to pickup trucks, which now account for more than half of all vehicles in the country.[15] Another factor influencing the preference for SUVs globally is that many of them use diesel fuel, which was around 7% cheaper than petrol on average as of 2018.[16]

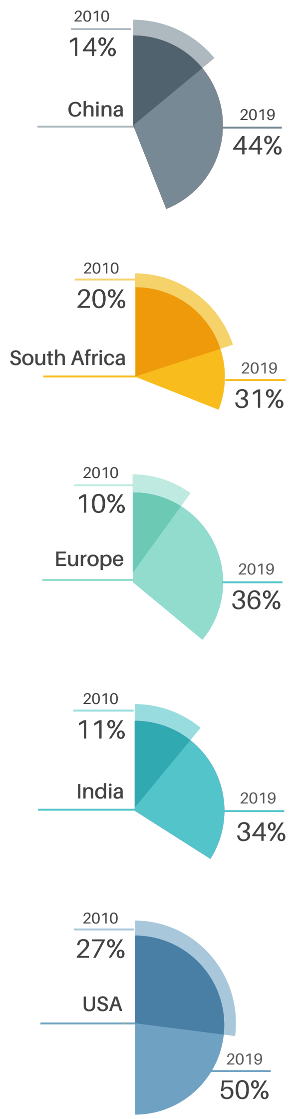
Emissions from motorised two-wheelers accelerated; however, vehicle-level CO_2 emissions for two-wheelers are relatively low compared to larger vehicles.[17] In **Vietnam**, a transition from conventional to electric motorcycles was seen as having the largest potential to mitigate emissions by 2030.[18]

Ride-hailing services have increased rather than decreased CO_2 emissions in many regions and cities, resulting in an estimated 69% increase in climate pollution compared to the trips they displace, in part by increasing traffic congestion.[19] This has been demonstrated in **Europe**, **India** and the **USA** as well as in cities such as **Bangkok**, **Cairo**, **Lagos** and **Manila**.[20] Ride-hailing has not produced the expected emission reductions because the distances that drivers travel to pick up customers offset the emission advantages of carrying multiple customers.[21] Unlike taxi fleets, which in some cases are shifting to electric or other low-emission vehicles, ridesharing fleets generally comprise newer internal combustion engine vehicles, which may provide only minor emission benefits because of their greater fuel efficiency.[22]

Aviation emissions increased 32% between 2013 and 2018, exceeding projections for this period.[23] Aviation is considered the hardest transport mode to decarbonise. Although electrification has made some headway for lighter aircraft, biofuels remain the most prevalent alternative energy source in aviation.[24] As new production came online, biofuel production capacity for aviation increased significantly in 2020.[25] However, biofuels face challenges with resource limitations and carbon neutrality, and are more expensive than jet fuel, which has no carbon price and is generally untaxed.[26]

Biofuels will likely struggle to compete in the aviation sub-sector until the policy environment changes. To make up for rising emissions from air travel, the International Air Transport Association has aimed for a 1.5% annual improvement in aviation fuel efficiency starting in 2020 (so-called carbon-neutral growth).[27] (*See Section 3.10: Aviation for more policy examples.*)

Figure 3. Share of SUVs in annual passenger car sales in selected countries and regions, 2010 and 2019



Source: See endnote 14 for this section.

Although freight transport accounted for only 5% of the vehicle fleet in 2017, it contributed 42% of total transport CO2 emissions as well as disproportionately high levels of local air pollutants.[28] The decarbonisation of freight has made some headway within metropolitan areas, including through more-efficient logistics operations and the electrification of delivery vans; however, on an inter-city level there has been little progress.

Decarbonisation efforts have been slower for freight transport than for passenger transport, although some national and sub-national governments have increased funding commitments.[29] The **Nordic region** stands out in its efforts to decarbonise freight, for example by taxing CO_2 and nitrogen oxides and setting long-term targets, even as regional GDP and freight activity have continued to grow.[30] In the USA, the state of **California** allocated USD 73 million for "freight demonstrations" and "advanced freight and fleet technologies" during 2018-2019.[31] For maritime freight, "cold ironing", or the electrification of ports, is a strategy for reducing both CO_2 emissions and local air pollution.[32] *(See Section 3.11: Shipping for more policy examples.)*

As nearly zero emission modes of transport, walking and cycling contribute to Paris Agreement targets for reducing transport-related emissions, while moving 6-8 times more people per hour in the same space compared to higher-carbon, motorised personal vehicles.[33] In some compact cities, walking and public transport account for up to 90% of trips, and cycling for nearly 50% of trips.[34] These modes have high potential to reduce emissions by replacing short car trips and lowering dependance on personal vehicles.

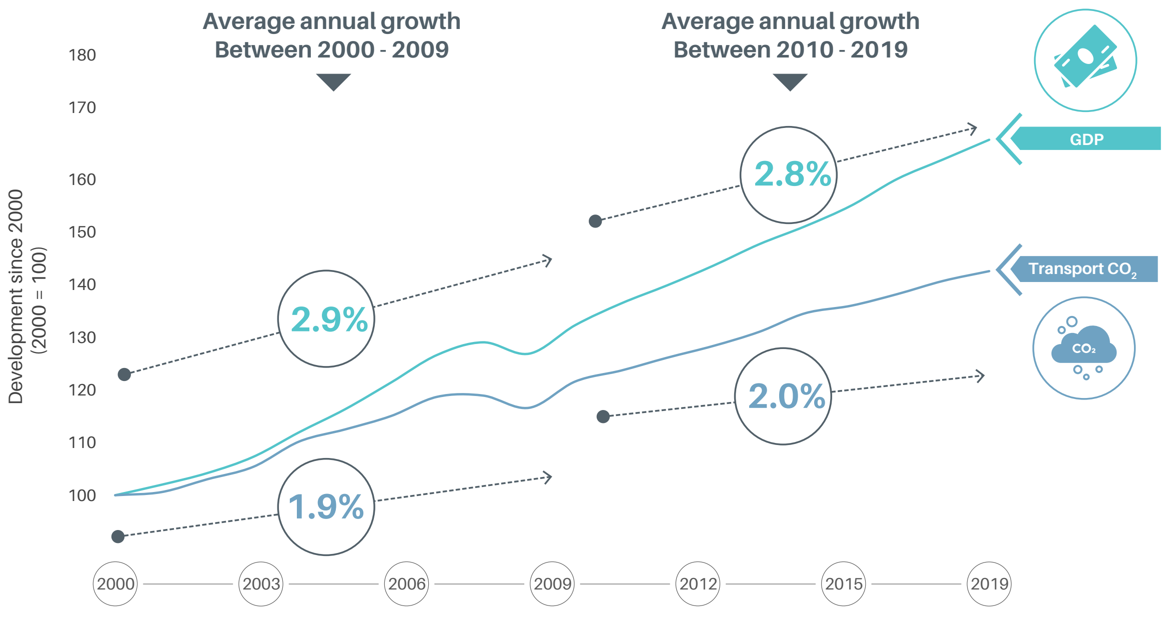
Transport emissions and GDP growth

Global population and economic growth have led to increases in both transport energy use and related CO_2 emissions (up 19% and 17%, respectively, between 2010 and 2019) (*see Figure 1 in Section 2.1*).[35] However, in the developed world, transport-related emissions have decoupled from economic growth. This may be because as more people live in cities, where average travel distances are shorter and there are more options for mobility (including public transport, cycling and walking), emissions per capita may decline.[36] Decarbonising cities remains an urgent challenge: although they account for 50% of the world's population and for 3% of the total land area, they represent 70% of total greenhouse gas emissions.[37]

Global GDP grew 2.9% annually on average between 2000 and 2019, while annual transport CO_2 emissions grew at a slower rate of 1.9% during 2000-2010 and 2.0% during 2010-2019; however, additional structural changes are needed to completely decouple economic growth and transport emissions (*see Figure 4*).[38] This decoupling was likely stronger during the former decade because of the effects of the 2007-2008 global financial crisis. The impact of the pandemic in reducing 2020 emissions may result in an equal or stronger decoupling.

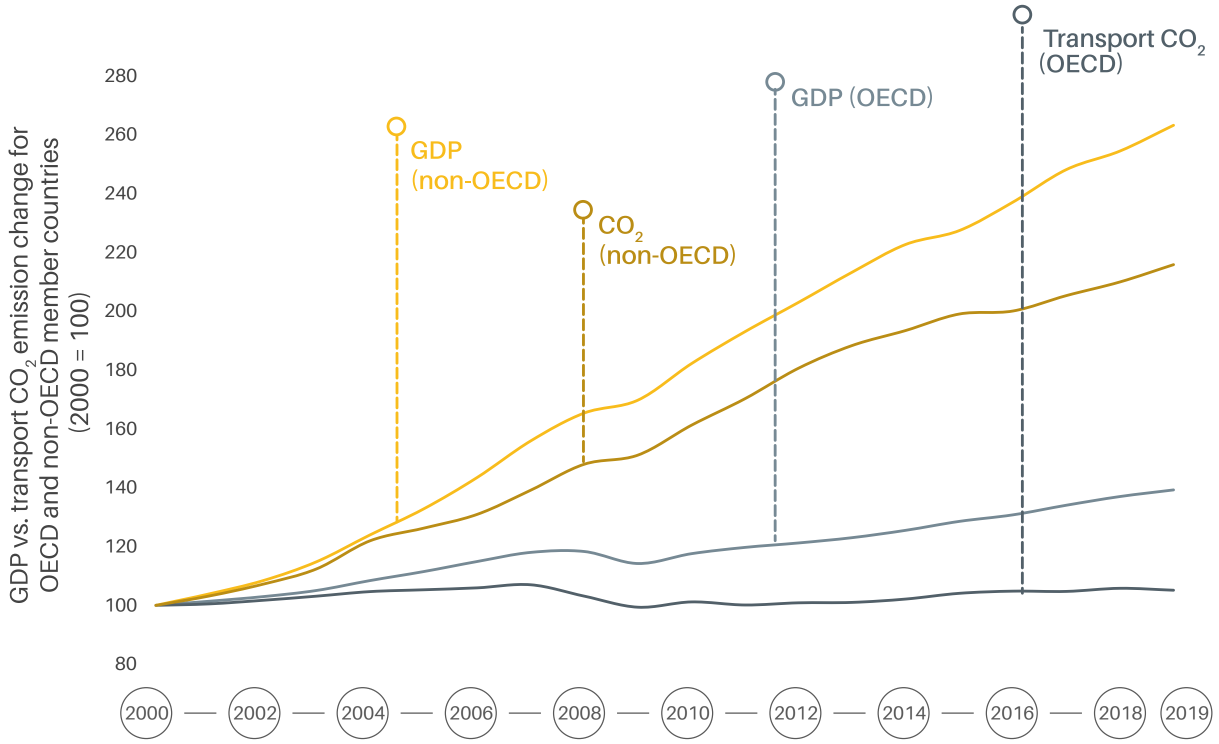
Since 2000, a strong decoupling of GDP and transport CO_2 emissions has been observed in OECD countries, with divergence beginning during the 2007 global financial crisis (*see Figure 5*).[39] Even starker decoupling has occurred in the **EU-27**, where the

Figure 4. Decoupling of transport CO_2 emissions and GDP, 2000-2019



Source: See endnote 38 for this section.

Figure 5. Change in GDP and transport CO_2 emissions in OECD and non-OECD countries, 2000-2018



Source: See endnote 39 for this section.

emission intensity of the economy declined by half between 1990 and 2018, and total transport emissions have held steady since 2017.[40] In 2019, emissions (of all types) regulated under the EU's carbon market dropped nearly 9% from the previous year.[41] Achieving the EU's goal for climate neutrality by 2050 will require drastic cuts in transport CO_2 emissions.[42]

Non-OECD countries have also experienced a decoupling of transport emissions and GDP growth, although at a lower intensity and a less rapid pace.[43] GDP in these countries grew on average 1.3% faster than transport CO_2 emissions from 2000 to 2010, although this margin dropped to 0.9% from 2010 to 2019.[44] Between 2005 and 2007, annual GDP growth in non-OECD countries was twice as high as annual growth in transport CO_2 emissions.[45]

Transport energy intensity

The energy intensity (total energy consumption per unit of GDP) of the transport sector continued to improve in 2018, decreasing 2.1% from the previous year, far faster than the 1.5% average annual decline for 2000-2017.[46] However, this rate of improvement falls short of the International Energy Agency's (IEA) target of a 3.2% annual decrease from 2020 to 2030.[47]

Major policies have been enacted in recent years to reduce the energy intensity of passenger car transport (*see Section 3.7: Fuel Economy*), but so far this has not resulted in absolute reductions in transport CO_2 emissions.[48] The IEA notes that freight energy intensity is not improving fast enough, and to achieve larger gains, urban freight needs to electrify.[49] For long-haul shipping, energy intensity will have to improve through goods consolidation, the use of alternative fuels, and gains in systems efficiency, and not necessarily through electrification, which is less suited for maritime transport.

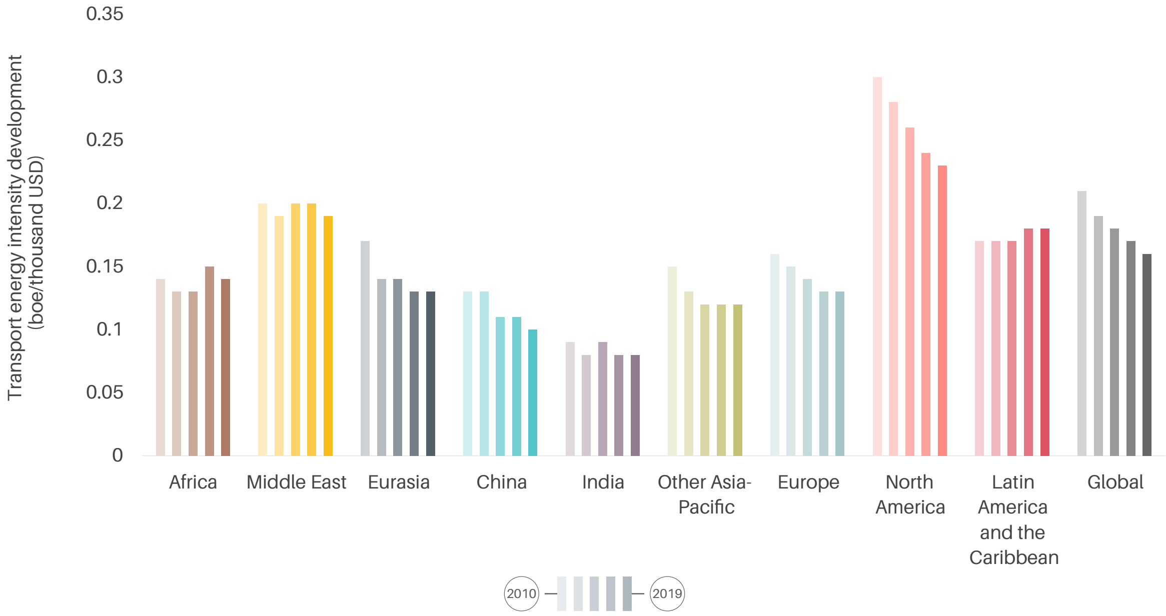
Energy intensity by region and country

Globally, the energy intensity of transport improved steadily between 2000 and 2019 (*see Figure 6*), although the rate of improvement has slowed in some regions, including in **Asia and the Pacific**, **Eurasia** and **Europe**.[50] Transport energy intensity increased in **Latin America and the Caribbean** due to low fuel economy standards.

At a national level, transport energy intensity improved nearly 20% in Japan and nearly 10% in Australia between 2000 and 2017 (*see Figure 7*).[51] However, the rate of improvement continues to lag behind the necessary ambition for alignment to the targets of the Paris Agreement.

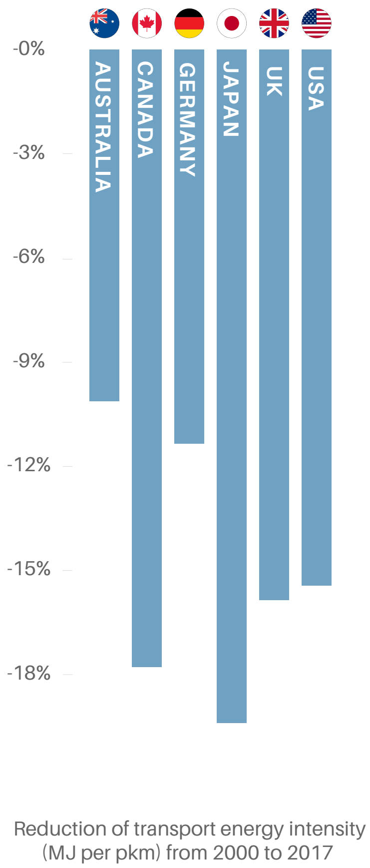
The transport sector is 97% fossil fuel-powered and is the least diversified of all energy end-use sectors, remaining far from being fuelled primarily by renewable sources.[52] Biofuels accounted for 90% of renewable energy use in the transport sector in 2017, a share that has not changed dramatically since 2000.[53] However, the absolute growth in oil products (including petrol and diesel) in the final energy consumption of transport has slowed, dropping to 15% for 2010-2017, down from 38% for 2000-2017.[54]

Figure 6. Transport energy intensity by region and country, 2010-2019



Source: See endnote 50 for this section.

Figure 7. Improvement of transport energy intensity in selected countries, 2000-2017



Source: See endnote 51 for this section.

As more electric vehicles enter the vehicle fleet, the carbon intensity of passenger transport has improved slightly.[55] On average, a battery electric car emits 60% less greenhouse gas emissions per kilometre than a petrol-powered car.[56] Passenger electric cars represented 2.6% of new vehicle sales in 2019 and accounted for just over 1% of the total global vehicle stock.[57] A larger shift has occurred towards the electrification of **buses**, mainly in **China**, which was home to more than 400,000 electric buses, or 99% of the world's e-bus fleet, in 2020.[58] **China** has also electrified most of its powered **two-wheelers**, for a total of around 250 million electric two-wheelers in 2020.[59]

The carbon intensity of the shipping sector (CO_2 per deadweight tonne-nautical mile) improved 30% during the period from 2008 to 2018 – faster than the sector's stated target of 40% by 2030 – due to an increase in the average ship size.[60] As a result, there have been recent calls for the International Maritime Organization to set a more ambitious target.[61] (*See Section 3.11: Shipping.*)

Between 2010 and 2018, the average carbon intensity of electricity generated globally improved 10%. As the market for electrified transport expands, it can leverage these cleaner grids to reduce overall transport emissions.[62] In 2018, renewable energy – mainly hydropower, wind and solar – accounted for just over a quarter (26.2%) of the world's power generation capacity.[63] Transport, which is still highly dependent on fossil fuels, will benefit from the clean energy grid in the transition to electrified mobility and other alternative fuels.

Other climate-related transport impacts

National and local efforts to decrease particulate matter and improve urban air quality often also result in reductions in greenhouse gas emissions. In addition to greenhouse gases (CO_2, methane, nitrous oxide), major transport pollutants include volatile organic compounds (VOCs), sulphur dioxide, carbon monoxide, F-gases, non-absorbing aerosols and black carbon. In **Germany**, sustainable transport measures such as speed limits led to a halving of the number of cities with poor air quality in 2019 compared to the previous year.[64] To improve air quality in **India**, electric buses have been deployed in 64 cities (including **Kolkata**) through the Faster Adoption and Manufacturing of Electric & Hybrid Vehicles (FAME) II scheme.[65]

As of June 2019, some 39 countries had adopted "soot-free" standards for heavier vehicles, helping to reduce black carbon emissions.[66] Black carbon, a by-product of incomplete combustion in the transport sector, is often produced in diesel buses, motorcycles, and ships, especially ones that are older or poorly maintained. A variety of options exist to decrease black carbon emissions from land transport (for example, upgrading bus fleets) and from the maritime sector (*see Section 3.11: Shipping for specific policy examples*).[67]

A decoupling of economic growth and black carbon emissions for heavy-duty vehicles is under way, and accelerating this shift would result in an estimated USD 1 trillion in societal savings.[68]

Box 1. COVID-19 impacts on transport emissions

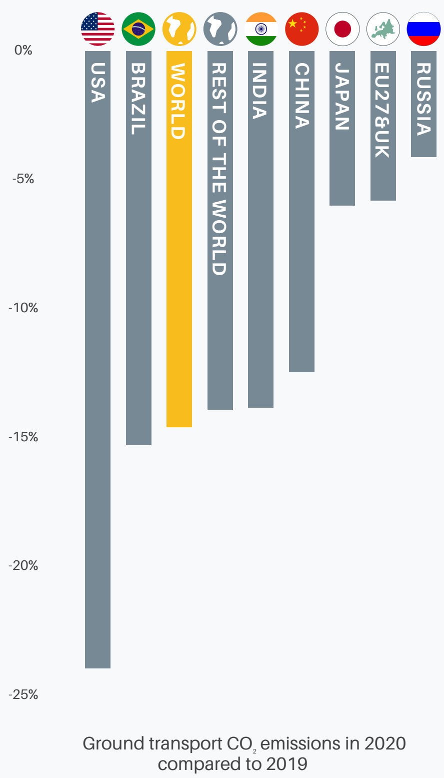
In 2020, global transport CO2 emissions dropped 19.4% below 2019 levels due to the pandemic, the biggest decrease of any sector; however, this decline is projected to be short-lived. CO_2 emissions from ground transport (road and railways) fell an estimated 14.6%, from domestic aviation 31.9%, from international aviation 56.4% and from international shipping 25%. Overall, energy-related CO_2 emissions in all economic sectors dropped an estimated 5.4% for the year, the largest recorded decline in CO_2 emissions in modern history.

The USA saw the strongest decline in ground transport CO_2 emissions in 2020, down 24% from 2019 levels, followed by Brazil (down 15.3%) (*see Figure 8*). China and India experienced declines of 12.5% and 13.8%, respectively. In the aviation sector, Europe released an estimated 48% fewer CO_2 emissions compared to 2019.

The impact of the COVID-19 pandemic on both GDP and transport CO_2 emissions may result in an equal or stronger decoupling of economic growth and emissions than seen in recent years. The ongoing decline in oil demand became a freefall in 2020 as the pandemic affected not only oil demand but also prices.

Source: See endnote 1 for this section.

Figure 8. CO_2 emissions from ground transport, by country, 2020



2.3

Low Carbon Transport Pathways

Key findings

2020 emission reduction targets

- While the majority of Annex I countries (industrialised countries and economies in transition) under the Kyoto Protocol have met their 2020 targets for reducing greenhouse gas emissions, the world is not on track to meet the overall Paris Agreement target for 2030.
- Transport is the only sector where emission levels rose in Annex I countries between 1990 and 2020, increasing 19%.
- Had the transport sector contributed proportionally to the agreed 2020 targets of the Kyoto Protocol 2020, transport CO_2 emissions would have been reduced by at least an additional 7%.
- Vehicle electrification and transport renewable energy targets for 2020 set in early 2010 have largely not been met.

2050 transport emission pathways

- To keep the rise in global temperature below 2 degrees Celsius (°C), annual transport emissions must be reduced to 2-3 gigatonnes of CO_2 or less by 2050; and to keep the rise below 1.5 °C, emissions must be reduced to roughly 3 gigatonnes of CO_2 or less. This would mean slashing per capita transport CO_2 emissions from 0.88 tonnes in 2019 to 0.2 tonnes in 2050.
- To achieve the 1.5 °C scenario with ambitious low carbon transport measures, emissions must start to decline now. To achieve a 2 °C scenario, the mitigation can be delayed until 2030, but emissions must plateau at around 2020 levels.
- Studies indicate that high-income countries were nearing their peak in transport CO_2 emissions by 2020.
- The majority of projected growth in transport emissions is in road transport (both passenger and freight) in middle-income countries, as well as in international aviation and shipping.

- Despite progress in reducing the energy intensity of transport, the sector is expected to have the highest carbon intensity among all sectors in 2040 due to its high dependency on fossil fuels.
- An analysis of transport emission pathways based on national studies shows that despite recent efficiency gains, the sector is not on track to meet 2050 emission reduction targets. In the most recent (2019) analysis, under the average business-as-usual pathway, global transport CO_2 emissions could increase from 8 gigatonnes in 2019 to 14.5 gigatonnes in 2050.
- Low carbon transport measures are becoming increasingly efficient and lead to a more positive trend than previously projected. Whereas previously (in 2017) the emission gap was estimated to reach 16 gigatonnes of CO_2 by 2050, new estimates (based on studies up to 2019) show a gap of around 12 gigatonnes.
- A balanced and inter-modal application of Avoid, Shift and Improve measures is capable of yielding an estimated reduction in transport emissions of 2.39 gigatonnes of CO_2-equivalent by 2030 and 5.74 gigatonnes of CO_2-equivalent by 2050.
- An analysis of personal consumption options has identified low carbon transport choices as the most effective area for reducing emissions, well above shifts in food, housing and other sectors.

Impacts of the COVID-19 pandemic

- As the pandemic subsides, transport emissions are likely to return to previous growth trends. In projections for 2030, climate models estimate that, compared to global temperatures if countries were to adhere to their emission pledges, the halt in transport during COVID-19 would have made only a -0.01 °C difference.
- Emission growth in international shipping has been slowed by the pandemic and is not projected to return to pre-COVID-19 levels until 2030.
- Growth in international aviation emissions was previously projected to be 230% to 310% between 2015 and 2050, and the pandemic has had a minimal impact on these projections (as of mid-2020, they were revised to 220% to 290% growth).
- Many COVID-19 recovery packages and bailout programmes have invested more heavily in fossil fuel-related companies than in clean energy, a trend that is likely to drive transport emission curves upward.

Overview

The transport sector's share of energy-related greenhouse gas emissions is on a trajectory to grow in both absolute and percentage terms. Overall, the Intergovernmental Panel on Climate Change has identified transport as one of the most difficult sectors to fully decarbonise.[1] The COVID-19 pandemic is perceived to have effects on the future pathways of transport CO_2 emissions, but the long-term impact will likely depend on the recovery measures implemented (*see Box 1*).[2]

The International Energy Agency (IEA) projects in its sustainable development scenario that transport will be the second highest emitter of CO_2 in the energy end-use sector (after industry) by 2032, and the highest emitter in 2070, due to lingering fossil fuel use in aviation, road freight and maritime shipping.[3] Similar results from the International Renewable Energy Agency project that the transport sector's share of global emissions will equal that of industry by 2030, and then overtake industry to become the largest emitter of CO_2 in end-use sectors in the period from 2030-2040.[4]

2020 emission reduction targets

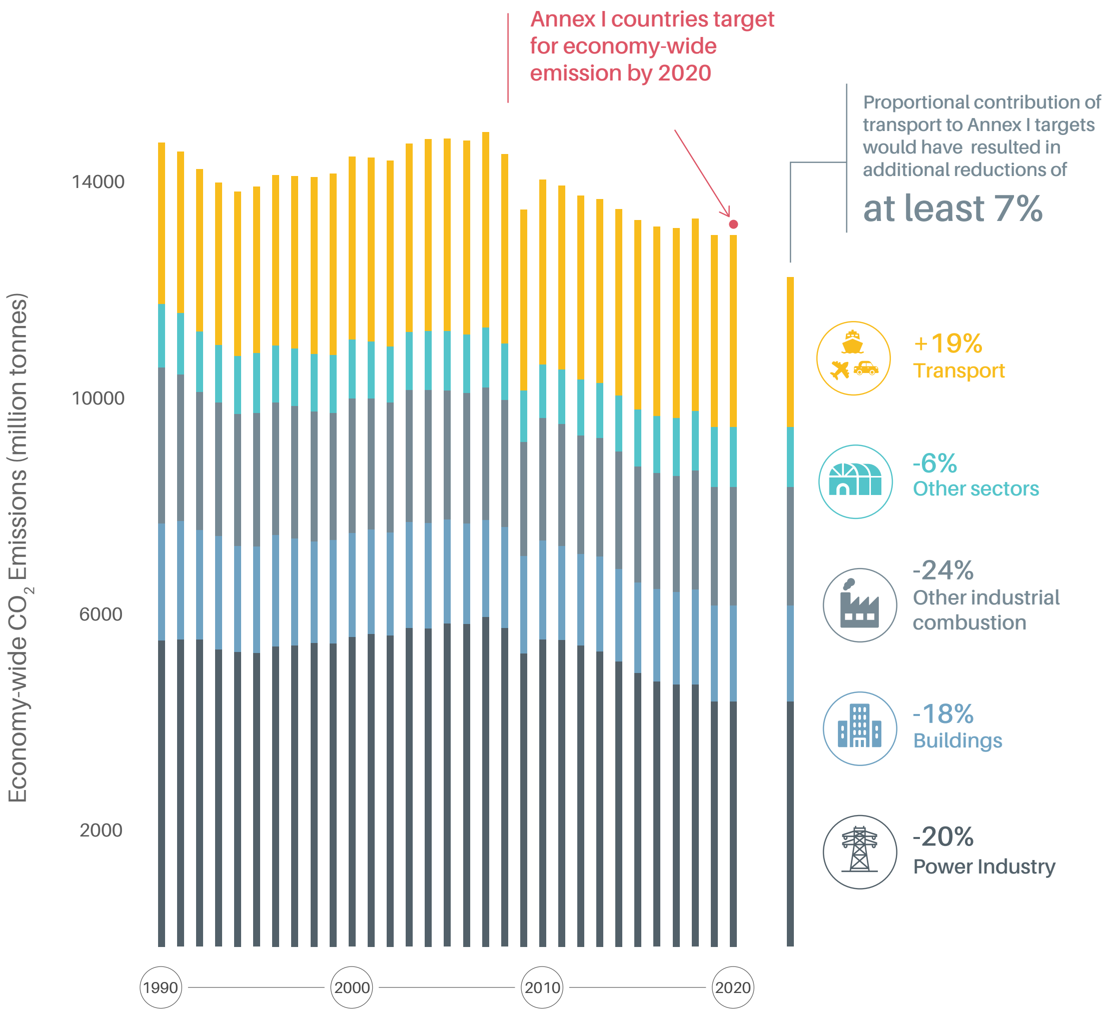
As an outcome of the 1997 Kyoto Protocol and subsequent international climate negotiations, the so-called Annex I countries (industrialised countries and economies in transition) agreed to economy-wide CO_2 emission reduction targets for 2020. These targets called for reductions in the range of 5% to 20% below 1990 levels.[5] Based on the latest robust data on CO_2 emissions available (for 2019[i]), these countries were able to meet their aggregated 2020 targets, with 22 out of the 38 Annex I countries actively contributing to this goal.[6]

While the majority of Annex I countries under the Kyoto Protocol have met their 2020 targets for reducing greenhouse gas emissions, the world is not on track to meet the overall Paris Agreement target for 2030.[7] Current emission trends will result in a global temperature increase of around 2.5 °C to 3.5 °C by 2100.[8] A major push to stem the impacts of climate change can be realised if countries set and seek to achieve targets for net zero emissions. As of April 2021, 127 countries representing 63% of global emissions had announced net zero targets.[9] If all these announcements are fully achieved, the temperature increase could be limited to 2.1 °C by 2100.[10]

Transport is the only sector where emission levels rose in Annex I countries between 1990 and 2020, increasing 19% (*see Figure 1*).[11] Although some gains in the sector were made in the areas of energy efficiency and fuel economy, improvements in standards were undercut by skewed emission testing (for example, the Volkswagen "Dieselgate" scandal) and by the shift from smaller cars to larger sport utility vehicles (SUVs). According to the IEA, this shift to SUVs outweighed almost all fuel economy progress during 2010-2018.[12] SUVs were responsible for the second largest increase in energy demand since 2010, even more so than heavy industry.[13]

i It is difficult to estimate 2020 levels due to uncertainties caused by COVID-19.

Figure 1. CO_2 emissions in Annex I countries by sector, 1990-2020



Source: See endnote 9 for this section.

In addition, freight activity increased strongly in Annex I countries, as did freight transport emissions; prior to 2016, the majority of new trucks sold were in countries that lacked both fuel economy and CO_2 emission standards for trucks and commercial vehicles.[14]

Had the transport sector contributed proportionally to the agreed 2020 targets of the Kyoto Protocol 2020, transport CO_2 emissions would have been reduced by at least an additional 7%.[15] To speed emission reductions, accelerated action and structural change in the transport sector is required in the coming years. Given current trends, the European Union (EU) is unlikely to meet its original 2030 target for reducing transport emissions (which includes a 37.5% reduction in CO_2 per kilometre for passenger cars, from 2021 levels) – much less its newer, economy-wide target (a 55% reduction).[16]

Vehicle electrification and transport renewable energy targets for 2020 set in early 2010 have largely not been met.[17] For example, Ontario, **Canada**, targeted sales of 18,000 electric vehicles in 2020, yet as of 2019 only 8,025 had been sold in the province, well off the target (2020 data were not yet available).[18] The **EU** targeted a 10% renewable share in transport energy consumption by 2020, but had achieved only a 7.6% share by 2017 and 8.1% by 2018.[19]

2050 transport emission pathways

Low carbon pathways

To keep the rise in global temperature below 2 °C, annual transport emissions must be reduced to 5 gigatonnes of CO_2 or less by 2050; and to keep the rise below 1.5 °C, emissions must be reduced to roughly 3 gigatonnes of CO_2 or less (*see Figure 2*).[20] **This would mean slashing per capita transport CO_2 emissions from 0.88 tonnes in 2019 to 0.2 tonnes in 2050.**[21]

To achieve the needed emission reductions for the more ambitious 1.5 °C goal, the transport sector needs to contribute rapid and significant additional emission reductions, as compared to the 2 °C pathway.[22] Analysis shows that the sector could reach emissions levels of 4.7 gigatonnes of CO_2 equivalent by 2050 through steps such as modal shifts, improved vehicle electrification, the avoidance or reduction of motorised travel, and shortened travel distances.[23]

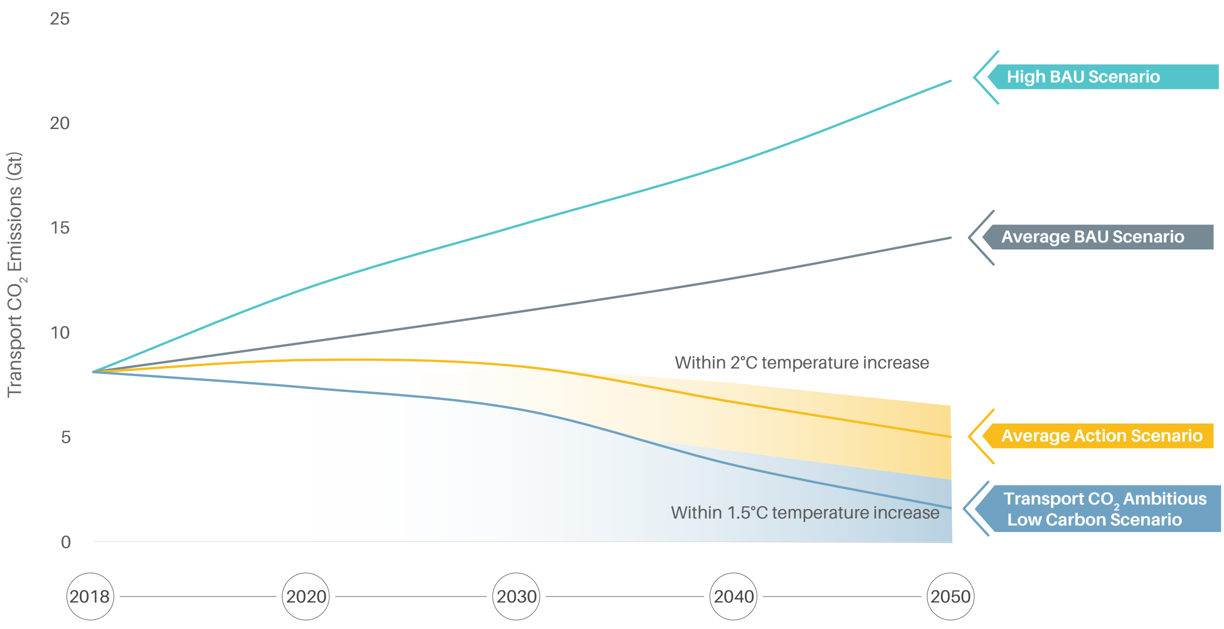
The analysis of mitigation studies on low carbon transport shows that the projections are within the Paris Agreement targets of 2 °C and 1.5 °C.[24] However, **to achieve the 1.5 °C scenario with ambitious low carbon transport measures, emissions must start to decline now.**[25] **To achieve a 2 °C scenario, the mitigation can be delayed until 2030, but emissions must plateau at around 2020 levels.**[26]

Studies indicate that high-income countries were nearing their peak in transport CO_2 emissions by 2020.[27] As of 2019, around 46% of all countries had conducted assessments of low carbon transport pathways to 2050, up from 42% of countries in 2017.[28] Among low-income countries, however, 94% still did not have transport projections for 2050.[29]

The majority of projected growth in transport emissions is in road transport (both passenger and freight) in middle-income countries, as well as in international aviation and shipping.[30] Under the average business-as-usual pathway, the share of emissions from international aviation and shipping could nearly double from 14% in 2000 to 29% in 2050.[31]

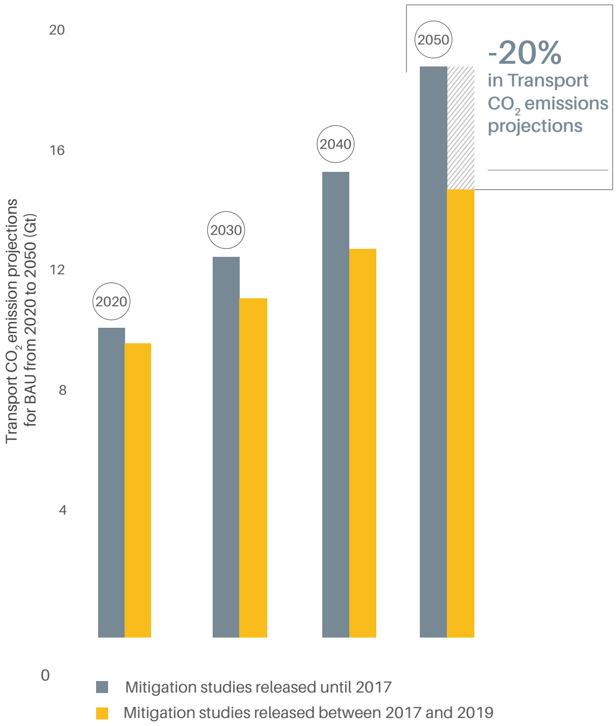
Despite progress in reducing the energy intensity of transport, the sector is expected to have the highest carbon intensity among all sectors in 2040 due to its high dependency on fossil fuels.[32] In the coming decades, transport activity is expected to grow steadily, driven mainly by freight transport and aviation, if no countermeasures are taken.[33] According to projections, the global vehicle fleet will reach between 2 billion and 3 billion vehicles by 2050, more than double the current road vehicle fleet of over 1 billion vehicles; freight activity will increase 225%, and non-urban passenger travel will grow similarly.[34]

Figure 2. Transport emission pathways for the business-as-usual, 2 °C and 1.5 °C scenarios, 2018-2050



Source: See endnote 20 for this section.

Figure 3. Comparison of business-as-usual projections for transport emissions, 2017 and 2019 studies



Source: See endnote 35 for this section.

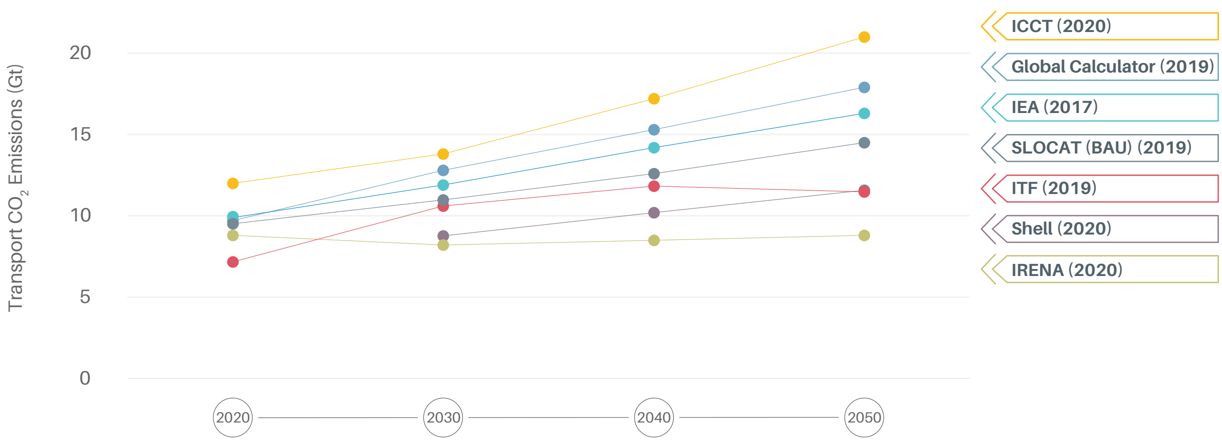
Business-as-usual emission projections

An analysis of transport emission pathways based on national studies shows that despite recent efficiency gains, the sector is not on track to meet 2050 emission reduction targets. In the most recent (2019) analysis, under the average business-as-usual pathway, global transport CO_2 emissions could increase from 8 gigatonnes in 2019 to 14.5 gigatonnes in 2050 (*see Figure 3*).[35] This suggests an improvement from the previous (2017) analysis, which showed CO_2 emissions rising to 18.5 gigatonnes in 2050 – highlighting that existing policies are now assumed to be more efficient than was previously estimated.[36] The updated analysis results in a 22% reduction in average business-as-usual emissions for 2050 compared to the earlier study.[37]

Low carbon transport measures are becoming increasingly efficient and lead to a more positive trend than previously projected. Whereas previously (in 2017) the emission gap was estimated to reach 16 gigatonnes of CO_2, new estimates (based on studies up to 2019) show a gap of around 12 gigatonnes. The improvements for business-as-usual result in a smaller emission gap between the business-as-usual pathways and the low carbon pathways – suggesting that current transport policies are seen as being more effective than previously projected.[38]

Other recent business-as-usual projections based on top-down analysis of global data show a similar outlook (*see Figure 4*).[39] Decarbonisation in line with the targets of the Paris Agreement is seen as especially challenging for freight and long-distance transport (air and shipping).[40] The projections reinforce the need to implement every possible measure to divert from the business-as-usual pathway.[41]

Figure 4. Projections for business-as-usual transport CO_2 emissions, 2020-2050



Source: See endnote 39 for this section.

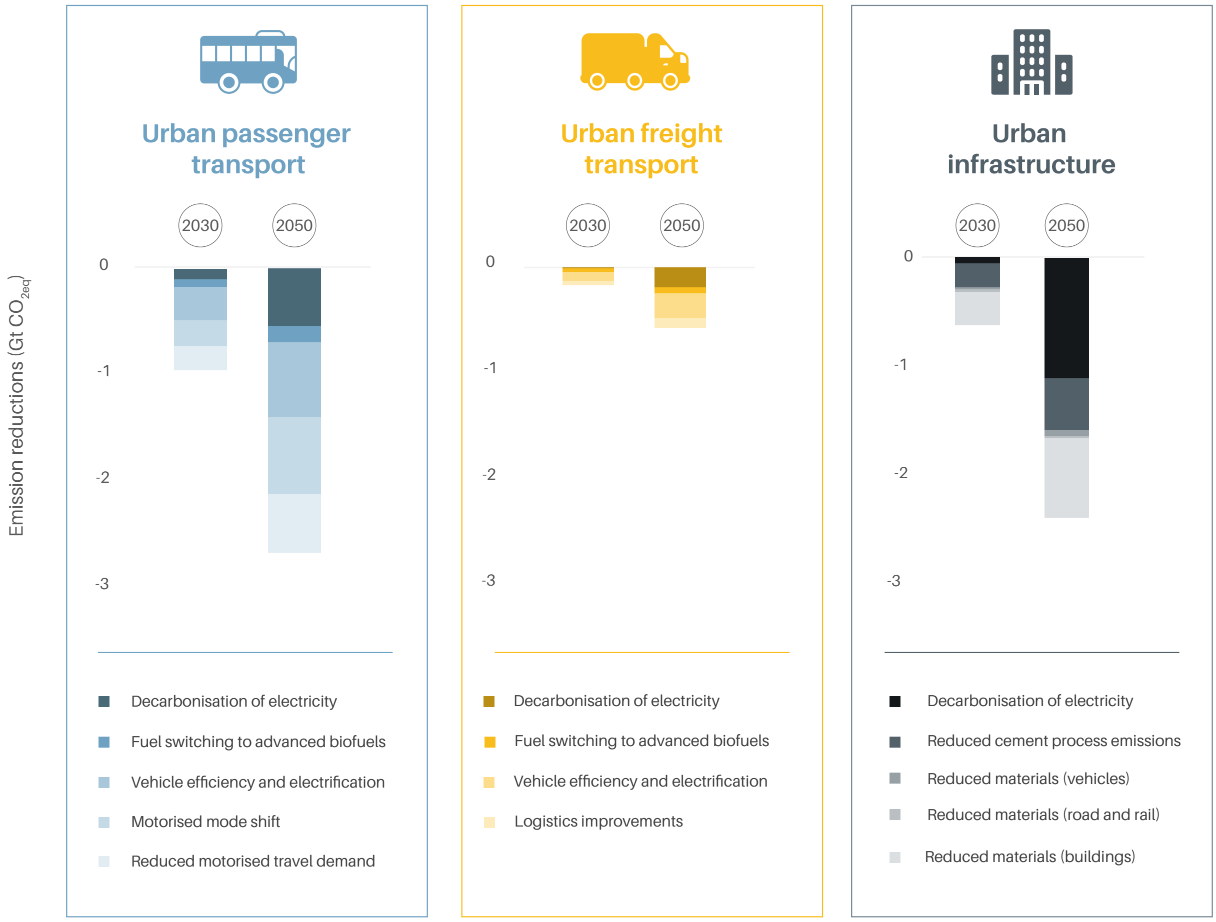
Emission trajectories and the *Avoid-Shift-Improve* framework

A balanced and inter-modal application of *Avoid*, *Shift* and *Improve* measures is capable of yielding an estimated reduction in transport emissions of 2.39 gigatonnes of CO_2-equivalent by 2030 and 5.74 gigatonnes of CO_2-equivalent by 2050 (*see Figure 5*).[42] The transformation of transport to a low carbon system can be guided by the *Avoid-Shift-Improve* framework (*see Section 1: Global Overview*). A balanced and inter-modal application of this framework that respects its inherent hierarchy (first *Avoid*/Reduce, then *Shift*, then *Improve*) can yield better mitigation results. Most of the reductions can be achieved in urban passenger transport.[43]

Achieving a 1.5 °C scenario will require a 40% reduction in transport's final energy consumption.[44] This can be achieved through better urban planning and land use, since a compact city can yield lower transport energy demand, less car dependency, higher passenger density in public transport, and more walking and cycling. Much of this relates to "Shift" measures as well as to implementing "*Avoid/Reduce*" measures, which would result in the most direct reductions in final energy consumption.

Among "*Improve*" measures, the most promising action is electric mobility, although it is unlikely that transport decarbonisation can be achieved by electrifying transport alone.[45] To achieve a 1.5 °C scenario pathway, the majority of the world's passenger and freight

Figure 5. Projected emission reductions resulting from various transport measures, 2030 and 2050



Source: See endnote 42 for this section.

vehicle fleets need to be electrified by 2050, including freight vehicles.[46] In Europe, electric cars currently contribute three times fewer CO_2 emissions than internal combustion engine cars based on life-cycle assessment.[47]

A comparison of national electric vehicle sales targets with manufacturers' plans for producing the vehicles suggests that a significant gap will remain between supply and demand through 2050 (*see Figure 6*).[48] Several national and regional entities have announced intentions to phase out sales of cars and trucks with internal combustion engines (*see Section 3.8: E-mobility*). However, this ambition cannot be supported by current levels of electric vehicle production. To help countries meet their government targets, the share of electric cars in vehicle sales needs to be around 66%.[49]

An analysis of personal consumption options has identified low carbon transport choices as the most effective area for reducing emissions, well above shifts in food, housing and other sectors (*see Figure 7*).[50] A car-free lifestyle can save on average 2.1 tonnes of CO_2-equivalent per capita a year, while the use of battery electric passenger cars can save on average 2 tonnes per capita a year, although several studies indicate even greater potential savings depending on the circumstances.[51] Meanwhile, taking fewer long-distance flights can save on average 1.8 tonnes of CO_2-equivalent per capita a year.[52]

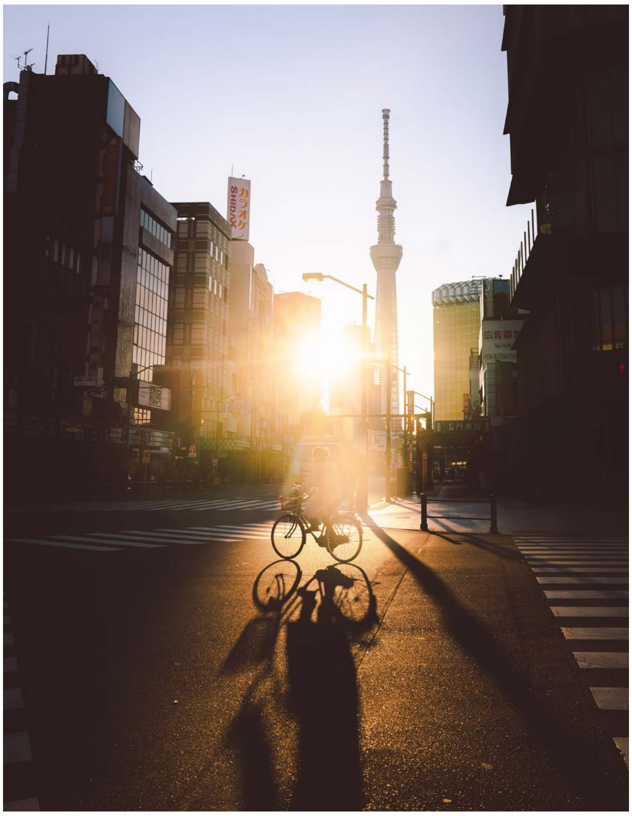
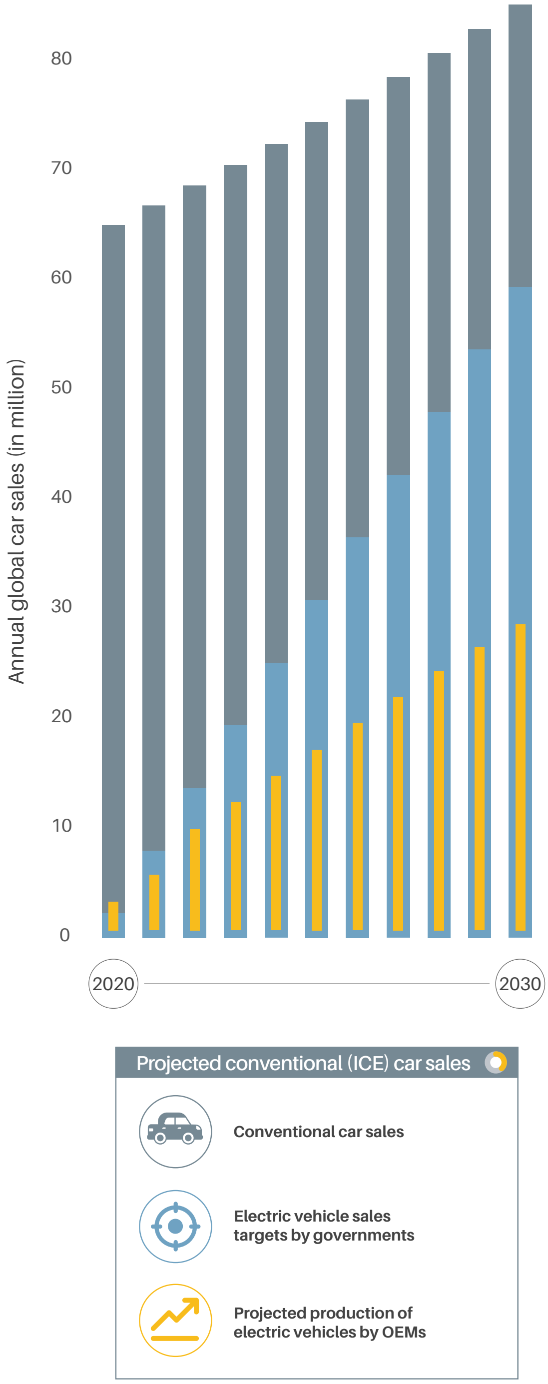
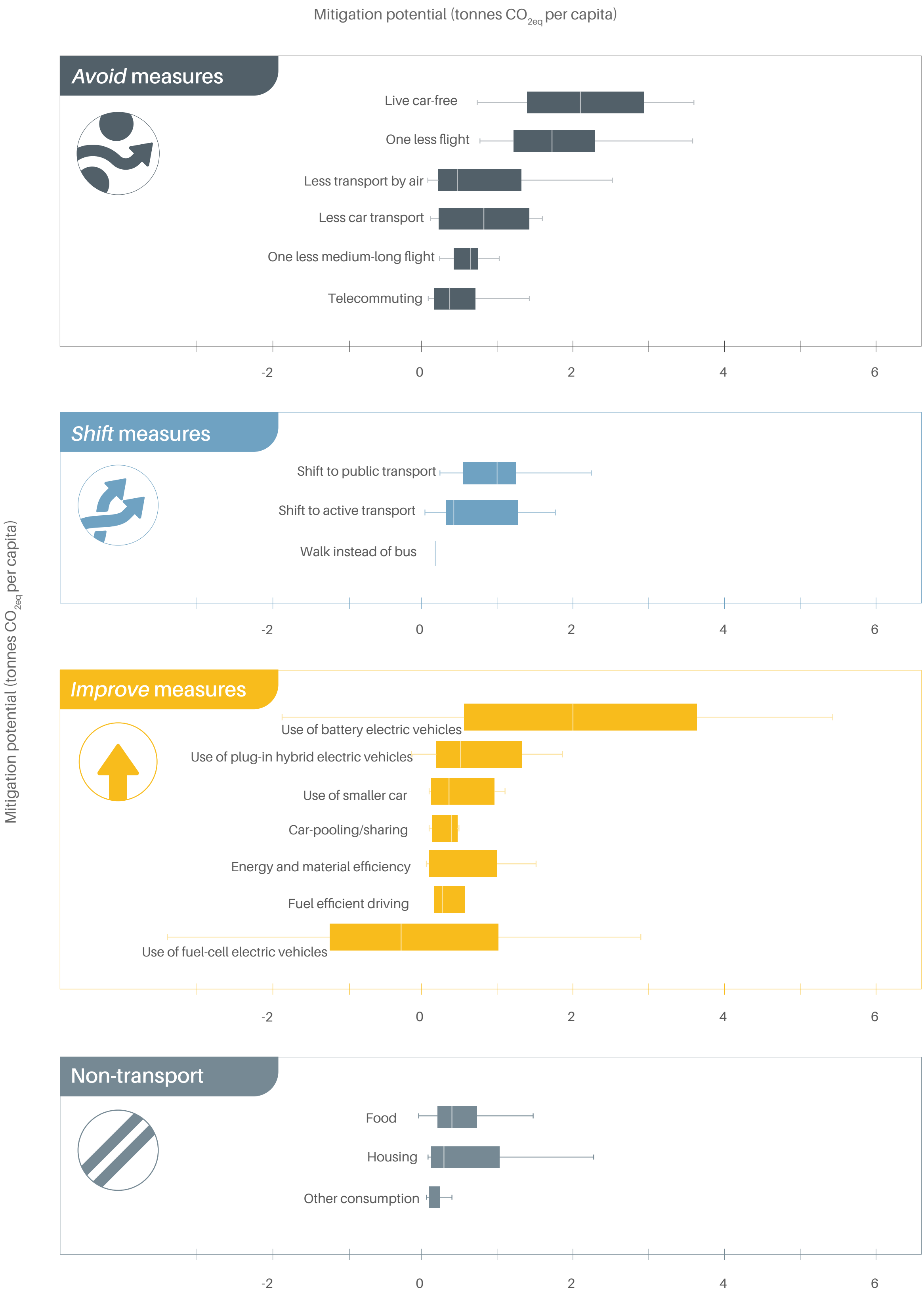


Figure 6. Projections for global electric vehicle fleet development, 2020-2030



Source: See endnote 48 for this section.

Figure 7. Estimated mitigation potential of various low carbon transport options



Source: See endnote 50 for this section.

Box 1. Impacts of the COVID-19 pandemic on transport pathways

As the COVID-19 pandemic subsides, transport emissions are likely to return to previous growth trends. In projections for 2030, climate models estimate that, compared to global temperatures if countries were to adhere to their emission pledges, the halt in transport during COVID-19 would have made only a -0.01 °C difference. The pandemic can be seen as an opportunity to transition to low carbon mobility systems and to shift to lower-emission pathways; however, initial assessments indicate that it made little difference to global temperatures and will not permanently accelerate the decarbonisation of transport. Without green investments in economic recovery packages, transport will fail to contribute proportionally to meeting the Paris Agreement targets of keeping global temperature rise well below 2 °C and below 1.5 °C.

Emission growth in international shipping has been slowed by the pandemic and is not projected to return to pre-COVID-19 levels until 2030. Shipping emissions fell an estimated 18-35% in 2020 from 2019 levels. Emission growth for 2030 is projected to range between a drop of around 13% compared to pre-COVID (2019) projections and a return to pre-COVID projections.

Growth in international aviation emissions was previously projected to be 230% to 310% between 2015 and 2050, and the pandemic has had a minimal impact on these projections. By mid-2020, the revised projections based on COVID-19 had fallen only slightly to a 220% to 290% increase by 2015-2050. The International Civil Aviation Organization's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) had originally intended to use 2019 and 2020 as the baseline for reducing emissions, but due to the pandemic this was changed to only 2019, at least for the first three years of the scheme.

Many COVID-19 recovery packages and bailout programmes have invested more heavily in fossil fuel-related companies than in clean energy, a trend that is likely to drive transport emission curves upward. An analysis of recovery packages including from China, the EU-27, India, the Republic of Korea and the US concluded that, as of September 2020, these countries had not seized the opportunity to introduce structural changes to their economies that would induce transformational change in transport decarbonisation policies. (*See Section 4: Financing Climate Action in Transport*.)

Source: See endnote 2 for this section.

Responses to Address Climate Change in the Transport Sector

3

Assessing progress towards meeting the goals of the Paris Agreement requires evaluating whether the policy responses of countries are adequate to address the scale of the transport and climate change challenge. While some countries have begun building commitments to reduce transport emissions – for example, by *avoiding* unnecessary motorised trips, *shifting* to less carbon-intensive modes and *improving* vehicle design, efficiency and clean energy sources – many countries have yet to make firm commitments.

3

Section 3 provides an overview of recent policies, commitments, targets and actions to enable climate change mitigation and adaptation in the transport sector. It covers 10 major thematic areas: sustainable mobility planning and transport demand management, walking and cycling, urban passenger and freight transport, passenger and freight railway, shared mobility services, fuel economy, e-mobility, renewable energy in transport, aviation and shipping.

- Section 3.1 provides an overview of national policy frameworks on transport and climate change. It summarises mechanisms to enable action on climate change and sustainable development, and illustrates country efforts to use these mechanisms to advance low carbon transport targets and measures.
- Sections 3.2 to 3.11 explore recent progress in the 10 major thematic areas, based on the latest available data and information. They assess the alignment of these areas with the Paris Agreement goals, the actions being taken to move towards compliance with these goals, and how existing obstacles are being addressed.

An assessment of responses also requires evaluating the significant financing requirements for countries to scale up sustainable low carbon transport systems (particularly in the Global South), as well as the current gap between needs and resources (especially from governments and institutions). Section 4 of this report includes an assessment of current transport and climate change investments, as well as insights on the potential to leverage existing and emerging funding sources, and the momentum to phase out fossil fuel subsidies and scale up renewable energy use for transport.

3.1

National Policy Frameworks for Transport and Climate Change

Key findings

Nationally Determined Contributions (NDCs) in the framework of the Paris Agreement

- During 2015 and 2016, 166 first-generation NDCs were submitted (from 165 countries, plus the European Union-28); 76% of these highlight transport as an important sector for climate mitigation, but only 8% include specific targets for reducing transport emissions.
- From November 2018 through May 2021, 54 second-generation NDCs were submitted (from 53 countries, plus the European Union-27); 72% of these include specific measures for mitigating transport emissions, but only 15% include a specific target for reducing transport emissions, showing insufficient progress towards meeting Paris Agreement goals.
- Among second-generation NDCs, "*Improve*" measures account for 53% of all measures (versus 52% in first-generation NDCs); "*Shift*" measures account for 19% (versus 32% in first-generation NDCs); and "*Avoid*" measures account for 8% (versus 6% in first-generation NDCs), with other measures being cross cutting. This illustrates a continued bias towards technological solutions.
- Among second-generation NDCs, 15 countries have increased their attention to climate change adaption for transport (28%, compared to 4% of first-generation NDCs), although fewer than 6% include a transport adaptation target.
- While 37% of second-generation NDCs make reference to Long-Term Low Emission Development Strategies, there is potential to more strongly leverage transport decarbonisation synergies between these mechanisms.
- While 13 second-generation NDCs set higher targets for reducing economy-wide emissions, a recent assessment estimates that current pledges would still lead to warming of 2.6 degrees Celsius (°C) by 2100, far exceeding the Paris Agreement goals.

Voluntary National Reviews (VNRs) of the United Nations Sustainable Development Goals (SDGs) in the framework of the UN 2030 Agenda for Sustainable Development

- Among VNRs submitted in 2020, 48% connect transport to SDG 13 (Climate Action), while only a single VNR submission sets a specific transport target, illustrating the need for further alignment between Paris Agreement mechanisms and the 2030 Agenda for Sustainable Development.
- Among second-generation NDCs, 13% establish direct linkages between sustainable transport measures and specific SDGs, including SDG 3 (Good Health and Well-Being), SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action).
- Creating a common methodological framework between the Paris Agreement and the implementation and monitoring mechanisms for the 2030 Agenda can maximise the combined potential of both global frameworks for accelerating sustainable, low carbon transport.

Long-Term Low Emission Development Strategies (LT-LEDS) in the framework of the Paris Agreement

- All 29 LT-LEDS submitted from November 2016 through May 2021 contain references to transport sector actions, and more than 20% propose specific targets for mitigating transport emissions.
- Submitted LT-LEDS focus strongly on "*Improve*" measures (representing 56% of all measures), whereas only 13% represent "*Shift*" measures and 7% represent "*Avoid*" measures.

National Adaptation Plans (NAPs) and National Adaptation Programmes of Action (NAPAs) in the framework of the Paris Agreement

- Among the 22 NAPs submitted from October 2015 through March 2021 (with 14 submitted since 2018), more than 50% refer to specific transport adaptation measures. While this reflects an increase in adaptation considerations in transport, significant gaps remain.
- 51 NAPAs were submitted from November 2004 to February 2017, followed by no submissions through May 2021. This lack of substantive progress is likely linked to the absence of a clear reporting process on implementation status.

Linkages between national climate change planning processes and Paris Agreement mechanisms

- NDCs are increasingly referencing national climate change and strategic plans, to enhance synergies in the interest of accelerating transport decarbonisation and sustainability objectives.
- Many countries have captured enhanced ambition on transport in recent national climate change plans and commitments, which complement measures detailed in global climate change mechanisms.

Impacts of the COVID-19 pandemic on transport and climate change policy frameworks

- In 2020, due to the pandemic, the UN Conference on Climate Change (COP26, originally scheduled for November) and other key processes around the UN Framework Convention on Climate Change (UNFCCC) were delayed, resulting in shifted timelines for progress towards updated NDCs and NAPs.
- To accelerate collective and timely action towards a low carbon transport transition, many initiatives were announced at the En Route to COP26 event in December 2020.
- The pandemic has prompted low carbon transport measures in national recovery efforts (see Section 4.1 on Financing), which should be linked to the development of enhanced NDCs.

Overview

To achieve the goals of the Paris Agreement, the transport sector must accelerate climate action immediately to achieve decarbonisation by mid-century. Under the Agreement, Parties to the UN Framework Convention on Climate Change (UNFCCC) are required to submit Nationally Determined Contributions (NDCs), or frameworks and strategies outlining their specific targets and actions to reduce emissions. NDCs communicate planned mitigation and adaptation actions by the Parties, including plans to achieve resilient, low carbon transport systems.[1]

In addition to NDCs, the UNFCCC provides several mechanisms under the Paris Agreement to describe intended measures and ambitions on climate change mitigation and adaptation. These include: Long-Term Low Emission Development Strategies (LT-LEDS); National Adaptation Plans (NAPs); National Adaptation Programmes of Action (NAPAs); and Nationally Appropriate Mitigation Actions (NAMAs).[2] The Paris Agreement also provides a mechanism for collaboration among Parties and so-called non-Party stakeholders (all stakeholders that are not national governments) through the Marrakech Partnership for Global Climate Action. The Marrakech Partnership elaborates Climate Action Pathways, which set out visions for various sectors – including transport – to achieve a 1.5 °C resilient world in 2050.[3]

Sustainable transport is an important component of additional UN frameworks on sustainable development and resilience, including the 2030 Agenda for Sustainable Development (and its Voluntary National Reviews (VNR) for tracking progress towards these goals), as well as the adaptation and resilience objectives of the Sendai Framework for Disaster Risk Reduction (and its Global Assessment Report).[4] There is significant potential to strengthen the nexus between the UNFCCC mechanisms for the Paris Agreement and the 2030 Agenda and Sendai Framework. Enhancing linkages among these global frameworks and their monitoring and reporting processes can help assure that progress towards climate change mitigation and adaption yields broader positive impacts on sustainable development.

The COVID-19 pandemic impacted transport and climate change policy frameworks, resulting in a postponement of the 2020 UN Conference on Climate Change (COP26) and in shifts in submissions for new NDCs. The pandemic has also prompted efforts to include low carbon transport measures in national recovery plans (*see Box 1*).[5]

Nationally Determined Contributions (NDCs) in the framework of the Paris Agreement

NDCs are submitted in a five-year cycle, with the first generation of NDCs submitted in 2015 and subsequent generations to be submitted every five years thereafter. The NDC process is supported by a set of "global stocktakes" to assess progress towards implementation of the Paris Agreement, with the first one scheduled to take place in 2023 (and subsequent ones every five years thereafter).[6]

Transport in first-generation NDCs

During 2015 and 2016, 166 first-generation NDCs were submitted (from 165 countries, plus the European Union-28); 76% of these highlight transport as an important sector for climate mitigation, but only 8% include specific targets for reducing transport emissions.[7] First-generation NDCs were submitted as Intended Nationally Determined Contributions (INDCs), which then officially became NDCs following the ratification of the Paris Agreement in 2015.[8]

Around half of the transport actions described in the first-generation NDCs represent "*Improve*" measures, while a more balanced set of "*Avoid*" and "*Shift*" measures is needed to optimise the mitigation potential of transport (*see Avoid-Shift-Improve hierarchy in Section 1.1*).[9] Despite commitments to decarbonise transport in more than three-quarters of NDCs, few of the first-generation NDCs include quantified targets and timelines for achieving these measures.

Transport in second-generation NDCs

Parties to the UNFCCC were requested to submit second-generation NDCs by the end of 2020, according to the established five-year cycle. However, due to the COVID-19 pandemic, and mindful of countries' needs to focus on pandemic-related emergencies, the UNFCCC extended the timeline for Parties to submit second-generation NDCs until 9 to 12 months before the UN Climate Change Conference (COP26, which was postponed to November 2021).[10]

From November 2018 through May 2021, 54 second-generation NDCs were submitted (from 53 countries, plus the European Union-27); 72% of these include specific measures for mitigating transport emissions, but only 15% include a specific target for reducing transport emissions, showing insufficient progress toward Paris Agreement goals.[11] The Parties that submitted these 54 NDCs collectively account for 59% of global transport CO_2 emissions, but only 8 of the NDCs include transport mitigation targets (*see Table 1*).[12] Submission of additional second-generation NDCs is anticipated before COP26.

Among second-generation NDCs, Improve measures account for 53% of all measures (versus 52% in first-generation NDCs); Shift measures account for 19% (versus 32% in first-generation NDCs); and Avoid measures account for 8% (versus 6% in first-generation NDCs), with other measures being cross cutting (*see Figure 1*).[13] **This illustrates a continued bias towards technological solutions.**

As of May 2021, 10 countries had expanded the scope of their second-generation NDCs to amplify Avoid measures (e.g., avoiding unnecessary motorised transport; planning more compact cities) and Shift measures (e.g., increasing access to opportunities through public transport, walking and cycling).[14] Amplifying *Avoid* and *Shift* measures is seen as a key opportunity to enhance transport in NDCs.[15]

- **Cabo Verde, Colombia, Moldova** and **Suriname** intend to avoid motorised travel through urban planning and car-free zones.[16]

Table 1. Second-generation NDC submissions with specific targets for mitigating transport emissions

Country	Target
Andorra	Reduce road transport emissions 50% by 2030 (new in second-generation NDC)
Bangladesh	Reduce transport emissions 9% below business-as-usual by 2030 (repeated from first-generation NDC)
Cuba	Reduce fossil fuel use in ground transport 50% by 2030 (new in second-generation NDC)
European Union	- Reduce carbon dioxide (CO_2) emissions per kilometre from passenger cars sold by 37.5% on average, and from new vans by 31% on average, by 2030 (from 2021 levels) (new in second-generation NDC) - Reduce CO_2 emissions per kilometre from new large lorries 30% on average from 2019/2020 levels (new in second-generation NDC)
Fiji	Reduce domestic maritime shipping emissions 40% below business-as-usual levels by 2030 (new in second-generation NDC)
Grenada	Reduce transport CO_2 emissions 20% below business-as-usual levels by 2025, with further reductions by 2030 (repeated from first-generation NDC)
Japan	Reduce transport CO_2 emissions 27% below 2013 levels by 2030, to reach 163 million tonnes of CO_2 or less (repeated from first-generation NDC)
Norway	Reduce transport emissions 40% below 2005 levels by 2030 (new in second-generation NDC)

Source: See endnote 12 for this section.

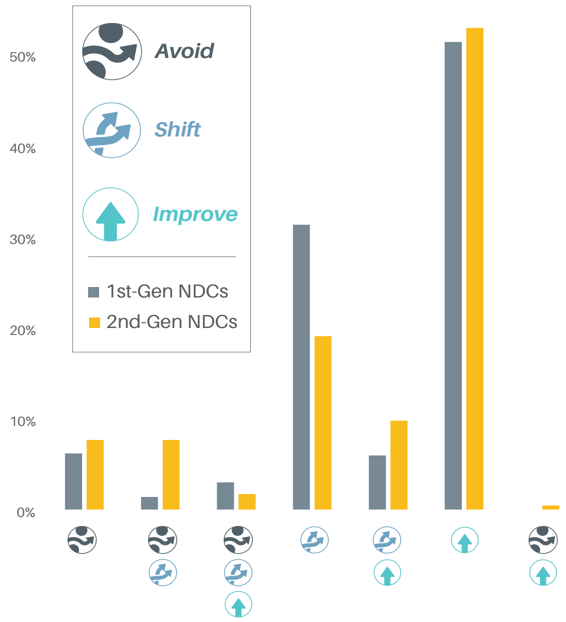
- **Switzerland** notes the importance of removing fossil fuel subsidies and being actively involved in Friends of Fossil Fuel Subsidies Reform.[17]

As of May 2021, 21 of the 54 second-generation NDCs referred to electric mobility, and several NDCs included electric mobility-related targets, reflecting continued emphasis on Improve measures.[18]

- **Brunei** aims for electric vehicles to represent 60% of total annual vehicle sales by 2035.[19]
- **Nepal** aims for 90% of private passenger cars and two-wheelers sold and 60% of public transport vehicles in operation to be electric by 2030.[20]
- **Tonga** aims for 10% of all newly registered vehicles to be electric or hybrid by 2030.[21]

Among second-generation NDCs, 15 countries have increased their attention to climate change adaption for transport (28%, compared to 4% of first-generation NDCs), although fewer than 6% include a transport adaptation target.[22] Among first-generation NDCs, 16% highlight the transport sector within the scope of adaptation activities, while only 4% include specific transport adaptation measures, underscoring the need to further emphasise transport adaptation in the NDC framework.[23]

Figure 1. *Avoid, Shift* and/or *Improve* transport measures in second-generation NDCs



Source: See endnote 13 for this section.

Among the 15 second-generation NDCs with greater attention to adaptation for transport (as of May 2021), the most common adaptation measures were transport infrastructure resilience improvements (20 actions), design standards (8 actions) and disaster information systems (7 actions).[24] Transport adaptation targets in second-generation NDCs include the following:

- **Cambodia** aims to develop climate-proofing road standards by 2022 and to implement them on all roads by 2030.[25]
- **Kenya** aims to climate-proof at least 4,500 kilometres of roads by 2030.[26]
- **Papua New Guinea** has committed to making USD 1.2 billion in transport infrastructure assets climate resilient.[27]

While 37% of second-generation NDCs make general references to Long-Term Low Emission Development Strategies, there is potential to more strongly leverage transport decarbonisation synergies between these mechanisms.[28] LT-LEDS are beneficial for transport because new or expanded projects typically take many years to design and build, and reaching transport targets typically requires more than 10 years. As NDCs have only a 5- to 10-year horizon, LT-LEDS are necessary to bridge the planning and implementation processes for structural transformations.[29]

While 13 second-generation NDCs set higher targets for reducing economy-wide emissions, a recent assessment estimates that current pledges would still lead to warming of 2.6 °C by 2100, far exceeding the Paris Agreement goals.[30] The Intergovernmental Panel in Climate Change (IPCC) concludes that while emission reductions are urgent, they are also feasible and will require robust mitigation commitments, bold policy support and dedicated funding streams.[31] A pathway for the transport sector that is compatible with keeping the rise in global temperature below 1.5 °C can deliver critical emission reductions as well as more equitable mobility access, expanded job creation and improved air quality.[32]

Voluntary National Reviews (VNRs) of the UN Sustainable Development Goals (SDGs) in the framework of the UN 2030 Agenda for Sustainable Development

Sustainable, low carbon mobility is a powerful driver for positive, systemic transformation of societies in areas that go well beyond climate action. This transformation is outlined in the UN 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals.[33] The 2030 Agenda is a cross-cutting, interconnected agenda, with the achievement of one SDG often dependent on the achievement of a series of others. SDG 13 (Climate Action) provides a direct linkage between the actions to support the 2030 Agenda and the Paris Agreement.

While sustainable, low carbon mobility is not represented by a stand-alone SDG, its successful implementation supports the achievement of almost every SDG. The extent of positive interactions between sustainable, low carbon transport and mobility and the 2030 Agenda is captured among four cross-cutting themes – Equitable, Healthy, Green and Resilient – each of which incorporates impacts of transport climate action (*see Figure 2*).[34]

The 2030 Agenda encourages UN Member States to submit VNRs to the annual UN High-Level Political Forum on Sustainable Development.[35] The VNR process facilitates sharing of successes and challenges among Member States, with a view towards accelerating implementation of the 2030 Agenda.[36] Since the first High-Level Political Forum in 2016, countries have reported on transport as a vital sector to implement the SDGs, showcasing on-the-ground implementation and best practices.

Among VNRs submitted in 2020, 48% connect transport to SDG 13 (Climate Action), while only a single VNR submission sets a specific transport target (*see Figure 3*), illustrating the need for further alignment between Paris Agreement mechanisms and the 2030 Agenda for Sustainable Development.[37] VNRs submitted in 2020 with climate-focused transport targets include the following:

- **Argentina** set a target to increase universal access to public transport from 82% in 2010 to 91% by 2030.[38]
- **Estonia** aims to increase the share of renewable energy in its transport sector to 10% by 2021.[39]
- **Slovenia** set a target to reduce transport greenhouse gas emissions "significantly" by 2030 and 2050.[40]

Among second-generation NDCs, 13% establish direct linkages between sustainable transport measures and specific SDGs, including SDG 3 (Good Health and Well-Being), SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action).[41] Examples of second-generation NDC linkages to SDGs include the following:

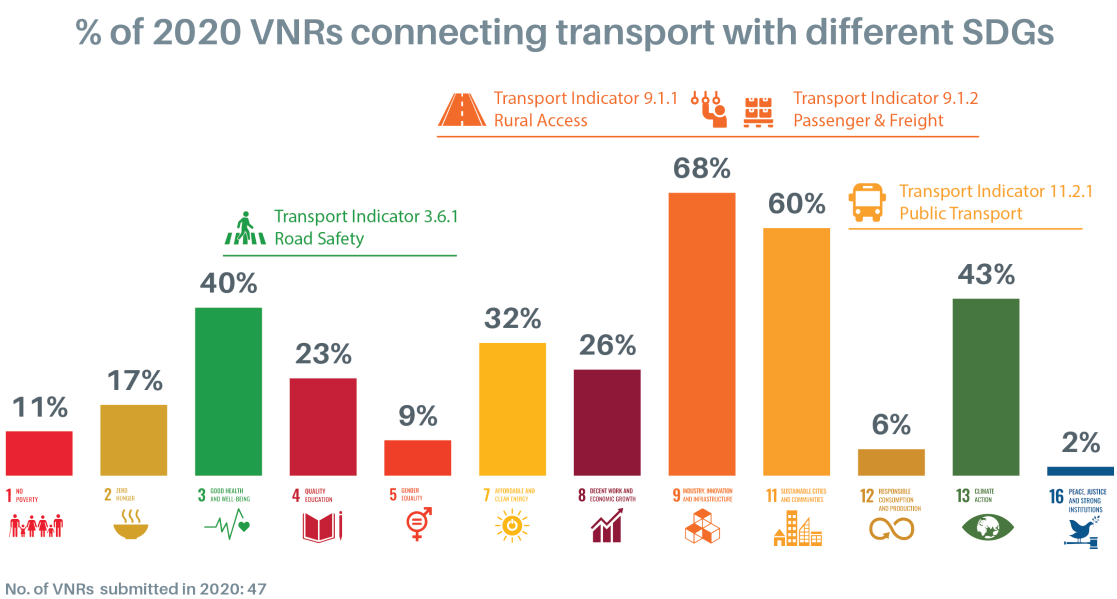
- **Cambodia** aims to promote integrated public transport systems, enhance vehicle inspection and maintenance, and shift long-distance freight from truck to train, linking these measures to SDG 3 (Good Health and Well-Being), SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation and Infrastructure).[42]
- **Chile** aims to reduce total black carbon emissions at least 25% by 2030 (from 2016 levels), linking this measure to SDG 3 (Good Health and Well-Being), SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action).[43]
- **Rwanda** aims to increase vehicle emission standards to enhance resilience to disease, linking this measure to SDG 3 (Good Health and Well-Being), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action).[44]

The development, implementation and reporting of NDCs and VNRs can be optimised and leveraged through concerted and co-ordinated efforts to scale up sustainable transport (*see Box 1*).[45]

Figure 2. Transport and the SDGs: Four cross-cutting themes

Source: See endnote 34 for this section.

Figure 3. Shares of VNRs submitted in 2020 that connect transport with different SDGs



Source: See endnote 37 for this section.

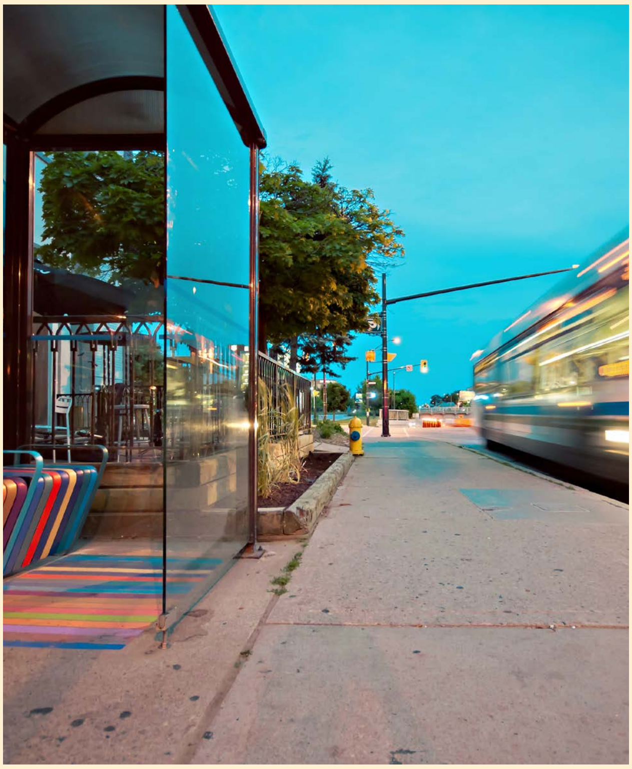
Box 1. Synergies among NDCs and VNRs

Creating a common methodological framework between the Paris Agreement and the implementation and monitoring mechanisms for the 2030 Agenda can maximise the combined potential of both global frameworks for accelerating sustainable, low carbon transport.

A successful implementation of sustainable transport measures in the context of the Paris Agreement and the 2030 Agenda must involve concerted and co-ordinated efforts to more closely link the processes of developing, implementing and tracking progress towards both NDCs and VNRs. Such alignment is required both in the governance of the processes themselves and in the co-ordination among the national and sub-national actors that are formulating and putting them into practice.

In response to this identified need, a guidance was proposed in 2020 by the Islamic Development Bank and the SLOCAT Secretariat to support the implementation of NDCs and SDGs for the transport sector at the national level. The guidance presents a set of eight components for mainstreaming the 2030 Agenda and the Paris Agreement objectives within the transport sector, to support convergence between climate action and sustainable development.

Source: See endnote 45 for this section.



Long-Term Low Emission Development Strategies (LT-LEDS) in the framework of the Paris Agreement

To complement the NDCs, the Paris Agreement invites (but does not require) Parties to formulate and communicate Long-Term Low Emission Development Strategies, to help establish low carbon trajectories to 2050. Parties were invited to submit LT-LEDS by the end of 2020, and as of May 2021, 29 had been submitted.[46]

All 29 LT-LEDS submitted from November 2016 through May 2021 contain references to transport sector actions, and more than 20% propose specific targets for mitigating transport emissions.[47] Proposed decarbonisation actions include electric mobility (24 countries), transport infrastructure improvements (16 countries) and vehicle efficiency improvements (13 countries).[48] Six LT-LEDS propose explicit transport mitigation targets, as follows:

- **Belgium** aims achieve a 100% reduction of transport CO_2 emissions by 2050.[49]
- **Germany** aims to reduce transport greenhouse gas emissions 40% to 42% below 1990 levels by 2030, reaching 95 million to 98 million tonnes of CO_2 equivalent or less.[50]
- **Japan** aims to reduce transport CO_2 emissions 80% below 2010 levels by 2050.[51]
- **Portugal** targets reducing transport CO_2 emissions 43-46% by 2030, 84-85% by 2040 and 98% by 2050.[52]
- **Sweden** aims to reduce transport CO_2 emissions 70% below 2010 levels by 2030.[53]
- **Switzerland** is targeting zero greenhouse gas emissions from domestic land transport by 2050, and net zero emissions from international aviation from the country by 2050.[54]

Submitted LT-LEDS focus strongly on *Improve* measures (representing 56% of all measures), whereas only 13% represent *Shift* measures and 7% represent *Avoid* measures (*see Figure 4*).[55] Despite providing a more comprehensive narrative on low carbon transport measures, the LT-LEDS still depend largely on technological solutions. (*See Box 2 for a recently established process for tracking the the role of transport in NDCs and LT-LEDS.*[56]) Examples of transport measures and targets captured in recently submitted LT-LEDS include the following:

- **Costa Rica** establishes three axes for transport decarbonisation: public transport and active mobility; light-duty vehicle fleets powered by renewables; and low-emission freight transport.[57]
- **Finland** targets a 5-to-1 ratio of electric to petrol vehicles by 2030.[58]
- **Singapore** targets having 9 out of 10 trips during peak periods performed through walking, cycling and public transport modes by 2040 and envisions the development of 20-minute towns and a 45-minute city, which would reduce the need for motorised travel.[59]

National Adaptation Plans (NAPs) and National Adaptation Programmes of Action (NAPAs) in the framework of the Paris Agreement

The impacts of climate change on transport infrastructure and services are already being experienced and are likely to increase in the future *(See Focus Feature on Adaptation)*. For example, in the European Union, costs to transport systems from extreme weather events are projected to increase 20% by 2040-2050, ranging from an estimated 7% increase for road transport to a 72% increase for rail.[60] Thus, it is important for governments to recognise the value of transport adaptation plans and strategies within global processes and national and local plans. Despite these needs, transport adaptation has received less attention than transport mitigation in NDCs, and most low- and middle-income countries have not completed climate vulnerability studies.

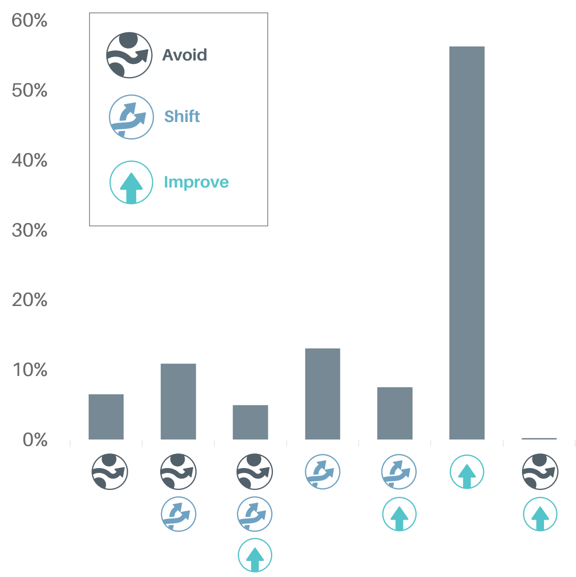
National Adaptation Plans (NAPs), established in 2011, identify medium- and long-term adaptation needs for developing countries, and strategies to address those needs. NAPs aim to facilitate integration of climate change adaptation into new and existing policies, programmes and activities to establish and develop planning processes and strategies across various sectors and levels of government.[61]

Among the 22 NAPs submitted from October 2015 through March 2021 (with 14 submitted since 2018), more than 50% refer to specific transport adaptation measures.[62] **While this reflects an increase in adaptation considerations in transport, significant gaps remain.** Among the submitted NAPs, 13 mention climate change impacts on transport, and 13 refer to specific transport adaptation measures. Action on NAPs shows little change from previous years in addressing transport vulnerabilities, despite increasing climate impacts in the sector.

- **Brazil** aims to incorporate adaptation studies in technical standards for design and maintenance of the urban mobility infrastructure and has highlighted transport impacts and needs in a NAP sectoral strategy.[63]
- **Kenya** aims to climate-proof buildings, roads, railway, marine, aviation, and information and communications technology infrastructure through the use of appropriate designs and building materials.[64]
- **Sri Lanka** aims to improve climate resilience and disaster risk preparedness of transport and to assess the impacts of projected changes and extreme weather scenarios on transport systems.[65]

National Adaptation Programmes of Action (NAPAs), established in 2001, allow least-developed countries to prioritise a list of ranked adaptation activities, in order to facilitate the development of project proposals for implementation. The UNFCCC has established a Least Developed Countries Fund to assist in the preparation and implementation of NAPAs and an Expert Group to provide technical support.[66]

Figure 4. Transport measures in Long-Term Low Emission Development Strategies



Source: See endnote 55 for this section.

Box 2. Tracker of Climate Strategies for Transport: A database on ambition, targets and policies in NDCs and LT-LEDS

The Tracker of Climate Strategies for Transport was developed by the SLOCAT Partnership on Sustainable, Low Carbon Transport and the Advancing Transport Climate Strategies in Rapidly Motorising Countries (TraCS) project[i]. It enables tracking of national-level climate policies and targets in transport, and specifically provides information on the role of transport in NDCs and LT-LEDS. The Tracker will be continually updated, adding the newest NDCs and LT-LEDS once they are published on the UNFCCC portal. The Tracker will eventually be updated with other major national strategies, starting with relevant transport documents referenced in NDCs and LT-LEDS.

Source: See endnote 56 for this section.

i Implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and financed by the International Climate Initiative (IKI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

51 NAPAs were submitted from November 2004 to February 2017, followed by no submissions through May 2021.[67] This lack of substantive progress is likely linked to the absence of a clear reporting process on implementation status.[68] Among the submitted NAPAs, 34 include general descriptions of climate change impacts on transport, and 18 include specific transport adaptation measures.

- **Comoros** aims to reinforce energy infrastructure for production and transport.[69]
- **Timor-Leste** aims to deliver a comprehensive maintenance programme for all existing roads.[70]
- **Tuvalu** aims to implement a multi-million dollar tar-sealed road infrastructure project to increase connectivity of rural communities with the urban centre.[71]

Additional support is needed to increase attention to transport in NAPs and NAPAs, through NAP Expos and other opportunities for peer exchange on international best practices. The Marrakech Partnership Climate Action Pathway on Transport provides guidance on mitigation and resilience strategies for transport (*see Box 3*), although planning and implementation of transport resilience strategies continues to vary widely, especially among least-developed countries.[72]

Linkages between national climate change planning processes and Paris Agreement mechanisms

NDCs are increasingly referencing national climate change and strategic plans, to enhance synergies in the interest of accelerating transport decarbonisation and sustainability objectives. Strengthening linkages between climate and transport plans is an area of increasing convergence, and several countries refer to national strategies in their NDCs to achieve a broader set of sustainable development, including the following:

- In its second-generation NDC in December 2020, **Costa Rica** refers to its 2050 National Strategic Plan, which states a priority to close the digital divide and allow more equitable access through telecommuting and virtual tourism to reduce the need to travel.[73]
- In its second-generation NDC in December 2020, **Kenya** refers to its National Climate Change Action Plan 2018-2022, which contains specific measures to climate-proof the energy and transport sectors, and to promote low carbon action in the aviation and maritime sectors.[74]

Box 3. Transport adaptation measures in the Marrakech Partnership Climate Action Pathways

The Climate Action Pathways are among the Marrakech Partnership tools to enhance climate ambition and action towards fully implementing the Paris Agreement. First launched in 2019, they set out sectoral visions – including for transport – for achieving a 1.5° C resilient world in 2050, which include overarching transformational milestones and key impacts to be achieved.

The Pathways aim to provide a roadmap to help both Parties and non-Party stakeholders under the UNFCCC identify actions needed by 2021, 2025, 2030 and 2040 as steps to get to the 2050 vision. The key aim of the updated Pathways for 2021 is to strengthen the aspects of a just transition, gender responsiveness, resilience, and the circular economy, deepening the alignment of actions across the Pathways.

The sectoral Climate Action Pathway for Transport includes guidance on strategies for mitigating transport emissions and building more resilient transport systems. The Pathway for Transport section on adaptation refers to the need to increase resilience to extreme weather events at the level of transport systems or networks; specific infrastructure assets; and transport vehicles.

Milestones for resilient transport through the Pathway for Transport include:

- **By 2021:** Climate risk assessments, adaptation strategies and disaster response plans are prepared and implemented for critical transport infrastructure; review of legal, policy and institutional frameworks for effective climate-risk assessment and adaptation planning.
- **By 2025:** Climate resilience of new transport infrastructure and systems to at least 2050; innovative adaptation finance mechanisms are available; finance for new transport systems requires consideration of climate risks; nature-based solutions are mainstreamed into transport infrastructure wherever practicable.
- **By 2030:** Climate resilience of all critical transport infrastructure to at least 2050; design of new vehicles incorporates needed modifications to strengthen resilience to extreme weather.
- **By 2040:** Climate-resilience of all critical transport infrastructure and systems to at least 2100.

The Transport Pathway Action Table includes an impact area on Resilient Transport Systems, Infrastructure and Vehicles, which includes recommended actions for policy makers, financial institutions, technology providers and innovators, business and service providers, and civil society.

A complementary vision for resilient infrastructure and services, including transport sector action, is detailed in the cross-cutting Climate Action Pathway on Climate Resilience.

Source: See endnote 72 for this section.w

Many countries have captured enhanced ambition on transport in recent national climate change plans and commitments, which complement measures detailed in global climate change mechanisms. Governments are increasingly embedding sustainable, low carbon transport into their overall national climate change strategies, as demonstrated in recent climate change plans, including the following:

- In September 2020, **China** announced plans to reach peak CO_2 emissions by 2030 and to achieve carbon neutrality before 2060, with an implicit contribution to decarbonisation from the transport sector.[75]
- In September 2020, the **European Commission** proposed a 2030 Climate Target Plan with a target to cut CO_2 emissions at least 55% by 2030.[76] The proposal includes increasing the share of public transport and walking and cycling trips, and increasing the share of renewable energy in transport 24% by 2030 by scaling up electrification, advanced biofuels and other low carbon fuels.[77]

National urban mobility plans and investment programmes (NUMPs) and sustainable urban mobility plans (SUMPs) are another key element of national and sub-national climate change planning processes. NUMPs refer to national strategic frameworks to enhance the capabilities of cities to fulfil their mobility needs in a sustainable way, and SUMPs are strategic frameworks designed to improve quality of life by addressing major challenges related to urban transport.[78] (*See Section 3.2 on Sustainable Mobility Planning and Transport Demand Management.*)

Box 4. Impacts of the COVID-19 pandemic on transport and climate change policy frameworks

COVID-19 has created unprecedented changes to transport systems around the world and to national and global processes that support action on transport and climate change. The pandemic has confronted governments and the private sector with unforeseen challenges, while also shifting national and global processes to address the pandemic and to increase readiness for forthcoming global shocks.

In 2020, due to the pandemic, the UN Conference on Climate Change (COP26, originally scheduled for November) and other key processes around the UNFCCC were delayed, resulting in shifted timelines for progress towards updated NDCs and NAPs. COVID-19 has slowed the process of updating NDCs, with delays around collection and validation of data, decision-making processes and convening key stakeholders. The pandemic also led to postponement of the 2020 NAP Expo, which serves as an annual forum for exchange of experience and best practices on NAPs, thus slowing progress towards filling adaptation gaps among developing countries in transport and other sectors.

To accelerate collective and timely action towards a low carbon transport transition, many initiatives were announced at the En Route to COP26 event in December 2020. Scheduled to mark 12 months before the postponed UN Climate Change Conference under the UK Presidency, En Route to COP26 was designed to accelerate collective and timely action by engaging transport actors to quickly, efficiently and fairly realise the low carbon transport transition.

The *En Route to COP26* Outcome Document highlights essential transport decarbonisation messages towards COP26. It also outlines exciting initiatives announced during *En Route to COP26* to further enable and accelerate collective action. It provides no-regret recommendations for action by different stakeholders.

The pandemic has prompted low carbon transport measures in national recovery efforts (*see Section 4.1 on Financing*)**, which should be linked to the development of enhanced NDCs.** Transport demand and emission trends have shifted due to COVID-19 and continue to take shape. Emerging trends include how companies will shift operations from global supply chains to regional ones, and how changes in work arrangements may reduce work-related commuting and travel. Forthcoming policy commitments – through a combination of NDCs, LT-LEDS, and national transport and climate change plans – will determine which changes are likely to be retained or reversed after the pandemic

In December 2020, the UNFCCC, the UN Development Programme and the NDC Partnership convened an event titled "NDC Enhancement and COVID-19 Recovery: Regional Trends and Country Experiences". The event presented global and regional trends in the NDC revision process and showcased efforts to align enhanced NDCs with national COVID-19 recovery efforts. Tools and resources were shared to further support countries in linking NDCs and recovery efforts, with a desired outcome of sharing best practices in this endeavour.

Source: See endnote 5 for this section.

3.2 Sustainable Mobility Planning and Transport Demand Management

Key findings

Demand trends

- Traffic congestion increased in 57% of cities worldwide between 2018 and 2019, while only 15% of cities recorded reductions in congestion.
- The global average price of petrol rose 17% between 2017 and 2019, while the price of diesel rose 25%; however, fuel prices remained below market value in 53 countries in 2019, contributing to increased demand for motorised travel.
- Average parking prices increased 5% between 2017 and 2019 in cities with the highest parking fees worldwide.
- Teleworking can help reduce transport demand and congestion; however, this potential varies widely, with remote work available to only 13% of workers in developing countries based on a 2020 study.

Policy measures

- During 2018-2020, cities around the world prioritised low-emission zones among strategies for transport demand management, whereas vehicle restrictions and congestion charging remained unchanged.
- More than two-thirds of sustainable urban mobility plans (SUMPs) were found in European cities in 2018, but SUMPs have expanded greatly in Africa and in Latin America and the Caribbean since then.
- "Complete streets" programmes are contributing to social inclusion and equity through specific sustainability-related parameters.
- Planning concepts that prioritise proximity (such as the "15-minute city") and land-use planning guidance are growing in prominence, supporting increased and more equitable access to economic and social needs in cities around the world.

Emission trends

- Deployment of low-emission zones has helped to greatly reduce emissions of carbon dioxide (CO_2) and nitrogen dioxide and has yielded measurable improvements in road safety and public health.
- Research on road pricing indicates that it has significant potential to reduce motorised travel demand, traffic congestion, and carbon emissions, but examples of implementation remain limited.

Impacts of the COVID-19 pandemic

- Responses to the pandemic have encompassed a wide range of measures to enable social distancing, help people avoid unnecessary trips and spread out travel during periods of peak demand.
- COVID-19 caused major disruptions to both urban public transport and commercial real estate in 2020, creating uncertainty for investments in transit-oriented development in the near term.
- Automobile use and sales declined during the pandemic, creating the potential for changing patterns of motorised travel in the medium to long term.

Overview

As transport demand and emissions continue to rise worldwide, countries and cities have responded by using sustainable mobility planning and transport demand management to improve transport planning and to provide enhanced access to mobility options. Sustainable mobility planning is a broad strategy that helps to improve access to mobility while achieving other goals, such as reducing emissions and lowering traffic fatalities. Transport demand management refers to diverse transport and land-use planning tactics that result in more efficient use of transport and spatial resources.[1] Both approaches focus on ensuring access to opportunities, services and goods rather than simply trying to move vehicles.[2]

A number of frameworks exist to help implement these strategies. **Sustainable urban mobility plans** (**SUMPs**), for example are strategic frameworks designed at the local level to improve citizens' overall quality of life by addressing major challenges related to urban transport.[3] **National urban mobility policies and investment programmes** (**NUMPs**) refer to national strategic frameworks to enhance the capabilities of cities to fulfil their mobility needs in a sustainable way.[4]

Other valuable planning approaches include: **transit-oriented development**, which intends to integrate people, activities, buildings and public spaces in designed urban places; **low -and ultra-low emission zones**, which are areas where access for more-polluting vehicles is restricted; and **road pricing**, which refers to variable road tolls intended to reduce peak-period traffic volumes to optimal levels.[5] In this discussion, the term **"vehicle restrictions"** summarises measures put in place to limit the number of vehicles entering a city and/or measures limiting the ownership of private vehicles.

Demand trends

Traffic congestion increased in 57% of cities worldwide between 2018 and 2019, while only 15% of cities recorded reductions in congestion.[6] Worsening traffic congestion is estimated to cost local economies billions of dollars annually.[7] The main drivers of congestion are rapid urbanisation and the growth in car ownership in emerging economies, and the concentration of activities in economic development centres.[89]

- The world's top five most congested cities are: **Bengaluru**, India (requiring 71% extra travel time due to traffic); **Manila**, Philippines (71%); **Bogotá**, Colombia (68%); **Mumbai**, India (65%); and **Pune**, India (59%).[10]
- Europe's most congested cities are **Moscow**, Russia Federation (59%); **Istanbul**, Turkey (55%); and **Kiev**, Ukraine (53%).[11]
- The most congested USA cities are **Los Angeles** (42%), **New York** (37%) and **San Francisco** (36%).[12]
- **Cairo**, Egypt is the most congested city in Africa (40% extra travel time) followed by four cities in South Africa (Cape Town, Johannesburg, Pretoria and East London).13 Traffic in South African cities worsened 7% on average from 2018 to 2019.[14]

The global average price of petrol rose 17% between 2016 and 2018, while the price of diesel rose 25%; however, fuel prices remained below market value in 53 countries in 2019, contributing to increased demand for motorised travel.[15] While diesel is still cheaper than petrol globally (USD 1.07 versus USD 1.14 on average in 2018), diesel prices are rising more rapidly, due mainly to growing requirements for improved fuel quality.[16] United Nations Sustainable Development Goal 12 calls for phasing out inefficient fossil fuel subsidies, which can help reduce demand for travel in internal combustion vehicles.[17]

- In 2018, the highest average petrol price was reported in **Hong Kong** (USD 2.09 per litre), and the highest average diesel price was in **Norway** (USD 1.93 per litre).[18]
- The lowest average fuel prices were reported in **Venezuela**, where both petrol and diesel were virtually free of charge.[19]

Average parking prices increased 5% between 2017 and 2019 in cities with the highest parking fees worldwide.[20] A strong increase in parking prices occurred in Asian cities, whereas in North America parking fees remained stable or even fell.[21] The cities with the most expensive parking in 2019 included several cities in Australia as well as New York and London (*see Table 1*).[22]

Teleworking can help reduce transport demand and congestion; however, this potential varies widely, with remote work available to only 13% of workers in developing countries based on a 2020 study.[23] Working from home can be a significant lever for policy makers, although its overall potential for energy savings and climate benefits is uncertain.[24]

- In **Maryland** (USA), if only 5% of regular private car commuters switched to working from home, this would lead to a reduction in traffic congestion on major highways of 32% to 58%.[25]
- Research shows that remote work in **Canada** measurably reduces daily commute times, although morning peak trips are not affected because of school runs.[26]
- In **Germany**, 56% of workers are able to work from home, and in the **USA** the share is 26%, but in developing countries only 13% of workers can do so.[27]
- An estimated 26% to 29% of jobs in **Argentina** can be done remotely, while in **Uruguay** the proportion ranges from 20% to 34%, which could enhance travel reliability and improve air quality and noise levels.[28]

Table 1. Top 10 cities with the most expensive parking, 2017 and 2019

Average cost of parking (USD)

City	2017	2019	Change
Sydney	34.85	36.66	5%
New York	32.97	34.94	6%
Brisbane	26.67	27.53	3%
Melbourne	22.85	26.61	16%
London	20.78	23.19	12%
Chicago	20.8	20.08	-3%
Tokyo	15.89	19.35	22%
Boston	21.56	18.36	-15%
Washington, D.C.	14.85	15.56	5%
Hong Kong	13.62	14.91	9%
Average	**22.48**	**23.71**	5%

Note: Based on the average price for two hours of off-street parking, measured in USD using purchasing power parity.

Source: See endnote 22 for this section.

Emission trends

Deployment of low-emission zones (LEZs) has helped to greatly reduce emissions of CO_2 and nitrogen dioxide and has yielded measurable improvements in road safety and public health. Although LEZs have emerged mainly as a measure to tackle poor air quality in urban centres, several studies point to their benefits in reducing CO_2 emissions and improving health and social equity in cities.[29] To maximise their emission reduction potential, LEZs require effective enforcement systems and provision of public infrastructure for active, shared and zero-emission transport modes.[30]

- In the first half of 2019, the ultra-low-emission zone in **London**, UK resulted in an estimated 29% fewer nitrogen dioxide emissions, 31% fewer nitrogen oxide emissions and 4% fewer CO_2 emissions, as well as a 3-9% reduction in traffic and 65% fewer older vehicles in the zone.[31]
- The new LEZ in **Paris**, France aims to reduce nitrogen oxide levels 76-87% by 2024.[32]
- The LEZ in **Madrid**, Spain, first implemented in November 2018, led to a 38% decrease in nitrogen dioxide concentrations and to a 14% decrease in CO_2 emissions within the first month of its launch, making it one of Europe's most effective such policies.[33] The LEZ helps to avoid 3,000 premature deaths annually, and, on one road, the average speed of public buses increased 14%.[34]

Research on road pricing indicates that it has significant potential to reduce motorised travel demand, traffic congestion, and carbon emissions, but examples of implementation remain limited. Road pricing schemes increase the relative cost of private car trips compared to public transport and bike sharing. By reducing private car demand, road pricing also reduces congestion, helping to make public transport and active transport modes safer and more pleasant.[35] Road pricing has the potential to boost reductions in CO_2 emissions by supporting public transport, walking and cycling, traffic management and user subsidies.[36]

- Road pricing investments improve traffic flow and are highly cost effective, not only leading to reduced emissions but also providing a net benefit to society valued at EUR 70 (USD 84) per tonne of CO_2 reduced.[37]
- An analysis combining studies from **Austria**, **Italy**, **New Zealand**, **Singapore**, the **UK** and the **USA** shows potential for road pricing to reduce transport demand up to 20% (7% on average) depending on tolls.[38] The research supports evidence of road pricing contributing to a more than 10% reduction in CO_2.[39]
- A study on the potential impact of road pricing in **Bogotá**, Colombia; **Mexico City**, Mexico; and **Santiago**, Chile identified a 25-29% reduction in vehicle-kilometres travelled, less congestion and revenues of USD 100,000 to USD 600,000 per day (*see Figure 1*).[40]

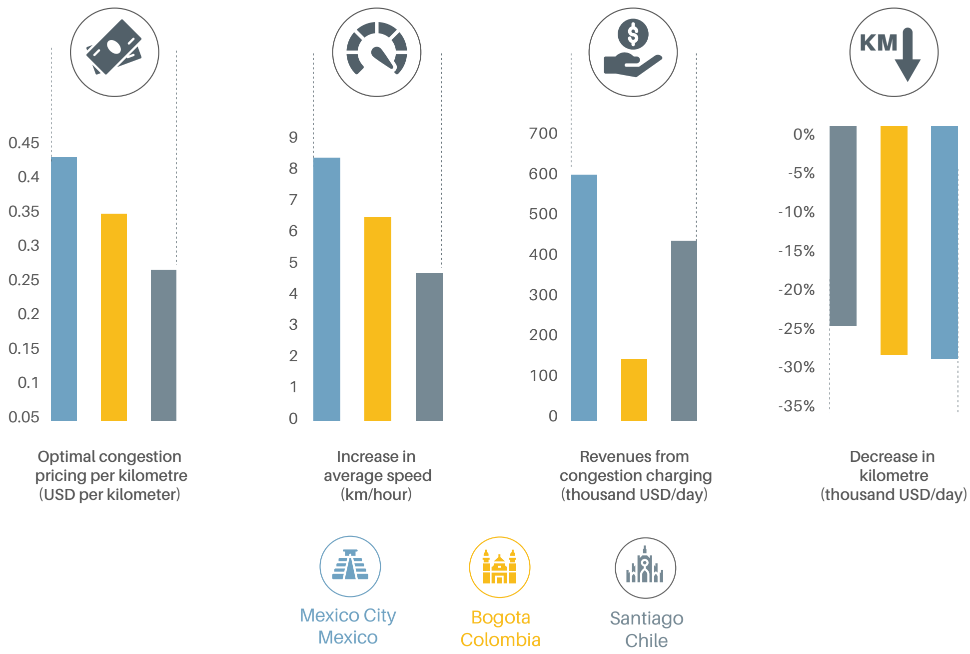
Policy Measures

During 2019 and 2020, cities around the world introduced targets and measures to scale up investments and facilities for public transport, walking and cycling, vehicle sharing services and electrification of bus rapid transit and light rail. Although policy makers have given greater attention to transport demand management in recent years, the implementation of specific policies, such as parking pricing, road pricing and comprehensive smart growth strategies, remains limited globally.

During 2018-2020, cities around the world prioritised LEZs among strategies for transport demand management, whereas vehicle restrictions and congestion charging remained unchanged. LEZs reduce transport-related emissions not only by banning polluting vehicles, but also by promoting walking and cycling and other transport demand management strategies (*see Figure 2*).[41] Demand from policy makers and citizens for improved urban air quality in 2020 in the wake of the COVID-19 pandemic has paved the way for additional LEZs (*see Box 1*).[42]

- Cities that implemented or updated their LEZ regulations in 2020 included: **Ghent**, Belgium; **Aalborg**, **Aarhus**, **Copenhagen**, **Frederiksberg** and **Odense** in Denmark; **Grenoble**, **Greater Lyon** and **Greater Paris** in France; **Aberdeen**, **Bath**, **Birmingham**, **Edinburgh**, **Leeds** and **Southampton** in the UK, and **Jakarta**, Indonesia.[43]
- Between 2018 and 2020, at least nine cities in China including **Beijing**, **Shanghai** and **Shenzhen** introduced LEZs focused on

Figure 1. Potential impacts of congestion charging in three cities in Latin America and the Caribbean



Source: See endnote 40 for this section.

freight vehicles; in these cities, access for deliveries is restricted to certain hours, and permits are prioritised for zero-emission commercial vehicles under 4.5 tonnes.[44]

- A multi-modal e-mobility hub is being implemented in the historical centre of **Quito**, Ecuador, accessible only by clean public transport vehicles, cyclists and pedestrians.[45]
- In Spain, a law drafted in 2020 calls for implementing LEZs in all urban areas with a population of more than 50,000, following the government's declaration of a "climate emergency".[46] **Barcelona**, which includes neighbouring communities in its LEZ, is a national leader and intends to reduce the number of cars in the city by 125,000 within three years and air pollution by 20% within four years.[47]

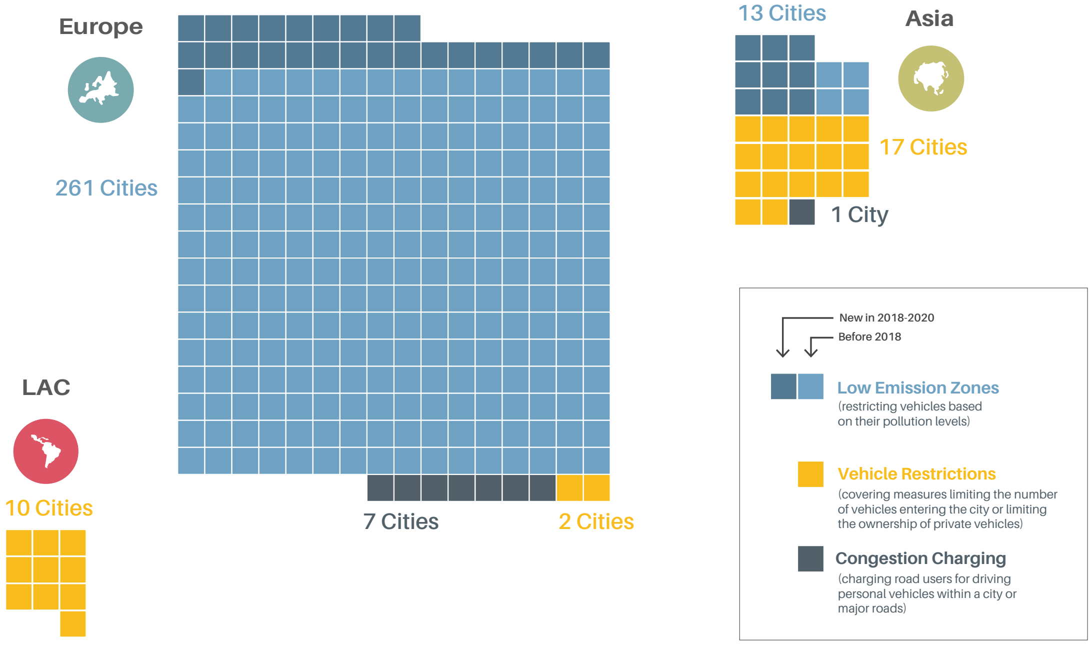
More than two-thirds of SUMPs were found in European cities in 2018, but SUMPs have expanded greatly in Africa and in Latin America and the Caribbean since then.[48] The share of SUMPs in European cities increased from around 63% in 2018 to 68% in 2020 (*see Figure 3*).[49] However, by 2020 many additional SUMPs were established in developing countries, including **Cameroon, Ecuador** and **Uganda.**[50]

Recent policy targets in the area of transport demand management have encouraged investments in the development of SUMPs and mobility strategies focused on comprehensive mobility planning and modal share. As SUMPS and national urban mobility plans (NUMPs) continue to reach critical mass in the Global South, there is an opportunity for peer countries to emulate policies that offer key lessons for policy makers.

- In 2020, **Colombia** adopted a National Urban and Regional Transport Policy, a comprehensive framework to support local authorities in activities to reduce congestion, fatalities and harmful emissions from transport using the *Avoid-Shift-Improve* framework.[51]
- **Ethiopia**'s Non-Motorised Transport Strategy, released in 2020, sets modal share targets for 2029 that include: 80% of all motorised trips to be taken on public transport and paratransit (also called "informal transport"), 60% of all trips to be by walking and cycling, and women to constitute 50% of cyclists.[52]
- The 2020 SUMP for the Kisumu area of **Nairobi**, Kenya includes targets for keeping walking and cycling levels above 55% (with half of all cyclists to be female) and having public transport constitute 80% of motorised trips.[53]
- **Mexico City** approved a mobility strategy that includes 100% integration of public transport fares, bicycle infrastructure, efficiency improvements and more.[54]

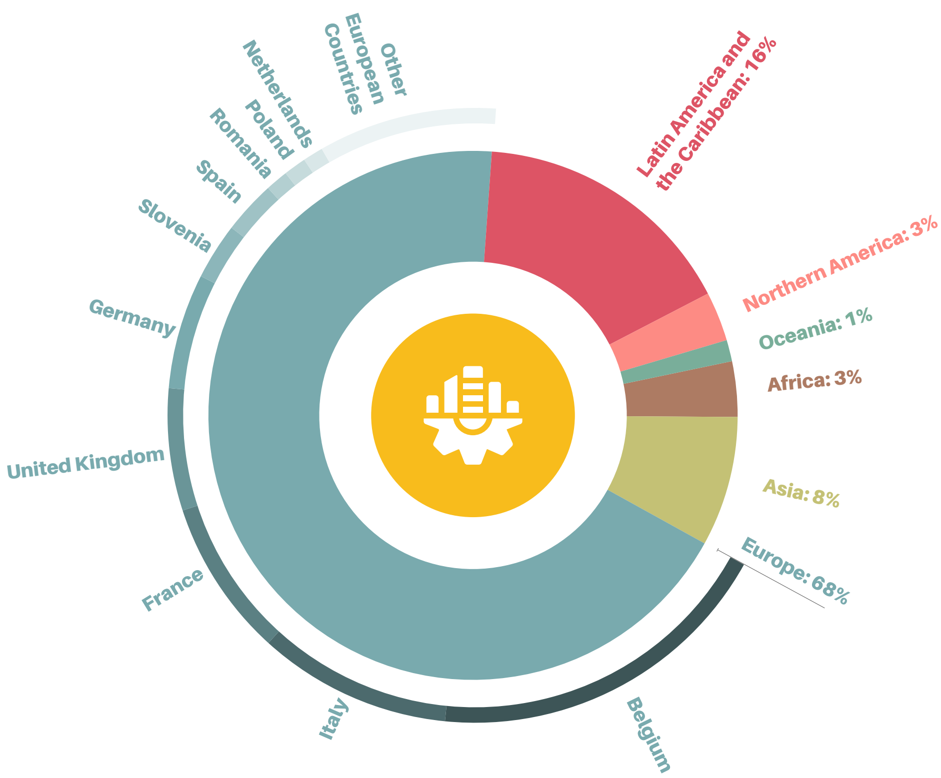
"Complete streets" programmes are contributing to social inclusion and equity through specific sustainability-related parameters. Complete streets are roads designed to safely accommodate diverse activities by people walking, cycling, driving and using public transport.[55] Complete streets can help to increase safe access for all users – particularly caretakers, children, the elderly and people with disabilities – and can be scaled up with minimal cost and time.[56]

Figure 2. Overview of transport demand measures in 2019 and 2020



Source: See endnote 41 for this section.

Figure 3. Sustainable urban mobility plans in Europe versus other regions, 2020

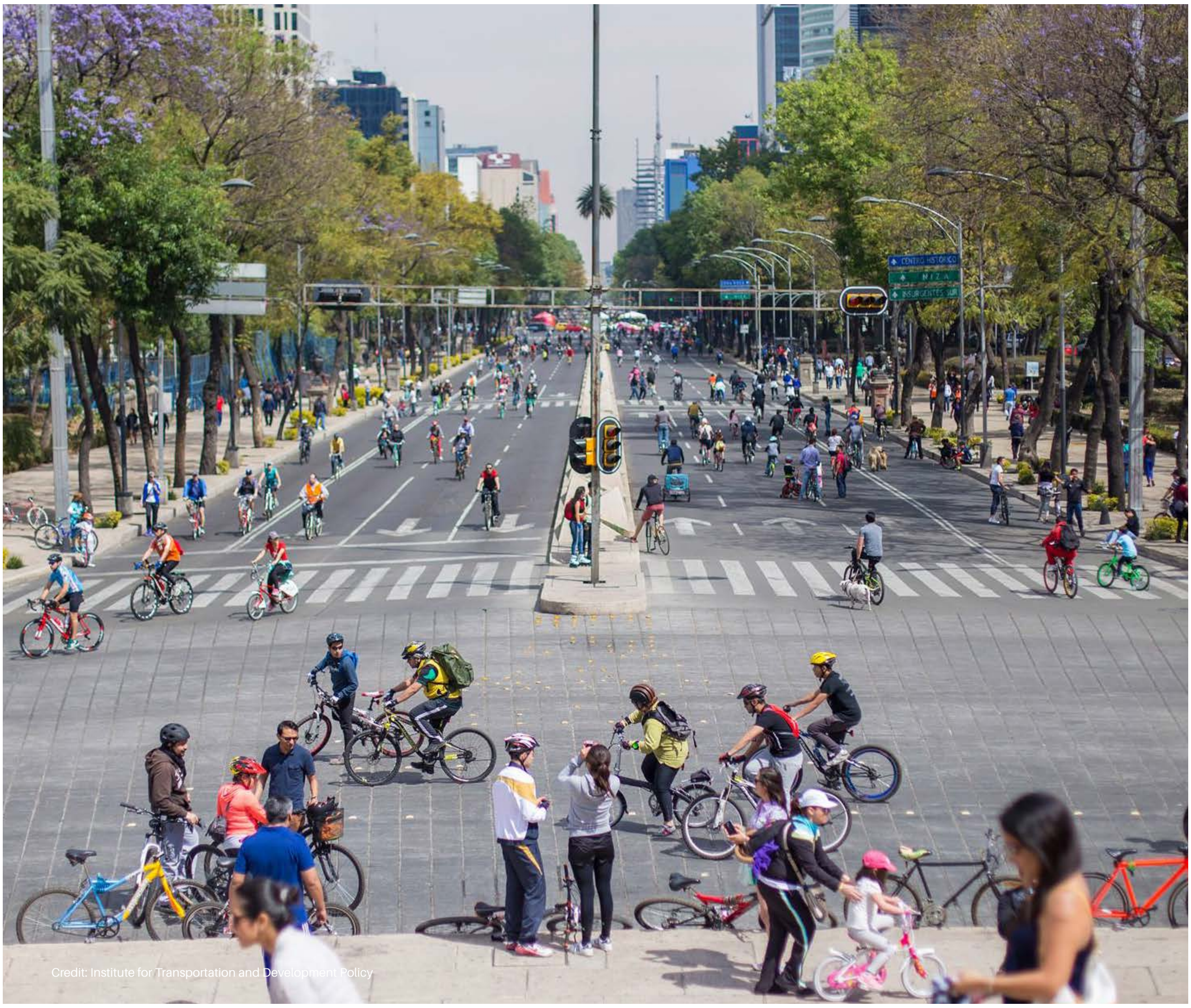


Source: See endnote 49 for this section.

- An ongoing complete streets programme in Brazil covers 19 cities, of which 5 (**Campinas, Juiz de Fora, Porto Alegre, Salvador** and **São Paulo**) had conducted pilot projects and 4 (Curitiba, Fortaleza, Niterói and São José dos Campos) were implementing projects as of the end of 2019, challenging the paradigm of urban design geared to motor vehicles.[57]
- By October 2020, 87 **Canadian** municipalities had adopted at least one form of complete streets policy, typically within transport master plans or other official planning documents.[58]
- Smart Growth America recorded more than 1,600 complete streets policies across 35 **USA** states through 2018, which encourage the implementation of walking, bicycling and public transport facilities with universal accessibility in every street improvement.[59]

Planning concepts that prioritise proximity (such as the "15-minute city") and land-use planning guidance are growing in prominence, supporting increased and more equitable access to economic and social needs in cities around the world. The "15-minute city" is an emerging urban planning paradigm in which all residents are able to meet their essential needs (for shopping, health care, green space, etc.) within a short walk or bicycle ride from their homes.[60]

- Among the cities incorporating variations of this concept into long-term urban and transport planning strategies are **Bogotá**, Colombia; **Glasgow**, Scotland (UK); **Milan**, Italy and **Portland**, Oregon (USA).[61]
- The Ministry for Planning in **Melbourne**, Australia launched a 20-Minute Neighbourhood Pilot Program in January 2018.[62]
- **Ottawa** became one of the first Canadian cities to explicitly include the 15-minute city concept in its Official Plan for 2021.[63]
- **Paris**, France set planning goals in 2020 to transform the city to a 15-minute city.[64]


Credit: Institute for Transportation and Development Policy

Box 1. Impact of the COVID-19 pandemic on sustainable mobility planning and transport demand management

Responses to COVID-19 have encompassed a wide range of measures to enable social distancing to help people avoid unnecessary trips and spread out travel during periods of peak demand. Due to lockdowns and travel restrictions, travel demand was reduced in 2020 while public transport served mainly essential trips. As summarised in Figure 4, responses to manage travel demand showed a significant preference for allocating road space from motorised travel to active transport modes.

- Research in **Australia** suggests a 10-15% improvement in metropolitan transport networks in 2020 as remote work during the pandemic led to reduced road traffic congestion and less crowding on public transport.
- **France** and the **Netherlands** encouraged people to spread out their travel to avoid peak hours, and in Montevideo, **Uruguay** a time-extended ticket was launched to allow people to wait for less-crowded services.
- Cities such as **Rio de Janeiro**, Brazil; **Dublin**, Ireland; **Lagos**, Nigeria; **Lima**, Peru; and **Madrid**, Spain limited the seating in public transport to avoid crowding, while some other cities, such as **Dubai**, United Arab Emirates, increased frequency.[65]
- Demand from policy makers and citizens for improved urban air quality in the wake of the pandemic has strengthened calls for LEZs, with **London** poised to expand its ultra-low-emission zone in October 2021.

COVID-19 caused major disruptions to both urban public transport and commercial real estate in 2020, creating uncertainty for investments in transit-oriented development in the near term. Ridership on public transport dropped sharply in many urban areas, and commercial real estate values fell 29% globally in the first half of 2020. This has led to uncertainty about the long-term effects of the pandemic in the transport sector.

USA cities including **Akron**, **Detroit**, **Philadelphia** and **San Jose** have created flexible urban spaces for social activities, with positive ripple effects on local economies (i.e., more visitors and higher revenue).

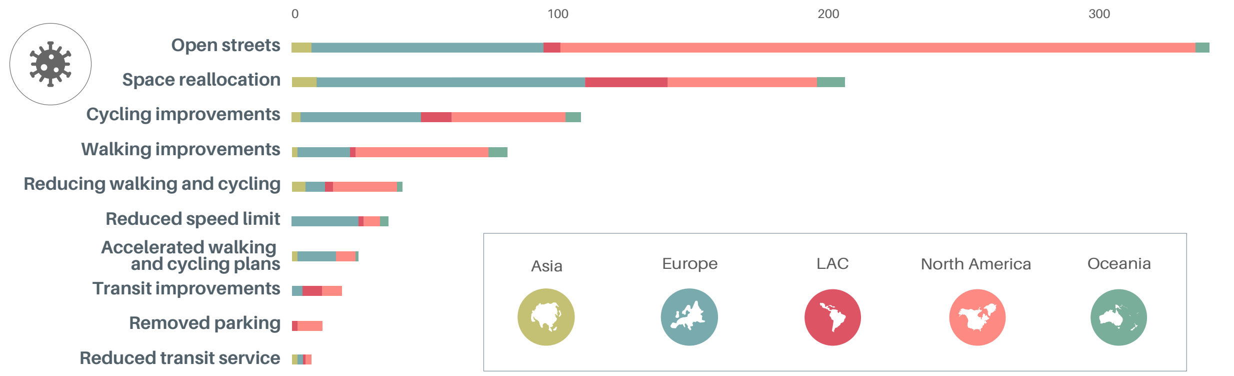
- **Calgary**, Canada redistributed public space for social distancing through "pop-up patios" as one element of the city's pandemic response.
- A **USA** study found that the increase in remote work and the shrinking of office space could boost interest in residential and commercial real estate in smaller cities.
- Market players in the transit-oriented development space expressed confidence that projects would result in few changes to planning processes, regardless of the evolution of the pandemic and lockdowns.

Automobile use and sales declined during the pandemic, creating the potential for changing patterns of motorised travel in the medium to long term. Global sales of new vehicles dropped to 77 million in 2020, down 14.5% from 2019; overall, new passenger car sales fell by 10 million, and commercial vehicle sales by 2.3 million.

- Congestion decreased in 93% of cities worldwide (and increased in just 3% of cities) between 2019 and 2020.
- **Peru** adopted a nationwide provision to limit the use of private cars during the state of emergency, making public transport and authorised taxis the only modes available for long-distance travelling.
- Other countries also imposed bans on driving to control the spread of the virus, although **Georgia** created exemptions for freight and delivery vehicles.
- In **Europe** and the **USA**, new vehicle sales are not expected to return to pre-pandemic levels before 2023. In contrast, **China** is expected to reach 30 million new vehicles sold by 2025.

Source: See endnote 42 for this section.

Figure 4. Responses to manage travel demand during the COVID-19 pandemic, by region, 2020



Initiatives supporting sustainable mobility planning and transport demand management

- **C40's TOD (Transit-Oriented Development) Network** supports cities' efforts to deliver compact, walkable, mixed-use communities centred around high-quality public transport. Participating cities are actively sharing knowledge in four priority areas: financing, social equity, public engagement and active mobility.[66]
- **CIVITAS, Eltis** and other actors released their *SUMP Guidelines 2.0* in 2019 after a one-year consultation process, updating the original guidelines from 2013.[67] CIVITAS is a network for cities dedicated to cleaner and better transport, and Eltis is Europe's main urban mobility observatory, facilitating the exchange of information, knowledge and experience on sustainable urban mobility.
- The **Global Designing Cities Initiative (CGCI)** is a programme of the National Association of City Transportation Officials supporting city practitioners on mobility projects in major North American cities. CGCI focuses on empowering local officials and communities to become change makers. Its *Global Street Design Guide* offers technical details about complete streets design and supports practitioners worldwide in redefining the role of streets.[68]
- The **Institute for Transportation and Development Policy (ITDP)**, in its *TOD Standard 3.0* of June 2017, outlines eight core principles of urban design and spatial planning, each supported by specific performance objectives and easily measurable indicators or metrics[69] In 2018, ITDP released *Pedestrians First: Tools for a Walkable City* to facilitate the understanding and measurement of features that promote walkability in urban environments around the world at multiple levels.[70]
- The **MobiliseYourCity Partnership** assists beneficiary partners in preparing NUMPs and SUMPs. Along with support and consultation at early stages, the partnership provides guidance in budgeting and financial planning, such as the development of financial mechanisms and the initiation of funding to secure implementation.[71]
- The **Transformative Urban Mobility Initiative (TUMI)** aims to change mobility for the benefit of both people and the environment with a view to the future. The organisation supports policy makers in implementing transformative transport pilot projects based on innovation, knowledge and investment with the objective of sharing knowledge on modern mobility concepts among planners.[72]

Key indicators

	2017*	2019/2020*	% change
Policy Indicators			
Congestion charging zones (# of zones worldwide)	17	17	0
Low-emission zones (# of cities worldwide)	251	274	9%
Vehicle restrictions (# of cities worldwide)	28	28	0%
Sustainable urban mobility plans (SUMPs) (# of plans)	1,588	1,686	6%
Market Development Indicators			
Diesel fuel prices (average US cents/litre)	87.2 (2016)	105.6 (2018)	21%
Super petrol fuel prices (average US cents/litre)	97.1 (2016)	113.3 (2018)	17%

(*) Data are for the indicated year unless noted otherwise.

Source: See endnote 73 for this section.

In Practice: Additional Policy Measures

Policy targets set

General targets for comprehensive mobility planning

- **Malaysia** introduced a National Transport Policy (2019-2030) that includes actions such as prioritising public transport, accelerating low carbon initiatives and enforcing compliance with international environmental standards.[74]
- **Mexico City**, Mexico introduced a 2019-2020 Mobility Strategy focused on integration measures (such as a uniform fare across all public transport), cycling infrastructure and improving vehicle efficiency.[75]

Modal share targets

- In 2018, **San Francisco**, USA set a target for 58% of travel to occur via sustainable transport modes (cycling and public transport) by 2019 and 80% by 2030 (*see Figure 5*).[76] The city has implemented wide-ranging transport demand management measures (such as mixed-use projects, parking management, active transport and delivery optimisations) in an effort to shift to more sustainable options and to outweigh the influence of increasingly popular ride-hailing services.[77]
- **Zambia** launched a Non-Motorised Strategy in April 2019 that has similar targets and implementation time frames as the 2020 SUMP in **Kisumu**, Kenya.[78]

Policy measures adopted

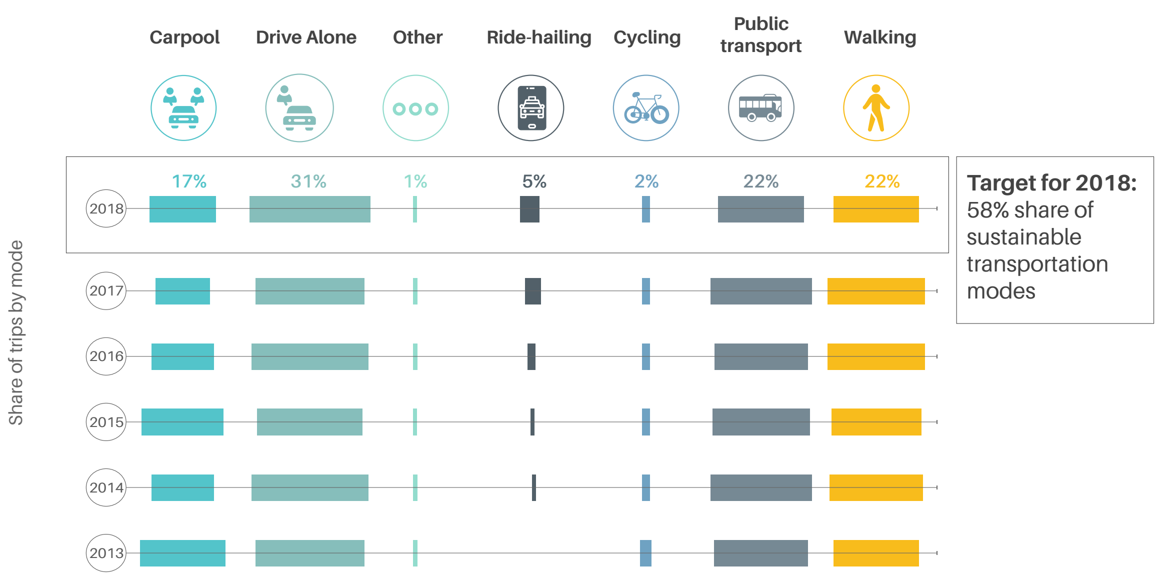
National urban mobility plans (NUMPs)

- In 2020, the government of **Nepal** approved the #AirQuality Management Action Plan of Kathmandu Valley, aiming to develop integrated bus transport systems.[79]
- **Singapore** released in 2019 its Land Transport Master Plan 2040, while maintaining its cap on the growth of commercial vehicles and a zero-growth policy for other types of cars.[80]
- **South Africa** launched a Green Transport Strategy in 2018 that fosters alternative fuels and efficient-technology vehicles, new fuel economy standards, a modal shift to rail and public transport, biogas and e-charging stations, a review of the levy on CO_2 emissions and limits on the circulation of trucks in urban hubs.[81]
- **Turkey** adopted legislation in 2019 aimed at improving energy efficiency in the transport sector by incentivising alternative fuels, improving transport infrastructure and reducing vehicle use in city centres.[82]

Sustainable mobility plans at the local level supported by national and regional policies

- The **EU**, through its Sustainable and Smart Mobility Strategy towards zero-pollution transport, encourages city governments in EU Member States to put in place their own SUMPs by 2030.[83]

Figure 5. Transport in San Francisco by modal share, 2013-2018



Source: See endnote 76 for this section.

- **Cameroon**, with the support of MobiliseYourCity, advanced its NUMP, which is helping to guide the urban mobility plans in Doula and Yaoundé.[84]
- **Estonia** was preparing a new national transport plan for the 2021-2030 time frame, and SUMP processes were under way in the cities of Kohtla-Järve/Jõhvi, Narva, Pärnu, Tallinn and Tartu.[85]
- In **Italy**, an estimated EUR 58 million (USD 70 million) has been dedicated to developing SUMPs and related projects since 2019.[86] The country also launched its Sustainable Urban Mobility Incentive Program, providing EUR 15 million (USD 18 million) to develop cycling infrastructure, shared mobility and mobility management activities to municipalities with more than 50,000 inhabitants.[87] By October 2020, **Italy** had 44 approved SUMPs, 40 adopted SUMPs and 96 SUMPs in development.[88]
- Additional cities that advanced or completed sustainable mobility plans in 2019 and 2020 included **Feira de Santana**, Brazil; **Doula** and **Yaoundé**, Cameroon; **San José's four districts** in Costa Rica; **Ambato** and **Cuenca**, Ecuador; **Madeira**, Portugal; **Belgrade**, **Šabac**, **Pirot** and **Valjevo** in Serbia; **Greater Kampala**, Uganda; **Antofagasta**, Chile; and the western Balkan capitals of **Tirana**, Albania; **Sarajevo**, Bosnia and Herzegovina; and **Podgorica**, Montenegro.[89]

Transit-oriented development

- The presence of public transit makes it possible to develop urban areas around this infrastructure, guaranteeing residents access to a variety of transport options. Bogotá, **Colombia** included transit-oriented development principles in the planning of its first metro line and gave the new managing agency a mandate to advance land value capture mechanisms around its stations.[90]
- When **Quito**, Ecuador built its first metro line in 2018, it put in place a regulation to encourage real estate development around mass transport.[91]
- In conjunction with the construction of its new underground light rail line, **Guadalajara**, Mexico advanced an ambitious urban renovation project, the Paseo del Alcalde, that features more dense, diverse and well-connected urban development as part of a low-emission development programme.[92]
- **Nairobi**, Kenya announced plans in 2019 to build a multi-modal urban development project focused on expanding rail infrastructure, to take place over 20 years at an estimated cost of KES 29.7 billion (USD 257 million).[93]

Speed reductions

- The **Netherlands** lowered the driving speed on highways to 100 kilometres per hour in March 2020 to reduce greenhouse gas emissions from vehicles and to free up the emission budget for housing construction.[94] In October 2020, the country set a new speed limit for built-up areas at 30 kilometres per hour.[95]
- **Spain** announced that it would reduce its speed limit in cities to 30 kilometres per hour in an effort to halve the number of traffic-related deaths and injuries by 2030.[96]

Congestion charging and road tolls

- An electronic toll system was introduced on national highways in **India** in December 2019.[97]
- **New York City**, USA approved congestion charging in 2019 after several years of discussion in the state legislature.[98] A surcharge is already in place for on-hire vehicles and licensed taxis, but full implementation has been delayed and is expected by 2022.[99] The collected funds will support the Metropolitan Transportation Authority's capital programme.
- Proposals for congestion charging exist in **São Paulo**, Brazil; **Beijing**, China; and **San Francisco**, USA, but final decisions are pending before implementation can occur.[100]

Parking management

- In 2017, **Mexico City** became the first large city worldwide to eliminate parking minimums (regulations requiring a certain number of parking spaces per building), and Edmonton, **Canada** also decided to eliminate parking minimums in 2020.[101]
- In 2019, **Amsterdam**, the Netherlands began progressively removing 10,000 parking spaces within the city.[102]
- **Warsaw**, Poland has tightened parking regulations by implementing paid zones for on-street parking and increasing both parking fees and fines.[103]

Off-peak deliveries

- Many major metropolitan areas support off-hour deliveries – freight deliveries made outside of regular business hours – with the goal of reducing the pollution and congestion associated with daytime deliveries. Recent examples include **Brussels**, Belgium; **São Paulo**, Brazil; **Bogotá**, Colombia; **London**, UK; and **New York City**, USA.[104]

3.3 Walking and Cycling

Key findings

Demand trends

- More than one-third of all trips globally are made on foot or by bicycle. Walking is the principal transport mode in most of the Global South, accounting for up to 70% of trips in some cities.
- Modal shares for walking and cycling have declined in many parts of the world (with some exceptions), driven by rising car ownership, poor infrastructure and unsafe conditions.
- Pedestrians are the main victims of road crashes in low-income countries, where they accounted for more than one-third of fatalities in 2016.
- In most areas of the world, male bicycle users greatly outnumber female users, whereas women walk for transport to a greater extent than men, due in part to gender differences in trip patterns.
- Cargo bicycles are enjoying a renaissance and recognition for being a cleaner, safer and more efficient means than trucks of transporting people and freight in cities.

Emission trends

- As nearly zero-emission modes of transport, walking and cycling contribute to Paris Agreement targets for reducing transport-related emissions, while moving 6-8 times more people per hour in the same space as automobiles.
- Walking and cycling are estimated to be feasible substitutes for more than 40% of short car trips; this could save nearly 5% of carbon dioxide (CO_2) equivalent emissions from car travel on top of the current estimated 5% of "avoided" emissions from walking and cycling trips.
- Recent growth in electric-assisted bicycles (e-bikes) is a positive trend for mobility, but it has a potentially negative impact on transport emissions if e-bikes replace zero-emission modes.

Policy measures

- Countries and cities are expanding integrated planning approaches that include walking and cycling as a central element and are setting targets for specified shares of these modes.

- Investments in walking and cycling infrastructure have gained momentum worldwide but remain far more limited than investments in traditional roadways.
- Many cities have restricted the flow and speed of motorised vehicles to improve the safety of pedestrians and cyclists, with some major cities reporting zero pedestrian and cycling deaths.
- An increasing number of global guidelines are specifying technical standards for creating human-scale street infrastructure to improve the safety, comfort and inclusion of all users.
- Increasing recognition of the value of walking and cycling has led to their inclusion in recent global policy frameworks, including the WHO Global Action Plan for Physical Activity 2018-2030 and the 2020 Stockholm Declaration on Road Safety.

Impacts of the COVID-19 pandemic

- During the pandemic, walking and cycling have demonstrated their potential as resilient transport modes with low contagion risks, endorsed by the World Health Organization.
- In 2020, more than 194 cities introduced dedicated space for pedestrians or temporary protected bike lanes, many of which are slated to become permanent.
- A change in travel preferences caused by the COVID-19 pandemic resulted in increased walking and cycling during the initial phase of the pandemic, which has been sustained in some places.

Overview

At little to no monetary cost, walking and cycling enable large segments of the world's population – including the poor, the young and the elderly – to independently fulfil their daily transport needs, while improving their personal health and posing little risk to other road users. Walking and cycling are ideal for short journeys, which comprise the majority of all journeys. Walking underpins all other modes of travel by providing "first- and last-mile" access, and walking and cycling have high potential for intermodal access to public transport, making them key to a sustainable modal shift.[1]

Walking and cycling are particularly well-suited transport solutions for addressing the ongoing and interlinked crises of climate change, road deaths, physical inactivity and urban liveability. They have proven to be the most resilient forms of transport and have been integral to mobility responses in the face of natural disasters and health crises, including the COVID-19 pandemic (*see Box 1*).[2] However, pedestrians and cyclists remain among the most at risk in road environments, warranting additional investments in safer infrastructure.

Although walking and cycling are both zero-emission, active modes of transport, significant differences exist between them in terms of speed, ability, usage rates, and infrastructure and policy needs. They are often grouped together in policy frameworks at the local, national and global levels, but deserve separate attention with different strategies and interventions.

Demand trends

More than one-third of all trips globally are made on foot or by bicycle.[3] **Walking is the principal mode of transport in most of the Global South, accounting for up to 70% of trips in some cities,** particularly in **Africa** and **Asia** (*see Figure 1*).[4] Virtually all trips include some degree of walking, which is not reflected in estimates of modal shares.[5] For cycling, shares exceeding 15% are found in **Denmark**, **the Netherlands**, **Japan** and **China.**[6] More than 1 billion bicycles are present worldwide, and recreational use is widespread, providing key building blocks for greater use.[7]

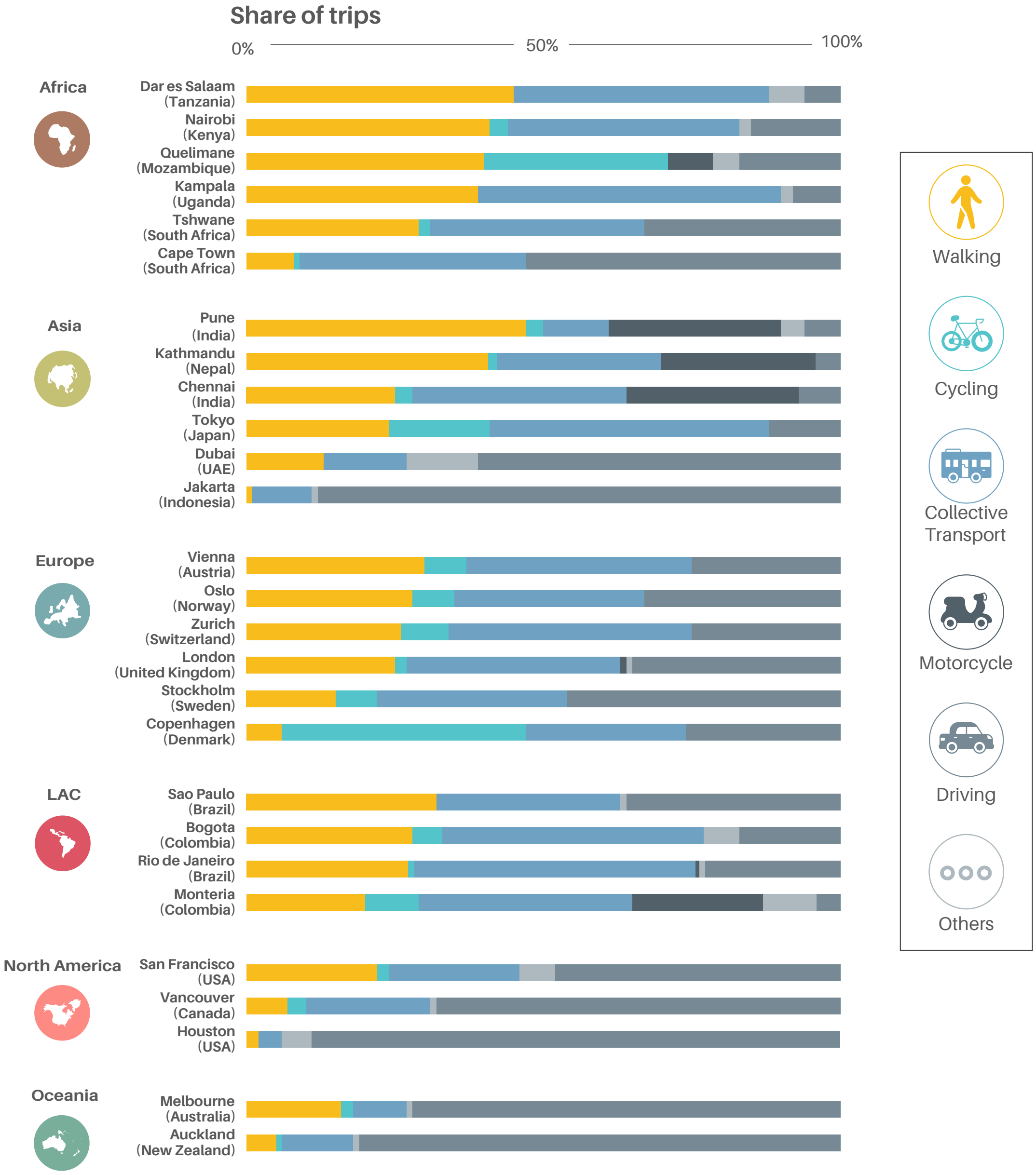
Across the Global South, high shares of walking (predominantly) and cycling largely reflect poverty or the lack of other transport options. World Health Organization (WHO) surveys between 2002 and 2016 found that people in low-income countries walk or cycle for transport 63 minutes per day on average, compared to 41 minutes for middle-income countries and only 25 minutes for high-income countries.[8]

Modal shares for walking and cycling have declined in many parts of the world (with some exceptions), driven by rising car ownership, poor infrastructure and unsafe conditions. The ongoing decline in walking and cycling rates in rapidly motorising and urbanising low- and middle-income countries in **Africa**, **Asia** and **Latin America and the Caribbean** makes retaining higher shares of these modes and preventing a high-carbon transport trajectory a key climate and public health priority.[9] By contrast, in much of the industrialised world, rates of car ownership have slowed, and some cities have seen increases in cycling rates.[10]

- Walking's share of trips has declined since 2000 in a diverse set of countries (e.g., **Austria**, **Germany**, **India** and the **UK**) and cities (**Almaty**, **Bogotá**, **Kathmandu**, **Rio de Janeiro** and **Tokyo**), generally in favour of increased auto use.[11]
- In **Beijing**, China the share of trips taken by bicycle fell from 58% in 1986 to 15% in 2011.[12]
- Bicycle use in **Barcelona**, Spain and **Paris**, France increased 150% and 135%, respectively, after these cities launched cycling programmes in 2007.[13]

Evidence from countries and cities where walking and cycling are prioritised and integrated into the transport system demonstrates that these declines can be reversed.[14] High-density, mixed-use neighbourhoods and cities are particularly favourable for walking and cycling due to shorter trip distances, which also allows for more efficient and viable public transport provision and multimodal trips.

Figure 1. Share of trips by transport mode in selected cities, various years



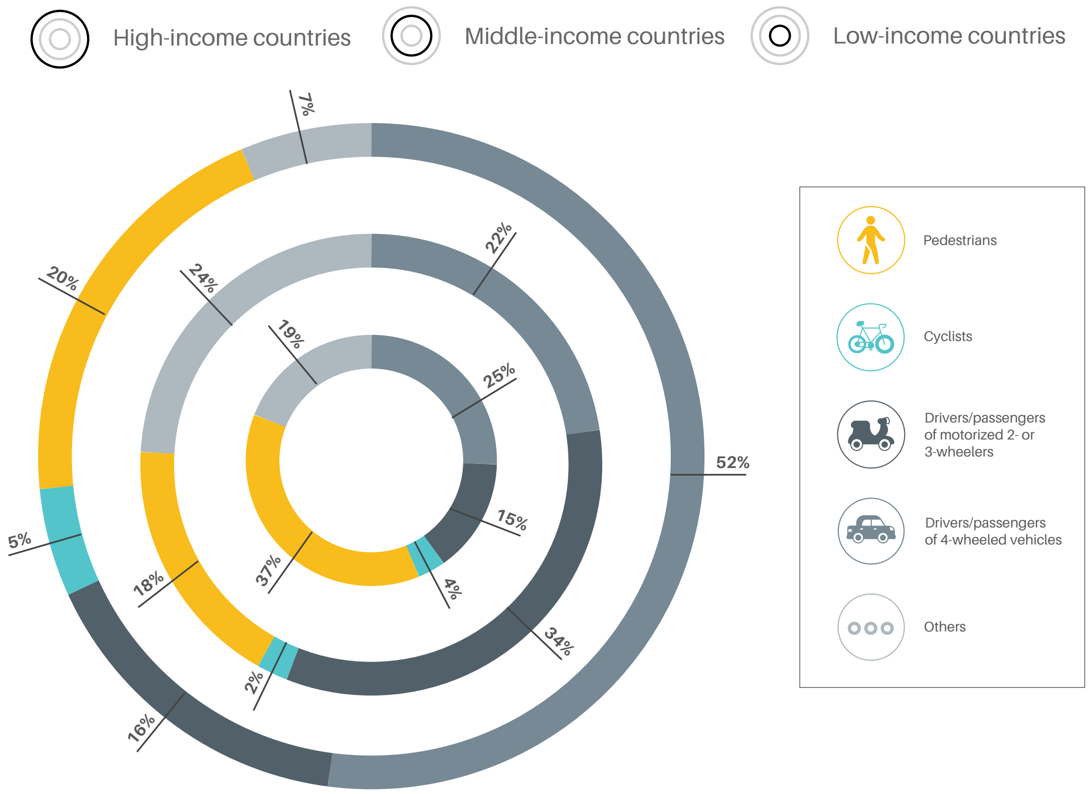
Source: See endnote 4 for this section.

While density is important to walking and cycling potential, short trip distances alone are not sufficient to foster widespread use. Overwhelming evidence indicates that road design and the provision of high-quality infrastructure and public space is fundamental to stimulating walking and particularly cycling. The rise of electric bicycles also represents an opportunity to cover longer distances by cycling (*see Section 3.8 on Electric Mobility*).

Pedestrians are the main victims of road crashes in low-income countries, where they accounted for more than one-third of fatalities in 2016 (*see Figure 2*).[15] Pedestrians and cyclists are among the most vulnerable road users, and actions to improve safety conditions are needed. In low-income countries in particular, road fatality rates for pedestrians remain high compared to other transport modes. In 2019, pedestrians accounted for 93% of combined walking and cycling deaths in Africa, due in part to the higher share of walking trips relative to cycling, rather than to the safety characteristics of these modes.[16]

Efforts related to the United Nations' First Decade of Action for Road Safety (2011-2020) identified strong synergies between improved road safety and the promotion of walking and cycling.[17] Safety

Figure 2. Road fatalities by group in low-, middle- and high-income countries, 2016



Source: See endnote 15 for this section.

strategies such as Vision Zero have focused on changing road designs and lowering vehicle speeds, which in turn improve the safety and comfort of pedestrians and cyclists.[18]

In most areas of the world, male bicycle users greatly outnumber female users, whereas women walk for transport to a greater extent than men, due in part to gender differences in trip patterns. A positive correlation exists between the share of trips by cycling, and female bicycle use.[19] Low-stress, inclusive conditions for walkers and cyclists are essential to achieve equity in transport and to promote broader use of these two modes, particularly by women, youth and the elderly.

Because women display different mobility patterns related to trip purpose, trip chains and travel distance, they may be more sensitive to the quality of infrastructure for walking and cycling.[20] Meanwhile, shorter travel distances, more local trips and/or trips combining walking, cycling and other modes, and higher public transport use would likely boost walking rates across genders.[21]

- In research studies, women and men identify different challenges to walking. For example, 50% more women than men indicate personal safety challenges (such as harassment or assault), and 43% more women point to the difficulties of travelling with groceries and bags.[22] In **Singapore**, 200% more women identify accompanying children or relatives as a challenge to walking.[23]

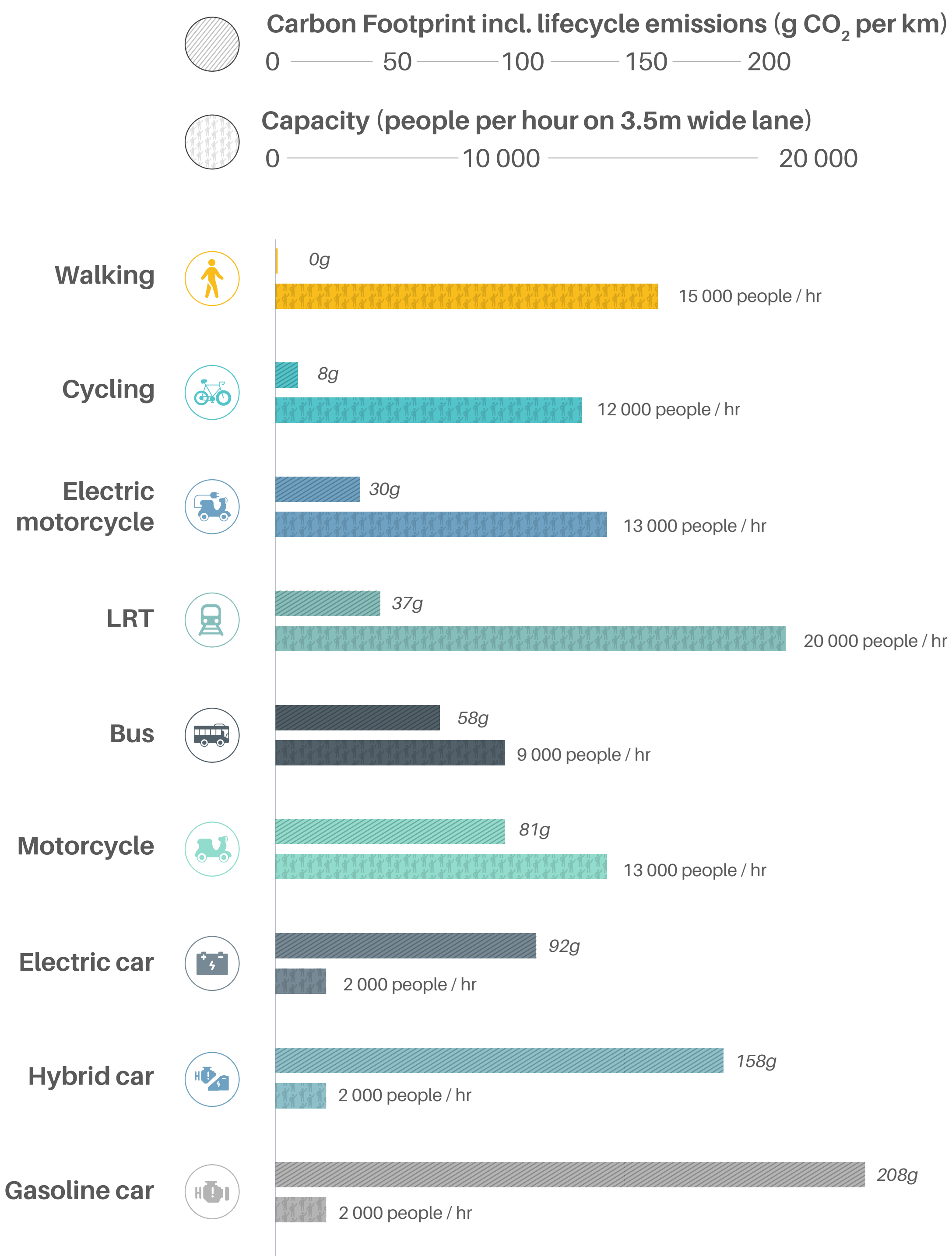
Bogotá, Colombia, where women make up only 21% of daily cycling trips, has adopted the long-term goal of gender parity in cycling and launched the first international "50-50 More Women on Bikes!" congress.[24]

- In **Denmark** and the **Netherlands**, where cycling conditions are generally safe and comfortable, female cyclists slightly outnumber males, and high cycling rates also exist among adolescents and the elderly.[25]

Cargo bicycles are enjoying a renaissance and recognition for being a cleaner, safer and more efficient means than trucks of transporting people and freight in cities.

- Around 40,000 cargo bikes are used daily In the metropolitan area of **Copenhagen**, Denmark, and more than 11,000 cargo bike deliveries occur every day in Rio de Janeiro, Brazil.[26]
- In **Lagos**, Nigeria, cargo bikes are commonly used for waste collection.[27]
- In **Kigali**, Rwanda, cargo bikes carry heavy goods loads and serve as bicycle taxis, providing a means of employment for thousands of young men.[28]
- In **Europe**, 25% of all goods and 50% of all light urban deliveries could be serviced by cargo bikes.[29]

Figure 3. Global capacity and CO_2 footprints for different transport modes and vehicles



Source: See endnote 30 for this section.

Emission trends

As nearly zero-emission modes of transport, walking and cycling contribute to Paris Agreement targets for reducing transport-related emissions, while moving 6-8 times more people per hour in the same space as automobiles (*see Figure 3*).[30]

Walking and cycling are estimated to be feasible substitutes for more than 40% of short car trips; this could save nearly 5% of CO_2 equivalent emissions from car travel on top of the current estimated 5% of "avoided" emissions from walking and cycling trips.[31] Rates of walking and cycling vary widely depending on land use, density and infrastructure, as well as cultural and social factors. In some cities, walking and public transport account for up to 90% of trips, and cycling for nearly 50% of trips.[32]

- Some high-density cities have high levels of walking and public transport, including **Hong Kong** (91%) and **Singapore** (66%) in Asia, and **Vienna** (68%) and **Zurich** (67%) in Europe.[33]
- High cycling rates occur in certain compact, cycling-friendly cities such as **Bordeaux**, France (where cycling accounts for 13% of all trips) and **Utrecht**, the Netherlands (51% of all trips).[34]

Recent growth in electric-assisted bicycles (e-bikes) is a positive trend for mobility, but it has a potentially negative impact on transport emissions if e-bikes replace zero-emission modes.[35] Sales of bicycles increased strongly in recent years through rising demand for e-bikes from both individual consumers and shared bike fleet operators.

- Overall e-bike sales increased 120% globally in 2019, and major bicycle brands doubled their e-bike sales that year.[36]
- More than 300 million e-bikes are projected to be in use globally by 2023.[37]
- The e-bike market share surpassed 50% in **the Netherlands** in 2019.[38]
- Bicycle exports from **Chinese Taipei** included 410,000 e-bikes in 2020, a 21% increase from 2019.[39]

Policy measures

Countries and cities are expanding integrated planning approaches that include walking and cycling as a central element and are setting targets for specified shares of these modes. Walking and cycling have strong synergies with public transport, which generates a large share of walking journeys for last-mile access. The integration of cycling and public transport has great potential to increase the catchment areas of public transport stations.[40]

Walking and cycling infrastructure is generally relatively inexpensive and can be implemented rapidly, although it requires careful attention to detail and design standards for successful implementation. Prioritising walking and cycling contributes to physical and psychological health, access and safety.

- In 2019, the government, research institutions and social organisations in the **Netherlands** joined the National Platform for Walking, aiming to exchange knowledge and experiences to create more space for walking.[41]
- **Queensland**, Australia launched its first Walking Strategy and two-year Action Plan in 2019 with supporting investments.[42]
- **Germany's** environment agency launched a Pedestrian Policy Framework ("Geht doch!") in 2018 that aims to increase the share of walking trips in big cities from 27% in 2011 to 41% by 2030, and the share in rural areas from 24% to 35%.[43]
- The **Tallinn region** of Estonia aims to achieve 10% cycling and 15% walking modal shares by 2035.[44]
- Promoting cycling is increasingly recognised as an urban transport strategy in **Africa**, with 35% of countries in the region having a walking and cycling policy as of March 2021.[45] **Cape Town**, South Africa launched a cycling strategy in 2017, and **Kampala**, Uganda opened its first dedicated cycling lane in 2018.[46]
- **Lagos**, Nigeria intends to increase the share of walking and cycling to at least 50% of all trips and to maintain this level (or greater) over a 15-year period.[47]
- In 2020, **Peru** adopted a new law for the promotion and regulation of cycling that includes provisions for education, infrastructure, parking, integration, bike-sharing and incentives for employees.[48]
- 50% of vehicle taxes and the motor vehicle transfer fee collected in Cuenca, **Ecuador** are earmarked for cycling infrastructure and the promotion of tactical urbanism (local, short-term, low-cost activities that are city- and citizen-led).[49]

Investments in walking and cycling infrastructure have gained momentum worldwide but remain far more limited than investments in traditional roadways.[50] National policies do not sufficiently enable safe and enjoyable walking and cycling, despite the sizable benefits of these modes. However, many cities have prioritised walking infrastructure both preceding and during the COVID-19 pandemic.

- Between 2018 and 2020, cities including **Skopje**, North Macedonia; **Seattle**, USA; **Beijing**, China; **Jakarta**, Indonesia and **Singapore** established new master plans to promote walking and cycling.[51]
- The transport department of **Mombasa**, Kenya completed 9 kilometres of wide footpaths on five streets in 2019.[52] **Tel Aviv**, Israel added 11 new pedestrian streets in commercial areas in 2020.[li]
- **Munich**, Germany has budgeted EUR 1.6 billion (USD 1.9 billion) to expand cycling infrastructure through 2025.[53] **Ireland** has committed to allocating 10% of its total transport capital budget to cycling projects and another 10% to pedestrian infrastructure, resulting in EUR 360 million (USD 428 million) for these modes every year.[54]

Dedicated long-distance cycling "highways", originally launched in the **Netherlands**, now cover more than 18 inter-city routes in that country and are increasingly common worldwide.[55] **Beijing**, China opened its first 6.5-kilometre route in 2019; **Bogotá**, Colombia is planning a cross-city 25-kilometre "cycling avenue"; and in **Germany**'s Ruhrgebiet, 101 kilometres of bike freeways connecting Duisburg and Hamm are under construction.[56]

Investment in bike lanes and pedestrian infrastructure yields greater positive job creation impacts than the manufacturing of cars and electric car batteries, creating between 8 and 23 jobs for every USD 1 million invested.[57] Cycling jobs (e.g., positions in bicycle manufacturing, repair, construction of cycling infrastructure, cycle tourism and bike sharing operations) are more geographically stable than other sectors, benefiting local economies and offering access to the labour market for less-qualified workers.[58]

Many cities have restricted the flow and speed of motorised vehicles to improve the safety of pedestrians and cyclists, with some major cities reporting zero pedestrian and cycling deaths.[59] Walking and cycling rates are likely to accelerate when safe, dedicated infrastructure is provided, supporting the growth in women's cycling in particular.[60] In August 2020, the UN General Assembly proclaimed 2021-2030 the Decade of Action for Road Safety 2021-2030, aiming to prevent at least 50% of road traffic deaths and injuries by 2030.[61]

- In **Africa**, more than 9 out of 10 walked and cycled streets are below the minimum level of service.[62]
- **Oslo**, Norway and **Helsinki**, Finland recorded zero pedestrian deaths during 2019, with Oslo also recording zero cycling deaths; this achievement is the result of decades of progress on road safety along the lines of Vision Zero, including by reducing speed limits, disincentivising automobile use and implementing safe infrastructure.[63]
- Campaigns to dismantle pedestrian bridges on urban streets and implement safe and level crossings have succeeded in various cities in **Mexico** as well as in **Medellín**, Colombia and **San Francisco**, USA.[64]
- Ciclovias (bikeways), car-free streets and "open streets" programmes continue to expand across cities around the world, creating safer and more equitable conditions for pedestrians. Several cities held their first ever open streets events between 2018 and 2020, including **Abuja**, Nigeria; **Temuco**, Chile; and **Shah Alam**, Malaysia.[65] Since 2018, **Ethiopia** has held the Menged Le Sew car-free day in up to 20 cities every month.[66]

An increasing number of global guidelines are specifying technical standards for creating human-scale street infrastructure to improve the safety, comfort and inclusion of all users. They include the *Global Street Design Guide* (2017), *Designing Streets for Kids* (2020) and *Pedestrians First: A Tool for Walkable Cities* (2018), which has been applied in a growing number of countries, including **Ethiopia** and **Zambia**.[67]

- Walking and cycling guidelines have been formulated for cities such as **Lagos**, Nigeria (2018); **Lima**, Peru (2017); and **Pune**, India (2016).[68]
- In 2019, Austroads updated the Pedestrian Planning and Design Guidance for **Australia** and **New Zealand** to align with national and international good practices.[69]
- Technical guidelines for cycling infrastructure were adopted in **Colombia** in 2016.[70] At a sub-national level in 2019, **British Columbia**, Canada adopted an active transport design guide, and **Queensland**, Australia planned a state cycling network.[71]
- A guidebook for tactical urbanism in **Indian** cities, released in 2020, provides case studies from recent developments in **Coimbatore, Mumbai, Ranchi, Rohtak** and **Udaipur**.[72]

Increasing recognition of the value of walking and cycling has led to their inclusion in recent global policy frameworks, including the WHO Global Action Plan for Physical Activity 2018-2030 and the 2020 Stockholm Declaration on Road Safety.[73] There is clear evidence that density and mixed land-use patterns are key to maintaining and increasing the modal share for walking and cycling. Efforts to improve the safety of road environments also help to ensure more widespread use, particularly by women, youth and the elderly.

- The **WHO's Global Action Plan on Physical Activity 2018-2030** ("More active people for a healthier world") aims to provide policy recommendations for walking and cycling to contribute to achieving the UN Sustainable Development Goals (SDGs). The plan targets a 15% relative reduction in the global prevalence of physical inactivity in adults and adolescents by 2030.[74]
- The majority of the **UN SDGs** can benefit from more (and safer) walking and cycling.[75] However, the UN's 2030 Agenda for Sustainable Development does not mention these modes specifically, and walking and cycling were included in only 2 of the 47 Voluntary National Reviews of the SDGs submitted by UN Member States in 2020.[76]
- The UN's **New Urban Agenda** adopted in 2016 sets a path to guide urbanisation over the next 20 years. In the area of mobility, it focuses on the availability of public spaces and the promotion of safe walkability and cycling, aimed at improving health and well-being.[77]
- The **2020 Stockholm Declaration on Road Safety** explicitly recognises that improvements in road safety outcomes require a "shift toward more walking and cycling as well as integrating these modes with the use of public transport" and also need to include "land-use, street design, transport system planning and governance, especially for vulnerable road users and in urban areas".[78]

Box 1. Impacts of the COVID-19 pandemic on walking and cycling

During the COVID-19 pandemic, walking and cycling have demonstrated their potential as resilient transport modes with low contagion risks, as endorsed by the World Health Organization. Walking and cycling have proven their fundamental importance to human mobility and their value for generating positive externalities and societal gains. Walking and cycling are therefore key elements for building socio-economic resilience in sustainable transport systems, which can be expanded to prepare for future shocks.

In 2020, more than 194 cities introduced dedicated space for pedestrians or temporary protected bike lanes, many of which are slated to become permanent. A preliminary assessment of measures taken indicates positive results and potential for longer-term change in cities around the world. Examples include the following:

- A number of cities have widened footpaths and sidewalks to promote walking, including **London**, **Milan** and **Nairobi**. Israel's **Tel Aviv-Yafo** municipality implemented a policy to prioritise pedestrian and cycling zones, including 11 new pedestrian streets and 20 kilometres of new bicycle lanes, increasing attractiveness for active transport. **Cape Town**, South Africa constructed 17 kilometres of new walkways for pedestrians and cyclists to facilitate commuting while enabling social distancing. Mobility grids in **Barcelona**, Spain are creating more walkable neighbourhoods with minimal infrastructure needs.
- In **Latin American** cities, temporary cycling infrastructure was implemented in 2020 to provide a safe mobility alternative. **European** cities announced more than 2,000 kilometres of temporary infrastructure and implemented over 1,000 kilometres. In **India**, the Cycles4Change Challenge and the Streets for People Challenge sought to support cities in implementing cycling-friendly actions and creating safe, healthy and happy streets through rapid low-cost measures.
- In **North America**, streets were opened for pedestrians and cyclists, for recreation, and in some cases for outdoor dining. A major road in **Mombasa, Kenya** was converted into a pedestrian zone. In **Turin**, Italy, public space near a school garden was transformed into learning space to guarantee social distance. Cities such as **Edmonton** in **Canada,** Charleston and **Los Angeles** in the **USA**, and Adelaide and Sydney in **Australia** disabled pedestrian push buttons and automated pedestrian phases.
- A study of infrastructure measures adopted in the wake of COVID-19 in 110 **European** cities showed a 7% increase in cycling on average, with estimated health benefits of EUR 3 billion (USD 4.3 billion) per year. In **London**, the implementation of low-traffic neighbourhoods showed an increase in walking, with a potential for sustained growth at low cost. Also in the **UK**, a GBP 250 million (USD 350 million) emergency active mobility fund facilitated pop-up bike lanes, wider pavements and safer crossings as the first stage of a GBP 2 billion (USD 2.8 billion) investment in improved walking and cycling infrastructure.
- Temporary measures can be converted into permanent infrastructure, as demonstrated in **Bogotá**, Colombia and **Paris**, France, where large sections of initial temporary networks were implemented permanently. **Lima**, Peru implemented more than 470 kilometres of new temporary and permanent infrastructure. In **Mexico**, "emergent" infrastructure was being expanded in various cities, including along main thoroughfares in **Guadalajara, León and Mexico City**. Some cities elected to fast-track existing plans, such as **Melbourne**, Australia, which is realising 40 kilometres of cycling lanes.

A change in travel preferences caused by the COVID-19 pandemic resulted in increased walking and cycling during the initial phase of the pandemic, which has been sustained in some places. In April 2020, the **UK**, the **USA** and other countries registered the highest retail sales volumes of bicycles on record. As of June 2020, the UK reported sales of 1.3 million bicycles as a direct result of COVID-19, and Google reported a two-fold increase in searches related to e-bikes between March and October 2020.

Rising bicycle sales in places that had seen declining interest in previous decades (such as **India** and the **Philippines**), combined with factory closures, led to shortages of bicycles and parts. In **Kampala**, Uganda, bicycle mechanics reported a boom in customers following restrictions on public transport. In **Scotland,** walking extensively gained popularity during both lockdown and post-lockdown periods, with the potential to maintain this trend after the COVID-19 pandemic.

Source: See endnote 2 for this section.

Initiatives supporting walking and cycling

- A group of non-profit organisations dedicated to resilient, inclusive and sustainable mobility created the **COVID Mobility Works** platform to collect initiatives by local governments and non-governmental organisations to help policy makers, innovators, researchers and advocates around the world.[79] As of October 2020, the database included more than 500 initiatives in 245 cities.[80] Additional resources on the rapid implementation of sustainable mobility measures during COVID-19 include **TUMI's Corona Transport Knowledge Platform** and the **Pedestrian and Bicycle Information Center** at the University of North Carolina, USA.[81]
- **Despacio** is a non-profit organisation that conducts research to promote quality of life and to improve the welfare of communities.[82] It develops and implements projects to make people feel good, generally based on the "slow movement" philosophy in every aspect of life: from the individual and family level to more collective topics such as planning and managing slow, humane and sustainable urban and regional spaces.
- Based on a systematic review of EU cycling policies, the **European Cyclists' Federation** developed the EU Cycling Strategy: Recommendations for Delivering Green Growth and an Effective Mobility in 2030, which seeks to inspire the European Commission to develop its own cycling strategy to avoid policy fragmentation across different institutions.[83]
- The EcoMobility initiative of **ICLEI-Local Governments for Sustainability** supports cities across the world to prioritise walking and cycling in the mobility pyramid.[84] Through the CitiesSHIFT project and the EcoMobility SHIFT+ performance measurement tool, ICLEI supported cities in **China**, **India** and **Uganda** to measure ecomobility and create an ecomobility pathway for long-term transformation.[85]
- The **International Federation of Pedestrians** advocates for walking and public space enhancement, especially safety, on behalf of its 48 member organisations from around the world.[86]
- The **Share the Road Programme**, jointly led by the **UN Environment Programme** and the **FIA Foundation for the Automobile and Society**, focuses on best practices and works with governments around the world to prioritise the needs of pedestrians and cyclists.[87] The programme supports developing countries to shift their priorities away from the car-driving minority and towards investing in infrastructure for the walking and cycling majority.[88]
- **Velo-city**, the premier international planning conference on cycling, brings together knowledge and information to encourage cycling as part of daily transport and recreation, and seeks to leave all participants as well as other target groups enriched and inspired. Velo-city conferences attract around 1,400 delegates from more than 60 countries.[89]
- **Walk21**, an international charity dedicated to ensuring the right to walk and the opportunity to enjoy it for everyone worldwide, convenes the largest international conference on walking each year.[90] Walk21's **Global Sidewalk Challenge** aims to build or rehabilitate 100,000 kilometres of additional dedicated, safe, barrier-free sidewalks in the proximity of public transport hubs; in 2019 projects to deliver new sidewalks were undertaken in **Lagos**, Nigeria and **Medellín**, Colombia, and additional projects will be realised in other low- and middle-income countries by 2030.[91] Walk21 is also launching the **Pathways to Walkable Cities** campaign to promote good governance for walkability and **Global Walking Indicators** to empower national agencies to generate data, report on and inform action, and accelerate progress towards a more walkable world.[92]
- The United Nations has declared June 3rd **World Bicycle Day** and encourages Member States to devote attention to the bicycle in cross-cutting development strategies and to include the bicycle in international, regional, national and sub-national development policies and programmes.[93]
- The **World Bicycle Forum** has been held yearly since 2012, and the 2020 event was held virtually in Kathmandu, **Nepal**, the first country outside of South America to host the forum.[94]
- The **World Cycling Alliance** is an advocacy network aimed at sharing best practices, research and statistics to improve cycling around the world. Its main objective is to promote bicycles as a mode of transport, including leisure and touristic cycling, for the benefit of people worldwide.[95]

Credits: ITDP

Key indicators

Reliable data on walking and cycling are generally lacking, as the existing data often are not disaggregated, are not counted at all or are grossly undercounted due to an exclusive focus in travel surveys on the principal commuting mode. Data collection at the city and country level is critical to improve policy making and infrastructure prioritisation, and a global data collection programme is needed urgently.

Reporting gaps on walking and cycling correspond with a wider lack of data collection and a disregard for these modes in transport policy and planning, particularly in low- and middle-income countries undergoing rapid growth in car ownership. Because walking and cycling trips historically have not been measured via adequate tools, and limited efforts have been put in place to account for their performance, a lack of reliable data at all scales leads to undervaluation of these modes and makes targeting policies more difficult.

More recent use of mobile devices and digital applications, such as the Pedestrian First tool developed by the Institute for Transportation and Development Policy, makes it possible to track and gather information on walking and cycling to fill in some of the data gaps.[96]

	2017*	2019*	% change
Policy Landscape Indicators			
Countries with national walking and cycling plans (number of countries)	N/A	103	N/A
Market Development Indicators			
Modal share of walking	N/A	N/A	N/A
Modal share of cycling	N/A	N/A	N/A
Mean minutes walked by day	N/A	N/A	N/A
Mean minutes cycled by day	N/A	N/A	N/A
Bicycle ownership (bicycles per 1,000 people)	N/A	N/A	N/A
Cycling infrastructure (dedicated protected cycling lanes per capita)	N/A	N/A	N/A
Cycling fatalities in low-/middle-/high-income countries (percentage of all fatalities)		4% / 2% / 5% (2016)	
Walking fatalities in low-/middle-/high-income countries (percentage of all fatalities)		37% / 18% / 20% (2016)	

(*) Data are for the indicated year unless noted otherwise.

Source: See endnote 97 for this section.

In Practice: Additional Policy Measures

Policy targets set

- A key promise of **Paris** Mayor Anne Hidalgo's successful 2020 re-election campaign was to create a "15-minute city" oriented around walking and cycling.[98] Paris has accomplished most of the aims of its Plan Vélo (2015-2020) scheme and now boasts more than 1,000 kilometres of cycling infrastructure and is expanding the network into surrounding areas.[99]

Restricting or banning cars in key streets or city centres is an effective strategy to improve walking and cycling, and such measures were recently adopted in **Belgrade**, Serbia; **Edinburgh**, Scotland, UK; and **Melbourne**, Australia.[100] In **Leuven**, Belgium, the elimination of through-traffic in the city centre has boosted cycling rates 32%.[101]

Setting a new standard for bike-train integration, the new bicycle parking garage at the Central Station in **Utrecht**, the Netherlands accommodates 12,500 bicycles, with a plan to house 22,000.[102] Various public transport hubs in the country have integrated bicycle garages in recent years.[103]

In the **UK**, Sheffield City Region announced plans in 2020 for 1,000 kilometres of walking and cycling routes, including 800 safe crossings.[104]

In **Houston**, USA, where more than 90% of commuter trips are by car, a 1,000 kilometre on-street cycling network is being created.[105]

Credit: REUTERS/Mohamed Azakir

3.4 Urban Passenger and Freight Transport

Key findings

Demand trends

- Public transport systems continued to grow between 2010 and 2020, led by strong growth in Asia (for bus rapid transit, light rail and metro) and Latin America (for bus rapid transit). The global rapid transit-to-resident ratio (a measure of these three urban services) increased 5% between 2017 and 2019, with a 25% increase in China and a 13% increase in India.
- While Europe accounts for the vast majority of urban rail systems, the largest growth from 2010 to 2020 took place in Africa (333%), Asia (69%) and Oceania (50%).
- Worldwide development of bus rapid transit systems has declined significantly since its peak in 2014, although a gradual increase has occurred since 2018, with nine new systems added during 2019-2020.
- Paratransit (sometimes called "informal transport") remains the main motorised urban transport option in Africa and across cities in the developing world.
- More than one-third of all urban trips globally are made on foot or by bicycle. As a large majority of trips in cities are less than 5 kilometres, walking and cycling can substitute more than 40% of short car trips.

Emission trends

- Transport emission shares from private passenger cars in urban areas ranged from less than 10% in Dar es Salaam, Tanzania to more than 80% in Vancouver, Canada. Globally, cities report widely varying shares of transport carbon dioxide (CO_2) emissions, depending on their public transport investments, land-use patterns and supportive policies.
- Urban rail, with an average energy consumption of 0.12 kilowatt-hours per passenger-kilometre, is seven times more energy efficient per passenger than urban car trips.

Policy measures

- Cities around the world set ambitious targets and made financial commitments during 2019-2020 to enhance sustainable urban mobility.
- Innovative pricing schemes for public transport, including free models, have been introduced to incentivise behavioural change.
- As an approach to reduce congestion, improve air quality and prioritise public transport, walking and

cycling, governments are exploring the use of low-emission zones (LEZs), ultra-low-emission zones (ULEZs) and zero-emission zones (ZEZs).

- As commercial operations in cities become major emitters of greenhouse gases and add to congestion, freight transport policies have received rising attention from both decision makers and practitioners.
- Freight policies aimed at improving the efficiency of last-mile delivery have increased in importance, given that one-third of urban truck traffic is engaged in the pick-up of goods.
- LEZs, ULEZs and ZEZs can also cover freight vehicles and can restrict the access of polluting vans and trucks to city centres. Freight vehicles represent 5% of road vehicles globally but contribute 27% of transport greenhouse gas emissions and 50% of toxic air pollutants from transport.
- The penetration of electric trucks in global markets for medium- and heavy-duty vehicles is projected to reach 9.4% by 2030.
- Many urban freight initiatives focus increasingly on delivery using (mostly electric-assist) cargo bikes, including initiatives in Rio de Janeiro, Brazil; Copenhagen, Denmark; Hamburg, Germany; Amsterdam, the Netherlands; Kigali, Rwanda and New York City, United States of America (USA).

Impacts of the COVID-19 pandemic

- Due to the pandemic, public transport ridership dropped 90% globally from March to August 2020. Meanwhile, pedestrian and cycling infrastructure expanded in more than 250 cities.
- The cost of allowing public transport ridership to collapse due to the pandemic – or reducing services to serve only those with no alternatives – is much greater than the cost of taking measures to make public transport safer for users and workers.
- Paratransit services have been impacted due to travel restrictions, reduced capacities and rising costs. Revenue losses of 50% to 70% and lack of government support brought many paratransit operators to the verge of bankruptcy.
- The COVID-19 pandemic resulted in an unprecedented preference for e-commerce and contactless deliveries (using either self-driving trucks or automated delivery robots), resulting in a re-invigoration of start-ups focused on driverless technologies.
- The pandemic disrupted road freight networks worldwide, although these were generally less affected than ocean and air freight.

Overview

Between 2018 and 2020, global efforts to introduce and increase the quality of urban public transport, such as urban rail and bus rapid transit, resulted in a substantial increase in the share of sustainable transport modes. Urban passenger and freight transport have focused not only on improving collective transport, but also on enhancing its accessibility, integrating different transport modes and improving road safety for other forms of urban transport such as walking and cycling. The intermodality of walking, cycling and public transport plays a major role in establishing efficient, clean and safe urban mobility.

With the majority of the world's people now living in cities, and this share projected to reach 68% by 2050, low carbon mobility options for urban dwellers are increasingly needed in order to manage the inherent pressures on transport demand. This includes increased provision and improvement of collective passenger transport services, including public buses and metro systems.

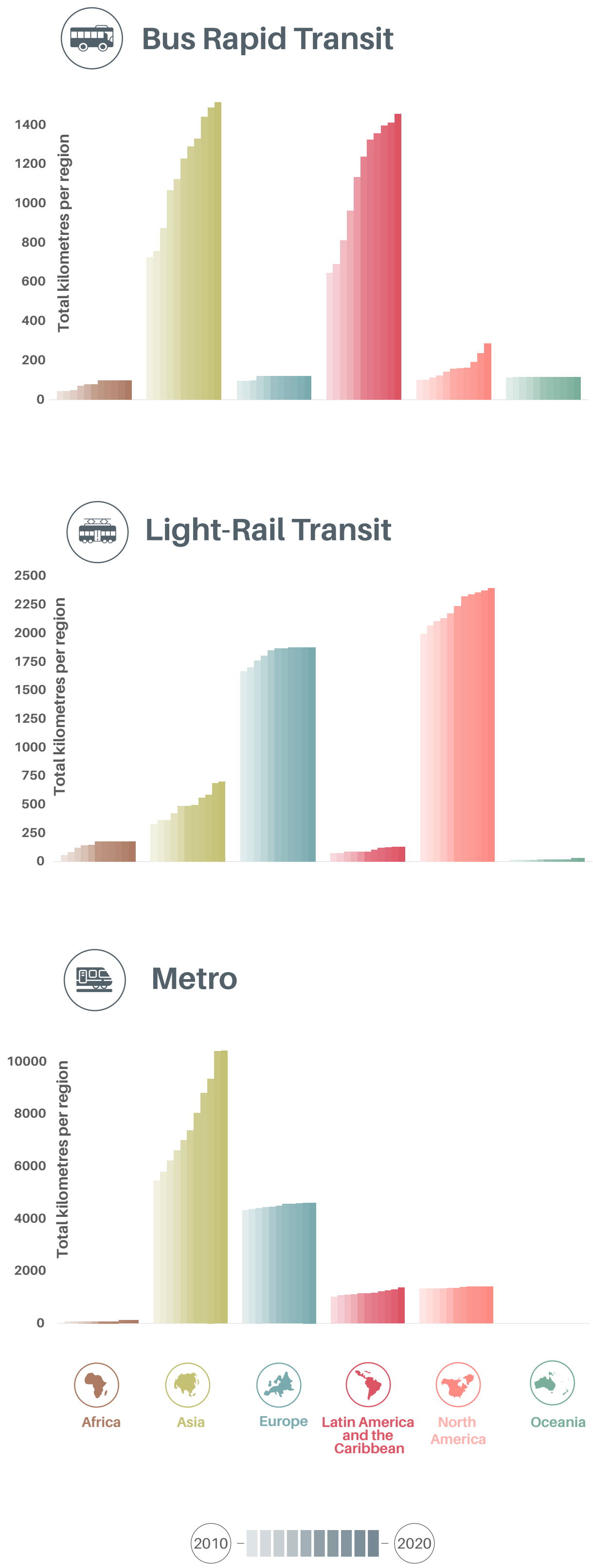
Public transport was hit the hardest (among all transport modes) by the COVID-19 pandemic, with ridership and revenues falling to unprecedented levels (*see Box 1*).[1] Cities around the world have responded in various ways to ensure the safety and operation of services. Many used the interruptions as a time to accelerate modernisation of payment systems, install temporary bicycle lanes and open up streets. Freight transport, after several years of constant growth in e-commerce, experienced a steep increase in grocery, food and retail deliveries. The demand for last-mile deliveries grew during pandemic-related lockdowns.

Demand trends

Public transport systems continued to grow between 2010 and 2020, led by strong growth in Asia (for bus rapid transit, light rail and metro) and Latin America (for bus rapid transit).[2] **The global rapid transit-to-resident ratio (a measure of these three urban services) increased 5% between 2017 and 2019,** with a 25% increase in **China** and a 13% increase in **India.**[3] **Asia** continued to dominate the metro rail market, while **North America** had the greatest total length of light rail systems, and bus rapid transit was divided equally between **Asia** and **Latin America** (*see Figure 1*).[4]

While Europe accounts for the vast majority of urban rail systems, the largest growth from 2010 to 2020 took place in Africa (333%), Asia (69%) and Oceania (50%) (*see Figure 2*).[5] Urban rail systems in Asia surpass many European urban rail systems in the number of passengers transported and lines in operation.[6] Africa's sharp increase in urban rail reflects growth starting from a low baseline, with new services inaugurated in **Algeria**, **Ethiopia**, **Morocco** and **Nigeria** between 2015 and 2020.[7]

Figure 1. Growth in major public transport systems (bus rapid transit, light rail and metro) by region, 2010-2020



Source: See endnote 4 for this section.

- Several cities in Asia continued to expand their metro systems between 2018 and 2020, including **Bangkok**, Thailand; **Delhi** and **Hyderabad**, India; **Manila**, the Philippines; and cities in **China**, **Japan** and the **Republic of Korea**.[8]
- Rapid expansion of urban rail systems also occurred in several Latin American cities. In 2019, **Panama City**, Panama inaugurated its second metro line (it aims to expand the network to five lines by 2040), and Brazil saw subway expansions in **Rio de Janeiro** and **São Paulo**.[9]

Worldwide development of bus rapid transit systems has declined significantly since its peak in 2014, although a gradual increase has occurred since 2018, with nine new systems added during 2019-2020 (*see Figure 3*).[10]

New bus rapid transit systems

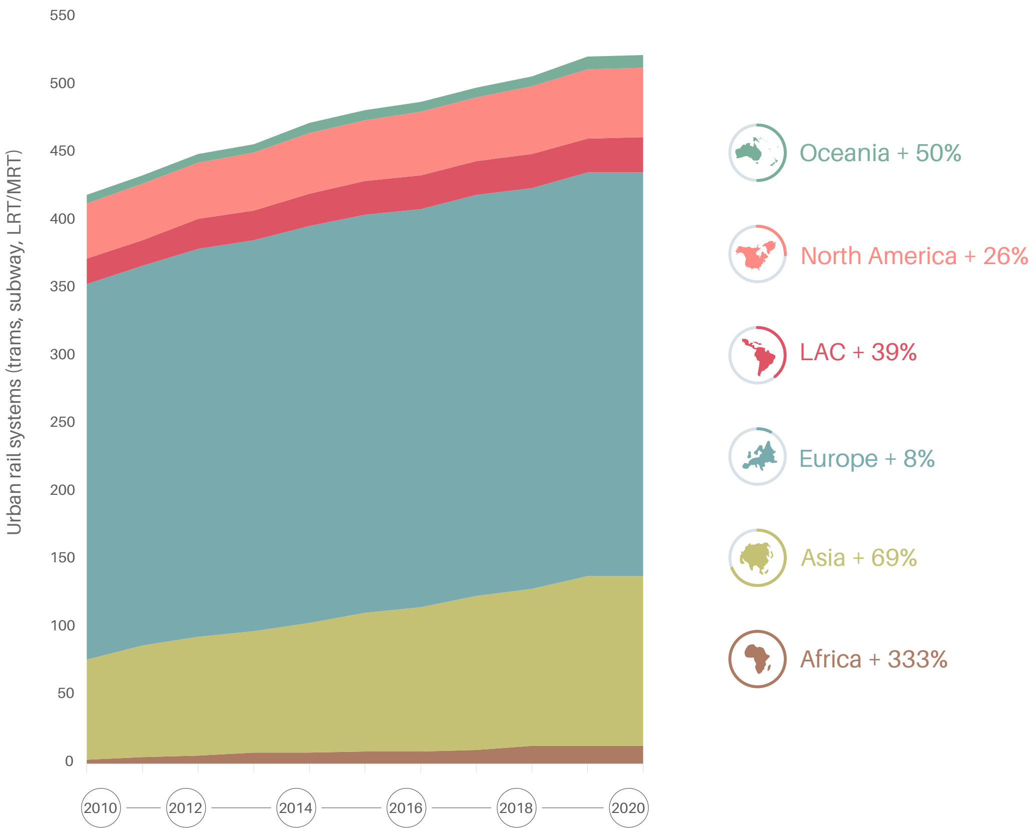
- The first 2.9 kilometres of bus rapid transit lanes were introduced in **Salvador**, Brazil in 2020, as part of a planned 32-kilometre network along 3 lines and 10 stations.[11]
- At least two cities in China – **Fuzhou** in Jiangxi Province and **Yongzhou** in Hunan Province – opened bus rapid transit systems in 2019 and 2020.[12]
- **Peshawar**, Pakistan opened a bus rapid transit system in August 2020 with 28 kilometres of lanes (50% of them elevated).[13]
- In the **USA**, bus rapid transit systems were opened in **Albuquerque**, New Mexico and **Oakland**, California in 2020.[14]

Expansion of bus rapid transit systems

- Several cities in Brazil expanded their existing bus rapid transit systems: **Campinas** developed a new 36-kilometre corridor that opened in 2020, and **Rio de Janeiro** extended the TransOceânica corridor in **Niterói** by 9.3 kilometres and 13 stations.[15]
- In 2019, new additions in bus rapid transit occurred in **Amritsar**, India and in **Nouméa**, New Caledonia (which added 22 electric buses).[16]
- The Chinese cities **Nanchang City** and **Shanghai** expanded their bus rapid transit networks between 2019 and 2020.[17]
- **Warsaw**, Poland added five dedicated bus lanes in 2020 (although these do not officially count as a bus rapid transit system by definition).[18]
- Additional exclusive bus lanes were added to the bus rapid transit network in **San Pedro**, Costa Rica.[19]
- Work on the Beirut Public Transport Project in **Greater Beirut Public Transport in Lebanon**, which includes a bus rapid transit system and 250 buses, was initiated in 2019.[20]

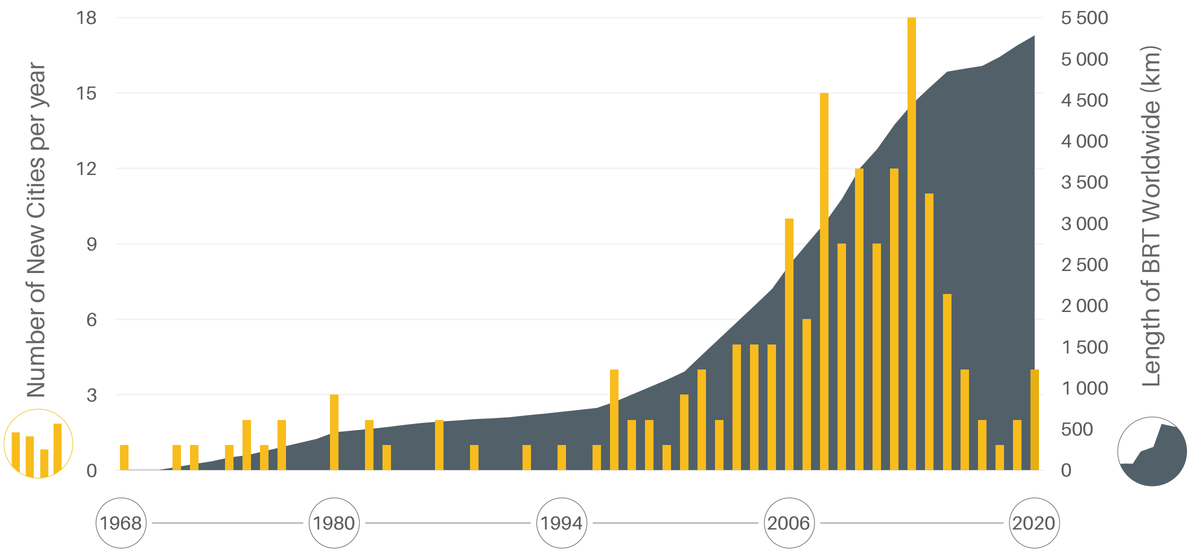
Paratransit (sometimes called "informal transport") remains the main motorised urban transport option in Africa and across cities in the Global South. It fills the gap left by limited public transport options, especially in African cities.[21] In recent years, slight enhancements to paratransit services – including mapping, fleet renewal and regulations – have been achieved that can help to later transition paratransit into more formal services. *(See In Focus: Paratransit.)*

Figure 2. Development of new urban rail systems, by region, 2010-2020



Source: See endnote 5 for this section.

Figure 3. Evolution of bus rapid transit systems in cities worldwide, 1968-2020



Source: See endnote 10 for this section.

- Between 2018 and 2020, mapping of paratransit services was implemented in more than a dozen African cities (e.g., **Accra**, **Addis Ababa**, **Djibouti**, **Kampala**, **Kisumu**, **Lusaka** and **Mombasa**).[22] By the end of 2019, the Digital Matatus project had mapped 140 routes for paratransit in **Nairobi**, Kenya, covering more than 3,000 kilometres and 4,000 stops.[23]
- **Burkina Faso** plans to regulate paratransit taxi services by 2025 by renewing fleets, increasing the share of drivers with health insurance and implementing a fare collection system in all vehicles.[24]
- **Kampala**, Uganda launched a licencing programme for minibus taxis in June 2020 in an effort to better regulate the network and routes.[25]
- The paratransit share is high in many Asian cities – reaching 58% in **Khulna**, Bangladesh; 54% in **Dhaka**, Bangladesh; and 50% in **Jakarta**, Indonesia – contributing to increased mobility but also rising congestion.[26]

More than one-third of all urban trips globally are made on foot or by bicycle.[27] As a large majority of trips in cities are less than 5 kilometres, walking and cycling can substitute more than 40% of short car trips.[28] Public transport, walking and cycling are more efficient and can move more people within a shorter time and with far fewer CO_2 emissions than private or shared cars (*see Section 3.3 on Walking and Cycling*).

Emission trends

Transport emission shares from private passenger cars in urban areas ranged from less than 10% in Dar es Salaam, Tanzania to more than 80% in Vancouver, Canada.[29] Globally, cities report widely varying shares of transport CO_2 emissions, depending on their public transport investments, land-use patterns and supportive policies (*see Figure 4*).[30]

- In **Addis Ababa**, Ethiopia and **Paris**, France, freight transport accounts for more than 80% of transport emissions, well above the shares in other cities and likely because fewer solutions for clean freight transport are being implemented.[31]
- In Kaohsiung, **Chinese Taipei**, two- and three-wheelers contribute 40% of emissions, roughly equal to the share from passenger cars.[32]
- **Dar es Salaam**, Tanzania is unique in having public buses account for 80% of transport emissions.[33] This may be because of the city's low levels of private vehicle ownership (with motorcycles dominating cars) as well as the lack of data on transport activity, which result in low estimates of emissions from motorcycles and private cars.[34]

Urban rail, with an average energy consumption of 0.12 kilowatt-hours per passenger-kilometre, is seven times more energy efficient per passenger than urban car trips.[35] The implementation of bus and rail systems is helping to decrease transport emissions in cities. Since 2019, electric buses have experienced a steep increase in Asia, Europe, and Latin America and the Caribbean (*see Section 3.8 on Electric Mobility*).

- **Cuenca**, Ecuador launched its first light rail service in 2020 to help reduce congestion and transport emissions, which account for 57% of the city's total greenhouse gas emissions.[36]
- In 2019, **Nairobi** was the first city in Kenya (and the eighth in Africa) to roll out a bus rapid transit system, which is expected to save 2 million tonnes of CO_2 equivalent by 2030.[37]
- In 2019, the Green Line in **Karachi**, Pakistan became the world's first zero-emission bus rapid transit system, running on biogas produced from organic waste and avoiding 2.7 million tonnes of CO_2 throughout the life cycle of the project.[38]
- **Doha**, Qatar opened a metro system in 2019 that is expected to reduce traffic by 190,000 private automobiles per day and to decrease CO_2 emissions by around 19,000 tonnes annually.[39]

Policy measures

Urban passenger transport

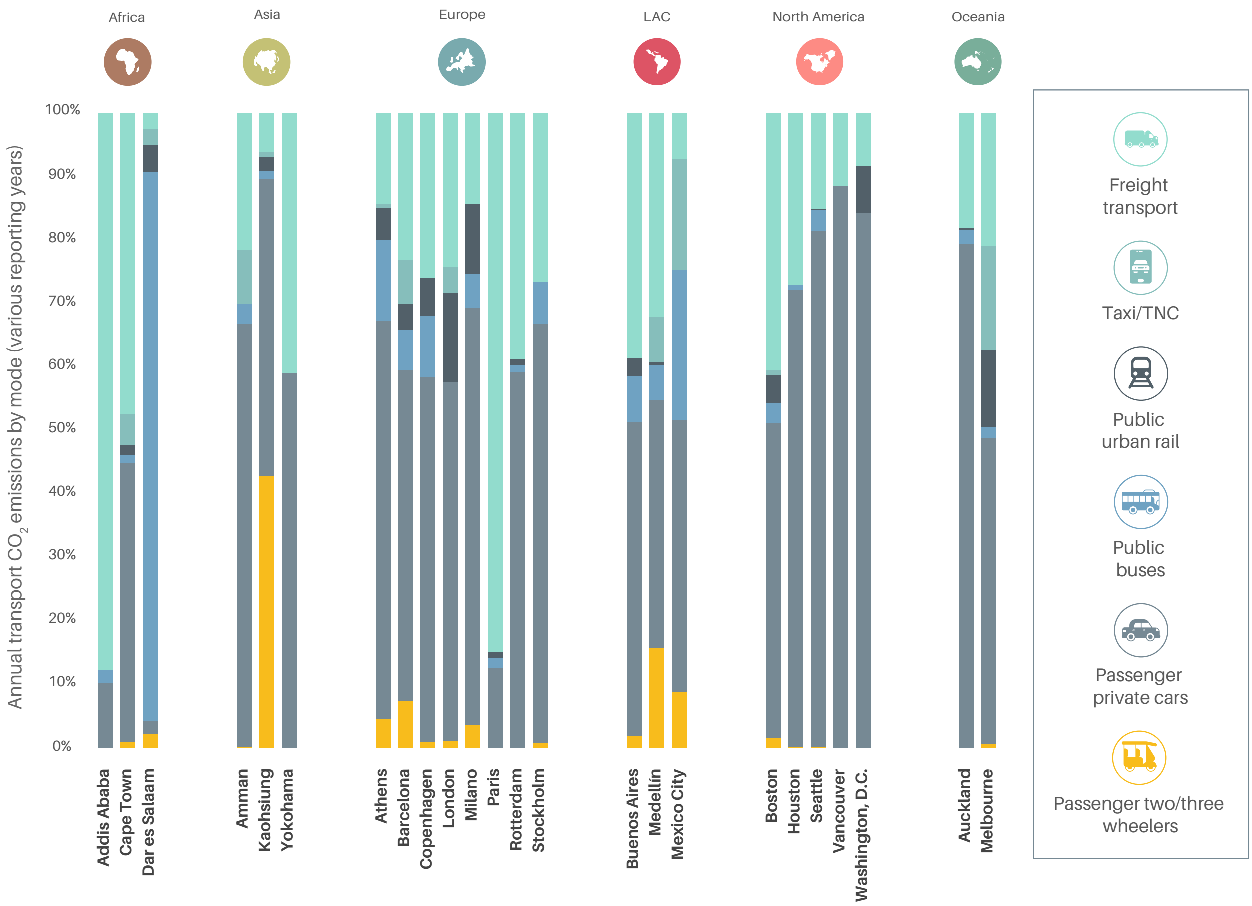
Cities around the world set ambitious targets and made financial commitments during 2019-2020 to enhance sustainable urban mobility. Investments in public transport have been enabled through national governments.

- **Jordan** increased the share of trips by public transport from 11% in 2016 to 15% by the end of 2020, and the bus rapid transit system in Amman is expected to boost this share to 40% by 2025.[40]
- In 2019, the government of **Malaysia** launched a USD 122 million fund to encourage the adoption of public transport while improving and enhancing transport-related infrastructure in the country.[41]
- In 2020, the **UK** government announced a GBP 5 billion (USD 6.7 billion) boost for sustainable transport, with a focus on improving bus services by introducing simpler fares, thousands of new buses, improved routes and higher frequencies.[42]

Innovative pricing schemes for public transport, including free models, have been introduced to incentivise behavioural change. Several countries have introduced and expanded free public transport, offering large potential for environmental and social benefits but also posing challenges for sustained funding, especially in a post-pandemic landscape. Funding streams can be secured through phasing out fossil fuel subsidies and dedicating revenues from congestion pricing and parking to public transport.

- In 2019, **Augsburg** introduced Germany's first "mobility flat rate", enabling users to enjoy bus, car-sharing, bicycles, and other participating modes for EUR 79 (USD 95) a month.[43]

Figure 4. Urban transport emissions by group in selected cities worldwide



Source: See endnote 30 for this section.

- After **Dunkirk**, France tested free buses in 2018, it found that 48% of new transit users regularly used the buses instead of cars, and 5% had sold their cars or decided against buying second ones.[44]
- **New Delhi**, India has offered free public transport to women since 2019 to provide more affordable, safe travel options.[45]
- In 2019, **Surabaya**, Indonesia launched a programme enabling residents to pay for the bus by trading in used plastic.[46]
- **Estonia** became the first country to make all public transport free, in 2018, and this policy was replicated by **Luxembourg** in March 2020.[47] Schoolchildren in **Germany** have been able to use public transport for free since August 2019.[48] **Hwaseong City**, Republic of Korea implemented free public transport in mid-2020 as part of its climate change policies.[49]
- **Barcelona**, Spain introduced a new travel card in 2020 that offers unlimited journeys on public transport within the metropolitan area for EUR 40 (USD 48) a month.[50]

As an approach to reduce congestion, improve air quality and prioritise public transport, walking and cycling, governments are exploring the use of low-emission zones (LEZs), ultra-low-emission zones (ULEZs) and zero-emission zones (ZEZs). (*See Section 3.2 on Sustainable Mobility Planning and Transport Demand Management.*)

- These zones exist mostly in European cities, although in March 2019, **New York City** announced that it would be the first USA city to implement a ULEZ through congestion charging by 2021.[51]

Urban freight transport

As commercial operations in cities become major emitters of greenhouse gases and add to congestion, freight transport policies have received rising attention from both decision makers and practitioners. These policies are critical for mitigating the negative environmental impacts of freight transport without hampering the role of goods movement in fuelling the economy and fulfilling the needs of urban residents.[52]

- In **India**, implementation of the Bharat Stage VI emission standards in 2020 aimed to restrict new registrations of large trucks after 2021 and to greatly reduce the negative impacts associated with freight trips in cities.[53]
- **New Delhi**, India implemented a pollution tax in 2018 to be paid at tolls by heavy-duty and light-duty vehicles to control the emissions that affect urban air quality.[54] (*For more on fuel efficiency and related topics, see Section 3.7 on Fuel Economy.*)

Freight policies aimed at improving the efficiency of last-mile delivery have increased in importance, given that one-third of urban truck traffic is engaged in the pick-up of goods.[55] Broader introduction of low-emission freight vehicles and operations, as well as low-emission zones and delivery hour schemes, are helping to accelerate the transition to low carbon logistics.[56]

- **Paris**, France implemented multiple LEZs in 2020 and prohibits older delivery vehicles from accessing these zones between 8 a.m. and 8 p.m.[57]
- **Nijmegen**, the Netherlands has successfully implemented urban consolidation programmes to facilitate the effective bundling of last-mile deliveries.[58]
- **New York City**, USA implemented an off-hour deliveries programme in 2018 to combat congestion and to improve the productivity of shippers.[59]

LEZs, ULEZs and ZEZs can also cover freight vehicles and can restrict the access of polluting vans and trucks to city centres. Freight vehicles represent 5% of road vehicles globally but contribute 27% of transport greenhouse gas emissions and 50% of toxic air pollutants from transport.[60] Such measures incentivise companies to renew their fleets and to introduce zero-emission commercial vehicles.

- In 2020, the **Netherlands** announced that starting in 2025 cities can introduce LEZs for freight vehicles, thus allowing only zero-emission freight vans or trucks to enter these areas.[61]
- Several cities in **China** (e.g., Beijing, Chengdu, Shanghai and Shenzhen) implemented zero-emission freight zones in 2018 and 2019, enabling an uptake of electric freight vehicles.[62]

The penetration of electric trucks in global markets for medium- and heavy-duty vehicles is projected to reach 9.4% by 2030.[63] While this offers hope for increasing the sustainability of long-distance trucking, it falls well short of needed reductions, and the market is still characterised by limited availability and high prices.

- In 2018, the Cleaner Trucks Initiative for updating nitrogen oxide emission standards for trucks was deployed in the **USA** to speed the adoption and use of low carbon trucks at trade nodes.[64]

Many urban freight initiatives focus increasingly on delivery using (mostly electric-assist) cargo bikes, including initiatives in Rio de Janeiro, Brazil; Copenhagen, Denmark; Hamburg, Germany; Amsterdam, the Netherlands; Kigali, Rwanda and New York City, USA.[65] Electric-assist cargo bicycles have emerged as an urban freight option to accommodate shifting consumer demand and an increase in in-home deliveries. The COVID-19 pandemic has highlighted the importance of improving last-mile delivery.

- A cycling company in **Scotland**, UK unveiled an integrated e-cargo bike delivery and food waste service in 2020.[66]
- In 2019, Royal Mail group in the **UK** experimented with and developed e-trikes, adding to its existing fleet of 100 electric vehicles that helped reduce the delivery company's carbon emissions 29% from previous estimates.[67]

Box 1. Impacts of the COVID-19 pandemic on urban passenger and freight transport

Due to the pandemic, public transport ridership dropped 90% globally from March to August 2020. Meanwhile, pedestrian and cycling infrastructure expanded in more than 250 cities. With 90% of the reported COVID-19 cases early in the pandemic occurring in high-density urban areas, cities faced many challenges to reduce the spread of the virus. Using public transport was initially perceived as a place for easy contagion, but sustained evidence from **Austria**, **France**, **Germany** and **Japan** has shown that public transport does not have to be associated with high infection rates if specific measures are adopted, such as the use of face masks, sufficient ventilation and surface cleaning.

The cost of allowing public transport ridership to collapse due to the pandemic – or reducing services to serve only those with no alternatives – is much greater than the cost of taking measures to make public transport safer for users and workers. Public transport operators worldwide have responded to the pandemic by adopting new safety measures, including reductions in rider capacity (for example, buses at only 75% capacity in **Quito**, Ecuador), more frequent service, enhanced cleaning, new infrastructure and streamlined ticketing/payment methods to reduce contact between staff and passengers, as well as social distancing and mandatory mask use.

Improvements to public transport during 2020 included new bus lanes to speed up transit and to increase the frequency (and thus capacity) of the existing fleet. For example, 109 kilometres of lanes were added in the **Metropolitan Region of Santiago**, Chile and 34 kilometres in **New York City**, USA. Several cities also enhanced their on-demand public transport services to provide mobility to essential workers, as in **Abu Dhabi**, United Arab Emirates; **Berlin**, Germany; **Columbus**, Ohio, USA; **Kent**, UK; and **Tel Aviv**, Israel.

Dubai, United Arab Emirates increased the number of subway trains and buses in operation in order to increase the frequency of service and to avoid overcrowding. Similar approaches were applied in **Bucharest**, Romania; **Hamburg**, Germany; and many other cities. Many cities enhanced the disinfection and cleaning of vehicles and public transport stations.

Paratransit services have been impacted due to travel restrictions, reduced capacities and rising costs. Revenue losses of 50% to 70% and lack of government support brought many paratransit operators to the verge of bankruptcy. In **Kampala**, Uganda, travel restrictions and lockdowns led to a temporary halt of all boda boda and minibus services, while in **Addis Ababa**, Ethiopia fares for minibuses doubled in early 2020 to recoup the lost revenues. In **Latin America and the Caribbean**, universities have conducted research to inform decision makers on how to support and formalise paratransit systems and how to best integrate them into climate change, energy and transport agendas at the city, regional and national levels, including as part of COVID-19 recovery measures.

The COVID-19 pandemic resulted in an unprecedented preference for e-commerce and contactless deliveries (using either self-driving trucks or automated delivery robots), resulting in a re-invigoration of start-ups focused on driverless technologies. E-commerce sales grew from between 15% (in **China**) and 70% (in **Canada**) within a single year, and in 2020 online sales represented 19% of all retail sales. The pandemic also accelerated existing trends in lower-carbon solutions, with crowd shipping services (e.g., Instacart, Postmates, etc.) emerging as a sustainable delivery alternative for congested megacities in **Asia**, and the wide-scale adoption of e-cargo bikes.

Expanded use of electric trucks, autonomous and connected trucks, and autonomous delivery robots in freight and logistics has occurred mainly in **Asia** and **North America**. For example, 13 locations in the **UK** and the **USA** began employing autonomous delivery robots, and 5G-powered autonomous food vehicles were launched in **China** in November 2020. Innovative freight delivery through alternative fuel vehicles, drones and autonomous robots is being tested. A McKinsey report projects that by 2030, 80% of items in **China**, **Germany** and the **USA** will be delivered by drones and autonomous robots with parcel lockers.

The pandemic disrupted road freight networks worldwide, although these were generally less affected than ocean and air freight. **Europe** and the **Americas** were the fastest to resume normal operations within their freight networks, whereas regions that experienced severe lockdown measures and border closures, such as the **Middle East** and **Africa**, experienced more prolonged and significant impacts.

Source: See endnote 1 for this section.

Initiatives supporting urban passenger and freight transport

Passenger transport

- The **C40 Green and Healthy Streets Declaration** highlights the growing demand for zero-emission products and services and aims to raise the level of ambition of cities to transition to zero-emission transport. Signatories commit to procuring only zero-emission buses from 2025 and to ensuring that major urban areas are zero emission by 2030.[68]
- The **MobiliseYourCity Partnership** supports local and national governments in emerging and developing countries in defining and implementing sustainable urban mobility policies and plans, in an effort to facilitate implementation of their Nationally Determined Contributions to reduce emissions under the Paris Agreement and to accomplish the United Nations Sustainable Development Goals.[69]
- The **Institute for Transportation and Development Policy** (**ITDP**) works to mitigate the impacts of climate change, improve air quality, and support prosperous, sustainable, and equitable cities.[70] ITDP's Rapid Transit to Resident Ratio tool tracks the growth of public transport in cities over time.[71]
- The **International Association of Public Transport** (**UITP**) represents public transport agencies and campaigns through its One Planet, One Plan climate action manifesto, a four-step plan to achieve zero-emission mobility and better public transport.[72]
- The **Transformative Urban Mobility Initiative** (**TUMI**) focuses on accelerating sustainable urban transport development and climate change mitigation by mobilising finance, capacity building and promoting innovative approaches.[73]

Freight transport

- **EcoLogistics by ICLEI** supports cities through a community network and projects that provide tools for self-monitoring of greenhouse gas emissions and for stakeholder mapping and engagement. It supports demonstration projects and planning for long-term sustainable urban logistics through action plans.[74]
- The **Global Green Freight Action Plan** focuses on facilitating collaboration among governments, the private sector, civil society and other actors, with the goal of aligning and enhancing existing green freight programmes, developing and supporting new programmes, and integrating black carbon reductions into these programmes.[75]
- The **Smart Freight Centre** works with industry and other stakeholders to remove market barriers and catalyse the uptake of solutions that improve fuel efficiency, reduce emissions and lower operating costs.[76]
- **VREF Center of Excellence for Sustainable Urban Freight Systems** investigates innovative ways to infuse sustainability and efficiency into the transport of goods, with a focus on activities such as the analysis of urban delivery trends and planning guides to improve freight system performance.[77]

Key indicators

	2017*	2020*	% change
Policy Landscape Indicators			
Countries with national urban mobility frameworks (# of countries)	N/A	44	–
Market Development Indicators			
Bus rapid transit (# of systems)	169	177	+5%
Urban rail (metro, tram and light rail) (# of systems)	478	502	+5%
Rapid transit-to-resident ratio (for cities of 500,000 people and more)	10.2	10.7 (2019)	+5%

(*) Data are for the indicated year unless noted otherwise.

Source: See endnote 1 for this section.

In Practice: Additional Policy Measures

Policy targets set

Investment commitments

- **Berlin**, Germany announced that it would spend EUR 28 billion (USD 34 billion) on improving public transport between 2019 and 2035.[78]
- In 2019, **India** received concessional loans from Germany of EUR 1 billion (USD 1.2 billion) until 2023 to improve urban mobility infrastructure and services.[79]
- **Indonesia** was preparing to spend around USD 40 billion in 2019 to extend the metro network in Jakarta.[80]
- **Turkey** plans to expand its urban rail length from 747 kilometres in 2019 to 1,154 kilometres by 2023.[81]
- In 2019, the Green New Deal of **Scotland**, UK included GBP 500 million (USD 670 million) for improved bus priority lanes to tackle congestion and increase usage.[82]
- Under the USA state of **Connecticut's** USD 21 million CT2030 investment to improve transport, adopted in 2019, mass transport is one of four key areas, and new corridors and e-buses are planned.[83]
- Sound Transit approved USD 60 million for the Pierce Transit bus rapid transit system in **Washington** state, USA.[84]

Policy measures implemented

Introduction of new urban rail systems

- The first light rail service started operation in the Waterloo region of **Ontario**, Canada in 2019, registering 1.2 million passengers between July and September 2019.[85]
- The first subway in **Jakarta**, Indonesia started operation in 2019, followed by a light rail line that same year.[86]

Expansion of urban rail systems

- In **Australia**, the cities of Canberra and Sydney both expanded their light rail systems in 2019.[87]
- Several European cities expanded their urban rail systems in 2019 and 2020, including **Nice**, France; **Budapest**, Hungary; and **Moscow**, Russian Federation.[88] The Cityring metro line opened in **Copenhagen**, Denmark in 2019, with 17 stations along a 17-kilometre line.[89]
- In 2020, several urban rail expansions were completed in **North America**, including (in the **USA**) the Southeast Rail Extension in Denver, Colorado and the Gilbert Road Extension in Phoenix, Arizona; and (in **Canada**) the Confederation Line in Ottawa and the Ion Light Rail in Waterloo.[90]
- Both light rail lines in **Minneapolis**, Minnesota, USA reportedly had their highest ever ridership in 2018, with more than 80 million rides.[91]

Autonomous freight vehicles

- In **Paris**, France, Nokia developed a last-mile autonomous delivery robot in 2019 that could deliver all small parcels within the Paris-Saclay campus.[92]
- In the **USA**, Plus.ai announced that a self-driving semi-truck packed with 20 tonnes of goods successfully made a cross-country trip from California to Pennsylvania in 2019 without having a single disengagement.[93] A robot food delivery service was launched in **Tempe**, Arizona, USA in 2020.[94]

Public bus fleet expansion

- In 2019, the **Congo** transport company TRANSCO renewed its rolling stock, adding 50 buses for inter-city travel services and 80 new buses for Kinshasa as part of the "Esprit de vie" programme that supports financing of local buses.[95]
- **Tehran**, Iran renewed its bus fleet in 2019 with 100 new buses.[96]
- **Gambia** added 20 new buses to an existing fleet of 50 buses in 2020.[97]
- In 2019, **Nigeria** added 820 medium- and high-capacity buses to its operations, and Google officially enabled its "Maps" feature for informal transport in Lagos.[98]

3.5

Passenger and Freight Railways

(*Note: The focus of this section is on long-distance passenger and freight railways; for a discussion of urban rail systems, see Section 3.4 on Urban Passenger and Freight Transport.*)

Key findings

Demand trends

- Global passenger rail activity grew 6% between 2016 and 2018, to 4 billion passenger-kilometres.
- The share of high-speed rail in global inter-city passenger rail activity doubled between 2010 and 2019, rising from 10% to 20%.
- Although high-speed rail accounts for only 2% of the global rail network, it transports one-quarter of all rail passengers. For distances up to 1,200 kilometres, high-speed rail competes with air transport.
- Rail freight activity increased 12% between 2010 and 2018, reaching a total of 11 trillion tonne-kilometres.

Emission trends

- The carbon intensity of rail transport dropped to around 14 grams of carbon dioxide (CO_2) equivalent per passenger-kilometre in 2019, less than one-tenth of the energy consumed by larger cars or airplanes.
- The share of electrified railways worldwide increased from 36.7% in 2015 to 40.2% in 2019. In 2020, three-quarters of passenger rail activity was on electrified systems, up from 60% in 2000.
- Nearly one-quarter of the electricity used to power electric trains is estimated to come from renewable sources, which supplied 9% of total global rail energy in 2015 (latest available data).
- Shifting from air travel to high-speed rail produces 3.4 times less pollution and uses 80-90% less energy.
- Scaling up the use of fuels such as green hydrogen can increase the efficiency of passenger and freight railways.

Policy measures

- Ambitious national rail investment programmes are reinvigorating passenger and freight rail systems, with significant investments in emerging economies in Asia and Latin America.
- New and expanding high-speed rail services in the Global South are outpacing investments in the Global North.
- As of 2020, there were 29 railway projects under China's Belt and Road Initiative, which aims to promote infrastructure across Africa, Asia and Europe; this has catalysed an increase in cross-border rail investments to accelerate economic integration.

- A shift from air travel to high-speed rail could displace 21% of domestic and international flights in North America, 10% of domestic flights in Europe and 9% of domestic flights in Latin America.

Impacts of the COVID-19 pandemic

- Passenger rail demand fell an estimated 8% during the first six months of 2020, while freight rail demand stayed at similar levels in all regions.
- In the first six months of 2020, the rail sector lost an estimated USD 36 billion globally due to the pandemic.
- Passenger rail demand is expected to recover steadily from COVID-19 impacts, with global average annual growth of 2.3% projected through 2025.
- Several national governments have announced plans to implement recovery measures to support and prioritise the competitiveness of railways.
- Around one-third of transport spending in recovery packages in G20 countries is allocated to green investment (USD 103 billion), with 26% of this amount for rail, exceeding investment in electric vehicles and alternative fuels (18%) and airlines and ports (13%).

Overview

Passenger railways are a backbone of long-distance mobility networks, providing commuter, regional and inter-city services across different regions of the world. Demand for long-distance passenger rail is growing in many countries, driven by the rapid development of high-speed rail globally.[1] This trend is expected to increase with emerging investments in high-speed rail networks in Africa, Asia and the Middle East.

Freight railways are a key driver of global trade and regional economic activity.[2] Rail freight is more cost effective per tonne-kilometre than road freight and causes fewer traffic fatalities and less noise pollution.[3] Railways facilitate inter-modal freight, providing efficient transport for the bulk of a trip and then allowing more flexible transport modes, such as trucks and cargo bikes, to complete deliveries to a final destination.

Railways are the most energy efficient means of long-distance passenger and freight transport on land. Although railways carry 8% of the world's passengers and 8% of global freight tonnes, they account for only 3% of total transport energy demand and produce only 0.3% of global direct CO_2 emissions.[4]

The COVID-19 pandemic led to strong reductions in rail passengers and rail freight in the first six months of 2020, but recovery packages support the modernisation of railways and a shift from air travel to railways (*see Box 1*).[5]

Demand trends

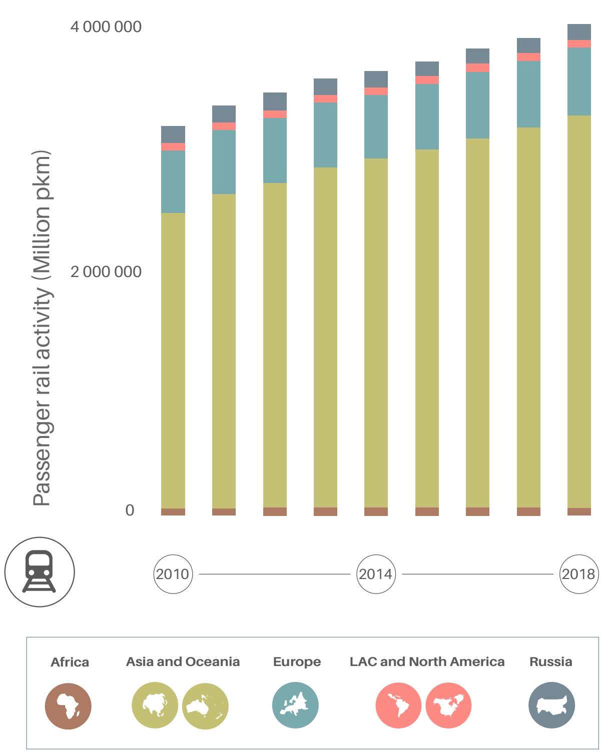
Global passenger rail activity grew 6% between 2016 and 2018, to 4 billion passenger-kilometres (*see Figure 1*).[6] **Asia** and **Europe** accounted for the vast majority (95%) of passenger rail activity in 2018, and passenger rail grew 33% and 9%, respectively, in these regions from 2010 to 2018.[7]

The state rail agency in **Bangladesh** received its highest ever allocation in the 2019-2020 fiscal year, launching new direct services from Dhaka to Benapole, Rajshahi and Siliguri.[8]

In **India**, the Vande Bharat Express, a semi-high-speed train operating from Delhi to Varanasi, was launched in 2019, and the Ahmedabad-Mumbai Tejas Express line was launched in 2020.[9]

- The first express train service in **Senegal** – a railway connection between Dakar city centre and the country's largest airport, Blaise Diagne International Airport – was launched in 2016 and was expected to start operation in 2021.[10] The line will provide both passenger and freight service.[11]
- The passenger rail operator Amtrak in the **USA** registered a 2.5% increase in ridership during the 2019 financial year, to a record 32.5 million passenger trips.[12]

Figure 1. Passenger rail activity by region, 2010-2018



Source: See endnote 6 for this section.

The share of high-speed rail in global inter-city passenger rail activity doubled between 2010 and 2019, rising from 10% to 20%.[13] This growth was driven largely by increased high-speed rail activity in **China** and to the introduction and expansion of high-speed rail service in several other countries (*see Figure 2, and Policy Measures section below*).[14]

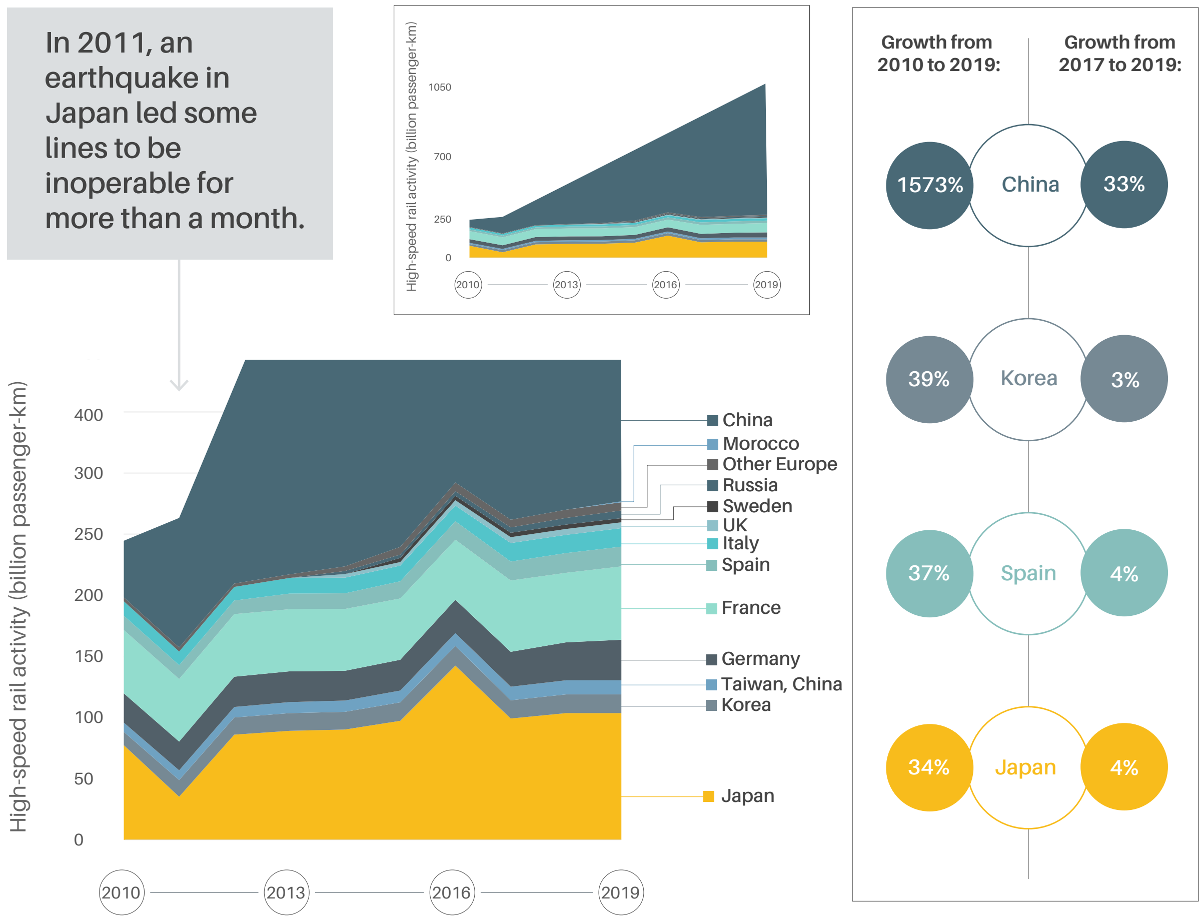
Although high-speed rail accounts for only 2% of the global rail network, it transports one-quarter of all rail passengers.[15] **For distances up to 1,200 kilometres, high-speed rail competes with air transport.**

- In **China**, 1 billion people travel by high-speed rail each year, more than double the country's 415 million domestic aviation passengers.[16]
- In 2018, **Morocco** inaugurated the 323-kilometre Al-Boraq high-speed rail line between Casablanca and Tangier, cutting travel time by more than half.[17] The project is the first high-speed rail in **Africa** and is part of a broader plan to connect Morocco's north and south via a 1,314-kilometre high-speed line.[18]
- In 2018, **Saudi Arabia** became the first Arab country to develop high-speed rail, as part of the country's 2030 vision to boost socio-economic development and relieve roadway congestion.[19] Its 449-kilometre high-speed line connects Jeddah, Mecca and Medina, with a capacity of 60 million passengers per year and a travel speed of 300 kilometres per hour.[20]
- Alongside its 594 kilometres of existing high-speed rail, **Turkey** is developing 16 new lines to connect major cities in a 1,652-kilometre network by 2023.[21] It is planning more than 30 new high-speed rail lines, for a total of 7,419 kilometres, and completed tests in 2020 on the 393-kilometre Ankara-Sivas line, expected to be operational in late 2021.[22]

Rail freight activity increased 12% between 2010 and 2018, reaching a total of 11 trillion tonne-kilometres.[23] Rail accounts for 60% of freight activity in the **Russian Federation**, 55% in the **USA**, and 50% in **China**, while in **Europe** the rail share of freight has stagnated at around 18%.[24] Regionally, rail freight activity is driven primarily by Asia and Oceania, and by Latin America and North America (*see Figure 3*).[25]

- In 2019, **Brazil** set a target to double the share of its freight moved by rail from 15% in 2019 to 31% in 2025.[26]
- **India** has set a target to move 70% of goods by rail along an 8,325 kilometre freight rail network being developed by the

Figure 2. Development of high-speed rail by country, 2010-2019

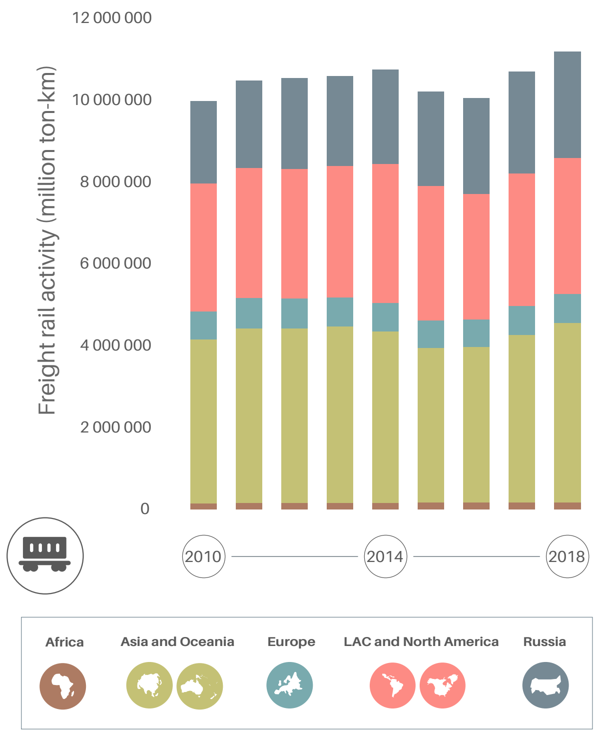


Source: See endnote 14 for this section.

Dedicated Freight Corridor Corporation of India.[27] As of mid-2020, the eastern corridor of the project was 60% complete and the western corridor was 55% complete.[28]

- in 2019, **Kenya** inaugurated the second phase of the 120-kilometre Nairobi-Naivasha railway, along with a standard-gauge rail connection to the Naivasha container terminal.[29]

Figure 3. Freight rail activity by region, 2010-2018



Source: See endnote 25 for this section.

Emission trends

The carbon intensity of rail transport dropped to around 14 grams of CO_2 equivalent per passenger-kilometre in 2019, less than one-tenth of the energy consumed by larger cars or airplanes.[30] Since 1990, rail's energy use has improved 37% per passenger-kilometre and its CO_2 emission intensity has improved 30% per passenger-kilometre.[31]

The share of electrified railways worldwide increased from 36.7% in 2015 to 40.2% in 2019.[32] **In 2020, three-quarters of passenger rail activity was on electrified systems, up from 60% in 2000.**[33] Railways have the highest share of electrification among all transport modes and can help to drive transport decarbonisation if rail electricity is increasingly generated from renewable sources.[34]

- In 2019, **India's** Cabinet Committee on Economic Affairs approved the complete electrification of the country's railway network, which will reduce CO_2 emissions and lower fossil fuel costs.[35]
- **Latvia** invested EUR 318.5 million (USD 378 million) in 2019 through the European Union Cohesion Fund, to electrify 308 kilometres of the country's main east-west railway network.[36]
- In 2019, **Scotland** (UK) committed to transitioning to a zero-emission railway network by 2035 through continued electrification of its network, using battery-powered trains and exploring the potential of hydrogen-powered trains.[37]
- The **UK** has detailed a strategy to phase out all purely diesel trains by 2040.[38]

Nearly one-quarter of the electricity used to power electric trains is estimated to come from renewable sources, which supplied 9% of total global rail energy in 2015 (latest available data).[39] From 2005 to 2015, the share of diesel in total rail energy use fell from 62% to 56%, while the share of electricity from renewable sources increased 66%.[40]

- **China** and the **Russia Federation** each derived 12% of their rail energy from renewables in 2015; however, the share of nuclear energy used to power railways in the Russian Federation exceeded that in China by nearly 10 times (13.3% versus 1.4%).[41]
- In the **EU**, the share of renewables in rail sector electricity more than tripled between 2005 and 2015, increasing from 6% to 21%.[42]
- Electricity generation from nuclear power in **Japan** dropped sharply after the 2011 Fukushima accident (from 25% in 2010 to 1% in 2015) and was replaced primarily by natural gas.[43] As a result, rail's share of transport CO_2 emissions in Japan rose from 4.2% in 2010 to 5.0% in 2015.[44]

Shifting from air travel to high-speed rail produces 3.4 times less pollution and uses 80-90% less energy.[45] Rail produces fewer emissions of nitrogen oxides and particulate matter than aviation.[46] Rail also has a lower emission impact than aviation due to its smaller infrastructure footprint and its ability to transport passengers directly to city centres, allowing shorter distances and more sustainable travel options (e.g., urban rail, walking) to reach final destinations.[47]

Scaling up the use of fuels such as green hydrogen can increase the efficiency of passenger and freight railways. Green hydrogen can be generated from surplus renewable energy generation to create a lower-carbon rail transport sector and contribute to economy-wide emission reduction targets. A shift to green hydrogen can also contribute to cleaner air, job creation and energy security, but it must overcome substantial cost barriers to achieve broad market penetration in the railway sector.[48]

- In 2019, **France's** rail operator SNCF ordered 15 hydrogen-powered train cars to replace diesel versions.[49]
- The **Netherlands** started operation of hydrogen fuel cell-powered passenger trains in 2019.[50]

Policy measures

Ambitious national rail investment programmes are reinvigorating passenger and freight rail systems, with significant investments in emerging economies in Asia and Latin America. Railway infrastructure is underdeveloped in many emerging economies. Enhanced rail investments are being driven by greater co-ordination among regional entities and national governments, supported by public-private partnerships.[51]

- In 2019, **Chile** developed the largest railway investment in its history. The country aims to triple passenger rail trips to 150 million annually by 2027 and to double freight rail volumes to more than 21 million tonnes annually, through 25 rail projects and 1,000 kilometres of rail lines.[52]
- **Costa Rica** plans to revitalise its railway system by upgrading infrastructure, introducing electrified trains in the Metropolitan Area of San José, adding freight service to Limón and establishing new rail lines to the Pacific coast by 2023.[53]
- In 2018, **Sri Lanka** started a 20-year railway development strategy, with strong public support, to overcome road delays and benefit from the lower cost of rail compared to bus services.[54]
- **Turkey** kicked off a strategic plan in 2020 that includes planning new rail lines, rehabilitating and electrifying existing rail lines, establishing rail-served logistics centres and developing domestic supply chains.[55]

New and expanding high-speed rail services in the Global South are outpacing investments in the Global North. Several emerging economies in Asia, Africa and the Middle East are initiating the development of high-speed rail lines to reinforce their transport systems, mitigate traffic and reduce emissions.

- **China** continued to expand its high-speed rail network, opening more than 50 new lines between 2018 and 2020 for a total length of 35,388 kilometres, with another 5,250 kilometres under construction.[56]
- Recent high-speed rail developments in **India** (4,634 kilometres of lines), **South Africa** (2,390 kilometres) and **Egypt** (1,210 kilometres) are doubling existing infrastructure in these countries and making significant contributions to the global high-speed rail market.[57]
- Two high-speed rail lines under construction in **Iran**, connecting Tehran to Isfahan and to Mashhad, are expected to be completed in 2021 and 2022, respectively. These lines are part of a planned 3,104-kilometre network of seven lines to be developed by the end of the decade.[58]

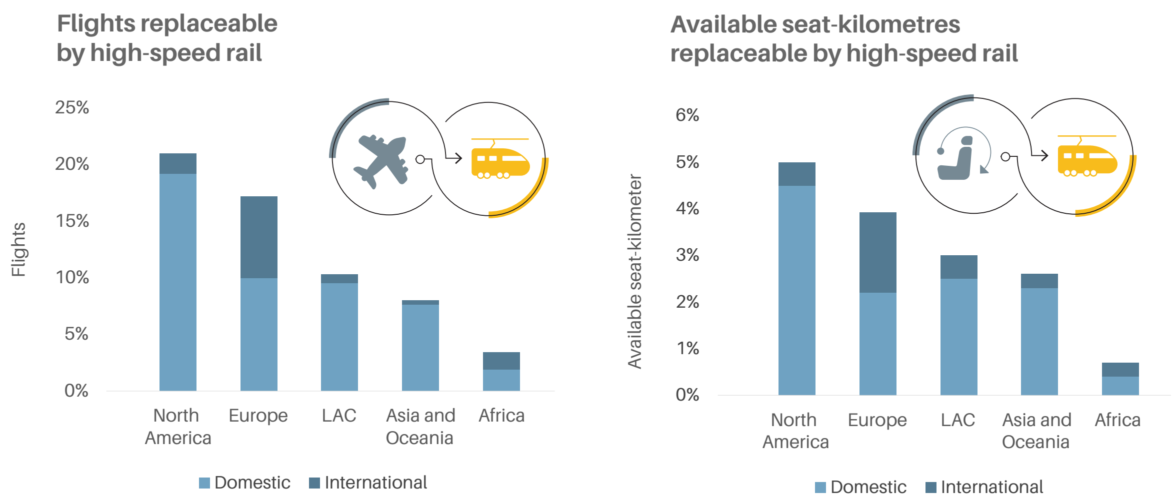
As of 2020, there were 29 railway projects under China's Belt and Road Initiative, which aims to promote infrastructure across Africa, Asia and Europe; this has catalysed an increase in cross-border rail investments to accelerate economic integration.[59] Historically, countries have adopted different track gauge standards and electrification and traffic management systems, which create barriers to the competitiveness of passenger and freight rail against other transport modes. International co-operation within rail programmes can establish standards to increase capacity, efficiency and economic activity.

- In 2019, **Indonesia** signed a USD 4.3 billion agreement with Japan to develop a medium-speed train project to link Jakarta and Surabaya, covering 715 kilometres.[60]
- **Jordan** plans to develop a 1,000-kilometre railway network in four phases, resulting in railway connections with China and Europe.[61]
- In **Nigeria**, the 157-kilometre Lagos-to-Ibadan standard-gauge rail line entered into service in April 2020, following the government's acquisition of the service from China.[62]
- In 2019, **Pakistan** began construction of the Main Line-1, a flagship project and strategic initiative under the China-Pakistan Economic Corridor, at an estimated cost of USD 8.2 billion over five years.[63]
- The first freight train on the 8,693-kilometre **China-Turkey** corridor, part of the Belt and Road Initiative, departed on a 12-day journey in December 2020.[64]

A shift from air travel to high-speed rail could displace 21% of domestic and international flights in North America, 10% of domestic flights in Europe and 9% of domestic flights in Latin America (*see Figure 4*).[65] Several European countries have seen reductions in flight volumes (e.g., **Sweden**) and increases in overnight train activity (e.g., **Austria**), with **the Netherlands** observing both trends in tandem *(see Section 3.9 on Aviation)*.[66]

- The first night train in **Austria** since 2003 started operation in 2020 by Austrian Railways OBB, travelling from Vienna to Brussels.[67]
- To reduce carbon emissions, **France** has banned short domestic flights that can be feasibly replaced with rail journeys.[68]
- In the **UK**, in the 12 months to July 2019, 29% of passengers chose to travel with Virgin Trains as opposed to flying between Glasgow and London, the country's second busiest domestic air route.[69]
- Carbon savings from shifting air travel to rail between **Glasgow** and **London** between 2005 and 2015 was equivalent to taking 145,000 cars off the road for a year.[70]

Figure 4. Potential of high-speed rail to displace air travel, by region



Source: See endnote 65 for this section.

Box 1. Impacts of the COVID-19 pandemic on rail

Passenger rail demand fell an estimated 8% during the first six months of 2020, while freight rail demand stayed at similar levels in all regions. Passenger activity in the first half of 2020 dropped 55% in **Spain**, 52% in **France**, 48% in the **European Union** (EU), and 42% in the **Russian Federation** and **Germany** compared to the same months in 2019. Freight rail activity stayed level across regions.

In the first six months of 2020, the rail sector lost an estimated USD 36 billion globally due to the pandemic. Passenger and freight rail are projected to lose USD 125 billion in total revenue for 2020 and 2021, with passenger rail suffering a higher loss than freight rail, at USD 78 billion. For 2020, 53% of the revenue loss for passenger rail was in Asia and 44% in Europe.

Passenger rail demand is expected to recover steadily from COVID-19 impacts, with global average annual growth of 2.3% projected through 2025. A shift from air travel to train travel is anticipated in the post-COVID-19 period. In **Europe**, the high-speed rail sector is projected to see compound annual growth of more than 10% in the medium term.

Several national governments have announced plans to implement recovery measures to support and prioritise the competitiveness of railways. Restoring rail activity in the post-pandemic period requires governmental economic support, and many rail agencies have expressed a preference for direct financial support. Other possible options are decreased access charges, elimination of value-added tax (VAT) and other taxes, and guarantee loans.

- In **France**, as part of its recovery package, the government banned short-haul domestic air travel on routes that have a journey time of 2.5 hours or less on rail.
- **Germany** will spend EUR 500 million (USD 610 million) to replace older passenger and freight rail systems with the newest digital interlocking technology to increasing railway capacity, punctuality and reliability.
- The **USA** proposes to invest USD 80 billion to improve, modernise and expand its passenger rail network, and to increase the safety, efficiency and electrification of passenger and freight rail.

Around one-third of transport spending in recovery packages in G20 countries is allocated to green investment (USD 103 billion), with 26% of this amount for rail, exceeding investment in electric vehicles and alternative fuels (18%) and airlines and ports (13%). (*For more on transport investment in COVID-19 recovery packages, see Section 4 on Financing.*)

Source: See endnote 5 for this section.

Initiatives supporting railways

- The **International Union of Railways (UIC) Low Carbon Sustainable Rail Transport Challenge** sets ambitious targets to improve the energy efficiency of the rail sector, reduce greenhouse gas emissions and achieve a more sustainable balance among transport modes.[71] The Challenge is supported by UIC's 240-member railway companies based in 95 countries. In 2015, more than 70 UIC members signed a Climate Responsibility Pledge, which was updated in 2019 with more ambitious targets and had more than 30 signatories as of November 2020.[72]
- **Shift2Rail** contributes to smart and sustainable growth by fostering research and innovation in Europe's railway sector. The purpose is to achieve a Single European Railway Area, to enhance the attractiveness and competitiveness of the European railway system to ensure a shift from roads towards rail, and to sustain the leadership of the European rail industry on the global market.[73]
- **Rail Freight Forward** is a coalition of European rail freight companies that are committed to drastically reducing the negative impact of freight transport on the planet and mobility, through innovation and a more intelligent transport mix. The coalition had 18 members as of November 2020 and aims to increase the modal share of rail freight in Europe from 18% in 2020 to 30% by 2030 as the macro-economic "better solution" for European growth.[74]
- The European Commission established the **European Year of Rail 2021** to support delivery of the EU's European Green Deal objectives in the transport field. The project includes a series of events, campaigns and initiatives in 2021 to promote rail as a sustainable, innovative and safe mode of transport, highlighting its benefits for people, the economy and the climate and focusing on the remaining challenges to create a Single European Rail Area without borders.[75]


Credit: Jalitha Hewage

Key indicators

	2017*	2019*	% change
Policy Landscape Indicators			
Countries with targets for railway mode shift (# of countries)	N/A	37	-
Market Development Indicators			
Rail passenger activity (million passenger-kilometres)	3,864,406 (2016)	4,068,548 (2018)	+6%
High-speed rail activity (billion passenger-kilometres)	704	1,051	+39%
Rail freight activity (million tonne-kilometres)	10,046,221 (2016)	11,190,112 (2018)	+11%
Rail network length (kilometres)	1,131,101 (2016)	1,142,891 (2018)	+1%
High-speed rail length (kilometres)	59,366 (2016)	65,812	+11%
Railway electrification share	36.7% (2018)	40.2%	+10%
Passenger rail energy intensity (grams of CO_2 per passenger-kilometre)	17.61 (2015)	14 (2018)	-20%

(*) Data are for the indicated year unless noted otherwise.

Source: See endnote 76 for this section.

In Practice: Additional Policy Measures

Policy targets set

Rail expansion

- A high-speed train service is envisioned to operate in Bangladesh starting in 2022, spanning 320 kilometres between **Dhaka** and **Chittagon.**[77]
- Several rail projects were approved in **Ghana** in 2019 and 2020, including construction of the 340-kilometre double-track electrified standard-gauge eastern railway connecting Accra, Koforidua, Kumasi and Tema; the Accra-Nsawam railway; and the Tema-Mpatadan railway.[78]
- In 2019, **Nigeria** awarded a USD 3.9 billion public-private partnership contract for the new Abuja-Itakpe-Lokoja rail line.[79]

Policy measures implemented

National rail expansion

- In 2018, **Ethiopia** finalised the Addis-Ababa-Djibouti Railway line, an electric railway system that reduces the travel time between the port of Djibouti and the capital from 84 hours to 10 hours.[80]
- **Pakistan** launched 10 new passenger trains and 2 freight trains in 2018, between the cities of Karachi and Peshawar.[81]
- In **Thailand**, the rail link between Bangkok and Pattaya was approved in 2019.[82]
- In **Nigeria**, 44 new coaches were deployed in 2020 on the 186.5-kilometre Abuja-Kaduna rail corridor.[83]

3.6

Shared Mobility Services

Key findings

Demand trends

- Car-sharing membership doubled between 2016 and 2018, surpassing 30 million globally, with 70% of members registered with services in Asia.
- Use of ride-hailing services has spiked since 2016, increasing passenger vehicle travel an estimated 10-20% in urban areas and 45-60% in suburban areas globally.
- The peak popularity of bike-sharing systems was reached in 2017, and by late 2020 a quarter of originally launched bike-sharing systems were no longer in operation. Africa is highly underrepresented in the bike-sharing market with just six services launched since 2016.
- System installations of shared e-scooter services, which were widely launched in 2018, increased 580% in 2019, including expansion in several countries in Europe and Latin America and the Caribbean.
- The initially strong venture capital backing enjoyed by global micromobility companies declined 64% from 2018 to 2019, leading services to cut staff or cease operations entirely.
- Autonomous vehicles, widely used in shared applications, have not seen increased market momentum, with 80% fewer cities introducing vehicle trials during 2019 than in 2017.

Emission trends

- According to some studies, electric scooter and bike-sharing services have reduced emissions by shifting trips from polluting transport modes; in contrast, ride-hailing services increase vehicle-kilometres travelled and result in more emissions.
- Many ride-hailing operators have accelerated the roll-out of electric vehicles to achieve zero-emission fleets, and some sub-national governments have adopted electric vehicle regulations and targets. Replacing conventional ride-hailing vehicles with electric vehicles has the potential to deliver three times the emission reductions compared to conventional vehicles.

Policy measures

- Regulation of new services and business models has been a key determinant of the pace of deployment of shared mobility services, with a number of cities and countries enacting stricter controls.
- New partnerships, tools and guidelines have emerged to increase co-ordination among public and private actors in planning and operating shared mobility services.
- Africa has been prominent in a surge of tech-based improvements in analysis, information and operating platforms for formal and informal shared mobility services.

Impacts of the COVID-19 pandemic

- Several ride-hailing services lost ridership during pandemic lockdowns, leading to job losses in the sector, with ride-hailing company Ola cutting 35% of its workforce in India, and Uber cutting 23% of its global workforce.
- Demand for bike-sharing services increased sharply in a number of cities in 2020, while in other cities, demand for bike sharing struggled to reach 2019 levels due to lockdowns and service restrictions.

Overview

"Shared mobility" is the deployment of innovative transport services using emerging technologies and original business models , based on shareability and the provision of on-demand service. Shared mobility services include car sharing, ride-hailing, micromobility (bike sharing, shared electric kick scooters) and on-demand micro-transit. Shared autonomous vehicle applications are also a rapidly emerging area, as many autonomous vehicles are likely to be initially deployed in the context of shared mobility services.[1]

When shared mobility services are well deployed, managed and regulated, they have the potential to reduce the demand for private cars, thus reducing associated emissions.[2] However, the impacts of shared mobility can vary depending on the kind of service, the specific operating context (including walking and cycling infrastructure), access to public transport and the general built environment. Enhanced data and information on these services, and a greater array of services for different purposes, have the potential to improve the economic conditions of lower-income populations.

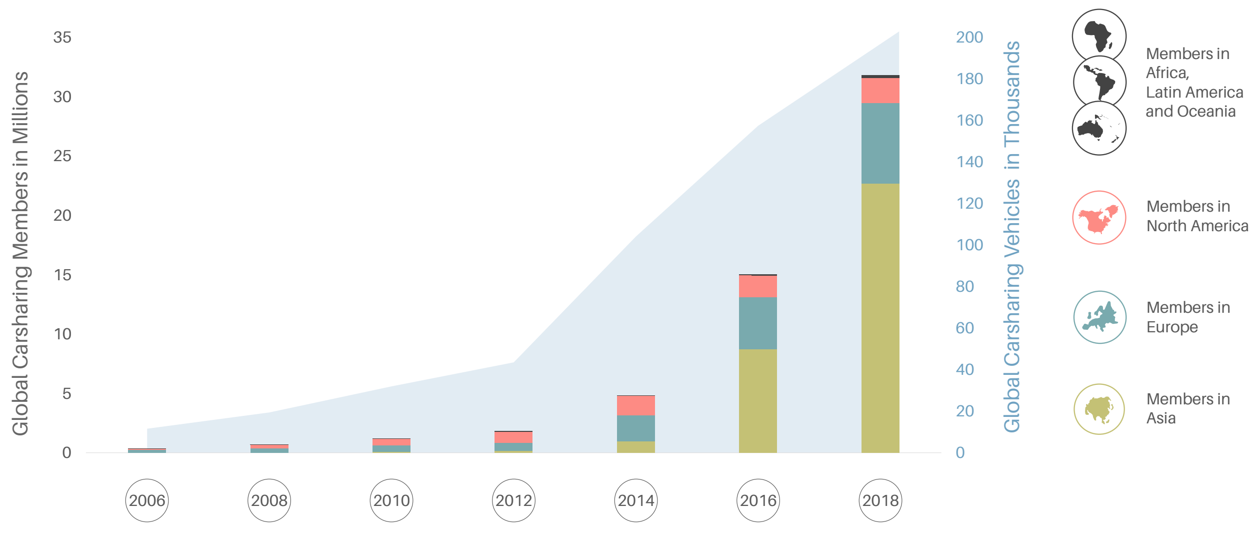
The development and positioning of shared mobility services has been mostly led by the private sector. However, in recent years there has been an increase in alliances and partnerships led by both the private sector and non-governmental organisations, indicating a shared agenda towards increasing the presence of shared mobility services and improving their environmental performance. Yet in many cases, shared mobility services are still struggling to find a well-established regulatory framework in which to operate.

In response to the COVID-19 pandemic, many ride-hailing companies shifted their activities from moving people to moving goods (especially food delivery) in Asia and North America. The pandemic has had an asymmetric impact across shared mobility services, with bikes and e-scooters generally faring better than ride-hailing services (*see Box 1*).[3] Recent reductions in funding (often linked to drops in revenue spurred by the pandemic) have put into question the financial sustainability of current shared mobility services business models.

Demand trends

Car-sharing membership doubled between 2016 and 2018, surpassing 30 million globally, with 70% of members registered with services in Asia (*see Figure 1*).[4] The total number of car-sharing vehicles increased from 157,000 to 198,000 during this period, and by 2019, 236 car-sharing services were operating in 59 countries.[5]

Figure 1. Global car-sharing membership by region and total number of vehicles, 2006-2018



Source: See endnote 4 for this section.

- **China**, **India** and the **Republic of Korea** lead in car sharing, accounting for more than three-quarters of the Asian market since 2015.[6] Overcrowded public transport facilities and population growth are the main variables explaining the switch to shared cars.[7] Worsening air pollution has also driven Asian governments to adopt measures aimed at reducing the overall number of vehicles on the road.[8]
- Major car-sharing players in the Asia-Pacific region include **Car2Go**, **CarShare Australia**, **Hertz Corporation**, **Locomute** and **Zipcar**. These companies often propose innovations to expand their regional presence.[9]

Use of ride-hailing services has spiked since 2016, increasing passenger vehicle travel an estimated 10-20% in urban areas and 45-60% in suburban areas globally.[10] A study in Denver, **United States** (**USA**) found that ride-hailing leads to around 83.5% more vehicle-kilometres travelled than if ride-hailing did not exist.[11]

- In **Bangladesh**, 10 companies were awarded ride-hailing service licences in July 2019; that year, the country's USD 26 billion ride-hailing industry represented 23% of the transport sector, recording more than 7.5 million trips per month.[12]
- Ride-hailing led to a dramatic increase in motorbikes and cars in **Dhaka**, Bangladesh, with 40 new cars being registered every day.[13]
- Based on a survey in Santiago, **Chile**, ride-hailing services increase the number of vehicles kilometres travelled, but this effect can be lessened if occupancy rises to at least 2.9 passengers per vehicle.[14]
- A study on the impacts of ride-hailing services in Bogotá, **Colombia** found that 33% of public transport trips could potentially shift to ride-hailing, increasing the vehicle-kilometres travelled by 14.5 times.[15]
- In early 2020, **Nigeria** banned the commercial use of motorcycles and tricycles operated by ride-hailing companies in Lagos, claiming the need for urgent measures to improve security and safety on the road. These so-called okadas provide access to zones where public transport is not fully deployed.[16]

The peak popularity of bike-sharing systems was reached in 2017, and by late 2020 a quarter of originally launched bike-sharing systems were no longer in operation.[17] **Africa is highly underrepresented in the bike-sharing market with just six services launched since 2016** (*see Figure 2*).[18] Since 2017, the major expansions in the bike-sharing market were in free-floating systems. The use of e-bikes in shared systems has also grown strongly since 2017 (*see Figure 3*), and a study found that 35% of shared electric bike trips substituted car travel, while 30% substituted walking.[19] As of August 2020, some 2,015 bike-sharing systems were in operation around the world.[20]

- An electric bike sharing system was launched in Kigali, **Rwanda** in 2019.[21]
- Dubai, **United Arab Emirates** aims to roll out 3,500 public shared bicycles with 350 stations between 2020 and 2025.[22]
- Of the 39 million trips using shared bicycle systems in the **USA** in 2019, 35% were undertaken to connect to public transport.[23]
- **Uber** purchased Jump Bikes in 2018 and then sold it to **Lime** in April 2020, greatly reducing the service's staff and operations.[24] Lime ceased operations in 12 major cities in Latin America and the Caribbean by the end of 2019.[25]

System installations of shared e-scooter services, which were widely launched in 2018, increased 580% in 2019, including expansion in several countries in Europe and Latin America and the Caribbean.[26] In total, around 265 cities worldwide had e-scooter services as of 2020, most of them in the **USA** and **Europe** (*see Figure 4*).[27]

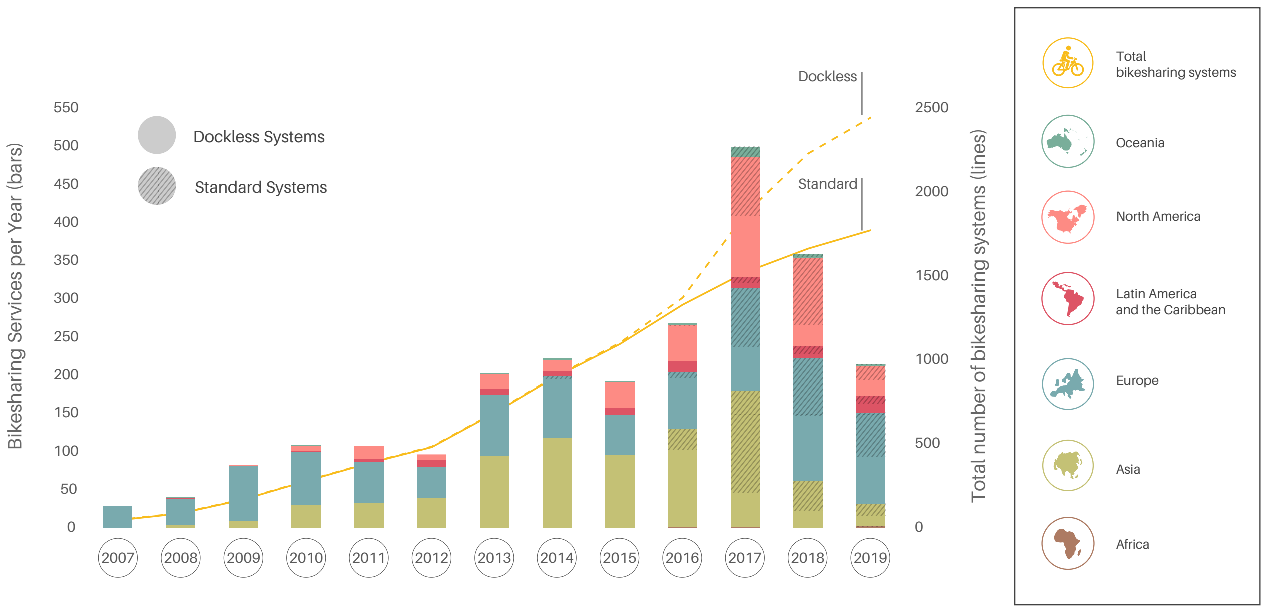
In the past few years, e-scooter services have overtaken bike sharing with large-scale deployment across many major cities. By the beginning of 2020, the e-scooter phenomenon was accompanied by the reduced presence of dockless bicycle services, leading to a reduction in micromobility services overall. Some companies argue that the limitations on the number of devices a company can introduce force them to follow popular trends and to prioritise e-scooters over shared bicycles.[28]

- In **Europe**, nearly 100 cities across 27 countries had an e-scooter sharing scheme as of 2020, and in Latin America and the Caribbean 32 cities across 7 countries had such a scheme.[29]
- In the **USA**, the number of trips using micromobility (shared bikes, e-bikes and e-scooters) increased from 84 million in 2018 to 132 million in 2019.[30] Between 2010 and 2019, a third of the total 1 billion trips made in the **USA** were done on e-scooters and shared bikes.[31]
- The most popular use of e-scooters in the **USA** in 2018 was to commute to work (28%).[32]

The initially strong venture capital backing enjoyed by global micromobility companies declined 64% from 2018 to 2019, leading services to cut staff or cease operations entirely.[33] Investors appear to have reached an inflection point in the micromobility market segment, pivoting from subsidised companies aiming to gain users towards profitable and revenue-oriented businesses.[34]

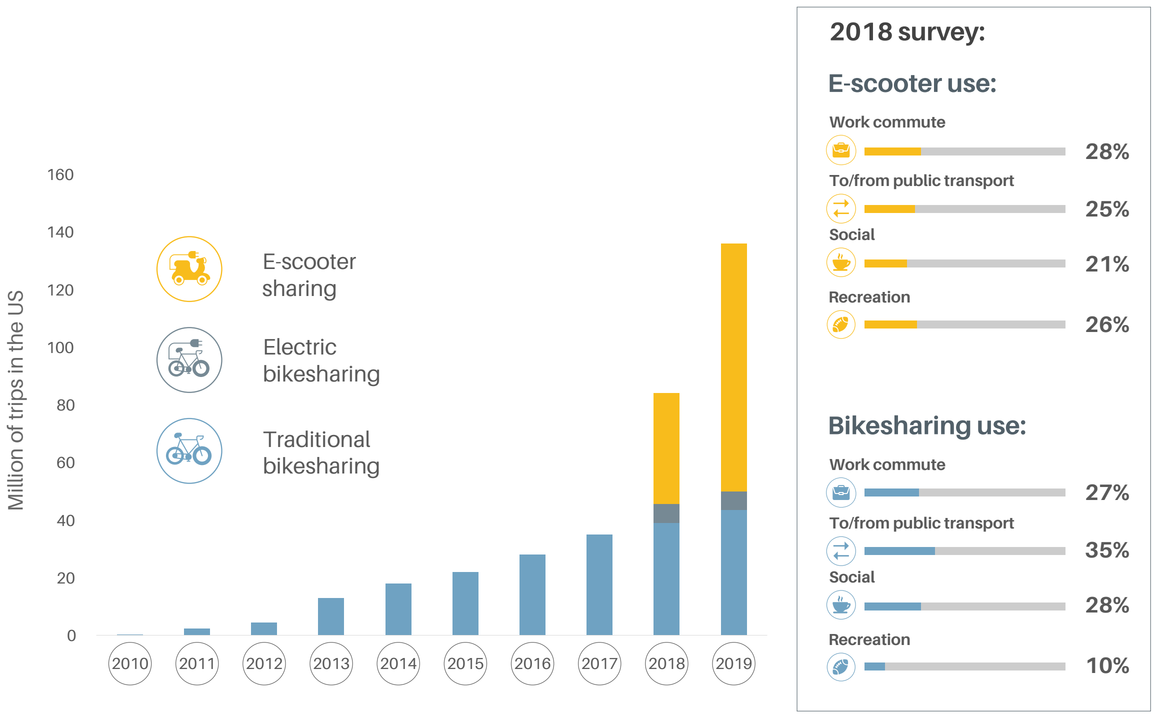
- More than 40 micromobility companies were founded in 2018, but in 2019 and 2020 this fell to only 17 and 8 companies respectively starting operations.[35]
- In 2019 and 2020, four e-scooter sharing companies representing more than USD 190 million in combined venture funding were acquired, three companies closed, and two others merged.[36]
- In early 2020, **Lime** announced that it would lay off 14% of its staff (100 people) and cease operations in dozens of **USA** cities, including Atlanta, San Diego, San Antonio and Phoenix. By that time, **Scoot**, **Lyft** and **Skip** had already announced similar measures.[37]
- **Bird** shed 30% of its employees in late March 2020, after having brought USD 75 million in venture capital a few months before.[38]

Figure 2. Total number and annual additions of bike-sharing systems, by region, 2007-2019



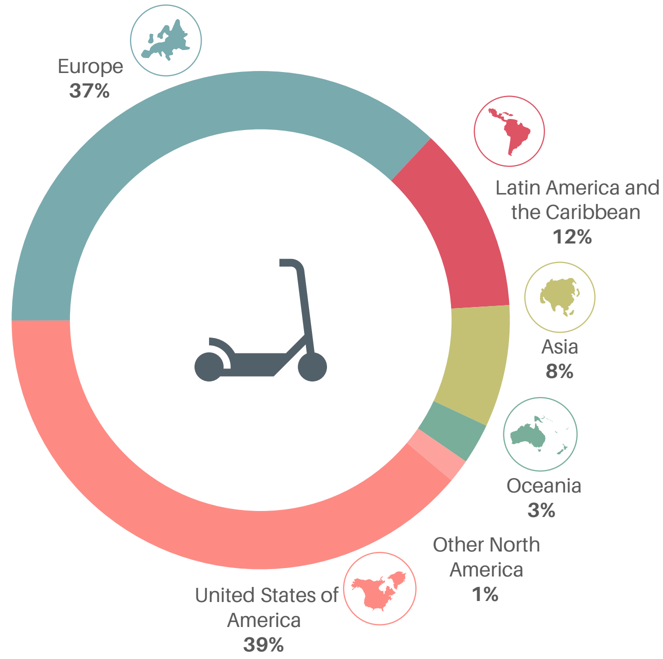
Source: See endnote 18 for this section.

Figure 3. Number and purpose of bike sharing, shared e-bike and shared e-scooter trips in the USA, 2010-2019



Source: See endnote 19 for this section.

Figure 4. Urban scooter services by region, early 2020

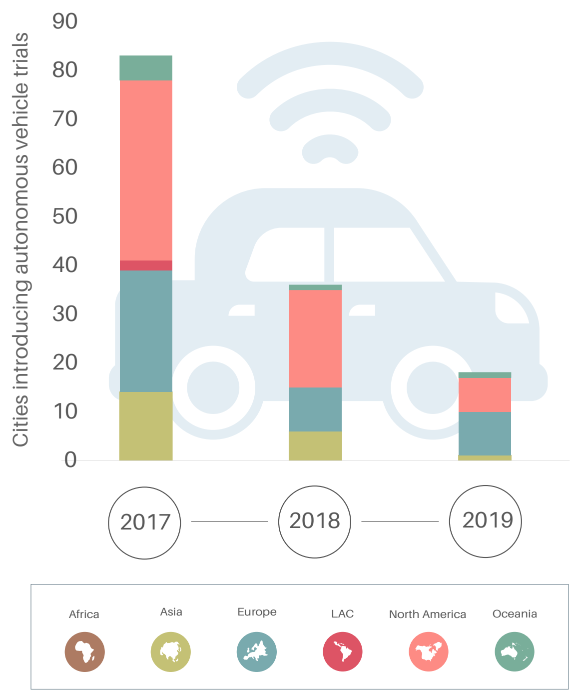


Source: See endnote 27 for this section.

Autonomous vehicles, widely used in shared applications, have not seen increased market momentum, with 80% fewer cities introducing vehicle trials during 2019 than in 2017 (*see Figure 5*).[39] Towards the end of 2018, the deployment of autonomous vehicles in many cities around the world was seen as a rising trend.[40] However, technical problems with the vehicles and mistrust from users, coupled with road safety concerns and a slow-moving regulatory environment, have slowed this growth.[41] Prospects surrounding the future of automated freight (both long-haul travel in trucks and short last-mile delivery by small robots) have been delayed for similar reasons.

- In countries where autonomous vehicles have been tested (**China**, **Germany** and several **USA** states), significant deployments occurred in cities between 2018 and 2020, and regulatory oversight was strengthened.[42]
- **Frankfurt**, Germany started operating a public autonomous shuttle on a 700-metre closed street in 2019.[43]
- In **Singapore**, a full-sized autonomous bus began testing on the campus of Nanyang Technological University in March 2019.[44]
- In the freight sector, a self-driving truck completed the first successful cross-country trip in the **USA** in December 2019.[45]
- Automaker **GM** announced in January 2020 its allocation of USD 2.2 billion for electric and autonomous vehicle production.[46]

Figure 5. New autonomous vehicle trials in cities, by region, 2017-2019



Source: See endnote 39 for this section.

Emission trends

While there is potential for shared mobility services to reduce emissions from the transport sector, there is no clear consensus on the environmental impact of these services. Improved monitoring, measuring and evaluation can ensure that research results are valid and can make the case for increased investment in shared mobility across new geographies and market segments.

According to some studies, electric scooter and bike-sharing services have reduced emissions by shifting trips from polluting transport modes; in contrast, ride-hailing services increase vehicle-kilometres travelled and result in more emissions. Shared mobility appears to offer a solution for providing first- and last-mile connectivity to and from public transport, increasing its access and use.

However, validating data on shared mobility and its impacts is challenging: most services are fairly new, and data series are limited. Private sector studies tend to focus on specific providers' data and show potential bias; academic studies often lack comprehensive datasets; and life-cycle analyses often make assumptions that are not reliable. Government-led studies appear to have greater validity but generally rely on less data and are based mostly on surveys. Further research by independent centres and academic institutions is needed.

Positive reported impacts on emission reductions

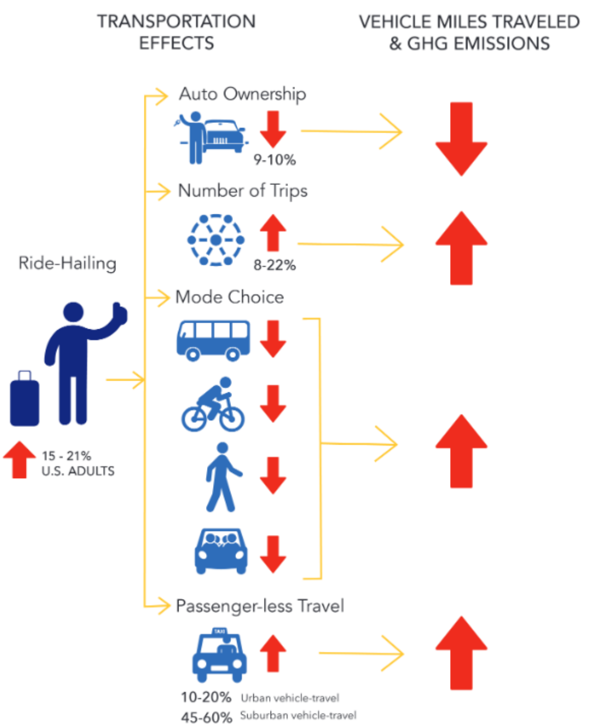
- E-scooters emit 75% fewer CO_2 emissions than passenger cars (based on life-cycle analysis that includes production), according to **Bird**.[47]
- **Lime** estimates that its e-scooter services in **Paris**, France replaced 1.2 million vehicle trips and avoided more than 330 tonnes of CO_2 between 2018 and 2019, while representing between 0.8 to 1.9% of all trips.[48] **Lime** estimates that this is the equivalent of taking 1,320 cars off the road.[49]
- A shift to lightweight electric vehicles (scooters and electric bicycles) results in mitigation levels of up to 68% by 2030, according to a case study of Paris, **France**.[50]
- An official report on an e-scooter pilot in Portland, Oregon, **US** found that the scooters replaced around 301,856 vehicle-miles and prevented around 122 tonnes of CO_2 emissions, equivalent to removing nearly 27 average passenger vehicles from the road for a year.[51]

Negative reported impacts on emission reductions

- A 2019 life-cycle analysis of e-scooter use by **North Carolina State University** reported much higher emissions than other modes of transport such as high-ridership buses or electric bicycles. The main sources of pollution are the vehicles used to redistribute the scooters and the materials used to manufacture them.[52]
- One study found that ride-hailing leads to around 83.5% more vehicle-kilometres travelled than if ride-hailing had not existed.[53]
- Another study found that ride-hailing accounts for a 10-20% increase in vehicle travel in urban areas and a 45-60% increase in vehicle travel in suburban areas (*see Figure 6*).[54]
- In a study of cities with large concentrations of ride-hailing services, carpooling trips led to at least a doubling of vehicle-kilometres travelled when compared to the transport modes they replaced.[55]
- Research indicates a slight increase in emissions when implementing car sharing because it provides access to automobiles to those who did not own them.[56]

Many ride-hailing operators have accelerated the roll-out of electric vehicles to achieve zero-emission fleets, and some sub-national governments have adopted electric vehicle regulations and targets. Replacing conventional ride-hailing vehicles with electric vehicles has the potential to deliver three times the emission reductions compared to conventional vehicles.[57] Due to impacts caused by the increasing use of ride-hailing systems, both public and private sector actors have taken recent action to electrify shared fleets.

Figure 6. The effects of increased ride-hailing on transport trends, vehicle-kilometres travelled and greenhouse gas emissions in a USA study



Source: See endnote 54 for this section.

Public sector actions

- **California**, USA passed a regulation targeting 100% electrification of ride-hailing fleets by 2030.[58]
- In **London**, UK, new licenced private-hire vehicles must be zero emission beginning in 2021.[59]
- **Shenzhen**, China set a goal for 100% of its ride-hailing fleet to be electric by 2020.[60]

Private sector actions

- **Lime** has committed to 100% zero-emission operations for its fleet vehicles (e.g., the trucks transporting the e-scooters) by 2030.[61]
- The ride-hailing service **Lyft** has committed to electrifying its entire fleet by 2030.[62]
- In Singapore, the ride-hailing service **Grab** added 200 electric cars to its fleet in 2019.[63]
- **Uber** aims for 50% of its rides in seven European capitals to be in zero-emission vehicles by 2025, and globally it aims for all rides to be in zero-emission vehicles, public transport and micromobility by 2040.[64]

Policy measures

During 2019 and 2020, funders showed greater caution towards shared mobility services. Overall, the integration of shared, electric and autonomous transport services has fallen short of its potential, given the challenges related to achieving a proper balance between the public and private sectors, developing adequate regulations and identifying appropriate market deployment. However, some regions have developed shared mobility services policies, stringent regulations and mobility standards.

Regulation of new services and business models has been a key determinant of the pace of deployment of shared mobility services, with a number of cities and countries enacting stricter controls. Because shared mobility services are generally market-led, regulations have typically been protective. Differences between the public and private sector, the need for clearer goals for these services, and the difficulty in creating adequate regulations (or the lag between market-led deployment and reactive regulations in different levels of government) have made it more difficult to move towards a well-co-ordinated environment for shared mobility services. This has reduced the initial interest of many companies to deploy such services, and of governments to implement decisive policies.

- In **Estonia**, an amendment to the Traffic Act passed at the end of 2020 put e-scooters in a new category of "light mobility vehicles" and created a set of comprehensive regulations for scooter use.[65]
- Between 2019 and 2020, European countries including **Germany**, **Italy** and **North Macedonia** enacted sidewalk bans, age restrictions and speed limits for e-scooter use.[66]
- In March 2019, **São Paulo**, Brazil enacted a law limiting the use of e-scooters to only roads and bicycle lanes with a maximum speed of 20 kilometres per hour.[67] Several other Latin American and Caribbean countries (**Chile**, **Colombia**, **Mexico** and **Peru**) implemented similar regulations in 2019.[68]
- **Singapore** prohibited the use of e-scooters on all footpaths from November 2019. Since the policy discouraging the use of personal mobility devices on roads is still in place, e-scooters can be used only on cycling paths and park connector networks.[69]
- In 2019, **Los Angeles**, USA began requiring operators of shared two-wheelers to submit real-time location data, using a shared mobility data specification programme that enables the city to track the location of each unit.[70]
- E-scooters were regulated in 46 of 50 **USA** states as of the end of 2020, and were illegal to use on sidewalks in 11 USA states.[71]

New partnerships, tools and guidelines have emerged to increase co-ordination among public and private actors in planning and operating shared mobility services. A substantial redefinition of several aspects of shared mobility services (for example, partnerships, data collection, regulations) has demonstrated the need to expand these services to a larger share of the population in order to achieve significant and measurable positive impacts on emission reductions.

- The **New Mobility Alliance** (**NUMO**), launched in 2019, brings together cities, non-governmental organisations, companies, mobility service operators and community advocates from diverse sectors to operationalise the Shared Mobility Principles for Livable Cities to increase urban equity and accessibility.[72]
- The World Economic Forum's **Global Future Council on Mobility** has created a set of guidelines to help strengthen partnerships among cities and mobility companies through greater collaboration on sharing trip data, managing public space and addressing community needs.[73]

Africa has been prominent in a surge of tech-based improvements in analysis, information and operating platforms for formal and informal shared mobility services that provide access to transport for those with internet connectivity. Regional models and tools are being developed to facilitate better organisation of paratransit (sometimes called "informal transport") services in Africa. These tools hold promise for increasing information about services deployed and for improved user connectivity to existing transport networks (e.g., providing solutions for first- and last-mile trips to access public transport).

- Between 2010 and 2019, 180 mobility-related start-ups were launched across **Africa**. Shared mobility accounted for 57% of these companies, including ride-hailing and ride-sharing services and app-based motorcycle services, such as **SafeBoda**.[74] Other initiatives address product innovation, commuter experience and data-driven decision making. Additional apps include **GoMetro** and **WhereIsMyTransport** (travel maps and planning), **Little** (to request services such as matatus and boda bodas) and **Epesi** (trip planning).[75]

- **SWVL**, a start-up founded in Egypt, merges tech with Africa's established traditional mobility offering. It provides better demand forecasting, market accessibility and certainty to ride-hailing suppliers, while giving users planned rides, app-supported transactions and seat bookings in minibus taxis.[76]
- Efforts have been undertaken in **Nairobi**, Kenya; **Gaborone**, Botswana; and **Accra**, Ghana to leverage GPS-enabled smartphones, open crowdsourced databases and other technologies to enhance paratransit operation.[77]

Initiatives supporting shared mobility services

- The **Shared Mobility Principles for Livable Cities**, launched in 2017, include 10 principles to support the development of sustainable, inclusive, prosperous and resilient cities and are endorsed by countries, international organisations and mobility service providers.[78] This initiative constituted the starting point for the New Urban Mobility Alliance.
- The **New Urban Mobility Alliance** (**NUMO**) is a global alliance that "channels tech-based disruptions in urban transport to create joyful cities where sustainable and just mobility is the new normal".[79] As of late 2020, NUMO had more than 280 allies (cities, non-governmental organisations, companies, mobility service operators, and community advocates from diverse sectors) to leverage the significant mobility revolutions to address urban challenges such as equity, sustainability, accessibility and labour, among others.[80]
- The **Global New Mobility Coalition**, curated by the World Economic Forum, is a diverse community of more 150 global experts, non-governmental organisations and companies. It aims to accelerate the shift to a Shared, Electric and Autonomous Mobility (SEAM) system that provides for healthier cities, reduces carbon emissions 95%, improves mobility efficiency 70%, and decreases commuting costs 40%, while tapping into a USD 600 billion business.[81]
- The **Innovative Mobility Research Group** at the **Transportation Sustainability Research Center** at the University of California, Berkeley explores innovative mobility technologies and services that could improve transport options while reducing their negative societal and environmental impacts.[82] The group publishes research on the environmental and social impacts of innovative and emerging mobility technologies, such as shared mobility.
- The **Shared-Use Mobility Center** is a public interest partnership working to foster collaboration around shared mobility and helping to connect the growing industry with public transport agencies, cities and communities across the USA.[83]
- The **Mobility as a Service** (**MaaS**) **Alliance** is a partnership aiming to establish the common principles for mobility as a service by facilitating a single, open market and full deployment of these services. It brings together the public and private sectors as well as associations willing to centre mobility on users' needs.[84]
- The **Mobility on Demand Alliance**, launched by the Intelligent Transportation Society of America, aims to shape the future of mobility by promoting the benefits of mobility-on-demand services and sharing ideas and opportunities around it.[85]
- The **New Mobility Services Initiative**, part of the Sustainable Urban Mobility Action Cluster, intends to integrate and manage urban transport, develop collective systems for multi-modal mobility, and create an open and collaborative marketplace for new mobility services in Europe.[86]

Key indicators

	2017*	2019*	% change
Policy Landscape Indicators			
Countries with shared mobility regulations (# of countries)	N/A	17	–
Market Development Indicators			
Car-sharing services (# of services in cities)	N/A	4,139	-
Bike-sharing systems (# of systems)	1,766	2,015	+14%
Car-sharing vehicles (# of vehicles)	157,357 (2016)	198,418 (2018)	+26%
Autonomous vehicle systems in trial (# of countries)	26	44	+69%

(*) Data are for the indicated year unless noted otherwise.

Source: See endnote 87 for this section.

Box 1. Impacts of the COVID-19 pandemic on shared mobility services

Several ride-hailing services lost ridership during pandemic lockdowns, leading to job losses in the sector, with ride-hailing company Ola cutting 35% of its workforce in India, and Uber cutting 23% of its global workforce. During the pandemic, the transport sector has faced the challenge of balancing user safety with the financial stability of services. The need for social distancing and the imposition of lockdowns in 2020 led to a surge in deliveries, which was made more dynamic through the use of mobile apps to improve the seamlessness between the customer and the delivery service. For Grab, the demand for its food delivery services overtook demand for its ride-hailing services.

Demand for bike-sharing services increased sharply in a number of cities in 2020, while in other cities, demand for bike sharing struggled to reach 2019 levels due to lockdowns and service restrictions (*see Figure 1*). CitiBike in New York City, **USA** saw a 67% year-on-year increase in usage before the spring 2020 lockdowns went into effect, and, afterwards, usage quickly increased to levels similar to 2019. However, many shared mobility systems suffered. As of July 2020, some 137 operations had been relaunched after being previously suspended, 285 operations remained suspended, and 56 operations ceased to exist. In March 2021, New York City, **USA** lifted its ban on e-bikes and e-scooters in order to support food delivery.

In a 2021 survey on transport mode choices in the USA, the UK, France, Germany, Italy, Spain, Singapore and China , respondents said they aimed to maintain or increase their use of micromobility and ride-hailing services compared to pre-COVID-19 levels.

Lessons learned from the COVID-19 pandemic can be applied in order to preserve the improvements of app-based shared mobility services. Ongoing deployment of tactical urbanism measures ((local, short-term, low-cost activities that are city- and citizen-led) can also increase flexibility in shared mobility implementation, which can help to increase mobility options and enhance economic resilience.

Source: See endnote 3 for this section.

Figure 7. Changes in bike-sharing use during the COVID-19 pandemic, in selected cities

3.7 Fuel Economy

Key findings

Demand trends

- Fuel economy improvements slowed in 2017 to an annual rate of just 0.2% in advanced economies and 2.3% in emerging economies, well below the target rate of 3.7% set by the Global Fuel Economy Initiative (GFEI).
- Average fuel economy in the European Union (EU) has worsened and is falling short of standards needed to meet the region's 2021 efficiency target, due in part to a 5-15% decline in the market share of diesel vehicles (which are more efficient) since 2014 and to a slow scale-up of electric vehicles.
- The market share of sport utility vehicles (SUVs) increased 15% between 2014 and 2019, offsetting the overall positive impacts of efficiency improvements in vehicles. SUVs were the second largest contributor to the increase in global carbon dioxide (CO_2) emissions among all energy sectors.
- Rising vehicle sales in developing and emerging markets also affected the global fuel economy average, with sales in emerging markets increasing 2% over those in advanced markets between 2015 and 2017.
- The used vehicle market is a major share of vehicle sales in the Global South. Africa imported the largest number of used vehicles (40%) during 2015-2018, followed by Eastern Europe (24%), Asia-Pacific (15%), the Middle East (12%) and Latin America (9%).

Emission trends

- Improving the efficiency of passenger transport saved the equivalent of 2.5 exajoules of energy from 2015 to 2018; however, this resulted in only halving the increase in transport energy use. Other factors contributing to increases in transport energy use include: increased vehicle activity; a shift towards private vehicles in developing countries; older, larger and more polluting vehicle types; and low occupancy rates (such as large vehicles with spare capacity or vehicles returning empty) as well as the shift from diesel vehicles.
- Achieving a fuel economy of 4.4 litres of gasoline-equivalent (lge) per 100 kilometres for new light-duty vehicles (compared to the current level of 7.2 lge in 2017) could save around 359 billion lge and avoid 844 million tonnes of CO_2 emissions from 2005 to 2030. This would result in a 16% reduction in business-as-usual emissions by 2030.
- Adding a shift to electric vehicles alongside improvements in internal combustion engines could achieve further CO_2 emission reductions of 3 million to 5 million tonnes per year, depending on how electricity grids are decarbonised.

Policy measures

- As of 2020, 54 countries had established fuel economy policies, such as labelling schemes that help consumers compare vehicle choices and understand tax implications over the lifetime of the vehicle.
- By 2019, 89 developing countries across Asia, Africa, Latin America and Eastern Europe had made national and regional commitments to improve fuel economy.
- Complementary "Avoid" and "Shift" strategies must be adopted to achieve the additional 2-5 million tonnes of annual CO_2 emission reductions from road transport needed to meet Paris Agreement goals.
- A number of emerging economies and regions are setting roadmaps and targets to accelerate the transition to more efficient vehicles through fuel economy improvements.
- In 2019 and 2020, no new national fuel economy mandates were adopted for trucks and other heavy-duty vehicles. **Canada**, **China**, the **EU** (including the United Kingdom, **UK**), **India**, **Japan** and the United States (**US**) remain the only entities with fuel economy standards for heavy-duty vehicles.
- Fuel economy policy is increasingly being integrated into wider frameworks for promoting the transition to electric vehicles.

Impacts of the COVID-19 pandemic

- In the wake of the pandemic, there has been pressure on regulators to ease future vehicle fuel economy and emission standards, which are critical to addressing the climate crisis and the health impacts of air pollution.
- Following the pandemic, many national and local trends point towards a short-term exodus from public transport and a shift to greater passenger car use, highlighting the need to maintain robust fuel economy standards.

Overview

Road transport is a major air polluter, contributing significant emissions of fine particulate matter and black carbon. Overall, transport is responsible for 25% of human-caused black carbon emissions, of which three-quarters are produced by diesel-powered heavy-duty vehicles.[1]

The average fuel economy of passenger vehicles in 2017 was 7.2 litres of gasoline-equivalent (lge) per 100 kilometres.[2] Between 2018 and 2019, overall fuel consumption increased in Europe but declined in China, the Republic of Korea and the US.[3] Improving the efficiency and fuel economy of all vehicles (particularly internal combustion engine vehicles) can result in a projected savings of 5 million tonnes of CO_{2eq} emissions annually by 2050, compared with current policies.[4] Such actions continue to be vital for decarbonising transport.

To maximise emission reductions, a switch to vehicle technologies with zero tailpipe emissions is also needed. This could save another 5 million tonnes of CO_{2eq} emissions annually by 2050, especially if combined with bans on internal combustion engine vehicles by 2030.[5] These steps will be especially important in the wake of the COVID-19 pandemic, when many national and local trends point towards a shift to greater passenger car use (*see Box 1*).[6]

The Global Fuel Economy Initiative (GFEI) is a partnership of six leading transport and energy organisations[i].[7] It serves as a global reference point on the improvement of fuel economy standards and has set a target to double the average fuel economy of light-duty vehicles by 2030, reducing CO_2 emissions 90% by 2050 (compared to 2005).[8] Meeting this target requires a 3.7% annual improvement in fuel economy, which countries are not yet close to meeting, as they have only achieved a 1.5% annual improvement.[9] The GFEI has also set reduction targets for two- and three- wheeled vehicles, heavy-duty vehicles and buses (*see Figure 2*).[10]

Demand trends

Fuel economy improvements slowed in 2017 to an annual rate of just 0.2% in advanced economies and 2.3% in emerging economies, well below the target rate of 3.7%.[11] This is in part because of rising vehicle sales in less-regulated markets, a trend towards larger vehicles, and fewer sales of (more efficient) diesel vehicles in **Europe**; meanwhile, growing sales of electric vehicles have yet to reach a significant share of the total market.

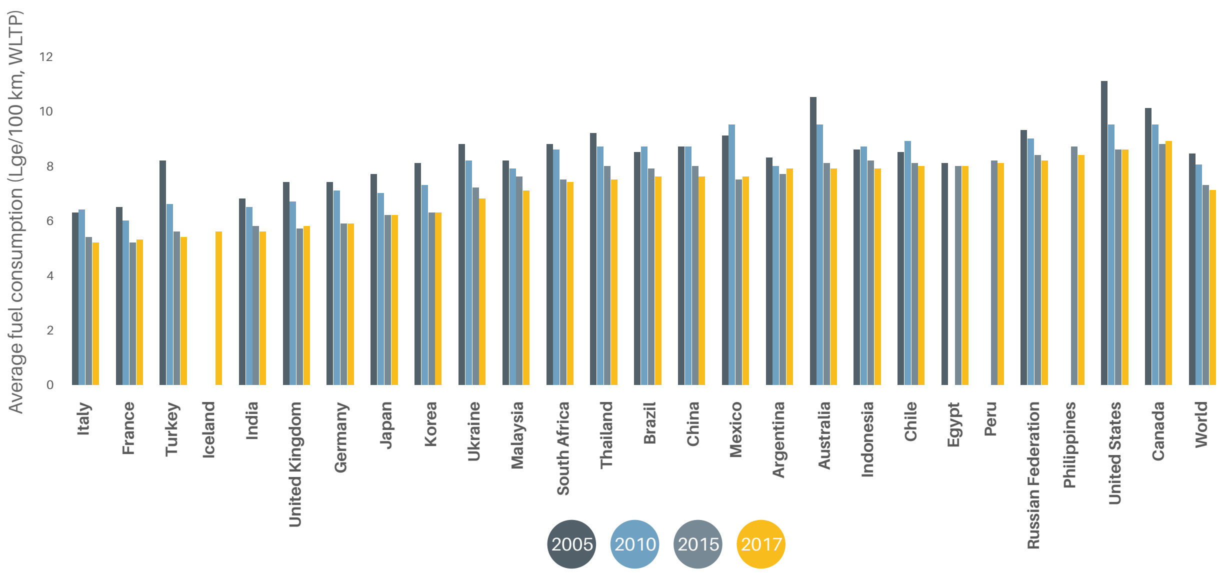
Overall, the average fuel economy of light-duty vehicles improved in all regions between 2005 and 2017, although absolute levels and trends differ widely among countries and regions (*see Figure 1*).[12] However, progress in improving fuel economy around the world is still well below the rate needed to achieve the GFEI target for 2030.[13]

Average fuel economy in the EU has worsened and is falling short of standards needed to meet the region's 2021 efficiency target, due in part to a 5-15% decline in the market share of diesel vehicles (which are more efficient) since 2014 and to a slow scale-up of electric vehicles.[14]

- In recent years, sales of diesel vehicles have declined in the largest EU markets.[15] The market share of diesel vehicles in Europe fell from 44% in 2017 to 31% in 2019 and 28% in 2020.[16]

i The FIA Foundation, the International Council on Clean Transportation, the International Energy Agency, the International Transport Forum, the Institute of Transportation Studies at the University of California at Davis and the United Nations Environment Programme.

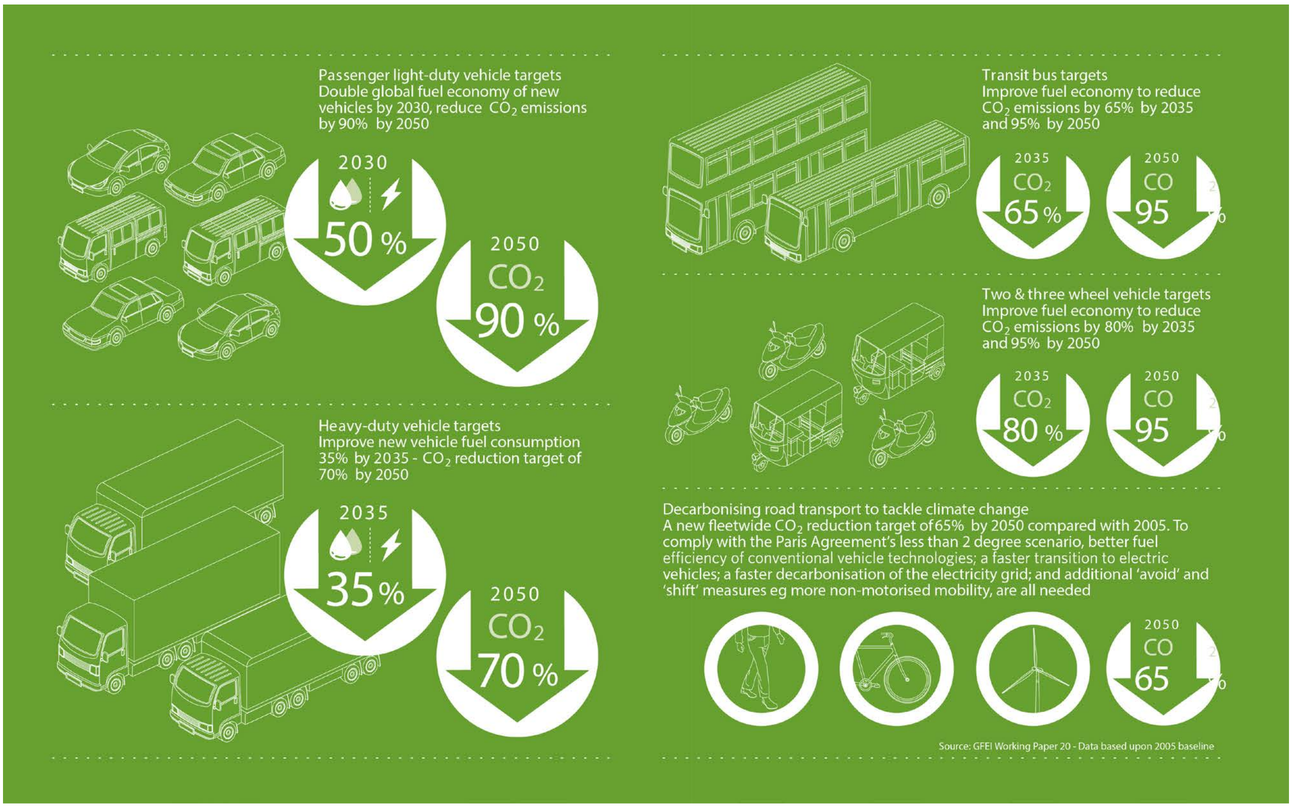
Figure 1. Light-duty vehicle fuel economy by country, 2005-2017



Note: Fuel economy is measured in litres of gasoline-equivalent per 100 kilometres; LDV = light-duty vehicle; L = litre

Source: See endnote 12 for this section.

Figure 2. Updated GFEI fuel economy targets (reductions from 2005 baseline)



Source: See endnote 42 for this section.

- While electric vehicle sales in the **EU** have grown, they still had only a 3% market share as of 2019.[17]
- For new cars registered in the **EU** in 2019, average emissions were 30% higher than the emissions target set for 2021. New-car emissions in 2019 reached 122 grams of CO_2 per kilometre (New European Driving Cycle, NEDC) compared to the targeted 95 grams (NEDC) or 109 grams (Worldwide Harmonised Light Vehicle Test Procedure).[18]

The market share of SUVs increased 15% between 2014 and 2019, offsetting the overall positive impacts of efficiency improvements in vehicles.[19] The largest increase has been in the small SUV segment (including many "crossover" vehicles), which consume more fuel on average than any other passenger car type.[20] As a consequence, **SUVs were the second largest contributor to the increase in global CO_2 emissions among all energy sectors.**[21] Emissions from the world's SUV fleet increased by nearly 0.55 gigatonnes (Gt) of CO_2 between 2010 and 2019, to roughly 0.7 Gt of CO_2.[22]

- **North America** and **Australia** have particularly high market shares of large vehicles.[23] In the **USA**, the market share of SUVs (both cars and trucks) reached 51% for model year 2019.[24]
- The market share of SUVs in the **EU** increased from 25% in 2017 to 38% in 2019.[25]

Rising vehicle sales in developing and emerging markets also affected the global fuel economy average, with sales in emerging markets increasing 2% over those in advanced markets between 2015 and 2017.[26] Developing countries have historically had less-efficient vehicles. Although emerging economies such as **China** and **India** have adopted fuel economy standards, in general developing countries remain well short of the 3.7% annual improvement needed to reach the GFEI's targeted average fuel economy of 4.4 lge per 100 kilometres for new vehicles by 2030.[27]

The used vehicle market is a major share of vehicle sales in the Global South.[28] **Africa imported the largest number of used vehicles (40%) during 2015-2018, followed by Eastern Europe (24%), Asia-Pacific (15%), the Middle East (12%) and Latin America (9%).**[29]

- As much as 70% of exported used light-duty vehicles head to developing countries.[30]
- In **Africa**, 60% of annual registrations were of used vehicles in 2020.[31]

Differences in regulations, even among neighbouring countries, can greatly impact the average fuel consumption and CO_2 emissions of a country's vehicle fleet.

- For example, the average fuel consumption and CO_2 emissions of vehicles in **Rwanda** are about a quarter higher than **Kenya's**.[32]

Emission trends

CO_2 emissions are directly correlated to vehicle efficiency (such as fuel economy or fuel consumption) and therefore are linked to the overall market shares of different types of vehicles sold. The growing consumer preference for larger and less efficient vehicles (such as SUVs) is negatively impacting average fleet emissions.

Improving the efficiency of passenger transport saved the equivalent of 2.5 exajoules of energy from 2015 to 2018; however, this resulted in only halving the increase in transport energy use.[33] **Other factors contributing to increases in transport energy use include: increased vehicle activity; a shift towards private vehicles in developing countries; older, larger and more polluting vehicle types; and low occupancy rates (such as large vehicles with spare capacity or vehicles returning empty) as well as the shift from diesel vehicles.** Thus, improving efficiency alone is not enough to reduce overall energy use in transport.

- In the **USA**, emission regulations for light-duty passenger vehicles and trucks are projected to cut 6 billion metric tonnes of CO_2 emissions over the life of vehicles sold in model years 2012-2025, and allow manufacturers flexibility in meeting the standards.[34] For heavy-duty vehicles, current federal regulations are projected to reduce CO_2 emissions by around 270 million tonnes over the life of vehicles, saving around 530 million barrels of oil.[35]
- In the **EU**, the increase in average CO_2 emissions for new passenger cars between 2017 and 2019 was affected by two main market trends: the continuing shift from diesel to petrol cars (the diesel car share decreased 5%), and the shift towards larger and heavier SUVs powered by petrol.[36] In 2019, as in 2017 and 2018, far more petrol cars (comprising nearly 63% of the new fleet) were sold than diesel cars (32%), and the shift also continued towards SUVs.[37]
- Because diesel cars are generally more fuel-efficient than petrol cars of comparable size, and smaller cars are more fuel-efficient than larger ones, these market trends negatively affected the average CO_2 emissions of the fleet.[38] Despite the efficiency advantages of diesel vehicles, consideration of their wider public health impacts, such as nitrogen oxide and particulate matter emissions, also must be factored in.[39]

Achieving a fuel economy of 4.4 litres of gasoline-equivalent (lge) per 100 kilometres for new light-duty vehicles (compared to the current level of 7.2 lge as of 2017) could save around 359 billion lge and avoid 844 million tonnes of CO_2 emissions from 2005 to 2030.[40] **This would result in a 16% reduction in business-as-usual emissions by 2030.**[41] The GFEI has defined targets for reducing energy consumption and CO_2 emissions, based on current vehicle trends and in line with Paris Agreement targets (*see Figure 2*).[42] Meeting these targets would require substantially decarbonising the electricity grid (to reduce emissions associated with electric vehicles), as well as increasing the use of Avoid and Shift measures, including more non-motorised transport trips.[43]

Adding a shift to electric vehicles alongside improvements in internal combustion engines could achieve further CO_2 emission reductions of 3 million to 5 million tonnes per year, depending on how electricity grids are decarbonised.[44] Assuming aggressive decarbonisation, improvements in electrification and fuel consumption for passenger vehicles could contribute around half of the annual reductions (more than 5 million tonnes) needed to meet the Paris Agreement's commitment to limit the global average temperature increase to "well below" 2 degrees Celsius; meanwhile, electrification of freight would contribute around 4 million tonnes, and electrification of buses and two- and three-wheelers would contribute less than 1 million tonnes each.[45]

Policy measures

Fuel economy improvements help to lessen dependence on fossil fuels and, when linked to more stringent vehicle emission standards, can reduce emissions of short-lived climate pollutants such as black carbon while also improving air quality, helping to prevent premature deaths.[46] Motor vehicles contribute between 25% and 75% of urban air pollution worldwide, depending on the pollutant and the location.[47] Policy measures aimed at improving fuel economy can increase these health and economic benefits.

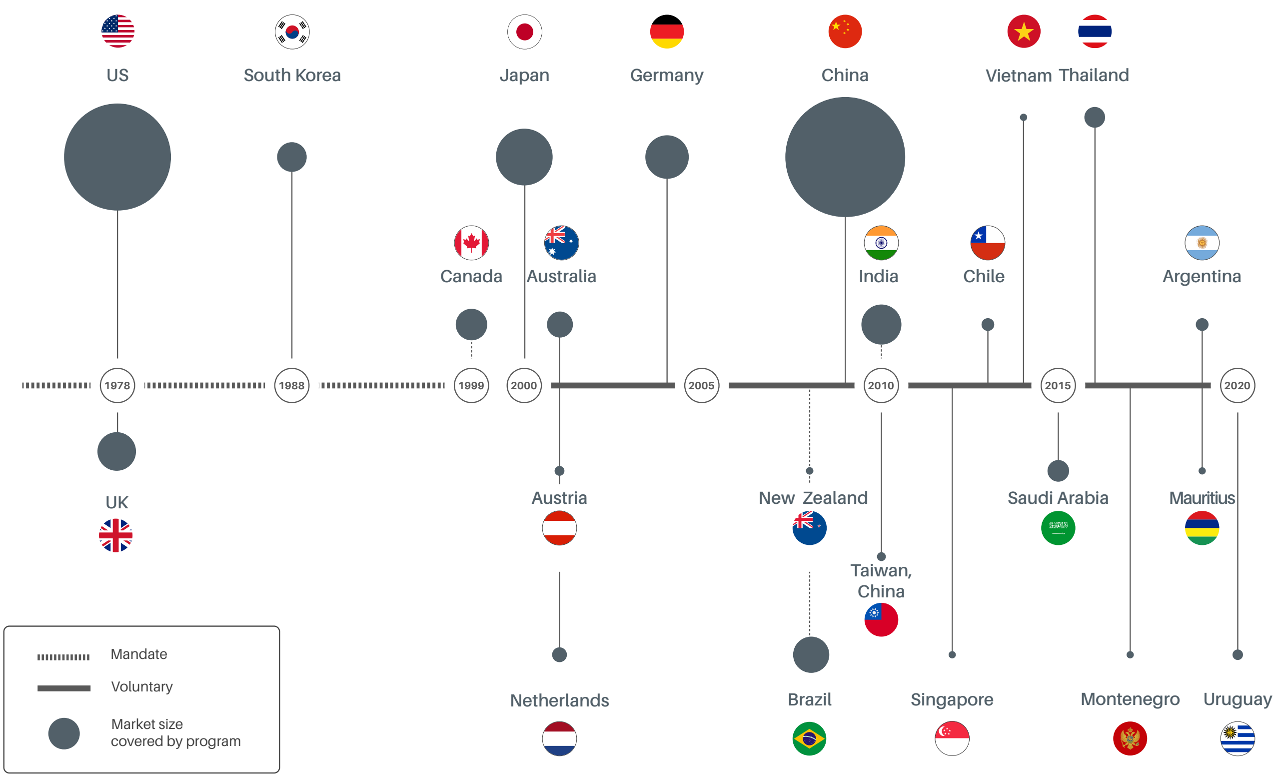
As of 2020, 54 countries had established fuel economy policies, such as labelling schemes that help consumers compare vehicle choices and understand tax implications over the lifetime of the vehicle (*see Figure 3*).[48]

- Between 2018 and 2020, **Argentina, Mauritius, Montenegro and Uruguay** all introduced fuel economy labelling schemes.[49]
- **The Philippines** plans to introduce new energy efficiency ratings for vehicles in 2021.[50]
- **Vietnam** introduced a mandatory fuel economy label for motorbikes in 2020.[51]

By 2019, 89 developing countries across Asia, Africa, Latin America and Eastern Europe had made national and regional commitments to improve fuel economy.[52] Most vehicles sold globally are now subject to some form of fuel economy policy, with a number of emerging economies and markets setting roadmaps and targets to accelerate the transition to more efficient vehicles. Multi-stakeholder collaboration is key to helping policy makers understand their existing fuel economy levels (including setting a baseline) and evaluate options for developing new policies. Recent efforts include the following:

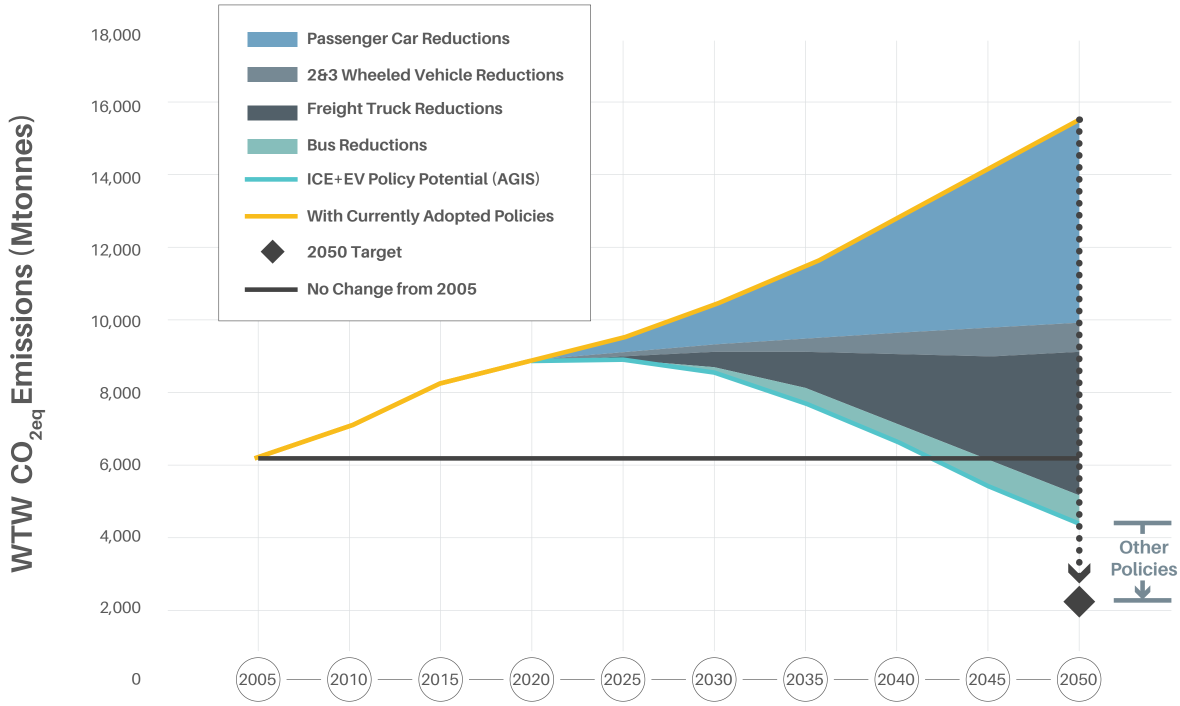
- In 2018, **Malaysia** announced its own fuel economy test cycle (to measure the volume of emissions produced) consistent with the Worldwide Harmonised Light Vehicle Test Cycle Procedure and taking into account the environment.[53]
- **Namibia** estimated the country's average fuel economy to be 6.7 litres per 100 kilometres in 2018, an improvement from 8.3 litres

Figure 3. Implementation of vehicle fuel economy labelling programmes in selected countries, 1978-2020



Source: See endnote 48 for this section.

Figure 4. Projected emissions reductions through vehicle efficiency-related measures by 2050



Source: See endnote 58 for this section.

in 2005. Recommendations to further improve the country's fuel economy include fiscal measures and programmes targeted at citizens to support the transition.[54]

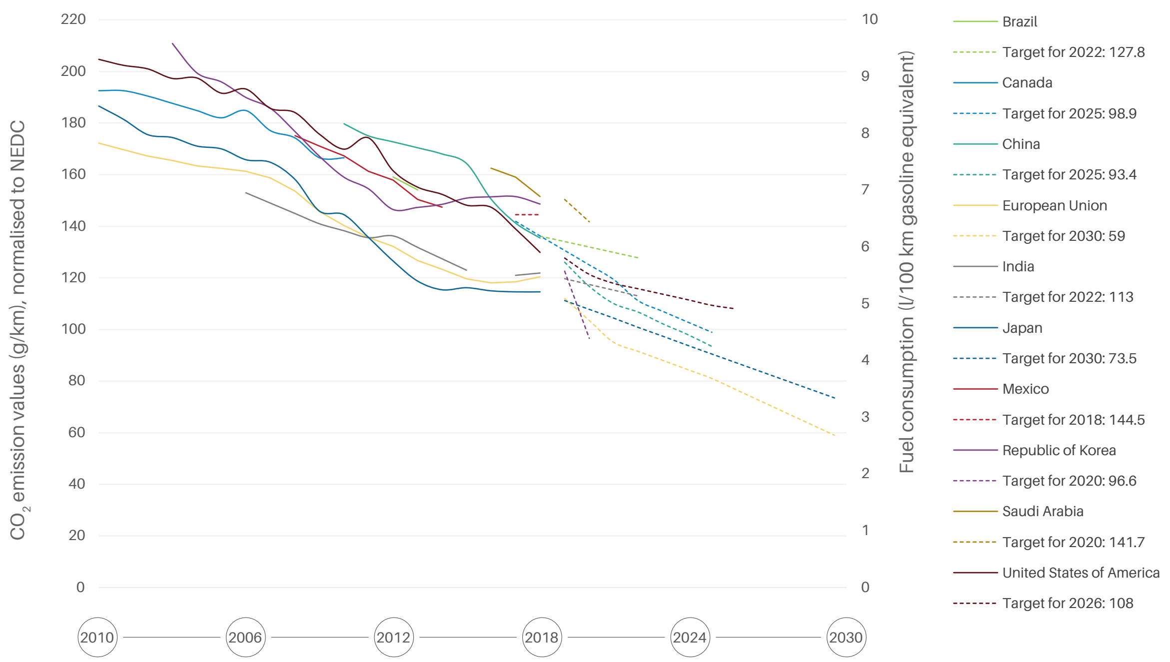
- **North Macedonia** introduced CO_2-based vehicle taxation starting in 2020, incentivising people to choose fuel-efficient vehicles due to higher tax levels.[55]
- In 2019, **South Africa** launched its first Green Transport strategy, which includes a commitment to promote fuel economy norms and standards as well as regulations that encourage improved efficiency in fossil fuel-powered vehicles.[56]
- In 2018, **Zambia** proposed a review of its carbon tax system for vehicles to include fuel economy as a consideration in order to promote a more efficient fleet.[57]

Complementary "*Avoid*" and "*Shift*" strategies must be adopted to achieve the additional 2-5 million tonnes of annual CO_2 emission reductions from road transport needed to meet Paris Agreement goals. Despite significant CO_2 savings projected from fuel economy improvements by 2050, emissions would remain 57% above 2005 levels and nearly five times higher than Paris Agreement targets (*see Figure 4*).[58] Thus, in addition to increasing the efficiency of light-duty and heavy-duty vehicles, complementary measures to reduce unnecessary journeys and to spur a shift to more efficient modes of transport (such as public transport, cycling and walking) are urgently needed.

A number of emerging economies and regions are setting roadmaps and targets to accelerate the transition to more efficient vehicles through fuel economy improvements. Southeast Asia and **West Africa** launched new regional roadmaps that aim to accelerate progress and co-ordinate measures among countries.[59]

- The Fuel Economy Roadmap of the **Association of Southeast Asian Nations (ASEAN)** aims to reduce the average fuel consumption of new light-duty vehicles 26% between 2015 and 2025.[60]
- In 2019, **Malaysia** was considering lowering fuel consumption to 5.3 litres per 100 kilometres by 2025 under the National Automotive Policy 2020 and in line with the **ASEAN** Fuel Economy Roadmap.[61]
- **West Africa**'s first ever Fuel Economy Roadmap, adopted in 2020, aims to improve fuel economy 34% by 2025 (compared to 2015 levels), setting an average fuel economy target of 5 litres per 100 kilometres by 2025 for member countries of the **Economic Community of West African States (ECOWAS)**.[62]
- In 2019, **China** published its fuel economy targets for 2025, which propose reducing the average fuel consumption of new passenger cars to 4 litres per 100 kilometres (NEDC).[63]
- In 2017, **India** set fuel economy standards for 2022, although estimates suggest that by 2018, the vehicle fleet was already only 8.7% away from achieving these levels.[64]

Figure 5. CO_2 emissions and fuel consumption of passenger cars in selected countries, 2000-2018 and future targets



Source: See endnote 65 for this section.

Passenger CO_2 emissions and fuel consumption standards in **Canada**, **China**, **the EU**, **India**, **Japan**, the **Republic of Korea**, **Mexico**, **Saudi Arabia** and the **USA** directly or indirectly influence the efficiency of vehicles sold in other markets, as many vehicles produced in these countries are exported (*see Figure 5*).[65]

- **Japan**'s new fuel economy standards, adopted in 2019, equate to a 32.4% improvement from 2016 levels by 2030.[66] The standards require an average gasoline-equivalent fuel economy of 25.4 kilometres per litre by 2030, second only to the EU's target in absolute fuel economy and emissions.[67]
- In 2020, the **USA** weakened and rolled back existing plans for fuel economy improvements, reducing the country's annual efficiency improvements from 5% to 1.5% and projecting no increase in the electric vehicle share by 2026.[68] The fuel economy standards are to be reviewed in 2021.[69]
- **Canada**, which previously aligned to the USA standards, has decided to maintain its existing targets, as this has proven to have wider economic and environmental benefits.[70]
- In its Climate Change Mid-Century Strategy, adopted in 2016, **Mexico** includes steps to increase the energy efficiency of public and private passenger and freight transport by establishing official standards and logistic and technological improvement programmes, including multi-modality and low-emission vehicles.[71]

In 2019 and 2020, no new national fuel economy mandates were adopted for trucks and other heavy-duty vehicles. Canada, China, the EU (including the UK), India, Japan and the USA remain the only entities with fuel economy standards for heavy-duty vehicles.[72] Fuel economy policies focusing on heavy-duty vehicles such as trucks are highly cost-effective because trucks travel much longer distances on average.[73]

- Phase III standards in **China**, the world's largest heavy-duty vehicle market, took effect in July 2019, helping to raise the efficiency of new buses and trucks sold in the country.[74]
- The **EU** adopted its first-ever CO_2 emission standards for heavy-duty vehicles in 2019, setting targets for 2025 and 2030 aimed at reducing the average emissions from new trucks.[75]
- In 2018, **India** put in place new fuel economy standards for heavy-duty vehicles.[76]
- In March 2019, **Japan** updated its fuel efficiency standards for trucks and buses, mandating improvements of 13.4% for trucks and 14.3% for buses by 2025 (compared with 2015).[77]
- **Brazil**, **Mexico** and the **Republic of Korea** are in various stages of developing policies to improve the efficiency of their heavy-duty vehicle fleets.[78]
- As of 2019, 39 countries had implemented soot-free standards for new heavy-duty vehicles (such as Euro VI or equivalent), and 5 more (**Brazil**, **China**, **Colombia**, **India** and **Mexico**) were preparing such policies.[79]

Fuel economy policy is increasingly being integrated into wider frameworks for promoting the transition to electric vehicles. This is being done through zero-emission vehicle (ZEV) mandates and through standardised accounting of average CO_2 emissions (such as NEDC).[80] Some regulations also include additional "credits" for electric vehicles to incentivise a rapid transition to electrified fleets, although such measures can risk weakening overall efficiency improvements by allowing car manufacturers to continue to produce conventional vehicles.

- **China** introduced a form of mandate for zero-emission vehicles for 2019 and 2020, requiring a minimum production level for "new energy vehicles".[81]
- The **EU's** planned fuel economy targets are the equivalent of reducing emissions from new cars and vans in the region 15% by 2025 and 37.5% by 2030 (31% for vans), compared to 2021 levels; they are expected to significantly boost the market for hybrid and electric vehicles.[82]

Box 1. Impacts of the COVID-19 pandemic on fuel economy

In the wake of the pandemic, there has been pressure on regulators to ease future vehicle fuel economy and emission standards, which are critical to addressing the climate crisis and the health impacts of air pollution. Some European countries are offering financial support to auto manufacturers, but to ensure overall emission reductions, these and other economic recovery policies for the transport sector must be linked to rapidly accelerating the transition to electric and efficient vehicles.

Following the pandemic, many national and local trends point towards a short-term exodus from public transport and a shift to greater passenger car use, highlighting the need to maintain robust fuel economy standards. In addition to policies focused on new vehicles, some governments have considered measures to increase fleet turnover and to remove older vehicles from the roads through "scrappage" schemes. The aim is often to boost demand for vehicles in the wake of post-pandemic economic shocks; however, research indicates that a vehicle replacement programme would achieve the largest environmental benefit if it was limited to sales of new battery electric vehicles.

This also highlights the need to greatly improve the energy efficiency of personal and commercial fleets in the context of broader sustainable transport planning, using a balanced *Avoid-Shift-Improve* framework.

Source: See endnote 6 for this section.

Initiatives supporting fuel economy and related areas

- **Below50** is a global collaboration that brings together the entire value chain for sustainable fuels, or fuels that produce at least 50% fewer CO_2 emissions than conventional fossil fuels. The initiative aims to create a critical mass of players (developers, users and investors) to grow the global market for the world's most sustainable fuels.[83]
- The **Climate and Clean Air Coalition's Heavy-Duty Diesel Vehicles and Engines Initiative** works to catalyse major reductions in black carbon through the adoption of clean fuel and vehicle regulations and supporting policies, with a focus on diesel engines in all economic sectors.[84]
- The **Global Fuel Economy Initiative** assists governments and transport stakeholders in improving vehicle fuel economy and reducing CO_2 emissions, and aims to double the average fuel economy of new light-duty vehicles globally by 2030, and all vehicles by 2050.[85] The initiative works to secure real improvements in fuel economy and the maximum deployment of vehicle efficiency technologies across the full range of vehicle sizes and technologies, including hybrid and fully electric vehicles.[86]
- The **Global Strategy for Cleaner Fuels and Vehicles** aims to virtually eliminate fine particle and black carbon emissions from new and existing heavy-duty diesel vehicles and engines through the introduction of low-sulphur fuels, as well as vehicle emission standards by 2030.[87]
- The **Partnership for Clean Fuels and Vehicles** is a global public-private partnership working with developing and transitional countries to reduce air pollution from vehicles through the promotion of cleaner fuels and vehicles.[88]

Key indicators

	2017*	2019*	% change
Policy Landscape Indicators			
GFEI fuel economy benchmarking (# of countries)	38	66	+73%
Fuel economy labelling schemes for light-duty vehicles (# of countries)	50	54	+8%
Fuel economy standards for light-duty vehicles (# of countries)	37	37	0%
Fuel economy standards for heavy-duty vehicles (# of countries)	33	33	0%
Green freight schemes (# of countries)	20	26	+30%
Market Development Indicators			
Average fuel economy of light-duty vehicles (litres of gasoline-equivalent per 100 kilometres)	7.4 (2015)	7.2 (2017)	+3%

(*) Data are for the indicated year unless noted otherwise.

Source: See endnote 89 for this section.

In Practice: Additional Policy Measures

Policies

- In 2018, the **Bangladesh** Road Transport Authority expressed the intention to develop appropriate policies and instruments to improve the average fuel economy of the national light-duty vehicle fleet in favour of EURO VI by 2025.[90]
- In 2020, **France** lowered the CO_2 emission threshold over which new cars are subjected to a penalty to 110 grams per kilometre, 7 grams lower than the 2019 threshold.[91]
- **Ghana** disseminated draft motor vehicle emission standards and regulations in 2018.[92]
- **Turkey** enacted new laws in 2019 to improve energy efficiency in the transport sector.[93]
- In 2019, the USA state of **California** signed an agreement with four major automakers to ensure that new vehicles would have an average fuel consumption of 15 kilometres per litre (36 miles per gallon) in real-world driving by 2026.[94]

Fuel economy trends

- The average fuel economy in **Bangladesh** improved from 8.98 litres per 100 kilometres in 2005 to 6.9 litres in 2017, a 23% improvement.[95]
- **Costa Rica** is in the process of transitioning its vehicle emission standards to Euro 6 in 2022, from Euro 3 in 2017 and Euro 4 in 2018.[96]

Fuel quality

- As of 2020, 63 countries had standards for ultra-low-sulphur diesel (less than 15 parts per million of sulphur), and 6 more (**Argentina**, **Colombia**, **India**, **Saudi Arabia**, **Thailand** and **Vietnam**) aim to transition to such standards by 2023.[97]

3.8

Electric Mobility

Key findings

Demand trends

- The global stock of electric passenger cars (battery and plug-in electric hybrids) grew 40% in 2020 to more than 10 million vehicles (up from more than 7.2 million in 2019); this represented 1% of the 2020 total vehicle stock.
- More than 600,000 electric buses were in operation in 2020. As of 2019, 18% of the world's buses were powered through electric sources, including battery electric (6.3%), hybrid-electric (7.9%) and direct overhead wires and similar (3%).
- The global stock of electric two- and three-wheelers (excluding electric-assisted bikes) totalled 290 million in 2020. Around one-quarter of all motorised two-wheelers worldwide were electric that year.
- Electric-assisted bicycles (e-bikes) are by far the most popular electrified road transport mode in Europe and North America; e-bike sales in Europe surpassed 4.8 million units in 2020, three times the number of electric passenger cars sold in the European Union (EU) that year.
- Between 2010 and 2020, the average price of electric vehicle batteries dropped 88%, from around USD 1,200 per kilowatt-hour (kWh) to USD 137 per kWh, increasing the potential for more widespread uptake of electric vehicles.
- By the end of 2020, more than 170,000 electric vehicles (three-wheelers, light trucks and company cars) were deployed through company fleets. Around 31,000 electric trucks were operating worldwide by year's end, but they represented less than 1% of total truck sales.
- Public and private charging infrastructure for electric vehicles has scaled up rapidly in some countries, although charging point distribution and the ratio of electric vehicles to charging points vary widely.

Emission trends

- Electric vehicles contribute at least 22% fewer carbon dioxide (CO_2) emissions than internal combustion engines, even when the electricity used for charging is generated from fossil fuel sources. While electric vehicles are more energy efficient than conventional vehicles overall, they offer even greater potential for emission reductions if they are based on clean renewable energy.
- Life-cycle emissions and the impact of electric vehicle batteries must be considered when comparing the environmental footprints of electric versus conventional vehicles. Major concerns include the extraction of raw materials and the recycling of batteries. Policies to extend the useful life of electric vehicle batteries can help governments and manufacturers offset the production costs, impacts and emissions.

Policy measures

- Countries have adopted ambitious time-bound targets to increase the share of electric vehicles in their overall fleets. By the end of 2020, 19 countries or sub-national jurisdictions had set targets to phase out diesel and petrol passenger vehicles.
- In 2020, the first-of-its-kind Zero Emission Vehicle Transition Council was established, comprising ministers and representatives from the world's largest and most progressive car markets.
- In response to phase-out targets by countries, major automobile companies are halting the development of internal combustion engines and accelerating their electric vehicle ambitions towards the 2030/2035 time frame.
- Leapfrogging to electric mobility in Africa, Asia and Latin America can bring significant benefits to local environments and economies.
- Utilities are taking on a greater role in the mobility ecosystem, thereby merging the value chains for electricity generation and electric vehicle charging.

Impacts of the COVID-19 pandemic

- Despite temporary shutdowns of auto factories and disruptions in global supply chains due to the pandemic, more than 3 million electric cars were sold worldwide in 2020, surpassing projections of 2.4 million.
- Electric vehicle sales jumped to 4.6% of global vehicles sold in 2020.
- A number of governments have increased electric vehicle investments as part of their COVID-19 recovery packages.

Overview

Between 2019 and 2020, the global landscape of electric mobility shifted from "commitment-centric" to "implementation-minded." Many public and private players have set specific targets for electrifying their fleets and banning diesel and petrol vehicles in countries or cities by a certain year. Interest has also risen in electric two- and three-wheelers. Logistics businesses have increased investments in electric fleets, and electric freight vehicles (such as trucks and electric cargo bikes) are being deployed in **Europe**, **North America** and **Asia**.

Large-scale progress in electric mobility has been concentrated in **China** and **Europe**. However, these experiences have pointed to the need to identify partnerships, policies and new business models for implementing projects (such as creating broad charging infrastructure networks) and operating them viably and equitably. Key to sustainable electric mobility is maximising the intermodality among sustainable, low carbon transport modes (both passenger and freight). Governments, industry, civil society and citizens need to create an enabling environment for sustainable mobility. In developing countries, electrifying all transport modes, starting with motorcycles, public transport, and rail, can avoid fossil fuel dependency and the high costs associated with air pollution and private car ownership.

The COVID-19 pandemic accelerated the uptake of electric vehicles through increased purchase subsidies, which were included in economic stimulus packages (*see Box*).[1] Sales of electric passenger cars grew strongly in major markets in 2020, and in **North America** and **Europe** many commuters shifted to electric-assisted bicycles, leading to three-digit growth in e-bike sales.[2]

Demand trends

The global stock of electric passenger cars (battery and plug-in electric hybrids) grew 40% in 2020 to more than 10 million vehicles (up from more than 7.2 million in 2019); this represented 1% of the 2020 total vehicle stock (*see Figure 1*).[3] **China**, **Europe** and **the United States of America** (**USA**) remained the leaders in electric passenger car sales, followed by the **Republic of Korea**, **Australia** and **Canada**.[4]

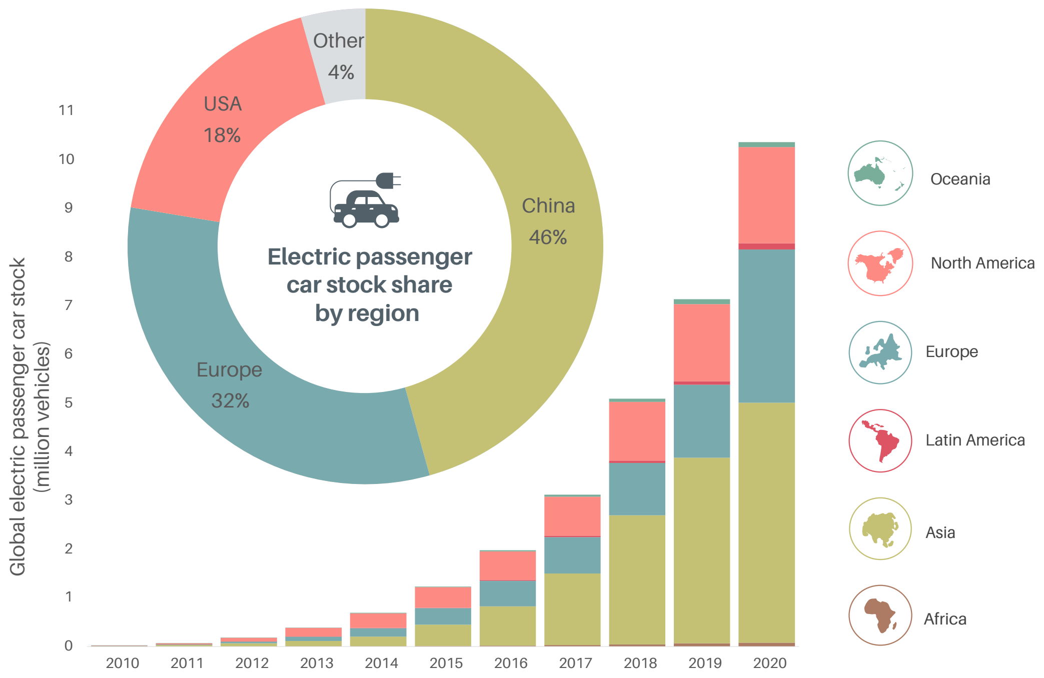
- The highest sales of passenger electric vehicles in 2020 were recorded in **China**, led by Shanghai followed by Beijing, Shenzhen, Hangzhou, Tianjin and Guangzhou.[5]
- In **Norway**, electric cars (battery and plug-in hybrids) accounted for more than 60% of new vehicle sales in 2019 and 69% of sales in the first six months of 2020.[6] Since January 2018, monthly sales of electric passenger cars have outnumbered any other drivetrain in Norway on average (*see Figure 2*).[7]

More than 600,000 electric buses were in operation in 2020.[8] **As of 2019, 18% of the world's buses were powered through electric sources, including battery electric (6.3%), hybrid-electric (7.9%) and direct overhead wires and similar** (*see Figure 3*).[9] Over 75,000 new electric buses were introduced each year in 2019 and 2020 (down 20% from 2018, when 93,000 units were sold).[10] **China** was home to more than 90% of the world's electric buses in 2020, followed by **North America** and **Europe**, whereas the buses are largely underrepresented in **Africa**.[11]

Electric buses can greatly improve the service quality of bus transport, bringing cleaner technology and resulting in less noise and more comfort, while improving air quality and having positive overall health benefits for citizens.[12] The advantages of electric buses have the potential to attract more people and to strengthen the use of sustainable transport modes.

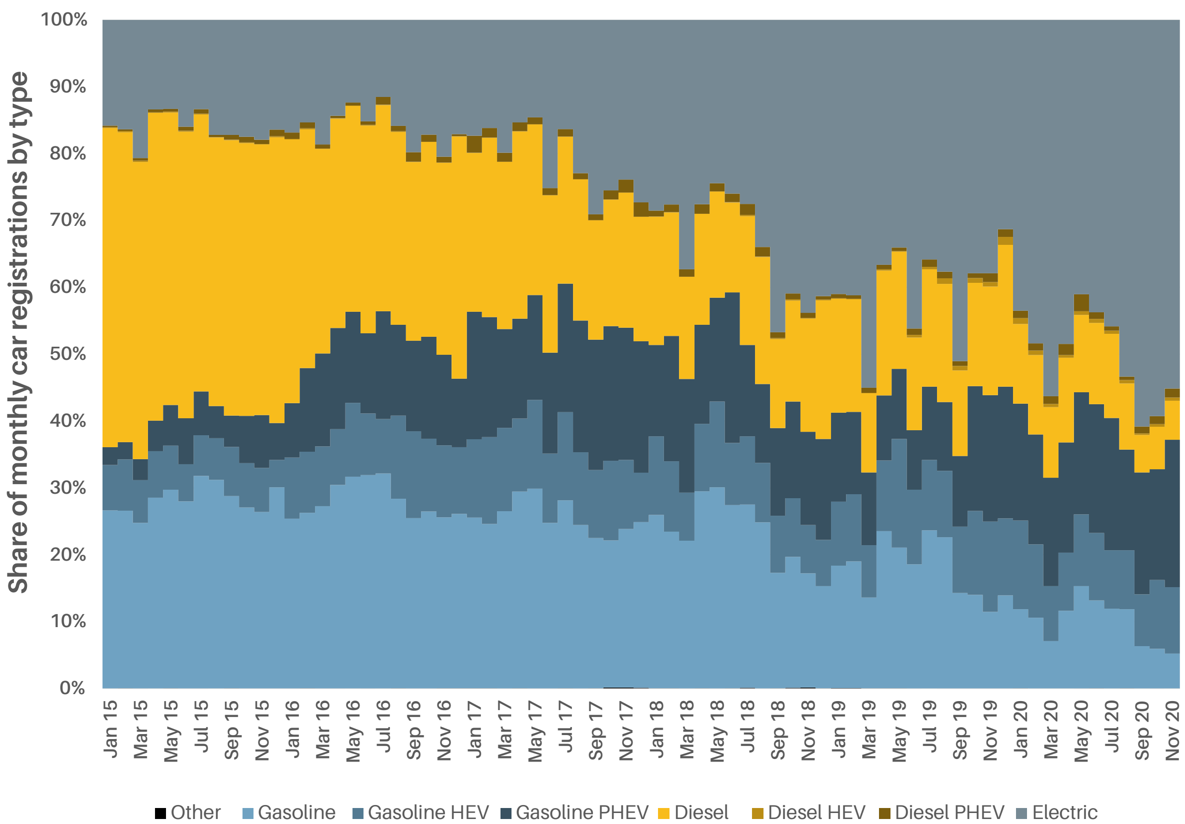
- In the **EU**, around 12% of newly registered buses in 2019 – or more than 1,600 units – were electric; this is more than the region's total electric bus fleet from 2012 to 2018 and a three-fold increase compared to 2018.[13]

Figure 1. Electric passenger car stock (battery and plug-in electric hybrids), by region, 2010-2020



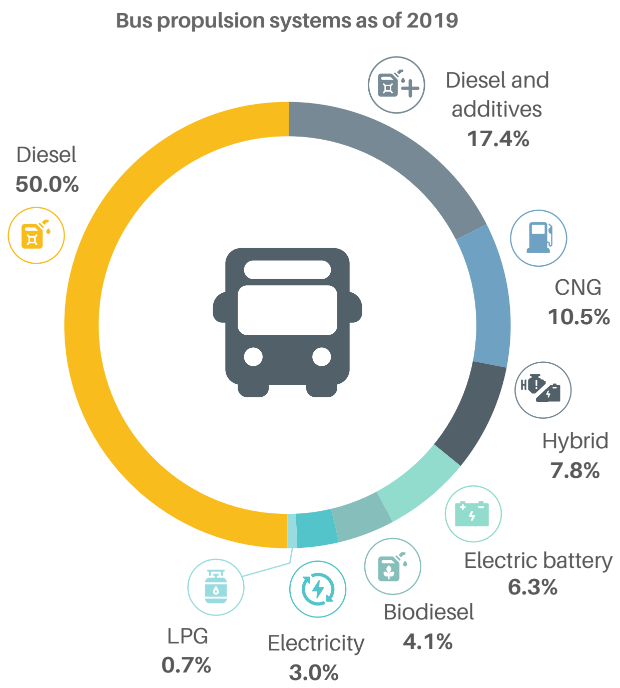
Source: See endnote 3 for this section.

Figure 2. New car registrations in Norway by vehicle type, 2015-2020



Source: See endnote 7 for this section.

Figure 3. Shares of bus propulsion systems globally, by type, 2019



Source: See endnote 9 for this section.

- As of March 2021, cities in **Latin America** had a total electric bus fleet of close to 3,000 buses.[14] **Santiago**, Chile and **Bogotá**, Colombia each had 400 electric buses, while **Brazil** and **Mexico** added around 250 electric buses each in 2019 and 2020.[15]
- The electrification of school buses has great potential in North America. The **USA** has a fleet of 480,000 school buses (representing 80% of all buses in the country) and the target is to electrify them by 2030.[16] **Canada** has committed to electrifying 5,000 buses between 2021 and 2025.[17]
- in December 2019, **Uganda** introduced its first electric buses, two units that were locally produced.[18]

The global stock of electric two- and three-wheelers (excluding electric-assisted bicycles) totalled 290 million in 2020.[19] Around one-quarter of all motorised two-wheelers worldwide were electric that year.[20] The majority of two-wheelers are in **China**, which is also one of the largest manufacturers of electric two-wheelers.[21] A rise in shared electric two-wheelers, particularly in **South Asia**, is attributed to their low operating costs and to long daily driving distances that are routine for last-mile connectivity and logistics businesses.[22]

- **India** has seen market-driven growth in electric three-wheelers, which are used for last-mile connectivity.[23] As of 2020, eight state governments in the country were offering rebates for three-wheelers as well as expedited permitting to vehicle owners who switch to electric three-wheelers powered by advanced batteries (lithium-ion over lithium-acid).[24]
- In its second Nationally Determined Contribution towards reducing emissions under the Paris Agreement, **Nepal** set a target for electric vehicle sales (passenger cars and two-wheelers) to represent 90% of all passenger vehicle sales (including two-wheelers) by 2030.[25]
- With support from the Department of Energy, 900 e-trikes started operation in **Metro Manila** in the Philippines as part of a larger national programme to support the introduction of 3,000 e-trikes.[26]

Electric-assisted bicycles (e-bikes) are by far the most popular electrified road transport mode in Europe and North America; e-bike sales in Europe surpassed 4.8 million units in 2020, three times the number of electric passenger cars sold in the EU that year.[27] If the trend continues, e-bike sales in Europe could reach 10 million units by 2024.[28] E-bikes can substitute car trips and serve as an important link to public transport. In the context of transport emissions, it is important to analyse where the shift to e-bikes comes from (*see Section 3.3 on Walking and Cycling*).

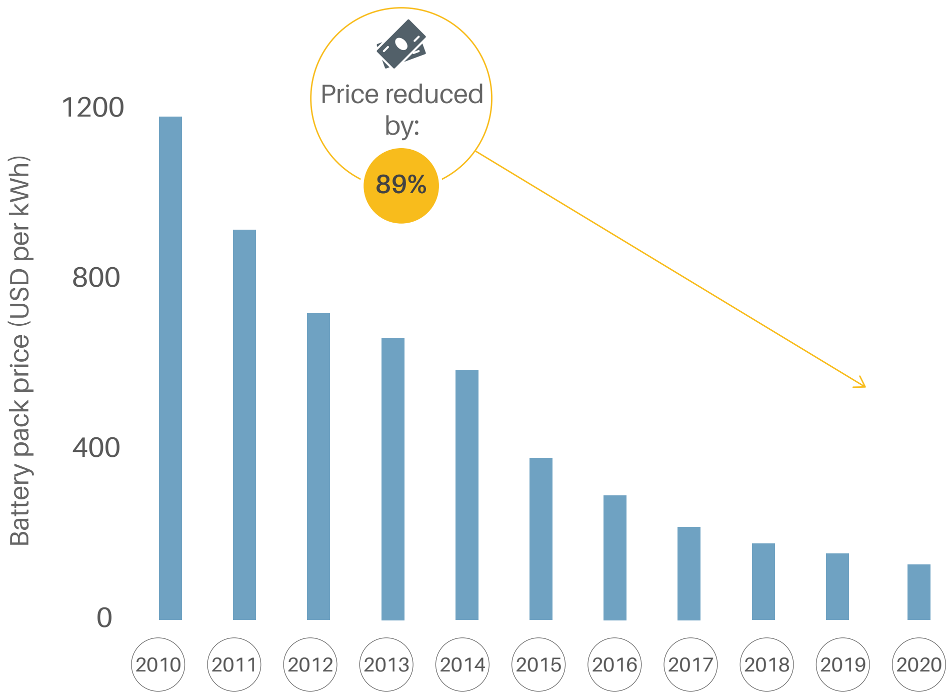
- E-bikes have entered the market in **Latin America and the Caribbean** mainly through bike-sharing services, as illustrated by examples from **Colombia** and **Ecuador** between 2015 and 2018.[29]
- In the **USA**, e-bike sales grew 145% between 2019 and 2020 as models became more affordable.[30] Bike-sharing services offering e-bikes are more popular and more widely used than services with regular shared bicycles.[31]

Between 2010 and 2020, the average price of electric vehicle batteries dropped 88%, from around USD 1,200 per kWh to USD 137 per kWh, increasing the potential for more widespread uptake of electric vehicles (*see Figure 4*).[32] Batteries represent 30-40% of the capital cost of an electric vehicle and play a key role in increasing the potential for more widespread uptake of affordable models.[33] Battery prices are projected to fall below USD 100 per kWh by 2024 as cumulative demand grows.[34] At this price point, electric vehicles could reach price parity with internal combustion engine vehicles, depending on the region and vehicle segment.[35]

Systems for swapping out electric vehicle batteries are seen as a solution to reduce costs and increase operational efficiency, due to faster recharging times. Battery swapping systems are increasingly relevant in markets with large shares of electric two-wheelers, such as **India** and **Chinese Taipei**.[36]

By the end of 2020, more than 170,000 electric vehicles (three-wheelers, light trucks and company cars) were deployed through company fleets.[37] Around 31,000 electric trucks were operating worldwide by year's end, but they represented less than 1% of total truck sales.[38] Freight and logistics companies, among other corporate fleets, are adopting electric vehicles for last-mile deliveries to increase performance and reduce operating costs. Urban deliveries have grown rapidly in past years and then skyrocketed during the COVID-19 pandemic. For long-distance

Figure 4. Average price of an electric vehicle battery pack, 2010-2020



Source: See endnote 32 for this section.

road freight, the electrification of trucks requires both high-capacity batteries and high-power charging infrastructure (to minimise the charging time).[39]

- **Amazon** is slated to begin using 10,000 electric delivery vehicles (three- and four-wheeler) in India from 2021 onwards.[40] The company invested in **Rivian**, an electric truck start-up that will deliver 100,000 electric trucks to Amazon by 2030.[41]
- In 2018, **IKEA** began goods delivery using solar-powered auto-rickshaws in **India**.[42] The company completed a transition to electric vehicle fleets in **Shanghai** in 2019 and will next target **New York**, **Los Angeles**, **Paris** and **Amsterdam**.[43] IKEA aims for all customer deliveries from stores worldwide to occur via electric vehicle by 2025.[44]
- The UK's **Royal Mail** trialled e-trikes in cities for a six-month period in 2019.[45]
- In 2020, **UPS** ordered more than 10,000 electric freight vehicles, which are being rolled out in the company's European and North American fleets to 2024.[46]

Public and private charging infrastructure for electric vehicles has scaled up rapidly in some countries, although charging point distribution and the ratio of electric vehicles to charging points vary widely. Creating a network of electric vehicle charging points (public or private) in a city is a capital-intensive and collaborative process. It requires adequate financing, land-use planning and real estate acquisition, local permitting, grid connection (and related pricing), equipment installation, and the implementation of safety and wayfinding measures for consumers, among other steps.[47] The ratio of electric vehicles to charging points is 3:1 in **China**, 25:1 in California, **USA** and 30:1 in **Norway**.[48]

- In **China**, more than 1.2 million charging points had been installed by the end of 2019.[49] The country has allocated USD 638 million for construction related to charging infrastructure, and many regions have amended their building codes to help create electric vehicle-ready buildings.[50]
- Among the 144,000 charging points in the **EU** by 2019, more than 26% were in the **Netherlands** (37,037), 19% in **Germany** (27,459), 17% in **France** (24,850) and 13% in the **UK** (19,076).[51]
- Policy tools for growing the charging infrastructure network in **Europe** include tax benefits and subsidies for individuals, housing co-operatives and businesses to install charging equipment.[52]
- In 2019, the first public electric vehicle charging stations in **Qatar** were installed, with 216 solar panels enabling the charging of 24 cars.[53]
- In the **USA**, the government-funded charging network programme ChargePoint collaborates with industry players to help expand the EV charging network in US cities.[54]

Emission trends

Electric vehicles contribute at least 22% fewer CO_2 emissions than internal combustion engines, even when the electricity used for charging is generated from fossil fuel sources.[55] **While electric vehicles are more energy efficient than conventional vehicles overall, they offer even greater potential for emission reductions if they are based on clean renewable energy.** In general, the energy loss associated with electric vehicles is lower than for vehicles with internal combustion engines.[56] Even in a carbon-intensive scenario (e.g., a battery produced in China and charged through a coal-heavy power grid, such as in Poland), electric vehicles emit 22% fewer life-cycle CO_2 emissions than diesel cars and 28% fewer emissions than petrol cars.[57]

- The electric bus fleet in **Latin America** saves an estimated 129,070 tonnes of CO_2 per year, while accounting for only 1.3% of public buses in the region.[58]
- The trial introduction of 60 electric buses in **Singapore** reduced CO_2 emissions by an estimated 7,840 tonnes annually, equivalent to the amount produced by 1,700 passenger cars.[59]
- In **Vietnam**, the electrification of motorcycles has the second highest potential for reducing CO_2 emissions from transport (after new fuel economy standards).[60]

Life-cycle emissions and the impact of electric vehicle batteries must be considered when comparing the environmental footprints of electric versus conventional vehicles.[61] **Major concerns include the extraction of raw materials and the recycling of batteries. Policies to extend the useful life of EV batteries can help governments and manufacturers offset the production costs, impacts and emissions.**[62] Electric vehicles are made from many different materials, including rare earth metals that are located in a small number of countries and are extracted via processes that lack environmental protection measures and reflect poor working conditions.[63] Automakers have formed partnerships with battery cell makers as well as state-owned mines to secure raw materials, including cobalt, lithium and graphite.

- Some regions have enacted policies supporting the reuse of electric vehicle batteries (for example, as stationary energy storage systems on telecommunication towers in **China**) as well as battery recycling (to recover scarce minerals, as through directives in **Europe** and **Japan**), in addition to safe disposal.[64]
- In 2020, a large-scale **EU**-funded research initiative released a roadmap for forward-looking battery research and approaches to identify safe, sustainable and affordable battery technologies.[65]
- Mining companies are investing in battery cell products, in a form of "vertical integration" (from extraction to manufacturing). One **Australian** company is following "cyclical integration", from extraction to manufacturing to recycling of cells.[66]

Policy measures

Countries have adopted ambitious time-bound targets to increase the share of electric vehicles in their overall fleets. By the end of 2020, 19 countries or sub-national jurisdictions had set targets to phase out diesel and petrol passenger vehicles (*see Figure 5*).[67] However, there is a strong need to consider how electric mobility projects around the world are (or are not) integrating wider socio-economic and environmental equity considerations into these formal targets.

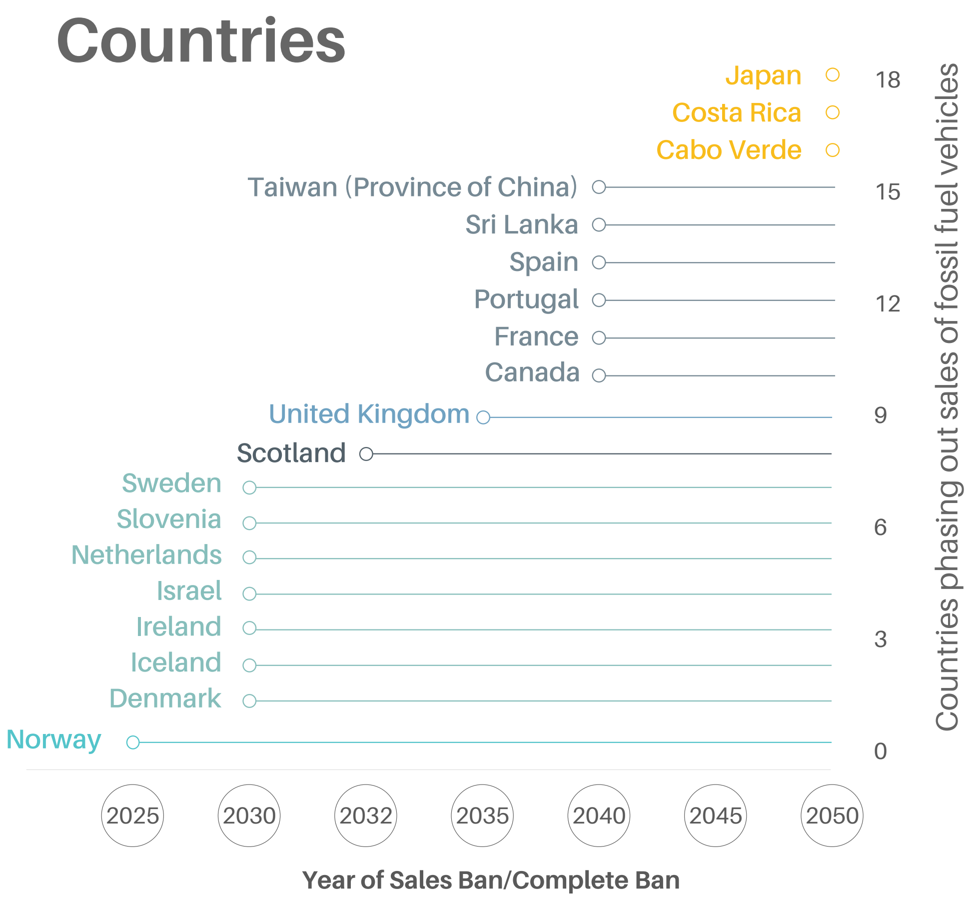
- In 2019, several countries announced that they would phase out sales of diesel and petrol cars, including **Sweden** by 2030, **Canada** and **France** by 2040 and **Cabo Verde** by 2050.[68] In 2020, the **UK** moved forward its phase-out target to 2035, while **Spain** announced a phase-out target for 2040.[69]
- Many sub-national entities have made commitments to ban fossil fuel vehicles. For example, **Amsterdam**, the Netherlands; **Brussels**, Belgium; and **San Francisco**, California, US aim to allow only zero-emission vehicles within their city centres by 2030.[70]
- **British Columbia**, Canada, under its CleanBC initiative, has funded a province-wide training programme with the British Columbia Institute of Technology to prepare an electric vehicle maintenance workforce.[71] The province also aims for 100% of light-duty vehicle sales to be electric from 2040.[72]

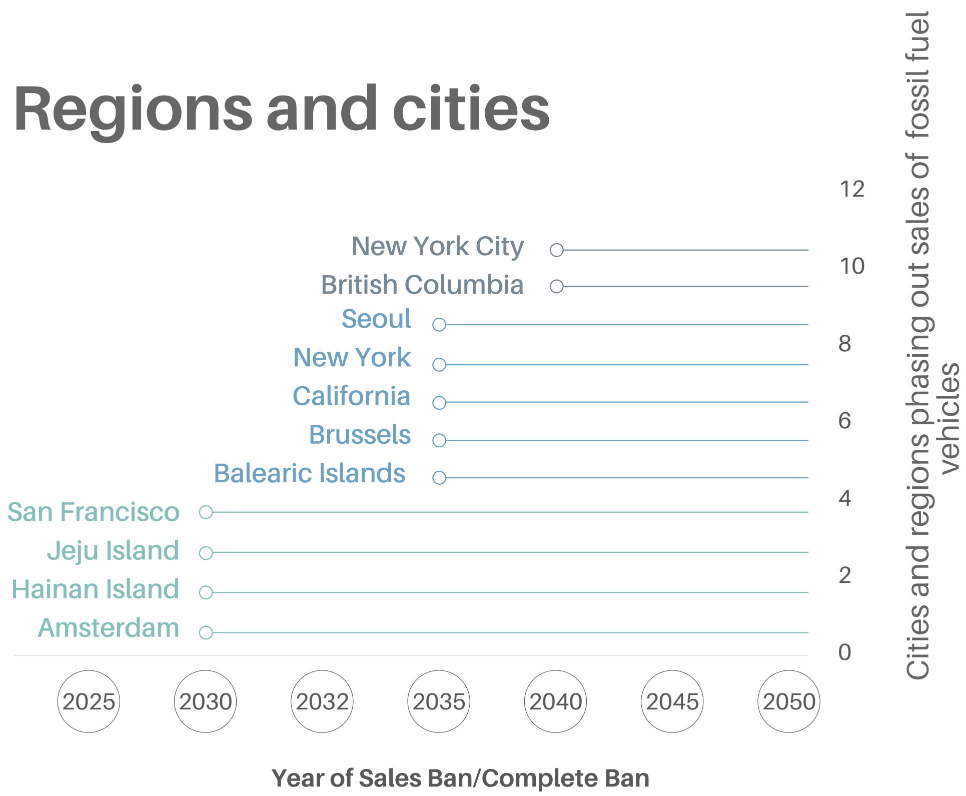
(*See the end of this section for an overview of electric mobility targets set by countries.*)

In 2020, the first-of-its-kind Zero Emission Vehicle Transition Council was established, comprising ministers and representatives from the world's largest and most progressive car markets.[73] Hosted by the UK presidency of the 2021 United Nations Climate Conference (COP26), the council includes representatives from California, Canada, Denmark, the EU, France, India, Italy, Japan, Mexico, the Netherlands, Norway, the Republic of Korea, Spain, Sweden and the UK.[74] It aims to co-ordinate efforts to overcome strategic, political and technical barriers to zero-emission vehicles, while accelerating their production.[75]

In response to phase-out targets by countries, major automobile companies are halting the development of internal combustion engines and accelerating their electric vehicle ambitions towards the 2030/2035 time frame. Automakers have started to revise their electric vehicle production and to shift research and investments from combustion engines to electric drivetrains. However, current plans still leave a gap between the electric vehicle demand required to support national targets for electric mobility by 2030 and the potential supply *(see Section 2.3 on Responses to Address Climate Change in the Transport Sector)*.

Figure 5. Countries, regions and cities with commitments to phase out fossil fuel vehicles, by target year





Source: See endnote 67 for this section.

- **BMW** announced a target to double its electric car sales starting from 2021.[76]
- **GM** set a goal in 2021 to sell only zero-emission vehicles after 2035.[77]
- At the end of 2020, **Hyundai** announced that it was suspending the development of diesel engines.[78]
- Since 2019, **Volkswagen** has offered its modular electric drive technology platform to other auto manufacturers, enabling global efforts to scale up the production of electric passenger cars.[79]
- In 2019, **Volvo** was the first European car company to divert from internal combustion engines, and in 2021 the company expressed its plan to produce only electric vehicles by 2030.[80]

Leapfrogging to electric mobility in Africa, Asia and Latin America can bring significant benefits to local environments and economies. Discussions and implementation strategies around electric vehicles do not fully incorporate the needs and perspectives of developing countries. Progress on e-mobility in low-and middle-income countries is being advanced through initiatives such as the Urban Electric Mobility Initiative (see below), but there is more room to guide and support the mobility and energy transitions.

- More than 3 million people in East Africa earn money as motorcycle taxi drivers.[81] Start-ups, such as Ecobodaa in **Kenya**, began rolling out electric motorcycles in 2020 through a "rent-to-own" model that helps taxi drivers improve their health and save money on fuel and maintenance.[82]

- **Rwanda** announced a plan in 2019 to replace all fossil fuel-powered motorcycles with electric two-wheelers in the coming years.[83]
- In 2019, a local vehicle manufacturer in **Vietnam** committed to selling 250,000 electric motorcycles a year.[84]
- The Urban Electric Mobility Initiative has produced electric vehicle-readiness assessments for cities across Africa, Asia and Latin America, including **Accra**, **Belo Horizonte**, **Cape Town**, **Kathmandu**, **Quito** and **Thimpu.**[85]

Utilities are taking on a greater role in the mobility ecosystem, thereby merging the value chains for electricity generation and electric vehicle charging.[86] Utilities are increasingly partnering with municipalities to plan battery charging and swapping networks, and with automakers to design vehicles that can be integrated with electricity grids for bi-directional flow of electricity and the feed-in of renewable energy. Electric vehicles can be seen as decentralised units in the energy system to store surplus electricity during periods of peak supply and release it during periods of peak demand.[87]

- The energy service company Enel X installed 80 charge points in **Chile** in 2019 and has worked closely with **Santiago** and **Bogotá** on their transitions to electric buses.[88]
- In **India**, three state-owned oil companies, accounting for 90% of the fuel retail market, have invested in electric vehicle battery charging and swapping infrastructure, in partnership with ride-hailing and metro rail companies whose parking lots will house battery swapping stations for three-wheelers.[89]
- **Stockholm**, Sweden, in its Charging Master Plan, aims to build 4,000 public charge points by 2022 and has worked with the grid operator **Ellevio**, the municipal planning department and local businesses to map priority areas for investment.[90]
- Utilities benefit from putting to use surplus power, and some have opened vehicle manufacturing subsidiaries; for example, **Thailand**'s second largest electric utility, Energy Absolute, created its Mine Mobility subsidiary to manufacture electric vehicles.[91]
- In some cases, utilities invest in electric vehicle chargers and stations, while in other cases private companies act as intermediaries (as with **ChargePoint**, **EVgo** and **Electrify America** in the USA).[92] Other companies, such as **EVBox**, provide both smart charging and related software.
- **Vancouver**, Canada has set a target to power its municipal transport fleet with 100% renewable energy by 2050.[93]

To accommodate the uptake of electric vehicles, the capacity of the grid must be increased. Ways to smooth electricity demand curves and increase alignment between the transport and energy sectors include smart charging, providing additional power through renewable energy, incentives for off-peak charging and vehicle-to-grid systems.

- In 2020, **Shanghai**, China completed its first pilot project using electric vehicles as a flexible energy source in the power grid.[94]
- As electric vehicle sales in **Stockholm**, Sweden increased, the city's power grid was unable to meet electricity demand during peak times in 2020 with other appliances also in heavy use.[95]

Initiatives supporting e-mobility

- **Action towards Climate-friendly Transport** (**ACT**) is the largest global coalition aiming to catalyse transport as an enabler of sustainable development in line with the 2030 Agenda for Sustainable Development and the Paris Agreement. The coalition connects innovative approaches with integrated, long-term planning, speeding up deployment of electric vehicles, creating a mass market for zero-emission freight vehicles and fostering global dialogue with and among the private sector.[96]
- The **EV30@30** campaign, launched at the Eighth Clean Energy Ministerial in 2017, set the collective aspirational goal of a 30% market share for electric vehicles among all passenger cars, light commercial vehicles, buses and trucks by 2030.[97]
- **EV100**, part of the Marrakech Partnership for Global Climate Action, is a transport initiative that aims to accelerate the transition to electric mobility by leveraging the role of corporate demand in driving electric vehicles uptake and the roll-out of charging infrastructure. The initiative was launched in 2017 with 10 member companies from various sectors in Europe and China.[98]
- The **International Zero-Emission Vehicle Alliance** (**ZEV Alliance**) is a collaboration of governments acting together to accelerate the adoption of zero-emission vehicles (electric, plug-in hybrid and fuel cell). The governments have committed to making all passenger vehicle sales in their jurisdictions ZEVs by no later than 2050 and to collaborating on policies and actions to achieve ZEV targets.[99]
- The **Taxi4SmartCities** coalition connects worldwide taxi companies that are committed to transitioning their vehicle fleets to low-emission vehicles by 2020 and 2030. More generally, the coalition defends a progressive and modern version of the taxi as a key actor in the Smart City.[100]
- The **Urban Electric Mobility Initiative** (**UEMI**) aims to boost the share of electric vehicles in individual mobility (two- and three-wheelers and light-duty vehicles) and to integrate electric mobility into a wider concept of sustainable urban transport that achieves a 30% reduction in urban greenhouse gas emissions by 2030.[101]

Key indicators

	2018*	2020*	% change
Policy Landscape Indicators			
Electric vehicle targets	61 (2017)	63	+3%
Internal combustion engine vehicle phase-out targets	7 (2017)	19	+171%
Electric vehicle incentives (subsidies, enabling legislation)	67 (2017)	73	+9%
Market development Indicators			
Electric vehicle market share (% of sold vehicles by year)	2.5%	4.6%	+84%
Electric vehicle stock (plug-in hybrids and battery passenger cars)	5,106,341	10,228,265	+100%
Public charging points (public and fast chargers)	(550,602	1,307,894	+98%
Public fast-charging points (charging power more than 22 kW)	145,461	263,802	+165%
Public slow-charging points (charging power below 22 kW)	405,140	922,215	+128%

(*) Data are for the indicated year unless noted otherwise.

Source: See endnote 102 for this section.

Box 1. Impacts of the COVID-19 pandemic on electric mobility

Despite temporary shutdowns of auto factories and disruptions in global supply chains due to the pandemic, more than 3 million electric cars were sold worldwide in 2020, surpassing projections of 2.4 million. While sales of electric vehicles increased, sales of new diesel and petrol cars fell around 14.5% below 2019 levels. Among all transport modes, electric-assisted bikes saw a spike in popularity, as manufacturers saw record sales and e-bike sales in the **USA** increased 145%.

Electric vehicle sales jumped to 4.6% of global vehicles sold in 2020. In the **EU**, the electric vehicle market share reached 9.9% in the third quarter of 2020, up sharply from 3% during the same period in 2019. In **Norway**, supported through subsidies and various incentives, the share of EVs sold in the first half of 2020 was higher than in 2019; fully electric vehicles accounted for 48% of all automobile sales in the country, and fully electric and plug-in hybrid vehicles represented 69% of sales – both of which were global records.

A number of governments have increased electric vehicle investments as part of their COVID-19 recovery packages (*see also Section 4 on Financing*). The long-term effects of the pandemic on the electric vehicle market are hard to predict. The International Energy Agency has projected a rebound in global energy use and CO_2 emissions, making "building back better" a sensible proposition.

However, policy measures remain indispensable to address the high initial capital costs of electric vehicles and to attract consumers and investors. Several countries have included electric vehicle purchase incentives and vehicle replacement programmes in national recovery packages, including the following:

- **China** promoted two programmes for electric mobility: one extending an existing programme that provides subsidies and tax breaks for 2 million new electric vehicles annually until 2022, and the other to implement 600,000 EV charging points, with a USD 1.45 billion investment.
- The **EU** agreed to the Next Generation EU recovery fund of EUR 750 billion (USD 900 billion), which supports transport decarbonisation through investments in cleaner, healthier and more affordable active and public transport.
- **France** created several programmes to encourage purchases of electric and plug-in hybrid vehicles, support research and development (R&D) in the automotive industry, provide relief during the pandemic and advance charging infrastructure, totalling USD 8.7 billion.
- **Germany** approved a EUR 50 billion (USD 60 million) investment package to support electric vehicle purchases, charging infrastructure, R&D for electric mobility and battery cell production, and innovation in the automotive industry.
- **Italy** approved programmes to deduct taxes for electric vehicles and charging infrastructure (110% tax deductions) and to subsidise new electric vehicles (EUR 6,000 (USD 7,300) per unit, up from EUR 4,000 (USD 4,800) previously).
- The **Republic of Korea** introduced a Green New Deal totalling USD 61 billion over five years, which includes plans to enhance the country's fleet to 1.33 million electric (including hydrogen-powered) vehicles.
- **Spain** advanced a USD 1.12 billion package for public transport and shared mobility, replacing government fleets with zero-emission vehicles, R&D in sustainable mobility and its associated industry, and subsidising the replacement of old vehicles for zero- and low-emission ones.
- The **US** has proposed USD 174 billion to build a national network of 500,000 electric vehicle chargers by 2030, to support manufacturing of batteries and electric vehicles, and to retool factories to compete globally. The plan would also replace 50,000 diesel transit vehicles; electrify at least 20% of the country's school bus fleets, and electrify the federal fleet, including postal vehicles.

Source: See endnote 1 for this section.

In Practice: Additional Policy Measures

Policy targets set

Phase-out targets

- **Amsterdam** aims to ban petrol and diesel vehicles completely by 2030, while at a country level the **Netherlands** plans to ban sales of new petrol and diesel cars from 2030.[103]
- **Pakistan**'s National Electric Vehicle Policy aims to have 90% of sales of passenger cars and heavy-duty trucks be electric by 2040, as well as 90% of sales of electric two- and three-wheelers and buses.[104]
- The Balearic Islands (Mallorca, Menorca, Ibiza and Formentera) of **Spain** announced a target for 100% renewable energy use by 2050 and a phase-out of sales of internal combustion vehicles by 2035.[105]
- In 2019, **Sweden** announced a sales ban on diesel and petrol cars by 2030.[106]
- **Ukraine** envisions that 75% of all motorised trips by 2030 will be via electric mobility.[107]
- In early 2020, the **UK** advanced its target for phasing out internal combustion vehicles from 2040 to 2035.[108]
- San Francisco, California, **USA** aims to ban sales of internal combustion vehicles by 2030, in an effort to achieve an emission-free transport system by 2040.[109]
- **Canada** announced deployment targets as well as various financial incentives for zero-emission vehicles such as electric vehicles.[110]

Electric fleets (private and shared)

- **Nepal** expressed in its second NDC that by 2030 the sales of electric vehicles should represent 90% of all passenger vehicle (cars and two-wheelers) sales and 60% of all four-wheeler public passenger vehicle sales.[111]
- In the first electric taxi deployment in **Panama**, the province of Colon plans to create a fleet of 1,500 electric taxis; as of 2019, 7 of the vehicles were already deployed through a partnership between BYD, Ensa Servicos and Traservi, which also installed a rapid charging station for the fleet.[112]
- In 2020, **Turkey** released a vision target to have 1 million electric cars and 1 million charging points by 2030.[113]
- Companies such as **Amazon**, **DHL**, **FedEx**, **IKEA** and **UPS** have established targets and pilot programmes to fully convert their fleets to electric.[114]
- By the end of 2020, at least 74 jurisdictions worldwide had some form of financial support in place for electric vehicles.[115]

Electric buses

- **São Paulo**, Brazil introduced its first 15 electric buses at the end of 2019 and aims to increase the fleet to 400 buses in the coming years, to support the city's vision of halving CO_2 emissions by 2027 and becoming carbon-free by 2037.[116]
- **Chile** aims to have a fully electric public transport system nationwide by 2040.[117] In 2019, the city of **Santiago** deployed 200 e-buses as part of a plan to cut emissions and reduce air pollution.[118]
- **Costa Rica**, as part of its economy-wide roadmap to achieve net zero emissions by 2050, committed to public procurement of electric buses and taxis and the provision of funds to create an electric train line.[119]
- In 2019, the president of **Colombia** signed a law targeting the complete electrification of mass transport by 2040.[120]
- **Ecuador** has committed to converting its entire bus fleet to electric by 2025 as part of its ordinance for the gradual decarbonisation of transport.[121] At the end of 2019, the first 20 electric buses and 50 taxis arrived in **Guayaquil**.[122]
- In the **EU**, the revised Clean Vehicles Directive of 2019 aims to accelerate the procurement of zero-emission vehicles and sets a target for the majority of procured public buses to be electric from 2026.[123]
- **Amsterdam**, the Netherlands aims to convert its municipal bus fleet to electric by 2025, and **Milan**, Italy has a similar target for 2030.[124]
- **India** plans to deploy 5,595 electric buses in 63 cities under its FAME II subsidy scheme launched in 2019.[125]
- In the USA, **New York City** plans to convert its bus fleet to electric by 2040, and **San Diego** and **San Jose** also plan to convert their fleets by 2040 to comply with a California state-wide mandate.[126]

EV charging infrastructure

- In **Germany**, the 2030 climate plan targets 1 million charging points by 2030, for which a masterplan is under way.[127]
- Since 2020, in the **EU**, new residential units or major renovations with more than 10 parking spaces are required to be 100% electric vehicle-ready, while 20% of space in new non-residential units must be electric vehicle-ready by 2025.[128]
- In **India**, the FAME II scheme as well as state policies have laid out subsidies to support 2,636 new charging stations in 62 cities.[129] The governments of **Delhi** and **Kerala** have enacted policies to support battery charging and swapping systems, and state-owned thermal power companies have partnered with metro rail companies to provide charging points and fuel retail in parking lots.[130]
- In 2020, the **UK** government announced the allocation of GBP 500 million (USD 700 million) over the next five years for electric vehicle charging infrastructure on national roads.[131]
- **Canada** announced nearly CAD 100 million (USD 76.5 million) in funding in 2019 to deploy new electric vehicle charging (and hydrogen fuelling) stations.[132]
- In 2019, **the Netherlands** committed to installing 2,000 charging points to support electrification of its national government fleet.[133]

Policy measures implemented

Electric fleets (private and shared)

- **China** enacted stricter standards for automakers to gain credits for zero-emission vehicles for 2021-2023 so that they would build vehicles that use even less fuel.[134]
- Local governments in **Shanghai**, China are providing subsidies to car-sharing companies to purchase electric vehicles and to build and buy charging infrastructure; so far, 39 cities in **China** have followed this policy implementation model, resulting in the addition of 50,000 electric vehicles in total.[135]
- **Shenzhen**, China adopted a regulation in 2019 that requires all newly registered ride-hailing vehicles in the city to be battery electric.[136]
- In 2019, **India** implemented the Faster Adoption and Manufacturing of Electric Vehicles in India Phase II (FAME Phase II) scheme, which includes a USD 1.4 billion budget over three years to reduce the purchase price of hybrids and electric vehicles through rebates.[137]
- In **Norway**, local governments have instituted the majority of electric vehicle incentives and policy support tools, such as planning zero-emission zones where the vehicles have priority access, providing incentives for purchasing vehicles and setting up charging infrastructure, developing building codes amenable to electric vehicle charging points and offering 50% reductions in parking charges. **Norway** also has exempted electric vehicles from weight, CO_2 and nitrogen oxide emissions taxes and value-added tax to the end of 2021.[138]
- In December 2019, the **California** Air Resources Board in the US amended its Clean Vehicle Rebate Project to increase rebates for low- to moderate-income communities while reducing rebates for electric vehicles above USD 60,000 and plug-in hybrids below 35-mile range.[139]

Electric buses

- As of 2020, **Brazil** had 247 electric buses (including electric trolley buses and 12-15 metro buses), and **Mexico** had 238 (electric trolley buses).[140]
- In 2019, the government of **Chile** helped launch an electric bus corridor with 411 buses through a partnership in which electric utility Enel X procures the buses and leases them to local operator MetBus, and provides charging services.[141] The corridor is further supported through policy measures related to air quality improvements, fuel efficiency labelling and green taxation.[142]
- **Shenzhen**, China diligently planned a charging network to support its growing electric bus fleet, allocating real estate, finances, charging technology and required electricity connections.[143]
- In Colombia in 2019, the city of **Cali** procured 26 electric buses with support from the energy company Celsia, and **Medellín** installed 64 electric buses following a successful single-bus pilot.[144] **Bogotá** was set to procure 483 electric buses to begin operations in September 2020, but this was postponed due to the COVID-19 pandemic.[145]

Electric two- and three-wheelers

- In **India**, state and central government policies have prioritised electric two wheelers, with the FAME subsidy scheme applicable to 86 different models of electric two-wheelers.[146]
- **Portugal** introduced an electric bicycle subsidy scheme in 2019 supporting the purchase of 1,000 e-bikes.[147]

Other

- **Thailand** began operating its first electric battery-powered commuter boats in Bangkok's canals in 2018; by 2020, the pilot proved so successful that the city planned to further expand the service.[148]

3.9

Renewable Energy in Transport

Key findings

Demand trends

- Transport remains the sector of energy use with the lowest share of renewables, with more than 95% of energy needs coming from oil and petroleum products and less than 4% from biofuels and renewable electricity in 2018.
- Renewable energy sources – mostly renewable electricity and biofuels – contributed an estimated 11% of the energy use associated with global rail in 2019.
- Biofuels accounted for 91% of the renewable energy use in road transport in 2019, but further growth in biofuels is constrained by sustainability issues and competition between fuel and food sources.
- Aviation is among the fastest growing transport sectors; however, despite significant efforts to incorporate renewable energy in the sector, biofuels provided only around 0.01% of aviation fuel during 2019.

Emission trends

- Heavy-duty vehicles account for three-quarters of the energy demand and carbon dioxide (CO_2) emissions from freight, yet they remain the most challenging type of road vehicle to find cost-effective energy alternatives for.

Policy measures

- Policies to promote renewable energy in the transport sector continue to focus mainly on road transport, with rail, aviation and shipping receiving less attention despite being large energy consumers.
- As of the end of 2019, only 46 countries had some form of renewable energy target for transport, and just 11% of countries included measures for renewables-based transport in their Nationally Determined Contributions (NDCs) towards reducing emissions under the Paris Agreement.
- Biofuel blending mandates remain one of the most widely adopted policies for increasing renewable fuels in road transport; however, no new countries introduced such mandates in 2018 or 2019, with the total remaining at 70 countries.
- The maritime transport sector has scaled up efforts to incorporate renewable energy by using fuels generated from renewable sources and applying electrification and wind energy as complementary strategies.
- The increasing scope of policies to electrify road vehicles and other transport modes offers significant potential to increase the share of renewable energy in transport.

Impacts of the COVID-19 pandemic

- Due to the pandemic, oil demand was down nearly 5% in the first quarter of 2020, reflecting reduced demand for land-based transport, shipping and aviation; meanwhile, the demand for renewables grew.
- Economic recovery packages offer significant potential to align renewable energy and transport policies for a green and equitable recovery, but initial plans have fallen short in this area.

Overview

To achieve the energy transformation required for decarbonisation, the transport sector will need to rely increasingly on renewable energy sources.[1] The main entry points for renewables in the transport sector are:

- The use of biofuels blended with conventional fuels, as well as higher blends including 100% liquid biofuels;
- Natural gas vehicles and infrastructure converted to run on upgraded biomethane; and
- The electrification of transport modes, including through the use of battery electric and plug-in hybrid vehicles or of hydrogen, synthetic fuels, and electro-fuels, where the electricity is itself renewable.[2]

Some renewable energy carriers (such as biofuels) can be used in the internal combustion engines of conventional vehicles, whereas others require alternative drivetrains, such as in battery electric or fuel cell vehicles. Overall, fuels and vehicle technologies vary greatly in their technical maturity, costs, level of sustainability, climate mitigation potential, distribution and acceptance rates among users.[3] Renewable energy policy strategies are being implemented at different levels (from international to sub-national), and while some are relevant to the transport sector overall, others are specific to certain sub-sectors to accommodate the needs and preferences of different industries and users.

Plug-in hybrid and fully electric passenger cars, electric scooters, electric bicycles and electric waste trucks have become more common in an increasing number of countries, often as a result of policies and targets adopted in prior years.[4] Although rarely linked directly to renewable sources, the use of electricity in transport continued in 2019 and 2020, offering greater potential entry points for integration with renewable energy. Public subsidies can reduce the cost of sustainable transport measures. However, fiscal support from governments has remained limited, and many governments continue to heavily subsidise fossil fuels or fail to adequately tax them, artificially lowering the retail price of petrol below the price of crude oil on the world market, which continues to undermine climate action *(see Section 4 on Financing Climate Action in Transport)*.[5]

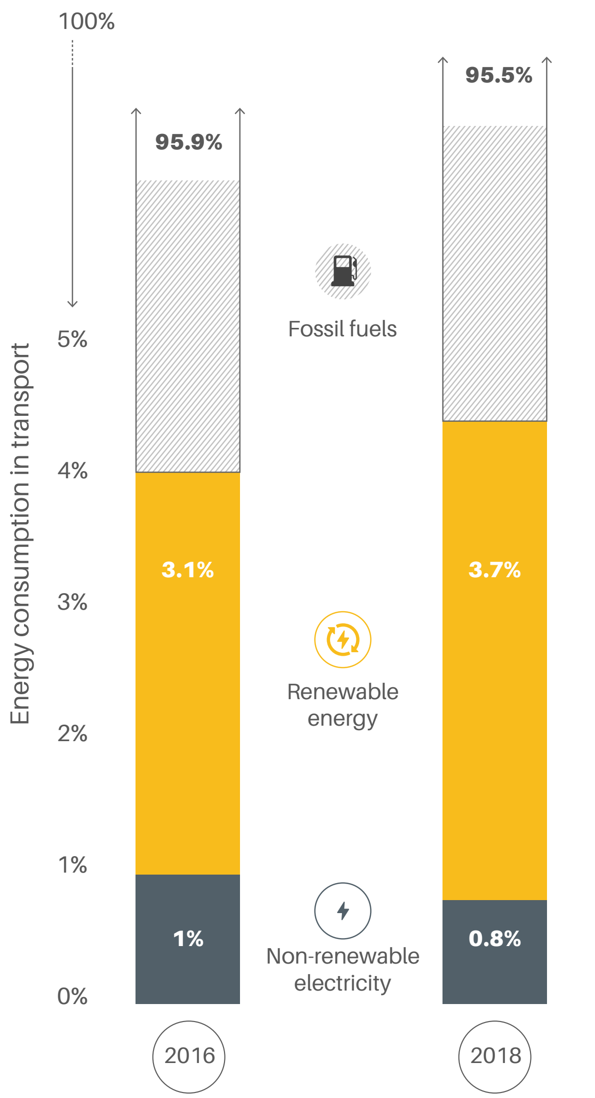
The COVID-19 pandemic led to a strong decline in oil demand as well as opportunities to shift investments towards renewable energy sources. Economic recovery packages offer significant potential to align renewable energy and sustainable transport policies (*see Box 1*).[6]

Demand trends

Transport remains the sector of energy use with the lowest share of renewables, with more than 95% of energy needs coming from oil and petroleum products and less than 4% from biofuels and renewable electricity in 2018 (*see Figure 1*).[7] Some countries have seen gradual increases in the use of renewable hydrogen and synthetic fuels for transport, but these remain minimal overall.[8] Road transport accounted for around 75% of global transport energy use in 2018, with passenger vehicles representing more than two-thirds of this.[9]

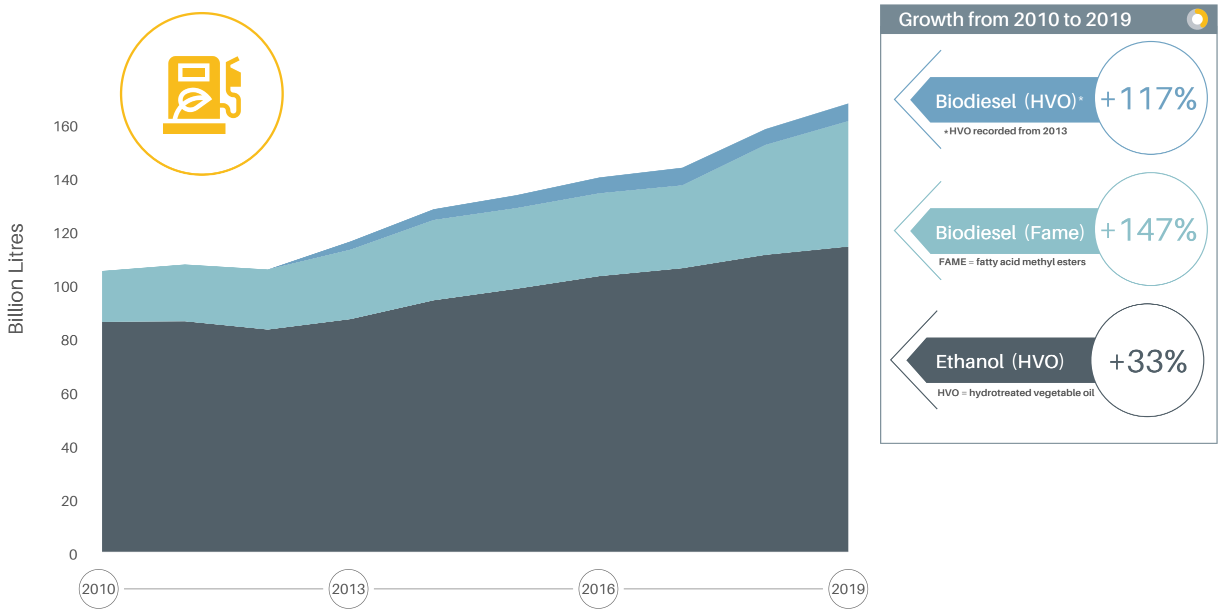
Renewable energy sources – mostly renewable electricity and biofuels – contributed an estimated 11% of the energy use associated with global rail in 2019.[10] In recent years, some jurisdictions have attempted to increase the link between renewable power generation and rail transport, since this remains the most highly electrified transport sub-sector.

Figure 1. Share of renewable energy in transport, 2016 and 2018



Source: See endnote 7 for this section

Figure 2. Global biofuel production, 2010-2019



Source: See endnote 15 for this section.

- In 2019, **Melbourne**, Australia connected a 128 megawatt solar photovoltaic system to its grid network specifically to power the city's tram system.[11]
- **Scotland**, UK adopted a Green New Deal package of policy measures in 2019 that included commitments to electrifying the rail network and battery-powered trains.[12]

Biofuels accounted for 91% of the renewable energy use in road transport in 2019, but further growth in biofuels is constrained by sustainability issues and competition between fuel and food sources.[13] In 2019, global production of liquid biofuels increased 5% to reach 161 billion litres (equivalent to 4 exajoules).[14] Ethanol increased 2%, while biodiesel increased 13% (*see Figure 2*).[15] Production of biomethane and advanced biofuels remained low, at less than 1% of the biofuel total.[16] Although efforts to develop advanced biofuels continue (and some new production capacity has been installed), so far only small quantities of these fuels have been produced and used.

Aviation is among the fastest growing transport sectors; however, despite significant efforts to incorporate renewable energy in the sector, biofuels provided only around 0.01% of aviation fuel during 2019.[17] Slow progress with renewables in aviation is due to the cost of advanced biofuels, challenges related to battery weight and range (for electrification), and jurisdictional issues in regulating cross-border industries.[18]

Technology exists for producing renewable electro-fuels for aviation, but costs remain much higher than for fossil-based fuels, and policy support is lacking.[19] Although interest in the electrification of aviation is increasing, so far only electric drones or small planes for 1 to 12 passengers have been developed (or are under development), while some companies are aiming for hydrogen-powered electric planes.[20]

Support for and use of renewable fuels in aviation made slight progress in recent years. In 2018, the International Civil Aviation Organization (ICAO) Council endorsed the 2050 ICAO Vision for Sustainable Aviation Fuels, which is expected to greatly increase commercial production of these fuels by 2050.[21]

- By early 2020, 119 ICAO Member States (representing 94.3% of global air traffic) had submitted State Action Plans to support the production and use of sustainable alternative[i] aviation fuels; these include drop-in fuels (which can be blended with or directly replace fossil fuels in transport systems) produced from biomass and from different types of organic waste.[22]
- More than 200,000 commercial flights had flown on blends of alternative fuels by early 2020, up from 150,000 in 2019.[23]
- At least 8 airports had regular distribution of blended alternative fuel as of early 2020, up from 5 in 2019, while at least 14 airports had batch deliveries of such fuels.[24]

i These include fuels produced from three families of bio-feedstock: the family of oils and fats, or triglicerides, the family of sugars, and the family of lignocellulosic feedstock.

Emission trends

Heavy-duty vehicles account for three-quarters of the energy demand and CO_2 emissions from freight, yet they remain the most challenging type of road vehicle to find cost-effective energy alternatives for.[25] Heavy-duty vehicles are the fastest growing source of oil demand worldwide, even though they account for less than a quarter of total freight activity.[26] The larger the vehicles and the longer the range, the more challenging it is to find cost-effective alternatives to diesel fuel.[27] Although not all alternative fuels come from renewable sources, many are already commercially viable, and technological development continues.[28]

- In 2019, **Volvo** introduced trucks running on liquefied biogas in **Finland** and **Sweden.**[29]
- In the USA states of **California**, **Oregon** and **Washington**, between 2011 and 2018, Class 3-8 trucks fuelled by renewable diesel saved 12.3 million tonnes of CO_2 and eliminated 1.8 million tonnes of nitrogen oxides.
- By 2030, the increased use of the cleanest diesel technologies is expected to deliver an additional 120.7 million tonnes of CO_2 reductions and eliminate an additional 5.5 million tonnes of nitrogen oxides collectively in these three West Coast states.[30]

Policy measures

Policies to promote renewable energy in the transport sector continue to focus mainly on road transport, with rail, aviation and shipping receiving less attention despite being large energy consumers.[31] In general, policy makers are turning greater attention to expanding the use of renewables in transport as a means to improve local air pollution and meet greenhouse gas emission targets.[32] However, the development of renewable energy policies in the transport sector has not nearly been as rapid as in other economic sectors, such as the power sector.

As of the end of 2019, only 46 countries had some form of renewable energy target for transport, and just 11% of countries included measures for renewables-based transport in their Nationally Determined Contributions towards reducing emissions under the Paris Agreement.[33] However, around 80% of countries worldwide have acknowledged the transport sector's role in mitigating emissions by including transport in their NDCs.[34]

More than 50 cities worldwide had targets for electric mobility as of early 2020, but most of these are not directly linked to renewable electricity.[35] At least 28 cities and 39 countries or other sub-national jurisdictions had separate targets for both electric vehicle deployment and renewable electricity generation, but only 6 cities and 2 countries explicitly linked the two.[36] Better aligning electric vehicle and renewable electricity targets offers significant opportunity to advance the use of renewables in transport, as current renewable transport targets are heavily skewed towards the use of biofuels.

- Cities that have adopted separate targets for electric mobility and renewable electricity include **Amsterdam,** Netherlands; **Cape Town**, South Africa; **Dubai**, United Arab Emirates; **Hamburg**, Germany; **Portland**, Oregon, US: and **Toronto**, Canada.[37]
- **Austria** and **Japan** were the only two countries with a policy directly linking renewables with electric vehicles as of early 2020.[38]

Biofuel blending mandates remain one of the most widely adopted policies for increasing renewable fuels in road transport; however, no new countries introduced such mandates in 2018 or 2019, with the total remaining at 70 countries.[39] Some countries with existing blending mandates added new ones, and several existing mandates were strengthened (*see Figure 3*).[40] At least 8 countries had mandates for advanced biofuels, and at least 24 countries had future targets for advanced biofuels.[41]

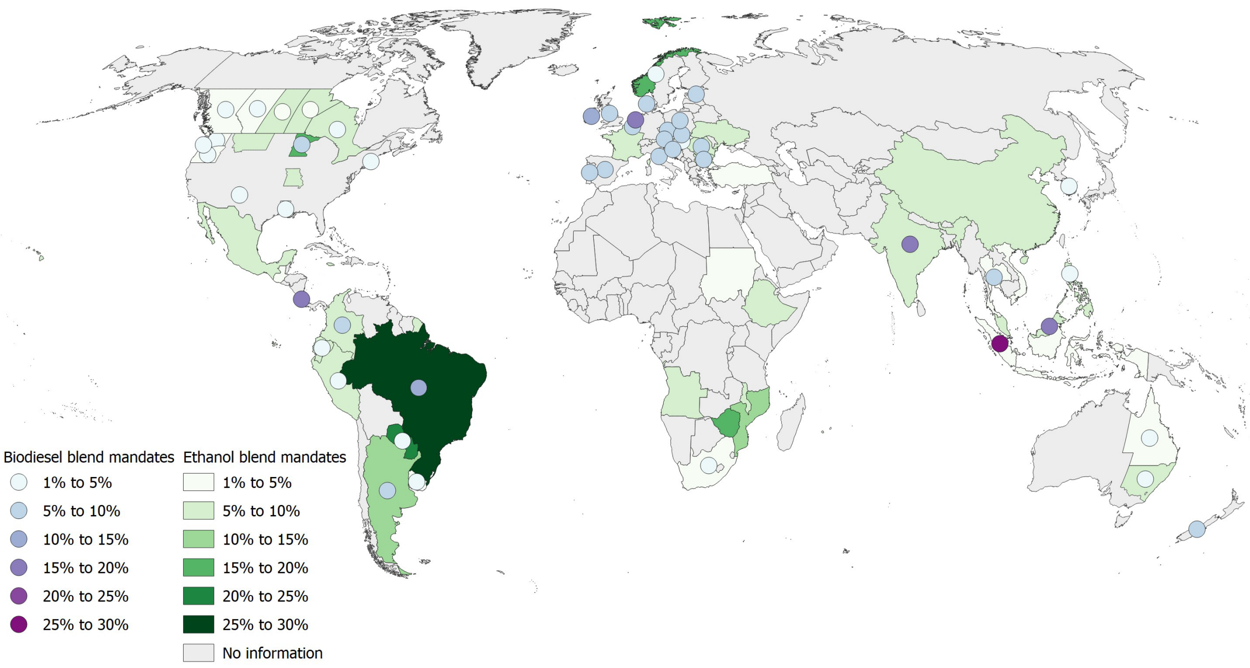
Policies supporting the production and use of biofuels, including ethanol and biodiesel, continue to be the most common type of direct renewable energy policies in the transport sector (to support energy security and economic development, and also because of biofuels' similarity to liquid petroleum fuels).[42] These policies include blending mandates, financial incentives, public procurement, and support for fuelling and blending infrastructure and advanced biofuels.

- **Brazil**'s RenovaBio programme scales up biofuel production through the use of tax exemptions that provide financial support for increased sugarcane production.[43] The programme also introduced emission reduction targets for fuel distributors, with the option of demonstrating compliance by buying traded emission reduction certificates awarded to biofuel producers.[44]
- In 2019, **Indonesia** became the first country to implement B30 (30% blending of biodiesel in diesel) – the highest such blending mandate in the world – in an effort to boost renewable energy use in the country.[45]
- At the sub-national level, **Quebec**, Canada has proposed lowering the blending requirements for ethanol that contains at least 10% cellulosic content.[46]

The maritime sector has scaled up efforts to incorporate renewable energy by using fuels generated from renewable sources and applying electrification and wind energy as complementary strategies. The International Maritime Organization agreed on stricter energy efficiency targets and new fuel and emission standards beginning in January 2020, while the industry called for speed limits on commercial vessels to reduce emissions.[47] By early 2020, trials had begun on using ammonia as a shipping fuel, with the potential to produce it with renewable electricity.[48]

In September 2019, maritime industry leaders launched the Getting to Zero Coalition, with the objective of operating zero-emission vessels along deep-sea trade routes by 2030.[49] World leaders in shipping and the oil industry joined the coalition to co-ordinate the launch of improved propulsion technologies and "clean" fuels.[50] Some ports have adopted their own targets to increase energy efficiency, decrease greenhouse gas emissions and/or increase the use of renewable fuels.

Figure 3. Biofuel blending mandates worldwide, by blend level, as of 2020



Source: See endnote 40 for this section.

- By the end of 2019, at least 11 ports in **Europe** and the **United States of America** (USA) had joined the World Ports Climate Action Programme to develop measures related to efficiency, emissions and renewables, up from 7 ports the year before.[51]
- In 2019, some shipping companies in **Scandinavia** entered into agreements to use liquefied biogas.[52]
- The **Port of Houston**, Texas announced in 2019 that it would purchase renewable electricity port-wide starting in 2020, making it the first **USA** port to administer such a programme.[53]
- **Norway** released an Action Plan for Green Shipping in 2019, stating the government's ambition to halve emissions from domestic shipping and fisheries by 2030 and to promote low- and zero emission solutions for all vessel categories.[54]
- The **UK** published a Clean Maritime Plan, the "Route Map" for its Maritime 2050 strategy, which includes research on incentives for zero-emission shipping and consultations on encouraging the uptake of low carbon fuels.[55]

The increasing scope of policies to electrify road vehicles and other transport modes offers significant potential to increase the share of renewable energy in transport.[56] Policies aimed at the electrification of transport, particularly road transport, increased in importance and frequency in 2019 and 2020.[57] These policies can promote the use of renewable electricity in the transport sector, both indirectly and directly.

Indirectly, in jurisdictions that support growing shares of renewable energy in the power grid, any policy that promotes electric mobility also increases the penetration of renewables in the transport sector

Credit: Clean Energy Ideas

(*see Section 3.8 on Electric Mobility*).[58] Policies can also directly support the use of renewable energy, for example by requiring that electric vehicles be charged using renewable power, or through tariffs that incentivise "smart" charging during times of peak renewable power generation. Railways are the most highly electrified transport mode and thus are particularly good candidates for renewable energy linkages.

- In 2019, **Cabo Verde** developed an integrated set of policies to promote electric vehicle adoption. The country's Electric Mobility Policy Charter (CPME) includes policies aimed at developing nationwide charging infrastructure by 2030, electrifying the public fleet by 2030 and replacing all internal combustion engine vehicles with electric vehicles by 2050.[59]
- **New Delhi**, India approved a target in 2019 to completely electrify its railway network by 2022-2023.[60]
- In 2019, **Pakistan** approved a national electric vehicle policy with targets and incentives aimed at having electric vehicles comprise 30% of all passenger vehicle and heavy-duty truck sales by 2030, and 90% by 2040.[61]
- The first urban train service in **Japan** relying entirely on renewable energy sources began operation in 2019.[62]

Initiatives supporting renewable energy in transport

- The **BioFuture Platform** is a country-led, multi-stakeholder mechanism for policy dialogue and collaboration among leading countries, organisations, academia and the private sector. As of late 2020, 20 participating countries had agreed to scale up their bioenergy commitments and develop sustainable biofuel targets, and the Mission Innovation Sustainable Biofuels Challenge was launched to stimulate and co-ordinate efforts to bring new sustainable biofuels to the market.[63]
- **Future of Fuels**, a collaborative initiative led by the non-governmental organisation Business for Social Responsibility, aims for a sustainable transition to low carbon commercial road freight with new tools, convenings and partnerships. Outcomes include the Sustainable Fuel Buyers' Principles and a Fuel Sustainability Tool.[64]
- The **Low Carbon Technology Partnership initiative on Low Carbon Freight**, led by the World Business Council for Sustainable Development, is a coalition of companies, governments and customers that aims to share and scale replicable models to achieve emission reductions in road freight globally.[65]
- **RE100**, a global initiative led by The Climate Group in partnership with CDP, involves more than 130 influential businesses committed to 100% renewable electricity, including companies in the transport sector. Members include FIA Formula E, the first electric single-seater championship where all cars run on 100% renewable power, and the French mail service La Poste, whose express delivery service Chronopost has used 100% renewable electricity to power its electric delivery vehicles in 18 French cities since mid-2020. [66]
- **The Transport Decarbonisation Alliance** (**TDA**) was launched in 2018 as a unique collaboration to accelerate the worldwide transformation of the transport sector towards a net zero emission mobility system before 2050. The TDA brings together countries, cities/regions and companies (the "3Cs") as the major drivers in sustainable, low carbon mobility.[67]

Box 1. Impacts of the COVID-19 pandemic on renewable energy

Due to the pandemic, oil demand was down nearly 5% in the first quarter of 2020, reflecting reduced demand for land-based transport, shipping and aviation; meanwhile, the demand for renewables grew. The declines in oil demand offered an opportunity to shift investment towards greater uptake of renewable energy in transport. Fossil fuels are subject to increasing competition from renewables as well as growing concerns about air pollution and carbon emissions.

Economic recovery packages offer significant potential to align renewable energy and transport policies for a green and equitable recovery, but initial plans have fallen short in this area. So far, recovery packages have not included direct linkages between transport and renewable energy.

Source: See endnote 6 for this section.

Key indicators

	2017*	2019*	% change
Policy Landscape Indicators			
Biofuel mandates (# of countries)	70	70	0%
Advanced biofuel mandates (# of countries)	2	8	+300%
Renewable transport targets (# of countries)	42	46	+10%
100% renewable energy in transport target (# of countries)	1	1	0%
Policies for electric vehicles combined with renewable electricity (# of countries)	2	1	-50%
Renewable electricity target and electric vehicle targets (# of countries)	44	39	-11%
Market Development Indicators			
Share of renewable energy in transport (%)	3.3%	3.7% (2018)	+12%
Share of biofuels in transport (%)	3%	3.4% (2018)	+13%
Share of renewable electricity in transport (%)	0.3%	0.32% (2018)	+7%
Share of renewable energy in road transport (%)	4.2% (2016)	4.4% (2018)	+5%
Share of renewable energy in rail transport (%)	9% (2016)	11%	+22%
Biofuels global production (billion litres)	143.2	161	+12%
Ethanol global production (billion litres)	104	114	+10%
Biodiesel (FAME) global production (billion litres)	33	47.4	+44%
Biodiesel (HVO) global production (billion litres)	6.2	6.5	+5%
Biofuel use in road transport (mboe/d)	1.7 (2016)	2 (2018)	+18%
Biofuel use in aviation and maritime (mboe/d)	< 0.1	< 0.1	0%

(*) Data are for the indicated year unless noted otherwise.

FAME = fatty acid methyl esters; HVO = hydrotreated vegetable oil; mboe/d = million barrels of oil equivalent per day

Source: See endnote 68 for this section.

In Practice: Additional Policy Responses

Policy targets set

Aviation

- By the end of 2019, **Brazil**, **Finland**, **Indonesia** and **Norway** had announced biofuel targets for aviation, while other countries adopted policies that could indirectly support the use of renewables in the sector.[69]
- In July 2019, the government of **Finland** announced a 30% biofuel target to be achieved by 2035 through a biofuel blending obligation for aviation.[70]
- In Scotland, **UK**, the 2019 Green New Deal policy package included a commitment for net zero aviation by 2040.[71]
- In 2019, the **USA** announced up to USD 55 million in funding for two programmes to support the development of electric aviation technology and powertrain systems, although these are not directly linked to renewable electricity.[72]

Policy measures implemented

Financial incentives

- **Thailand** subsidised the retail price of B10 (10% biodiesel blend in diesel) to encourage its use until January 2020, when B10 replaced B7 as the mandatory diesel option at pumps.[73]
- In the **US**, the biodiesel tax credit of USD 1 per gallon (USD 0.26 per litre) that expired in 2017 was extended retroactively until 2022, and the cellulosic ethanol tax credit was extended through 2020.[74]

Public procurement

- In 2019, **Toronto**, Canada began installing new equipment to transform biogas produced from the city's organic waste into renewable natural gas (RNG) to fuel its waste collection trucks.[75]
- **Santa Barbara**, US replaced petroleum diesel with renewable diesel in its municipal bus fleet in 2019.[76]

Infrastructure support

- In 2019, the USA state of **Minnesota** enacted a grant programme that provides funding for biofuel blending infrastructure.[77]

Energy utilities

- In 2019, the public utility commission in **Uttar Pradesh**, India implemented electric vehicle-specific electricity pricing structures for utility customers specifically designed to encourage the uptake of electric vehicles.[78]
- In 2018, the public utility commission for the USA state of **New York** introduced a time-of-use rate for residential customers charging electric vehicles, and the **Maryland** public utility commission required utilities to develop time-of-use rates and rebates for residential chargers.[79]

3.10 Aviation

Key findings

Demand trends

- Global demand for passenger air travel grew 6.1% in 2018, while demand for freight aviation declined 4.6%.
- Passenger aviation demand continues to be driven by generous subsidies on airline fuels and airport infrastructure as well as value-added tax exemptions on international flights.
- Biofuels provided only around 0.01% of aviation fuel demand in 2019. Sustainable aviation fuels must be scaled up significantly to make a substantive impact on aviation emissions.

Emission trends

- Passenger and freight aviation were responsible for around 2.5% of global energy-related carbon dioxide (CO_2) emissions in 2018.
- Incremental efficiency gains in operations and aircraft continue to be outpaced by global demand for air travel.
- Non-CO_2 emissions in aircraft contrails contribute twice as much to climate change as direct aircraft CO_2 emissions.

Policy measures

- The expansion of airline pricing measures is internalising a share of the external costs of aviation but remains insufficient to significantly influence consumer behaviour.
- Airlines must significantly increase the ambition of their emerging commitments to reduce aviation emissions in order to meet Paris Agreement mitigation targets; they can have greater impact with more industry co-ordination, increased alignment with global targets and strengthened national ambitions.
- It is critical to complement "Improve" strategies in the aviation sector with appropriate "Avoid" and "Shift" measures.
- The optimisation of complementary transit modes such as high-speed rail is reducing the demand for air travel in some countries, but additional investments and incentives are needed to make a global impact.

Impacts of the COVID-19 pandemic

- The impacts of the pandemic on international flight capacity ranged from an estimated 37% reduction in Africa to 72% in Asia, although this near-term drop in flights is not expected to greatly alter emission trajectories.
- Pandemic recovery packages are reshaping discussions among airlines and governments on bailouts, taxes, fuel mandates and sustainability conditionalities.
- The large impact of the COVID-19 pandemic on commercial aviation operations is likely to reduce the prioritisation of aviation policies on climate change – which were increasing before the pandemic – in favour of maintaining air connectivity for economic activity.

Overview

Aviation started 2020 on an upward trend, after global demand for flying grew 6.1% in 2018 led by Asia, Europe and Latin America.[1] With the demand for air travel growing rapidly, calls accelerated in 2019 for the International Civil Aviation Organization (ICAO) to introduce stricter restrictions on carbon offset credits under the market-based Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which has been criticised for lacking ambition.[2]

As the COVID-19 pandemic spread in early 2020, aviation demand plummeted, and the ICAO predicted that global passenger traffic for the year could drop by 1.9 million to 3.2 million passengers, with a 33% to 60% reduction in seats (compared to business as usual) (*see Box 1*).[3] As recovery plans began taking shape, a few European governments linked airline bailout packages to sustainability conditions, but most did not, underscoring the limitations of individual commitments.[4] Although CORSIA initially sought to rely on average aviation emissions in 2019 and 2020 as the baseline for its annual offsetting requirements, the ICAO Council later opted to exclude 2020 data in light of the short-term decline in flights due to the pandemic.[5]

Box 1. Carbon offsets and aviation

Carbon offsets are intended to reduce the impacts of air travel by investing in projects that mitigate carbon emissions. The Paris Agreement requires all countries and all sectors to directly reduce emissions; thus, carbon offsetting is not a Paris-compliant strategy. Further, CORSIA's low ambition level and offset costs do not provide sufficient incentive to drive needed efficiency improvements for aviation.

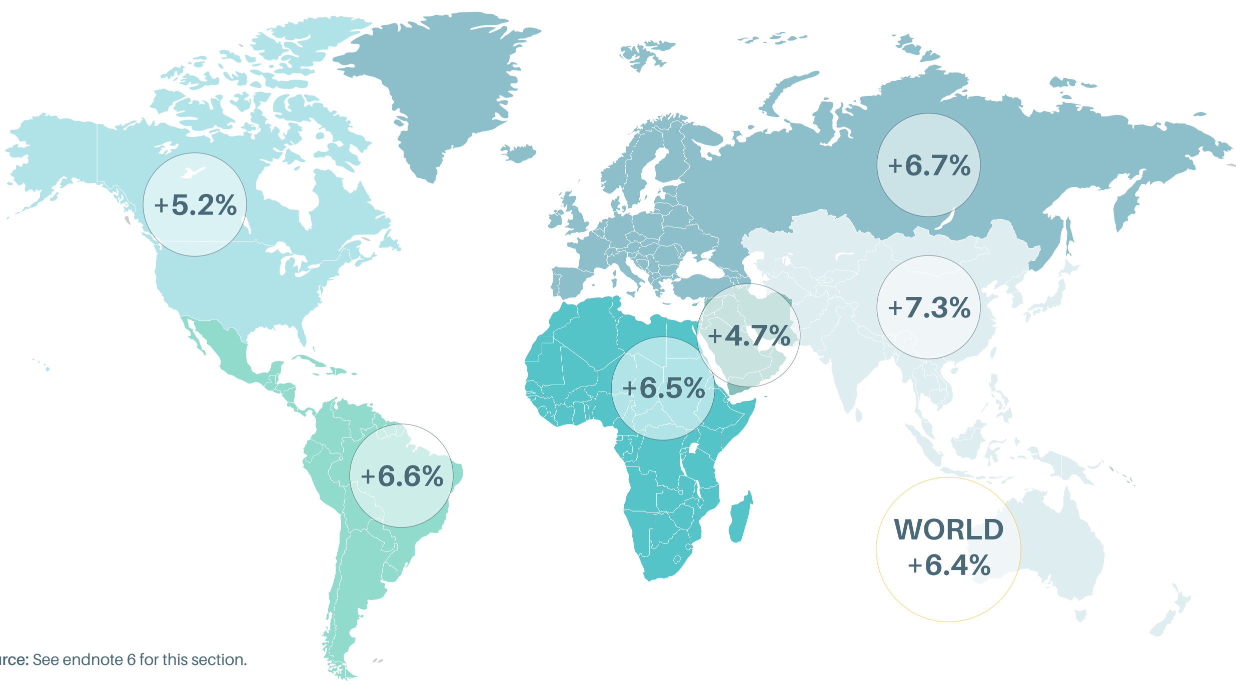
A recent European Commission study found that up to 85% of offsets from projects under the United Nations Clean Development Mechanism have not fully delivered claimed emission reductions. Therefore, offsets are not a reliable strategy to reduce fuel consumption or emission growth, which can only be assured through direct measures like aircraft efficiency standards and phase-outs of fuel subsidies.

Source: See endnote 36 for this section.

Demand trends

Global demand for passenger air travel grew 6.1% in 2018, while demand for freight aviation declined 4.6% (*see Figure 1*).[6] Passenger activity increased to 8.2 trillion revenue passenger-kilometres, with the total number of passengers reaching a record 4.3 billion.[7] Growth was led by Asia (up 7.3%), Europe (6.7%) and Latin America (6.6%).[8] Aviation freight demand was already falling in 2018 due to weak growth in global trade and then plummeted in 2020 after the onset of the COVID-19 pandemic.[9]

Figure 1. Growth in passenger aviation, 2018



Source: See endnote 6 for this section.

Passenger aviation demand continues to be driven by subsidies on airline fuels and airport infrastructure as well as value-added tax exemptions on international flights. Airlines benefit from a universal exemption from fuel taxation and thus are subsidised at an estimated annual value of more than EUR 60 billion (USD 73 billion) globally and EUR 20 billion (USD 24 billion) in Europe alone.[10] A leaked 2018 European Commission study concludes that the aviation sector is undertaxed and that taxing aviation fuels (which is common in other countries) could cut emissions from aviation at least 10% without adverse impacts on gross domestic product (GDP).[11]

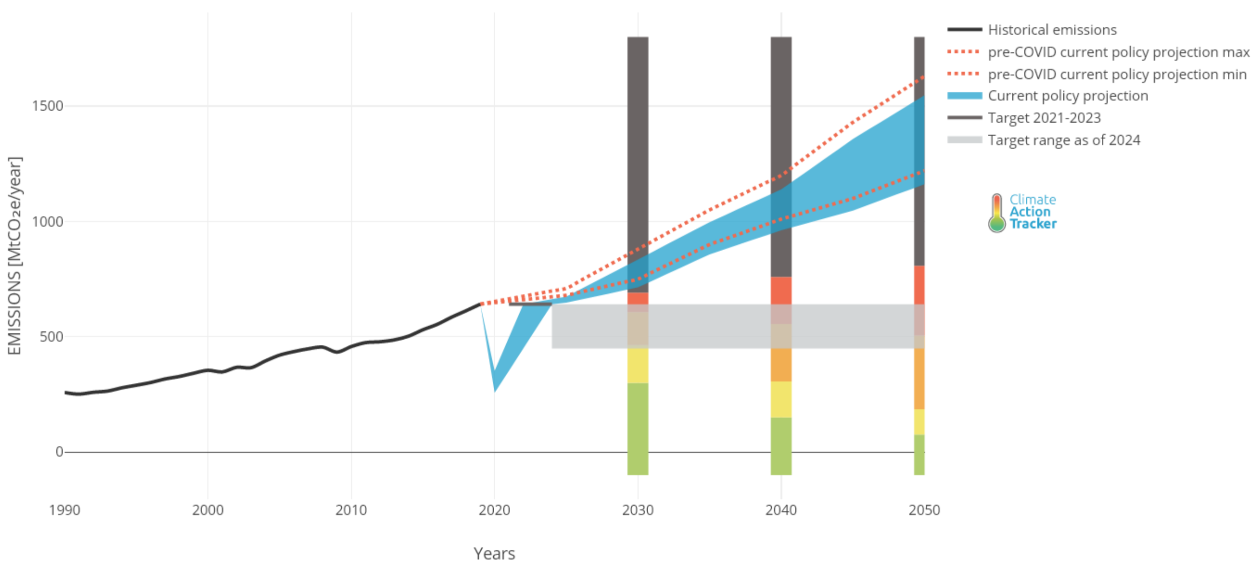
Biofuels provided only around 0.01% of aviation fuel demand in 2019.[12] Sustainable aviation fuels must be scaled up significantly to make a substantive impact on aviation emissions. Technology for producing renewable electro-fuels for the sector exists, but costs remain much higher than for fossil-based fuels, and policy support is lacking.[13] Mandates for biofuels and other sustainable aviation fuels are critical to reducing fossil fuel use in the sector, but to ensure their sustainability, advanced biofuels must meet strict criteria and crop-based biofuels must be excluded.[14] Recent efforts to scale up demand for biofuels include the following:

- The **European Union** (EU) published its updated Renewable Energy Directive (RED II) in December 2018, outlining the use of renewable transport fuels from 2021 to 2030. Robust national implementation is needed to promote clean advanced renewable fuels (and avoid unsustainable biofuels) for effective decarbonisation.[15]
- In 2019, **Finland** announced a target for 30% biofuels in aviation by 2030 to be achieved through a blending obligation, although this target may rely on biofuels derived from palm oil.[16]
- **France** adopted legislation in 2020 requiring all airliners refuelling in the country to use at least 1% renewable bio-jet fuel, with plans to increase this obligation to 5% by 2030 and 50% by 2050.[17]
- In 2020, **Germany** set a mandate for 2% hydrogen-based electro-fuels in aviation by 2030.[18]
- At the end of 2019, **Sweden**'s Halmstad Airport committed to requiring airlines to use at least 5% sustainable aviation fuel at the airport, in line with the municipality's target to be fossil fuel-free by 2030.[19]

Emission trends

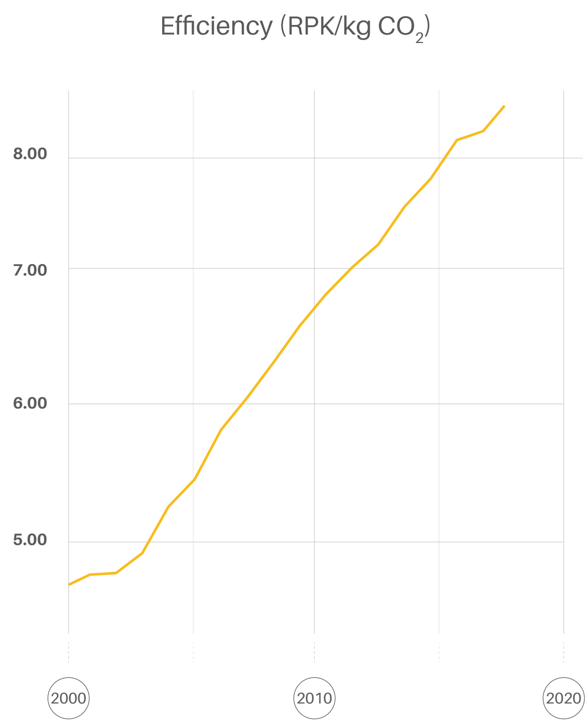
Passenger and freight aviation were responsible for around 2.5% of global energy-related CO_2 emissions in 2018.[20] Passenger aviation represents more than 80% of this total.[21] Aviation emissions grew 32% between 2013 and 2018, but the onset of the COVID-19 pandemic in 2020 temporarily reduced emissions (*see Figure 2*).[22]

Figure 2. Pre- and post-COVID-19 projections for aviation emissions to 2050



Source: See endnote 22 for this section.

Figure 3. Fuel economy in aircraft, 2000-2020



Source: See endnote 24 for this section

International aviation has continued to grow in the absence of sufficient policies and measures in place to reduce direct aviation emissions. Despite the declines during the COVID-19 pandemic, emissions from international aviation could still increase a projected 220-290% between 2015 and 2050 (compared to an increase of 230-310% projected before the pandemic), underscoring the challenge of achieving carbon-neutral growth in the sector.[23]

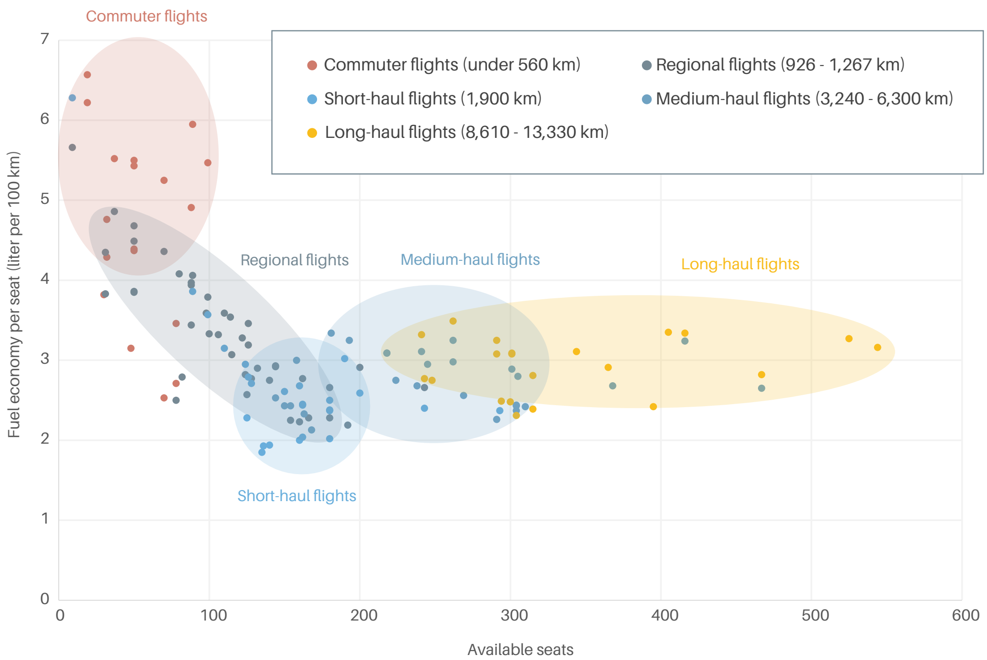
Incremental efficiency gains in operations and aircraft continue to be outpaced by global demand for air travel. Airline fuel efficiency gains averaged 2% annually between 2009 and 2019, whereas estimated growth in aviation CO_2 emissions during the same period averaged 3% annually (*see Figure 3*).[24]

Total revenue passenger-kilometres in 2019 increased 4.2% over 2018, as consistent with projected growth rates from 2013 to 2035.[25] Growth in air travel has outpaced both historic fuel economy improvements and corresponding CO_2 emission reductions for aircraft, compromising the sustainability of the airline industry (*see Figure 4*).[26]

Non-CO_2 emissions in aircraft contrails contribute twice as much to climate change as direct aircraft CO_2 emissions.[27] Using cleaner aviation fuels and changing flight paths to lower altitudes can reduce contrail formation and reduce emissions of nitrogen oxides, water vapour, soot and black carbon.

- Rerouting fewer than 2% of flights in **Japan** reduced the warming effect of contrails by almost 60% during a six-week period.[28]

Figure 4. Fuel economy (litres/100 kilometres) per seat by flight type, 1981-2020



Source: See endnote 26 for this section.

Policy measures

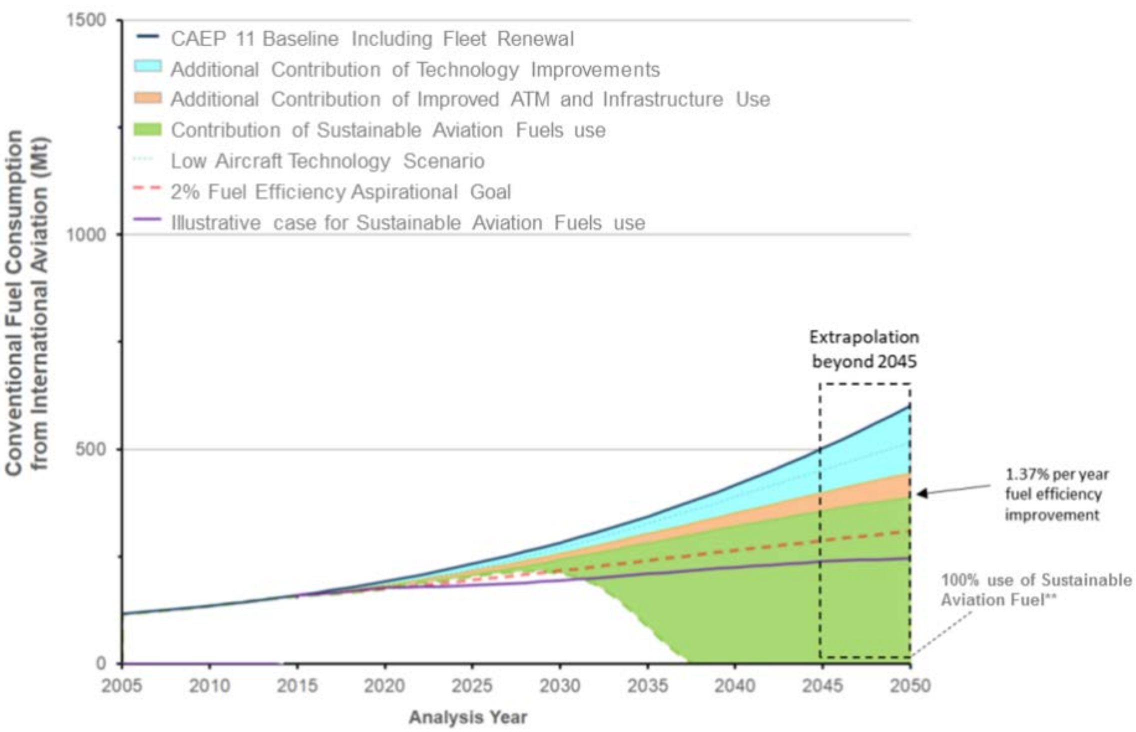
The expansion of airline pricing measures is internalising a share of the external costs of aviation but remains insufficient to significantly influence consumer behaviour.

- The **EU**'s Green Deal provides a model for other regions in creating a set of co-ordinated airline taxes that signal clear incentives and avoid carbon leakage across national and corporate borders.[29] In 2020, a consultation was launched to test the waters for a pan-European tax on jet fuel.[30] The tax, if classified as "environmental", could avoid the need for unanimous agreement among ministers.
- In 2020, **France** introduced an aviation "eco tax" ranging from EUR 1.50 (USD 1.8) per economy ticket within the EU to EUR 18 (USD 22) per business ticket outside the EU; a subsequent proposal could raise these fees.[31]
- **Germany** advanced a duty on air passengers in 2020 despite the impacts of the COVID-19 pandemic, although it reduced the rate during severely impacted months and funded a EUR 8 billion (USD 9.7 billion) bailout for the aviation industry (but with no climate commitment).[32]
- **Spain** introduced an air transport tax in 2020 to fight climate change, in line with European Commission recommendations.[33]
- The parliament of **Switzerland** approved a tax in 2020 on all departing flights, which ranges from CHF 30 to CHF 120 (USD 33 to USD 133) depending on the class of travel and on the flight distance.[34]
- In 2020, Climate Assembly **UK**, an advisory group of private citizens commissioned by a parliamentary select committee, called for a frequent-flyer levy linked to individual air travel frequency and distance.[35]

Airlines must significantly increase the ambition of their emerging commitments to reduce aviation emissions in order to meet Paris Agreement mitigation targets; they can have greater impact with more industry co-ordination, increased alignment with global targets and strengthened national ambitions. A number of major airlines have set significant policy targets and implemented measures. However, many of these are insufficient to offset rising passenger demand, and carbon offset strategies cannot be equated to real and sufficient emission reductions within the aviation sector (*see Box 2*).[36]

- The **International Air Transport Association** (IATA) has adopted targets to mitigate CO_2 emissions from aviation including a cap on net CO_2 emissions from 2020 (carbon-neutral growth) and a reduction in net aviation CO_2 emissions of 50% by 2050, relative to 2005 levels (a goal echoed by the 10 member

Figure 5. Aviation CO_2 emission projections and potential greenhouse gas reductions to 2050



Source: See endnote 40 for this section.

airlines of Airlines for America).[37] However, such measures are insufficient to achieve emission levels compatible with the Paris Agreement, as net zero emissions by 2050 are required of all sectors, yet aviation emissions currently exceed 600 million tonnes annually.[38]

- **ICAO's Alternative Fuels Task Force** estimates that it is possible to meet 100% of international demand for aviation jet fuel with sustainable fuels by 2050, yielding a 63% reduction in CO_2 emissions.[39] However, this level of sustainable fuel production would require unprecedented capital investments in production infrastructure and robust policy support (*see Figure 5*).[40]

In early 2020, USA airline **Delta** committed USD 1 billion over 10 years to mitigate emissions through strategies such as fleet renewal, biofuels and carbon offsets, although it later reduced its offset targets due to the impacts of the COVID-19 pandemic.[41]

Starting in November 2019, UK carrier **easyJet** pledged to purchase carbon offsets to equal the fuel used on all flights in its network.42 However, carbon offsets are not compliant with the Paris Agreement (*see Box 1*).[43]

In 2019, **Lufthansa** and **Swiss International Air Lines** began offering passengers the option to reduce their carbon footprints by selecting sustainable aviation fuel when booking flights.[44] However, customer willingness to pay for voluntary aviation offsets remains low, and thus emission reductions from offsets are also limited.[45]

It is critical to complement "*Improve*" strategies in the aviation sector with appropriate "*Avoid*" and "*Shift*" measures.[46] Technology improvements and improved air traffic management will still result in an increase in aviation emissions. Thus, it is urgent to also implement measures that avoid unnecessary air travel and shift demand to more sustainable modes.[47]

The optimisation of complementary transit modes such as high-speed rail is reducing the demand for air travel in some countries, but additional investments and incentives are needed to make a global impact. Collaborative planning between aviation and rail systems (including high-speed and overnight rail services) can help drive the use of these more energy-efficient modes for shorter trips, meet greenhouse gas reduction targets and reduce costs in emission trading schemes (*see Section 3.4 on Passenger and Freight Railway*).

Flygskam (Swedish for "flight-shame", which describes unease about flying by environmentally conscious travellers) emerged as a reaction to the failure of governments to regulate the aviation industry, and the resulting increase in emissions.48 In **Sweden**, the movement led to seven consecutive months of reductions in the number of air travel passengers and to a total annual decline of 4% in 2019.[49]

- A flight-shame analysis by **Citigroup** suggested that rising attention to the climate impacts of flying could create growing pressure for airlines to offset emissions, and thereby raise industry costs; the analysis noted that carbon offsets cannot be correlated to real emission reductions from aviation.[50]

In 2020, **Sweden** proposed launching sleeper train services to **Belgium** and **Germany** to reduce dependence on aviation and minimise travel impacts.[51]

Revenues from **France**'s eco-tax on flights are to be spent on boosting local train services.[52]

Box 2. Impacts of the COVID-19 pandemic on aviation

The impacts of the pandemic on international flight capacity ranged from an estimated 37% reduction in Africa to 72% in Asia, although this near-term drop in flights is not expected to greatly alter emission trajectories. The global airline industry is being reshaped by the pandemic, which will likely affect air travel provision and consumer behaviour for years to come. Impacts to aviation during 2020 included a global reduction in airline capacity from 55% to 64%, an overall reduction in passengers from 1.18 billion to 1.39 billion, and gross operating losses of USD 214 billion to USD 252 billion (*see Figure 6*).

Economic recovery packages are reshaping discussions among airlines and governments on bailouts, taxes, fuel mandates and sustainability conditionalities. Green and equitable recovery packages to rationalise subsidies and internalise aviation externalities can help to create more efficient aviation policies and infrastructure in line with climate action goals. In many countries, governments supported the aviation industry with direct and indirect subsidies as well as special regulations.

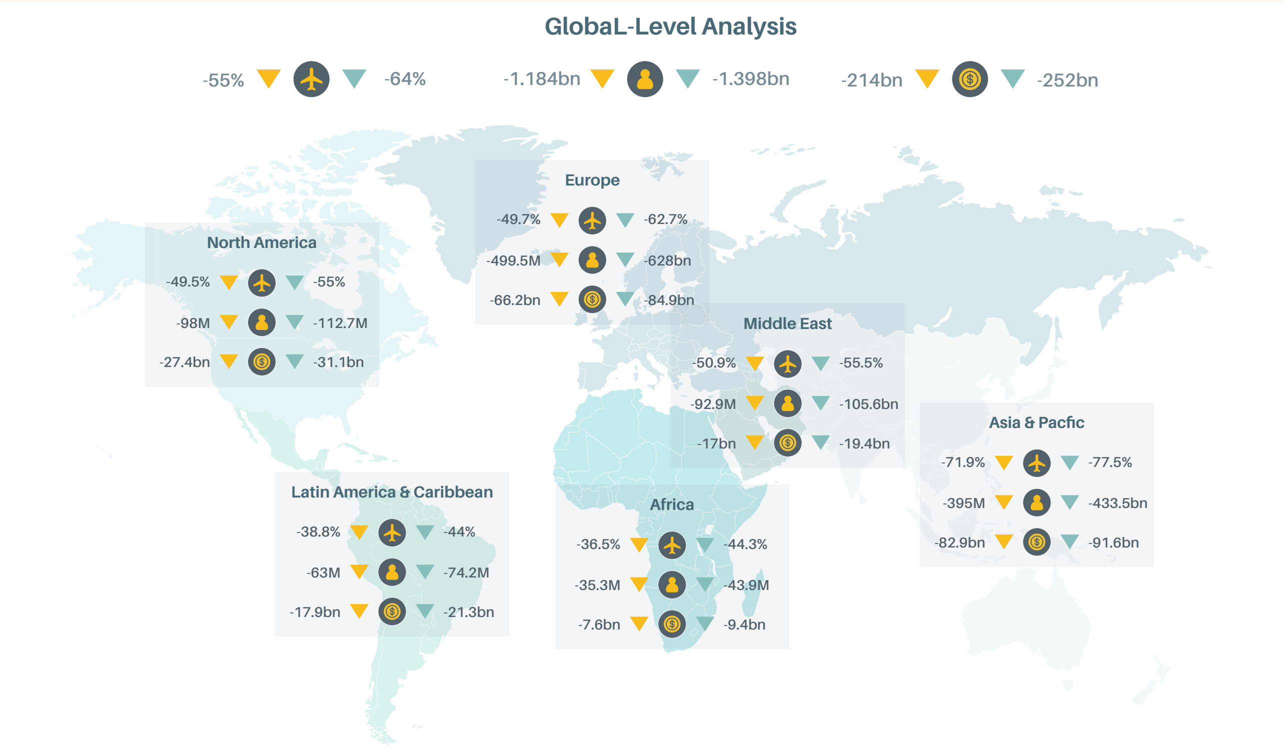
- **Austrian Airlines** was granted a EUR 600 million (USD 730 million) bailout in July 2020, subject to the airline reducing its total emissions 30% below 2005 levels by 2030.
- In **France**, a EUR 7 billion (USD 8.5 billion) state loan for **Air France** approved in May 2020 was contingent on the airline becoming more eco-friendly, including cutting domestic flights in favour of rail.
- However, other governments provided support to the airline industry without environmental conditions (e.g., **Germany**'s EUR 8 billion (USD 9.7 billion) package), missing an opportunity to improve sustainability.

The large impact of the COVID-19 pandemic on commercial aviation operations is likely to reduce the prioritisation of aviation policies on climate change – which were increasing before the pandemic – in favour of maintaining air connectivity for economic activity.[53] Despite the reduced emissions due to policies restricting air travel, the pandemic has put some aviation-related climate policies at risk.

The price of carbon in the EU's Emission Trading Scheme (which covers aviation) dropped almost 40% in March 2020 to a near two-year low of just above EUR 15 (USD 18) per tonne of CO_2, before bouncing back to EUR 22 (USD 26) per tonne by June 2020. Moreover, the proposal to the ICAO to use CO_2 emissions levels of 2019 (rather than averaging 2019-2020 levels) as the CORSIA baseline will have negative impacts for the adoption of ambitious climate targets.

Source: See endnote 3 for this section.

Figure 6. Impacts of the COVID-19 pandemic on international passenger traffic, 2020



Initiatives supporting low carbon aviation

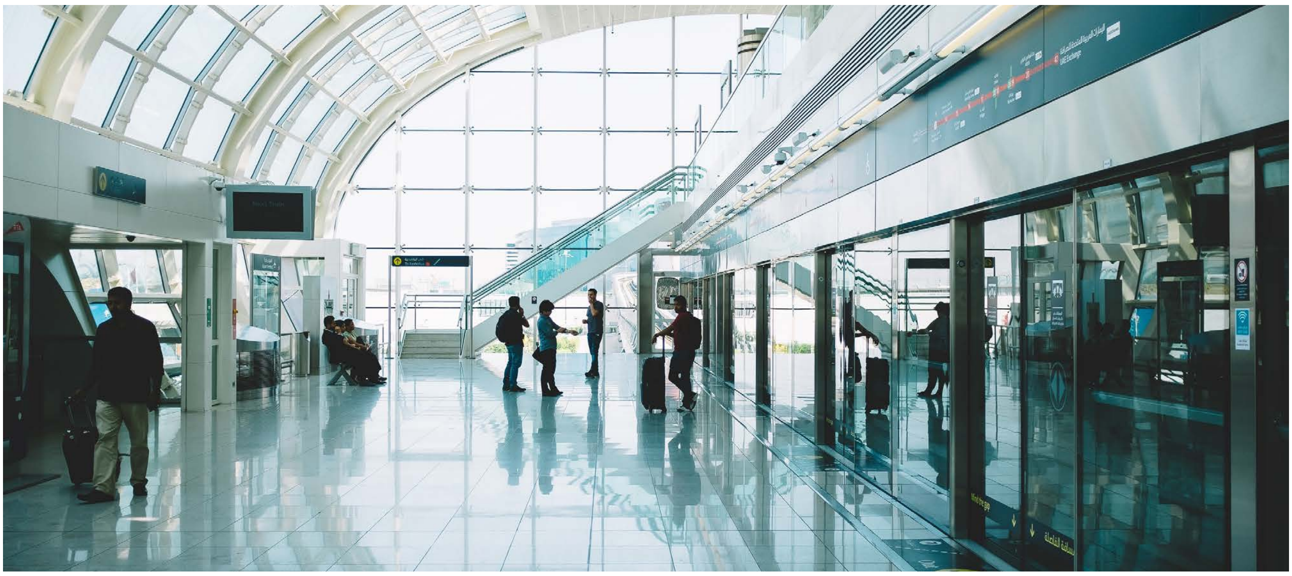
- The **International Coalition for Sustainable Aviation**, representing millions of non-profit organisations, works to reduce pollution from air travel and is the only environmental civil society group accredited as an observer by the ICAO.[54]
- The **International Council on Clean Transportation** works to ensure that environmental policy for the aviation sector is informed by high-quality, transparent analysis of the environmental performance of aircraft and airlines, a goal pursued through research on aircraft technology, airline fuel efficiency, environmental standard design and the use of alternative fuels in aviation.[55]
- **Sustainable Aviation**, launched in 2005, is a world-first long-term strategy that brings together major UK airlines, airports, manufacturers, air navigation service providers and key business partners to ensure a cleaner, quieter, smarter future for UK aviation.[56]
- **Transport & Environment** campaigns with members of the International Coalition for Sustainable Aviation and others to call for ambitious global and regional targets to reduce emissions from aviation, for full inclusion of aviation in the EU's strategy to meet its reduction targets and for removing exemptions on fuel taxation and value-added tax for airlines in the EU.[57]

Key indicators

	2018*	2019*	Change
Policy Landscape Indicators			
Carbon-neutral airports (and above) (# of airports)	62 (2019)	64 (2020)	+3.2%
Market Development Indicators			
Passenger-kilometres flown (millions)	8,329,776	8,679,621	+4.20%
Available seat-kilometres (millions)	10,174,828	10,519,174	+3.38%
Passenger load factor (%)	81.9%	82.5%	+0.73%
Freight and mail tonne-kilometres (millions)	262,333	253,982	-3.18%
Available freight tonne kilometres (millions)	532,000	543,717	+2.20%
Freight load factor (%)	49.3%	46.7%	-5.27%

(*) Data are for the indicated year unless noted otherwise.

Source: See endnote 58 for this section.



In Practice: Additional Policy Measures

Policy targets set

Sustainable aviation fuels

- Aspirational biofuel mandates – such as 30% targets proposed by Finland and Norway – are being complemented by advances in electricity-based fuels.[59]
- Electro-fuels could help to lower aviation emissions if strict sustainability criteria are observed, but they are significantly more expensive than fossil fuels and thus require sustained policy support.[60]
- In 2019, **British Airways** announced plans to build a plant to transform plastic waste into sustainable fuel, with a goal to reduce greenhouse gas emissions 70%.[61]
- **Boeing** flew a 787 Dreamliner delivery flight for EgyptAir powered entirely by agriculturally sourced biofuel, travelling more than 10,000 kilometres from Seattle to Cairo in July 2019.[62]

Air network efficiencies

- In 2018, the **African Union** launched the Single African Air Transport Market, which could help improve the efficiency of intra-continental trips and avoid inefficient routings to Africa via Europe.[63]
- While more efficient routing leads to shorter flight times, it may also lead to more flights, as airlines have incentives to keep planes in the air for as long as possible. To achieve positive impacts, routings must be climate efficient as well as time efficient.[64]

Airport expansion planning

- In 2019, France's environment authority asked planners of the **Marseille** airport expansion to reconcile increased flights with the country's national target for net zero emissions by 2050.[65]
- The proposed expansion of **London Heathrow** airport was ruled unlawful in February 2020 for its alleged failure to consider Paris Agreement commitments; this ruling was subsequently overturned by the UK's supreme court in December 2020.[66]
- Planned expansions at **Bristol**, **London Stansted** and **Rome Fiumicino** airports have been cancelled due to environmental concerns and opposition related to the need to achieve climate commitments.[67]
- While some cities scaled back airport expansion plans (including **Leeds**, **New York** and **Paris**), a number of other cities continued expansion plans and projects (including **Belgrade**, **Helsinki** and **Taipei**), blunting the emission reduction impacts of revised or cancelled expansion efforts.[68]

Policy measures implemented

Electrification

- In 2019, Scandinavian regional airline **Widerøe** partnered with **Rolls Royce** to electrify the airline's regional fleet of more than 30 planes by 2030.[69]
- In 2019, the **US** Department of Energy pledged up to USD 55 million to develop low-cost electric engine technology/ powertrain systems.[70]
- The first fully electric commercial aircraft, a six-seated seaplane, completed a 15-minute test flight in Canada in 2019.[71]
- In 2020, the European Aviation Safety Agency granted the first certification for an electric aircraft, a two-seater capable of up to 80 minutes of flight, built by a Slovenia-based aerospace company.[72]
- Germany's Aviation Research Program has dedicated EUR 25 million (USD 30 million) between 2020 and 2024 to hydrogen technologies to develop hybrid-electric aviation.[73]

"Carbon-neutral" airport facilities

- In 2019, airport facilities in **Quito** (Ecuador), **San Diego** (California, USA) and 11 airports in **Europe** became newly accredited "carbon-neutral" airports, bringing the global total to 62 airports in 2020, up 27% from 2018.[74]

3.11 Shipping

Key findings

Demand trends

- In 2019, 11 billion tonnes of goods were transported in global maritime trade, with growth stalled at 0.5%; this was down sharply from growth rates of 2.8% in 2018 and 4.7% in 2017.
- The global commercial shipping fleet expanded 4.1% in 2020, the greatest annual growth since 2014, reaching a total of 98,140 commercial ships above 100 gross tonnes in weight.
- Global shipping connectivity (how well countries are connected to global shipping networks) increased more than 25% between 2010 and 2019, with the greatest regional increases in Asia (35%) and Latin America and the Caribbean (25%).

Emission trends

- Carbon dioxide (CO_2) emissions from maritime transport (both freight and passenger activity) increased an estimated 7.2% between 2010 and 2019.
- Improvements in shipping fuel efficiency slowed between 2015 and 2020, with annual progress of 1% to 2%.
- Short-lived climate pollutants from shipping increased sharply between 2012 and 2018, including a 12% increase in black carbon emissions and a 150% increase in methane emissions.

Policy measures

- Processes under the International Maritime Organization (IMO) have had limited impact on meeting emission targets, while regional and national measures show greater levels of ambition and innovation.
- Alternative maritime fuels are increasingly attractive to countries and companies due to recent IMO regulations on conventional fuels, but the mitigation potential varies widely by fuel type.
- Fiscal incentives in combination with enhanced regulations will play an important role in the uptake of sustainable maritime fuels.
- Countries are making considerable investments into electrification of shipping vessels and ports to increase efficiency and reduce emissions and operational costs.
- Shipping emissions could be reduced more than 75% by 2050 through a balanced combination of decarbonisation measures including sustainable biofuels, capacity utilisation and speed optimisation.

Impacts of the COVID-19 pandemic

- International maritime trade dropped an estimated 4.1% in 2020, but trade volumes are expected to recover and grow 4.8% in 2021.
- Global port container volumes fell 7.3% during 2020, and around 12% of the container fleet was assumed to be idle at the peak of initial pandemic lockdowns.
- Growth in emissions from international shipping has been slowed by the pandemic and is not projected to return to pre-COVID-19 levels until 2030.

Overview

Maritime shipping is the backbone of global trade, and international maritime transport caters almost exclusively to freight. Maritime transport accounts for more than 80% of global trade by volume and more than 70% by value.[1] International shipping emits more CO_2 annually than the entire regions of Latin America and the Caribbean, Africa or Oceania.[2] Challenges to decarbonisation of the shipping sector include high initial investment costs for vessels as well as their long life spans.[3]

In 2018, the International Maritime Organization adopted targets to reduce the carbon intensity of shipping at least 40% by 2030 and to at least halve emissions by 2050; the baseline of these targets (2008) represents the historical height of shipping activity and thus a peak in the sector's emissions.[4] The IMO target aims for full decarbonisation as early as possible this century.[5]

In early 2020, the IMO postponed a key session aimed at assessing measures to make progress towards the 2030 target and adopting a resolution urging Member States to develop voluntary National Action Plans.[6] In 2020, the IMO agreed on implementing short-term emission reduction measures to achieve greenhouse gas emissions reductions before 2023.[7]

Despite limited policy action, the shipping industry appears to have overachieved its 2030 carbon intensity target, which was rated "critically insufficient" by Climate Action Tracker even before the onset of the pandemic; however, the industry remains far from meeting its 2050 emission reduction target (which is rated "insufficient").[8]

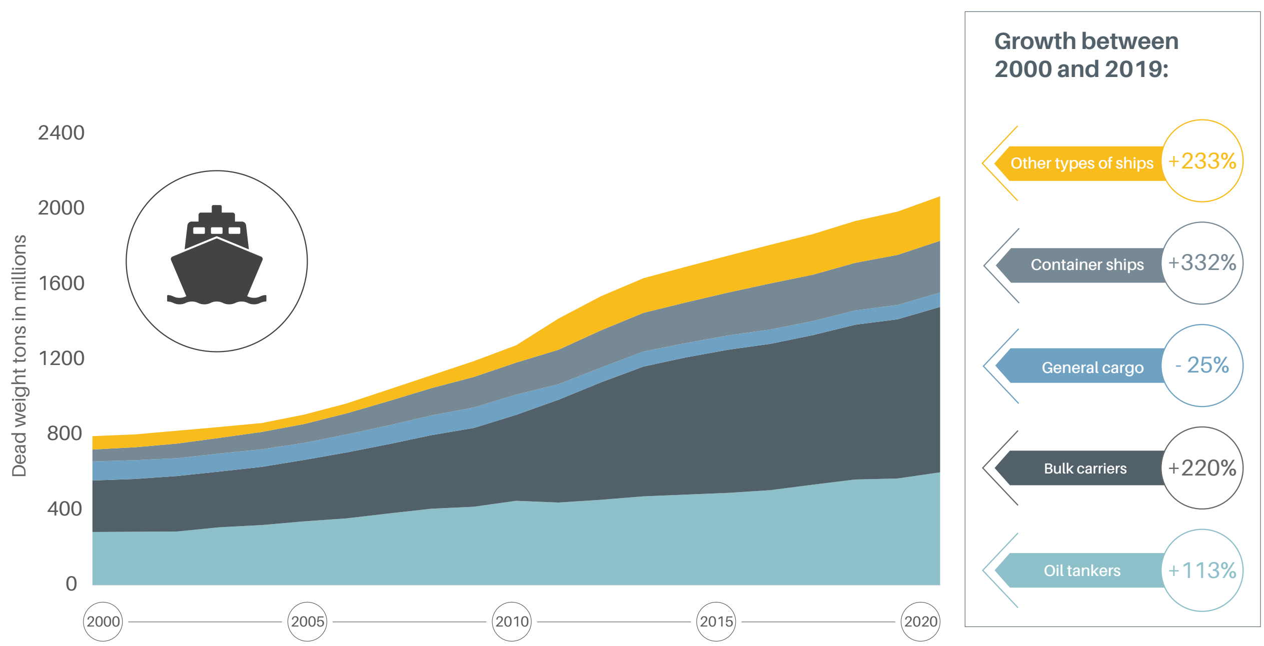
The COVID-19 pandemic led to a brief halt in international maritime trade, and in the first six months of 2020 major routes experienced sharp declines in container-based trade. CO_2 emissions from shipping declined between 18% and 35% for the year and are expected to only slowly return to pre-COVID-19 levels (*see Box 1*).[9]

Demand trends

In 2019, 11 billion tonnes of goods were transported in global maritime trade, with growth stalled at 0.5%; this was down sharply from growth rates of 2.8% in 2018 and 4.7% in 2017.[10] Trade tensions between China and the United States of America (including tariff hikes in 2018 and 2019) are estimated to have affected nearly 2% of world maritime trade volume.[11] Other factors for the slow growth include lingering impacts from the United Kingdom's (UK) exit from the European Union (EU), recessions in some emerging economies, and supply-side disruptions to petroleum and other sectors.[12]

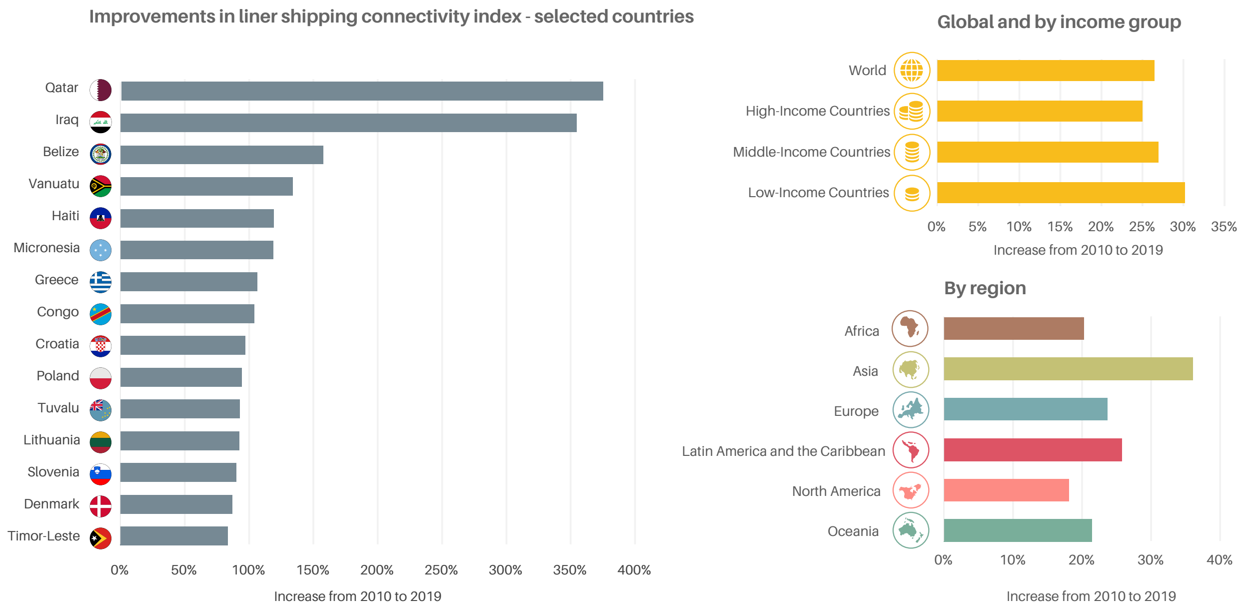
The global commercial shipping fleet expanded 4.1% in 2020, the greatest annual growth since 2014, reaching a total of 98,140 commercial ships above 100 gross tonnes in weight.[13] Maritime transport witnessed a trend towards larger vessels from 2010 to 2020, led by 332% growth in the capacity of container ships and 220% growth in bulk carriers (*see Figure 1*).[14] For the first time in

Figure 1. World shipping fleet by principal vessel type, 2000-2020



Source: See endnote 14 for this section.

Figure 2. Liner Shipping Connectivity Index, improvements by country and region, 2010-2019



Source: See endnote 18 for this section.

history, the global shipping fleet surpassed a total capacity of 2 billion dead weight tonnes in 2020.[15] Larger vessels create greater challenges for incorporating sustainable technologies and fuels.[16]

Global shipping connectivity (how well countries are connected to global shipping networks) increased more than 25% between 2010 and 2019, with the greatest regional increases in Asia (35%) and Latin America and the Caribbean (25%).[17] The Liner Shipping Connectivity Index measures the total number and capacity of vessels deployed in a country, as well as the number of shipping lines servicing a country and connecting to other countries. The greatest national increases occurred in **Qatar** (374%), **Iraq** (355%), **Belize** (157%), **Vanuatu** (134%) and **Haiti** (119%) (*see Figure 2*).[18]

Emission trends

CO_2 emissions from maritime transport (both freight and passenger activity) increased an estimated 7.2% between 2010 and 2019.[19] As global maritime shipping demand has increased, so have CO_2 emissions, totalling 730 million tonnes in 2019.[20] However, emissions from maritime shipping have risen more slowly than those from aviation: between 2010 and 2019, CO_2 emissions from international shipping grew 1.8% annually on average, whereas emissions from international aviation grew 3.8%, reaching 627 million tonnes.[21]

Improvements in shipping fuel efficiency slowed between 2015 and 2020, with annual progress of 1% to 2%.[22] The IMO developed the Energy Efficiency Operational Indicator (EEOI) in 2009 to measure the efficiency of ships. The EEOI can be improved by increasing the amount of cargo transported and by reducing a vessel's fuel consumption (i.e., reducing the speed of operation or making modifications to the vessel). Additional policy actions are needed to accelerate fuel-efficiency technologies such as wind-assist and hull air lubrication, along with low- and zero-emission fuels.[23]

Short-lived climate pollutants from shipping increased sharply between 2012 and 2018, including a 12% increase in black carbon emissions and a 150% increase in methane emissions.[24] In 2019, major container operation companies rejected proposals for mandatory 20% slower speed limits, which could reduce CO_2 emissions an estimated 34% and black carbon emissions an estimated 20%.[25] In 2020, the IMO reduced the allowable sulphur content in shipping fuel oil to 0.5% (from 3.5%).[26] However, new fuel blends have the potential to increase black carbon emissions by up to 85%.[27]

Policy measures

Processes under the IMO have had limited impact on meeting emission targets, while regional and national measures show greater levels of ambition and innovation.[28] IMO actions have focused primarily on energy efficiency measures.[29] The IMO's 2020 regulations on low-sulphur and cleaner fuels are expected to raise fuel costs around 50%, with shipping operators likely to pass these costs to customers through the supply chain, which may have indirect impacts on demand.[30]

- Several Pacific countries have submitted position papers to the IMO to increase ambition on decarbonising the shipping sector.[31]
- Shipping and water-borne projects are eligible for funding through the **2020 EU Innovation Fund** if they demonstrate low-carbon-energy propulsion.[32]
- In 2019, the **UK** released its Maritime 2050 strategy to transition to zero emission shipping and a plan to deploy zero emission-capable ships by 2025.[33]
- In 2020, the **Marshall Islands** demanded a carbon pricing measure from the IMO as the most effective way to cut shipping emissions and to restore the confidence of the international community.[34]
- The governments of **Fiji**, **Marshall Islands**, **Samoa**, **Solomon Islands**, **Tuvalu** and **Vanuatu** jointly called for USD 500 million in 2019 to increase the sustainable development of maritime transport.[35]

Alternative maritime fuels are increasingly attractive to countries and companies due to recent IMO regulations on conventional fuels, but the mitigation potential varies widely by fuel type.[36] Following the adoption of the IMO's sulphur regulations in 2020, there has been a shift towards liquefied natural gas (LNG) as a cleaner fuel alternative, along with biofuels, e-methanol and hydrogen.[37] However, continued investments in LNG ships and onshore facilities could slow a broader transition to low carbon fuels.[38]

- In 2019, **IKEA** Transport & Logistics Services and partners completed a biofuel trial, the first to blend heavy fuel oil-equivalent biofuel and fossil fuel.[39]
- Finnish company **Wärtsilä** is engaging in large-scale testing of ammonia as an alternative fuel for use in shipping vessels to reduce the emissions of the industry, with tests planned for 2022.[40]
- The use of "drop-in" liquid biofuels for large marine diesel engines with minimal modifications may reduce shipping emissions in the short run.[41]
- Studies show that adopting LNG as a bridging fuel is likely to increase the life-cycle climate impacts of international shipping.[42]

Fiscal incentives in combination with enhanced regulations will play an important role in the uptake of sustainable maritime fuels.[43]

The use of biofuels for shipping raises concerns, as verifying sustainability criteria is challenging. Generating liquid ammonia or hydrogen shipping fuels requires only half the amount of renewable electricity as generating fuels such as synthetic methane or synthetic diesel, but cost remains a factor.[44]

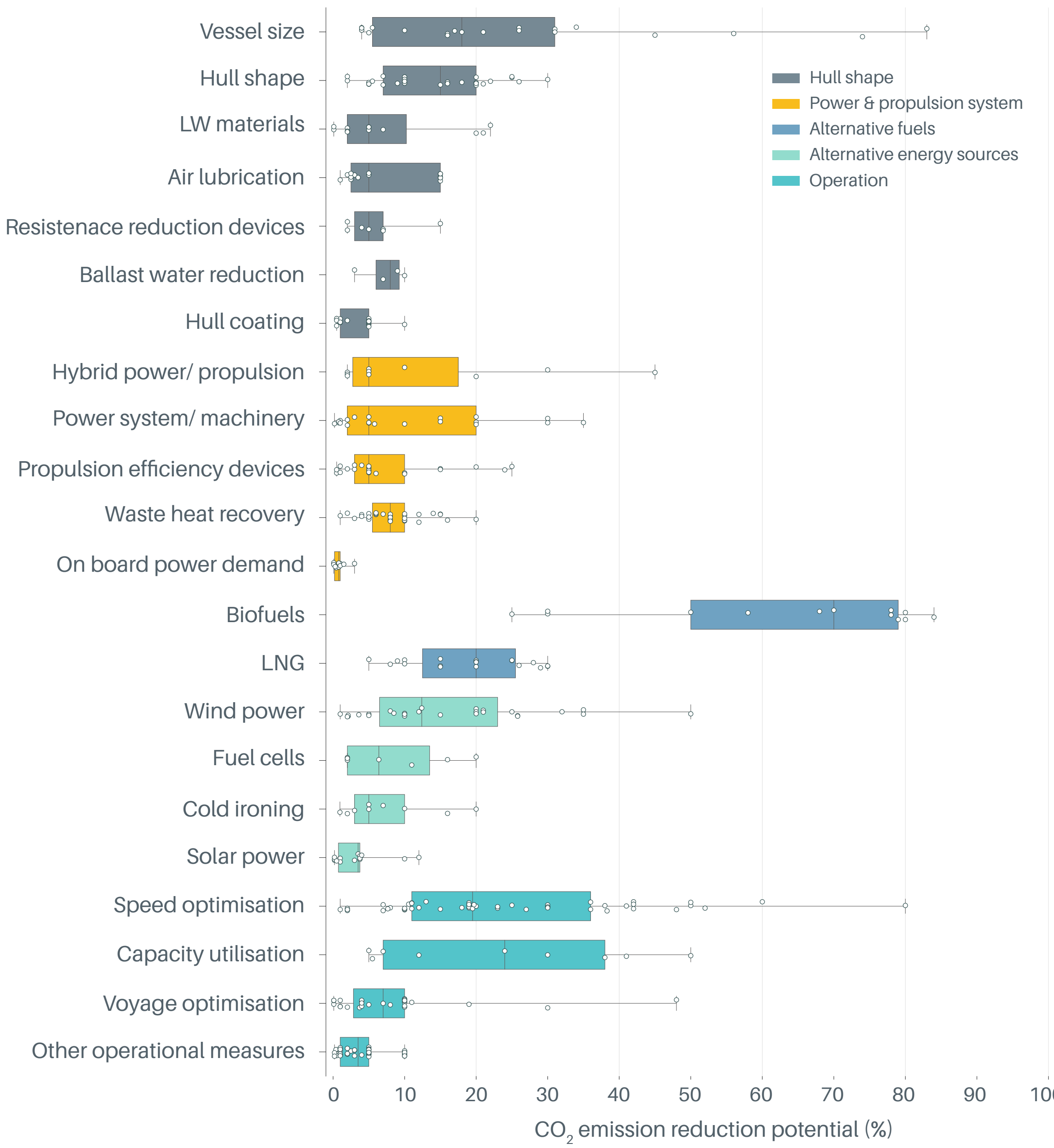
- The **European Parliament** approved a proposal in 2020 to extend the EU Emissions Trading System to the maritime sector, setting binding targets to reduce annual shipping emissions 40% by 2030, starting with ships of at least 5,000 tonnes gross.[45]
- Through the European Green Deal, introduced in 2019, the **European Commission** proposes to examine current tax exemptions for maritime fuels and to determine how best to close any loopholes.[46]
- **Germany**'s national hydrogen strategy, updated in June 2020, includes around EUR 25 million (USD 30 million) in funding for a Maritime Research Programme from 2020 to 2024, a share of which will support hydrogen-powered shipping applications.[47]

Countries are making considerable investments into electrification of shipping vessels and ports to increase efficiency and reduce emissions and operational costs.[48] Policy measures implemented in recent years show that maritime decarbonisation trends are shifting towards renewable electricity for shorter distances and towards electro-fuels (e.g., ammonia, e-methanol, hydrogen) for longer distances.[49]

- The European Green Deal proposed obliging docked ships to use shore-side electricity.[50]
- In 2020, **Norway** announced plans to launch a prototype vessel powered by zero-emission hydrogen in the coming years, with the aim of ferrying cargo and delivering hydrogen supplies to strategic areas. The EU's research and innovation fund has allocated EUR 8 million (USD 9.8 million) to this pilot project.[51]
- In June 2020, **Denmark** completed a successful trial of the world's largest battery electric ferry boat, which is nearly twice as energy efficient as diesel boats.[52] This service complements a battery-powered ferry service launched in November between **Denmark** and **Sweden**, which is powered by renewable energy and prevents an estimated 28,000 tonnes of carbon emissions per year.[53]
- In early 2020, a ferry service in **Estonia** introduced a fleet of battery-hybrid vessels that reduce diesel fuel consumption 20%.[54]

Shipping emissions could be reduced more than 75% by 2050 through a balanced combination of decarbonisation measures including sustainable biofuels, capacity utilisation and speed optimisation.[55] Although biofuels appear to hold great potential for decarbonisation in the shipping sector, assumptions of carbon-neutrality depend strongly on the location and harvesting of source crops. Factors such as competition for land resources for food and fuel reveal that a broader set of evaluation parameters is needed to capture relevant sustainable development concerns.[56] A balanced set of emission reduction measures is likely an optimal path towards decarbonising shipping (*see Figure 3*).[57]

Figure 3. Emission mitigation potential of major maritime transport measures



Source: See endnote 57 for this section.

Box 1. Impacts of the COVID-19 pandemic on maritime shipping

International maritime trade dropped an estimated 4.1% in 2020, but trade volumes are expected to recover and grow 4.8% in 2021. In the first six months of 2020, container-based trade on major routes experienced significant reductions compared to the same period in 2019: for instance, the Europe-North America corridor saw 13% to 16% less trade activity in the second quarter of 2020 than a year prior.

Global port container volumes fell 7.3% during 2020, and around 12% of the container fleet was assumed to be idle at the peak of initial pandemic lockdowns. In May 2020, ports recorded cancellations of sailing operations of 10% in **Hamburg** (Germany) and **Rotterdam** (the Netherlands); 20% in **Beirut** (Lebanon) and **Visakhapatnam** (India); and up to 25% in **Manila** (Philippines) and **Odessa** (Ukraine). Meanwhile, maritime passenger transport came to a near halt in 2020, with many countries imposing travel restrictions and tourist arrivals dropping an estimated 60-80%.

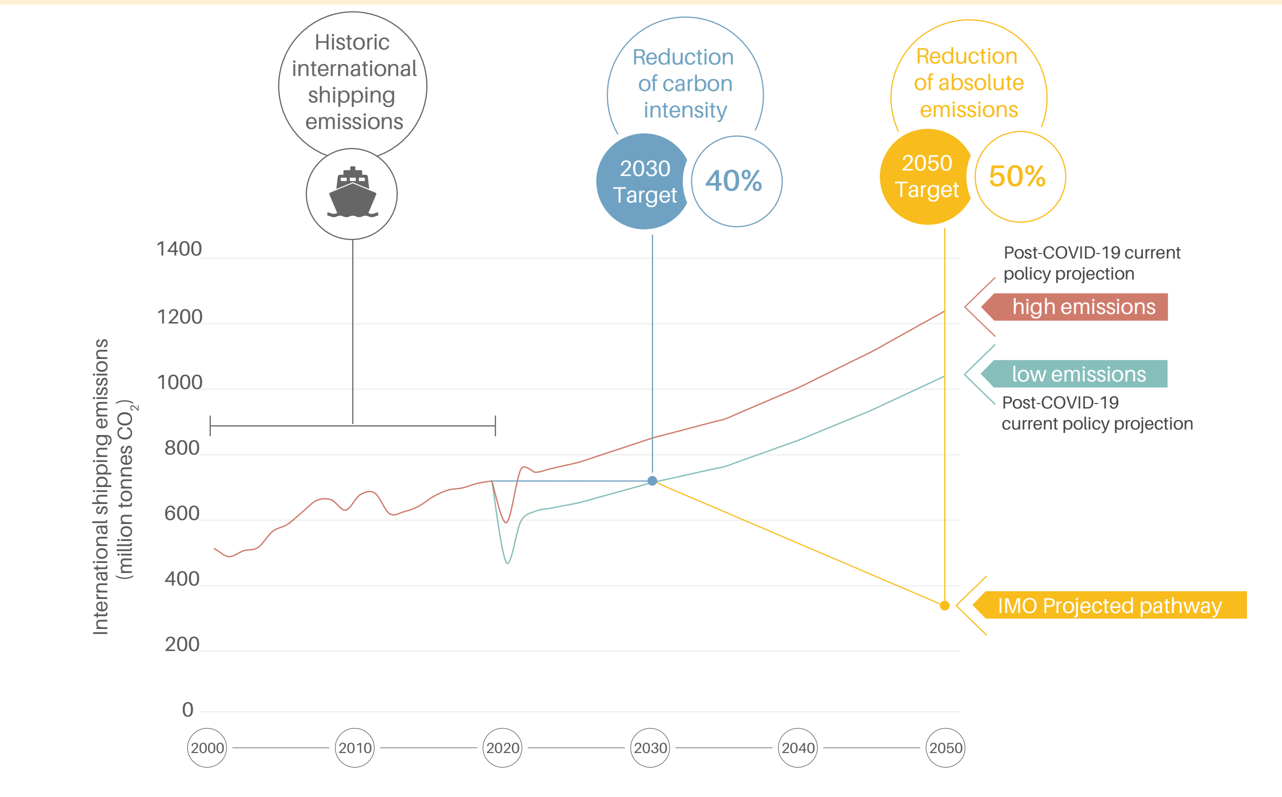
Growth in emissions from international shipping has been slowed by the pandemic and is not projected to return to pre-COVID-19 levels until 2030. Shipping emissions in 2020 dropped an estimated 18-35% from 2019 levels. Emission growth for 2030 is projected to range between two scenarios: a low-emission scenario showing a 13% decline from pre-COVID projections (i.e., international shipping emissions to stay at 2019 levels until 2030), and a high-emission scenario showing a return to pre-COVID projections (i.e., emissions regain strong growth and reach original projections for 2030).

Under the low-emission scenario, the estimated emission reduction still remains 600 million tonnes short of the IMO's 2050 target for a 40% reduction below 2008 levels (*see Figure 4*). The IMO target also remains insufficient to achieve levels compatible with the Paris Agreement, which requires net zero emissions in all sectors by 2050.

Although the decline in demand has reduced emissions from shipping, the COVID-19 pandemic may also stifle efforts to adopt low carbon shipping operations and technologies.

Source: See endnote 9 for this section.

Figure 4. Historic and projected emissions from international shipping, 2000-2050



Initiatives supporting low carbon shipping

- The World Economic Forum's **Friends of Ocean Action** is a coalition of more than 50 ocean leaders from business, civil society, international organisations, science and technology that are fast-tracking solutions to the most pressing challenges facing the oceans.[58] Their action to decarbonise the maritime and shipping sector focuses on testing technology and innovations to advance the 50-70% emission reduction target by 2050.[59]
- The **Getting to Zero Coalition**, led by the Global Maritime Forum, is committed to getting commercially viable deep-sea vessels powered by zero-emission fuels into operation by 2030.[60] The coalition unites more than 140 public and private organisations and has been endorsed by governments in 14 countries across Africa, Asia, Europe, Latin America and the Caribbean, and Oceania.[61]
- The **High Ambition Coalition** (HAC) was created under the leadership of the Marshall Islands in the run-up negotiations to the Paris Agreement, helping to secure key elements of the deal (including the goal of keeping global temperature rise below 1.5 degrees Celsius and reaching net zero global emissions).[62] The HAC co-ordinates with the Shipping High Ambition Coalition within the IMO.[63]
- In 2019, the **Pacific Blue Shipping Partnership** announced that the governments of Fiji, Marshall Islands, Samoa, Solomon Islands, Tuvalu and Vanuatu had set targets for 40% emission reduction by 2030 and full decarbonisation by 2050.[64]
- The **Sea Cargo Charter** is a global framework aligning chartering activities to promote decarbonisation in the shipping sector. It provides a benchmark defining a responsible charterer in the maritime sector and guidance on how to achieve it.[65]
- **Transport & Environment** (T&E) works with other members of the Clean Shipping Coalition to reduce the air pollution and climate impacts of shipping globally and in Europe, by advocating for stricter sulphur limits in maritime fuels at the regional and global levels and for the inclusion of shipping in emission trading schemes.[66]

Key indicators

	2017*	2018*	% change
Market Development Indicators			
Energy Efficiency Operational Indicator (grams of CO_2 per tonne per nautical mile)			
• Vessel-based	11.87	11.67	+1.7%
• Voyage-based	10.88	10.70	+1.6%
Container port traffic (million TEU)	795.7 (2018)	811.2 (2019)	+1.9%
World fleet (million dead weight tonnes)	1,937,777 (2018)	2,068,970 (2020)	+6.8%
• Oil tankers	563,188 (2018)	601,544 (2020)	+6.8%
• Bulk carriers	822,905 (2018)	879,330 (2020)	+6.9%
• General cargo	75,701 (2018)	76,139 (2020)	+0.6%
• Container ships	253,632 (2018)	274,856 (2020)	+8.4%
• Other types of ships	222,348 (2018)	237,099 (2020)	+6.6%

(*) Data are for the indicated year unless noted otherwise. TEU = twenty-foot equivalent unit

Source: See endnote 67 for this section.

In Practice: Additional Policy Measures

Policy targets set

General measures

- **Norway** released its Action Plan for Green Shipping in 2018, which aims to halve domestic emissions by 2030 and to promote zero-emission solutions.[68]
- In 2019, the Swedish shipping association started work on a roadmap towards a fossil-free shipping industry by 2045 in accordance with national plans.69
- Maersk announced in 2018 plans to reach carbon neutrality by 2050 and to support efforts to make carbon-neutral vessels commercially viable by 2030.[70]

"Improve" measures

- In 2020, **Mitsubishi** announced plans to develop a carbon capture system for vessels, with the aim of reducing emissions up to 90% and producing raw materials for new fuels.[71]
- In 2020, a consortium of industry partners (including **Lloyd's Register, MAN Energy Solutions, MISC Berhad** and **Samsung Heavy Industries**) announced a joint development project for an ammonia-fuelled tanker, with the first ammonia engine estimated to be in operation by 2022.[72]

Policy measures implemented

Port construction and operation

- The **European** Green Deal, introduced in 2019, includes a plan to develop multi-modal freight operations for rail and waterborne transport, including short-sea (coastal) shipping.[73]
- In early 2020, **Nigeria** commenced service at its upgraded eastern ports to facilitate more shipping activity, which is expected to increase emissions from the sector.[74]

Carbon-neutral facilities

- In 2019, **Houston**, Texas became the first USA port to use renewable energy, reducing its annual CO_2 emissions an estimated 25,000 tonnes.[75]
- The Sustainable and Climate-Resilient Connectivity Project, launched in 2019, aims to improve port operations in **Nauru**, decrease vessel wait times and reduce CO_2 emissions an estimated 11,000 tonnes annually.[76]

Financing Climate Action in Transport

4

Not only is adequate financing required to achieve transport sustainability and climate objectives, but technical assistance and multi-stakeholder collaboration are also necessary (*see Focus Feature: Multi-stakeholder Mobilisation for Climate Action*).

This section provides an overview of the current state of investments in sustainable transport, including through official development assistance and support from multilateral development banks. It also looks at current and potential sources of transport finance and discusses the use of pricing mechanisms, such as congestion and carbon taxes, to help support the transition to low carbon mobility. Finally, current investment commitments, projected investment needs and funding gaps are discussed.

Key findings

Transport investment trends

- Nearly two-thirds of the investment in transport infrastructure in 2015 (USD 666 billion, or 66%) went to road transport, followed by rail (USD 231 billion; 23%) and airports and ports (around USD 55 billion, or 5%, each).
- In member countries of the Organisation for Economic Co-operation and Development (OECD), transport infrastructure spending grew 7% annually on average between 2010 and 2017, before falling nearly 5% in 2018 driven by reduced investment in rail and water transport.
- In 2019, an estimated USD 250 billion was invested in energy efficiency for buildings, industry and transport, but the transport sector received only 26% of this (USD 65 billion), and overall investment in transport has fallen dramatically since 2014.
- On a global basis, investments in walking and cycling infrastructure and in electric vehicle charging infrastructure hold the highest potential to multiply employment opportunities.

Estimated transport investment needs and gaps

- There remains an estimated annual financing gap of around USD 440 billion for transport infrastructure to meet the United Nations (UN) Sustainable Development Goals by 2030.
- Investments required to reduce urban emissions through low carbon urban mobility are projected to total USD 1.83 trillion (around 2% of global gross domestic product, GDP) annually, which would result in savings of USD 2.80 trillion in 2030 and USD 6.98 trillion in 2050.
- Globally, investments of USD 2.7 trillion per year from 2016 to 2030 (or USD 40.5 trillion in total) will be needed to achieve low carbon transport pathways, with 60-70% of these investments in emerging economies.
- Regional investment gaps for transport infrastructure by 2040 are significant, estimated at USD 0.8 trillion for Africa, USD 1.6 trillion for Asia and USD 6.0 trillion for the Americas.
- Globally, 88% of roadways do not meet minimum walking safety requirements, and 86% do not meet minimum cycling safety requirements. In Africa, more than 9 out of 10 streets do not meet minimum walking and cycling safety requirements.

Sources of transport infrastructure finance

- In 2019, 37% of infrastructure official development finance (including government aid to developing countries and grants/loans from multilateral financial institutions) was allocated to the transport and storage sectors, compared to 36% to energy and 20% to water and sanitation.
- In 2014-2015 (latest aggregated data), 75% of official development finance for climate objectives in transport was targeted for adaptation activities (mainly port and road transport) and 25% was targeted for mitigation activities (mainly air and rail transport).
- The Multilateral Development Bank (MDB) Working Group on Sustainable Transport reported nearly USD 22 billion of new funding for sustainable transport in 2017 and nearly USD 19 billion in 2018; the Working Group is on track to achieving its 2012 commitment of USD 175 billion over 10 years.
- Multilateral development banks set new climate change targets in 2020, to be achieved primarily by reducing funding for fossil fuels.
- Climate finance for sustainable transport continued a downward trend since 2012, with only 16 new transport projects added to climate finance instrument pipelines between 2018 and 2020.
- Transport represents 20% of green bond proceeds, making it the third largest sector after energy (32%) and buildings (30%). Green bonds for transport reached USD 52 billion in 2019, up 71% from 2018.
- In December 2020, Climate Bonds updated the transport criteria for green bonds to reflect a stricter threshold for passenger transport.
- The COVID-19 pandemic led to a low-yield environment in 2020, making transport infrastructure assets even more attractive to investors by offering predictable cash flows as well as consistent and reasonable returns.

Transport pricing mechanisms and subsidies

- In 2020, around 16% of global greenhouse gas emissions were covered by a carbon pricing mechanism (up from 5% in 2010). However, transport remains largely marginalised in discussions of carbon pricing and emission trading schemes, with few exceptions.
- Global energy subsidies reached an estimated USD 5.2 trillion (6.5% of GDP) in 2017. Despite repeated pledges to end subsidies, support for fossil fuels among G20 governments has declined only 9% since 2014-2016, totalling USD 584 billion annually during 2017-2020.
- Between 2015 and 2018, 50 countries enacted fossil fuel subsidy reforms focused on either consumption or production, or a combination of the two. Despite these and other efforts, global consumer subsidies for fossil fuels increased slightly in 2017.

COVID-19 pandemic recovery investment commitments

- Current COVID-19 recovery packages dwarf existing low carbon investments; only a fraction of the investment in these packages could put the world on track towards decarbonisation by 2050.
- Within recovery packages, only around a third of transport investments are associated with clean transport, which are outweighed by fossil fuel-focused investments.
- G20 countries have committed more than half of total tracked stimulus spending to transport projects (USD 276 of USD 506 billion as of December 2020), but only around one-third of this transport spending (USD 103 billion) targets green transport improvements.
- In September 2020, the mayors of 12 major cities (Berlin, Bristol, Cape Town, Durban, London, Los Angeles, Milan, New Orleans, New York City, Oslo, Pittsburgh and Vancouver) committed to divesting funding from fossil fuel companies and to shifting to a green and just recovery from COVID-19 and to tackling climate change (although the target dates were unspecified).

Overview

Adequate financing is critical to reaching the scale of decarbonisation of the transport sector necessary to achieve Paris Agreement targets. There is often a lack of government capacity to design transport climate change projects that are attractive to financial institutions and the private sector. Capacity building support is essential and can be leveraged by a wide range of stakeholders.

Transport investment trends

Transport infrastructure investments

Nearly two-thirds of the investment in transport infrastructure in 2015 (USD 666 billion, or 66%) went to road transport, followed by rail (USD 231 billion; 23%) and airports and ports (around USD 55 billion, or 5%, each).[1] Infrastructure investments across 50 countries reached an estimated USD 2.3 trillion, representing roughly 12% of total fixed investments that year.[2] Around USD 1 trillion of this was invested in transport infrastructure.[3] In **Africa**, the **Americas** and **Oceania**, road transport accounted for 75% of all transport infrastructure investments.[4] **Asia** and **Europe** are the only regions where rail infrastructure spending represented a quarter of transport investment volume.[5]

In member countries of the OECD, transport infrastructure spending grew 7% annually on average between 2010 and 2017, before falling nearly 5% in 2018 driven by reduced investment in rail and water transport.[6] OECD member countries greatly increased their investments in transport infrastructure between 2010 and 2018. After the financial crisis in 2007/08, the spending for road and aviation infrastructure in these countries nearly doubled within 10 years (*see Figure 1*).[7] On average, **OECD member countries** spent 1.17% of their GDP on transport infrastructure in 2018; roughly 0.9% of GDP was allocated to road infrastructure and only 0.2% to rail infrastructure.[8]

China spent 5.6% of its GDP on transport, while **Denmark**, **France**, **Germany**, **Mexico**, the **Russian Federation** and the **United Kingdom** (UK) spent around 0.7% to 0.9% each.[9] Notable examples include **Serbia**'s recent investment of more than EUR 3.5 billion (USD 4.2 billion) in railway projects (in addition to around EUR 5 billion (USD 6 billion) for road projects) as part of its EUR 14 billion (USD 17 billion) Serbia 2025 transport investment programme.[10]

In **Africa**, 41.7% of infrastructure finance commitments in 2017 went towards transport.[11] **Latin America and the Caribbean**, which has a similar density of paved roads as **Africa**, spent around 44% of its total infrastructure investments on transport between 2008 and 2015.[12] During 2015-2019, around 1.2% of public spending in the region on average went to transport infrastructure, with higher shares in countries such as **Belize** (5.4%), **Bolivia** (5.3%) and **Nicaragua** (3.9%).[13]

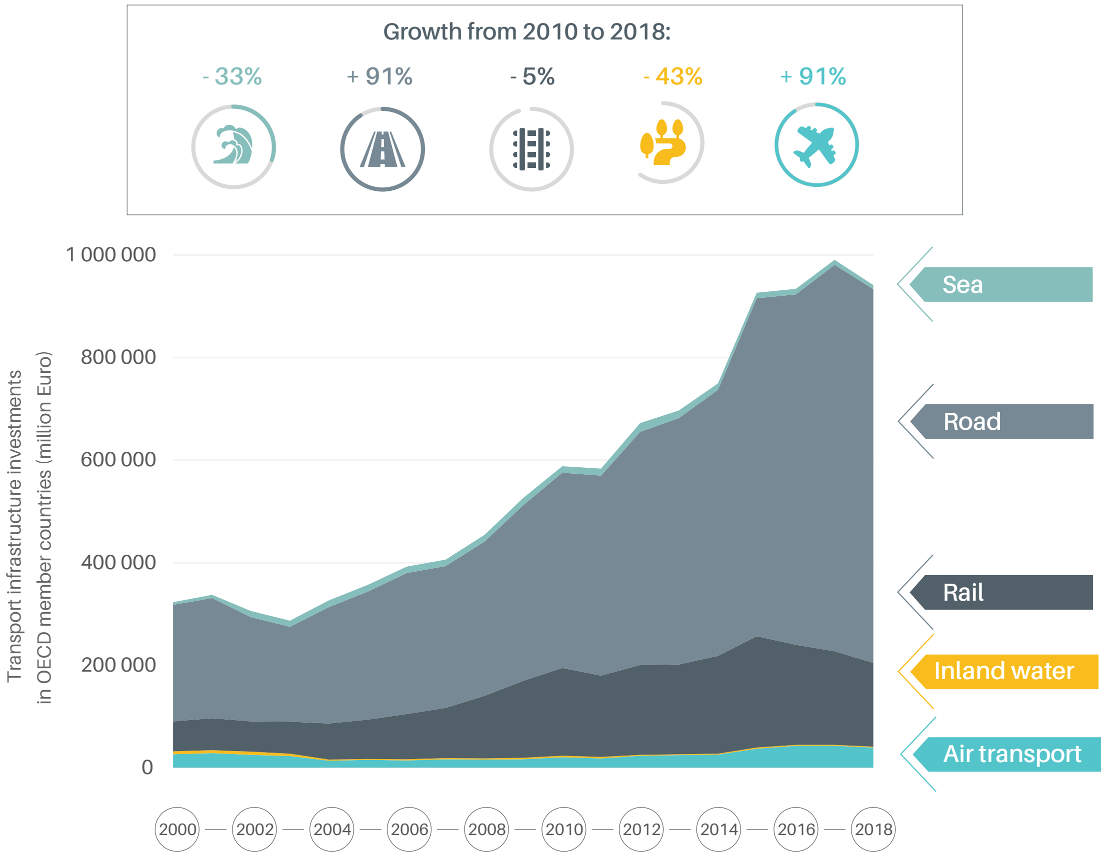
Investments in transport energy efficiency

In 2019, an estimated USD 250 billion was invested globally in energy efficiency for buildings, industry and transport, but the transport sector received only 26% of this (USD 65 billion), and overall investment in transport has fallen dramatically since 2014 (*see Figure 2*).[14] The transport sector has recorded major achievements in energy efficiency (e.g., through improved fuel economy, vehicle electrification and fleet renewal), although they remain insufficient to meet global sustainability goals. A key reason for the reduction in investments in energy efficiency in the sector is that transport demand is favouring larger vehicles such as sport utility vehicles (SUVs).[15]

Employment multipliers for investment in the transport sector

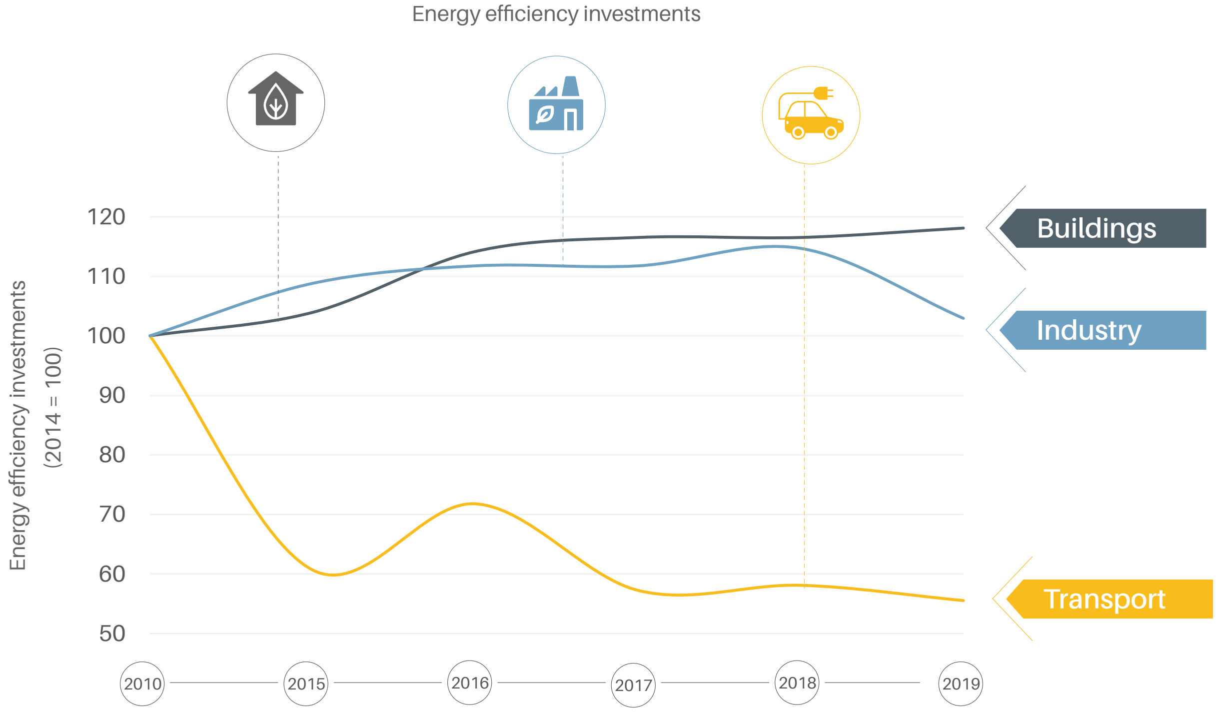
On a global basis, investments in walking and cycling infrastructure and in electric vehicle charging infrastructure hold the highest potential to multiply employment opportunities (*see Figure 3*).[16] Employment benefits of sustainable transport investments exceed those of other sectors (including building retrofits and solar/wind power conversion), and these benefits are likely even higher in developing regions. Job creation potential across 21 countries in developing regions in Africa, Asia, Eastern Europe and Latin America is estimated at more than 50 million jobs (in public transport and vehicle electrification) created by 2030.[17] A green recovery strategy could generate at least an estimated 10 million additional new jobs in low carbon transport compared to a business-as-usual strategy.[18]

Figure 1. Transport infrastructure investments in OECD countries, 2000-2018



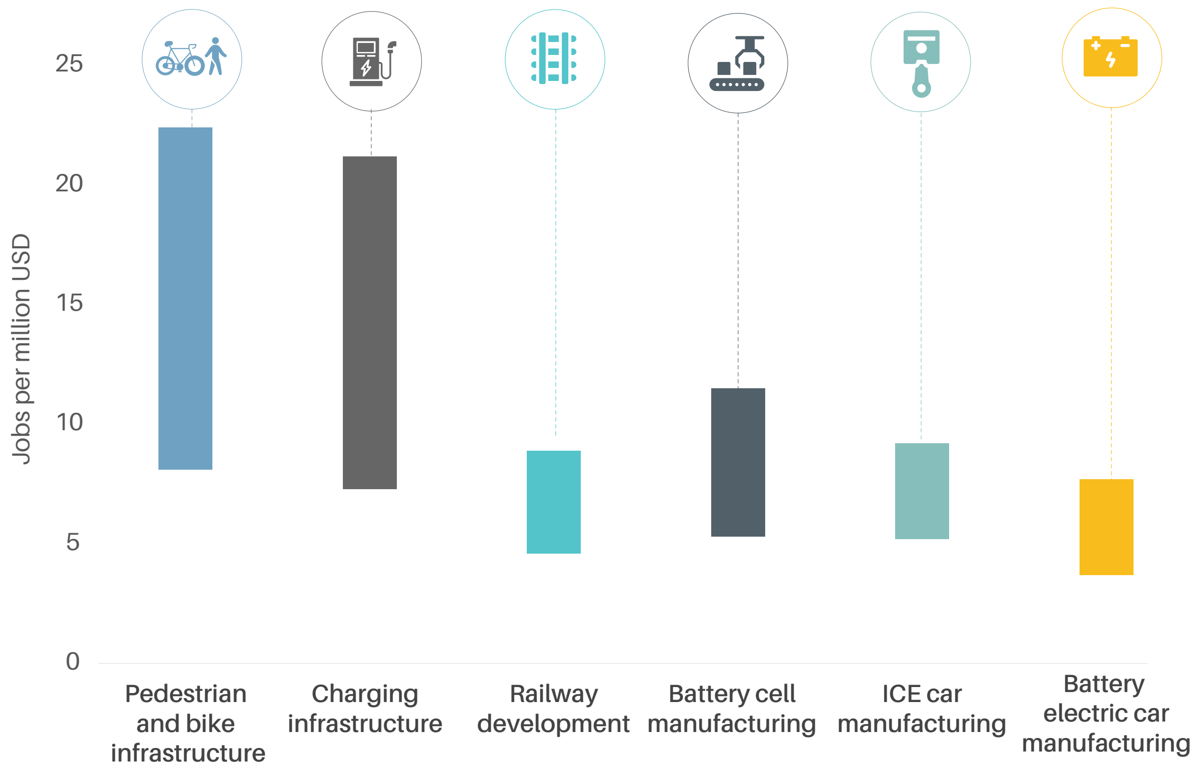
Source: See endnote 7 for this section.

Figure 2. Global investment in energy efficiency by sector, 2014-2019



Source: See endnote 14 for this section.

Figure 3. Potential jobs created through transport investments



Source: See endnote 16 for this section.

Projected transport investment needs and gaps

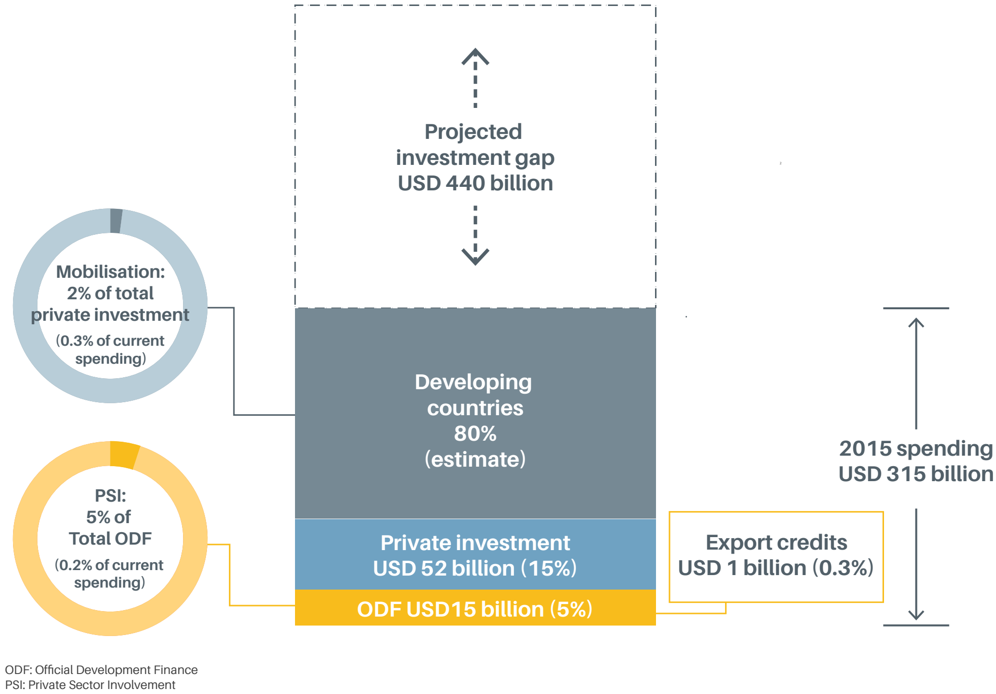
There remains an estimated annual financing gap of around USD 440 billion for transport infrastructure to meet the UN Sustainable Development Goals by 2030 (*see Figure 4*).[19] In 2015, the annual spending for transport infrastructure totalled roughly USD 315 billion.[20] Of this amount, developing country governments financed around 80%, the private sector around 15% and development partners around 5% through official development finance.[21]

Investments required to reduce urban emissions through low carbon urban mobility are projected to total USD 1.83 trillion (around 2% of global GDP) annually, which would result in savings of USD 2.80 trillion in 2030 and USD 6.98 trillion in 2050.[22] Global investment needs for transport infrastructure are estimated to be USD 50 trillion through 2050.[23]

Globally, investments of USD 2.7 trillion per year from 2016 to 2030 (or USD 40.5 trillion in total) will be needed to achieve low carbon transport pathways, with 60-70% of these investments in emerging economies.[24] Low carbon transport pathways entail an integrated approach of *Avoid*, *Shift* and *Improve* measures that have to be implemented quickly to avoid lock-in effects of carbon-intensive and cost-intensive infrastructure and behaviour.[25] **However, regional investment gaps for transport infrastructure by 2040 are significant, estimated at USD 0.8 trillion for Africa, USD 1.6 trillion for Asia and USD 6.0 trillion for the Americas.**[26]

In **Africa** and in the **Americas**, 95% and 88% respectively of the investment gap is associated with road transport, whereas in Oceania the gap for road infrastructure is the smallest concern.[27] **Globally, 88% of roadways do not meet minimum walking safety requirements, and 86% do not meet minimum cycling safety requirements.**[28] **In Africa, more than 9 out of 10 streets do not meet minimum walking and cycling safety requirements.**[29] The Rural Access Index, measuring the proportion of people with access to an all-season road within walking distance of 2 kilometres, shows that African countries have the lowest access: for example, in 2017 rural access was estimated at 11.4% of the population in **Malawi** and 22.3% in **Mali**.[30]

Figure 4. Spending for transport connectivity by financier in 2015 and the annual investment gap to 2030



Source: See endnote 19 for this section.

Sources of transport infrastructure finance

Transport infrastructure (especially road transport) is traditionally financed by taxpayers and/or by the users of this infrastructure, while in some cases (e.g., railways and airports) it is built by private stakeholders and financed through bond issuance. Given the need to continuously maintain, expand and update transport infrastructure, public revenue sources are often insufficient to meet rising demand.[31] Additional private investment and international development finance is often required, including loans, grants and loan guarantees.[32]

Blended finance schemes, which use some combination of domestic resources, development aid and private finance (including public-private partnerships), also have proven effective in financing transport. The COVID-19 pandemic led to an increased attractiveness of transport infrastructure investments as an emerging investment trend (*see Box 1*).[33]

Investment mechanisms

Pension funds are a potential source of transport finance, as these funds typically have longer timelines and an interest in stable returns. Some of the largest pension funds in **Canada** now own major transport facilities worldwide, including the UK's lone high-speed rail line; airports in **Brussels, Copenhagen** and **Sydney**; toll roads in **Melbourne, Santiago** and **Toronto**; and seaports in **New Jersey, New York** and **Vancouver.**[34]

In 2020, New York State's USD 226 billion pension fund committed to divest from many of its fossil fuel stocks by 2025 and to sell (by 2040) its shares in other companies that contribute to global warming, "because investing for the low carbon future is essential to protect the fund's long-term value."[35] This decision highlights a growing trend in climate-conscious pension funds, with increasing opportunities to finance the decarbonisation of transport.[36] However, legal changes are often necessary to unlock such funds.[37]

Public procurement mechanisms provide another opportunity for financing sustainable transport. Almost all publicly procured services have an impact on transport, and thus can contribute greatly to making the sector more sustainable.[38] For public procurement to regularly support sustainable transport, necessary factors include frameworks and regulations that take a lifetime approach to cost analysis, and the use of multi-criteria cost-benefit analyses that assess the full environmental, social and economic costs and benefits of purchasing decisions.[39] For urban transport infrastructure, other potential sources of revenue include **land**

value capture tools, which generate funds for transport projects based on the increase in the value of land and real estate adjacent to new subway lines, roads and other public works.[40]

"Green" taxonomies are also increasing opportunities for financial institutions to support sustainable transport investments. According to the World Bank, "a green taxonomy identifies the activities or investments that deliver on environmental objectives, helping drive capital more efficiently toward priority environmentally sustainable projects."[41] Such guidance can help financial institutions originate and structure green banking products such as loans, credits and guarantees, and it can help investors identify opportunities for impact investments that comply with sustainability criteria.[42]

In July 2020, the **EU** established a region-wide classification framework to enable investors to identify which economic activities and investments can be treated as "environmentally sustainable".[43] However, there has been some debate over the inclusion of specific transport standards in this taxonomy, with some calling for stricter environmental standards for the shipping industry, for example.[44]

Official development assistance for transport

The OECD Development Assistance Committee tracks flows of official development finance – including both government aid to developing countries and other official transactions such as export credits and funds supporting private investment – for infrastructure across sectors.[45]

In 2019, 37% of infrastructure official development finance (including government aid to developing countries and grants/ loans from multilateral financial institutions) was allocated to the transport and storage sectors, compared to 39% for energy and 20% for water and sanitation.[46] This included allocations of 18% to road transport, 11% to rail transport, and less than 2% each to air transport, water transport, and general education and training for the transport and storage sectors.[47]

In 2014-2015 (latest aggregated data), roughly 75% of official development finance for climate objectives in transport was targeted for adaptation activities (mainly port and road transport) and 25% was targeted for mitigation activities (mainly air and rail transport).[48] Official development finance for transport connectivity allocated from development partners averaged USD 15 billion annually (compared to an average of USD 52 billion from the private sector).[49] Among the USD 15 billion, only a third was directly connected to meeting climate objectives.[50]

Of the USD 15 billion financed by development partners, 25% was financed by bilateral partners, and 75% was financed by multilateral development banks and other international organisations.[51] In 2019, of the total official development assistance to transport from the top 10 of 27 development partners, 62% went to road transport, followed by 22% for transport policy and administrative management (*see Figure 5*).[52]

Multilateral development bank investments in sustainable transport

The MDB Working Group on Sustainable Transport reported nearly USD 22 billion of new funding for sustainable transport in 2017 and nearly USD 19 billion in 2018; the Working Group is on track to achieving its 2012 commitment of USD 175 billion over 10 years.[53] As part of the 2012 Rio+20 Commitment for Sustainable Transport, this working group of eight multilateral development banks committed to investing USD 175 billion in loans and grants for sustainable transport in developing countries from 2012 to 2022.[54] As of 2018, the banks had provided nearly 85% of their pledged finding, with three years left to reach the target (*see Figure 6*).[55]

Multilateral development banks also have independently invested in sustainable transport. In 2019, the **European Investment Bank (EIB)** had 81 new transport projects inside the **EU** with a volume of EUR 10.5 billion (USD 12.5 billion), enabling sustainable mobility services for 630 million additional passengers.[56] From 2017 to 2020, the **Asian Development Bank** invested USD 1 billion in transport projects in the **Pacific.**[57]

Multilateral development banks are important sources for climate change mitigation and adaptation finance in transport and other sectors. In 2019, multilateral development banks financed USD 46.6 billion for climate change mitigation (with around 30% allocated to transport) and USD 14.9 billion for climate adaptation (with around 25% allocated to energy, transport and other infrastructure).[58] In low- and middle-income economies, funding for mitigation accounted

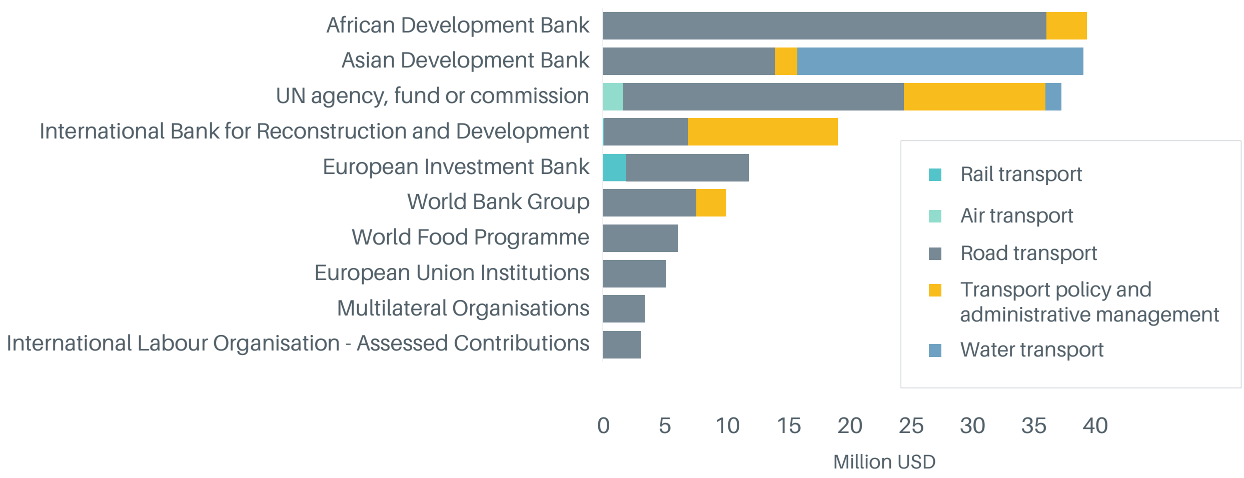
Box 1. Emerging transport investment trends

The COVID-19 pandemic led to a low-yield environment in 2020, making transport infrastructure assets even more attractive to investors by offering predictable cash flows as well as consistent and reasonable returns. The year marked an important and growing interest in sustainable investing, with global "environmental, social and corporate governance" (ESG) assets tripling to USD 40.5 trillion during the year.

Additional factors leading to a more supportive environment for investments in sustainable transport include increased national commitments to achieve net zero emissions by a specified year (including from China, the European Union (EU), Japan and the UK); a new USA administration that has rejoined the Paris Agreement; new climate-related financial reporting requirements; and increased media coverage and public understanding of climate issues.

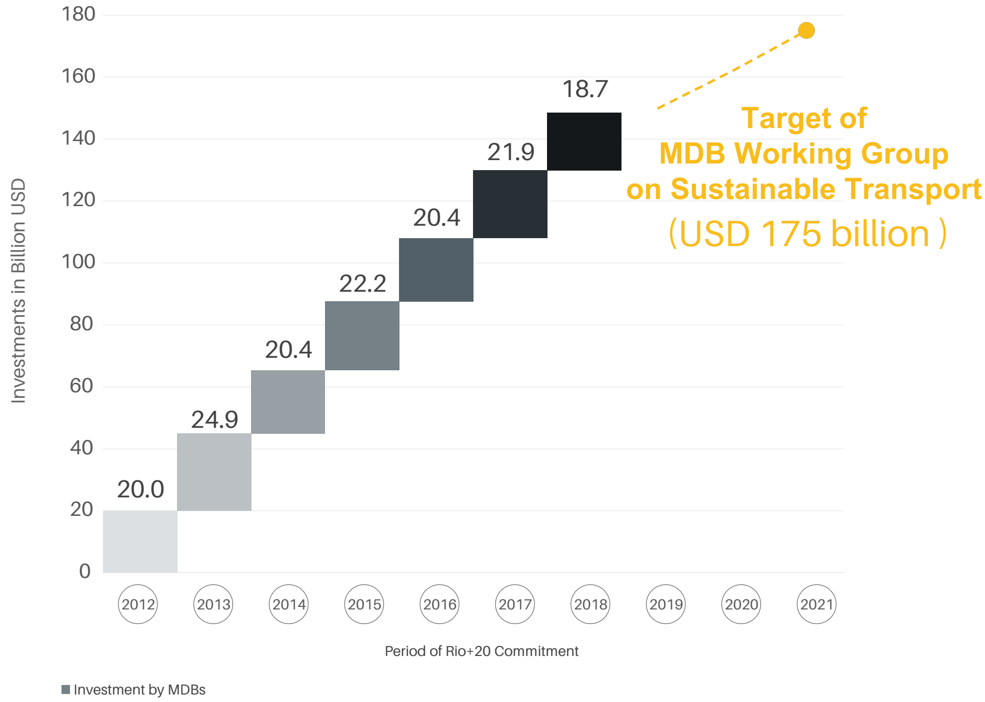
Source: See endnote 33 for this section.

Figure 5. Official development assistance to transport from the top 10 development partners, by sub-sector, 2019



Source: See endnote 52 for this section.

Figure 6. Contributions by the Multilateral Development Bank Working Group on Sustainable Transport, 2012-2018



Source: See endnote 55 for this section.

for 66% of total climate finance from multilateral development banks, and adaptation finance accounted for 34%.[59] In high-income economies, mitigation finance exceeded adaptation finance by a ratio of nearly 20:1.[60]

Multilateral development banks set new climate change targets in 2020, to be achieved primarily by reducing funding for fossil fuels. The **EIB** aimed to become the first multilateral development bank to align all financing activities with the Paris Agreement by the end of 2020 and to end financing for fossil fuel energy projects by the end of 2021.[61] The **Asian Infrastructure Investment Bank** announced that it would end funding for coal but has not specified a date.[62] The bank aims for 50% of investments to be linked to climate change mitigation by 2025, and by 2019 it had already achieved nearly 40%.[63]

The **European Bank for Reconstruction and Development** published a Transport Strategy for 2019-2024 with the goal of closing the infrastructure gap with more green economy, climate resilience and private sector involvement.[64] The **Islamic Development Bank** released a new Climate Action Plan in 2020 that sets a much more ambitious target for climate finance to account for 35% of overall annual lending (by finance volume) by 2025 (it represented only 18.7% of projects in 2013-2017).[65]

Climate finance for sustainable transport

Climate finance for sustainable transport continued a downward trend since 2012, with only 16 new transport projects added to climate finance instrument pipelines between 2018 and 2020.[66] SLOCAT's climate finance instrument database included 300 sustainable transport projects, covering mechanisms such as the Clean Development Mechanism, the Clean Technology Fund, the Green Climate Fund (GCF), the Global Environment Facility (GEF), the International Climate Initiative (IKI), the Joint Crediting Mechanism, Joint Implementation, Nationally Appropriate Mitigation Actions (NAMAs) and the Nordic Development Fund (*see Figure 7*).[67]

The GEF supported four transport projects during 2018-2020: electric public buses in **Mauritius**, sustainable low-emission transport systems in **Lebanon**, the low-emission transport strategy in **Chile** and a global programme for a shift towards electric mobility.[68] Of the 143 climate projects financed by the GCF as of August 2020, only 4 are focused on transport, and the only new transport project since 2018 is the USD 583 million bus rapid transit project in **Karachi**, Pakistan, which aims to avoid 2.6 million tonnes of carbon dioxide (CO_2).[69]

In 2019 and 2020, the IKI kickstarted three major projects: the NDC Transport Initiative for **Asia**, Growing Smarter: Sustainable Mobility in **East Africa** and Decarbonising Transport in Emerging Economies.[70] IKI also supported a NAMA initiated in 2020 on the promotion of electric vehicles in **Cabo Verde**.[71] In 2018, the Nordic Development Fund co-financed with EUR 8 million (USD 9.6 million) a 58-kilometre climate-resilient National Road in **Lao People's Democratic Republic**.[72]

Other funding mechanisms are emerging to help address the gap in climate finance for sustainable urban mobility. The City Climate Finance Gap Fund was established to support cities and local governments in developing countries in prioritising climate-smart investments. The goal of the fund is to attract support for turning low carbon, climate-resilient investment priorities into finance-ready, implementable projects.[73]

Green bonds

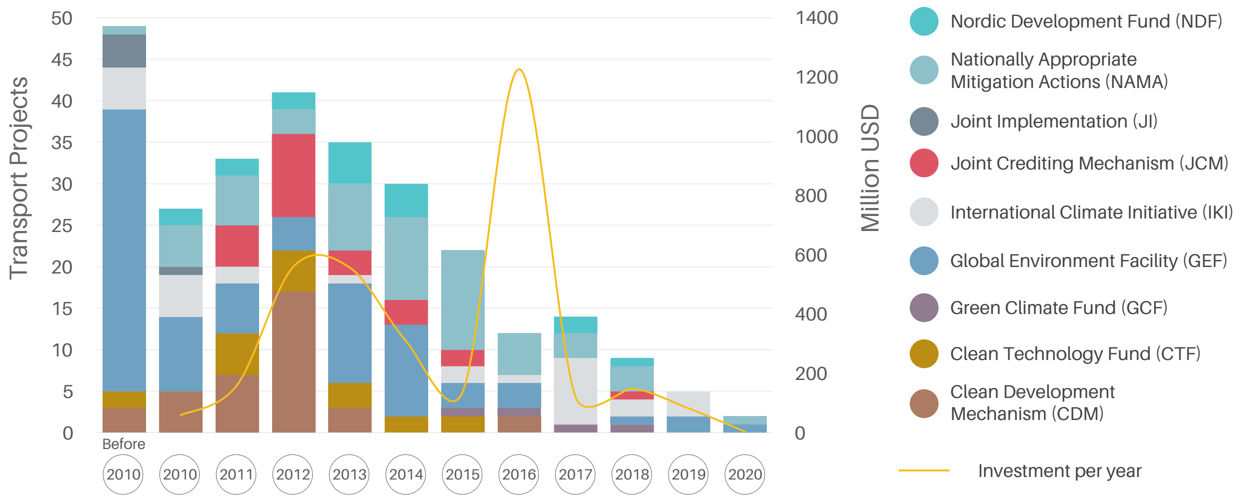
Transport represents 20% of green bond proceeds, making it the third largest sector after energy (32%) and buildings (30%).[74] **Green bonds for transport reached USD 52 billion in 2019, up 71% from 2018** (*see Figure 8*).[75] Transport is gaining prominence in "green" and other climate-themed bonds, in which the proceeds are earmarked for projects with environmental or climate benefits. Green bonds help attract investor demand for climate-aligned investments, reduce market friction and facilitate financial flows.[76] The green bond market totalled USD 258.9 billion in 2019, up 51% from 2018.[77]

Government-backed entities have been the driving force of green bond transport activities. Between 2018 and 2020, **France** certified 10 bonds worth over USD 9 billion, more than any other issuer, to finance the expansion of metro lines in Paris.[78] **Thailand** issued a THB 30 billion (USD 1 billion) Sustainability Bond in August 2020, with a third of the sum allocated for construction of the Bangkok Mass Rapid Transit Orange line.[79] Automobile companies certified green bonds to support their electric vehicle programmes, such as **Porsche** (USD 1.2 billion in August 2019) and **Volkswagen Group** (USD 2.34 billion in September 2020).[80]

Certified Climate Bonds – based on criteria consistent with the Paris Agreement's target to keep global temperature rise this century below 2 degrees Celsius – passed the USD 100 billion mark in 2019.[81]

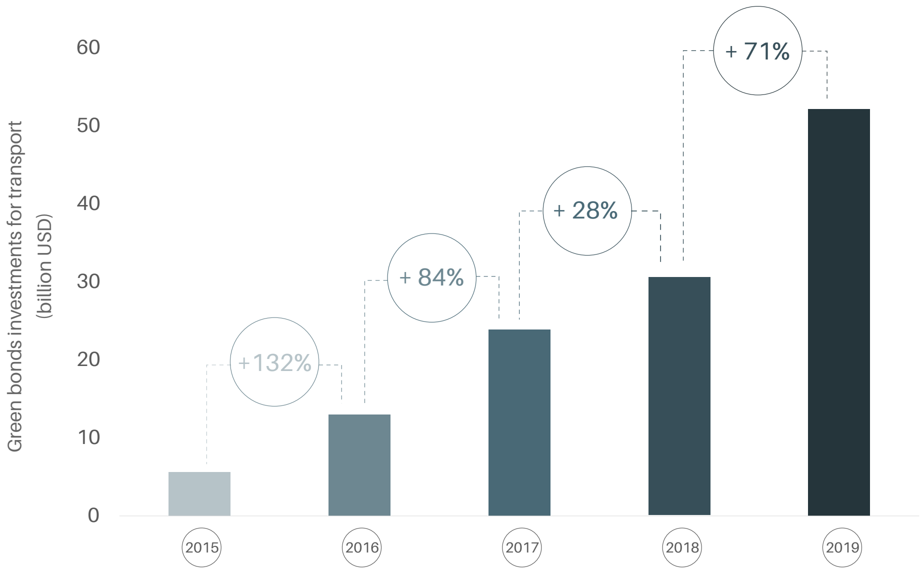
In December 2020, Climate Bonds updated the transport criteria for green bonds to reflect a stricter threshold for passenger transport. To qualify, a passenger transport project cannot exceed 50 grams of direct CO_2 emissions per passenger-kilometre for 2020-2024 and must be zero emissions from 2025.[82] New inter-urban rail projects need to prove a 25% emission reduction in the corridor, and for freight, fossil fuel transport is allowed to represent only 25% of the freight rail cargo (down from 50% previously).[83]

Figure 7. Climate finance projects and investment volume by year



Source: See endnote 67 for this section.

Figure 8. Total proceeds of green bonds for transport, 2015-2019



Source: See endnote 75 for this section.

Transport pricing mechanisms and subsidies

Pricing mechanisms can help account for negative externalities caused by transport – such as greenhouse gas emissions, congestion, road accidents and air pollution – and can support investors in further divesting from carbon-intensive mobility options. Pricing mechanisms include carbon pricing, taxes on fuels and vehicles, fossil fuel subsidy reforms, congestion charging and parking prices (*see Section 3.2 on Sustainable Mobility Planning and Transport Demand Management*).[84]

Carbon pricing

In 2020, around 16% of global greenhouse gas emissions were covered by a carbon pricing mechanism (up from 5% in 2010).[85] However, transport remains largely marginalised in discussions of carbon pricing and emission trading schemes, with few exceptions.[86]

In 2019, **South Africa** implemented a carbon tax covering transport, among other sectors.[87] **Canada** also implemented a carbon pricing scheme that year, and as of April 2020 the price was USD 30 per tonne of CO_2 equivalent in provinces that lacked their own carbon pricing systems, leading to an increase in fuel charges.[88] **Germany** and **Luxembourg** planned to launch national carbon markets in 2021 that would also cover transport, and **Austria** aimed to in 2022.[89] The **EU** has proposed extending its Emissions Trading System to the maritime sector and reducing the allowances allocated for free to airlines.[90] **China** plans to expand its Emission Trading System to cover domestic aviation.[91] In general, carbon pricing mechanisms are currently too low to be fully effective.[92]

Transport subsidies

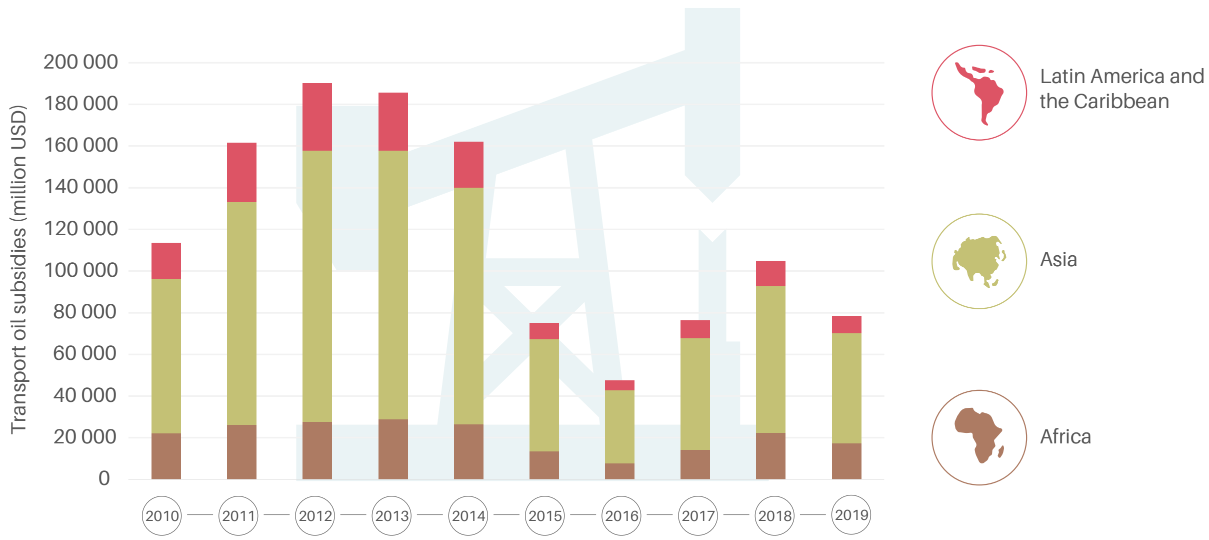
Public subsidies can reduce the cost of sustainable transport measures, including for low-emission transport modes and freight transport. This can help incentivise shifting trips from energy-intensive, higher-emitting modes to more sustainable modes. Although in some cases public subsidies target transport users (such as subsidising public transport fares for low-income populations), current subsidies do not always benefit those with the greatest need. Other subsidies target transport operators (such as increasing the supply of public transport services), although there is broad evidence that operating subsidies can lead to inefficiencies.[93]

Fossil fuel subsidies

Subsidies also may incentivise less-sustainable modes by reducing the cost of fossil fuel-based transport. Many governments maintain subsidies for fossil fuels or fail to adequately tax them, suppressing retail prices of petrol below the price of crude oil on the world market and continuing to undermine climate action.[94] Public subsidies lock society in to private road transport powered by petroleum or diesel fuels. The International Monetary Fund (IMF) estimates that the monetised impacts of externalities are 10 times the direct financial cost of subsidies.[95] While the distortionary effects of direct and indirect subsidies are well recognised, many governments find these policies difficult to abandon due to vested interests.

Global energy subsidies reached an estimated USD 5.2 trillion (6.5% of GDP) in 2017.[96] Despite repeated pledges to end subsidies, support for fossil fuels among G20 governments has declined

Figure 9. Transport oil subsidies, 2010-2019



Source: See endnote 100 for this section.

only 9% since 2014-2016, totalling USD 584 billion annually during 2017-2020.[97] The top five largest subsidies (in terms of total spending) are provided by **China**, the **United States of America** (USA), the **Russian Federation**, the **EU** and **India.**[98] The OECD and BRICS countries (**Brazil**, the **Russian Federation**, **India**, **Indonesia**, **China** and **South Africa**) collectively spend USD 41.6 billion a year subsidising fossil fuel use in urban areas.[99]

Global subsidies for transport oil dropped sharply in 2015 and 2016 but have risen in subsequent years (*see Figure 9*).[100] This trend may continue due to disproportionate funding committed to fossil fuels in COVID-19 recovery packages (*see Box 2*).[101]

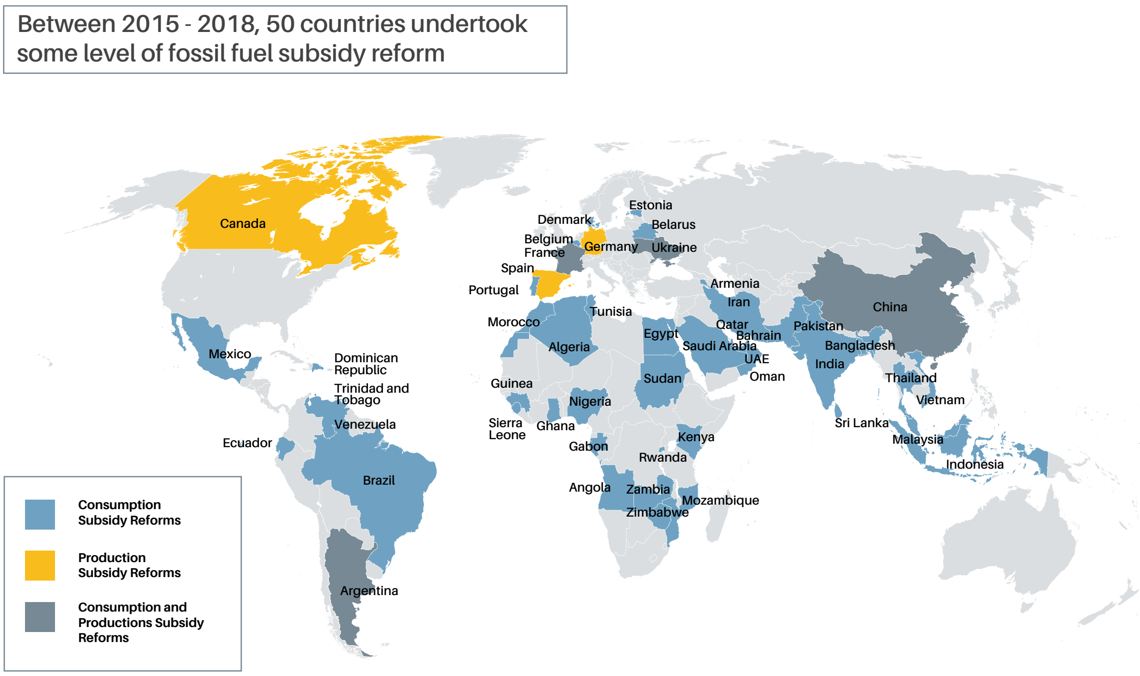
Fossil fuel subsidy reform can help accelerate a transition to a low carbon economy, as outlined in Sustainable Development Goal target 12.c on rationalising inefficient fossil fuel subsidies.[102] The IMF estimates that in 2015, more-efficient fuel prices would have reduced global CO_2 emissions 28%, avoided 46% of air pollution deaths, increased tax revenues by 3.8% of global GDP and added economic benefits worth 1.7% of global GDP.[103]

Between 2015 and 2018, 50 countries enacted fossil fuel subsidy reforms focused on either consumption or production, or a combination of the two (*see Figure 10*).[104] **Despite these and other efforts, global consumer subsidies for fossil fuels increased slightly in 2017.**[105] **Nigeria** reformed its fossil fuel subsidy framework, saving the government at least USD 2 billion a year.[106] **India** incrementally reduced oil and gas subsidies 75% from 2014 to 2017 – while increasing funding for renewable energy six-fold – and also implemented communication campaigns to assess consumer views to deliver successful reforms.[107]

Pricing reform for transport fuels remains a complicated issue in many countries. In 2019, **Ecuador** announced the removal of subsidies for petrol and diesel, causing petrol prices to increase by a quarter and diesel prices to roughly double.[108] The policy set off 12 days of violent protests, which led the government to ultimately re-install fossil fuel subsidies.[109] In 2015, **Indonesia** completed petrol and diesel subsidy reforms, saving up to USD 15.5 billion; however, it has not implemented fuel price changes in a regular manner, with gaps between price adjustments increasing over time.[110]

Aligning fossil fuel subsidy and finance reforms can create more efficient mechanisms for sustainable transport. Fossil fuel finance reform can help channel lending from development banks and other international financial institutions to more sustainable uses. In November 2020, the **EIB Group** released its Climate Bank 2021-2025 Roadmap, which considers as "ineligible transport uses" any vehicles that exceed minimum efficiency thresholds, road and rail vehicles and infrastructure dedicated to transporting fossil fuels, and airport expansion projects.[111] Also that November, the world's **450 public development banks** jointly committed to align their lending with Paris Agreement targets. The UN Secretary General has recurrently called for governments to develop concrete plans and targets to phase out fossil fuel subsidies and for development banks to phase out fossil fuel finance.[112]

Figure 10. Countries undertaking fossil fuel subsidy reforms, 2015-2018



Source: See endnote 104 for this section.

Box 2. Transport investment commitments in COVID-19 pandemic recovery packages

Current COVID-19 recovery packages dwarf existing low carbon investments; only a fraction of the investment in these packages could put the world on track towards decarbonisation by 2050. To address the economic and social impacts of the COVID-19 pandemic and set a course for the future, multiple countries have approved emergency recovery packages. Some of these packages include sustainable mobility measures, although many represent disproportionate investments in fossil fuels, further perpetuating lock-in effects.

Within recovery packages, only around a third of transport investments are associated with clean transport, which are outweighed by fossil fuel-focused investments. As of April 2021, the Global Recovery Observatory covered more than 3,700 investment responses to the COVID-19 pandemic; of these, around 115 belong to the category "clean transport", which equals more than USD 80 billion (or 29% of captured total transport investments). Another analysis on the environmental contribution of stimulus packages as of February 2021 concluded that in 23 out of 28 economies the packages supported transport developments that will result in negative impacts on the environment.

G20 countries have committed more than half of total tracked stimulus spending to transport projects (USD 276 of USD 506 billion as of December 2020), but only about one-third of this transport spending (USD 103 billion) targets green transport improvements (*see Figure 11*).

Examples of national recovery packages with sustainable transport investments include the following:

- **China** promoted two programmes for electric mobility; one extending an existing programme that provides subsidies and tax breaks for 2 million new electric vehicles annually until 2022, and the other to implement 600,000 electric vehicle charging points, with a USD 1.45 billion investment.
- The **EU** agreed to the Next Generation EU recovery fund of EUR 750 billion (USD 900 billion), which supports transport decarbonisation through investments in cleaner, healthier and more affordable active and public transport.
- **Finland** assigned USD 1.7 billion to help offset the loss of revenue in public transport, to advance projects to support walking and cycling, and to support new public transport investments.
- **France** created several programmes to encourage purchases of electric and plug-in hybrid vehicles, support research and development (R&D) in the automotive industry, provide relief during the pandemic, and advance charging infrastructure, totalling USD 8.72 billion, as well as USD 70 million to support bike repairs, installing temporary parking spaces for bikes and cycle training.
- **Germany** approved EUR 2.5 billion (USD 3 billion) to support local public transport during 2020 and a EUR 50 billion (USD 60 million) investment package to support electric vehicle purchases, charging infrastructure, R&D for electric mobility and battery cell production, innovation in the automotive industry and fleet renewal to promote electric vehicles. The package also plans tax changes to require higher-carbon emission vehicles to pay more.
- **Ireland** approved USD 136 million for active travel, public transport and renewal of transport infrastructure.
- **Italy** approved programmes to deduct taxes for electric vehicles and charging infrastructure (110% tax deductions), encourage bicycling (claim back 60% of investments up to USD 500 million per city), cover losses in revenue in public transport and subsidise new electric vehicles (EUR 6,000 or USD 7,300 per unit, up from EUR 4,000 or USD 4,800 previously).
- **New Zealand** approved USD 720 million to enhance the resiliency and reliability of national rail and ferry services.
- The **Republic of Korea** introduced a Green New Deal totalling USD 61 billion over five years, which includes plans to enhance the country's fleet to 1.33 million electric (including hydrogen-powered) vehicles.
- **Spain** advanced a USD 1.12 billion package for public transport and shared mobility, replacing government fleets with zero-emission vehicles, R&D in sustainable mobility and its associated industry and subsidising the replacement of old vehicles for zero- and low-emission ones.
- The **UK** approved a GBP 5 billion (USD 6.9 billion) package for buses, walking and cycling, with the first stage including GBP 250 million (USD 350 million) for pop-up bike lanes, wider pavements, safer junctions, and cycle- and bus-only corridors.
- In early 2021, the **USA** proposed USD 174 billion to build a national network of 500,000 electric vehicle chargers by 2030, to support manufacturing of batteries and electric vehicles, and to retool factories to compete globally. The plan would also replace 50,000 diesel transit vehicles, electrify at least 20% of the nation's school bus fleets, and electrify the federal fleet, including postal vehicles.

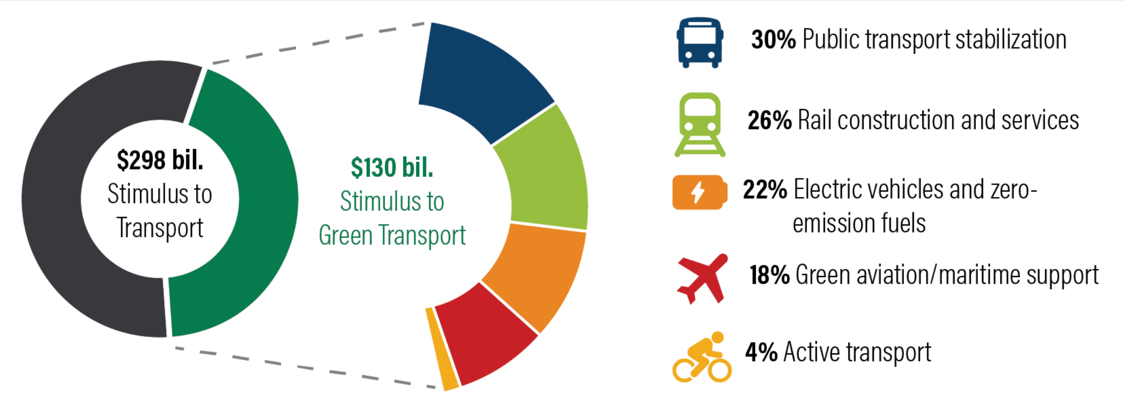
Cities around the world are leveraging the pandemic to advance investments in sustainable, low carbon transport. **In September 2020, the mayors of 12 major cities (Berlin, Bristol, Cape Town, Durban, London, Los Angeles, Milan, New Orleans, New York City, Oslo, Pittsburgh and Vancouver) committed to divesting funding from fossil fuel companies and to shifting to a green and just recovery from COVID-19 and to tackling climate change** (although the target dates were unspecified).

Examples of city recovery plans with sustainable transport investments include the following:

- **Bogotá**, Colombia announced implementation of a further 35 kilometres of cycleways, in addition to the city's existing 550-kilometre network.
- The government of **Mexico City**, Mexico will invest USD 1 billion to create 1 million new construction jobs, including efforts to fast-track a bus rapid transit line and two cableways planned before the pandemic.
- **Milan**, Italy launched an integrated strategy to reduce demand for travel, improve integration of public transport with other mobility systems, and promote shared vehicles, bicycles and scooters, among other measures.
- **Seoul**, the Republic of Korea plans to scale up goods delivery via robots and to accelerate implementation of a bicycle expressway network, with the aim of achieving a 15% cycling mode share by 2030.

Source: See endnote 101 for this section.

Figure 11. Stimulus spending for sustainable transport by transport mode, as of December 2020



Focus Features

Seven Focus Features put a spotlight on important cross-cutting issues: improving access to opportunities, adaptation policy measures in the transport sector, behavioural change in transport as a result of the COVID-19 pandemic, gender and sustainable mobility, the health impacts of transport, paratransit as a complement to formal transport networks, and multistakeholder mobilisation for climate action.

Focus Feature 1

Impact of COVID 19 on Travel Behaviour

Disruption

Disruptive scenarios such as the COVID-19 pandemic can lead to changes in people's attitudes and habits.[1]

Lockdowns led to:.

- Reduced well-being
- Increased loneliness
- Uncontrolled fear
- Frustration, boredom and pervasive anxiety[3]

Public bus usage in Greater Jakarta, Indonesia declined by 85% during the first two weeks of April 2020.[2]

During the pandemic, social relations and mobility were creating a context of new social norms.[4]

New social norms[5]

- Maintaining physical distance
- Wearing mask
- Sanitising hands frequently
- Avoiding unnecessary travel

Issues

People's attitudes (their predisposition to behave in a certain way) and behaviour changed, driven mostly by unexpected circumstances.[6]

Essential workers and those with low-income jobs (especially in the informal sector) have not had the option to shift to teleworking and many people still had to maintain their travel habits.[7]

The perception of lack of control causes stress and have induced people to stick to established travel modes and patterns.[8]

In countries that have a high presence of informal and non-regulated jobs, the experience of lack of control over one's personal life, tied to the reduced income, has created a scenario of uncertainty.[9]

Transition to sustainable mobility through behavioural change

Attitudes: People have changed their attitudes towards transportation.

Social norms: The current scenario favours the development of new and sustainable social norms.

Perceived control: New policies and investment in infrastructure can give people an increased perception that they have control over their travel mode choices.

Trust: How the governments will deal with transportation may increase or decrease people's trust in public and active transportation.

Habits: Trying new ways of travelling during the pandemic and having positive experiences with them may trigger new behaviours in the future.

Cycling usage increased in many cities. For example, the public bike-sharing system in Seoul, Republic of Korea recorded over 2.7 million rides during June 2020 (up from 1.2 million rides during June 2018 and June 2019 combined).

What do policy makers need to do

Enforce safety measures in public transport to regain trust and nudge less carbon-intensive behaviours.

In all regions, public transport service providers ensured additional sanitary measures.[10]

Convert temporary to permanent measures and policies. (bicycle lanes, open streets) and communicate the benefits of active mobility.

Bogotá implemented 76 km of pop-up bicycle lanes in the first months of the pandemic.[11]

Support green recovery, local commerce and local leaders to create networks of change makers.

The Next Generation EU recovery fund of USD 900 billion over 7 years supports decarbonisation through active and public transport.[12]

Focus Feature 2

Addressing Climate Change and Improving Access to Opportunities

Climate action in the transport sector can simultaneously address key transport needs for people, including providing access to opportunities such as jobs, education and services that enable people to thrive and economies to grow.

In cities, providing more equal access to transport for all residents can be well aligned with addressing climate change. In many cities, more than half of residents lack access to opportunities within 60 minutes' travel time.[1] A recent study analysing access to jobs in Johannesburg (South Africa) and Mexico City found that 42% and 56% of urbanites, respectively, are under-served in their ability to reach job locations (see Figure 1).[2]

The research shows that residents who are under-served by transport options face severe access constraints and are unable to travel to reach destinations.[3] This includes people who can afford to commute only on foot or by bicycle, or who do not have any viable means to travel. It also includes those that spend above-average amounts of time and money on commuting (as much as 35% of income), who are often located in peripheral suburbs far from economic opportunities. [4]

The following three recommendations can improve access for all in cities, while simultaneously helping to achieve climate goals:

- Build complete, democratic, and safe street networks, reprioritising road space and improving pedestrian safety and security, including rethinking the role of streets and who they serve;
- Shift from individual transport modes towards an integrated network of multimodal user-oriented services;
- Temper the demand for private vehicle use.

These solutions to improving access can also address climate change within the Avoid-Shift-Improve approach (see *Part I.A Box on Avoid-Shift-Improve framework*), particularly in the first two areas of avoiding unnecessary travel and shifting to more sustainable modes. Investments in sustainable transport modes in urban areas can bring significant emission reductions: analysis shows that better public transport, walking, and cycling, together with a fuel economy goal, could cut annual urban passenger transport CO_2 emissions 55% below business-as-usual levels in 2050.[5]

There are also ways to improve transport access in rural areas while mitigating carbon emissions. Much of the world lacks adequate access in rural areas. For example, 65% of people in rural **sub-Saharan Africa** live farther than 2 kilometres from a weatherised road, stranding many from life-saving healthcare and market opportunities that improve farming productivity and earnings.[6] The World Bank's Rural Access Index, developed in 2006, intends to capture this issue in support of Sustainable Development Goal 9 (focused on building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation).[7] The updated methodology was applied to 25 countries, indicating that among the assessed countries, those in Africa have far lower access to transport than those in Asia (see Figure 2).[8]

While expanding and improving road networks will be necessary to improve access challenges, climate-friendly policies can also be taken into account. These may include, but are not limited to:

- Reducing the need to travel in rural areas by shaping land-use policy to reduce trip lengths and cluster planning around villages and small towns;
- Providing for the needs of rural residents by improving conditions for walking and bicycling, as well as intercity bus or other shared transport routes;
- Creating sustainable freight and supply chains that efficiently transport goods to market or needed goods to rural populations; and
- Improving transport modes with more-efficient technologies (such as electrification or other less carbon-intensive vehicles) for trips that are necessary to access markets or reach jobs and services.

Lastly, in order to simultaneously improve access to opportunities and address climate change in transport, policy makers must address the mobility needs of all people, such as women and historically underserved groups (*see sidebar on Gender and Sustainable Mobility*). For example, public transport is not accessible unless it is safe and secure for women to use.

Figure 1. Unequal distribution of accessibility to jobs in Johannesburg and Mexico City

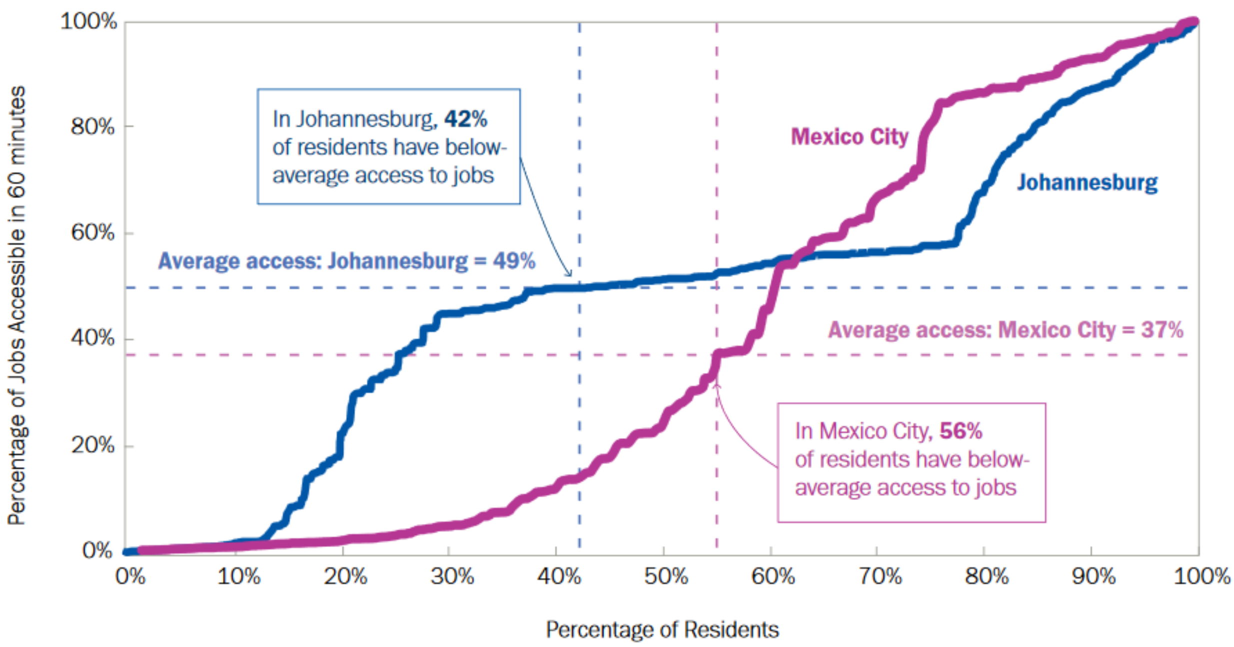
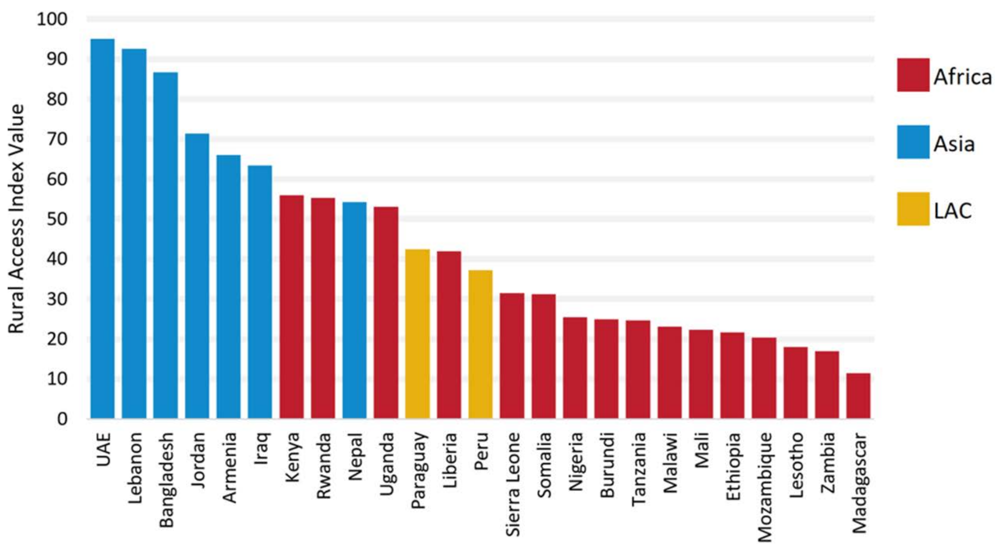


Figure 2. Rural Access Index, 2020 update



Focus Feature 3

Adaptation Policy Measures in the Transport Sector

Photo credits: AP Photo/ Lee Jin-man

Transport systems, assets and modes worldwide are vulnerable to shocks and stresses – including climate change. Depending on their nature and the degree of exposure, some systems will be affected by gradual (or slow-onset) changes, such as in temperature or sea level, while others may be impacted by more frequent or severe hydro-meteorological events, including heatwaves, rainfall (flooding or drought), extreme wind speeds or wave heights.[1]

The types of impacts vary. Heatwaves can damage infrastructure such as rail tracks, overhead wires, and pavement surfaces, disrupting transport. Droughts can reduce water levels for inland navigation, and long dry spells can affect the integrity of infrastructure. High winds, extreme waves and storm surges can impact coastal infrastructure, including ports; high winds can affect airports; and extreme rainfall can flood river-based transport corridors. Trucks, trains, ships, buses, planes, cars and other transport modes may need to be modified to ensure safe and reliable operation in extreme conditions.

Adapting to slow-onset changes

In some cases, the response to gradual changes in temperature and hence in sea level, precipitation patterns, etc. may require physical interventions such as relocating, reinforcing, raising, strengthening or otherwise modifying transport infrastructure or systems. However, not all adaptation requires such costly interventions. Operational changes may suffice, including revised working practices, rescheduled activities or operations, or restrictions in high-risk areas. Monitoring can help inform decisions on when action is needed, but climate change exacerbates existing uncertainties and introduces new ones. These uncertainties, including about the rate and magnitude of change in key climate parameters and processes, must be accommodated in order to avoid "maladaptation" (an action, or inaction, that leads to an increased risk of an adverse climate-related outcome).

Climate change demands innovative solutions, which first require a recognition and understanding of the challenge. To help identify these challenges when options are being considered for adaptation of a system, asset or operation with an operational life of more than 10 years, a range of climate change scenarios will need to be assessed.[2] In some cases, the extent of difference between the various plausible climate futures may indicate a preference for an adaptive solution that can be modified as conditions change. In other cases, back-up provisions or engineered redundancy may need to incorporated. The cost of inaction can be significant.

Preparing for extremes

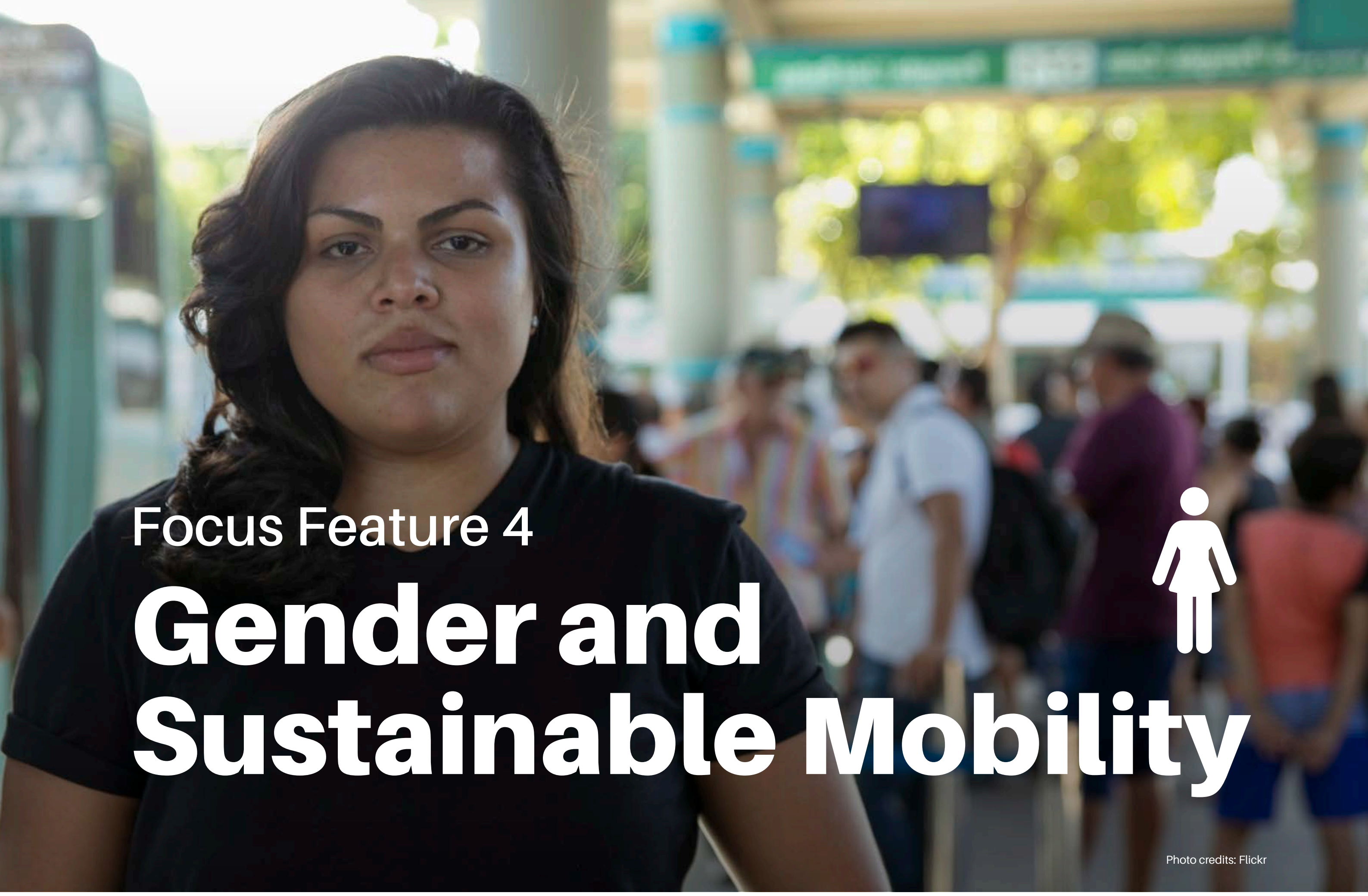
As with slow-onset changes, some of the challenges facing transport infrastructure and systems can be addressed through modifications to existing networks or assets, or by the design of new ones. However, structures and operations that are prone to failure should be designed to fail "gracefully" (in a managed way) rather than catastrophically when conditions exceed design standards. This may involve undertaking risk assessments and preparing contingency plans; developing early-warning systems; prioritising asset inspection and maintenance; and investing in back-up provisions. Sharing information and engaging with relevant stakeholders plays a critical role in delivering sustainable and resilient transport networks.

Institutional support

Effective adaptation of transport systems, infrastructure and modes requires more than just technical/physical and operational/management action. Institutional measures are also vital.[3] Climate change adaptation plans need to be prepared and strategies developed. Land-use planning and development control policies can reduce risks by encouraging transport infrastructure to locate (or relocate) out of high-risk areas, and by introducing "build back better" and similar policies. Technical guidelines and codes of practice may also need to be revised.

Financing organisations and the insurance industry are key players in encouraging and delivering effective adaptation. Climate risk and adaptation costs should be embedded in finance decisions for all new development. Climate risk disclosure is an important tool but is often inadequate. Improved information on physical risks will be needed, as the cost and availability of insurance will increasingly reflect the adequacy of investment in resilience.

The early months of the COVID-19 pandemic exposed many vulnerabilities in transport systems: a lack of contingency planning and preparedness; inflexible operations with insufficient adaptive capacity; and a limited ability to respond quickly. But over time, new ways of working have evolved and important lessons about adaptation planning have been learned. The potential for extreme events to disrupt transport has many parallels with the pandemic. Improved preparedness and resilience will be essential if consequences are to be minimised and recovery rates optimised.



Focus Feature 4

Gender and Sustainable Mobility

Photo credits: Flickr

Why it matters

Women's mobility and collective action has huge potential to enhance the use of sustainable mobility and to help achieve low-carbon mobility targets. Evidence from around the globe demonstrates that women and men have different mobility patterns, needs and experiences.[1] Due to limited access to transport resources, women are also more likely to use more sustainable forms of transport. In many cities, women tend to take public transport with greater frequency than men, and also walk more.[2] India's 2011 census reported that 84% of women use low-carbon transport modes to travel to workplaces in urban areas.[3] Research also suggests that women's greater familiarity with varied trip patterns makes them more open to multiple and sustainable modes of transport.[4]

In turn, sustainable mobility can advance gender equality by broadening women's access to employment and education opportunities, participation in public life and women's right to the city. A recent study from the International Labour Organization showed that limited access to transport in developing countries was the greatest obstacle to women's participation in the labour market, reducing their probability of participation by 15.5 percentage points.[5] Recognising the crucial role of sustainable infrastructure in advancing gender equality, the 2019 session of the United Nations Commission on the Status of Women recommended the creation of inclusive transport.[6] To create more inclusive societies, efforts to achieve sustainable mobility should enhance the rights, dignity and capabilities of women. The first step is to identify and address barriers to women's mobility.

Barriers to women's mobility

Restrictive social norms – including gender roles, taboos, prohibitions, stigma and expectations – have been used as rationales to unfairly distribute resources and reinforce gender inequality, including in the transport sector.[7] Norms and attitudes on gender and mobility, such as the value assigned to care activities and whether or not women should be in public spaces, may affect access and use of transport modes.

Women face a complex interaction of financial, physical and socio-cultural factors.[8] Unsafe infrastructure, lack of physical distance, time poverty, limited information, skills, affordability and limited access to technology have been identified as key barriers to women and girls' mobility.[9] For example, **a World Bank study showed that in Lima, Peru, women are more likely to make transport decisions based on safety.**[10] In a UN Women study in Kigali, Rwanda, 55% of women reported concerns about using public transport to go to educational institutions after dark. Minority women face additional challenges and discrimination that affect their mobility options. In London, the under-representation of black women cyclists portrayed in the media and seen on the streets is a barrier for cycling for black women.[11]

Evidence suggests that women's decision-making power, self-efficacy and control of transport is more limited compared to men. Research suggests that men mostly have priority use of the family car or bicycle, even if women in the family have a greater need for it due to a more complex set of trips.[12] Women's ability to negotiate and control transport resources and budgets is limited not only in the household, but also within transport institutions and city planning offices, where women are overwhelming underrepresented in the work force, especially in decision-making positions. In the European Union, women make up only 22% of the transport sector workforce, and globally women represent only 18% of staff in infrastructure ministries, including energy, transport and communications.[13]

There is an untapped potential to transform these gender inequalities in mobility into opportunities to make women central actors in moving towards sustainable mobility.

Recommendations

In the last decade, the need to move away from gender-blind mobility has been recognised and has led to several calls for action, including an increase in research, documentation of practices, and strategies to enhance women's sustainable mobility.[14] Today, as cities respond to a health pandemic and rethink mobility policies, transport systems and public spaces, it is the perfect time to capitalise on gender-responsive sustainable mobility. Doing so requires a comprehensive and multi-pronged approach that addresses women's mobility challenges and mainstreams gender in sustainable mobility policies, plans and budgets. Failure to do this would be a missed opportunity for the environment and gender equality.

Recommendations for action include:

Governments and international community

- Ensure that mobility and urban policies and planning are gender-responsive and take into account the different needs of women and men.
- Conduct systematic assessments of the environmental *and* gender impacts of sustainable mobility and undertake gender analysis to understand the motivations, expectations and perceptions of different modes of transport and technologies.
- Engage equal participation and leadership of women, women's organisations and LGBTQI communities in policy dialogues and decision making relating to sustainable mobility.
- Incorporate a gender mainstreaming approach throughout mobility policies and transport infrastructure life cycles, especially during the investment and design stages.
- Identify and remove barriers to women and girls' access to sustainable mobility, such as space to physically distance from others on public transport, limited information, skills, unsafe infrastructure, stigma and discrimination.
- Ensure that progress in gender-responsive mobility is not undermined by budget cuts and austerity measures.

Civil society, environmental and feminist movements

- Raise public awareness of women's mobility needs with respect for local culture.
- Conduct safety audits of sustainable mobility investments to identify the safety needs of women and girls in and around transport systems.
- Promote an intersectional understanding and approach to sustainable mobility.
- Advocate for data collection on sustainable mobility, disaggregated by sex, age, ethnicity and race where possible in existing surveys and rapid assessments.
- Support sustainable mobility programmes for women and girls, racial minorities, and LGBTQI communities.

Transport operators / Private sector

- Set high-level and clear commitments to upholding inclusive and sustainable mobility.
- Strengthen the capacity of employees on gender and mobility.
- Continue to invest and collaborate with transport experts, women's rights organisations and female tech companies in the development of sustainable mobility solutions.
- Scale up investments in mobility infrastructure that is safe, affordable and gender-responsive.
- Monitor the uptake of different modes of transport with sex-disaggregated data and address accessibility barriers.
- Promote gender, race and ethnic diversity in marketing strategies.

Photo credits: colombiacycling.com

Focus Feature 5

Health Impacts of Transport

The way that societies organise systems of transport and mobility has a decisive impact on public health. For example, transport affects health by contributing to air and noise pollution, by impacting people's physical activity (such as walking and cycling, including walking to public transport) and through road injuries.[1] Most of the top 10 causes of death worldwide are directly and strongly linked to risk factors (such as air pollution and physical inactivity) that are influenced by how transport systems are shaped; they include heart attack (#1 cause of death), followed by stroke, pneumonia, chronic respiratory disease, lung cancers and diabetes, as well as road injuries (#10).[2] Transport can also shape our exposure and susceptibility to infectious agents, such as the viruses causing influenza and COVID-19, and is heavily affected by global pandemics.

Less well known, but equally relevant, are the more beneficial health impacts of transport infrastructure. For example, changes in the design and social interaction of neighbourhoods, including access to public and green space, can result in positive health outcomes, and well-planned transport systems can offer protection against interpersonal violence, particularly for women and children. Improved mobility for women, children, elderly and the poor, who have less access to private vehicles, enhances health equity.[3] Transport also has a decisive influence on more upstream determinants of health and health equity by enabling and facilitating access to education, jobs, health care, recreation and clean water; it also has indirect effects on health through its impacts on natural ecosystems and climate change.[4]

Climate action that alters transport systems can either improve or harm societal health. Global growth in transport demand and emissions, particularly in low- and middle-income countries and cities – coupled with rapid urbanisation, weak transport regulation and enforcement, and poor infrastructure – will further deepen the health and equity impacts of transport systems.[5] Conversely, climate action can yield large, immediate public health benefits while reducing rising greenhouse gas emissions from the transport sector; this is because many of the pathways to reduce CO_2 emissions are closely linked to policies supporting sustainable mobility and better land-use planning, which are both known to be good for health and equity.[6]

If well planned, implemented and monitored, sustainable transport systems can bring multiple benefits and contribute to many relevant Sustainable Development Goals and related targets. These include Good Health and Well-being (SDG 3), Climate Action (SDG 13), Affordable and Clean Energy (SDG 7), Reduced Inequality (SDG 10) and Sustainable Cities and Communities (SDG 11), as well as the SDG targets directly linked to transport (3.6 and 11.2).

Assessing the health and economic impacts of climate action through transport in an integrated manner is essential. For example, making cities more compact – by increasing land-use density and diversity, and reducing distances to public transport – can result in net health gains for cities, mainly by reducing air pollution and increasing physical activity levels (see Figure 1).[7] A large share of these benefits will come from more walking, cycling and public transport. For instance, if an average person cycled one trip per day more and drove one trip per day less for 200 days a year, this would not only improve health substantially, but also decrease mobility-related lifecycle CO_2 emissions by around 0.5 tonnes over a year, an important share of average per capita CO_2 emissions from transport.[8]

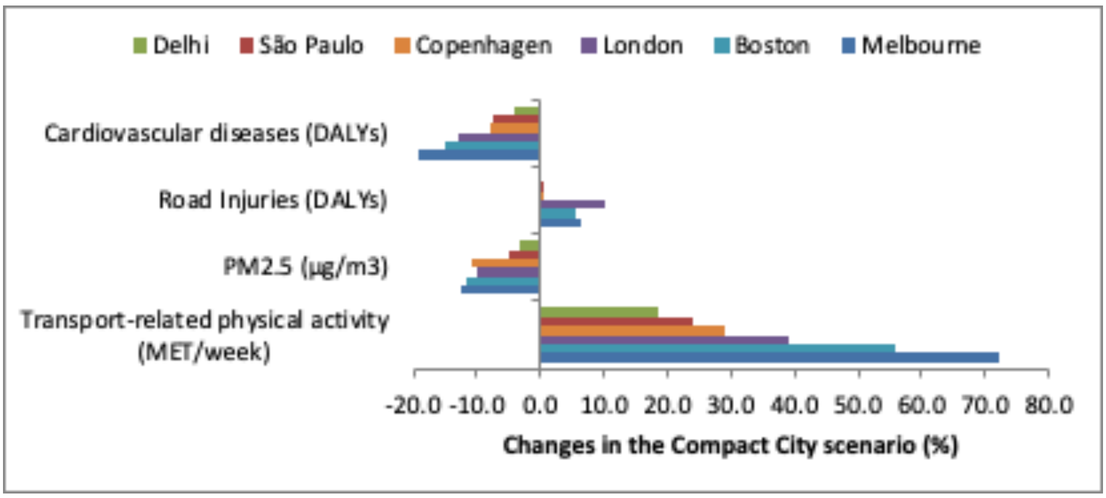
Transport interventions with the potential to improve climate and public health are wide ranging. They include measures that:

- ***Avoid*** motorised passenger trips and freight movement through urban and regional development policies, integrated transport and spatial planning, and travel demand management;
- ***Shift*** passenger and freight travel to more environmentally friendly modes, such as walking, cycling and clean public and freight transport; and
- ***Improve*** energy efficiency of all transport modes through low-carbon fuel and vehicle technologies.

In the example of Accra, a very progressive policy scenario incorporating avoid, shift and improve measures towards sustainable transport in 2050 could yield a net health gain of nearly 40,000 deaths averted, while reducing CO_2 emissions by nearly 160 million tonnes. Investments in strengthening mobility systems that take into consideration social and environmental determinants of health can also ensure equitable access and reduce disparities.

These are just a few examples of the potential health impacts of transport-related climate action. Advancing progress requires a co-ordinated effort across sectors, including the health, transport and environmental sectors, and across all levels of government, from local to global.

Figure 1. Changes from baseline in transport-related physical activity levels, particulate matter concentrations, and cardiovascular diseases and road injuries, under the Compact City scenario



Note: Smaller health gains were also observed for type-2 diabetes and respiratory diseases (not shown).DALYs = disability-adjusted life-years, a measure commonly used to combine the health impact of different risk factors, such as air pollution and physical inactivity; MET: metabolic equivalent of task, a measure for human energy expenditure.
Source: Author elaboration, using estimates from Stevenson et al. (2016).

Photo credits: Unspalsh

Focus Feature 6

Paratransit as a Complement to Formal Transport Networks

Paratransit (sometimes called "informal transport") is an essential service for moving people and goods in low- and middle-income countries. It includes the use of minibus taxis and other private vehicles for hire and is an increasingly popular transport mode in rapidly urbanising cities in Africa, Asia and Latin America. Paratransit users are often middle- and low-income individuals, or citizens who lack convenient and affordable access to formal transport services. This sidebar will focus on examples from Africa.

In some cities in Sub-Saharan Africa, up to 80% of the population relies on paratransit.[1] For example, in **Kampala, Uganda** the fleet of private minibus taxis grew 5.4% annually since 2015, totalling 16,000 vehicles and carrying 82.6% of commuters that year.[2] In **South Africa**, the share of inhabitants using minibus taxis reached 44.1% in Gauteng province and 39.6% in the Eastern Cape and Mpumalanga in 2018.[3] Paratransit also drives local employment, with the services directly employing around 100,000 people in Kampala in 2015.[4]

Paratransit operations often rely on privately owned, second-hand vehicles, which tend to face less government oversight than formal public transport services.[5] This can result in poorly maintained vehicles, unsafe driver behaviour and fierce competition among operators for routes and passengers.[6] However, paratransit services are usually still subject to regulation on licencing, routes, and fares, making the term "informal transport" misleading. Because these modes are viewed as less formal (and typically less desirable), planning and operations are often neglected. However, paratransit plays a critical role in expanding collective transport options and providing vulnerable populations with access to essential services and opportunities.

Some governments have made efforts to improve the quality of paratransit and to better integrate these informal systems alongside more formal public transport services, which declined around 30% per capita in developing country cities between 1995 and 2012.[7] In African cities such as **Cape Town**, **Dar es Salaam**, **Johannesburg** and **Lagos**, flexible and responsive paratransit services provide a crucial supplement to formal bus rapid transit systems, which mainly serve transport demand along major travel corridors.[8]

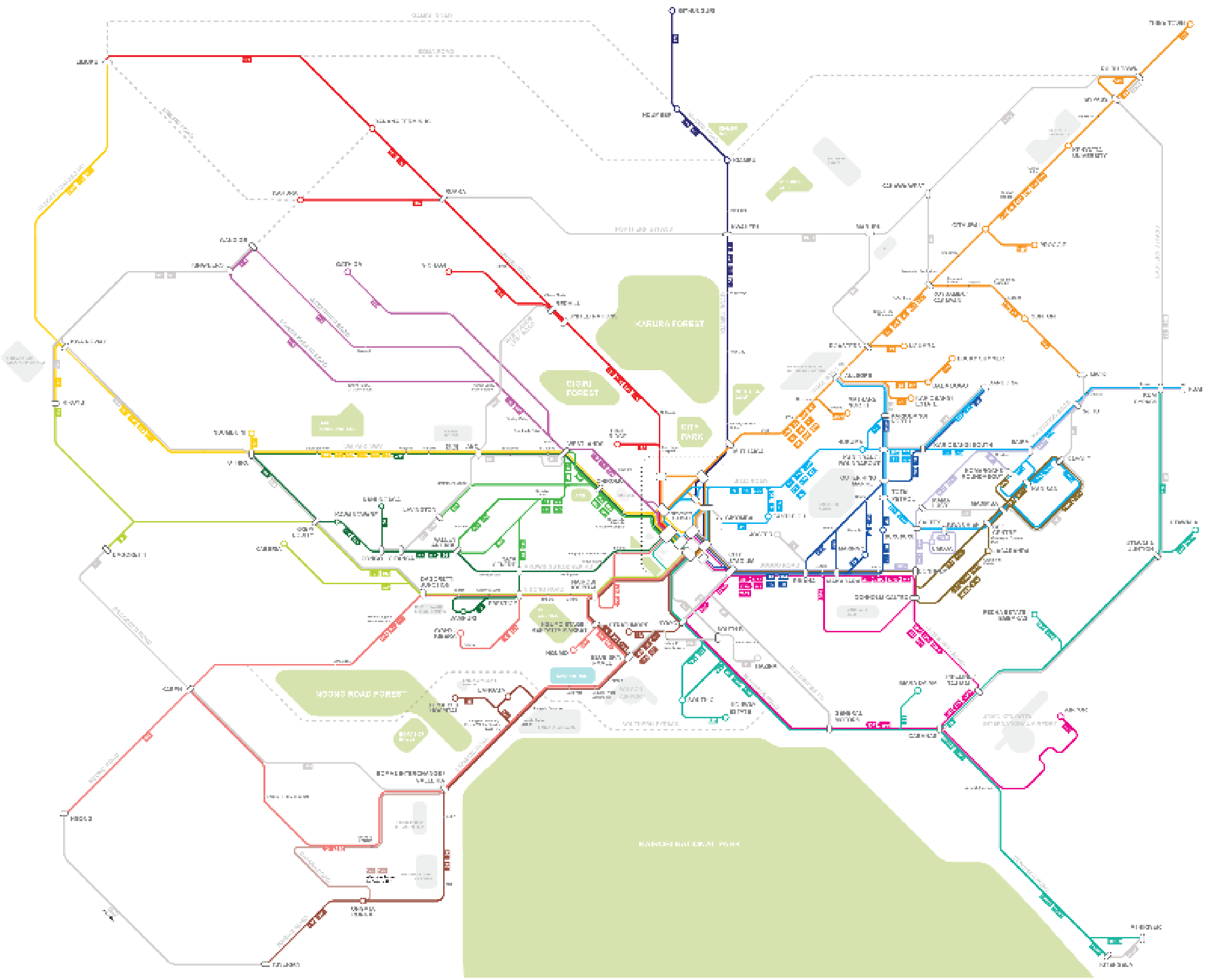
Photo Credit: Phuoc Anh Dang

Technological interventions have helped to integrate paratransit with more formal networks. The use of geolocation data (via mobile phones) provides more information on routes and stops, making it possible to match passenger demand and supply and to improve the efficiency of both informal and formal transport services.[9] The Digital Matatus project mapped informal bus services across **Nairobi, Kenya** (see Figure 10), improving both accessibility for users and planning opportunities for city officials.[10] However, additional efforts are needed to move beyond mapping and towards improved paratransit planning in cities, so these services can complement large-scale transport reform through bus rapid transit and other corridor-based systems.

Paratransit contributes to urban air pollution because the vehicles are often old and poorly maintained and rely on reconditioned diesel engines, which produce higher local emissions.[11] A lack of formal scheduling and fixed routes can lead to uneven service quality, vehicle degradation, and congestion, which increases emissions due to frequent start-and-stop patterns and rapid acceleration and deceleration.[12] However, large knowledge and research gaps remain regarding both paratransit overall and its impacts on the environment and climate.[13]

Governments can take numerous policy actions around paratransit, including increased regulation, imposing vehicle maintenance requirements and supporting electrification of minibus fleets.[14] More applied research and coordinated action on paratransit operations can increase the potential impact of these policies on reducing emissions and improving air quality in developing countries.[15]

Figure 1. Map of paratransit services in Nairobi, Kenya



Focus Feature 7

Multi-stakeholder Mobilisation for Climate Action in Transport

Photo credits: Pexels

A wide range of stakeholders – from the public and private sectors, transport sector associations, knowledge and academia, governments, multilateral and non-governmental organisations (NGOs), philanthropy and industry – are forming collaborative mechanisms to mobilise climate action in transport.

- Transforming transport and mobility systems to address climate change requires multi-sectoral and multi-stakeholder strategic collaborations beyond the transport community. The urban sustainability, renewable energy, health and behavioural change communities are key in this multi-sectoral interface for climate action in transport.
- In the era of transport electrification, increased attention is needed on championing balanced, people-centred, planet-sensitive approaches across the *Avoid-Shift-Improve* framework.
- Empowering emerging leaders and broadening the debate with perspectives from the Global South should be a shared goal among all actors involved.
- Despite growing initiatives to include more women in the transport sector and better gender perspectives in transport services, much work remains ahead of us. This includes taking steps to boost the visibility of women transport professionals, highlighting the negative impacts of gender-neutral transport and climate policy debates and planning (e.g., assessing travel needs and behaviour) and voicing the need for adaptation (e.g., implementing more equitable and resilient transport options).
- A wealth of initiatives and resources are available related to technical assistance and capacity building support in the area of transport and climate change. There is a prevailing tendency in the transport community to neglect resilience and adaptation planning. There is also an increasing need to enhance the coherence of efforts between and among donors, policy makers, knowledge producers and practitioners.

Below are selected examples of initiatives that aim to provide technical assistance and capacity building support for climate action in transport. The list is not intended to be exhaustive, and additional global initiatives covering a wide range of transport modes and thematic areas can be found in *Section 3: Responses to Address Climate Change in the Transport Sector*.

Global initiatives

The **Action towards Climate-friendly Transport (ACT) initiative** is the largest global coalition aiming to catalyse transport as an enabler of sustainable development in line with the 2030 Agenda for Sustainable Development and the Paris Agreement.[1]

The **Advancing Transport Climate Strategies (TraCS)** project focuses on capacity building, training activities and fostering research systems to help policy makers in developing countries and emerging economies align their mobility and transport sector action plans with their

Nationally Determined Contributions (NDCs) towards reducing emissions under the Paris Agreement.[2]

The **Decarbonising Transport Initiative** provides decision makers with tools to select specific measures for mitigating carbon dioxide (CO_2) emissions to help them deliver on stated climate commitments. The Transport Climate Action Directory is a catalogue of effective CO_2 mitigation measures that offers analytical assistance for countries and partners, gathers evidence for best practices and provides information to facilitate global policy dialogues.[3]

The **Institute for Transportation and Development Policy** (**ITDP**) is a global organisation at the forefront of innovation, using technical expertise, direct advocacy and policy guidance to mitigate the impacts of climate change, improve air quality and support prosperous, sustainable and equitable cities.[4]

The **MobiliseYourCity Partnership** assists beneficiary partners in their preparation of national urban mobility policies and investment programmes (NUMPs) and sustainable urban mobility plans (SUMPs).[5] Along with support and consultation at early stages, the partnership supports budgeting and financial planning (i.e., the development of financial mechanisms and the initiation of funding to secure implementation).[6]

The **Nationally Determined Contribution Partnership** (**NDC Partnership**), a coalition of more than 180 countries and institutions, supports member countries in implementing and enhancing their NDCs under the Paris Agreement. On request from member countries, the Partnership helps to ensure that countries have access to the support they need to turn their NDCs into action. Working with the Partnership can help both countries and support providers find the right partners to advance clean transport under the NDCs.[7]

The **New Urban Mobility Alliance** (**NUMO**) targets urban issues and works to leverage the momentum of mobility revolutions, including equity, sustainability, accessibility and labour. NUMO aims to align actions, investments and values of community allies to achieve on-the-ground transformation in mobility.[8]

Safetipin is a social organisation that works with urban stakeholders, including governments, to make public spaces safer and more inclusive for women.[9] It provides data and recommendations for relevant stakeholders and also generates a data-based safety score that users of the My Safetipin app can consult to make safe and informed decisions about their mobility.

SOLUTIONSplus is a global platform for shared, public and commercial e-mobility solutions to kick-start the transition towards low carbon urban mobility. The project encompasses city-level demonstrations to test different types of innovative and integrated e-mobility solutions, complemented by a comprehensive toolbox, capacity development and replication activities.[10]

The **Transformative Urban Mobility Initiative** (**TUMI**) is the leading global implementation initiative on sustainable mobility, concentrated on three pillars: innovation, knowledge and investment. In addition to supporting innovative pilot projects globally, TUMI shares knowledge on modern mobility concepts with planners through workshops and conferences and invests in the construction and modernisation of sustainable urban infrastructure.[11]

The **UITP Academy** offers training programmes, based exclusively on international expertise and practice, to public transport and urban mobility stakeholders.[12] Its trainings organise in 58 different cities and involve more than 250 expert trainers on over 60 urban mobility topics.[13]

Regional organisations and initiatives

Africa

Africa Network for Walking and Cycling is a space for organisations and experts to convene and collaborate in order to make the lives of people who walk and cycle in African countries safer, healthier and more comfortable. It serves as a platform to champion best practice and to influence research, policy and practice as well as strengthen partnerships and share experiences and knowledge.[14]

Amend works with development agencies, foundations, private sector companies and governments in developing countries to increase mobilisation.[15] In addition to scientific research, Amend provides technical assistance for road safety and community engagement in rural road design.[16]

Digital Transport for Africa (**DT4A**) hosts an online, collaborative platform that scales up and supports urban mobility projects, especially mapping public transit systems, through open data and peer-to-peer knowledge sharing.[17]

The **First African Bicycle Information Organisation** (**FABIO**) partners with national and regional networks for capacity building in communities, advocating for better service delivery and good governance especially in transport policies and planning.[18]

Sustainable Transport Africa provides support in developing policies that reduce transport emissions through promoting and lobbying for non-motorised transit, bus rapid transit, light rail transit, other forms of mass rapid transit, land-use planning, transit-oriented cities, clean fuels, green transport, traffic demand management, sustainable rural transport and sustainable shipping.[19]

Asia

AIP Foundation works globally in partnership with local governments and communities to improve road safety through its "five gears" model. AIP provides assistance in tailored road safety education programs; direct provision of road safety tools; public awareness and behaviour change campaigns; the development and enforcement of traffic standards and laws; and research tools to support policy change, programmes and best practices.[20]

The **Asian Transport Outlook** (**ATO**) collects, organises and shares data on the transport sector in 51 countries using more than 400 indicators. It strengthens the knowledge base on transport in the Asia-Pacific region by documenting the institutional frameworks, policies and financing of transport in these countries.[21]

Clean Air Asia focuses on reducing air pollution and greenhouse gas emissions from transport and other sectors by translating research into policies and actions. Its projects and activities aim to strengthen regional and national policies and standards; enhance national and local frameworks for programmes and urban development; and increase access to information, tools and partners.[22]

The **Low Emission Development Strategies Global Partnership** (**LEDS GP**) **Transport Working Group** in Asia provides technical assistance, tools and knowledge exchange activities that support low-emission development for transport systems. A Community of Practice focusing on clean mobility provides an informal space for members to exchange experiences and link expert assistance and technical know-how with on-the-ground challenges and priorities.

The **NDC Transport Initiative for Asia** (**NDC-TIA**) is a regional initiative aiming at a holistic approach to decarbonise the transport sector in China, India, Vietnam and other Asian countries. This includes the development of a coherent strategy for efficient policy approaches that is co-ordinated among various sector ministries, civil society and the private sector.[23]

Latin America and the Caribbean

EUROCLIMA+ provides technical and financial support for developing and implementing climate change adaptation and mitigation policies. It also facilitates regional policy dialogue and climate action in seven sectors, including urban mobility.[24]

The **Latin American Association for Sustainable Mobility** (**ALAMOS**) comprises associations of companies, citizens and other organisations promoting sustainable mobility at the regional level, with the aim of satisfying current and future needs for the movement of people and goods while balancing social well-being, environmental care and economic growth.[25]

The Low Emission Development Strategies Global Partnership Transport Working Group in Latin America and the Caribbean (**LEDS-LAC**) has launched two Communities of Practice in the region: Sustainable Logistics and Electric Mobility. Both aim to provide a platform – virtual and in-person – for sector stakeholders within a region to discuss experiences and seek guidance on these topics; learn from practitioners in peer countries that have experience planning and implementing sustainable actions; and share relevant reports and resources.

MOVE LATAM is a capacity building platform to enable the transition towards electric mobility in the region.[26] Its objective is to bridge the knowledge, financial, technical and policy gaps that governments, cities, the private sector and technological centres face in accelerating the deployment of electric mobility in the region.

Mujeres en Movimiento is focused on supporting sustainable leadership in sectors where there is limited participation by women and promoting gender equity policies through an active network of co-operation and governance from civil society and the public and private sectors.[27] It provides technical and political tools to expand, reinforce and apply ideas and knowledge, especially in the fields of transport, mobility and energy.

The **Zero Emissions Bus Rapid-deployment Accelerator** (**ZEBRA**) partnership aims to deploy electric buses and pioneer the adoption of electric vehicles in transport systems across Latin America in four core cities – Medellín, Mexico City, Santiago and São Paulo – and builds knowledge and best practices from which all cities in the region can benefit.[28]

Strategic alliances in other sectors

Local government associations working at the global level

C40 supports a network of 97 cities to collaborate, exchange knowledge and drive measurable and sustainable action on climate change. Its programmes include localised direct support, improved access to data and partnering in finance.[29]

ICLEI's **EcoLogistics** project aims to advance effective regulatory, planning and logistical instruments at all levels of government to support low carbon urban freight.30 The **EcoMobility Alliance** provides a collaborative platform for participants to share the latest policy and technology developments in their cities and regions, with the goal of making effective reforms to their own transport networks.31

Civil society

The **Child Health Initiative** operates as a collaborative partnership, with a focus on global and national advocacy, research and programme implementation. It aims to mainstream child health and mobility issues into international development and climate change policies.[32]

HealthBridge works to strengthen the ability of local partners in lower- and middle-income countries to increase understanding of policies and programmes for liveable cities. Projects include children-focused parks, advocating for safe pedestrian spaces and preserving fresh markets for access to healthy foods.[33]

REN21 is a global renewable energy community of actors from science, governments, non-governmental organisations and industry. It provides peer-reviewed facts, figures and analysis of global developments in technology, policies and markets. REN21's overall goal is to enable decision makers to make the shift to renewable energy, including in the context of decarbonisation pathways for transport.[34]

Business community

Movin'On brings together start-ups, academic research labs and other businesses to exchange expertise in developing cutting-edge technologies in sustainable mobility. In addition to operating as a "think tank", the initiative hosts an annual event to facilitate this exchange for policy makers, experts, researchers, start-up founders and politicians.[35]

EV100 brings together more than 100 of the world's leading companies to transition their fleets to electric vehicles and to install charging infrastructure for staff and customers by 2030, making commitments across more than 80 markets.[36] Members of the initiative are sending a powerful demand signal to vehicle manufacturers and governments to accelerate the market scale-up worldwide. [37]

Cross-cutting alliances

The **Transport Decarbonisation Alliance** works to accelerate global transformation in the transport sector towards net zero mobility systems by 2050.[38] It focuses on designing a common vision for "front-runners" and setting up Communities of Interest among the "3Cs" (countries, cities/regions and companies). The Alliance promotes effective advocacy by influencing decision makers in key international fora on climate change (such as the United Nations Framework Convention on Climate Change) and sustainable development (such as the United Nations High Level Political Forum – Sustainable Development Goals); in international political processes (such as the European Union, G7, G20 and B20); and in bilateral dialogues.

Country Fact Sheets

31 country fact sheets are presented in this section for countries that had the highest absolute transport carbon dioxide (CO_2) emissions in 2019. These fact sheets present data on transport demand, emission trends and measures taken at the national level towards achieving a decarbonised, sustainable transport system.

31 countries covered:

8 in Africa
Algeria, Angola, Egypt, Ghana, Kenya, Morocco, Nigeria and South Africa

6 in Asia
China, India, Indonesia, Iran, Japan and Saudi Arabia

5 in Europe
France, Germany, Italy, the Russian Federation and the United Kingdom

8 in Latin America and the Caribbean
Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico and Peru

2 in North America
Canada and the United States of America

2 in Oceania
Australia and New Zealand

Algeria

Algeria has had a substantial growth in transport activity and emissions, with all major indicators related to transport showing a 50% growth since 2010. This has led to transport emission levels above the region's average and more than other countries of similar income levels. Algeria has limited policies in place to help curb these growing transport emissions. Most notably, the country has an interest in developing high-speed rail and introducing alternative fuels.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	43.9 million	72.9%	4710.5
Growth (2010 to 2020)	21.9%	31%	25.8%

Income group: **Middle-income**

Human Development Index: **0.75**

Mobility Demand Trends

Passenger travel activity

1 550

million rail passenger-km in 2017

+48% (2010 to 2017)

Freight transport activity

4 259

million ton-km in 2017

+56% (2010 to 2017)

Fuel consumption (2018)

15 310

thousand tonnes of oil equivalent

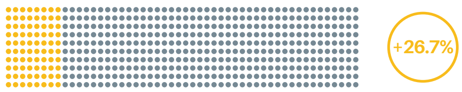
+44% (2010 to 2018)

Average light duty fuel economy consumption (2017)

Not available

Car ownership growth (2005 to 2015)

140 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	118689	-4.1%
Commercial	6311	75.2%

Diesel

US cents per litre (2018)

19

Super gasoline

US cents per litre (2018)

35

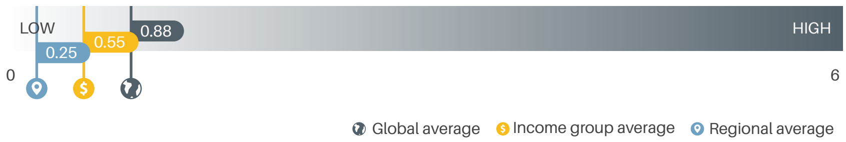
Transport Emission Trends

Transport CO_2 emissions (2019)

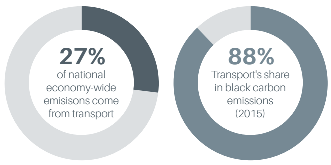
48.1 million tonnes

Per capita transport CO_2 emissions (2019)

1.12 tonnes

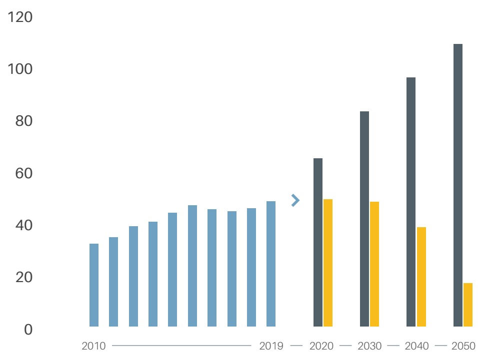


Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✕
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted:	1st NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✕
Other non-emission related transport targets in NDC	Increased share of LPG and natural gas in fuel consumption by 2030
Voluntary National Review highlights transport:	2019 VNR with transport linkages to SDG 1, SDG 7, SDG 11 and SDG 13



Transport CO_2
2010 to 2019
+52%

Business-as-Usual Scenario
2020 to 2050
+68%

Low Carbon Scenario
2020 to 2050
-66%

Transport measures in NDC

Mitigation

- LPG/CNG/LNG

Adaptation

- Transport laws, regulations and programmes

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Not available
Sustainable Urban Mobility Plans (2020)	Not available
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	Not available
Cycling infrastructure in capital (2020)	Not available

Urban Passenger and Freight Transport

Bus rapid transit (2020)	Not available
Urban rail (LRT, metro, tram) (2020)	78 km in 6 cities
Bus rapid transit daily passenger volume (2020)	Not available
Rapid Transit to Resident Ratio (2019)	14.2

Passenger and Freight Railways

Rail network (2019)	4 020 km
High-speed rail	Not available
High-speed rail travel activity	Not available
National plans for passenger and freight rail expansion (2020)	✓
Targets	• To develop high-speed rail and electrify railways • Double passenger volume by 2025
Rail travel activity (2018)	1 602 million passenger-km
Rail freight activity (2018)	1 026 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	Not available
Electric scooter services (2020)	Not available
Carsharing services (2021)	Not available
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Not available
CO2 emissions performance for LDVs (2017)	Not available
Emission standards for HDVs (2018)	Not available
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	0.65%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	6.7 million people
Air freight activity (2019)	25.6 million ton-km
Carbon-accredited airports (2020)	✗
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	12.8
Container port traffic (2019)	1 080 000 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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List of acronyms

GDP	Gross-domestic product
HDV	Heavy-duty vehicle
ICE	Internal combustion engine
LDV	Light-duty vehicle
LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Angola

Angola's transport emissions are the country's second-largest CO_2-producing sector, and transport CO_2 emissions have grown by over 20% since 2010. Overall, very limited details on the country's transport policies are available. A new railway link to Zambia is in preparation, but no other transport measures have been identified.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	32.9 million	66.8%	3 103.5
Growth (2010 to 2020)	40.7%	57%	17.9%

Income group: **Middle-income**

Human Development Index: **0.58**

Mobility Demand Trends

Passenger travel activity
Not available

Freight transport activity
Not available

Fuel consumption (2018)
2 300

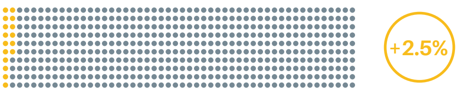
thousand tonnes of oil equivalent

+7% (2010 to 2018)

Average light duty fuel economy consumption (2017)

Not available

Car ownership growth (2005 to 2015)
32 vehicles per 1,000 people



Vehicle sales (2019)

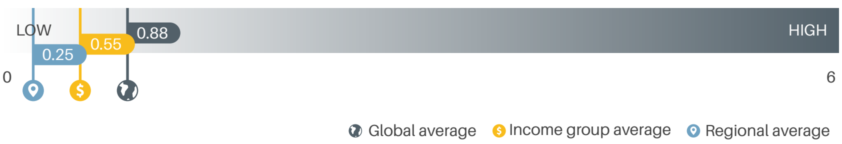
		(Growth 2010 to 2019)
Passenger	2080	14.0%
Commercial	750	29.5%

	Diesel	Super gasoline
US cents per litre (2018)	44	52

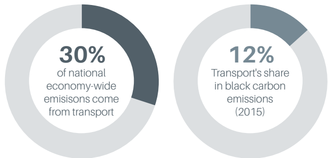
Transport Emission Trends

Transport CO_2 emissions (2019)
7.8 million tonnes

Per capita transport CO_2 emissions (2019)
0.2 tonnes

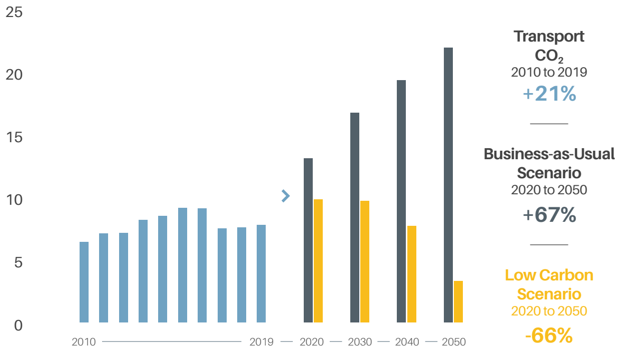


Second-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	×
Transport mitigation targets in NDC	×
Other non-emission related transport targets in NDC	×
Voluntary National Review highlights transport	Not submitted



Transport measures in NDC

Mitigation
- Not available

Adaptation
- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Not available
Sustainable Urban Mobility Plans (2020)	Not available
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	Not available
Cycling infrastructure in capital (2020)	Not available

Urban Passenger and Freight Transport

Bus rapid transit (2020)	Not available
Urban rail (LRT, metro, tram) (2020)	Not available
Bus rapid transit daily passenger volume (2020)	Not available
Rapid Transit to Resident Ratio (2019)	Not available

Passenger and Freight Railways

Rail network (2011)	Not available
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion (2020)	✓
Targets	• Railway link to Zambia and overall railway improvements
Rail travel activity (2018)	Not available
Rail freight activity (2016)	Not available

New Mobility Services

Bike-sharing systems (2020)	Not available
Electric scooter services (2020)	Not available
Carsharing services (2021)	Not available
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Not available
CO2 emissions performance for LDVs (2017)	Not available
Emission standards for HDVs (2018)	Not available
Targeted CO2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	10% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	Not available
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	1.4 million people
Air freight activity (2019)	68 million ton-km
Carbon-accredited airports (2020)	✗
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	25.7
Container port traffic (2019)	672 212.5 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Argentina

Transport CO_2 emissions in Argentina have been on the decline, with growth rates in the single digits, following slow economic growth overall. Freight rail activity reduced significantly between 2010 and 2017.

Argentina has identified sustainable transport as a key national objective, with a comprehensive package of sustainable transport activities currently envisioned.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	45.2 million	92.8%	9 763.5
Growth (2010 to 2020)	10.5%	11.9%	3.21%

Income group: **Middle-income**

Human Development Index: **0.85**

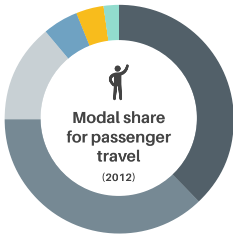
Mobility Demand Trends

Passenger travel activity

57 145

million passenger-km in 2017

+8.3% (2010 to 2017)



Freight transport activity

8 377

million ton-km in 2017

-30% (2010 to 2017)

Fuel consumption (2018)

18 060

thousand tonnes of oil equivalent

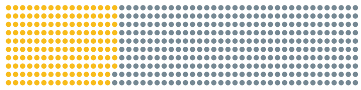
+13% (2010 to 2018)

Average light duty fuel economy consumption (2017)

7.9 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

316.4 vehicles per 1,000 people



+29%

Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	282 299	-53.8%
Commercial	126 375	-22.3%

Diesel
US cents per litre (2018)
94

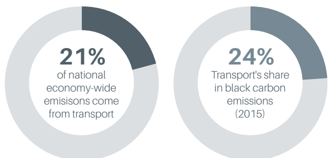
Super gasoline
US cents per litre (2018)
105

Transport Emission Trends

Transport CO_2 emissions (2019)
41.2 million tonnes

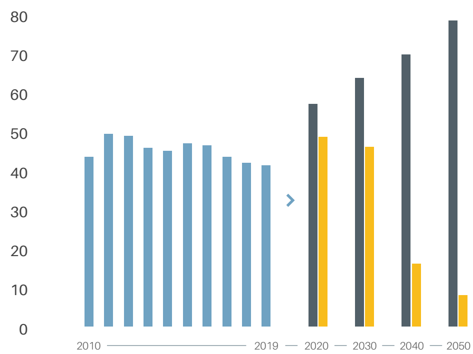
Per capita transport CO_2 emissions (2019)
0.9 tonnes

Second-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st and 2nd NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2020 VNR with transport linkages to SDG 3, SDG 7, SDG 9, SDG 11, SDG 13 and SDG 16	



Transport CO_2
2010 to 2019
-5%

Business-as-Usual Scenario
2020 to 2050
+37%

Low Carbon Scenario
2020 to 2050
-84%

Transport measures in NDC

Mitigation

- Use of renewable energy
- General comprehensive planning
- LPG/CNG/LNG
- Hydrogen
- Electricity
- Vehicle labelling
- General alternative fuels
- Emission standards
- General active mobility
- General e-mobility
- Biofuels
- High capacity vehicles in freight
- Intelligent transport systems (ITS)
- Vehicle scrappage scheme
- Sustainable transport capacity building
- Freight transport shifting to rail or inland
- Ship efficiency improvements

Adaptation

- Transport infrastructure resilience
- Education and training
- Design standards and updates
- Repair & maintenance
- Risk assessment

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Targets	• Bill to establish framework for sustainable mobility • To achieve zero-emission public transport by 2030
Sustainable Urban Mobility Plans (2020)	✓
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	Not available
Cycling infrastructure in capital (2020)	300 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	76 km in 3 cities
Urban rail (LRT, metro, tram) (2020)	105 km in 2 cities
Bus rapid transit daily passenger volume (2020)	1717000
Rapid Transit to Resident Ratio (2019)	6

Passenger and Freight Railways

Rail network (2018)	17866 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion	✓
Rail travel activity (2017)	8361 million passenger-km
Rail freight activity (2017)	8377 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	7 systems
Electric scooter services (2020)	1 operator in 1 city
Carsharing services (2021)	1 service
National legal frameworks for shared mobility (2020)	Yes, in Buenos Aires
Autonomous vehicles in operation or in preparation (2020)	1
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 5
CO_2 emissions performance for LDVs (2017)	187 gCO_2/km
Emission standards for HDVs (2018)	Euro V
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	4
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	10% Biodiesel, 12% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	8.42%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	19.5 million people
Air freight activity (2019)	280.3 million ton-km
Carbon-accredited airports (2020)	1 airport
of which carbon neutral	None

Shipping

Liner shipping connectivity index (2019)	31.5
Container port traffic (2019)	1998822 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available
Examples	• Bus terminal expansion in Ushuaia and Rio Grande

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VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Australia

Australia is the largest emitter of transport CO_2 emissions in the Oceania region. In the past decade, transport CO_2 emissions have grown by 13%, mainly due to a strong increase in domestic freight activity.

The country focuses on improving urban passenger transport through the introduction of light-rail train systems and alternative energy sources for transport, such as hydrogen and electricity.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	25.5 million	85.9%	57 436
Growth (2010 to 2020)	15.1%	16.3%	26.3%

Income group: **High-income**

Human Development Index: **0.94**

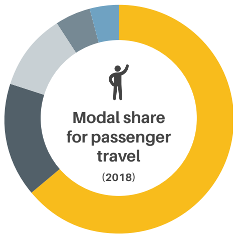
Mobility Demand Trends

Passenger travel activity

452 650

million passenger-km in 2018

+12% (2010 to 2018)

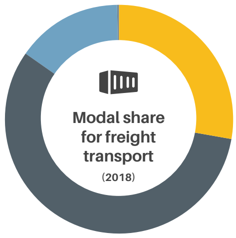


Freight transport activity

727 000

million ton-km in 2016

+29.5% (2010 to 2016)



Fuel consumption

33 994

thousand tonnes of oil equivalent

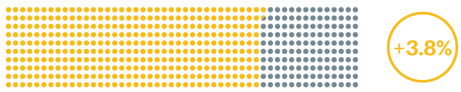
+13% (2010 to 2018)

Light Duty Vehicle average fuel consumption (2017)

7.9 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

723 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	799 263	-8.5%
Commercial	235 116	-5.1%

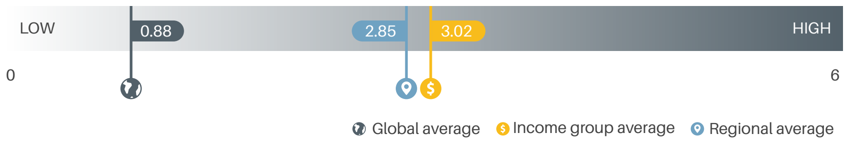
Diesel US cents per litre (2018): 119

Super gasoline US cents per litre (2018): 116

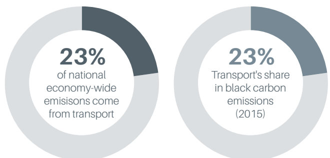
Transport Emission Trends

Transport CO_2 emissions (2019)
98.8 million tonnes

Per capita transport CO_2 emissions (2019)
3.9 tonnes

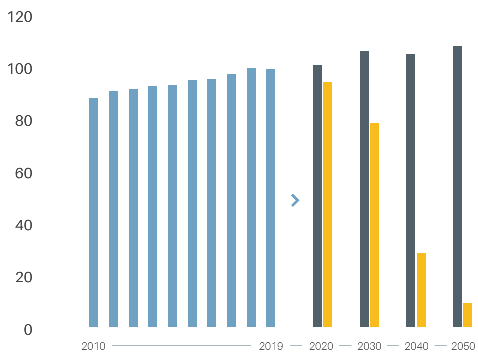


Second-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted:	1st and updated NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
VNR highlights transport	✓ 2018 VNR with transport linkages to SDG 3 and SDG 11



Transport CO_2 2010 to 2019: +13%

Business-as-Usual Scenario 2020 to 2050: +7%

Low Carbon Scenario 2020 to 2050: -90%

Transport measures in NDC

Mitigation

- Hydrogen
- General technical improvements

Adaptation

Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Targets	Objectives around productivity, sustainability and liveability
Sustainable Urban Mobility Plans (2020)	✗
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	Not on national level, but subnational (e.g. Queensland)
Targets	• Planning for walkable communities and places • Building connected, comfortable and safe walking environments for all • Encouraging more people to walk as part of their 'everyday' • Working together to deliver on walking
National cycling strategies (2020)	✓
Target	Double the number of people cycling
Cycling infrastructure in capital (2020)	Not available

Urban Passenger and Freight Transport

Bus rapid transit (2020)	90 km in 3 cities
Urban rail (LRT, metro, tram) (2020)	608 km in 7 cities
Bus rapid transit daily passenger volume (2020)	413 300
Rapid Transit to Resident Ratio (2019)	9.1

Passenger and Freight Railways

Rail network (2011)	8 829 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion (2020)	✓
Targets	• AUD 10 billion for passenger rail • Several targets in support of resilient rail freight
Rail travel activity (2018)	17 586 million passenger-km
Rail freight activity (2016)	413 490 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	22 systems
Electric scooter services (2020)	3 operators in 11 cities
Carsharing services (2021)	19 services
National legal frameworks for shared mobility (2020)	Varying by state
Autonomous vehicles in operation or in preparation (2020)	7
Autonomous vehicles strategies (2020)	✓

Fuel Economy

Emission standards for LDVs (2018)	Euro 6
CO_2 emissions performance for LDVs (2017)	188 gCO_2/km
Emission standards for HDVs (2018)	Euro VI
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	20 100
Market share of electric vehicles (2019)	1.1%
No. of cities with electric buses (2019)	1
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	1.86%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	76.9 million people
Air freight activity (2019)	1931.2 million ton-km
Carbon-accredited airports (2020)	12 airports
of which carbon neutral	1 airport

Shipping

Liner shipping connectivity index (2019)	34.3
Container port traffic (2019)	8 282 189 TEU

COVID-19

Traditional transport infrastructure investment	12.13 billion USD
Clean transport infrastructure investment	Not available
Examples	• Geelong to Melbourne railway line • Melbourne airport rail link • Infrastructure investment and road safety

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ICE	Internal combustion engine
LDV	Light-duty vehicle
LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Bolivia

Transport CO_2 emissions are growing at a very high rate in **Bolivia**, increasing by more than 80% since 2010. Due to an absence of transport policies, this trend can be expected to continue. No transport strategies or comprehensive frameworks have been identified in the country.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	11.7 million	69.4%	2579.9
Growth (2010 to 2020)	16.2%	22.9%	51.2%

Income group: **Middle-income**

Human Development Index: **0.72**

Mobility Demand Trends

Passenger travel activity

Not available

Freight transport activity

Not available

Fuel consumption (2018)

3 648

thousand tonnes of oil equivalent

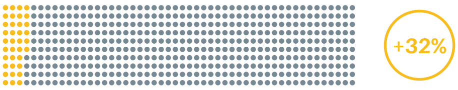
+65% (2010 to 2018)

Average light duty fuel economy consumption (2017)

Not available

Car ownership growth (2005 to 2015)

71.8 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	20 319	-10%
Commercial	9 565	-16%

Diesel US cents per litre (2018): 50

Super gasoline US cents per litre (2018): 70

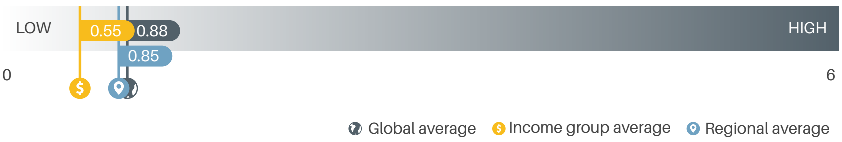
Transport Emission Trends

Transport CO_2 emissions (2019)

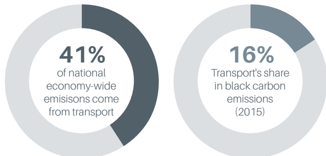
10.1 million tonnes

Per capita transport CO_2 emissions (2019)

0.9 tonnes

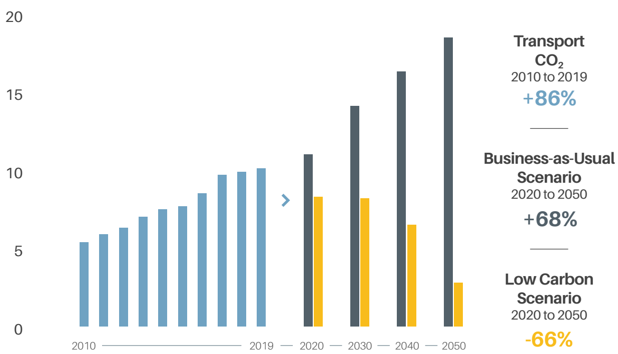


Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	Not available
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	×
Transport mitigation targets in NDC	×
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	Not submitted



Transport measures in NDC

Mitigation

- Not available

Adaptation

- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Not available
Sustainable Urban Mobility Plans (2020)	Not available
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	Not available
Cycling infrastructure in capital (2020)	78 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	Not available
Urban rail (LRT, metro, tram) (2020)	Not available
Bus rapid transit daily passenger volume (2020)	Not available
Rapid Transit to Resident Ratio (2019)	Not available

Passenger and Freight Railways

Rail network (2006)	1 244 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion (2000)	✓
Rail travel activity (2018)	Not available
Rail freight activity (2016)	Not available

Shared Mobility Services

Bike-sharing systems (2020)	Not available
Electric scooter services (2020)	Not available
Carsharing services (2021)	Not available
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 2
CO2 emissions performance for LDVs (2017)	Not available
Emission standards for HDVs (2018)	Not available
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	Not available
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	4.1 million people
Air freight activity (2019)	23.0 million ton-km
Carbon-accredited airports (2020)	✗
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	Not available
Container port traffic (2019)	Not available

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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Brazil

Brazil has seen transport emission growth aligned with the country's overall population growth and economic development. Transport is currently Brazil's largest CO_2-producing sector.

At the national level, transport policy is narrowly focused on supporting the use of biofuels in transport. On the local level, many cities are developing urban mobility plans, which are important tools to enable long-term sustainable mobility.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	212.6 million	87.6%	11 121.7
Growth (2010 to 2020)	8.6%	12.2%	6.26%

Income group: **Middle-income**

Human Development Index: **0.77**

Mobility Demand Trends

Passenger travel activity

15 807

million passenger-km in 2017

+4% (2013 to 2017)

Not Available

Freight transport activity

Not available

Not Available

Fuel consumption (2018)

83 448

thousand tonnes of oil equivalent

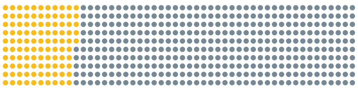
+19% (2010 to 2018)

Average light duty fuel economy consumption (2017)

7.6 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

207.5 vehicles per 1,000 people



+27%

Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	2 262 069	+7.6%
Commercial	525 781	+43.4%

Diesel US cents per litre (2018): 101

Super gasoline US cents per litre (2018): 125

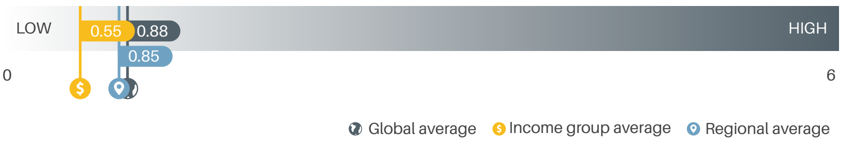
Transport Emission Trends

Transport CO_2 emissions (2019)

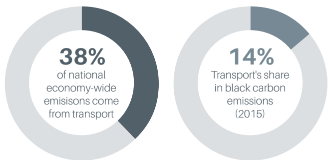
181.2 million tonnes

Per capita transport CO_2 emissions (2019)

0.9 tonnes

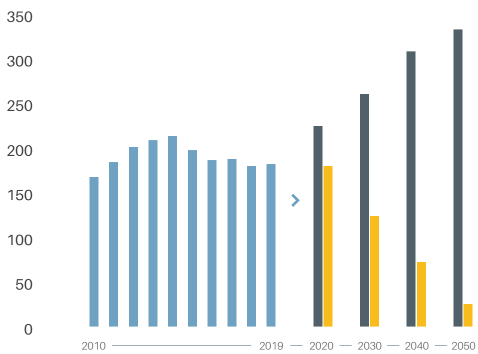


Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st and Updated NDC
NDC highlights transport for GHG mitigation	✗
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✗ 2017 VNR with no transport linkages



Transport CO_2 2010 to 2019 +8%

Business-as-Usual Scenario 2020 to 2050 +48%

Low Carbon Scenario 2020 to 2050 -86%

Transport measures in NDC

Mitigation

- Biofuels

Adaptation

- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Targets	• Reduce inequalities and promote social inclusion; • Promote access to basic services and facilities; • Improve access and mobility and promote sustainable development; • Ensure participatory proccesss and continuous improvement of urban mobility.
Sustainable Urban Mobility Plans (2020)	✓ Over 200 plans finalised
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling strategies combined under Active Mobility Plans
Targets	• Improve conditions for urban active mobility; • Foster the shift of users from private to active transport modes; • Improve and foster integration between sustainable transport modes.
Cycling infrastructure in capital (2020)	420 km

Urban Passenger and Freight Transport

Bus rapid transit (2020)	789 km in 22 cities
Urban rail (LRT, metro, tram) (2020)	308 km in 9 cities
Bus rapid transit daily passenger volume (2020)	10 634 415
Rapid Transit to Resident Ratio (2019)	12.1

Passenger and Freight Railways

Rail network (2007)	32 622 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion (2020)	✓
Targets	• Increase share of rail freight from 15 to 31% by 2025
Rail travel activity (2017)	15 807 million passenger-km
Rail freight activity (2007)	9 394 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	41 systems
Electric scooter services (2020)	1 operator in 1 city
Carsharing services (2021)	3 services
National legal frameworks for shared mobility (2020)	✓
Autonomous vehicles in operation or in preparation (2020)	1
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 4
CO_2 emissions performance for LDVs (2017)	179 gCO_2/km
Emission standards for HDVs (2018)	Euro V
Targeted CO_2 emissions performance	128 gCO_2/km by 2022

Electric Mobility

Electric vehicles (2019)	3 000
Market share of electric vehicles (2019)	0.1%
No. of cities with electric buses (2019)	9
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	11% Biodiesel, 27% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	23%
Targeted % of renewable energy	30% biodiesel and 10% biokerosene in aviation fuel by 2030

Aviation

Air passengers caried (2019)	102.9 million people
Air freight activity (2019)	1521.2 million ton-km
Carbon-accredited airports (2020)	4 airports
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	34.2
Container port traffic (2019)	10 982 130 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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LRT	Light-rail transit
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TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Canada

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	37.7 million	81.3%	51 834.5
Growth (2010 to 2020)	10.5%	10.9%	20.2%

Canada has kept transport emissions at relatively constant levels since 2010, despite strong increases in freight activity. The country has one of the world's highest car ownership rates, with nearly all passenger trips completed using private vehicles (passenger cars and light trucks).

The country envisions an end to the sale of diesel and gasoline vehicles by 2040. Several national and subnational strategies support this vision (for example, charging infrastructure along highways). Urban transport improvements are underway, but progress needs to accelerate to support transport decarbonisation.

Income group: **High-income**

Human Development Index: **0.93**

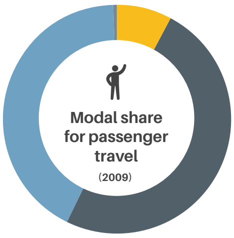
Mobility Demand Trends

Passenger travel activity

538 800

million passenger-km in 2009

+6.5% (2000 to 2009)

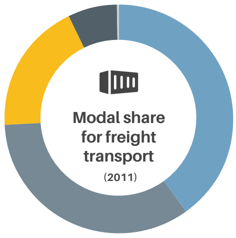


Freight transport activity

727 900

million ton-km in 2011

+19% (2000 to 2011)



Fuel consumption (2018)

68 194

thousand tonnes of oil equivalent

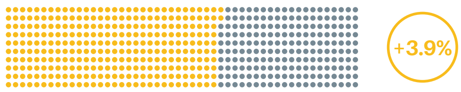
+12% (2010 to 2018)

Average light duty fuel economy consumption (2017)

8.9 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

645.7 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	496 603	-14%
Commercial	1 479 252	5.1%

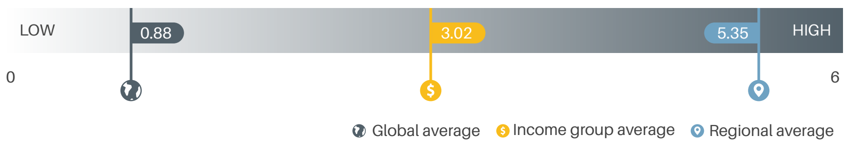
Diesel
US cents per litre (2018)
100

Super gasoline
US cents per litre (2018)
100

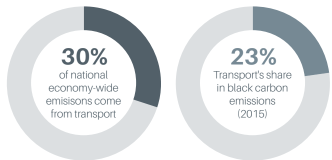
Transport Emission Trends

Transport CO_2 emissions (2019)
173.8 million tonnes

Per capita transport CO_2 emissions (2019)
4.7 tonnes

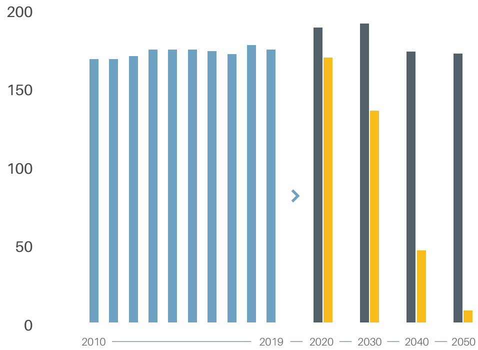


Second-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	✓
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2018 VNR with transport linkages to SDG 7 and SDG 8	



Transport CO_2
2010 to 2019
+3%

Business-as-Usual Scenario
2020 to 2050
-9%

Low Carbon Scenario
2020 to 2050
-96%

Transport measures in NDC

Mitigation

- Vehicle efficiency standards

Adaptation

- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Not available
Sustainable Urban Mobility Plans (2020)	Not available
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling combined in Guidance Document for Active Mobility
Targets	• Support local projects (since 2015 CAD 130 million in 126 projects).
Cycling infrastructure in capital (2020)	236 km of bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	246 km in 7 cities
Urban rail (LRT, metro, tram) (2020)	304 km in 6 cities
Bus rapid transit daily passenger volume (2020)	503 407
Rapid Transit to Resident Ratio (2019)	20.2

Passenger and Freight Railways

Rail network (2018)	47 687 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion	✓
Rail travel activity (2018)	1 598 million passenger-km
Rail freight activity (2019)	433 139 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	23 systems
Electric scooter services (2020)	2 operators in 5 cities
Carsharing services (2021)	67 services
National legal frameworks for shared mobility (2020)	Only on subnational level
Autonomous vehicles in operation or in preparation (2020)	9
Autonomous vehicles strategies (2020)	✓

Fuel Economy

Emission standards for LDVs (2018)	Euro 6
CO_2 emissions performance for LDVs (2017)	206 gCO_2/km
Emission standards for HDVs (2018)	Euro VI
Targeted CO_2 emissions performance	99 gCO_2/km by 2025

Electric Mobility

Electric vehicles (2019)	141 100
Market share of electric vehicles (2019)	3%
No. of cities with electric buses (2019)	9
ICE phase-out targets	2040

Renewable Energy

Biofuel blend mandate (2019)	2% Biodiesel, 5% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	4.2%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	93.4 million people
Air freight activity (2019)	2 395.1 million ton-km
Carbon-accredited airports (2020)	17 airports
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	42.8
Container port traffic (2019)	7 004 090 TEU

COVID-19

Traditional transport infrastructure investment	USD 1.76 billion
Clean transport infrastructure investment	USD 0.07 billion
Examples	• Public transport support

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Chile

A third of Chile's CO_2 emissions come from the transport sector, with transport CO_2 emission levels above the regional average. The country's motorisation rate is also relatively high.

Chile highlights the need for low-carbon mobility in several major strategies, outlining that transport decarbonisation can be achieved through e-mobility, public transport, and overall urban transport improvements. Transport strategies and frameworks are under development.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	19.1 million	84.8%	15 091.5
Growth (2010 to 2020)	12.0%	9.5%	30.9%

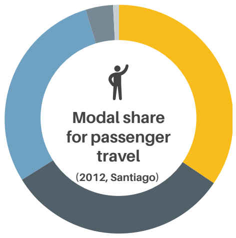
Income group: **High-income**

Human Development Index: **0.85**

Mobility Demand Trends

Passenger travel activity
Not available

Freight transport activity
Not available



Fuel consumption (2018)
9 477

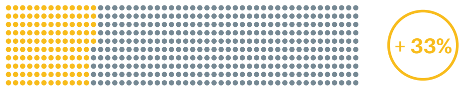
thousand tonnes of oil equivalent

+33% (2010 to 2018)

Average light duty fuel economy consumption (2017)

8 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)
250.2 vehicles per 1,000 people



Vehicle sales (2019)

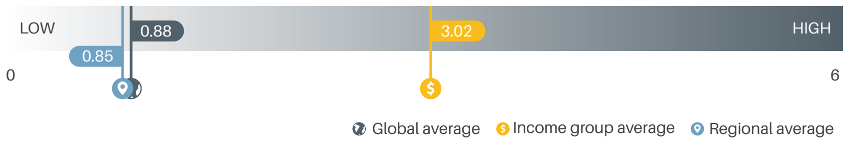
		(Growth 2010 to 2019)
Passenger	259 860	-17.6%
Commercial	85 652	-16.1%

Diesel	Super gasoline
US cents per litre (2018)	US cents per litre (2018)
96	123

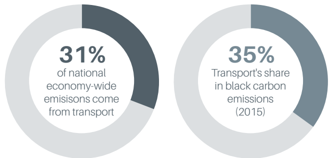
Transport Emission Trends

Transport CO_2 emissions (2019)
27.8 million tonnes

Per capita transport CO_2 emissions (2019)
1.5 tonnes

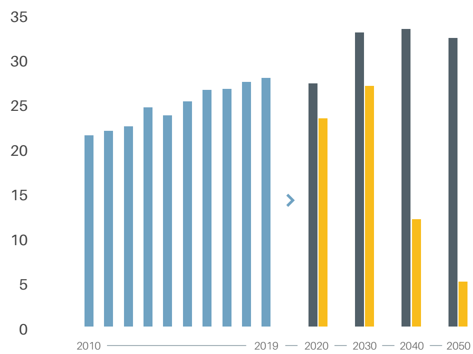


Second-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st and Updated NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✓
Reduce total black carbon emissions by at least 25% by 2030, with respect to 2016 levels	
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2019 VNR with transport linkages to SDG 9 and SDG 13	



Transport measures in NDC

Mitigation
- General e-mobility
- General public transport improvement
- Cycling measures
- Hydrogen

Adaptation
- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Sustainable Urban Mobility Plans (2020)	✓ in 37 cities
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling covered in local urban mobility plans
Cycling infrastructure in capital (2020)	36 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	105 km in 2 cities
Urban rail (LRT, metro, tram) (2020)	145 km in 2 cities
Bus rapid transit daily passenger volume (2020)	476 800
Rapid Transit to Resident Ratio (2019)	28

Passenger and Freight Railways

Rail network (2005)	2 120 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion (2020)	✓
Targets	• 25 new projects covering 1,000 km of railway lines • To triple number of passengers (to reach 150 million a year) by 2027 • To double freight volumes (to reach 21 million tons a year) by 2027
Rail travel activity (2018)	677 million passenger-km
Rail freight activity (2019)	3 079 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	7 systems
Electric scooter services (2020)	5 operators in 8 cities
Carsharing services (2021)	1 service
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	1
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 4
CO_2 emissions performance for LDVs (2017)	189 gCO_2/km
Emission standards for HDVs (2018)	Euro V
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	700
Market share of electric vehicles (2019)	0.1%
No. of cities with electric buses (2019)	4
ICE phase-out targets	Only buses by 2040

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	1%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	21.2 million people
Air freight activity (2019)	1232.4 million ton-km
Carbon-accredited airports (2020)	1 airport
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	35.7
Container port traffic (2019)	4 658 310 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	USD 0.08 billion
Examples	• Electric bus terminal

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HDV	Heavy-duty vehicle
ICE	Internal combustion engine
LDV	Light-duty vehicle
LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

China

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	1 439.3 million	60.8%	8 046.7
Growth (2010 to 2020)	5.2%	30.7%	89.5%

China emits the second-highest transport CO_2 emissions in the world, and has seen a growth of over 70% in transport emissions since 2010. However, in China, transport is only the fourth-largest CO_2-emitting sector.

China aims to become carbon-neutral by 2060. It has established frameworks to accomodate future growth while pursuing sustainable mobility. The country's most significant strategies are around the electrification of transport. In cities, urban mobility plans support zero-emission freight, walking and cycling.

Income group: **Middle-income**

Human Development Index: **0.76**

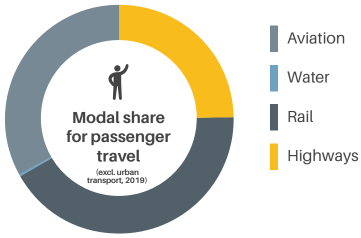
Mobility Demand Trends

Passenger travel activity

3 534 920

million passenger-km in 2019

+ 27% (2010 to 2019)

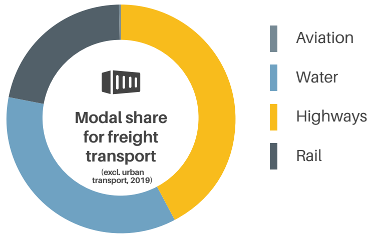


Freight transport activity

13 998 760

million ton-km in 2019

+ 49% (2010 to 2019)



Fuel consumption (2018)

324 599

thousand tonnes of oil equivalent

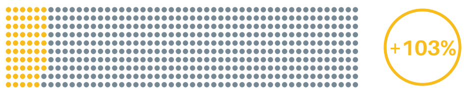
+65% (2010 to 2018)

Average light duty fuel economy consumption (2017)

7.6 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

115.9 vehicles per 1,000 people



Vehicle sales (2019)

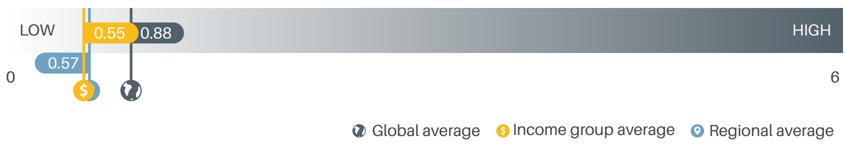
		(Growth 2010 to 2019)
Passenger	21 444 180	-9.6%
Commercial	4 324 497	-1.1%

Diesel US cents per litre (2018)	Super gasoline US cents per litre (2018)
106	118

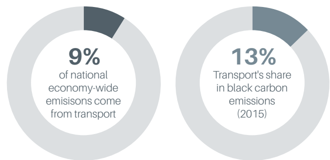
Transport Emission Trends

Transport CO_2 emissions (2019)
986.5 million tonnes

Per capita transport CO_2 emissions (2019)
0.69 tonnes

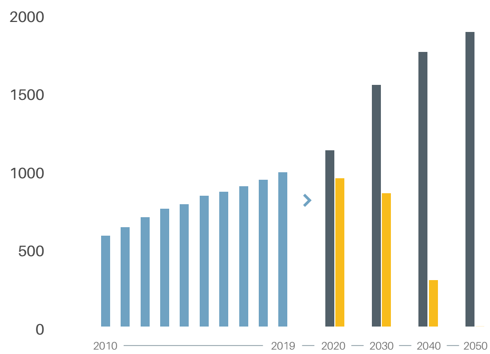


Fourth-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	×
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	× 2016 VNR with no transport linkages



Transport CO_2 2010 to 2019 **+70%**

Business-as-Usual Scenario 2020 to 2050 **+67%**

Low Carbon Scenario 2020 to 2050 **-100%**

Transport measures in NDC

Mitigation

- Fuel quality improvement
- Alternative fuels
- Walking measures
- Cycling measures
- Freight efficiency measures
- System improvements
- Comprehensive planning
- Public transport integration and expansion

Adaptation

- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Targets	• Building an integrated urban transport network • Implementing comprehensive urban transport systems • Aimed to increase the share of public transport to 30% of all motorised trips by 2020, including by promoting walking and cycling
Sustainable Urban Mobility Plans (2020)	✓
Low Emission Zones (2020)	11 cities

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling are part of the national transport strategy
Cycling infrastructure in capital (2020)	900 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	672 km in 20 cities
Urban rail (LRT, metro, tram) (2020)	6 100 km in 37 cities
Bus rapid transit daily passenger volume (2020)	4 375 250
Rapid Transit to Resident Ratio (2019)	13.9

Passenger and Freight Railways

Rail network (2019)	68 141 km
High-speed rail (2018)	29 904 km
High-speed rail travel activity (2019)	774.7 billion passenger-km
National plans for passenger and freight rail expansion (2020)	✓
Targets	• By 2035, expand overall rail network to 200,000 km; with 70,000 km of high-speed railways.
Rail travel activity (2017)	1 345 690 million passenger-km
Rail freight activity (2018)	2 882 100 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	650 systems
Electric scooter services (2020)	Not available
Carsharing services (2021)	14 services
National legal frameworks for shared mobility (2020)	✓
Autonomous vehicles in operation or in preparation (2020)	7
Autonomous vehicles strategies (2020)	✓

Fuel Economy

Emission standards for LDVs (2018)	Euro 4
CO_2 emissions performance for LDVs (2017)	175 gCO_2/km
Emission standards for HDVs (2018)	Euro IV
Targeted CO_2 emissions performance	93 gCO_2/km by 2025

Electric Mobility

Electric vehicles (2019)	3 349 100
Market share of electric vehicles (2019)	4.9%
No. of cities with electric buses (2019)	32
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	10% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	4.5%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	659.6 million people
Air freight activity (2019)	25 394.6 million ton-km
Carbon-accredited airports (2020)	6 airports
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	151.9
Container port traffic (2019)	242 030 000 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	USD 7.7 billion
Examples	• High-speed rail • Beijing light truck operation • Upgrade of ships • Rural transport infrastructure

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LDV	Light-duty vehicle
LRT	Light-rail transit
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TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Colombia

Colombia is experiencing a large increase in transport demand, fuel consumption, and related CO_2 emissions. Transport is the largest CO_2-emitting sector in the country, and emissions are above the average of other middle-income countries.

The country's national climate action plans outline a comprehensive set of sustainable transport measures. At the local level, Colombian cities are leading in BRT development. Recent transport developments focus on the implementation of subway systems and electrification of public buses. However, electric car uptake is still largely missing in Colombia, yet it is highly needed in order to address the poor CO_2-performance of the current road vehicle fleet.

Income group: **Middle-income**

Human Development Index: **0.77**

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	50.9 million	80.4%	7842.9
Growth (2010 to 2020)	12.5%	14.2%	38%

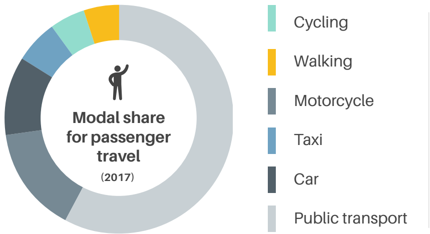
Mobility Demand Trends

Passenger travel activity

Not available

Freight transport activity

Not available



Fuel consumption (2018)

10 660

thousand tonnes of oil equivalent

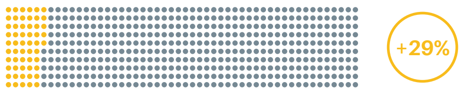
+47% (2010 to 2018)

Average light duty fuel economy consumption (2017)

Not available

Car ownership growth (2005 to 2015)

110.6 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	220 581	-0.22%
Commercial	28 108	10.1%

Diesel US cents per litre (2018)	**Super gasoline** US cents per litre (2018)
74	101

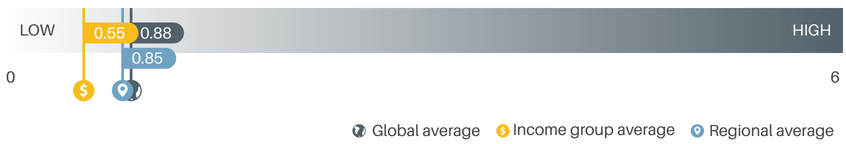
Transport Emission Trends

Transport CO_2 emissions (2019)

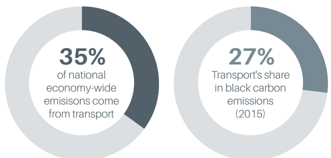
30.7 million tonnes

Per capita transport CO_2 emissions (2019)

0.6 tonnes

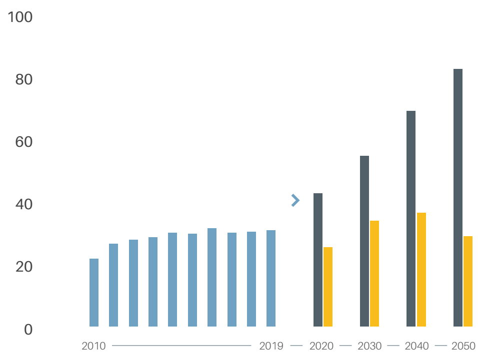


Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st and Updated NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	✓
Scenario envisions 600,000 electric vehicles by 2030	
Voluntary National Review highlights transport	✓
2016 VNR with transport linkages to SDG 3, SDG 8 and SDG 13	



Transport CO_2 2010 to 2019 **+41%**

Business-as-Usual Scenario 2020 to 2050 **+94%**

Low Carbon Scenario 2020 to 2050 **14%**

Transport measures in NDC

Mitigation

- General e-mobility
- Smart charging policies
- Vehicle efficiency standards
- Vehicle labelling
- EV purchase incentives
- General transport subsidies
- General logistic General aviation improvement
- General freight efficiency improvements
- Freight transport shifting to rail or inland
- Cycling measures
- Development density or intensiveness
- General infrastructure improvements
- Emission standards

Adaptation

- Information system (focusing on mobility)
- Risk assessment
- Transport planning for adaptation
- Monitoring
- Education and training
- Information system (focusing on mobility)

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Targets	• Pilot projects in medium-sized cities in development
Sustainable Urban Mobility Plans (2020)	✓
Low Emission Zones (2020)	✗

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling included in national development plan
Targets	• To develop a national action plan guiding walking and cycling promotion
Cycling infrastructure in capital (2020)	550 km of bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	225 km in 7 cities
Urban rail (LRT, metro, tram) (2020)	31 km in 1 city
Bus rapid transit daily passenger volume (2020)	3 071 541
Rapid Transit to Resident Ratio (2019)	9.8

Passenger and Freight Railways

Rail network (1994)	1 915 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion (2020)	✓
Targets	• Enhance the competitive advantages of railways • Double commercial operation length from 420 km to 1,077 km by 2024 • Implement intermodal cargo mobilization strategy
Rail travel activity (1990)	141 million passenger-km
Rail freight activity (1994)	2 216 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	16 systems
Electric scooter services (2020)	1 operator in 1 city
Carsharing services (2021)	2 services
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 2
CO2 emissions performance for LDVs (2017)	Not available
Emission standards for HDVs (2018)	Euro IV
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	3
ICE phase-out targets	2035

Renewable Energy

Biofuel blend mandate (2019)	10% Biodiesel, 10% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	7.2%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	37 million people
Air freight activity (2019)	1 547.7 million ton-km
Carbon-accredited airports (2020)	1 airport
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	45.4
Container port traffic (2019)	4 254 900 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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ICE	Internal combustion engine
LDV	Light-duty vehicle
LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Ecuador

In **Ecuador**, the growth of transport CO_2 emissions is outpacing economic growth. While the country's motorisation rate is very high, at the same time, in cities such as Quito, more than half of all trips are completed using collective transport.

Ecuador is working towards the implementation of comprehensive transport strategies. At the local level, a number of cities have ambitious plans to increase public transport and walking and cycling infrastructure. At the national level, an urban mobility plan is under development, but the country currently lacks sufficient frameworks to increase the efficiency of transport, such as fuel consumption standards and measures to promote electrification.

Income group: **Middle-income**

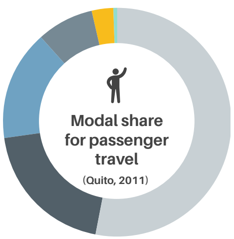
Human Development Index: **0.76**

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	17.6 million	63%	5097.1
Growth (2010 to 2020)	17.5%	18.8%	27.3%

Mobility Demand Trends

Passenger travel activity
Not available

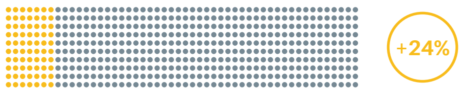
Freight transport activity
Not available



Fuel consumption (2018)
6 170
thousand tonnes of oil equivalent
+47% (2010 to 2018)

Average light duty fuel economy consumption (2017)
Not available

Car ownership growth (2005 to 2015)
140.4 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	98 597	-6.1%
Commercial	21 919	-14.8%

Diesel US cents per litre (2018): 27

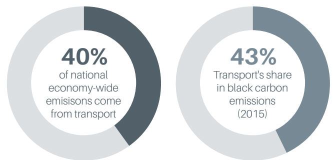
Super gasoline US cents per litre (2018): 79

Transport Emission Trends

Transport CO_2 emissions (2019)
16.3 million tonnes

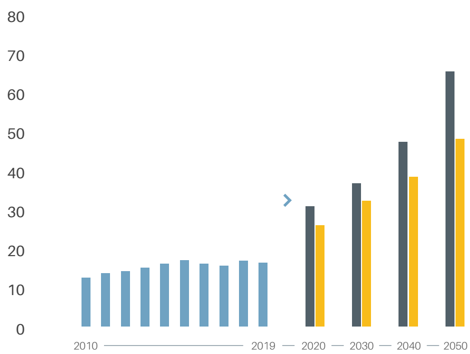
Per capita transport CO_2 emissions (2019)
0.9 tonnes

Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✗
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2020 VNR with transport linkages to SDG 3, SDG 7, SDG 9 and SDG 11	



Transport CO_2 2010 to 2019: +30%

Business-as-Usual Scenario 2020 to 2050: +112%

Low Carbon Scenario 2020 to 2050: 85%

Transport measures in NDC

Mitigation
- General e-mobility

Adaptation
- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	In development
Sustainable Urban Mobility Plans (2020)	Yes, several cities and will be further expanded
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	Not available
Cycling infrastructure in capital (2020)	136 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	117 km in 2 cities
Urban rail (LRT, metro, tram) (2020)	11 km in 1 city
Bus rapid transit daily passenger volume (2020)	1 055 000
Rapid Transit to Resident Ratio (2019)	21

Passenger and Freight Railways

Rail network (2000)	956 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion	Not available
Rail travel activity (2018)	Not available
Rail freight activity (2016)	Not available

Shared Mobility Services

Bike-sharing systems (2020)	1 system
Electric scooter services (2020)	Not available
Carsharing services (2021)	Not available
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 1
CO2 emissions performance for LDVs (2017)	Not available
Emission standards for HDVs (2018)	Euro II
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	2
ICE phase-out targets	✕

Renewable Energy

Biofuel blend mandate (2019)	5% Biodiesel, 10% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	0.32%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	4.8 million people
Air freight activity (2019)	50.8 million ton-km
Carbon-accredited airports (2020)	3 airports
of which carbon neutral	2 airports

Shipping

Liner shipping connectivity index (2019)	33.1
Container port traffic (2019)	2 096 300 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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Egypt

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	102.3 million	43%	3 008.8
Growth (2010 to 2020)	23.7%	21.7%	38%

Egypt has had a modest growth in transport CO_2 emissions in recent years. However, per capita transport emissions are twice as high as the regional average in Africa. Within Egypt, transport is the third-largest CO_2-emitting sector, and the country has relatively low levels of vehicle ownership. Egypt intends to improve road transport by implementing public transport and increasing the efficiency of vehicles. A shift of freight transport to rail is envisioned. However, the country lacks specific strategies to implement these measures and achieve transport decarbonisation.

Income group: **Middle-income**

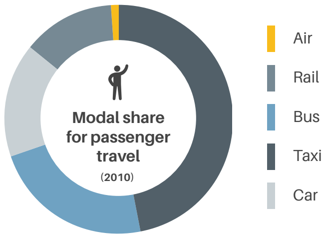
Human Development Index: **0.71**

Mobility Demand Trends

Passenger travel activity

1 021

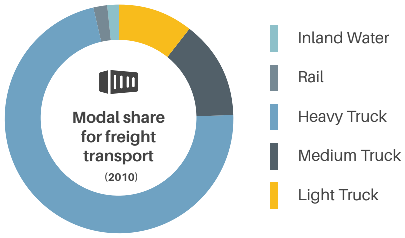
million passenger-km in 2012



Freight transport activity

211

million ton-km in 2012



Fuel consumption (2018)

18 000

thousand tonnes of oil equivalent

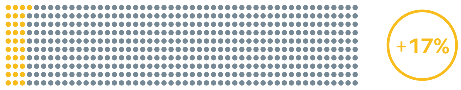
+21% (2010 to 2018)

Average light duty fuel economy consumption (2017)

8 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

61.1 vehicles per 1,000 people



Vehicle sales (2019)

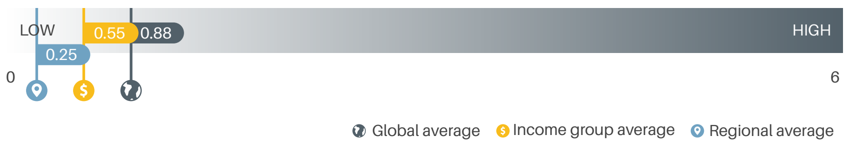
		(Growth 2010 to 2019)
Passenger	126 431	-13.3%
Commercial	43 569	12.9%

Diesel US cents per litre (2018)	**Super gasoline** US cents per litre (2018)
31	43

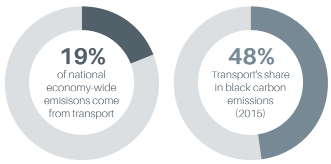
Transport Emission Trends

Transport CO_2 emissions (2019)
48.1 million tonnes

Per capita transport CO_2 emissions (2019)
0.5 tonnes

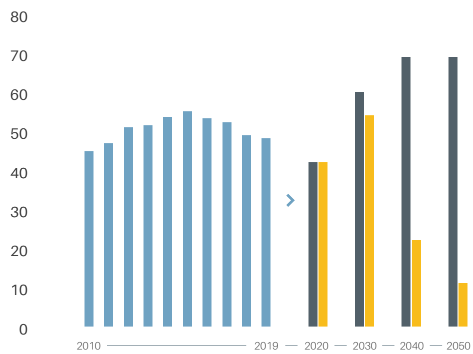


Third-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2018 VNR with transport linkages to SDG 7, SDG 8 and SDG 9	



Transport CO_2
2010 to 2019
+7%

Business-as-Usual Scenario
2020 to 2050
+64%

Low Carbon Scenario
2020 to 2050
-74%

Transport measures in NDC

Mitigation

- Freight transport shifting to rail or inland
- General public transport improvement
- General vehicle improvements

Adaptation

- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Not available
Sustainable Urban Mobility Plans (2020)	✓ Cairo Vision 2050
Targets	• A global, green and connected city
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	Not available
Cycling infrastructure in capital (2020)	Not available

Urban Passenger and Freight Transport

Bus rapid transit (2020)	Not available
Urban rail (LRT, metro, tram) (2020)	108 km in 2 cities
Bus rapid transit daily passenger volume (2020)	Not available
Rapid Transit to Resident Ratio (2019)	Not available

Passenger and Freight Railways

Rail network (2016)	5 153 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion	✓
Rail travel activity (2008)	40 837 million passenger-km
Rail freight activity (2010)	1 592 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	1 system
Electric scooter services (2020)	Not available
Carsharing services (2021)	Not available
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 2
CO_2 emissions performance for LDVs (2017)	187 gCO_2/km
Emission standards for HDVs (2018)	Euro II
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	0.2%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	13 million people
Air freight activity (2019)	483.4 million ton-km
Carbon-accredited airports (2020)	✗
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	66.7
Container port traffic (2019)	6 306 866 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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List of acronyms

GDP	Gross-domestic product
HDV	Heavy-duty vehicle
ICE	Internal combustion engine
LDV	Light-duty vehicle
LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

France

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	65.2 million	81.5%	45 630.8
Growth (2010 to 2020)	3.8%	7.7%	12.5%

France has been able to achieve an overall reduction of transport CO_2 emissions, which is currently the country's largest CO_2-emitting sector.

Several strategies support a transition to low-carbon mobility - at the national level, there are plans to upgrade high-speed rail service, and the country has set a target to ban the sale of new diesel and gasoline vehicles by 2040. At the local level, Paris is being transformed into a walking and cycling-oriented city, popularising the "15-minute city" concept. Several cities are also implementing zero-emission public transport and have expanded significantly on new mobility solutions.

Income group: High-income

Human Development Index: 0.9

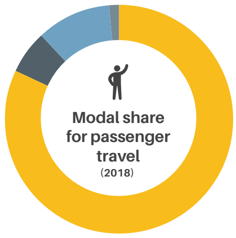
Mobility Demand Trends

Passenger travel activity

922 500

million passenger-km in 2018

+5% (2010 to 2018)

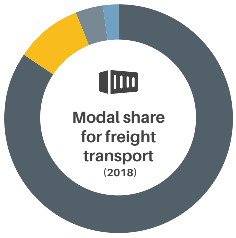


Freight transport activity

335 100

million ton-km in 2018

+40% (2010 to 2018)



Fuel consumption (2018)

45 310

thousand tonnes of oil equivalent

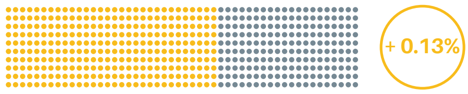
+4% (2010 to 2018)

Average light duty fuel economy consumption (2017)

5.3 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

599.7 vehicles per 1,000 people



Vehicle sales (2019)

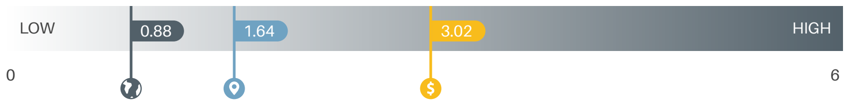
		(Growth 2010 to 2019)
Passenger	2 214 279	-1.9%
Commercial	479 698	-4.5%

Diesel	**Super gasoline**
US cents per litre (2018)	US cents per litre (2018)
168	168

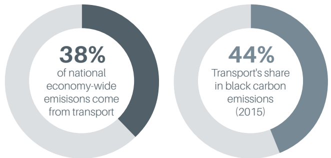
Transport Emission Trends

Transport CO_2 emissions (2019)
118.9 million tonnes

Per capita transport CO_2 emissions (2019)
1.83 tonnes

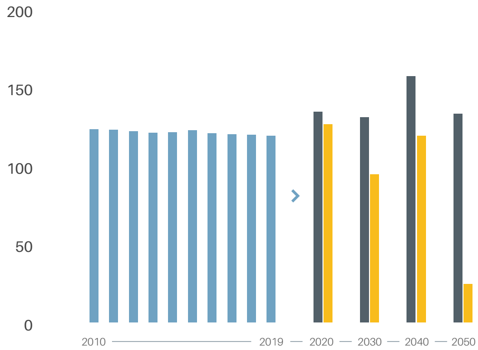


Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	✓
NDC submitted	✓
1st and Updated NDC as European Union	
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✓
CO_2 emissions per kilometre from new passenger cars sold to be reduced by 37.5% on average by 2030 (from 2021 levels), with new vans reduced by 31%, and new large lorries reduced by 30% (from 2019/2020 levels)	
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2016 VNR with transport linkages to SDG 11 and SDG 13	



Transport CO_2
2010 to 2019
-4%

Business-as-Usual Scenario
2020 to 2050
-1%

Low Carbon Scenario
2020 to 2050
-81%

Transport measures in NDC

Mitigation
- Vehicle efficiency standards

Adaptation
- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Targets	• Compulsory in urban areas of over 100,000 inhabitants
Sustainable Urban Mobility Plans (2020)	✓
Low Emission Zones (2020)	6 cities

Walking and Cycling

National walking strategies (2020)	Subnational level
National cycling strategies (2020)	✓
Targets	• Triple the modal share of cycling by 2024
Cycling infrastructure in capital (2020)	700 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	342 km in 21 cities
Urban rail (LRT, metro, tram) (2020)	Over 586 km in 30 cities
Bus rapid transit daily passenger volume (2020)	457 919
Rapid Transit to Resident Ratio (2019)	65.8

Passenger and Freight Railways

Rail network (2019)	5 923 km
High-speed rail (2018)	2 792 km
High-speed rail travel activity (2019)	60 billion passenger-km
National plans for passenger and freight rail expansion (2020)	✓
Targets	• Open rail market for competition and further improvement
Rail travel activity (2018)	107 920 million passenger-km
Rail freight activity (2019)	31 829 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	69 systems
Electric scooter services (2020)	7 operators in 12 cities
Carsharing services (2021)	23 services
National legal frameworks for shared mobility (2020)	Yes, on subnational level for electric scooters
Autonomous vehicles in operation or in preparation (2020)	7
Autonomous vehicles strategies (2020)	✓

Fuel Economy

Emission standards for LDVs (2018)	Euro 6
CO_2 emissions performance for LDVs (2017)	126 gCO_2/km
Emission standards for HDVs (2018)	Euro VI
Targeted CO_2 emissions performance	59 gCO_2/km by 2030

Electric Mobility

Electric vehicles (2019)	226 800
Market share of electric vehicles (2019)	2.8%
No. of cities with electric buses (2019)	7
ICE phase-out targets	2040

Renewable Energy

Biofuel blend mandate (2019)	7.5% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	9.5%
Targeted % of renewable energy	2.3% diesel fuel and 3.4% gasoline fuel from advanced biofuels by 2023

Aviation

Air passengers caried (2019)	71.3 million people
Air freight activity (2019)	4 522.6 million ton-km
Carbon-accredited airports (2020)	36 airports
of which carbon neutral	5 airports

Shipping

Liner shipping connectivity index (2019)	72.6
Container port traffic (2019)	5 871 100 TEU

COVID-19

Traditional transport infrastructure investment	USD 5.6 billion
Clean transport infrastructure investment	USD 1.5 billion
Examples	• Biking and public transport support • Infrastructure funding

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LDV	Light-duty vehicle
LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Germany

Transport is the second largest CO_2-emitting sector in **Germany** and no emission reductions have been recorded thus far. The large majority of transport activity is conducted through road transport, for both passengers and goods.

Supported by the European Union's climate action plan and important policy frameworks, Germany intends to drastically reduce transport CO_2 emissions by 2050. However, the country currently has only implemented a limited number of measures to initiate a transformational change of the transport system. National strategies for urban mobility, walking, cycling, and railways aim to improve the efficiency of transport.

Income group: **High-income**

Human Development Index: **0.95**

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	83.8 million	76.3%	47 408.9
Growth (2010 to 2020)	3.7%	2.7%	16.6%

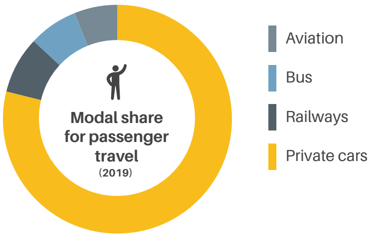
Mobility Demand Trends

Passenger travel activity

1 187 640

million passenger-km in 2019

+6% (2010 to 2019)

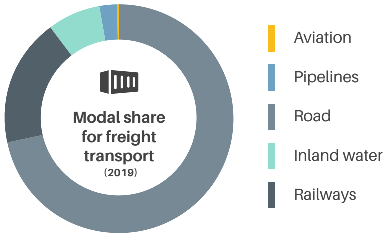


Freight transport activity

695 434

million ton-km in 2019

+14.5% (2010 to 2019)



Fuel consumption (2018)

56 140

thousand tonnes of oil equivalent

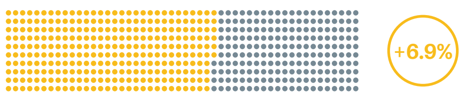
+6% (2010 to 2018)

Average light duty fuel economy consumption (2017)

5.9 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

592.7 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	3 607 258	5%
Commercial	409 801	6%

Diesel
US cents per litre (2018)

156

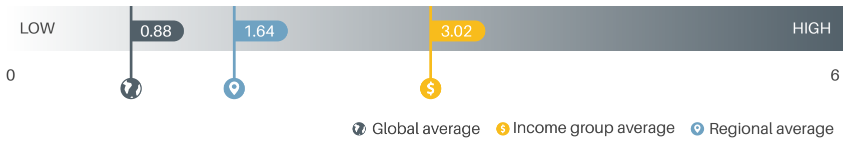
Super gasoline
US cents per litre (2018)

168

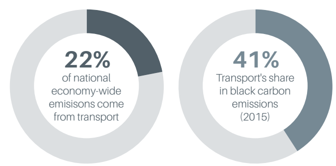
Transport Emission Trends

Transport CO_2 emissions (2019)
152.6 million tonnes

Per capita transport CO_2 emissions (2019)
1.8 tonnes

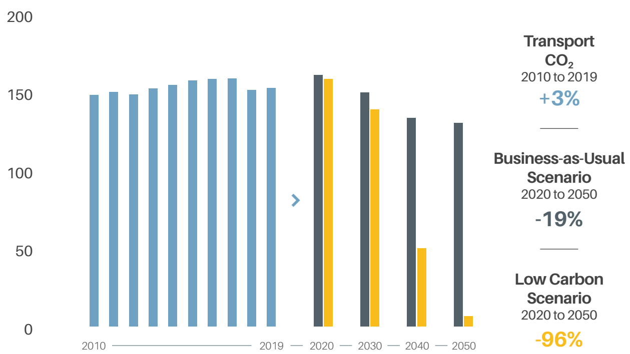


Second-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	✓
NDC submitted	✓
1st and Updated NDC as European Union	
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✓
CO_2 emissions per kilometre from new passenger cars sold to be reduced by 37.5% on average by 2030 (from 2021 levels), with new vans reduced by 31%, and new large lorries reduced by 30% (from 2019/2020 levels)	
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓ ✗
2016 VNR with transport linkages to SDG 7, SDG 9, SDG 11 and SDG 13	



Transport measures in NDC

Mitigation

- Vehicle efficiency standards

Adaptation

- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Sustainable Urban Mobility Plans (2020)	✓
Low Emission Zones (2020)	82 cities

Walking and Cycling

National walking strategies (2020)	✓
Targets	• Increase of foot traffic and more shorter ways
National cycling strategies (2020)	✓
Targets	• To make cycling more attractive and safer
Cycling infrastructure in capital (2020)	620 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	31 km in 2 cities
Urban rail (LRT, metro, tram) (2020)	Over 2200 km in 57 cities
Bus rapid transit daily passenger volume (2020)	42000
Rapid Transit to Resident Ratio (2019)	87.9

Passenger and Freight Railways

Rail network (2019)	33422 km
High-speed rail (2019)	2663 km
High-speed rail travel activity (2019)	33.2 billion passenger-km
National plans for passenger and freight rail expansion (2020)	✓
Targets	• Modernising and maintaining as well as building and expanding the rail network
Rail travel activity (2019)	98000 million passenger-km
Rail freight activity (2019)	113114 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	106 systems
Electric scooter services (2020)	9 operators in 52 cities
Carsharing services (2021)	1646 services
National legal frameworks for shared mobility (2020)	✓
Autonomous vehicles in operation or in preparation (2020)	4
Autonomous vehicles strategies (2020)	✓

Fuel Economy

Emission standards for LDVs (2018)	Euro 6
CO_2 emissions performance for LDVs (2017)	140 gCO_2/km
Emission standards for HDVs (2018)	Euro VI
Targeted CO_2 emissions performance	59 gCO_2/km by 2030

Electric Mobility

Electric vehicles (2019)	258800
Market share of electric vehicles (2019)	3%
No. of cities with electric buses (2019)	14
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	10% Biodiesel, 10% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	6.7%
Targeted % of renewable energy	0.05% advanced biofuels from 2020 and 0.5% by 2025

Aviation

Air passengers caried (2019)	109.6 million people
Air freight activity (2019)	7763.6 million ton-km
Carbon-accredited airports (2020)	5 airports
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	82.8
Container port traffic (2019)	19596420 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	USD 2.97 billion
Examples	• Public transport infrastructure and service support

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Ghana

Since 2010, transport CO_2 emissions have increased by over two thirds in **Ghana.** It is the largest CO_2-emitting sector in the country, but there are currently no comprehensive strategies in place to establish a pathway towards low carbon, sustainable transport. Recent transport developments have been limited to improvements in rail transport. In urban areas, formal public transport, as well as frameworks for walking, cycling, and other efficient transport modes are lacking.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	31.1 million	56.7%	1 884.3
Growth (2010 to 2020)	25.4%	41.8%	78.1%

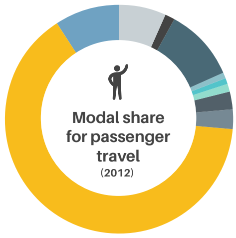
Income group: **Middle-income**

Human Development Index: **0.61**

Mobility Demand Trends

Passenger travel activity
Not available

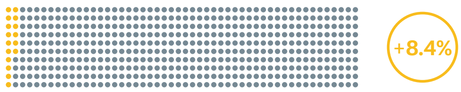
Freight transport activity
Not available



Fuel consumption (2018)
2 685
thousand tonnes of oil equivalent
+57% (2010 to 2018)

Average light duty fuel economy consumption (2017)
Not available

Car ownership growth (2005 to 2015)
32.2 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	3 394	-20.5%
Commercial	2 306	-17.8%

Diesel
US cents per litre (2018)
107

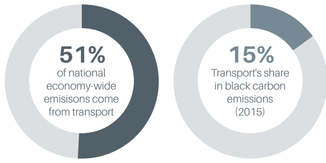
Super gasoline
US cents per litre (2018)
118

Transport Emission Trends

Transport CO_2 emissions (2019)
8.6 million tonnes

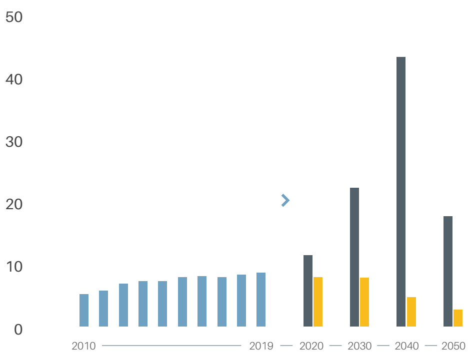
Per capita transport CO_2 emissions (2019)
0.3 tonnes

Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2019 VNR with transport linkages to SDG 3	



Transport CO_2
2010 to 2019
+67%

Business-as-Usual Scenario
2020 to 2050
+54%

Low Carbon Scenario
2020 to 2050
-66%

Transport measures in NDC

Mitigation
- Public transport integration and expansion
- Standards for urban mobility planning

Adaptation
- Transport infrastructure resilience

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Not available
Sustainable Urban Mobility Plans (2020)	Not available
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling combined in Guidance Document for NMT-Planning
Targets	• Goals suggested for improvements in environments to support walking and cycling
Cycling infrastructure in capital (2020)	Not available

Urban Passenger and Freight Transport

Bus rapid transit (2020)	Not available
Urban rail (LRT, metro, tram) (2020)	Not available
Bus rapid transit daily passenger volume (2020)	Not available
Rapid Transit to Resident Ratio (2019)	Not available

Passenger and Freight Railways

Rail network (2006)	953 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion	✓
Targets	• 6-part phase rehabilitation and expansion plan to develop nation-wide railway system
Rail travel activity (2006)	85 million passenger-km
Rail freight activity (2006)	181 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	Not available
Electric scooter services (2020)	Not available
Carsharing services (2021)	Not available
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Not available
CO2 emissions performance for LDVs (2017)	Not available
Emission standards for HDVs (2018)	Not available
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	Less than 0.1%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	0.6 million people
Air freight activity (2019)	Not available
Carbon-accredited airports (2020)	✗
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	19.8
Container port traffic (2019)	1 100 205 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

India

India has experienced a large increase in transport activity in line with the country's economic growth. Passenger travel more than doubled and car ownership levels increased by 50% between 2005 and 2015. Transport is the county's third-largest CO_2-emitting sector, and the most dominant mode is road transport.

India has set up significant frameworks to improve urban mobility and accelerate the uptake of electrified transport, including electric-powered rickshaws. The railway sector has experienced a strong increase in electrification, and domestic freight transport is shifting towards rail.

Income group: **Middle-income**

Human Development Index: **0.65**

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	1380 million	35%	2 169.1
Growth (2010 to 2020)	11.8%	26.9%	76.9%

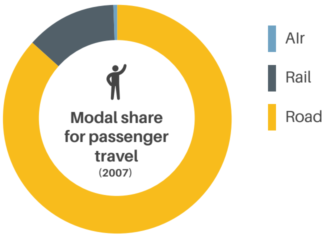
Mobility Demand Trends

Passenger travel activity

20 879 333

million passenger-km in 2017

+ 122% (2010 to 2017)

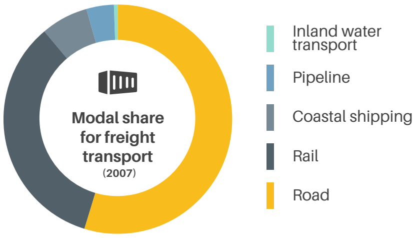


Freight transport activity

3 094 502

million ton-km in 2017

+ 51% (2010 to 2017)



Fuel consumption (2018)

103 767

thousand tonnes of oil equivalent

+60% (2010 to 2018)

Average light duty fuel economy consumption (2017)

5.6 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

22 vehicles per 1,000 people

+51%

Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	2 962 052	-12.8%
Commercial	854 839	-15%

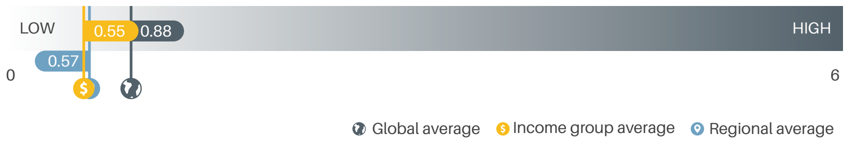
Diesel US cents per litre (2018): 100

Super gasoline US cents per litre (2018): 107

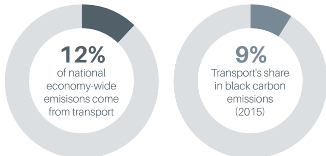
Transport Emission Trends

Transport CO_2 emissions (2019)
306.8 million tonnes

Per capita transport CO_2 emissions (2019)
0.2 tonnes

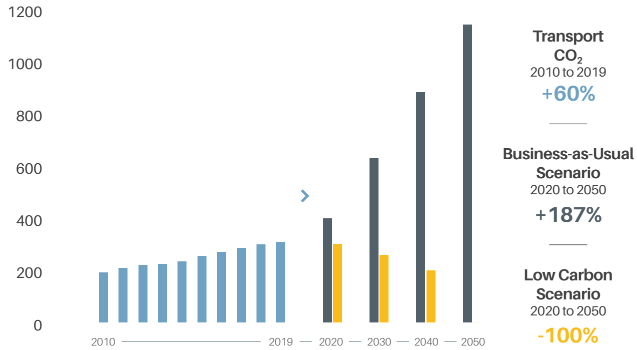


Third-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2020 VNR with transport linkages to SDG 5, SDG 11 and SDG 13	



Transport measures in NDC

Mitigation

- Expansion of infrastructure
- General shipping improvement
- Electric vehicles
- Biofuels
- Emission standards
- Fossil fuel subsidy removal
- Use of renewable energy
- Expansion of infrastructure
- Public transport integration and expansion

Adaptation

- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Targets	• People-centered urban development • Low-carbon transport growth
Sustainable Urban Mobility Plans (2020)	✓
Low Emission Zones (2020)	1 city

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling combined in Guidance Document for NMT-Planning
Targets	• No specific modal share targets
Cycling infrastructure in capital (2020)	No separated bikelanes currently, network of 200 km planned

Urban Passenger and Freight Transport

Bus rapid transit (2020)	228 km in 9 cities
Urban rail (LRT, metro, tram) (2020)	485 km in 11 cities
Bus rapid transit daily passenger volume (2020)	497 411
Rapid Transit to Resident Ratio (2019)	4.4

Passenger and Freight Railways

Rail network (2019)	68155 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion (2020)	✓
Targets	• Increase the rail modal share for freight from 27% to 45% by 2030 and achieve net-zero carbon emissions by 2030
Rail travel activity (2017)	1 161 333 million passenger-km
Rail freight activity (2017)	654 285 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	30 systems
Electric scooter services (2020)	1 operator in 6 cities
Carsharing services (2021)	58 services
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 3
CO_2 emissions performance for LDVs (2017)	135 gCO_2/km
Emission standards for HDVs (2018)	Euro IV
Targeted CO_2 emissions performance	113 gCO_2/km by 2022

Electric Mobility

Electric vehicles (2019)	11 200
Market share of electric vehicles (2019)	0.1%
No. of cities with electric buses (2019)	12
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	20% Biodiesel, 10% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	2.4%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	167.5 million people
Air freight activity (2019)	1 938.2 million ton-km
Carbon-accredited airports (2020)	8 airports
of which carbon neutral	3 airports

Shipping

Liner shipping connectivity index (2019)	55.5
Container port traffic (2019)	17 053 200 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available
Examples	• Investments in electric buses and charging stations

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List of acronyms

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ICE	Internal combustion engine
LDV	Light-duty vehicle
LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Indonesia

Indonesia has seen a strong growth in transport activity and related CO_2 emissions. Cities are becoming increasingly congested with traffic, and Jakarta, for example, is responding by providing public transport. The first subway service opened in Jakarta in 2019 and the city has several strategies to develop sustainable urban mobility.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	273.5 million	56.4%	4 450.7
Growth (2010 to 2020)	13.1%	27.4%	59.5%

Income group: **Middle-income**

Human Development Index: **0.72**

Mobility Demand Trends

Passenger travel activity

114 202

million passenger-km in 2018

+43% (2010 to 2018)

Freight transport activity

22 892

million ton-km in 2018

+26% (2010 to 2018)

Fuel consumption (2018)

54 378

thousand tonnes of oil equivalent

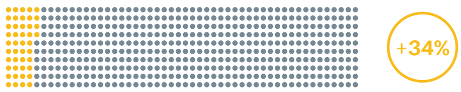
+80% (2010 to 2018)

Average light duty fuel economy consumption (2017)

7.9 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

87.2 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	798 813	-9%
Commercial	244 204	-10.9%

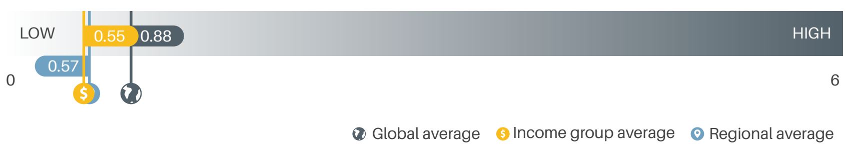
Diesel US cents per litre (2018): 66

Super gasoline US cents per litre (2018): 83

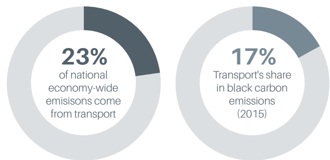
Transport Emission Trends

Transport CO_2 emissions (2019)
141 million tonnes

Per capita transport CO_2 emissions (2019)
0.5 tonnes

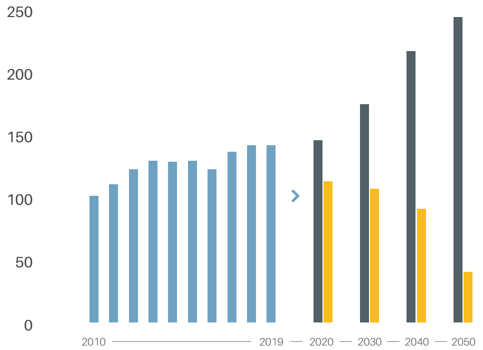


Second-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	Not available
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✗
2019 VNR with transport linkages to SDG 7, SDG 8 and SDG 9	



Transport CO_2 2010 to 2019
+39%

Business-as-Usual Scenario 2020 to 2050
+68%

Low Carbon Scenario 2020 to 2050
-64%

Transport measures in NDC

Mitigation
- Biofuels

Adaptation
- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Targets	• People-centered urban development • Low-carbon transport growth
Sustainable Urban Mobility Plans (2020)	In Development
Targets	• GHG mitigation: 0.9 to 1.7 Mt CO_2e per year by 2030 (up to 13.9 Mt CO_2e in total) in pilot cities • To leverage financing of EUR 100 million
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling combined in Guidance Document for NMT-Planning
Cycling infrastructure in capital (2020)	86 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	207 km in 1 city
Urban rail (LRT, metro, tram) (2020)	220 km in 2 cities
Bus rapid transit daily passenger volume (2020)	370 000
Rapid Transit to Resident Ratio (2019)	7

Passenger and Freight Railways

Rail network (2018)	5 483 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion	✓
Targets	• 10,524 km national railways in 2030 including 3,755 km urban railways • Railway share to increase to 7-9% for passenger and 11-13% for freight transport
Rail travel activity (2018)	16 932 million passenger-km
Rail freight activity (2018)	15 091 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	5 systems
Electric scooter services (2020)	Not available
Carsharing services (2021)	10 services
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 2
CO_2 emissions performance for LDVs (2017)	184 gCO_2/km
Emission standards for HDVs (2018)	Not available
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	30% Biodiesel, 3% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	5.3%
Targeted % of renewable energy	30% biodiesel, 20% ethanol and 5% biofuel in aviation fuel by 2025

Aviation

Air passengers caried (2019)	91.3 million people
Air freight activity (2019)	981.7 million ton-km
Carbon-accredited airports (2020)	✗
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	44.4
Container port traffic (2019)	14 763 630 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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WLTP	Worldwide harmonised light vehicles test procedure

Iran

Transport is only the fourth-largest CO_2-emitting sector in **Iran,** but the per capita levels are above the regional average for Asia. Energy sources are based on fossil fuels.

No specific transport strategies have been identified for Iran, but the country has plans to expand railways and build high-speed rail. Tehran is working on improving the quality of life of residents by reducing air pollution and increasing cycling and walking.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	84 million	75.5%	5 922.5
Growth (2010 to 2020)	13.9%	20.4%	-10.3%

Income group: **Middle-income**

Human Development Index: **0.78**

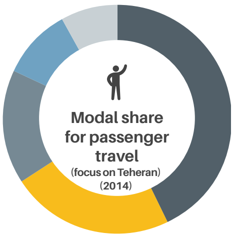
Mobility Demand Trends

Passenger travel activity

13 272

million passenger-km in 2018

-24.5% (2010 to 2018)



Freight transport activity

30 299

million ton-km in 2018

+ 39% (2010 to 2018)

Fuel consumption (2018)

48 100

thousand tonnes of oil equivalent

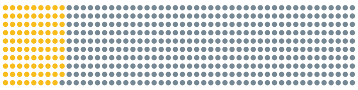
+20% (2010 to 2018)

Average light duty fuel economy consumption (2017)

Not available

Car ownership growth (2005 to 2015)

178 vehicles per 1,000 people



+ 45%

Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	619 028	-32.2%
Commercial	36 487	-22.5%

Diesel
US cents per litre (2018)

7

Super gasoline
US cents per litre (2018)

29

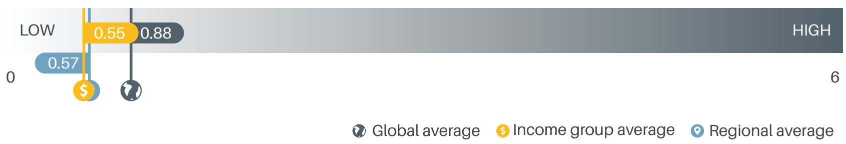
Transport Emission Trends

Transport CO_2 emissions (2019)

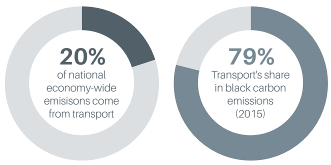
138.5 million tonnes

Per capita transport CO_2 emissions (2019)

1.7 tonnes

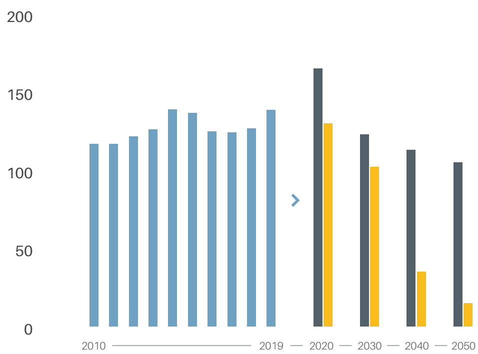


Fourth-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	Not available
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	Not submitted
NDC highlights transport for GHG mitigation	×
Transport mitigation targets in NDC	×
Other non-emission related transport targets in NDC	Not submitted
Voluntary National Review highlights transport	× 2017 VNR with no transport linkages



Transport CO_2
2010 to 2019
+19%

Business-as-Usual Scenario
2020 to 2050
-36%

Low Carbon Scenario
2020 to 2050
-88%

Transport measures in NDC

Mitigation
- Not available

Adaptation
- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Not available
Sustainable Urban Mobility Plans (2020)	Not available
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking and cycling strategies (2020)	Not identified on national level but strong ambitions in Teheran
Cycling infrastructure in capital (2020)	550 km of separated bikelanes by 2040

Urban Passenger and Freight Transport

Bus rapid transit (2020)	165 km in 3 cities
Urban rail (LRT, metro, tram) (2020)	134 km in 5 cities
Bus rapid transit daily passenger volume (2020)	2 135 000
Rapid Transit to Resident Ratio (2019)	9.4

Passenger and Freight Railways

Rail network (2018)	9 146 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion	✓
Targets	• By 2025, 5000 km railway network with approximately 6000 km double-tracked, • Total capacity for passenger transport to be increased to 160 million, • Carrying 220 million tons of cargo, • Railway market share in cargo transport to be 30% and 18% for passenger transport
Rail travel activity (2018)	15 239 million passenger-km
Rail freight activity (2016)	34 859 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	Not available
Electric scooter services (2020)	Not available
Carsharing services (2021)	Not available
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 2
CO2 emissions performance for LDVs (2017)	Not available
Emission standards for HDVs (2018)	Not available
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✕

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	Not available
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	21.6 million people
Air freight activity (2019)	152.3 million ton-km
Carbon-accredited airports (2020)	✕
of which carbon neutral	✕

Shipping

Liner shipping connectivity index (2019)	19.8
Container port traffic (2019)	1 516 900 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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Italy

Italy has experienced a decline in transport CO_2 emissions thanks to their strong planning frameworks supporting the management and improvement of urban transport. Every municipality over 100,000 inhabitants develops sustainable urban mobility plans. Additional actions are supported on the EU-level, enabling a transition towards low carbon mobility.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	60.5 million	69.5%	35 465.2
Growth (2010 to 2020)	1.9%	2.9%	0.6%

Income group: High-income

Human Development Index: 0.89

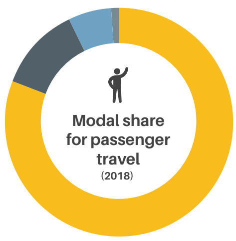
Mobility Demand Trends

Passenger travel activity

888 200

million passenger-km in 2018

+ 3.5% (2010 to 2018)

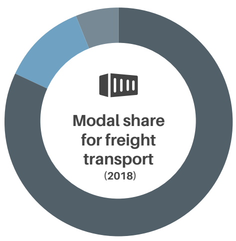


Freight transport activity

178 500

million ton-km in 2018

-13% (2010 to 2018)



Fuel consumption (2018)

35 579

thousand tonnes of oil equivalent

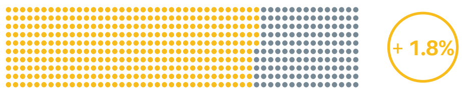
-8% (2010 to 2018)

Average light duty fuel economy consumption (2017)

5.2 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

709.9 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	1 916 320	0.3%
Commercial	215 596	1.8%

Diesel	Super gasoline
US cents per litre (2018)	US cents per litre (2018)
175	184

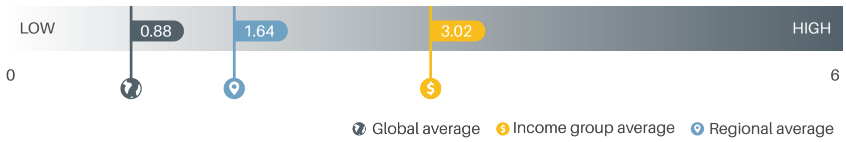
Transport Emission Trends

Transport CO_2 emissions (2019)

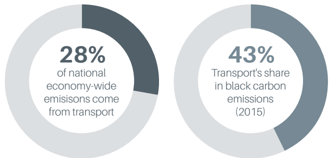
93 million tonnes

Per capita transport CO_2 emissions (2019)

1.5 tonnes

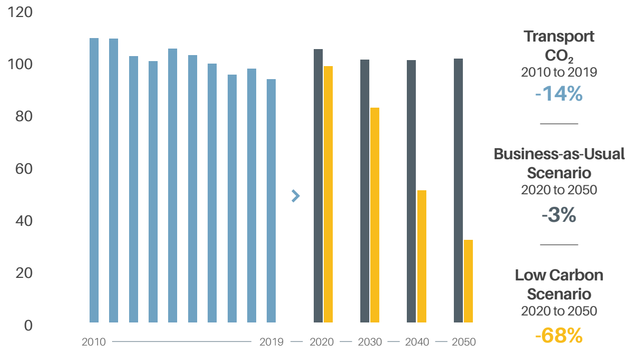


Second-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	✓
1st and updated NDC as European Union	
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✓
CO_2 emissions per kilometre from new passenger cars sold to be reduced by 37.5% on average by 2030 (from 2021 levels), with new vans reduced by 31%, and new large lorries reduced by 30% (from 2019/2020 levels)	
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✗



Transport measures in NDC

Mitigation

- Vehicle efficiency standards

Adaptation

- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Targets	• Required for every city above 100,000 population
Sustainable Urban Mobility Plans (2020)	✓ over 90 SUMPs adopted or approved
Targets	• Overall objectives to improve air quality and reduce transport GHG emissions
Low Emission Zones (2020)	112 cities

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	Not available
Cycling infrastructure in capital (2020)	225 km of bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	Not available
Urban rail (LRT, metro, tram) (2020)	289 km in 16 cities
Bus rapid transit daily passenger volume (2020)	Not available
Rapid Transit to Resident Ratio (2019)	12.7

Passenger and Freight Railways

Rail network (2019)	16 779 km
High-speed rail (2018)	3 676 km
High-speed rail travel activity (2018)	15 billion passenger-km
National plans for passenger and freight rail expansion (2020)	✓
Targets	• By 2023, Accommodate 70 million more passengers per year, • Add more than 700 new train vehicles, the majority freight wagons, • Each year, support the removal of 400,000 cars from the road and reduce CO_2 emissions by 600 million kg
Rail travel activity (2017)	55 493 million passenger-km
Rail freight activity (2019)	21 309 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	166 systems
Electric scooter services (2020)	8 operators in 17 cities
Carsharing services (2021)	126 services
National legal frameworks for shared mobility (2020)	On subnational level (Milan as example)
Autonomous vehicles in operation or in preparation (2020)	1
Autonomous vehicles strategies (2020)	✓

Fuel Economy

Emission standards for LDVs (2018)	Euro 6
CO_2 emissions performance for LDVs (2017)	124 gCO_2/km
Emission standards for HDVs (2018)	Euro VI
Targeted CO_2 emissions performance	59 gCO_2/km by 2030

Electric Mobility

Electric vehicles (2019)	40 274
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	9
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	Overall 7%
Renewable energy (biofuels and electricity) share in transport (2018)	6.3%
Targeted % of renewable energy	0.9% advanced biofuels by 2020, 1.85% by 2022

Aviation

Air passengers caried (2019)	27.8 million people
Air freight activity (2019)	1 345 million ton-km
Carbon-accredited airports (2020)	14 airports
of which carbon neutral	7 airports

Shipping

Liner shipping connectivity index (2019)	72.8
Container port traffic (2019)	10 014 210 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	USD 0.24 billion
Examples	• Funding to support transport activities • Incentives for the purchase of a new car • Local public transport support

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List of acronyms

GDP	Gross-domestic product
HDV	Heavy-duty vehicle
ICE	Internal combustion engine
LDV	Light-duty vehicle
LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Japan

Japan as a high-income and high-urbanised country is successful on reducing transport CO_2 emissions by providing a very efficient transport system, strong rail transport and high density cities. Japan has regulations (e.g. the Low Carbon City Act) prioritising sustainable mobility and long-term vision aim to transition the vehicle fleet to zero-emission vehicle by 2050.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	126.5 million	91.8%	48 957
Growth (2010 to 2020)	-1.6%	-0.6%	9%

Income group: **High-income**

Human Development Index: **0.92**

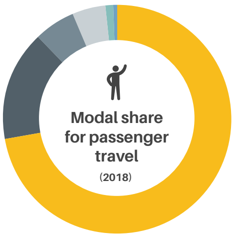
Mobility Demand Trends

Passenger travel activity

611 250

million passenger-km in 2018

+11% (2010 to 2018)

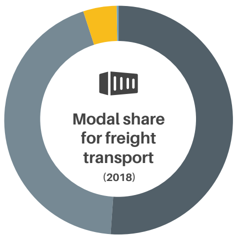


Freight transport activity

409 902

million ton-km in 2018

-7.7% (2010 to 2018)



Fuel consumption (2018)

70 549

thousand tonnes of oil equivalent

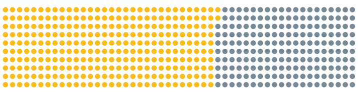
-10% (2010 to 2018)

Average light duty fuel economy consumption (2017)

6.2 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

604.8 vehicles per 1,000 people



+ 3.2%

Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	4 301 091	-2.1%
Commercial	894 125	1.5%

Diesel US cents per litre (2018)	**Super gasoline** US cents per litre (2018)
110	129

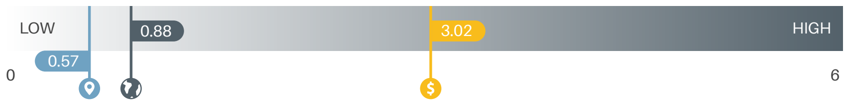
Transport Emission Trends

Transport CO_2 emissions (2019)

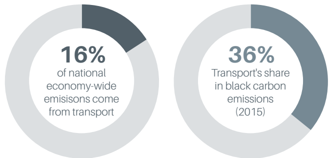
187.2 million tonnes

Per capita transport CO_2 emissions (2019)

1.5 tonnes

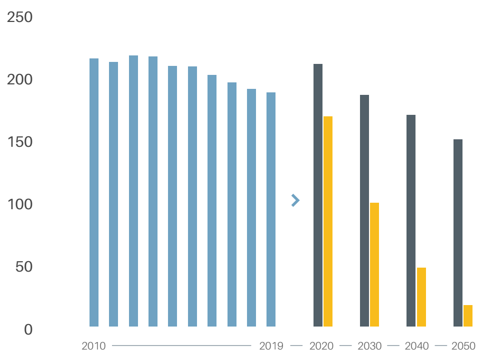


Third-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	✓
NDC submitted	1st and Updated NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	27% below 2013 (163 million tCO_2 less by 2030)
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	×



Transport CO_2 2010 to 2019 **-13%**

Business-as-Usual Scenario 2020 to 2050 **-29%**

Low Carbon Scenario 2020 to 2050 **-90%**

Transport measures in NDC

Mitigation

- General fuel improvement policies
- General vehicle improvements
- General innovations and digitalisation
- National mobility plans

Adaptation

- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Targets	• Support activities of local governments through grants to develop comprehensive transport strategy
Sustainable Urban Mobility Plans (2020)	No but Low Carbon City Act
Targets	• Realize compact urban structure • Promote measures to address traffic flow • Promote the use of public transport
Low Emission Zones (2020)	1 city

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	✓
Cycling infrastructure in capital (2020)	10 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	29 km of BRT in 2 cities
Urban rail (LRT, metro, tram) (2020)	Over 1 000 km in 26 cities
Bus rapid transit daily passenger volume (2020)	9 100
Rapid Transit to Resident Ratio (2019)	18.7

Passenger and Freight Railways

Rail network (2018)	19 123 km
High-speed rail (2018)	2 848 km
High-speed rail travel activity (2018)	103.7 billion passenger-km
National plans for passenger and freight rail expansion	✓
Targets	• 25% energy consumption reduction of 2014 levels by 2031
Rail travel activity (2018)	437 363 million passenger-km
Rail freight activity (2016)	20 117 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	28 systems
Electric scooter services (2020)	1 operator in 2 cities
Carsharing services (2021)	12 services
National legal frameworks for shared mobility (2020)	Yes
Autonomous vehicles in operation or in preparation (2020)	3
Autonomous vehicles strategies (2020)	✓

Fuel Economy

Emission standards for LDVs (2018)	Euro 5
CO_2 emissions performance for LDVs (2017)	144 gCO_2/km
Emission standards for HDVs (2018)	Euro VI
Targeted CO_2 emissions performance	74 gCO_2/km by 2030

Electric Mobility

Electric vehicles (2019)	294 000
Market share of electric vehicles (2019)	0.9%
No. of cities with electric buses (2019)	5
ICE phase-out targets	2050

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	2.7%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	130.2 million people
Air freight activity (2019)	8919.5 million ton-km
Carbon-accredited airports (2020)	4 airports
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	71.2
Container port traffic (2019)	21 708 860 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	USD 0.14 billion
Examples	• Local public transport support

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VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Kenya

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	53.8 million	27.9%	1 237.5
Growth (2010 to 2020)	27.9%	53.6%	62.7%

Transport is the largest CO_2-emitting sector in **Kenya,** and emissions have almost doubled since 2010. However, the country's transport emission levels are still below the regional average and motorisation levels are relatively low.

In Kenya's transport strategy, the need to move towards low-carbon, sustainable mobility has been highlighted. The country's Nationally Determined Contribution (NDC) includes transport efficiency improvements, but specific actions to support transport decarbonisation are still missing at the national level.

Income group: **Middle-income**

Human Development Index: **0.6**

Mobility Demand Trends

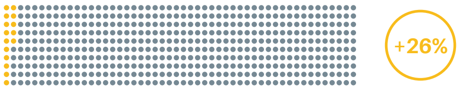
Passenger travel activity
Not available

Freight transport activity
Not available

Fuel consumption (2018)
3 090
thousand tonnes of oil equivalent
+86% (2010 to 2018)

Average light duty fuel economy consumption (2017)
Not available

Car ownership growth (2005 to 2015)
29.2 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	2 307	-19.3%
Commercial	3 336	-26.8%

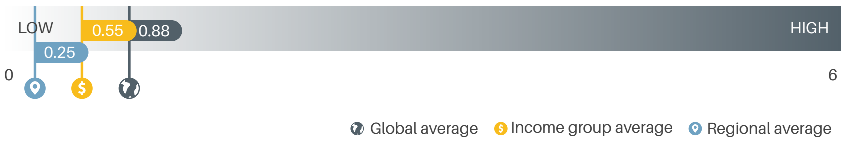
Diesel
US cents per litre (2018)
108

Super gasoline
US cents per litre (2018)
113

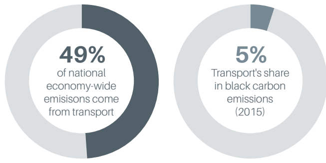
Transport Emission Trends

Transport CO_2 emissions (2019)
9.7 million tonnes

Per capita transport CO_2 emissions (2019)
0.19 tonnes

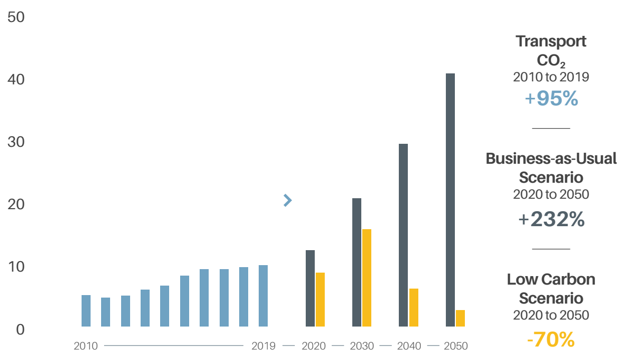


Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st and Updated NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2020 VNR with transport linkages to SDG 2, SDG 3, SDG 8 and SDG 13	



Transport measures in NDC

Mitigation
- General efficiency standards

Adaptation
- Transport infrastructure resilience
- Education and training
- Design standards and updates

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Not available
Sustainable Urban Mobility Plans (2020)	Pilot project in 1 city
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling combined in Guidance Document for NMT-Planning
Cycling infrastructure in capital (2020)	Not available

Urban Passenger and Freight Transport

Bus rapid transit (2020)	Not available
Urban rail (LRT, metro, tram) (2020)	Not available
Bus rapid transit daily passenger volume (2020)	Not available
Rapid Transit to Resident Ratio (2019)	Not available

Passenger and Freight Railways

Rail network (2004)	1 917 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion	✓
Targets	• Increase the railway capacity to handle 50% of freight cargo (25 Million Tonnes) from the Mombasa Port
Rail travel activity (2007)	109 million passenger-km
Rail freight activity (2004)	1 399 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	Not available
Electric scooter services (2020)	Not available
Carsharing services (2021)	Not available
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Not available
CO_2 emissions performance for LDVs (2017)	173 gCO_2/km
Emission standards for HDVs (2018)	Not available
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	Not available
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	6.4 million people
Air freight activity (2019)	321 million ton-km
Carbon-accredited airports (2020)	✗
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	17
Container port traffic (2019)	1 425 000 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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Mexico

Mexico has a strong dependence on fossil fuels for transport. While data shows a decrease in transport CO_2 emissions from 2010 to 2019, this decrease may have been caused by economic issues rather than efficiency improvements. Road transport is the most dominant mode for both passenger and freight transport.

Mexico has developed a long-term climate change plan and the country's NDC includes measures on vehicle and transport system improvements. These plans are supported by action on the subnational level promoting walking, cycling and public transport.

Income group: **Middle-income**

Human Development Index: **0.78**

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	128.9 million	83.8%	10 275.6
Growth (2010 to 2020)	13%	18.4%	23.9%

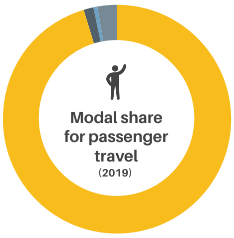
Mobility Demand Trends

Passenger travel activity

537 270

million passenger-km in 2019

+18% (2010 to 2019)

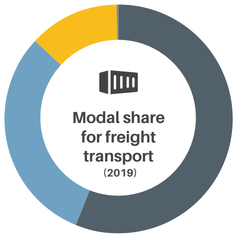


Freight transport activity

347 733

million ton-km in 2019

+16% (2010 to 2019)



Fuel consumption (2018)

53 257

thousand tonnes of oil equivalent

+4% (2010 to 2018)

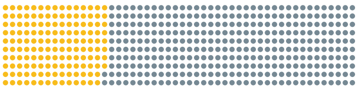
Average light duty fuel economy consumption (2017)

7.6 Lge/100 km (WLTP)

Diesel	Super gasoline
US cents per litre (2018)	US cents per litre (2018)
102	104

Car ownership growth (2005 to 2015)

296.7 vehicles per 1,000 people



+14%

Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	761 720	-13.7%
Commercial	597 951	11%

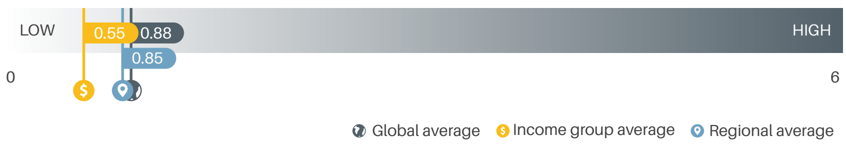
Transport Emission Trends

Transport CO_2 emissions (2019)

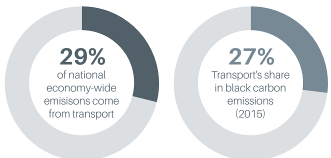
138.8 million tonnes

Per capita transport CO_2 emissions (2019)

1.1 tonnes

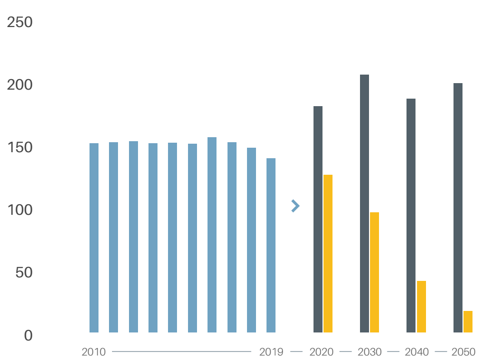


Second-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	Not available
Long-term strategy submitted to UNFCCC	✓
NDC submitted	1st and Updated NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2018 VNR with transport linakges to SDG 2, SDG 9 and SDG 13	



Transport measures in NDC

Mitigation

- General vehicle improvements
- General public transport improvement
- Expansion of infrastructure
- General e-mobility
- General comprehensive planning

Adaptation

- Transport infrastructure resilience (1st NDC)
- Repair & maintenance (1st NDC)
- Transport planning (1st NDC)
- Resilient transport technologies (1st NDC)

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Not available
Sustainable Urban Mobility Plans (2020)	Few isolated cases on local level
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	On subnational level
National cycling strategies (2020)	On subnational level
Cycling infrastructure in capital (2020)	128 km of bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	394 km in 11 cities
Urban rail (LRT, metro, tram) (2020)	282 km in 3 cities
Bus rapid transit daily passenger volume (2020)	2 652 204
Rapid Transit to Resident Ratio (2019)	10.5

Passenger and Freight Railways

Rail network (2018)	14 388 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion	✓
Rail travel activity (2018)	1 591 miliion passenger-km
Rail freight activity (2019)	89 049 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	18 systems
Electric scooter services (2020)	4 operators in 3 cities
Carsharing services (2021)	3 services
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 4
CO_2 emissions performance for LDVs (2017)	175 gCO_2/km
Emission standards for HDVs (2018)	Not available
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	4 700
Market share of electric vehicles (2019)	0.1%
No. of cities with electric buses (2019)	2
ICE phase-out targets	2050

Renewable Energy

Biofuel blend mandate (2019)	10% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	0.2%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	69.9 million people
Air freight activity (2019)	1 072.5 million ton-km
Carbon-accredited airports (2020)	19 airports
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	45.5
Container port traffic (2019)	7 090 800 TEU

COVID-19

Traditional transport infrastructure investment	USD 5.35 billion
Clean transport infrastructure investment	Not available
Examples	• Railway construction • Road construction investment • Cycling network investment

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Morocco

Morocco is experiencing a growth in transport CO_2 emissions which is outpacing populaton growth, and transport is a major source of air pollution.

Several key transport achievements have been realised in recent years: Morocco launched the first modern high-speed rail service on the African continent and has developed comprehensive sustainable mobility plans as well as ambitious climate plans. The country works at the national and local levels on implementing sustainable transport systems.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	36.9 million	63.8%	3 450.3
Growth (2010 to 2020)	14.1%	25.3%	35%

Income group: **Middle-income**

Human Development Index: **0.69**

Mobility Demand Trends

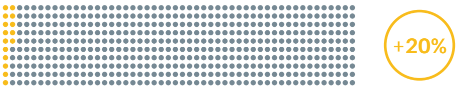
Passenger travel activity
Not available

Freight transport activity
Not available

Fuel consumption (2018)
5 968
thousand tonnes of oil equivalent
+34% (2010 to 2018)

Average light duty fuel economy consumption (2017)
Not available

Car ownership growth (2005 to 2015)
102.6 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	148 354	-9.1%
Commercial	17 562	24.2%

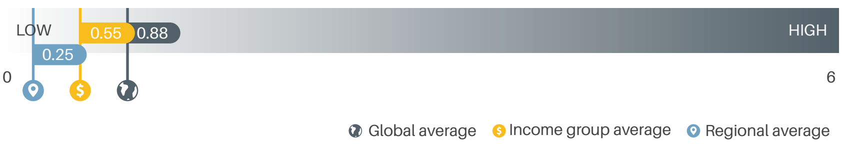
Diesel
US cents per litre (2018)
107

Super gasoline
US cents per litre (2018)
118

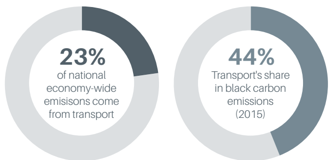
Transport Emission Trends

Transport CO_2 emissions (2019)
17.2 million tonnes

Per capita transport CO_2 emissions (2019)
0.5 tonnes

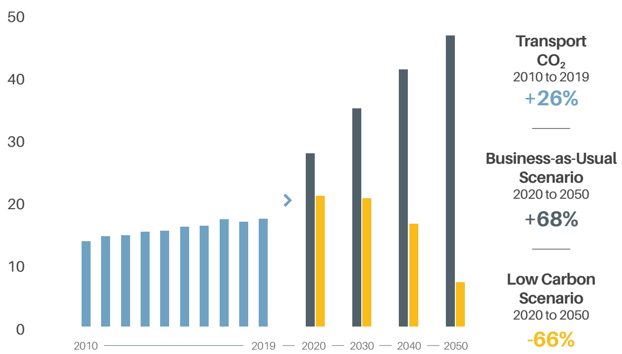


Second-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✓
Reduce energy consumption of transport by 23% by 2030	
Other non-emission related transport targets in NDC	✓
Reduce logistical costs from 20% to 15% by 2019 Create a USD 200 million support fund for urban road transport Implement public transport in major cities and create taxi fleet renewal	
Voluntary National Review highlights transport	✓
2020 VNR with transport linkages to SDG 3, SDG 4, SDG 7, SDG 9, SDG 11 and SDG 13	



Transport measures in NDC

Mitigation
- General land use and urban form
- Freight transport shifting to rail or inland
- Inspection and maintenance
- Emission standards
- General public transport improvement
- Financial instruments to support decarbonisation
- Vehicle restrictions

Adaptation
- Transport infrastructure resilience

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Sustainable Urban Mobility Plans (2020)	Several cities
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	Not available
Cycling infrastructure in capital (2020)	Not available

Urban Passenger and Freight Transport

Bus rapid transit (2020)	Not available
Urban rail (LRT, metro, tram) (2020)	50 km in 2 cities
Bus rapid transit daily passenger volume (2020)	Not available
Rapid Transit to Resident Ratio (2019)	4.4

Passenger and Freight Railways

Rail network (2019)	2 295 km
High-speed rail (2018)	200 km
High-speed rail travel activity (2018)	756 million passenger-km
National plans for passenger and freight rail expansion (2020)	✓
Targets	• Expand current network, through the construction of 2,743 additional km conventional rail and 1,500 km of high-speed lines
Rail travel activity (2018)	4 475 million passenger-km
Rail freight activity (2017)	3 896 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	1 system
Electric scooter services (2020)	Not available
Carsharing services (2021)	1 service
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 4
CO2 emissions performance for LDVs (2017)	Not available
Emission standards for HDVs (2018)	Not avaiable
Targeted CO_2 emissions performance	Not avaiable

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	0.5%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	9.4 million people
Air freight activity (2019)	102.2 million ton-km
Carbon-accredited airports (2020)	2 airports
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	58.2
Container port traffic (2019)	6 040 400 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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List of acronyms

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LDV	Light-duty vehicle
LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

New Zealand

New Zealand has experienced a modest growth in the transport of passengers and goods since 2010, resulting in a 14% increase in transport CO_2 emissions. Transport is the largest CO_2-emitting sector in the country, and is powered primarily by fossil fuels.

New Zealand has announced a long-term vision to be carbon-neutral by 2050. This vision has not yet been translated into a strategy for transport. However, cities are working to promote walking and cycling, and New Zealand has recently started promoting the use of electric vehicles.

Income group: High-income

Human Development Index: 0.93

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	4.8 million	86.9%	40 084.9
Growth (2010 to 2020)	10.4%	11.3%	30.8%

Mobility Demand Trends

Passenger travel activity

3 578

million passenger-km in 2019

+13% (2010 to 2019)

Freight transport activity

29 202

million ton-km in 2019

+16% (2010 to 2019)

Fuel consumption (2018)

5 347

thousand tonnes of oil equivalent

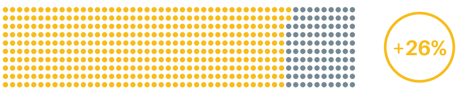
+17% (2010 to 2018)

Average light duty fuel economy consumption (2017)

Not available

Car ownership growth (2005 to 2015)

803.5 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	104 090	-3.3%
Commercial	50 389	4.2%

Diesel
US cents per litre (2018)

111

Super gasoline
US cents per litre (2018)

154

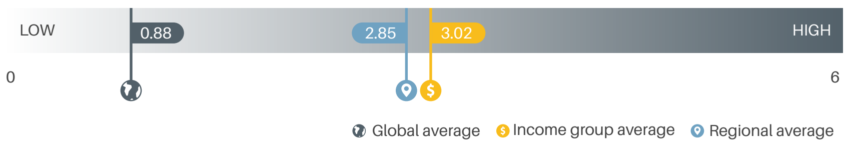
Transport Emission Trends

Transport CO_2 emissions (2019)

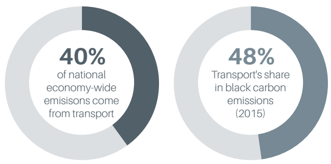
15.5 million tonnes

Per capita transport CO_2 emissions (2019)

3.2 tonnes

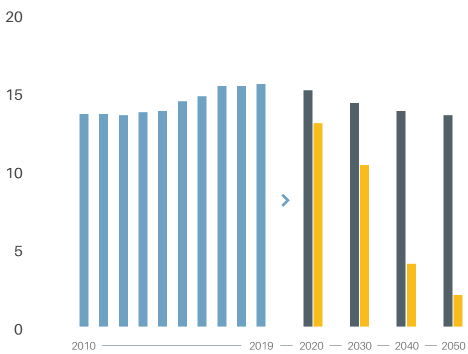


Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st and Updated NDC
NDC highlights transport for GHG mitigation	×
Transport mitigation targets in NDC	×
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2019 VNR with transport linkages to SDG 3, SDG 7, SDG 8, SDG 11 and SDG 13	



Transport CO_2
2010 to 2019
+14%

Business-as-Usual Scenario
2020 to 2050
-11%

Low Carbon Scenario
2020 to 2050
-85%

Transport measures in NDC

Mitigation
- Not available

Adaptation
- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Sustainable Urban Mobility Plans (2020)	Auckland developed first such plan in 2006
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling combined in National Land Transport Programme 2018-21
Targets	• Investments of NZD 390 million between 2018 and 2021, in support of uptake on walking and cycling
Cycling infrastructure in capital (2020)	41 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	6 km in 1 city
Urban rail (LRT, metro, tram) (2020)	192 km in 2 cities
Bus rapid transit daily passenger volume (2020)	22 900
Rapid Transit to Resident Ratio (2019)	4.4

Passenger and Freight Railways

Rail network (1998)	3908 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion	✓
Rail travel activity (1998)	321 million passenger-km
Rail freight activity (2019)	3 830 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	8 systems
Electric scooter services (2020)	4 operators in 6 cities
Carsharing services (2021)	7 services
National legal frameworks for shared mobility (2020)	Subnational roadmaps
Autonomous vehicles in operation or in preparation (2020)	1
Autonomous vehicles strategies (2020)	✓

Fuel Economy

Emission standards for LDVs (2018)	Euro 6
CO2 emissions performance for LDVs (2017)	Not available
Emission standards for HDVs (2018)	Not available
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	17 700
Market share of electric vehicles (2019)	2.8%
No. of cities with electric buses (2019)	1
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	7% Biodiesel
Renewable energy (biofuels and electricity) share in transport (2018)	0.1%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	17.8
Air freight activity (2019)	1207.9
Carbon-accredited airports (2020)	3 airports
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	31.9
Container port traffic (2019)	3 444 356 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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LDV	Light-duty vehicle
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WLTP	Worldwide harmonised light vehicles test procedure

Nigeria

Nigeria has experienced transport emission growth at a far slower pace than population and GDP growth. This can be largely attributed to a lack of supply of transport options rather than high efficiency, low-carbon mobility solutions. Thus, without the introduction of sustainable transport, Nigeria can expect a large growth in transport CO_2 emissions in coming years.

In climate action plans, Nigeria has outlined a comprehensive set of actions, but there are very few strategies that further specify the implementation of the suggested activities. A long-term transport plan for Lagos is currently being pursued, but overall more sustainable mobility options need to be introduced to put Nigeria on a decarbonisation pathway.

Income group: **Middle-income**

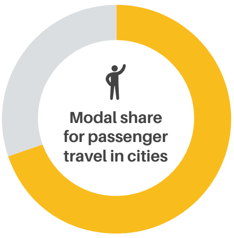
Human Development Index: **0.54**

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	206.1 million	52%	2 386.9
Growth (2010 to 2020)	30%	55.3%	32%

Mobility Demand Trends

Passenger travel activity
Not available

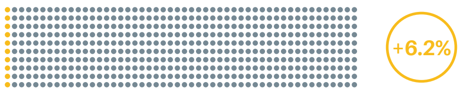
Freight transport activity
Not available



Fuel consumption (2018)
22 700
thousand tonnes of oil equivalent
+123% (2010 to 2018)

Average light duty fuel economy consumption (2017)
Not available

Car ownership growth (2005 to 2015)
20.7 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	5 100	-40.4%
Commercial	4 700	-44.4%

Diesel US cents per litre (2018): 57

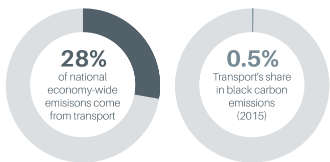
Super gasoline US cents per litre (2018): 40

Transport Emission Trends

Transport CO_2 emissions (2019)
28.4 million tonnes

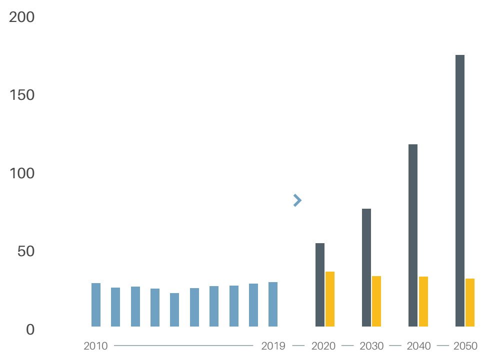
Per capita transport CO_2 emissions (2019)
0.1 tonnes

Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2020 VNR with transport linkages to SDG 2, SDG 4 and SDG 9	



Transport CO_2 2010 to 2019: +3%

Business-as-Usual Scenario 2020 to 2050: +226%

Low Carbon Scenario 2020 to 2050: -13%

Transport measures in NDC

Mitigation
- Public transport integration and expansion
- General public transport improvement
- General freight efficiency improvements
- System improvements
- Road charging and tolls
- LPG/CNG/LNG

Adaptation
- Transport infrastructure resilience
- Transport system adaptation
- Risk assessment
- Design standards and updates

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Not available
Sustainable Urban Mobility Plans (2020)	Not available but Lagos Urban Transport Master Plan defines long-term development
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling combined in Guidance Document for NMT-Planning
Targets	• Increase sustainable transport share to 75% or more • Halt the growth of private vehicle kilometers travelled • Improve road safety (to 10 fatalities or less per 100,000 people) • Ensure air quality at WHO standards and mitigate GHG emissions
Cycling infrastructure in capital (2020)	Not available

Urban Passenger and Freight Transport

Bus rapid transit (2020)	22 km in 1 city
Urban rail (LRT, metro, tram) (2020)	42 km in 1 city
Bus rapid transit daily passenger volume (2020)	200000
Rapid Transit to Resident Ratio (2019)	0.8

Passenger and Freight Railways

Rail network (2015)	3528 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion	✓
Rail travel activity (2005)	174 million passenger-km
Rail freight activity (2005)	77 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	Not available
Electric scooter services (2020)	Not available
Carsharing services (2021)	Not available
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 3
CO2 emissions performance for LDVs (2017)	Not available
Emission standards for HDVs (2018)	Euro III
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✕

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	Not available
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	6.5 million people
Air freight activity (2019)	22 million ton-km
Carbon-accredited airports (2020)	1 airport
of which carbon neutral	✕

Shipping

Liner shipping connectivity index (2019)	21.4
Container port traffic (2019)	1484000 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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WLTP	Worldwide harmonised light vehicles test procedure

Peru

Peru is a highly urbanised, middle-income country with average levels of transport emissions for Latin America. The large majority of trips are completed using collective transport or walking. However, transport CO_2 emissions have grown rapidly in the past decade, and transport is the country's largest CO_2-emitting sector.

To reverse this trend, a comprehensive transport strategy is necessary. The country is supported by several international organisations in the implementation of sustainable transport. However, the few identified transport measures focus mainly on the capital area, and more activites are required to decarbonise rural transport.

Income group: **Middle-income**

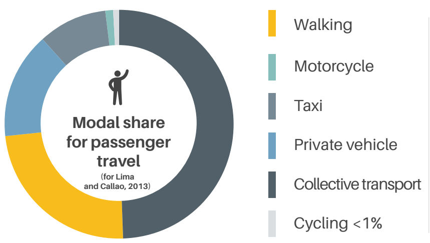
Human Development Index: **0.78**

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	33 million	79.1%	6486.6
Growth (2010 to 2020)	13.6%	16.2%	42.9%

Mobility Demand Trends

Passenger travel activity
Not available

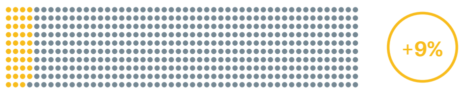
Freight transport activity
Not available



Fuel consumption (2018)
8 560
thousand tonnes of oil equivalent
+43% (2010 to 2018)

Average light duty fuel economy consumption (2017)
8.1 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)
77.9 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	115 836	0.3%
Commercial	39 861	22.7%

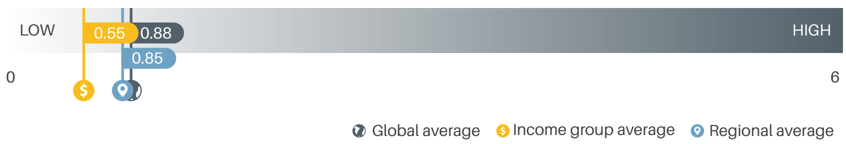
Diesel
US cents per litre (2018)
108

Super gasoline
US cents per litre (2018)
129

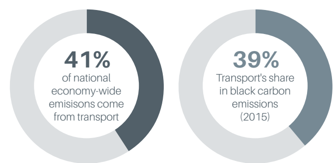
Transport Emission Trends

Transport CO_2 emissions (2019)
23.1 million tonnes

Per capita transport CO_2 emissions (2019)
0.7 tonnes

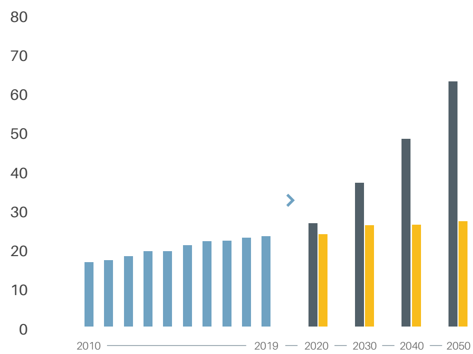


Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	Not available
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st and Updated NDC
NDC highlights transport for GHG mitigation	✗
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2020 VNR with transport linkages to SDG 3, SDG 4, SDG 8, SDG 9, SDG 11 and SDG 13	



Transport CO_2
2010 to 2019
+41%

Business-as-Usual Scenario
2020 to 2050
+138%

Low Carbon Scenario
2020 to 2050
14%

Transport measures in NDC

Mitigation
- Not available

Adaptation
- Transport infrastructure resilience

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓ Overview of challenges to implement sustainable transport in Peru was reviewed in this report.
Sustainable Urban Mobility Plans (2020)	In preparation
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	Not available
Cycling infrastructure in capital (2020)	466 km of bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	26 km in 1 city
Urban rail (LRT, metro, tram) (2020)	34 km in 1 city
Bus rapid transit daily passenger volume (2020)	704 803
Rapid Transit to Resident Ratio (2019)	3.8

Passenger and Freight Railways

Rail network (1998)	1639 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion (2020)	✓
Targets	• New 475 km line, railway tunnel and a 65 km line to shorten railway travel time
Rail travel activity (1998)	127 million passenger-km
Rail freight activity (1998)	599 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	1 system
Electric scooter services (2020)	Not available
Carsharing services (2021)	Not available
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 4
CO_2 emissions performance for LDVs (2017)	187 gCO_2/km
Emission standards for HDVs (2018)	Euro IV
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	1
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	2% Biodiesel, 8% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	4.2%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	18.8 million people
Air freight activity (2019)	340.3 million ton-km
Carbon-accredited airports (2020)	2 airports
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	38.9
Container port traffic (2019)	2 330 362 TEU

COVID-19

Traditional transport infrastructure investment	USD 3.5 billion
Clean transport infrastructure investment	Not available
Examples	• Funds for bicycles • Road maintenance • Airport maintenance • Port investment

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Russia

Russia has maintained transport CO_2 emissions at a constant level since 2010. The transport of goods and people is mainly carried out through road transport powered by fossil fuels. As a result, the private motorisation rate is very high.

Current measures are not sufficient to decarbonise the transport system. Although Russia recognises that transport is important to enable sustainable development, very few strategies have been identified to transform the sector.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	145.9 million	73.7%	12 082.2
Growth (2010 to 2020)	1.7%	1.9%	15.6%

Income group: **Middle-income**

Human Development Index: **0.82**

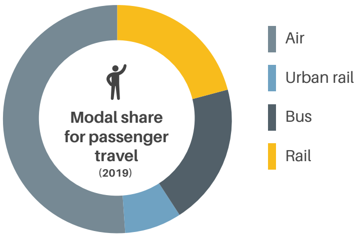
Mobility Demand Trends

Passenger travel activity

635 000

million passenger-km on collective, public modes in 2019

+32% (2010 to 2019)

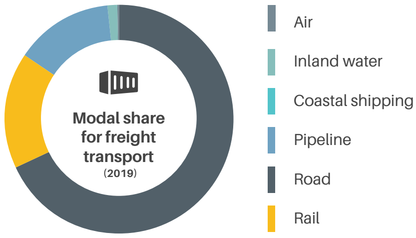


Freight transport activity

8 421

million ton-km in 2019

+ 8.7% (2010 to 2019)



Fuel consumption (2018)

101 100

thousand tonnes of oil equivalent

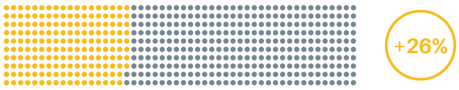
+5% (2010 to 2018)

Average light duty fuel economy consumption (2017)

8.2 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

356.9 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	1 567 743	-2.4%
Commercial	211 098	-1.7%

Diesel	Super gasoline
US cents per litre (2018)	US cents per litre (2018)
65	68

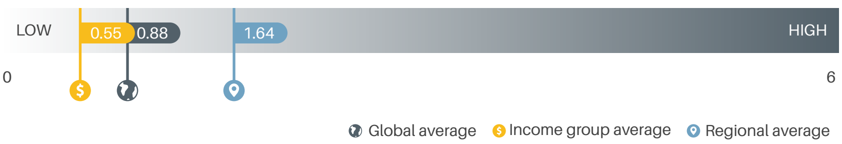
Transport Emission Trends

Transport CO_2 emissions (2019)

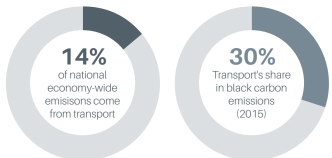
247.8 million tonnes

Per capita transport CO_2 emissions (2019)

1.7 tonnes

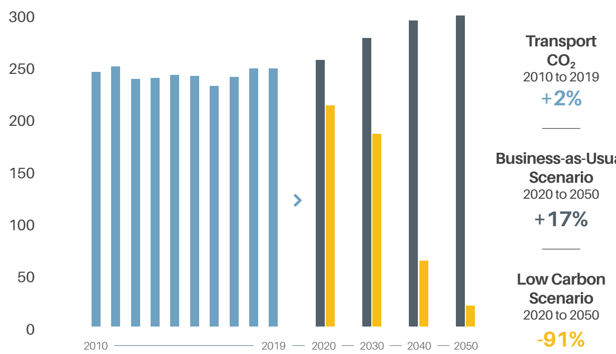


Third-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✗
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2020 VNR with transport linkages to SDG 2, SDG 3, SDG 7, SDG 9, SDG 19, SDG 11 and SDG 12	



Transport measures in NDC

Mitigation
- Not available

Adaptation
- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Targets	• Ensure high-quality road and urban electric transport for passenger and freight transport • Enable sustainable urban transport, including the development of sustainable urban mobility plans
Sustainable Urban Mobility Plans (2020)	1 city
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	Not available
Cycling infrastructure in capital (2020)	850 km of bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	Not available
Urban rail (LRT, metro, tram) (2020)	740 km in 59 cities
Bus rapid transit daily passenger volume (2020)	Not available
Rapid Transit to Resident Ratio (2019)	16.3

Passenger and Freight Railways

Rail network (2019)	85 494 km
High-speed rail (2018)	600 km
High-speed rail travel activity (2018)	6.2 billion passenger-km
National plans for passenger and freight rail expansion (2020)	✓
Targets	• To halve CO_2 emission intensity by rail • To double the speed of freight rail transport
Rail travel activity (2018)	129 542 million passenger-km
Rail freight activity (2019)	2 602 493 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	8 systems
Electric scooter services (2020)	1 operator in 12 cities
Carsharing services (2021)	34 services
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	✓

Fuel Economy

Emission standards for LDVs (2018)	Euro 6
CO_2 emissions performance for LDVs (2017)	192 gCO_2/km
Emission standards for HDVs (2018)	Euro IV
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	7%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	115.5 million people
Air freight activity (2019)	6620.7 million ton-km
Carbon-accredited airports (2020)	✗
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	38.1
Container port traffic (2019)	5 311 700 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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LDV	Light-duty vehicle
LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Saudi Arabia

Saudi Arabia has high car ownership rates and as a result, high transport CO_2 emission levels. Transport is currently the third-largest CO_2-emitting sector in the country, but emissions are growing rapidly.

Saudi Arabia has implemented relatively few measures to mitigate transport's impact on climate change. In 2018 the first high-speed rail service was inaugurated. Urban transport improvements are planned, including through rail systems which are under construction.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	34.8 million	84%	20542.1
Growth (2010 to 2020)	27%	30%	33.3%

Income group: High-income

Human Development Index: 0.85

Mobility Demand Trends

Passenger travel activity

464

million passenger-km for rail in 2018

+23% (2014 to 2018)

Freight transport activity

1 772

million ton-km for rail in 2018

-18% (2014 to 2018)

Fuel consumption (2018)

45 500

thousand tonnes of oil equivalent

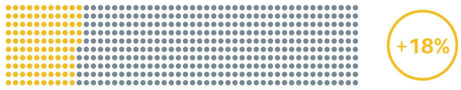
+29% (2010 to 2018)

Average light duty fuel economy consumption (2017)

Not available

Car ownership growth (2005 to 2015)

209.1 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	456311	34.1%
Commercial	72572	14%

Diesel

US cents per litre (2018)

13

Super gasoline

US cents per litre (2018)

54

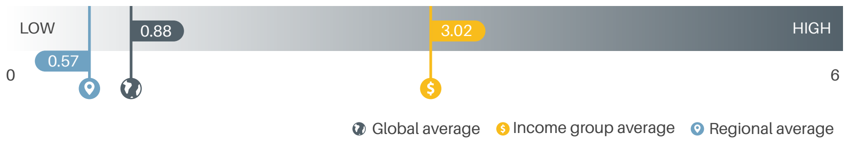
Transport Emission Trends

Transport CO_2 emissions (2019)

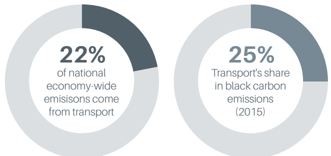
134 million tonnes

Per capita transport CO_2 emissions (2019)

3.9 tonnes

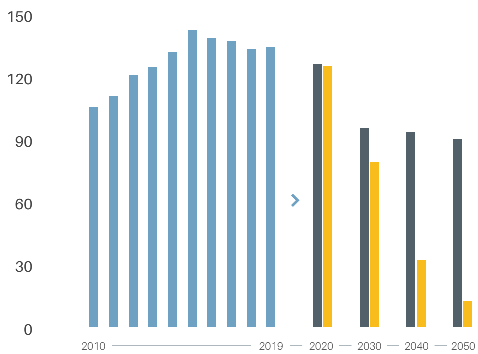


Third-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	Not submitted
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✗



Transport CO_2 2010 to 2019 **+27%**

Business-as-Usual Scenario 2020 to 2050 **-29%**

Low Carbon Scenario 2020 to 2050 **-90%**

Transport measures in NDC

Mitigation

- Public transport integration and expansion
- Fuel quality standards

Adaptation

- Resilient transport technologies

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Envisioned
Sustainable Urban Mobility Plans (2020)	Envisioned
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking strategies (2020)	Not available
National cycling strategies (2020)	Not available
Cycling infrastructure in capital (2020)	Not available

Urban Passenger and Freight Transport

Bus rapid transit (2020)	Not available
Urban rail (LRT, metro, tram) (2020)	Not available
Bus rapid transit daily passenger volume (2020)	Not available
Rapid Transit to Resident Ratio (2019)	Not available

Passenger and Freight Railways

Rail network (2018)	2939 km
High-speed rail (2018)	453 km
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion (2020)	✓
Targets	• To construct 9,000 km of railways by 2040
Rail travel activity (2018)	135 million passenger-km
Rail freight activity (2010)	1 852 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	2 systems
Electric scooter services (2020)	1 operator in 1 city
Carsharing services (2021)	7 services
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 2
CO2 emissions performance for LDVs (2017)	Not available
Emission standards for HDVs (2018)	Not available
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	Not available
Market share of electric vehicles (2019)	Not available
No. of cities with electric buses (2019)	Not available
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	Not available
Renewable energy (biofuels and electricity) share in transport (2018)	Not available
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	39.4 million people
Air freight activity (2019)	1 024.1 million ton-km
Carbon-accredited airports (2020)	✗
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	63
Container port traffic (2019)	8 905 391 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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South Africa

South Africa, as the strongest economy in the region, has transport levels far above the regional average. Car ownership is also relatively high. Transport CO_2 emissions are increasing in line with population and economic growth.

The country has implemented few transport decarbonisation measures, most of which focuse on vehicle efficiency improvements and electrification. South Africa's Green Transport Strategy outlines a target to reduce transport GHG emissions 5% by 2050.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	59.3 million	66.7%	7 346
Growth (2010 to 2020)	15.8%	23.2%	14.6%

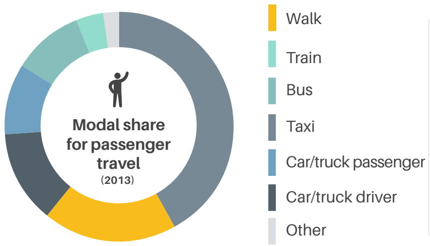
Income group: **Middle-income**

Human Development Index: **0.71**

Mobility Demand Trends

Passenger travel activity
Not available

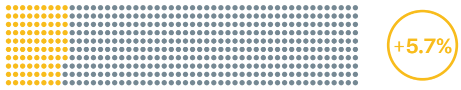
Freight transport activity
Not available



Fuel consumption (2018)
19 214
thousand tonnes of oil equivalent
+21% (2010 to 2018)

Average light duty fuel economy consumption (2017)
7.4 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)
173.6 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	355 378	-2.7%
Commercial	181 233	-3.1%

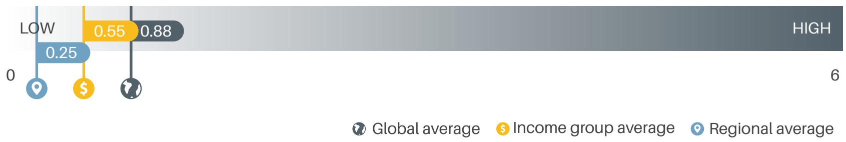
Diesel
US cents per litre (2018)
119

Super gasoline
US cents per litre (2018)
118

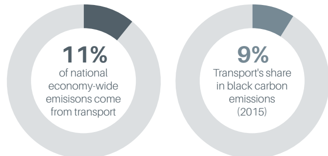
Transport Emission Trends

Transport CO_2 emissions (2019)
55.8 million tonnes

Per capita transport CO_2 emissions (2019)
1 tonnes

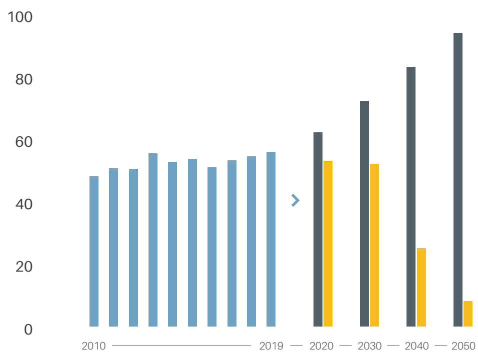


Second-largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	✓
NDC submitted	1st NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	×
Other non-emission related transport targets in NDC	✓
Achieve 20% share of hybrid and full-electric vehicles by 2030	
Voluntary National Review highlights transport	✓
2019 VNR with transport linkages to SDG 7, SDG 8, SDG 9, SDG 11 and SDG 13	



Transport CO_2
2010 to 2019
+16%

Business-as-Usual Scenario
2020 to 2050
+51%

Low Carbon Scenario
2020 to 2050
-85%

Transport measures in NDC

Mitigation
- General e-mobility

Adaptation
- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Sustainable Urban Mobility Plans (2020)	Not available
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling combined in Guidance Document for NMT-Planning
Cycling infrastructure in capital (2020)	450 km of bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	88 km in 3 cities
Urban rail (LRT, metro, tram) (2020)	Not available
Bus rapid transit daily passenger volume (2020)	111 578
Rapid Transit to Resident Ratio (2019)	3.4

Passenger and Freight Railways

Rail network (2017)	20 953 km
High-speed rail (2018)	Not available
High-speed rail travel activity (2018)	Not available
National plans for passenger and freight rail expansion (2020)	✓
Rail travel activity (2007)	13 865 million passenger-km
Rail freight activity (2008)	113 342 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	1 system
Electric scooter services (2020)	Not available
Carsharing services (2021)	4 services
National legal frameworks for shared mobility (2020)	Not available
Autonomous vehicles in operation or in preparation (2020)	Not available
Autonomous vehicles strategies (2020)	Not available

Fuel Economy

Emission standards for LDVs (2018)	Euro 2
CO_2 emissions performance for LDVs (2017)	176 gCO_2/km
Emission standards for HDVs (2018)	Euro II
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	1 200
Market share of electric vehicles (2019)	0.1%
No. of cities with electric buses (2019)	1
ICE phase-out targets	✗

Renewable Energy

Biofuel blend mandate (2019)	5% Biodiesel, 2% Ethanol
Renewable energy (biofuels and electricity) share in transport (2018)	1.4%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	25.7
Air freight activity (2019)	539.4
Carbon-accredited airports (2020)	6 airports
of which carbon neutral	✗

Shipping

Liner shipping connectivity index (2019)	34.6
Container port traffic (2019)	4 769 700 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

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United Kingdom

The UK has been able to maintain transport CO_2 emissions at a constant level, even as passenger travel demand has continued to rise.

The country has a comprehensive strategy to increase the share of public transport, walking, and cycling in cities, as well as inter-city railway services. Several plans in the UK support a transformational change of the mobility sector in the coming decade. For example, Scotland has plans which provide strong funding for sustainable transport.

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	67.9 million	83.2%	43 238.3
Growth (2010 to 2020)	7%	9.8%	18%

Income group: **High-income**

Human Development Index: **0.93**

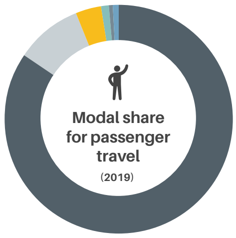
Mobility Demand Trends

Passenger travel activity

872 856

million passenger-km in 2019

+12.4% (2010 to 2019)



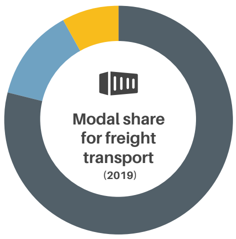
Air
Rail
Pedal cycles
Motor cycles
Cars, vans & taxis
Buses & coaches

Freight transport activity

195 561

million ton-km in 2019

-6.9% (2010 to 2019)



Water
Rail
Road

Fuel consumption (2018)

41 423

thousand tonnes of oil equivalent

+3% (2010 to 2018)

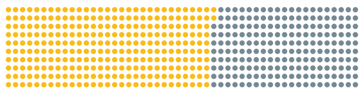
Average light duty fuel economy consumption (2017)

5.8 Lge/100 km (WLTP)

Oil products
Natural gas
Biofuels
Electricity

Car ownership growth (2005 to 2015)

584.4 vehicles per 1,000 people



+4.3%

Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	2 311 140	-2.4%
Commercial	365 778	-0.4%

Diesel US cents per litre (2018)	**Super gasoline** US cents per litre (2018)
177	167

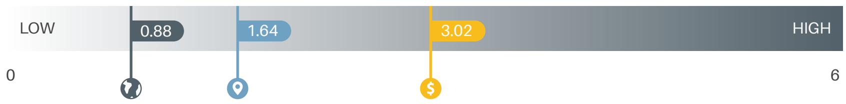
Transport Emission Trends

Transport CO_2 emissions (2019)

116.2 million tonnes

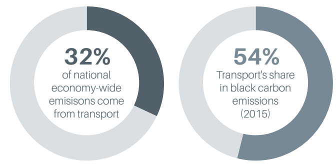
Per capita transport CO_2 emissions (2019)

1.7 tonnes



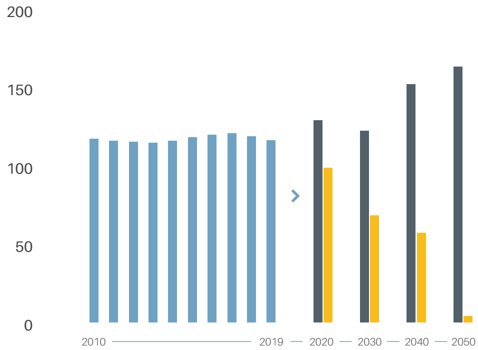
Global average · Income group average · Regional average

Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✓
Long-term strategy submitted to UNFCCC	✓
NDC submitted	1st and Updated NDC
NDC highlights transport for GHG mitigation	✗
Transport mitigation targets in NDC	✗
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	✓
2019 VNR with transport linkages to SDG 9	



Transport CO_2 2010 to 2019 **-1%**

Business-as-Usual Scenario 2020 to 2050 **+27%**

Low Carbon Scenario 2020 to 2050 **-96%**

Transport measures in NDC

Mitigation
- Not available

Adaptation
- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	✓
Sustainable Urban Mobility Plans (2020)	✓
Low Emission Zones (2020)	14 cities

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling combined in Cycling and Walking Investment Strategy
Targets	• Double cycling activity, achieve 1.6 billion modal shifts from other forms of transport to cycling in 2025 • Increase walking, achieve 300 modal shifts per person per year from other forms of transport to walking in 2025 • Increase share of children (aged 5 to 10) that walk to school from 49% in 2014 to 55% in 2025
Cycling infrastructure in capital (2020)	2 000 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	135 km in 7 cities
Urban rail (LRT, metro, tram) (2020)	Over 800 km in 10 cities
Bus rapid transit daily passenger volume (2020)	78 226
Rapid Transit to Resident Ratio (2019)	32

Passenger and Freight Railways

Rail network (2018)	16 295 km
High-speed rail (2018)	115 km
High-speed rail travel activity (2018)	4.8 billion passenger-km
National plans for passenger and freight rail expansion	✓
Targets	• Plan includes to improve railways, expand network and improve passenger service
Rail travel activity (2018)	80 526 million passenger-km
Rail freight activity (2018)	17 206 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	63 systems
Electric scooter services (2020)	7 operators in 14 cities
Carsharing services (2021)	143 services
National legal frameworks for shared mobility (2020)	Yes
Autonomous vehicles in operation or in preparation (2020)	7
Autonomous vehicles strategies (2020)	✓

Fuel Economy

Emission standards for LDVs (2018)	Euro 6
CO_2 emissions performance for LDVs (2017)	137 gCO_2/km
Emission standards for HDVs (2018)	Euro VI
Targeted CO_2 emissions performance	Not available

Electric Mobility

Electric vehicles (2019)	259 200
Market share of electric vehicles (2019)	2.8%
No. of cities with electric buses (2019)	2
ICE phase-out targets	2030

Renewable Energy

Biofuel blend mandate (2019)	Overall 7.3%
Renewable energy (biofuels and electricity) share in transport (2018)	4.1%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	142.4 million people
Air freight activity (2019)	5851.2 million ton-km
Carbon-accredited airports (2020)	16 airports
of which carbon neutral	6 airports

Shipping

Liner shipping connectivity index (2019)	84.9
Container port traffic (2019)	10 276 500 TEU

COVID-19

Traditional transport infrastructure investment	USD 140 billion
Clean transport infrastructure investment	USD 23.9 billion
Examples	• Local transport settlements • EV charging network investment • Tube support • Cycling and walking package • Buses and trams safety and services fund • Bus route funding • Transport network support • Transforming Cities Fund • Zero emissions buses • Electric vehicles charge points

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United States of America

	Population size (2020)	Urban population share (2020)	GDP per capita (2019)
Total	331 million	82.8%	55530.6
Growth (2010 to 2020)	7.1%	9.9%	21.9%

The USA is the largest national transport CO_2 emitter in the world in terms of absolute and per capita emissions. Transport is the largest CO_2-emitting sector in the US and emissions continue to grow.

Current national policies largely focus on fuel economy standards. However, many states have very ambitious plans to support transport decarbonisation. For example, California is working on transitioning to zero-emission vehicles. Many cities are also upgrading public transport and walking and cycling infrastructure.

Income group: **High-income**

Human Development Index: **0.93**

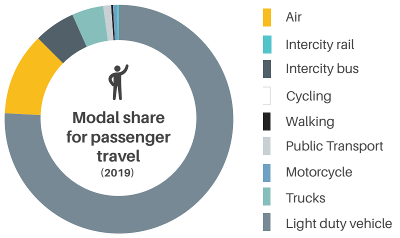
Mobility Demand Trends

Passenger travel activity

10 357 893

million passenger-km in 2019

+ 13.7% (2010 to 2019)

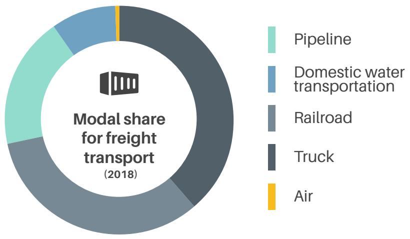


Freight transport activity

7 665 833

million ton-km in 2018

+ 5.6% (2010 to 2018)



Fuel consumption (2018)

638 099

thousand tonnes of oil equivalent

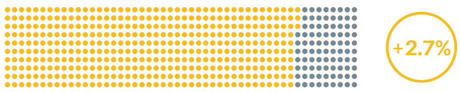
+7% (2010 to 2018)

Average light duty fuel economy consumption (2017)

8.6 Lge/100 km (WLTP)

Car ownership growth (2005 to 2015)

825.8 vehicles per 1,000 people



Vehicle sales (2019)

		(Growth 2010 to 2019)
Passenger	4715005	-11.1%
Commercial	12764999	3%

Diesel	**Super gasoline**
US cents per litre (2018)	US cents per litre (2018)
88	88

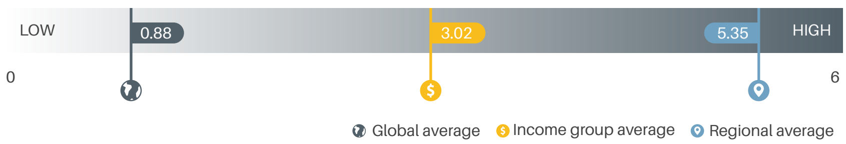
Transport Emission Trends

Transport CO_2 emissions (2019)

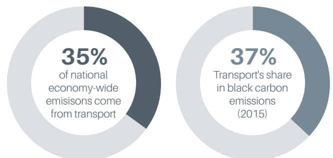
1788.3 million tonnes

Per capita transport CO_2 emissions (2019)

5.4 tonnes

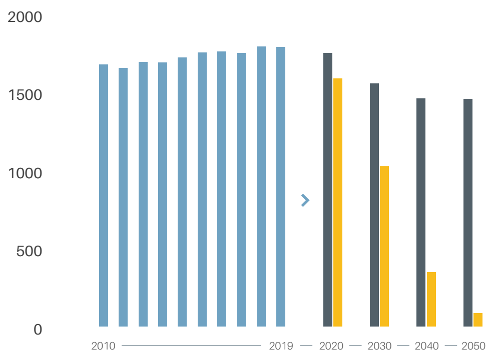


Largest CO_2 producing sector in the country



Low Carbon Transport Pathways

Transport strategy identifies climate change	✕
Long-term strategy submitted to UNFCCC	✓
NDC submitted	1st NDC and updated NDC
NDC highlights transport for GHG mitigation	✓
Transport mitigation targets in NDC	✕
Other non-emission related transport targets in NDC	Not available
Voluntary National Review highlights transport	Not submitted



Transport CO_2 2010 to 2019 **+7%**

Business-as-Usual Scenario 2020 to 2050 **-17%**

Low Carbon Scenario 2020 to 2050 **-95%**

Transport measures in NDC

Mitigation

- Vehicle efficiency improvements
- EV purchase incentives
- EV charging infrastructure
- Renewable energy
- General infrastructure improvements

Adaptation

- Not available

Policy Areas: Indicators and Targets

Sustainable Mobility Planning & Transport Demand Management

National Urban Mobility Framework (2020)	Not available on national level
Sustainable Urban Mobility Plans (2020)	✕
Low Emission Zones (2020)	Not available

Walking and Cycling

National walking and cycling strategies (2020)	Walking and cycling combined in Strategic Agenda for Pedestrian and Bicycle Transportation
Targets	• Development of networks, safety, equity and more walking and cycling trips
Cycling infrastructure in capital (2020)	151 km of separated bikelanes

Urban Passenger and Freight Transport

Bus rapid transit (2020)	438 km in 14 cities
Urban rail (LRT, metro, tram) (2020)	2 410 km in 43 cities
Bus rapid transit daily passenger volume (2020)	485 276
Rapid Transit to Resident Ratio (2019)	20

Passenger and Freight Railways

Rail network (2018)	150 462 km
High-speed rail (2018)	Not avaiable
High-speed rail travel activity (2018)	Not avaiable
National plans for passenger and freight rail expansion	✓
Rail travel activity (2018)	31 963 million passenger-km
Rail freight activity (2019)	2 364 144 million ton-km

Shared Mobility Services

Bike-sharing systems (2020)	397 systems
Electric scooter services (2020)	18 operators in 113 cities
Carsharing services (2021)	584 services
National legal frameworks for shared mobility (2020)	✓
Autonomous vehicles in operation or in preparation (2020)	55
Autonomous vehicles strategies (2020)	✓

Fuel Economy

Emission standards for LDVs (2018)	Euro 4
CO_2 emissions performance for LDVs (2017)	198 gCO_2/km
Emission standards for HDVs (2018)	Euro V
Targeted CO_2 emissions performance	108 gCO_2/km by 2026

Electric Mobility

Electric vehicles (2019)	1 450 000
Market share of electric vehicles (2019)	2.1%
No. of cities with electric buses (2019)	129
ICE phase-out targets	✕

Renewable Energy

Biofuel blend mandate (2019)	Ranging from 2 to 10% in some US states
Renewable energy (biofuels and electricity) share in transport (2018)	6%
Targeted % of renewable energy	Not available

Aviation

Air passengers caried (2019)	926.7 million people
Air freight activity (2019)	42498.3 million ton-km
Carbon-accredited airports (2020)	30 airports
of which carbon neutral	1 airport

Shipping

Liner shipping connectivity index (2019)	90
Container port traffic (2019)	55 518 880 TEU

COVID-19

Traditional transport infrastructure investment	Not available
Clean transport infrastructure investment	Not available

This fact sheet is part of the SLOCAT Transport and Climate Change Global Status Report - 2nd edition.

The information shown is based on desk research. Data has been collected to the best knowledge and availability. However, it might not be complete or reflect the most recent status. 'Not available' is indicated, when no information has been retrieved. The content does not represent the opinion of the SLOCAT Partnership. Find data sources and indicator glossary here.

List of acronyms

GDP	Gross-domestic product
HDV	Heavy-duty vehicle
ICE	Internal combustion engine
LDV	Light-duty vehicle
LRT	Light-rail transit
NDC	Nationally determined contribution
TEU	Twenty-foot Equivalent Unit
UNFCCC	United Nations Framework Convention on Climate Change
VNR	Voluntary national review of the Sustainable Development Goals
WLTP	Worldwide harmonised light vehicles test procedure

Annex: Methodological Note

Data usage

Time period for data:
The report strives to utilise the most recent publicly available data and information just prior to the time of publication (as of 31 May 2021). The figures in the report were developed between September and December 2020 using the most recent data available.

Secondary data:
SLOCAT relies on secondary data and information collected and provided by SLOCAT partners and other entities and does not make use of any internal modelling tools.

Data on sustainable mobility: A call to action

The report benefits directly from data collected by a wide range of stakeholders working in different areas of transport.

Data are important for providing a comprehensive picture of the status of sustainable, low carbon transport and are essential for both policy and investment decision making. In these times of change, it is critical to upgrade data and policy collection and interpretation capacities to better understand progress and the hurdles that must be addressed.

The data limitations mentioned below are not new. Obtaining regular, reliable and public data across regions and transport modes remains an outstanding issue. When an increasing number of stakeholders are collecting data and policy information, more and better open-access data and capacity building efforts for data interpretation are supported by many multi-stakeholder partnerships in the sustainable, low carbon movement.

If you share our passion for open-access data and knowledge towards greater impact on policy and investment decision making worldwide and/or would like to contribute data or knowledge to our collective efforts on this report, **please reach out to the research team in the SLOCAT Secretariat at tcc-gsr@slocatpartnership.org**.

Specific data used in this report

Data on emissions

The data in this edition of the report point to the direct carbon emissions from transport activity; they do not cover the indirect emissions and land-use impacts associated with certain modes of transport. The report primarily utilises CO_2 emission data compiled in the Emissions Database for Global Atmospheric Research (EDGAR) from the Joint Research Centre of the European Commission, as this represents the most recent, comprehensive dataset on transport CO_2 emissions. However, this global dataset does not convey in full detail the unique situations of individual countries.

EDGAR provides estimates for fossil CO_2 emissions from all anthropogenic activities with the exception of land use, land-use change, forestry and the large-scale burning of biomass. The main activities covered are CO_2 emissions emitted by the power sector (i.e., power and heat genertion plants), by other industrial combustion (i.e., combustion for industrial manufacturing and fuel production) and by buildings and other activities such as industrial process emissions, agricultural soils and waste. Transport activities covered within EDGAR include road transport, non-road transport, domestic aviation, and inland waterways on a country level, as well as international aviation and shipping.[1]

For the world, regions and countries, the CO_2 emission data (provided by EDGAR) span through 2019. In a few places in the report, CO_2 data for 2020 are shown to illustrate the impact of the COVID-19 pandemic; however, these data are based on a different methodology than the EDGAR dataset and should not be compared directly with the data from previous years.

The latest CO_2 emission data for individual transport modes are for 2018 and have been compiled only at the global level. For passenger and freight transport, the data on global CO_2 emissions are for 2017, as this is the latest year with robust data. Data on passenger activity (passenger-kilometres) and freight activity (tonne-kilometres) – provided mainly in the country fact sheets – are based on the latest available year, as indicated in the report analysis.

Information on greenhouse gas emissions – provided in CO_2 equivalent (CO_{2eq}) – include not only CO_2 but also methane, nitrous oxide, and industrial gases such as hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride.[2] These data are less up-to-date. As of 31 May 2021, data on greenhouse gas emissions were not readily available for the period 2019-2020. In some cases, additional data sources were used to provide detailed information about other climate pollutants besides CO_2.

All data on CO_2 and other greenhouse gas emissions, as well as CO_{2eq}, are provided in metric tonnes.

Data on car ownership

Information on car ownership rates is based on a global dataset from the International Organization of Motor Vehicle Manufacturers (OICA), with the latest release (as of 31 May 2021) dating from 2015.[3] Although newer information is available for some individual countries, using these data would hinder accurate global comparisons. Data on passenger and commercial vehicle sales were available only up to 2019.

Policy landscape data

The policy-related information presented in this report is not intended to be comprehensive. The data for the policy landscape indicators provided in Section 3 were gathered through desk research unless otherwise indicated. Barriers to accessing such information include language and limited availability of information through online media (e.g., websites, press releases and news articles).

Data in country fact sheets

Information in the fact sheets is based on desk research and on contributions from the national focal points. The data were collected to the best of the authors' knowledge and based on data availability, and thus may not be complete or show the most recent status. When no information was available for a given indicator, the term "Not available" is used.

Data gaps

Major data gaps exist in areas where there is no globally accepted data collection methodology. For example, the mapping of cycling and walking infrastructure is not currently done in all regions. Also, the modal share can be surveyed through different methods, leading to inconsistencies in available data. In addition, data on paratransit (informal transport), a predominant form of transport in many parts of the world, are largely lacking. This results in an incomplete picture of the impact of transport on climate change and sustainable development.

Methodological approach

Countries and regions

The report follows the M49 Standard of the United Nations Statistics Division.[4] In total, 196 countries have official United Nations membership and are also party to the United Nations Framework Convention on Climate Change. The available data have been put in a common structure for the United Nations member countries, regions and income groups to enable a consistent assessment. Income groups are based on the World Bank's classification of 2019.[5]

Economic calculations

The per capita and gross domestic product (GDP) calculations are based on the United Nations World Population Prospects 2019 and on World Bank GDP data using constant 2010 USD.[6]

Spatial and temporal scales

The geographic scale (global, national, city-level, etc.) as well as time scale (annual, monthly, daily) used in this report depends largely on the available dataset, as noted in the relevant figures and text. The detailed data forming the basis of the calculations and analysis are provided in the SLOCAT Transport Knowledge Base.[7]

Criteria for selection

The report covers policies, targets, emission reductions (achieved or envisioned) and market measures. To merit inclusion in the analysis, the policies, projects and trends must have been announced or completed between 2018 and 2020. Significant developments from January through May 2021 were included when deemed relevant, with the understanding that the next edition of the *Transport and Climate Change Global Status Report* will cover a period starting in 2021.

Pre- and post-COVID-19 pandemic trends

The year 2020 was pivotal for the world, and the COVID-19 pandemic has had substantial impacts on many of the transport trends monitored in this report. This edition attempts to differentiate between long-term trends and impacts due to the pandemic. To the extent possible, the analysis notes "pre-pandemic" (up to the end of 2019 or latest by February 2020) and "during pandemic" trends (starting in March 2020 until the end of 2020), as in some cases the pandemic led to reversals in long-term trends, at least for a specific period of time. In each section, a box describes the impacts that the pandemic has had on specific regions and sub-sectors.

Assembling the report

Global Strategy Team

This edition of the report was guided by a global strategy team consisting of 20 experts in the field who provided inputs over the span of six meetings between September 2019 and October 2020. Additionally, small group consultations were organised in February 2021, following the peer review process.

Authors and contributors

The report was collaboratively drafted by 22 authors and contributors from 16 organisations, led by the SLOCAT Secretariat. This includes additions and high-level inputs from the copy editor and from the special advisor who also co-authored the Executive Summary. Authors researched and compiled relevant facts and figures for the five sections of the report, including the Focus Features, with supporting review and inputs from several other organisations.

Peer review: A peer review process was carried out from 18 December 2020 to 20 January 2021 with 1,700 comments received from 74 reviewers. Each comment was individually reviewed by the SLOCAT Secretariat and considered in finalising the report.

National focal points: The report benefited from the contributions of voluntary national focal points, or experts from various regions and countries who have been essential to overcome language and information barriers. A public call for participation to provide information on policies and data resulted in several hundred initial registrations. Out of these registrations, 78 national focal points provided inputs through a first survey from 24 January to 3 February 2020; and through a second survey (focused on the country fact sheets) from 6 to 30 August 2020. All national focal points that contributed to the surveys are listed in the Acknowledgements.

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3.9 Renewable Energy in Transport

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Focus Feature 7 | Multi-stakeholder Mobilisation for Climate Action in Transport

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