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Agora Verkehrswende

# Towards Decarbonising Transport 2023

A Stocktake on Sectoral Ambition in the G20

# Imprint

## Towards Decarbonising Transport 2023

A Stocktake on Sectoral Ambition in the G20


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# About this report

This publication analyses the current state of decarbonisation and climate ambition in the transport sectors of G20 countries. In light of India's G20 presidency in 2023, and with emerging economies at the helm of the intergovernmental forum in 2022 (Indonesia) and 2024 (Brazil), this report seeks to support global discussions surrounding sustainable transport and the effort to achieve the goals stipulated in international climate accords, especially the Paris Agreement and the Glasgow Declaration.

The document is an update of the report "Towards Decarbonising Transport 2018 – A Stocktake on Sectoral Ambition in the G20", published by Agora Verkehrswende, GIZ, and REN21. A consortium of seven leading research and international cooperation institutes, under the umbrella of the NDC Transport Initiative Asia, has contributed to the new addition of the report. Agora Verkehrswende completed the work with the support of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), SLOCAT, WRI, ICCT, ITF, and REN21.

The report summarises the mitigation policies for the transport sector enacted by G20 countries and describes their progress in decarbonising the transport sector through 2022. We have concentrated on G20 countries because collectively they account for almost two-thirds of the world's population, around 80% of global economic output, nearly 75% of global exports, and more than 80% of current global $CO_2$ emissions.

The transport sector – responsible for the movement of people and goods by road, rail, air, or waterways – is necessary for economic development, international trade, and social participation. Despite global action to keep global warming well below 2°C, transport emissions continue to grow, which is why the efforts of G20 countries to decarbonise the sector are so important.

This report illustrates the current status and development of the transport sector by offering an in-depth analysis of G20 countries showcased in individual country fact sheets and providing the latest set of comprehensive data on transport, energy, and mobility. Five sections make up the report:

- **Section 1** elaborates global climate discussions and notable sector developments since the publication of the 2018 report.
- **Section 2** describes the role of G20 countries in the global climate crisis and the importance of the transport sector in achieving national ambitions.
- **Section 3** spotlights Indonesia, India and Brazil, presenting an overview of their G20 presidencies (2022, 2023, 2024) and their sectoral ambition.
- **Chapter 4** provides individual country fact sheets with the latest available data on transport, mobility, and energy indicators for G20 countries.
- **Chapter 5** summarises the report and provides recommendations for targeted climate action to decarbonise the transport sector in G20 countries.

# Preface

Dear readers,

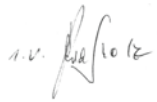
The need to decarbonise the transport sector has gained considerable attention in recent years in government, business and civil society. Since 2018, nations around the world have significantly ramped up their commitments to reducing greenhouse gas emissions. At the COP26 in 2021, over 100 national governments, states, cities and major corporations signed the Glasgow Declaration, which pledges to accelerate the transition to 100% zero-emission cars and vans. The number of countries with net-zero pledges and transport-related NDC targets is rising.

These are welcome developments. However, the dominant role played by fossil fuels remains unchanged, and transport emissions continue to rise worldwide. In addition, recent international conferences have failed to strengthen the political momentum for transformation. The COP27 in Sharm El Sheikh in November 2022 ended without agreements on further emissions reductions, much less a commitment to the phasing out of fossil fuels. The G20 Bali summit did not address transport matters at all. New initiatives are thus needed to bring transport to the forefront of governmental action on climate change.

To be sure, the journey to a decarbonised transport sector will be far from easy, not least because the world community is already facing enormous challenges. The Covid-19 pandemic is still a serious threat in various parts of the world. And the war in Ukraine has triggered a crisis marked by increased geopolitical tensions, supply chain disruptions, spiralling energy prices, and rising inflation. Apparently the need to address multiple crises simultaneously will be the rule rather than the exception in coming years. Of course, the future is notoriously difficult to predict, yet two things are abundantly clear: The climate crisis is intensifying and will become increasingly severe. Furthermore, given transport's status as the sector with the second largest emissions, the decarbonisation of transport is essential to avert the worst effects of climate change.

G20 countries can and should take the lead in moving towards a climate-neutral transport sector. G20 countries are responsible for the lion's share of global transport emissions. Furthermore, they are also in the best position to encourage change, given their political and economic influence. At this crucial moment in time, three emerging economies assume the G20 presidency: Indonesia in 2022, India in 2023 and Brazil in 2024. We hope these presidencies will usher in a transformative perspective for the global community, one that devotes due attention to the transport sector. India's motto for the current presidency – "One Earth, One Family, One Future" – certainly gives cause for optimism.

In this report, NDC Transport Initiative for Asia provides insights into the sector ambitions of G20 countries to date. Funded by the International Climate Initiative (IKI), the initiative is a joint program of seven organisations: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Agora Verkehrswende, the SLOCAT Partnership on Sustainable Low Carbon Transport, the International Council on Clean Transportation (ICCT), the International Transport Forum (ITF), the World Resources Institute (WRI) and the Renewable Energy Policy Network for the 21st Century (REN21). We hope that this report contributes to a vibrant policy dialogue during India's G20 presidency and in subsequent years, for the success of the transformation will depend crucially on evidence-based international exchange.



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# Acronyms

| | |
|---|---|
| **BAU** | Business as usual |
| **BEV** | Battery electric vehicle |
| **CEA** | Central Electricity Authority |
| **$CO_2$** | Carbon dioxide |
| **COP** | Conference of the Parties |
| **ETS** | Emission trading system |
| **EV** | Electric vehicle |
| **FAME** | Faster Adoption and Manufacturing of Hybrid and Electric Vehicles scheme |
| **FCEV** | Fuel cell electric vehicle |
| **G20** | Group of Twenty |
| **GDP** | Gross Domestic Product |
| **GHG** | Greenhouse Gas |
| **GIZ** | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| **HDV** | Heavy duty vehicles |
| **ICCT** | International Council on Clean Transportation |
| **ICE** | Internal combustion engine |
| **IEA** | International Energy Agency |
| **IKI** | International climate initiative |
| **INDC** | Intended nationally determined contribution |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **IRENA** | International Renewable Energy Agency |
| **ITF** | International Transport Forum |
| **JETP** | Just Energy Transition Partnership |
| **LDV** | Light duty vehicles |
| **LPG** | Liquefied petroleum gas |
| **LOTUS** | Low Carbon Transport for Urban Sustainability |
| **LTS** | Long Term Strategy |
| **NDC** | Nationally determined contribution |
| **OECD** | Organisation for Economic Co-operation and Development |
| **PHEV** | Plug-in hybrid electric vehicle |
| **REN21** | Renewable Energy Policy Network for the 21st Century |
| **SDS** | Sustainable development scenario |
| **SLoCaT** | Partnership on Sustainable Low Carbon Transport |
| **STEPS** | Stated policy scenario |
| **UN** | United Nations |
| **UNFCCC** | United Nations Framework Convention on Climate Change |
| **WRI** | World Resources Institute |

# 01

# CURRENT NATIONAL AND INTERNATIONAL TARGETS IN TRANSPORT

# 01 | Current national and international targets in transport

In 2021 the global community entered a new phase of climate ambition by devoting increasing attention to the decarbonisation of the transport sector. COP26 in Glasgow resulted in an unprecedented number of net-zero pledges, strategic declarations, commitments, and initiatives related to transport. First and foremost was the Declaration on Accelerating the Transition to 100% zero-emission cars and vans. Its signatories, industrialised and emerging economies alike, committed themselves to achieving the zero-emission target by 2035–2040. The willingness of countries to set more ambitious targets like these and take increased interest in transport decarbonisation show how much the discourse has intensified since 2018.

Alongside new international agreements came activist campaigns such as Fridays for Future, climate strikes, the occupation of mining sites, and other international protests. All the while, the world underwent political and environmental turmoil. The USA withdrew from the Paris Agreement and then rejoined under a new administration. There were record-breaking summer temperatures, unprecedented weather events, and severe drought. Geopolitical realities shifted and new international conflicts erupted. The COVID pandemic has not only killed millions but also underlined the connection between human economic activity and $CO_2$ emissions, which dropped as large parts of the globe went into lockdown. Moreover, it drove many off public transport and into personal cars, which rejuvenated debate about everyday mobility across the globe.

Amid all these developments, one thing has remained unvarying: **the reality of climate change and the urgent need for decarbonisation.**

As the world's largest economies, G20 countries are uniquely suited to play a leading role in enabling and enforcing the decarbonisation of the transport sector. And it is a role they have to take seriously if we are to prevent the direst projections from becoming reality.

Many countries around the globe set net-zero targets and some countries announced surprisingly ambitious policy actions. Since 2021, a number of countries have updated their NDCs or have been in the progress of finalising their revisions.

The following contains an overview of current international climate ambitions with a focus on the transport sector and G20 countries.

## NDCs

The most important targets regarding climate mitigation at the international level are the NDCs set by the Paris Agreement and submitted to the United Nations Framework Convention on Climate Change (UNFCCC). While the timeframe for developing the first round of NDCs was short (2014–2015), it impelled many countries to start assessing mitigation options and seek a national consensus on future development. In other words, despite its ambition shortfalls, the process has been extremely valuable. The second round of NDC submissions finished at the end of 2021. COP26 explicitly called for updating NDCs. This has been followed up only by a minor number of countries until end of 2022. The third round begins in 2025.

All in all, 41% of second-generation NDCs contain transport targets (either transport GHG mitigation targets and / or non-GHG targets for transport), according to SLOCAT's latest report update "Climate Strategies for Transport: An Analysis of Nationally Determined Contributions and Long-Term Strategies".[1] Among G20 countries, Japan was the only country to set quantitative GHG emissions target for the transport sector (46% below 2013 levels by 2030). In Europe, the EU sets emission targets for road transport that all EU member states have to follow: by 2030 emissions per kilometre for new road vehicles must be reduced between 31% (vans) and 37.5% (passenger cars) from 2021 levels. In the case of new large lorries, $CO_2$ emissions per kilometre have to be reduced on average by 30% from 2019–2020 levels. These targets may be extended to smaller lorries, buses, coaches, and trailers. Furthermore, the EU included the aviation sector in its ETS system.

Two other countries besides the EU have set specific targets regarding road vehicle emissions. Canada established a requirement of 100% zero-emission

1 SLOCAT 2022a

## Transport related NDC targets and measures in the G20

- Transport GHG reduction target
- Other quantitative targets
- Qualitative targets
- No targets
- No G20 member

**Agora Verkehrswende (2023)** | Source: NDC and INDC submissions to the UNFCCC by 2022

vehicle sales by 2035. China plans that by 2030 40% of all new vehicles will be powered by clean energy and the carbon emission intensity of railways will have fallen 10% relative to 2020 levels.

Thirteen of the G20 countries mention specific transport-related measures. By contrast, USA, Australia, Brazil, Saudi Arabia, and post-Brexit UK have not included any specific transport related measures in their NDCs.

Though many countries in their first-round submissions stated few if any transport-related mitigation measures, the submissions in 2020–2021 included a notable variety which ranged from vehicle electrification strategies and the promotion of low-emission vehicles to the expansion of public transport. Many countries also intend to support the shift from road to rail in passenger and freight transport. The NDC submitted by the USA also includes the promotion of charging infrastructure. China, which indicated one of the most extensive lists of measures, specifically named investment in walking and cycling infrastructure. Several G20 members plan to promote vehicle energy efficiency through labelling (China and Argentina) and improved energy efficiency standards (China, USA, and Canada).

Altogether, the new NDC climate strategies submitted globally (not only in the G20) feature a strong focus on electrification of road transport across vehicle types: 52% of second-generation NDCs include e-mobility-related action, as the SLOCAT authors concluded in their report.[2]

## Net-zero pledges

Net-zero pledges are usually laid down in the NDCs or in the Long-term Strategies (LTS). In 2017, Sweden became the first country to enshrine a net-zero target in law, vowing to achieve climate neutrality by 2045. The UK followed in 2019 with a 2050 net-zero target. Meanwhile also Greece, Hungary, Iceland and Spain have net zero laws. As further G20 members Japan and South Korea passed a net zero law in 2021 and Australia in 2022. To date the number of countries pledging to become climate neutral has grown significantly. Most pledges were made in 2020 and 2021, many at the Climate Action Summit 2020 or the COP26 World Leaders Summit. In 2022 some of these political pledges were then reflected in the updated submissions of NDCs or LTS.

Within the G20, Mexico is the only country that has yet to submit net-zero targets. Among the other G20 countries, the majority plans to achieve economy-wide climate neutrality by 2050. Turkey's target is 2053. China and Saudi Arabia are aiming for 2060. India envisages to be climate neutral by 2070. In Germany a landmark court ruling in 2021 found that the country's current climate law was in part unconstitutional because it did not go far enough to ensure the fundamental freedoms and rights of the next generations. In its revised climate law, Germany set a net-zero target for 2045. In 2022, Finland set the earliest legally binding net-zero target to which any country has ever committed itself: 2035.

A growing number of cities and companies are also making net-zero pledges. For example, Mumbai, a city with 15.4 million inhabitants and an area of 603 km², plans to be climate neutral by 2050 and achieve emissions reductions of 30% by 2030 and of 44% by 2040 relative to 2019 levels. In the private sector many global players are revamping their production processes and analysing supply chains for ways to reduce emissions. Siemens, an economic heavy weight with a revenue of 63 billion USD (2021) and 215 000 employees around the globe, plans to be net-zero by 2030.

According to Climate Watch's Net-Zero Tracker[3], 76 parties, representing 83 countries and 73.3% of global GHG emissions, have announced net-zero targets so far. The level of commitment towards these targets varies from official pledges and policy targets to legally binding regulations.

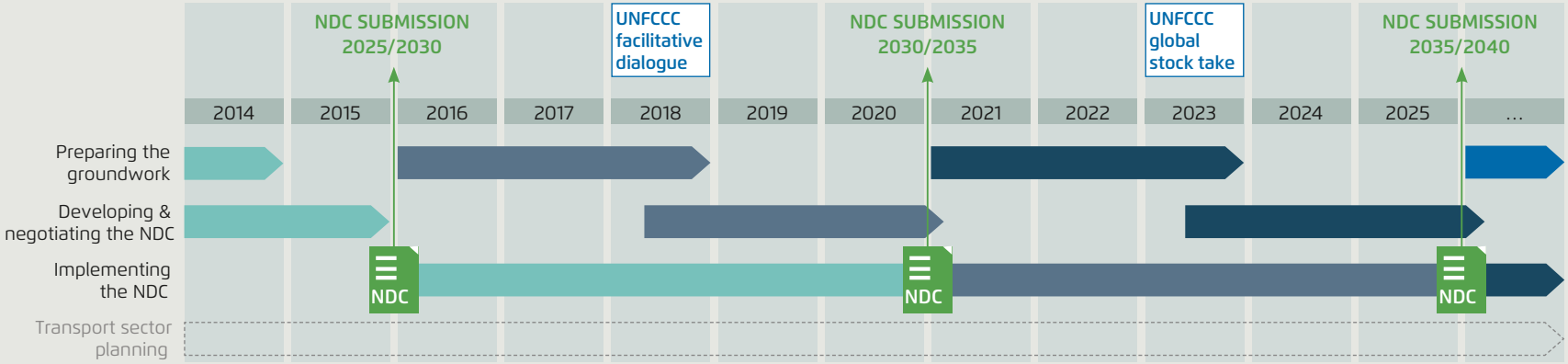
2 SLOCAT 2022a

3 Climate Watch, 2022


**Agora Verkehrswende (2023)** | Source: Climate Watch 2022

The NDC submission cycle

Figure 1.1




**Agora Verkehrswende (2023)** | Source: GIZ 2017

## National targets

Generally, G20 countries show more ambition in national policy than stated in their NDCs under the Paris Agreement.

Four countries outside the EU have set quantitative GHG emission targets for the transport sector in their national strategies or legislation: Argentina, Canada, the UK, and South Africa. Australia wants to reduce 50% of carbon emissions in the passenger road transport sector by 2030 relative to 2000 levels. Seven of the G20 countries have quantitative targets not related to GHG emissions. These targets include quantitative goals for fuel or final energy consumption and fuel efficiency. Australia plans to reduce fuel consumption by 30% in road transport by 2030. Japan intends to enhance fuel efficiency by approximately 13.4% for trucks and other heavy vehicles and by around 14.3% for buses by 2025 relative to 2015 fuel efficiency standards. South Korea aims to raise fuel efficiency for passenger vehicles to 35 km/l by 2035 and to 7.5 km/l for heavy-duty vehicles by 2040.

A number of countries aspire a modal shift from road to rail, waterways, public transport, and bicycles. The EU plans to double traffic on high-speed rail by 2030 and to double rail freight by 2050. Individual European countries have set additional targets. Germany plans to raise the modal share in rail freight to 25% in 2030 from 19% in 2019. India has set ambitious goals in rail freight and envisages an increase to 45% in 2030. Indonesia, South Africa and Turkey are also aiming for higher shares of rail transport. Modal shift targets for waterways have been set by the EU (25% more by 2030) and by India (doubling the current 6% share by 2025). France and Japan have defined goals for bike use.

Overview of national transport-related targets outside NDCs — Table 1.1

| Country | $CO_2$ targets | Other quantitative targets | | | | EV deployment targets | ICE phase-out targets |
|---|---|---|---|---|---|---|---|
| | | Efficiency targets | Technology targets | Renewables targets | Modal share targets | | |
| Argentina | ✓ | | ✓ | | | | |
| Australia | subsector | ✓ | ✓ | | ✓ | ✓ | |
| Brazil | | | | | | | |
| Canada | ✓ | | | | | ✓ | |
| China | | | | | | ✓ | |
| EU | ✓ | | | ✓ | ✓ | ✓ | ✓ |
| France | ✓ | | | | | ✓ | ✓ |
| Germany | ✓ | | | | ✓ | ✓ | |
| India | | | | | ✓ | ✓ | |
| Indonesia | | | | ✓ | ✓ | | ✓ |
| Italy | | | | | | ✓ | |
| Japan | | ✓ | | | | ✓ | |
| Korea, Rep. | | ✓ | ✓ | | | ✓ | |
| Mexico | | | | | | | |
| Saudi Arabia | | | | | | | |
| South Africa | ✓ | ✓ | | | ✓ | | |
| Turkey | | | | | ✓ | | |
| UK | ✓ | | | | | ✓ | ✓ |
| USA | subsector | | | | | ✓ | |

**Agora Verkehrswende (2023)** | Source: various (see annex)

✓ existing

Some countries have formulated specific quantitative targets for infrastructure expansion. Australia wants to construct 1,749 km of high-speed rail and India envisages a high-speed rail network expansion of 7,987 km through 2051.

Saudi Arabia does not have transport-specific national targets, although its "Vision 2030" formulates qualitative objectives to increase public transportation usage and improve the efficiency of vehicles and railways.

In 2018, only half of G20 countries had set deployment targets for **electric vehicles**. Since then, all G20 countries except Argentina and Saudi Arabia have established deployment goals. Their goals are expressed either as EV percentages in new sales and stock fleets or as absolute target numbers to be reached by a certain date. China planned to reach a 20% EV share in new sales by 2025, but achieved it early, with around 3 million new EVs sold in 2021. It expects that up to 7 million new EVs will be sold in 2022, and plans to reach a 40% share by 2030, though this is likely to happen sooner. Furthermore, China intends to electrify 100% of the public vehicle fleet by 2035. India has targeted a 30% EV share in passenger light-duty vehicle (LDV) sales by 2030. The EU intends to achieve a 15% share of BEVs and PHEVs by 2025 and a 35% share of BEVs and PHEVs by 2030. Among the G20 countries that have set absolute target numbers are Indonesia (2 million EVs and 13 million electric motorcycles by 2030) and Germany (15 million fully electric passenger cars by 2030).

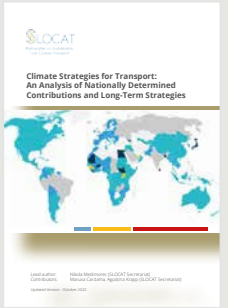

**Agora Verkehrswende (2023)** | Source: various (see annex)

To support the switch to EVs, eight countries and the EU set phase-out commitments for internal combustion engine (ICE) vehicles. This development was supported by the COP26 declaration on "accelerating the transition to 100% zero emission cars and vans," which was signed by over 130 countries. In 2022 at COP27, the declaration reached 214 signatories. The declaration includes the common goal of signatories to work towards all sales of new cars and vans being zero emission globally by 2040, and by no later than 2035 in leading markets. Among the G20 countries, the declaration was signed by Canada, the UK, India, and Mexico and around 15 countries in the EU. In October 2022, the EU council of ministers decided to reduce car fleet limits to zero by 2035, which effectively corresponds to a ban on ICE vehicles. However, after ongoing discussions and the intervention of Germany, the European Commission was asked to check if ICE vehicles powered exclusively by e-fuels could still be registered after 2035.

Finally, targets for charging infrastructure deployment have been established in eleven G20 countries. The goals are indicated in the number of charging points and sometimes (as in Japan and South Korea) in the types of chargers (e.g., fast and slow). Indonesia also mentions a target for the number of installed battery-swapping stations.

All in all, the level of ambitions at the national level has increased significantly since 2018. But it remains to be seen whether countries will be able to meet their targets through effective measures. Many targets from past years have gone unfulfilled. For example, Germany did not meet its 2020 targets for EV stock and the number of charging points. Several countries were able to satisfy 2020 emission reduction targets in the transport sector, but these achievements can largely be attributed to COVID-19 effects. China was one of the few countries to meet its 2020 targets for public charging points and EV adoption.

## Climate Strategies for Transport: An Analysis of Nationally Determined Contributions and Long-Term Strategies




This Report analyses trends in transport decarbonisation ambition, targets and actions in the climate strategies submitted by countries in the framework of the Paris Agreement. Specifically, the analysis focuses on Long-Term Strategies (LTS) starting from 2016 and on Nationally Determined Contributions (NDCs) starting from 2019. On the basis of the analysis, the report seeks to establish to what extent climate action in transport by countries is on track to deliver on the Paris Agreement goal of limiting global warming below 2°C. The Report also identifies gaps and shortcomings in the transport dimension of these national climate strategies; while it provides recommendations on how to enhance it. This October 2022 Update assesses the impact of NDCs with targets related to mitigating transport greenhouse gas emission on the overall trajectory of transport emissions. Findings show that, if the targets were to be met, the growth of transport emissions would only be slowed down but not put on the radical contention path that is required to support the goal of limiting global warming below 2°C.

SLOCAT (2022), Climate Strategies for Transport: An Analysis of Nationally Determined Contributions and Long-Term Strategies, October 2022 Update.
*www.slocat.net/ndcs*

## Translation into national measures

Overview of national measures across G20 countries — Table 1.2

| | National programmes to support shift to public transport | Measures to support low-carbon freight logistics | National-level measures to support new mobility services | National measures to support non-motorised transport | Energy / carbon emission standards LDV | Energy / carbon emission standards HDV | Pricing instruments | Mandatory vehicle labelling | Support mechanism for electric vehicles & charging infrastructure | Biofuel targets | Support for other low-carbon fuels & propulsion systems |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | ✓ | ✓ | | | | | ✓ | ✓ | ✓ | ✓ | |
| Australia | | ✓ | | | | | | ✓ | ✓ | | ✓ |
| Brazil | | | | | ✓ | | | | ✓ | ✓ | ✓ |
| Canada | ✓ | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| China | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| EU | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| France | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Germany | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| India | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ |
| Indonesia | ✓ | | | ✓ | | | ✓ | | ✓ | ✓ | ✓ |
| Italy | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Japan | ✓ | ✓ | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Korea, Rep. | ✓ | ✓ | | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Mexico | ✓ | | | | ✓ | | ✓ | | | ✓ | ✓ |
| Saudi Arabia | ✓ | ✓ | | | ✓ | | | ✓ | | | ✓ |
| South Africa | ✓ | ✓ | | | | | ✓ | ✓ | | ✓ | ✓ |
| Turkey | ✓ | ✓ | | ✓ | | | | ✓ | ✓ | ✓ | ✓ |
| UK | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| USA | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ |

**Agora Verkehrswende (2023)** | Note: The existence of measures does not imply their adequacy; Source: various (see annex)

✓ existing

In order to fulfil the targets, effective measures and political instruments are required. Table 1.2 breaks down the different measures used across G20.
The measures apply to specific subsectors such as passenger transport or freight logistics. Furthermore, they concern different modes of transport such as road or rail transport and different opportunities to shift volumes from one mode to another. Almost all G20 countries have policies in place to support the shift to public transport, including action plans or laws to extend services through infrastructure expansion or the renewal of public vehicle fleets. Some countries such as the UK are also striving to improve the connectivity between different transport modes in public transport. The Canadian programme "Investing in Canada" has set aside CA$28.7 billion (~USD 21 billion) to make public transportation options more affordable. Germany's "9-euro ticket" represents a similar effort (although the primary purpose of the test programme was to support citizens during the energy crisis, not decarbonise the transport sector). After a three-month trial phase from June to August 2022, Germany decided to introduce a nationwide successor ticket at a price of 49 euros. Furthermore, eleven of the G20 countries have launched measures to promote the two areas of active mobility: cycling and walking.

In the freight sector, many instruments seek to shift transport volumes to rail and inland waterways. As with the passenger sector, the key measures to support the shift include the expansion and upgrade of infrastructure. India plans to establish new rail infrastructure dedicated solely to freight transport. Another important tool to decarbonise the freight sector is the optimisation of logistic systems through the better connectivity of transport modes and the establishment of intermodal hubs. Currently, Japan, UK, and Germany are planning these improvements.

The political instruments also differ in their function. While some initiatives are regulatory, others focus on fiscal tools and pricing instruments. In the regulatory area, well-known instruments are energy and emission standards. Fourteen of the G20 countries have emission standards for passenger cars and LDVs. Japan now has the strictest emission standards, which permit passenger car fleets to emit only 73.5 g $CO_2$/km per year. The EU, the UK, and South Korea have emission standards of 95–97 g/km for passenger cars. In Brazil, Canada, China, India, and the USA, the fleet limit ranges from 111–128 g/km. In the future, the EU plans to reduce its emission standards to 59g/km (EU) in 2030.

Typical pricing policies include emission trading systems (ETS) and carbon prices / taxes. The EU plans to extend its ETS to the transport sector starting in 2026. China introduced a national ETS in 2021, which initially covered only the power sector, but the scope is expected to gradually expand to include domestic aviation. Several other countries – including Argentina, Mexico, Japan, and South Africa – have introduced carbon taxes.

Not all instruments function in a direct manner. For instance, many important instruments support the purchase of EVs and the roll-out of charging infrastructure, while others try to disincentivise the use of ICE cars. Direct support measures include purchase subsidies, import tax exemptions, and purchase and operational tax exemptions for electric vehicles. Except for Saudi Arabia and South Africa, all G20 countries have initiated support mechanisms for electric vehicles and charging infrastructure. Indirect measures, also known as "malus" systems, charge higher costs or taxes for vehicles with high $CO_2$ emissions. These kinds of instruments have been introduced in France and Italy.

Altogether, the current landscape of political instruments and measures reflects the high level of ambition observed in NDCs and national targets.

Whether these measures are adequate for achieving stated targets, let alone for satisfying the objectives of the Paris Agreement, would require intensive assessment and analysis, which goes beyond the scope of this report. But a closer look at the state of transport decarbonisation in G20 countries could trigger discussions among members and stakeholders about whether enhanced measures are required.

## Transport Emission Scenarios

The IPCC's Sixth Assessment Report states that the targets of the 2030 national determined contributions (NDCs) submitted prior to COP26 amount to emission reductions that are nowhere near what is needed for 2 °C and 1.5 °C pathways (see figure on the next page). Drastic reduction measures would have to be initiated starting in 2030 to enable a return to the 2 °C pathway, but even so, 1.5 °C would remain out of reach.[4]

The International Transport Forum (ITF) and SLOCAT published extensive reports that include forecasts of transport demand and emissions. According to the latest ITF report, by 2050 $CO_2$ emissions from transport will increase by 16%, even if today's political commitments are fully implemented (ITF, 2021, p. 14). A strong increase in transport demand is expected to offset policy-led emissions reductions. One of the latest SLOCAT publication states that by 2050 transport emissions have to drop by two-thirds relative to 2019 levels, or 8 gigatonnes, to achieve Paris Agreement targets.[5]

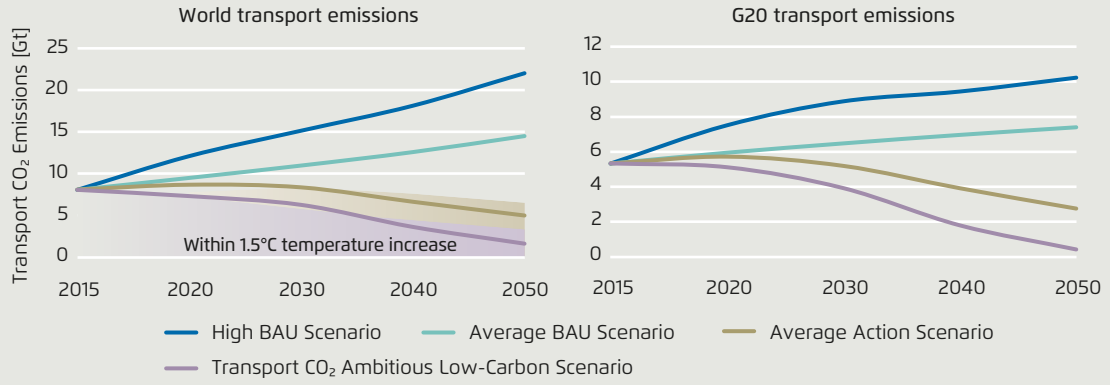
4 IPCC 2022
5 SLOCAT 2021

SLOCAT has developed several forecast scenarios for transport-sector emissions. These are depicted in the graphic below. The simulation data do not yet include COVID-19 effects and the associated decline in global transport emissions.

The "BAU HIGH" assumes a business-as-usual development for mobility patterns and investment trends. This scenario projects a 4 °C or higher increase in global temperatures. The "Average BAU scenario", which assumes incremental progress in transport mitigation and an increased focus on adaptation, results in a 3–4 °C temperature rise. The low carbon scenarios "Average Action" and "Transport $CO_2$ Ambitious" require the acceleration of radical action on transport behaviour and investment to deliver 2 °C and 1.5 °C of warming, respectively. Though a difference of just 0.5 °C, the forecast for the "Transport $CO_2$ Ambitious" entails significant additional measures and emission reductions.[6]

6 SLOCAT 2021

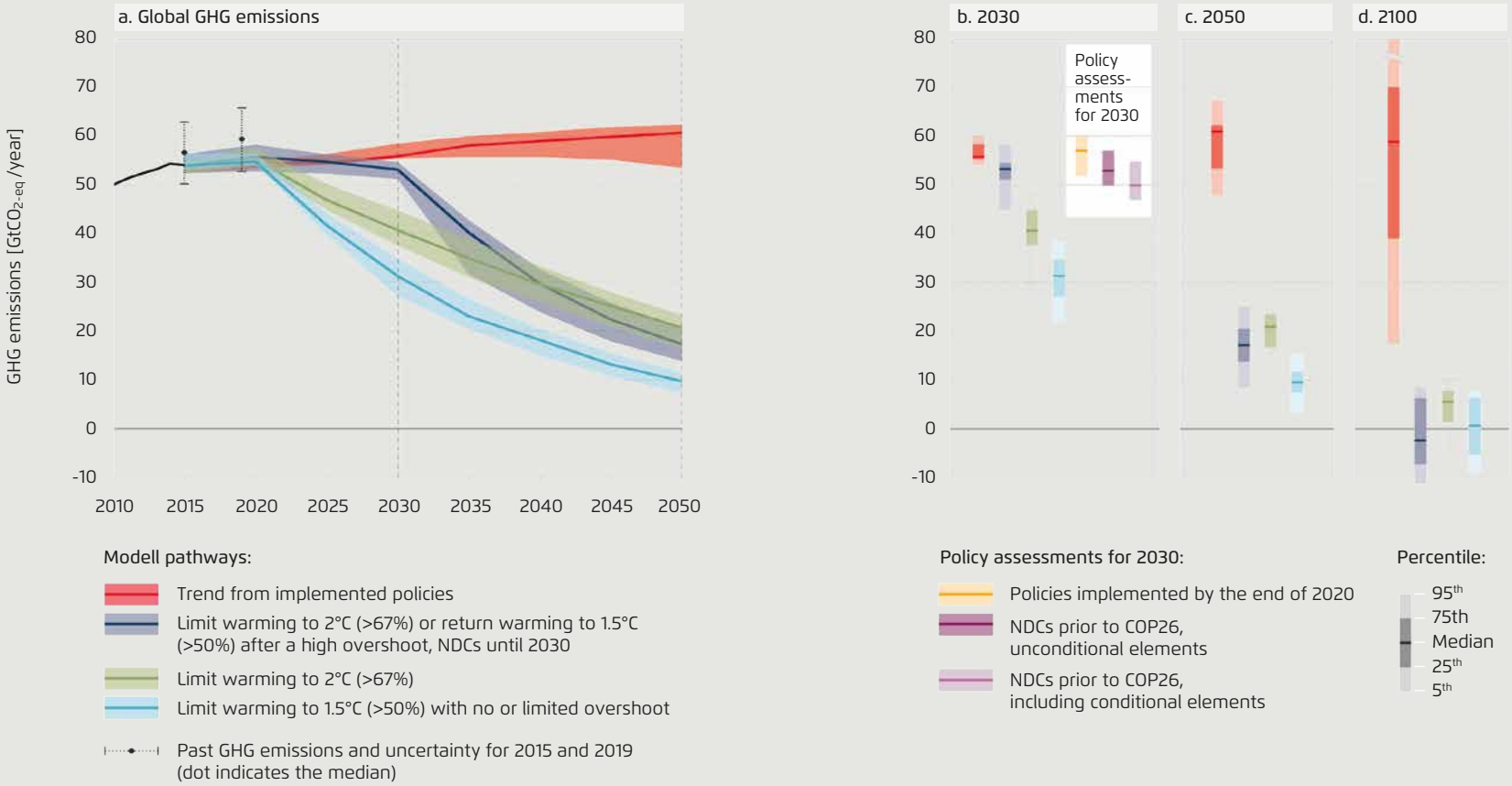
Transport emission pathways for the business-as-usual, 2°C and 1,5° scenarios, 2018-2050 — Figure 1.2




**Agora Verkehrswende (2023)** | Source: SLOCAT 2021

Projected global GHG emissions from NDCs announced prior to COP26 would make it likely that warming will exceed 1.5°C and also make it harder after 2030 to limit warming to below 2°C

Figure 1.3



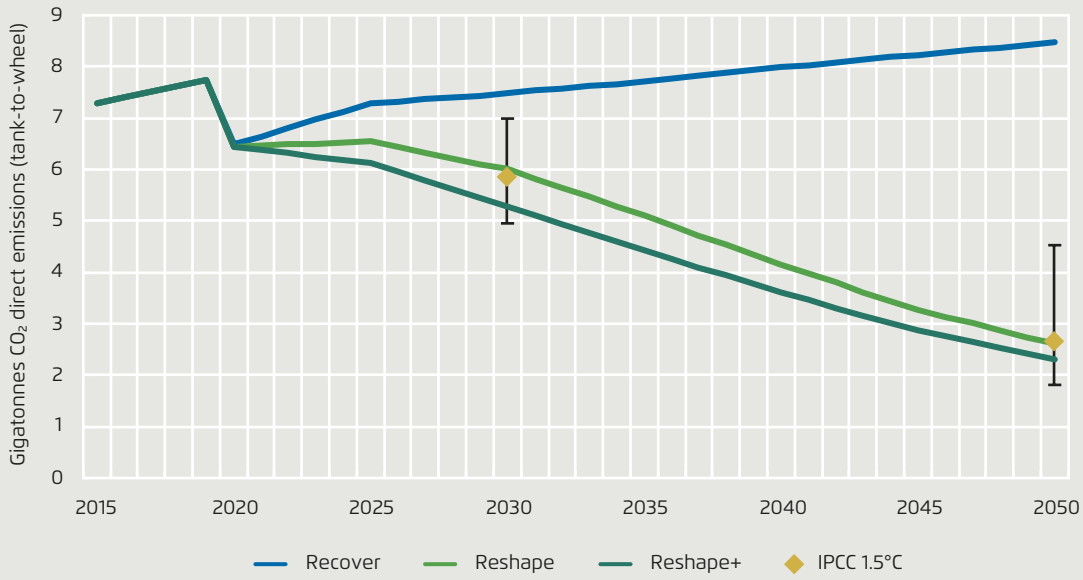

**Agora Verkehrswende (2023)** | Source: IPCC 2022

Another scenario analysis was conducted by the ITF. The chart on the right shows the ITF's transport emission forecast for three different scenarios:
The "Recover" scenario shows expected development if current efforts continue and includes the aforementioned 16% increase in emissions. More ambitious transport decarbonisation policies are assumed in the "Reshape" scenario, which projects a reduction of transport $CO_2$ emissions by almost 70% in 2050 relative to those in 2015. With this scenario, achieving the 1.5°C pathway is more likely. The "Reshape+" scenario includes more ambitious policies than those announced so far and leverages opportunities created by the COVID-19 pandemic to decarbonise the transport sector.[7]

Though the SLOCAT simulation is more conservative than the ITF model – it expects higher emissions in the business-as-usual scenario after factoring out COVID-19 effects – both indicate that current political efforts won't be enough to fulfil Paris Agreement targets. More ambitious policy actions, drastic targets, and rapid measures have to be implemented to bring the 1.5 °C goal into reach.

7 ITF 2021b

Three scenarios for future transport $CO_2$ emissions — Figure 1.4




**Agora Verkehrswende (2023)** | Source: ITF 2021b

Note: Figure depicts ITF modelled estimates. Recover, Reshape and Reshape+ refer to the three scenarios modelled, which represent increasingly ambitious post-pandemic policies to decarbonise transport. ITF models used in this Outlook are typically run by five-year increments, therefore the 2020 to 2025 recovery trend may not necessarily be linear despite being shown as such in the figure. The shape of this "recovery curve" will depend on policy implementation and economic trajectories. IPCC 1.5°C represents the emissions levels needed to limit warming to 1.5°C as introduced by the IPCC (2018) IPCC, 2018: Summary for Policymakers.

In: Global Warming of 1.5°C, https://www.ipcc.ch/sr15/. The levels were calculated based on data sourced from https://data.ene.iiasa.ac.at/iamc-1.5c-explorer similarly to ICCT (2020), https://theicct.org/sites/default/files/publications/ICCT_Vision2050_sept2020.pdf Transport sector emissions pathways with low or no overshoot were selected before estimating the median emissions in each year, error bars represent the 25th and 75th percentiles of scenarios. Emissions of black carbon are excluded as these are not estimated in the ITF or IEA MoMo models.

# 02

# THE ROLE OF G20 COUNTRIES IN ENABLING SECTOR DECARBONISATION

# 02 | The role of G20 countries in enabling sector decarbonisation

The mobility of people and goods is an intrinsic component of today's societies and our global economy. Transport systems are crucial to personal freedom, enabling choices about where to work, live, and spend free time. Transport also plays a vital role in the international movement of goods, the development of global production chains, and the operation of energy systems. Any serious discussion of climate ambition and decarbonisation will have to give the global transport sector ample consideration.

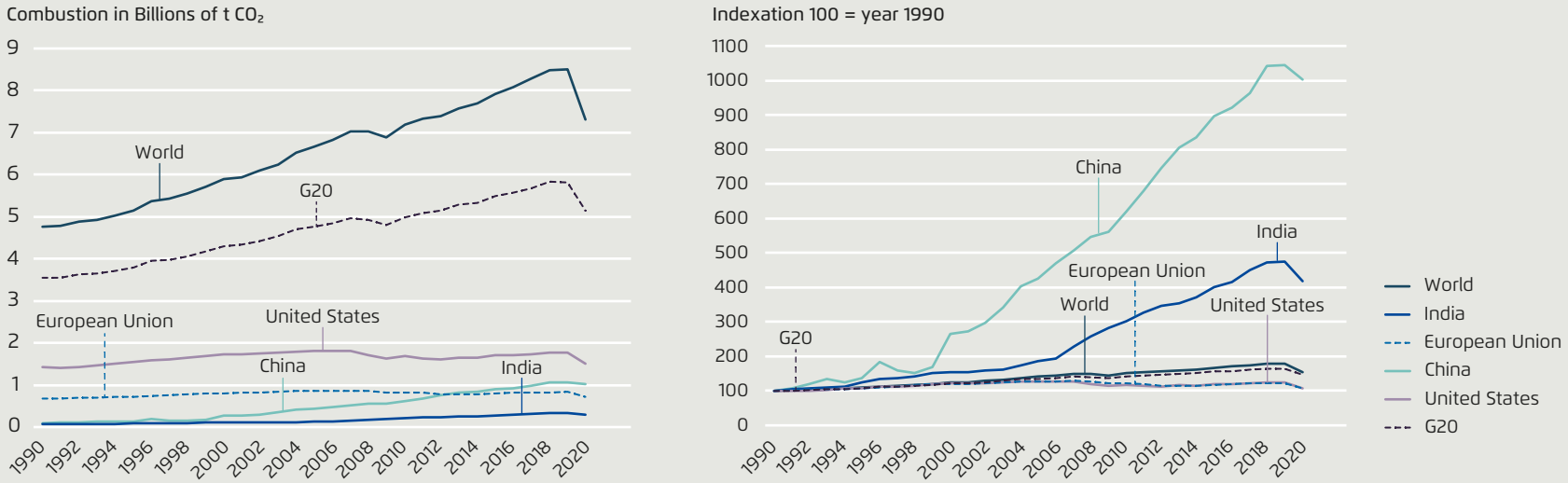
In 2020, G20 countries were home to more than 4.7 billion people, or 62% of the global population. By 2050 it is estimated that "only" half of the world's population will live in G20 countries. Nevertheless, per capita emissions in the G20 will continue to have a disproportionate effect. G20 countries are highly urbanised, many live in cities – in Argentina, the figure is 92% – and 16 nations have an urbanisation rate of more than 70%. In 2020, almost 68% of the world's urban population lived in G20 countries.

More to the point, the G20 produces around 80% of global economic output and nearly 75% of global exports, and is responsible for more than 80% of current global $CO_2$ emissions and with about 5.8 billion t $CO_2$ emissions from fuel combustion) almost 70% of worldwide transport emissions [8].

8 IEA 2022g

Transport $CO_2$ Emissions from fuel combustion

Figure 2.1

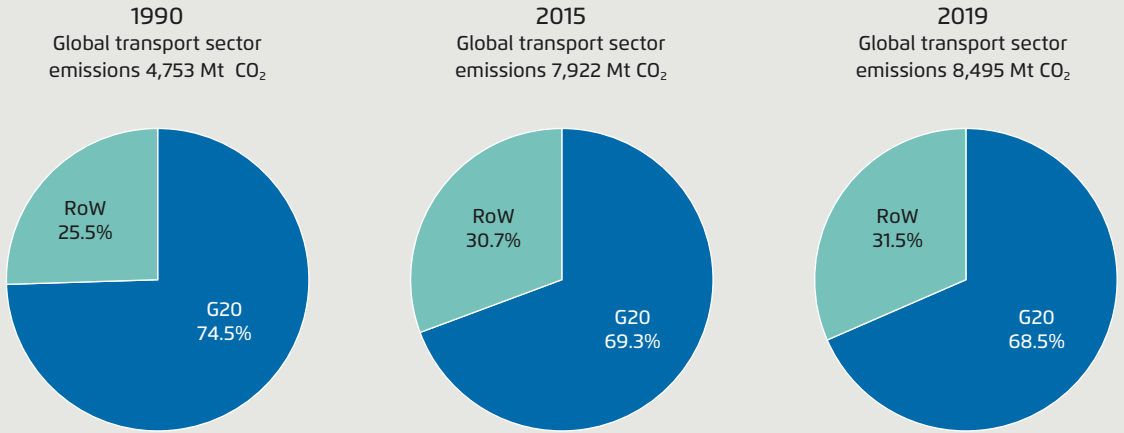



**Agora Verkehrswende (2023)** | Source: IEA 2022g

## 20 of the world's 195 countries contribute two-thirds of transport-related emissions

For decades now, there has a been strong link between economic prosperity, the movement of people and goods, and transport emissions. Worldwide, the transport sector accounts for about a quarter of $CO_2$ emissions from fuel combustion and for about 15% of GHG emissions. In G20 countries, transport makes up almost one-fifth of energy-related $CO_2$ emissions. Since 1990 the global share of transport-related $CO_2$ emissions by G20 countries has decreased as emissions elsewhere have risen. Even so, 20 of the world's 195 countries still contribute two-thirds of transport-related emissions, and the absolute numbers continue to increase. Even the worldwide drop in emissions due to the COVID pandemic did little to change the share compared with previous years, nullifying the impact of COVID on global climate change.

$CO_2$ emissions in the transport sector – 1990, 2015 and 2019 — Figure 2.2




**Agora Verkehrswende (2023)** | Source: Author's figure based on data from IEA 2022g

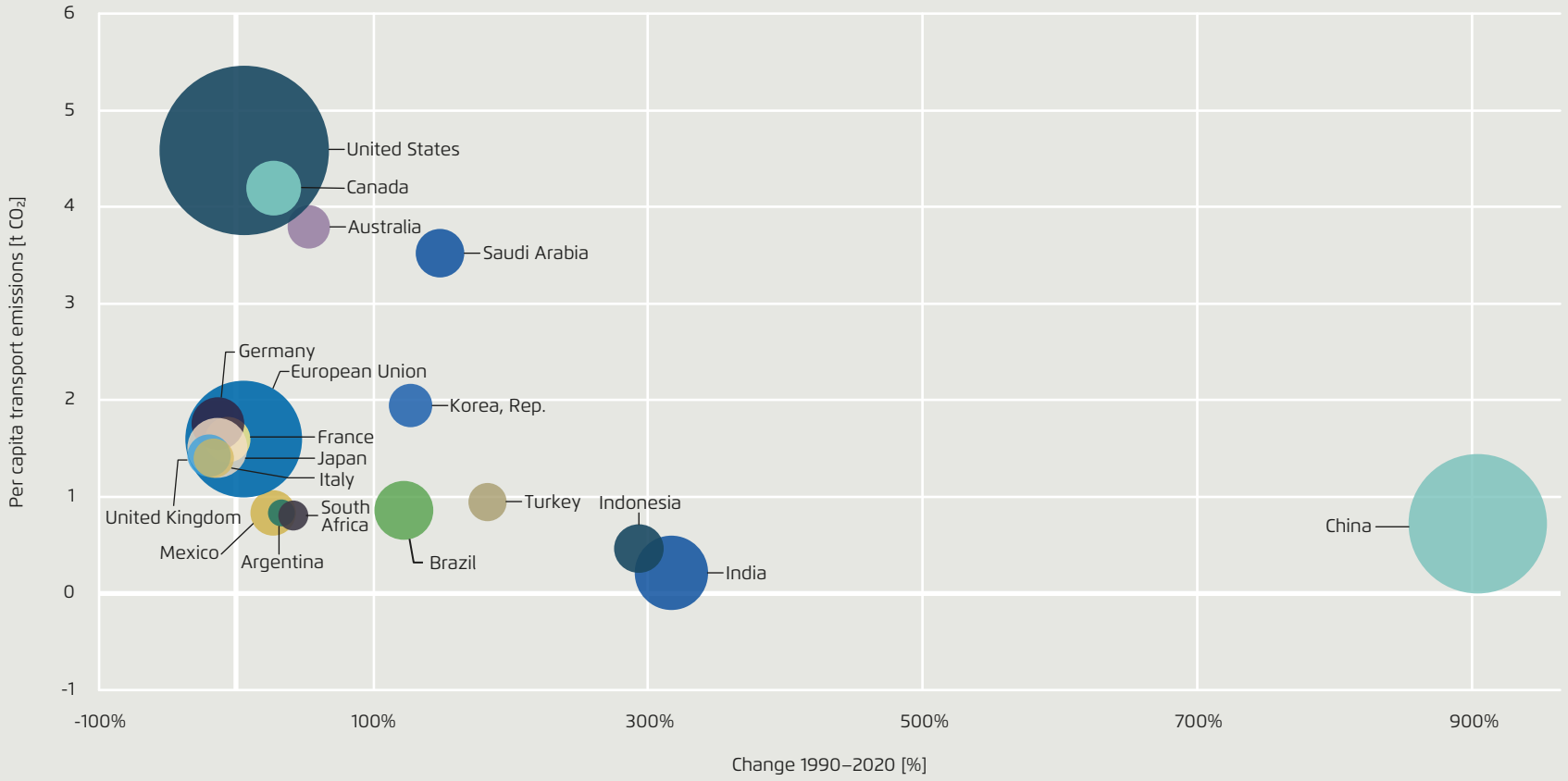
Transport emissions have undergone a steep increase – 64% in G20 countries, 79% worldwide – since 1990. Even in recent years, transport-related emissions in G20 countries have been on the rise. The most exponential growth can be found in China, which increased more than 940% since 1990 and 16.5% since 2015. In the same periods, India's transport emissions grew by 375% and 18.4%, respectively, while Indonesia's grew by 365% and 13.4%, respectively. Though these three countries remain the lowest among G20 in terms of per capita transport-related emissions (between 0.2 t $CO_2$ and 0.75 t $CO_2$), these values continue to increase as well.

Only Japan and Germany have seen decreases in emissions since 1990 – 5% and 2%, respectively – and only Japan has lowered its emission levels in recent years. Nevertheless, both continue to have relatively high per capita emissions at more than 1.6 t $CO_2$ each.

For the past decades, the country with the highest transport-related emissions has been the USA, which in 2019 released 1.763 Mt $CO_2$ in total, or 5.4 t $CO_2$ per capita. Its emissions have grown by 23% since 1990 and by 3.4% since 2015. Hence, USA continues to be the major $CO_2$ emitter globally.

Generally, transport emissions in the G20 continue to grow. Between 2015 and 2019, they increased by 6%,

Change in G20 per capita transport emissions between 1990 and 2020 Figure 2.3




**Agora Verkehrswende (2023)** | Note: the size of bubbles indicates total emissions from the transport sector. Source: Author's figure based on data from IEA 2022g

which was higher than the 2.7% increase in total G20 GHG emissions during the same period.

The vast majority of G20 emissions still stem from burning fossil fuels to produce energy. Around 80% of the energy used in 2019 was provided by gasoline or diesel. The other energy sources consisted of natural gas, LPG, electricity, kerosine, and various kinds of biofuels. Total energy use in the G20 transport sector increased by 25% between 2015 and 2019.

In terms of resource consumption, the outlook is worrying. The G20 transport sector currently consumes more than half of global oil demand, which besides negative effects on the environment and climate brings with it dependency on fossil-fuel imports. This puts a substantial burden on national budgets and economies and represents a risk for societies in general, as the current price increases in the wake of global crisis and conflict make plain. In the face of the COVID-19 pandemic and global trade conflicts, especially between China and the USA, the 2019–2022 period were an economically challenging period for G20 countries. With few exceptions, total freight transport performance increased continuously in China, the EU, Turkey, Mexico and the UK between 2015 and 2019 but saw declines in 2020 due to COVID-19 (decline rates ranged from -4% (Italy) to around -24% in China). Strongest declines in 2020 were seen in specific transport modes such as aviation and waterways. For instance, Europe's aviation freight transport fell by 25%.

By contrast, road transport, which accounts for over 40% of freight in China, the EU, and the UK, recovered quickly from COVID-19 disruptions and saw only moderate declines in 2020. It continues to be the largest source of GHG emissions in the global transport sector. It was responsible for around 85% of G20 transport sector emissions in 2020. In many G20 countries, rail freight proved to be resilient in the first phase of the pandemic. Not only is its carbon intensity less than that of road transport. It requires fewer personnel, and its operation procedures allow for easier fulfilment of COVID-related hygiene rules. Over the course of 2020, however, the effects of the modal shift vanished.

Road transport continues to be the dominant mode in most G20 countries for passengers as well as for freight. In Germany, trips in private cars account for almost 90% of passenger transport. In the USA, the share of private cars in passenger transport during the past five years was over 90%. In China and Japan, private cars made up around 40% and 60%, respectively. Total passenger kilometres travelled increased between 2015 and 2019 in most G20 countries, but in 2020, levels declined due to the pandemic. The decreases in passenger transport – e.g., -46% in China, -34% in the UK – were much steeper than in freight transport.

To safeguard operational transport systems without compromising long-term disadvantages, countries need to invest in clean, renewable, and efficient modes of transport. Fossil-fuel dependency, the prospect of limited resources, and ongoing motorisation are all reasons why G20 countries must prioritise the transition to clean energy and sustainable transport.

In 2020, even as many people remained isolated at home because of the pandemic, G20 countries increased their investment in transport infrastructure. China increased its cumulative investment in road, rail, and airport infrastructure by almost 40% relative to 2015 levels. The USA raised its investment in road, rail, and waterways infrastructure by 10%. Germany's aggregated investment for road, rail, waterways, and maritime ports and airport infrastructure was 44% higher than in 2015. While most G20 countries spend well over half of their transport investment budget on road infrastructure (USA 89%, China 85%, Japan 71%, Germany 55%), very few countries spend the majority on other modes of transport. One exception is the UK, which set aside 58% of its 2020 investment budget for rail infrastructure.

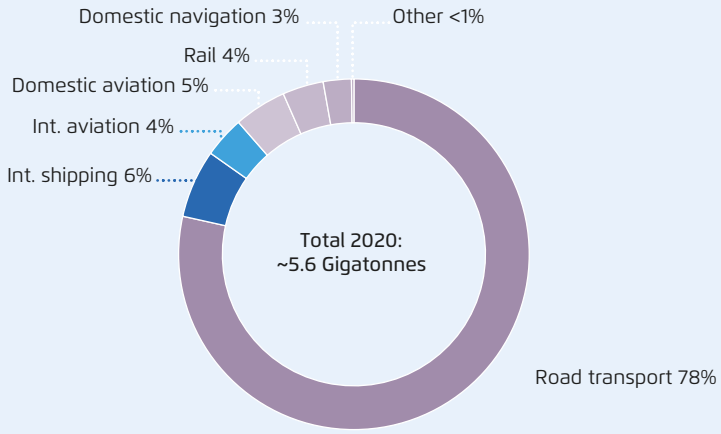
## Maritime and Aviation

Decarbonisation debates tend to focus on road transport. But international aviation and shipping also contribute large amounts of GHG emissions. As the figure on the right shows, international aviation and shipping together account for 10% of all transport emissions in the G20. According to the latest SLOCAT Transport and Climate Change Global Status Report, both modes globally emit more $CO_2$ per year than the regions of Latin America and the Caribbean, Africa, and Oceania combined[9].

An analysis of international aviation and shipping over time shows that emissions from both transport modes have increased significantly (with the exception of the year 2020 on account of COVID). Aviation is one of the fastest-growing sources of GHG emissions: between 1990 and 2020, G20 international aviation emissions increased by 132%. Even though the maritime shipping sector in general is a very energy-efficient mode of transport, it increasingly causes large volumes of emissions as well. As of 2021, maritime shipping was responsible for around 90% of global trade in terms of tonne kilometres. Emissions in international shipping caused by the G20 countries increased by 52% between 1990 and 2019.

9 SLOCAT 2021

G20 $CO_2$-emissions from international aviation and shipping (million ton of $CO_2$) Figure 2.4



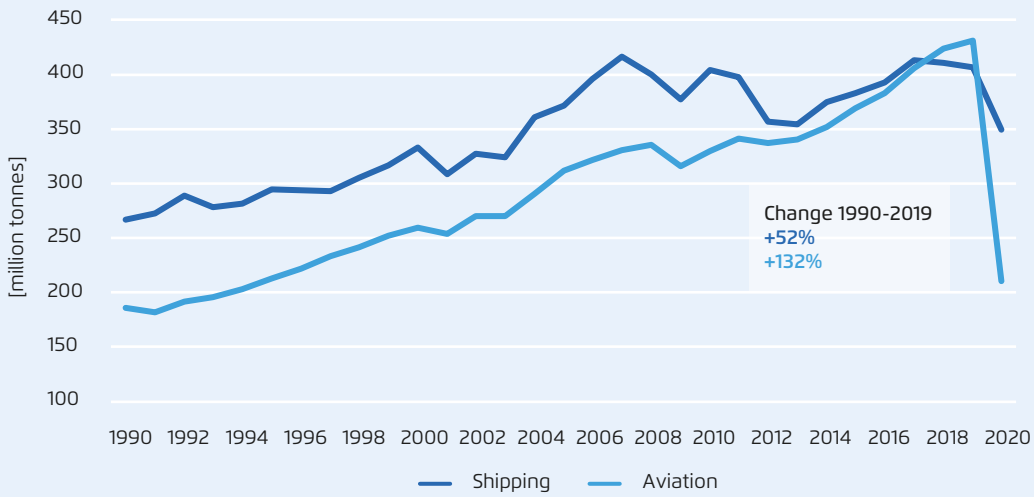

**Agora Verkehrswende (2023)** | Source: Author's figure based on data from IEA 2022g

In order to curb emissions from international aviation and shipping, policy regulations must be strengthened at both the international and national levels. But this requires that individual countries first determine their share of international emissions. While most countries systematically collect data on domestic aviation and inland waterway shipping, there are few comprehensive approaches in place to collect, calculate, or estimate international emissions. The International Energy Agency (IEA) calculates the emissions of international aviation and marine bunkers on the basis of departure and arrival locations.[10] Other methods allocate emission shares based on where the bunker fuel is sold, the nationality of the transporting company, where a ship or aircraft is registered, or the country of the operator. Another approach is to approximate

10 IEA 2022g

G20 $CO_2$-emissions from international aviation and shipping

Figure 2.5




**Agora Verkehrswende (2023)** | Source: Author's figure based on data from IEA 2022g

emissions. Some use global emission data, e.g., the EDGAR Database [11], and estimate individual country shares on the basis of GDP or national emissions.

Each approach brings both disadvantages and benefits. Methods analysing departure and destination countries offer a more detailed picture, but compiling the data is complex and gaps may arise. In addition, they do not take into account emissions caused by transport operations that are initiated by one country but originate and terminate elsewhere. The approximation method based on GDP requires less effort, and is supported by the strong link between a country's wealth and high levels of commercial air travel and container shipping. The method based on national emissions attributes a smaller amount of international aviation and shipping emissions to countries with a high share of nuclear or hydropower supply. These countries may still be very active in international transport, however.

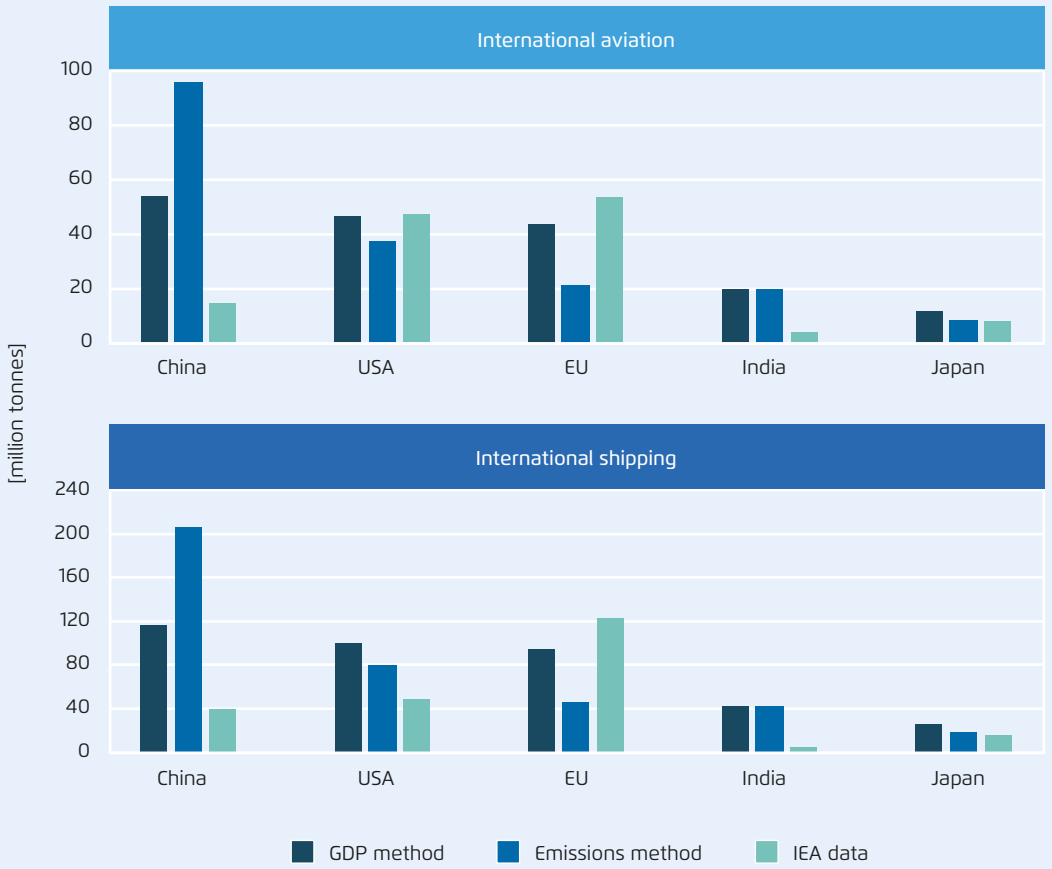
The figure on the next page compares emission estimates for international aviation and shipping produced from three different methods.

Regardless the method, China, the USA, and the European Union account for the largest amounts of emissions from international shipping and aviation, followed by India and Japan. When comparing the approaches, however, aviation and shipping emissions are higher when using the emissions method for China compared with the GDP technique.

By contrast, the emissions method results in lower values for the USA, the EU and Japan compared with the GDP method. The IEA data show the lowest emissions for China, India and Japan among all three methods both in the case of aviation and shipping. For the EU, the IEA data result in the highest emissions in international aviation and shipping. An explanation may be the high number of large European container ports and airports and many shipping procedures and journeys originating and ending at these points.

11 EDGAR 2021

$CO_2$ emissions in the largest G20 countries 2020 Figure 2.6




**Agora Verkehrswende (2023)** | Source: Author's figure based on data from EIA, approximations based on IEA 2022g and EDGAR 2021

Regardless of the precise breakdown, international aviation and shipping release enormous quantities of $CO_2$ and hence require urgent decarbonisation. But doing so faces three unique challenges. First, in contrast to domestic aviation and inland waterways shipping, there are no systematic approaches to collect, calculate, or estimate international emissions in these areas. The lack of standards will diffuse international responsibility and may lead to insufficient action. Second, in contrast to road transport, current technology does not allow the direct use of battery electricity for common planes or vessels. The only viable, climate-neutral solution at the moment are electric fuels, which require significant amounts of renewable electricity and considerable logistical and technical effort. However, no significant production capacities for such fuels are available today.

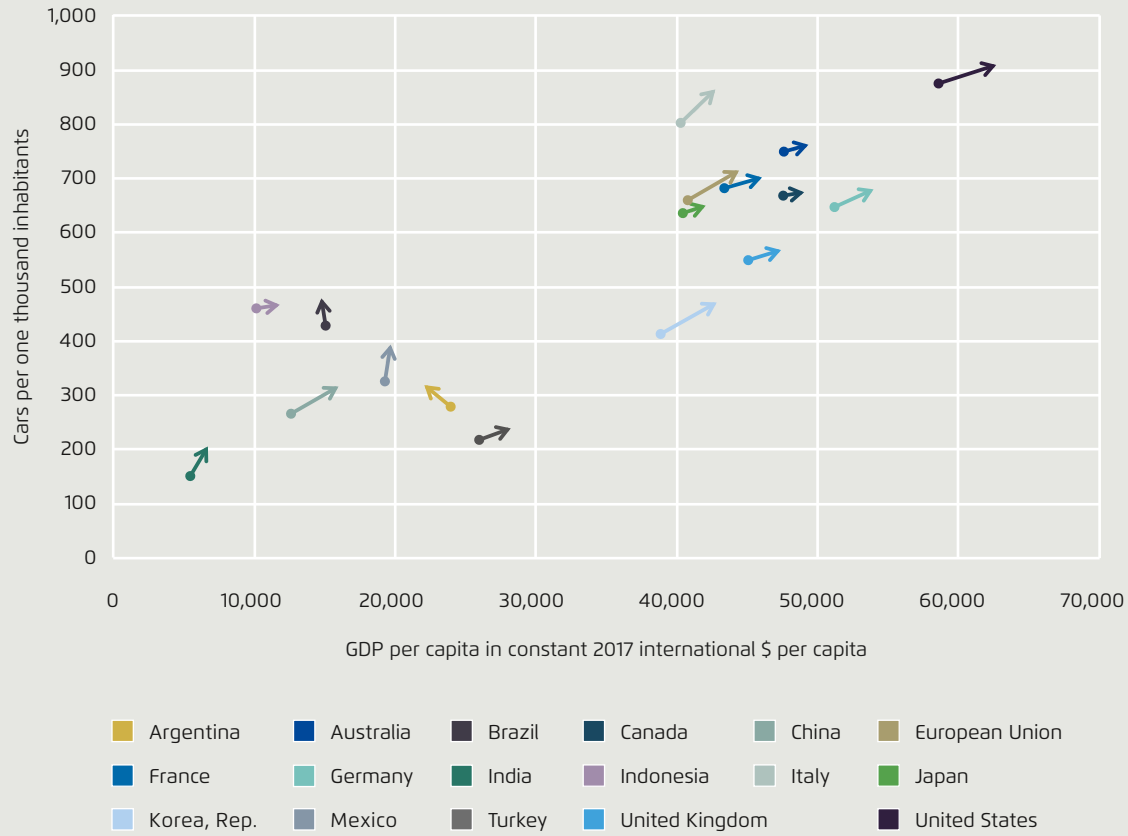
Finally, aviation has other harmful effects on climate and environment that are not related to $CO_2$ emissions (e.g., high-altitude nitrogen oxide emissions, contrail cirrus formation) and no solutions have been realised yet to mitigate these effects.

Decarbonising the transport sector poses considerable challenges to all G20 countries, which find themselves at different stages of motorisation, decarbonisation, and transition to sustainable transport.

When plotting the development of GDP per capita and the number of motor vehicles per person from 2015 until 2019–2020, it becomes clear that despite falling GDP in some cases, motorisation rates continue to grow. This means motorisation is far from being decoupled from economic growth – it has continued to increase even after economic growth slowed.

However, there are also positive trends when it comes to sustainable transport in G20 countries.

Development of per capita GDP and vehicle ownership in selected G20 countries 2015–2019 Figure 2.7




**Agora Verkehrswende (2023)** | Note: no vehicle ownership data available for South Africa, Saudia Arabia and Russia
Source: Author's figure based on data from various sources (see annex)

## E-Mobility

The market ramp-up of electric vehicles has gained significant momentum in recent years. With 8.4 million vehicles, the EV fleet in G20 countries was almost eight times as large in 2020 as in 2015. Fleet growth in absolute numbers was largest in China and the USA, where fleets grew by 4.9 million and 1.4 million vehicles, respectively. Recent figures for China in 2022, show new sales of electric vehicles hitting about 6 million vehicles in one year. Interesting side fact: to date more than 90% of Electric vehicles can be found in 25 cities around the globe[12]. The strongest relative fleet growth was observed in the countries Brazil and Mexico, which started with small fleets in 2015 (<500 electric vehicles) and moved up to fleets around 30 times as large. Electric vehicle new sales in G20 amounted to 1.6 million in 2020.

IEA's scenarios STEPS (stated policy scenario) and SDS (sustainable development scenario) forecast a cumulative stock fleet growth of EVs in China, India, the USA, and the EU of up to 123 million and 195 million EVs, respectively[13].

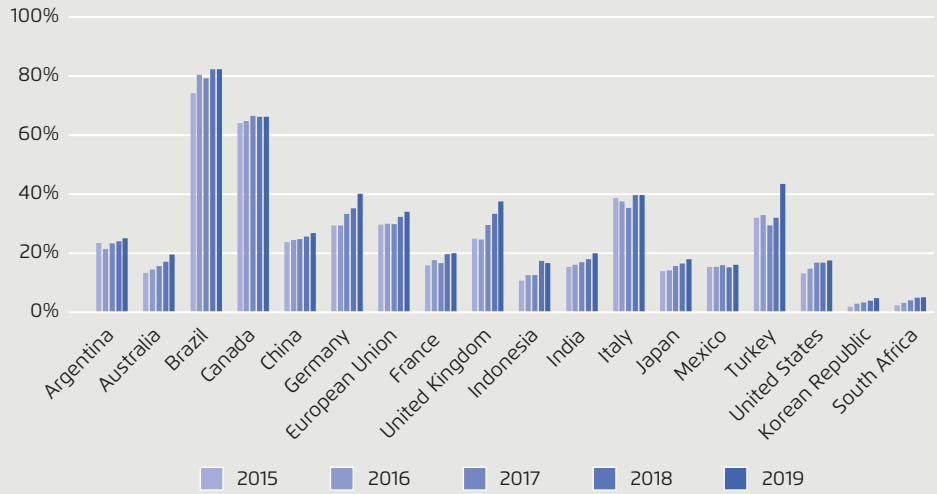
As of 2020, 560,000 slow charging points and 330,000 fast charging points were installed in the publicly available charging infrastructure of G20 countries. The average ratio of EVs per public charging point totals around 10.

This analysis is limited due to the availability of data. Only 14 countries provide up-to-date data for electric cars. Even fewer provide current data for busses, vans, or two-to-three wheelers.

## Energy

Alongside the transition to electric mobility, another key objective for reaching climate goals is to ensure that the transport sector runs on clean energy. The good news is that G20 countries show a clear decarbonisation trend. The average share of renewables in G20 countries amounted to around 28% in 2019 (~25% if weighted with respective total electricity generation in TWh) and increased by almost 5 percentage points

Share of renewables in electricity output for selected G20 members — Figure 2.8




**Agora Verkehrswende (2023)** | Source: REN21 2022.

12 ICCT 2019
13 IEA 2022c

between 2015 and 2019. Brazil has the highest share of renewable energy at over 80% (2019) due to its high share of hydropower.

Besides the increased share of renewables in the electricity grid, increased efficiency leads to a decarbonisation of energy supply and declining emission grid factors in G20 countries. The figure on the right shows a clear declining trend of emission intensities across most G20 countries. Some countries saw a deterioration and increase in the 2021 emissions factors as the post-COVID economic recovery was driven by fossil sources to a greater extent than by renewables. Countries such as Australia or Japan, however, were able to achieve a further decline in their emission factors in 2021. The average decline rate of the emission grid factors between 2015 and 2020 across G20 countries amounted to around 12%.

Almost all countries have ambitions to raise their share of renewables. For instance, Germany wants to reach 65% by 2030, while the USA wants to achieve 100% carbon-free electricity by 2035.

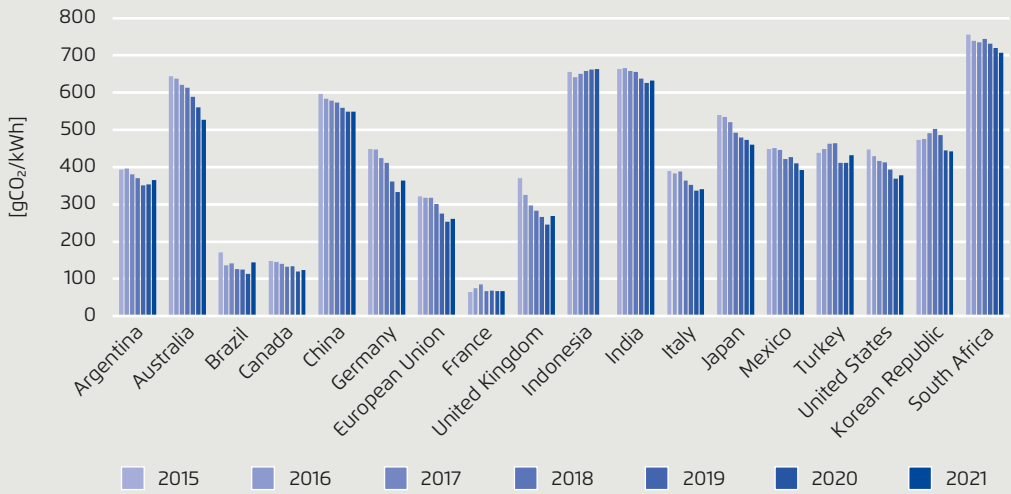
But the challenge lies in including the future electricity demand from EVs in the ramp-up of renewables. In its STEPS forecast, the IEA expects an aggregated electricity demand for EV charging of 800,000 GWh for China, India, the EU, and the USA by 2030. In its SDS projection, it expects a demand of 1 million GWh for the same group of countries.

In all G20 countries, fossil fuels in the transport sector are subsidised or exempted from fuel taxation in some form. Examples of financial support are fuel tax credits for businesses (e.g. Australia), tax reductions or exemptions (e.g., Brazil, USA, Germany, France, and many other countries), direct payments to taxi drivers and public transport (China), customs duty reductions for crude oil (India), and generous funding for the exploration, extraction, and refining of oil products and for the stockpiling of crude oil (Japan).

In order to promote the switch to electric vehicles and increase ambitions to reach climate goals in the transport sector, it is imperative that countries eliminate these subsidies. Moreover, they must not only support EV use but disincentivise the use of ICE vehicles and fuel consumption by means of malus systems.

Over recent years, there have been efforts to reform fiscal aid for fossil-fuel sectors (e.g., in Canada and France). However, the current energy crisis has put a hold or reversed these efforts in many countries.

Emissions intensity 2015-2021 for selected G20 members — Figure 2.9




**Agora Verkehrswende (2023)** | Source: EMBER 2022.

# 03

# THE INDONESIAN, INDIAN, BRAZIL G20 PRESIDENCIES

# 03 | The Indonesian, Indian, Brazil G20 presidencies

The G20 comprises the world's major industrialised and emerging economies, which together account for 60% of the world population, 80% of global GDP, nearly 75% of global exports, and 80% of global greenhouse gas emissions. This makes the G20 the premier forum for international cooperation and climate action. For the first time in history, the G20 is on track to see three emerging economies in a row at its helm: Indonesia in 2022, India in 2023, and Brazil in 2024. South Africa is in line to become the fourth, in 2025, though this has yet to be formally announced. After the notable increase of attention on transport-related matters at COP26, the G20 is expected to give greater priority to transport decarbonisation. Though COP27 did not provide substantial further impetus for increased ambition in this area, the LOTUS initiative introduced in Sharm El Sheikh addresses urban mobility challenges specifically in the Global South. This section provides a short snapshot of transport-related decarbonisation measures with regard to the G20 presidency of Indonesia and the directions the subject is expected to take during the presidencies of India and Brazil.

# INDONESIA – 2022

## 3.1 Indonesia – 2022

The Republic of Indonesia is the world's largest island country and, for the past decade, its fastest growing emerging economy after China and India. It is also the world's eighth-largest emitter of greenhouse gases, and as such plays a key role in the global effort to meet Paris Climate Agreement goals.

The country assumed the G20 presidency in November 2021, just as the world was tentatively starting to think beyond the pandemic. The multidimensional crisis needed a collaborative global effort, and Indonesia believed that the G20 could drive the global recovery. For the G20 summit in Bali, Indonesia chose the motto "Recover Together, Recover Stronger". Indonesia prioritised the global health architecture for the G20. During its presidency, it has also strongly advocated technological and financial support to help developing countries achieve a sustainable energy transition, especially the $100 billion a year in climate funding promised by developed countries in 2009. Lastly, Indonesia has emphasised the role of the G20 in advancing global discussions regarding an equitable digital transformation. Unfortunately, the decarbonisation of the transport sector has not featured in any G20 declaration or work stream under Indonesia's leadership.

### Indonesia's Nationally Determined Contribution (NDC)

Indonesia submitted its updated NDC to the UNFCCC in July 2021. Later that year, at the COP26, it announced a net-zero target by 2060 or sooner. Indonesia has not yet revised its 2030 emission reduction targets in its 2015 NDC – 29% without international support or 41% with international support relative to the business-as-usual scenario. The 2021 update reasserted the country's intention to retire all coal-fired power plants by 2055. Notably, over 97% of the reduction target will be in the forest, land, and energy sectors. Indonesia's Ministry of Energy and Mineral Resources (EMR) has developed a roadmap for renewables to increase the country's share in power generation to 23% by 2025, 57% by 2035, and 93% by 2045. While the transport sector accounts for one-third of the country's energy consumption and 40% of $CO_2$ emissions from final energy consumption, Indonesia has yet to set $CO_2$ targets for the sector and has focused instead on the adoption of biofuels.

### Transport

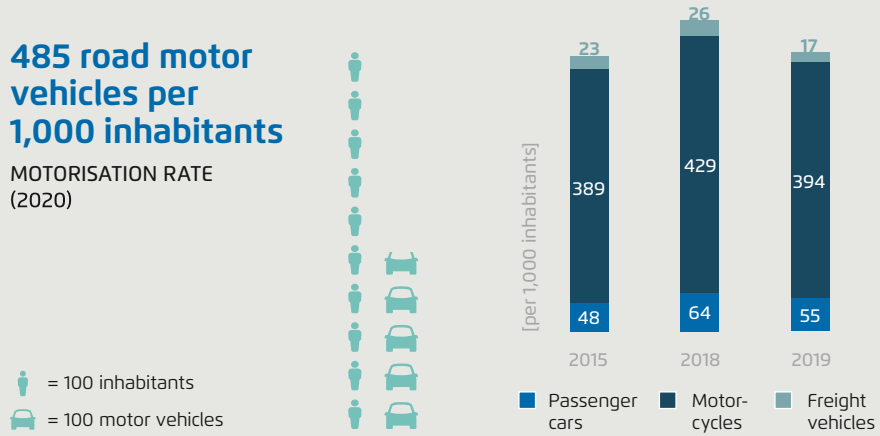
With 6,000 inhabited islands among 17,000 islands in all, Indonesia relies heavily on inter-island transport links. The larger islands of Java, Sumatra, and Sulawesi have extensive transport systems dominated by roads. Many of the smaller, less developed islands have incomplete, fragmented, and poorly maintained road networks for internal travel and underdeveloped infrastructure for inter-island shipping. Java and Sumatra both have rail networks, but freight transport is limited. The air sector is growing rapidly due in part to the emergence of discount airlines.

Indonesia's policy agenda includes the expansion and improvement of transport infrastructure, and since 2014 the country has seen 16 new airports, 18 new ports, and 2,100 km of new toll roads.[14] The country has set targets for its modal share as well, with the aim of increasing passenger rail to 7–9% and freight rail to 11–13% of their respective totals by 2030. Indonesia also wants to add 712 km of high-speed rail and 3,000 km of rail tracks, and to expand its biofuel share to 14% by 2025.

In October 2021, the country passed a carbon tax, but implementation has been postponed twice so far. In 2022, it began to test its new Emission Trading System. The Indonesian government cut its fossil-fuel subsidies substantially in September 2022, which increased gasoline prices by 30%. Other measures implemented to date have concentrated on incentives for electric vehicles and biofuels. A few measures support the energy / $CO_2$ efficiency of vehicles such as a tax discount for low-carbon passenger cars (updated in December 2021). Previous versions of the tax discount were so successful that it led to a rebound effect: many additional vehicles were sold as small low-cost cars became more affordable, increasing traffic volume and overall transport emissions. The tax discount

14 The Economist 2022a

Road motor vehicles per 1,000 inhabitants Figure 3.1




**Agora Verkehrswende (2023)** | Source: ATO 2022

helped the local auto industry but not the environment. The IEA reports that the average fuel consumption for new cars in Indonesia is 8.1 L/100 km – considerably higher than that of many similar countries. The Euro 4 emission standard was enacted in April 2022.

Due to the geography of Indonesia, rail plays a very limited role. Although water and air transport are vital for connecting the country's islands, they are responsible for less than 10% of transport sector emissions.

Within road transport, freight transport accounts for about 40% of total $CO_2$ emissions and is dominated by light- and medium-duty vehicles. Motorcycles dominate passenger transport: in 2019 there were 394 motorcycles per 1,000 inhabitants, versus 55 passenger cars and 17 freight vehicles. Two- and three-wheelers run almost exclusively on gasoline, consume 41% of all domestic transport fuels, and contribute to almost half of transport emissions.[15]

15 IEA 2022g

Indonesia's transport sector emitted 149.67 Mt $CO_2$ in 2019. Some 92% of total transport emissions came from road transport. Passenger transport accounted for around 60% in total transport emissions. Per capita emissions, both in total and in the transport sector, are among the lowest in the G20. Nevertheless, transport emissions grew by 365% from 1990 to 2019 and motorisation levels continue to increase.

In 2020, only 0.1% of all energy used in transport was renewable electricity. An additional 11.8% consisted of biofuels. Fossil fuels are mostly constituted by gasoline (51.1%) and gas / diesel (33%).

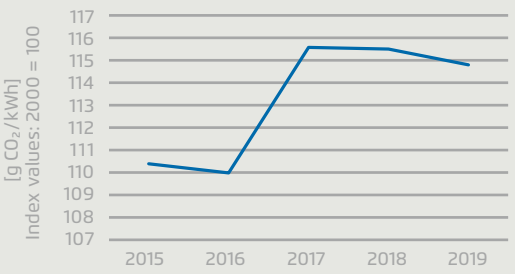
## Electric Mobility

Indonesia aims to develop a domestic EV industry and establish itself as a regional hub. The country possesses large amounts of natural resources needed for battery production (e.g. nickel and cobalt). Therefore, the government has introduced an active industrial policy with export restrictions and domestic production requirements to attract foreign direct investments.[16]

The Electric Vehicle Roadmap, published by the government in September 2020, set ambitious annual EV production targets: 600,000 four-wheeled and 2.45 million two/three-wheeled EVs on the road by 2030.[17] The EV stock targets are 2.5 million EVs by

16 The Economist 2022a
17 AHK Indonesia 2021

$CO_2$ intensity of power Figure 3.2




**Agora Verkehrswende (2022)** | Source: IEA 2022a

2025 and 2 million passenger vehicles and 13 million two/threewheelers by 2030. Indonesia also plans to allow the sale only of electric motorcycles by 2040 and electric passenger cars by 2050. Nevertheless, the current market share of EVs remains very low – below 1% (654 units) of total car sales in Q3 2021.[18]

## Energy

The energy sector in Indonesia relies heavily on coal (66.3% in 2020); the country's secondary source of energy is gas (16.8%). Compared with domestic potential, renewables play only a minor role in Indonesia's energy mix, with a share of 14%.[19] The energy sector's $CO_2$ emissions have more than doubled since 2000, reaching 598 Mt in 2021.[20] Growing energy demand is closely linked to GDP growth. Coal, with a share of 75%, has been the main driver of increasing $CO_2$ emission levels.[21]

In 2022, the government increased its efforts and promises for the green transition in the energy sector. In September, the Indonesian president Joko Wikodo announced a ban on new coal plants. In the same month, the Ministry of Energy and Mineral Resources (EMR) published a 2060 Net-Zero Emission Roadmap for the energy sector, and stated that additional energy generation from 2030 onwards will be produced only by new, renewable power plants.[22] On November 15, 2022 the Just Energy Transition Partnership (JETP) was signed, which promises 20 billion dollars of public and private foreign money to speed up Indonesia's green transition and its phase-out of coal. The partnership was accompanied by remarkable promises from the Indonesian government:

- achieving net-zero emissions in the power sector by 2050 (10 years earlier than initially planned),
- peaking emissions by 2030, and
- expanding renewables to make up one-third of electricity generation by 2030.[23]

18 IEA 2022h
19 GTAI 2022a
20 GTAI 2022b
21 IEA 2022g
22 ESDM 2022
23 The Economist 2022b


# INDIA – 2023

## 3.2 India – 2023

India is the world's largest parliamentary democracy, its second-most populous country, and its fifth-largest economy. It is also a key player in this unique moment of human history, as the global community works to build a decarbonised economy. In December 2022, it assumed the G20 presidency for the first time and will host the Leaders' Summit in 2023.

For India, the presidency is not only an opportunity to set new priorities among G20 members; it is also a chance to shape the global agenda on climate action from the vantage point of emerging economies.

> *"India understands the suffering of all other developing countries, shares them, and will continue to express their expectations."*
>
> *Prime Minister Modi at COP26*

Indonesia, who held the presidency for 2021–2022, chose the slogan "Recover Together, Recover Stronger" for its tenure. India has selected the motto "*Vasudhaiva Kutumbakam*", or "One Earth One Family One Future", and one of its six priority areas is to create a "clean, sustainable, just, affordable, and inclusive energy transition".

### India's updated Nationally Determined Contribution (NDC)

The Indian government submitted its updated NDC to the UNFCCC in August 2022. In its revised contributions, India took the five climate action elements (*Panchamrit*) that it announced at COP26 and included them as part of its enhanced climate targets. For India, it was a step towards achieving India's long-term goal of reaching net-zero by 2070.

The core targets of India's NDC are to reduce the emissions intensity of its GDP by 45% by 2030 relative to 2005 levels, to ensure that 50% of its installed electricity capacity is from non-fossil fuel-based energy resources by 2030, and to propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation through the government's flagship Mission LiFE (Lifestyle for Environment).

India's NDC targets and priorities are likely to form a realistic outline for other emerging economies and to further encourage international discussions of climate action under the G20 umbrella. New agreements, shared responsibilities, and obligatory international cooperation are expected to constitute the core elements of India's leadership. The country's updated NDC follows the stance it took at the COP26 on the transfer of funding and low-cost climate technologies from developing countries. In its NDC, India reiterated that "new and additional financial resources as well as the transfer of technology are the commitments and responsibilities of the developed countries under the UNFCCC and the Paris Agreement".

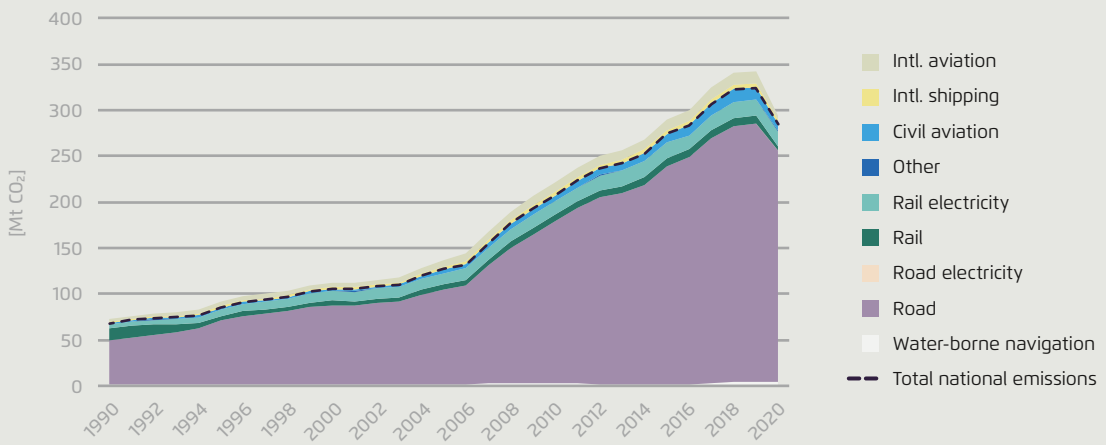
### Transport

The movement of people and goods is the backbone of India's fast-paced economic development. India's strong emphasis on socioeconomic growth and the pace of its urbanisation has increased its mobility demand. As a result, transport emissions rose from 105 Mt $CO_2$ in 2000 to 325 Mt $CO_2$ in 2019. While transport related emissions grew by 18.4% from 2015 to 2019, per capita emissions grew by 13.5% in the same period. Despite strong growth rates, however, its per capita emissions – 0.25 metric tons $CO_2$ – are the lowest in the G20. India's total $CO_2$ emissions from fuel combustion increased by 375% between 1990 and 2019, yet they represent a relatively low share of total emissions – only 14%. Among other reasons, this is due to the high carbon intensity of India's power generation. Nevertheless, transport sector emissions could increase 65% by 2030 and 197% by 2050 relative to 2020 levels. Road transport is the main contributor to sector emissions, followed by rail transport. The nearly 7% of sector emissions from rail is one of the highest shares in the G20.

India is committed to further increasing the share of rail in freight transport to 45% by 2030. The country aims to have a 30% share of electric LDV sales by 2030 and the government is working on plans to require all two-wheelers to be electric by 2026. India signed the

Transport sector emissions by subsector

Figure 3.3




**Agora Verkehrswende (2023)** | Source: IEA 2022g

COP26 declaration on transitioning to 100% zero-emission cars and vans by 2040. National, sub-national, and municipal measures are in place to support public transport and low-carbon freight and to enhance the energy and carbon efficiency of vehicles. Since April 2018 they have included a fuel efficiency standard for heavy-duty vehicles. In July 2020, India railways announced plans to achieve net-zero emissions by 2030. This follows a target to achieve complete electrification of its network by 2023.

India has taken dedicated actions in its push for cleaner mobility. It has accelerated electrification, initiated a drive for green hydrogen, integrated new transport systems via the Gati Shakti platform, planned industrial corridors to shift freight transport to cleaner modes, planned high-speed rail to move people from road and air, constructed several metro rail systems, developed lower-cost metro systems for smaller cities, emphasised green mobility in urban areas, and provided national support for bus systems, among many other measures.

Research suggests that up to 1.7 Gt $CO_2e$ can be avoided by 2030 if India adopts greener policies in its passenger and freight transport sectors[24].

According to a study by the India Energy Storage Alliance (IESA), the Indian EV market will grow at a compounded annual rate of 49% between 2021 and 2029.[25] To meet Paris Agreement targets, the share of EV sales (including two- and three -wheelers) will need to be between 80–95% by 2030 and 100% by 2040[26].

Several national programmes, including the National Urban Transport policy and the Smart Cities Mission, have been established to reduce vehicle traffic and increase transport efficiency. BS VI standards (based on Euro VI) standards, which were introduced in April 2020, establish an important precedent for leapfrogging directly from Euro IV-equivalent to Euro VI-equivalent standards. The Indian government has advanced different targets and policy frameworks to introduce alternative, emissions-reducing fuels in the transport sector. Blending petrol with 20% ethanol is one such initiative. Its target year was recently moved up from 2030 to 2025[27]. Hydrogen fuel-cell electric vehicles are seen as another potential clean-energy alternative for the transport sector. India has also laid out a detailed plan for energy storage systems to increase the grid integration of renewable energy, in which fuel cells play an important role.

24 NITI Aayog, 2020
25 IESA 2022
26 Climate Action Tracker, 2020a
27 NITI Aayog, 2021

## Electric Mobility

The global electric vehicle (EV) market is developing at a rapid pace. In 2021, the overall global share of electric vehicles (including both battery-electric vehicles [BEVs] and plug-in hybrid electric vehicles [PHEVs]) reached 8.3%, with 6.75 million vehicles on the road. This is an increase of 108% from the number of EVs in 2020.

Compared with other G20 countries, the Indian EV market is evolving quickly. Close to 0.32 million vehicles were sold in 2021, a year-on-year increase of 168%. The government has prioritised the adoption of electric mobility and already in 2013 it launched the National Electric Mobility Mission Plan 2020 (NEMMP) and subsequently the Faster Adoption of Manufacturing of Electric Vehicles (FAME) Phase I and Phase II. This scheme has earmarked $1.25 billion to incentivise demand for electric vehicles (EVs) with upfront subsidies and the support of a charging infrastructure. FAME II will subsidise one million electric two-wheelers, 500,000 electric three-wheelers, 55,000 electric cars, and 7,000 electric buses. Another $125 million has also been made available under FAME II for the provision of charging stations. Up to early 2022, the programme has supported more than 200 thousand electric vehicles (mostly two- and three-wheelers). Further programmes and measures have been put in place to support EV deployment:

National E-Bus Programme: NITI Aayog is driving an initiative to aggregate demand for 50,000 e-buses. More than 20,000 e-buses are at various stages of deployment. Prices of e-buses without subsidy have come down by 29% in relation to the cost of petrol/diesel vehicles.

State EV Accelerator Program: Based on the conviction that clear EV policies are important for attracting investment and generating employment and prosperity, NITI Aayog has been advocating for India's states and union terrorities (UTs) to adopt EV policies within the scope of this programme. So far, NITI Aayog has inspired 33 states/UTs to adopt EV policies. Twenty-six additional states/UTs have announced their intention to adopt EV policies; in 7 states/UTs, such policies are in the draft stage.

Shoonya – Zero Pollution Delivery Campaign: This campaign promotes the use of EVs for urban deliveries and ride-hailing. Shoonya, which means "zero" in Sanskrit, refers to the potential from which possibility emerges. Inspired by this meaning, the Shoonya campaign plans to revolutionise the transport sector with a radical and rapid transition to zero-emission vehicles. Together with 140 industry partners, 70 million deliveries and 40 million rides have been completed.

Battery Swapping Policy – A draft battery policy has been prepared by NITI Aayog.

Electric Freight Accelerator for Sustainable Transport – India (E-FAST India) is a platform designed to encourage policy discourse and support pilot projects in the area of heavy duty freight electrification.

EV and Battery Storage Centres of Excellence and Higher Education Programmes – Sixteen Indian Institutes of Technology (IITs) have launched dedicated courses and centres focusing on EV and battery storage research.

To provide a platform for public and private sector stakeholders to engage in discourse, NITI Aayog launched the Forum for Decarbonising Transport in August of 2021. It aims to catalyze and sustain stakeholder engagement for more ambitious policy action in transport. It also provides an impetus for international and cross-sectoral knowledge exchange, to identify concrete action opportunities and related implementation and monitoring strategies.

## Energy

Coal is still the dominant fuel source for power generation in India, representing around 75% of total generation. Presently, India's $3.12 trillion economy consumes 9,850 TWh. Electricity generation in 2021 was 1,715 TWh. Of this, green electricity makes up only 17%. Nevertheless, due to the efforts to increase renewable energy capacity, the $CO_2$ intensity of power has dropped significantly, as the figure below shows.

The Council for Energy, Environment, and Water Research has estimated that net-zero emissions by

2070 will require 5,630 GW of solar capacity, a 99% reduction in coal use between 2040 and 2060, and a 90% decline in crude oil consumption between 2050 and 2070. A wide range of mechanisms support renewable energy in India. Renewable Purchase Obligations (RPO) for distributors mandate minimum quantities of renewables. Since 2010, reverse auctions have been used to procure solar PV and solar thermal capacity; since 2017, these auctions have also been used for wind energy. Additional programmes support rooftop solar solutions and solar agricultural pumps through grant schemes. The solar cities programme aims to convert one city per state to run completely on solar power.

There is significant uncertainty over the future of coal power capacity in India. In the recent Third Biennial Report to the UNFCCC, India highlighted its desire to continue with coal, citing its need for development and energy security. While India has been reducing its share of coal power development, it remains the second largest coal pipeline globally after China, and has over 200 GW of coal-fired capacity in operation (11% of global capacity). The CEA projects that the capacity will increase to almost 266 GW by 2029–2030, and potentially reach 300 GW given the number of coal projects in the pipeline. Obviously, this planned increase is not consistent with the Paris Agreement. To produce a Paris Agreement compatible pathway, India's coal power generation would need to decrease immediately to a share of 5–10% by 2030 and be phased out before 2040[28]. As it stands now, there is a significant risk that India's coal assets will be stranded, especially when considering that two-thirds of India's coal-fired power plants were built in the last ten years.

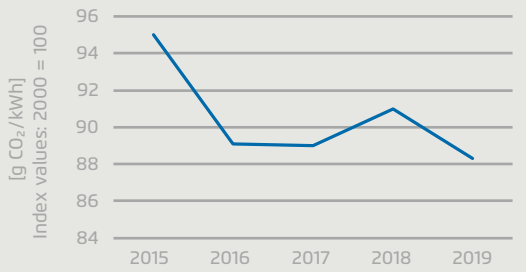
India has a largely homegrown nuclear power programme. The share of nuclear energy in the total electricity generation in the country has remained around 3 to 3.5% since 2014. As of March 2022, India's installed nuclear power capacity was 6780 MW and is targeted to increase to 22,480 MW by the year 2031. The Indian government is committed to growing its nuclear power capacity as part of its massive infrastructure development programme.

The government aims to transform India into an energy-independent nation by 2047. Its plan involves green hydrogen as an alternate fuel to fossil-based products. In 2020, India's hydrogen demand stood at 6 million tonnes (MT) per year. By 2070, green hydrogen could meet 19% of industry's needs. India has declared its ambition to become an exporter of hydrogen to Japan, South Korea, and Europe.

Currently, India is formulating a comprehensive policy framework to promote energy storage in the power sector. Its aim is to promote the creation of large-scale storage systems across the country. It foresees the construction of technology-agnostic storage system at the generation, transmission, and distribution levels of the electricity sector. The government's immediate target is to set up 4000 MWh of battery storage capacity to increase renewable penetration in the national grid. The Central Electricity Authority (CEA) / MoP's Report on Optimal Generation Capacity Mix has projected that 27,000 MW/108,000 MWh of battery storage capacity (or four hours' worth) will be installed by 2029–2030.

28 Climate Action Tracker, 2020b

$CO_2$ intensity of power — Figure 3.4




**Agora Verkehrswende (2022)** | Source: IEA 2022a

## Decarbonisation of Transport a Priority for Socioeconomic Growth

Indian society is filled with young entrepreneurs combining digital technology with innovative transport demand solutions to increase the effectivity and sustainability of mobility services. This fast-paced

environment is an ideal multiplier for the transformation of urban mobility. Likewise, India's G20 presidency represents a chance to inject clean transport into the G20 agenda and help mainstream the decarbonisation of the sector by mid-century. The approach adopted by India could be a lesson for others and help demonstrate its climate-action leadership.

On 2 May 2022, Prime Minister Narendra Modi and Federal Chancellor Olaf Scholz signed a partnership agreement for green development aligned with the climate and sustainability goals of the United Nations. The partnership is intended to strengthen bilateral cooperation and expand cooperation with actors in science, the business community, and civil society. To this end, Germany intends to invest at least ten billion euros by 2030.


# BRAZIL – 2024

## 3.3 Brazil – 2024

The Federative Republic of Brazil, the largest country in Latin America by size, population, and GDP, is seeking a return to sustainable GDP growth after years of economic and political volatility. Environmental protection was just one of the aspects that suffered from the socio-political turmoil of the past few years. In 2020, as the COVID pandemic slowed global economies, Brazil was one of just a few G20 members to see only a minor decrease in greenhouse gas emissions. In 2021, emissions grew by 12.2%, exceeding 2019 levels and representing the largest annual increase in 19 years.[29] Transport is one of the main sources of the country's emissions.

In October 2022, the former president Luiz da Silva won the general election and will once again become the country's head of state. Prior to the election, Da Silva, known as "Lula", promised a Brazilian "Green New Deal". The initiative he proposed focuses on

- the protection of the Amazon rainforest,
- the green transformation of the economy, and
- higher taxes on polluting industries and tax cuts for climate measures.

Another goal is to take a more active role in international climate protection policy.[30]

Brazil will assume the G20 presidency at the end of 2023 for the 2024 term, after India's term ends, making it the third emerging economy in a row to take the helm. Should Brazil's new climate focus hold sway, the decarbonisation of the transport sector may become a new area of focus for the G20.

### Brazil's Nationally Determined Contribution (NDC)

In 2015, Brazil submitted its first NDC, which was one of the most ambitious among the emerging economies. The country published its second NDC update in March 2022, when Jair Bolsonaro was still president. The country reiterated its commitment to achieving climate neutrality in 2050, with interim greenhouse gas emission reduction targets of 37% by 2025 and 50% by 2030 relative to 2005 levels. The 2022 NDC also contained improved percentage reduction targets vis-a-vis the country's first update in 2020.
But the second update also included increases in short-term emissions compared with the previous NDC – 314 million tonnes in 2025 and 82 million tonnes in 2030. The 2022 update also fails to clarify earlier pledges such as the elimination of deforestation by 2030 or Brazil's signing of the Global Methane Pledge. Furthermore, none of the NDC drafts contain transport-sector-specific targets for 2030. The head of Lula's environmental team promised in October 2022 to submit an updated NDC proposal if he wins the election.

### Transport

In Brazil, the world's fifth-largest country by area, long travel distances are the norm. It is no surprise that it has 4,000 domestic airports, more than most other countries worldwide but one (USA). Yet in most parts of the country transport infrastructure is underdeveloped and poorly maintained, posing a major obstacle to the movement of freight and people. The best developed infrastructure is along the coastline and in the southeast, around the densely populated metropolitan areas of Sao Paulo and Rio de Janeiro. But the further inland you go, the sparser and worse it becomes.[31]

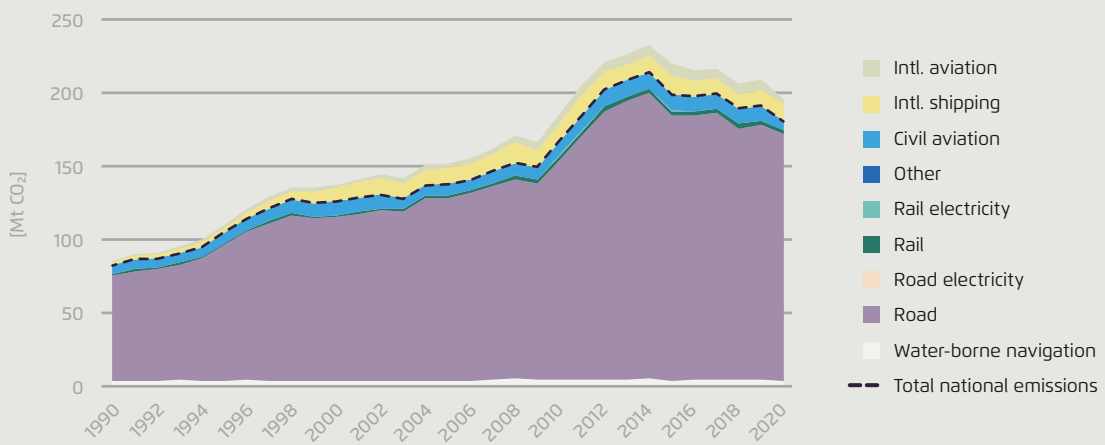
Brazil's total $CO_2$ emissions from fuel combustion increased by 98% between 1990 and 2020. Emission increases in the transport sector have outpaced those from fuel combustion in general, growing 136% during the same period. The domestic transport sector is responsible for 47% of emissions from fuel combustion. This is due to the large percentage of renewables (84%) in Brazil's energy generation. The country's per capita emissions from transport are below the G20 and world averages.

In Brazil, road is the most used mode of transport, and passenger cars are the most common motorised form. For every 1,000 inhabitants in 2020, 330 own a car, while only 137 own motorcycles and 22 own utility vehicles. Cars are responsible for more than 70% of the country's total vehicle kilometres, and road transport is

29 IEA 2022g
30 Reuters 2022a
31 GTAI 2021

Transport sector emissions by subsector

Figure 3.5




**Agora Verkehrswende (2023)** | Source: IEA 2022g

responsible for 91% of emissions within the transport sector. Emissions from the sector are projected to grow 16% by 2030 and 48% by 2050 relative to 2020 levels.[32]

Brazil has enacted a range of climate measures in the transport sector, particularly in the area of biofuels. The RenovaBio policy seeks to reduce the carbon intensity of the Brazilian transportation matrix by expanding the use of biofuels and creating a carbon credit market to offset emissions of greenhouse gases by fossil fuels. Still, there are significant gaps in the promotion of public transport and alternative modes of travel. The 2018 "Rota 2030" regulation includes tax reductions for EVs and a mandatory vehicle efficiency improvement of 11% by 2022.

## Electric Mobility

EVs are an absolute niche product in Brazil. So far, electric vehicles have not featured prominently in government or industry plans to decarbonise the transport sector, and the country has yet to develop an overall EV strategy. Less than 0.1% of the total passenger car fleet is electric. The same percentage applies to newly registered cars, and most of them are hybrids. Brazil's charging infrastructure is also insufficient. Nevertheless, the country has set an ambitious EV stock target: 600,000 EVs by 2030. It has also proposed phasing out the sale of fossil fuel-powered engines by 2060.

The country's main focus now is to increase the use of biofuels. Biodiesel blending with conventional diesel is currently mandated at 10%, and is required to increase to 15% in April 2023.[33] Almost one-quarter of the energy used in the transport sector comes from biofuels and renewable electricity. The largest part of energy used in the transport sector is gas / diesel (43.6%), followed by motor gasoline (24.9%).

The primary means of freight transport are trucks, which carry more than 60% of the total volume. The Brazilian transport sector consumes one-third of domestic final energy consumption.[34] Although freight transport accounts for only 4% of Brazil's vehicle fleet, it contributed 40% of total transport sector emissions in 2019.[35] The energy use of heavy trucks has risen substantially since 2000, and in 2020 the increase

32 World Bank (2022c)

33 Reuters 2022b

34 EPE 2021

35 ICCT 2021

reached 219%. Freight vehicles are also a major source of air quality pollutants in the big cities.[36]

After road transport, inland waterways and rail are the most dominant modes of transport in domestic freight traffic, each accounting for around 15% of goods transported. Brazil plans to expand their use in the future. The Bolsonaro administration planned to extend the domestic railway system by increasing investment considerably, adding 600km of railway annually through 2030.[37]

### Energy

Brazil is the leading G20 country in terms of the share of renewable energy in its energy mix, at almost 84%.[38] As a result, the country has one of the least carbon-intensive energy sectors in the world. Its current installed total energy generation capacity – 175 GW – makes it the world's seventh-largest global producer. Programmes such as PROFINA have been in place since 2002 to promote the expansion of renewable energies. Hydropower is the main contributor to energy generation and accounts for almost two-thirds of the total. This abundance is one of the main reasons for the projected increase in the updated 2022 NDC.

But Brazil has faced various droughts over the past years and has thus needed to intensify its use of fossil gas to compensate for the shortage of hydropower. This might explain the overall increase in the $CO_2$ intensity of its power supply.

36 EPE 2021
37 EPE 2021
38 McKinsey & Company 2021

## 3.4 Conclusion

While the decarbonisation of transport has not become a standalone priority under Indonesia's G20 presidency, its efforts and the available information regarding the presidencies of India and Brazil indicate the major role that the transport sector plays in national socioeconomic activity and climate action. Decoupling sector emission from economic growth will be a key element in creating a sustainable future not only for these three emerging economies but also, by virtue of their outsize influence in the G20, for the global community at large.

# 04

# G20 COUNTRY FACTSHEETS

# 04 | Country factsheets

## G20 Transport Sector Factsheets: Our Contribution to Enhanced Transparency

The country factsheets aim to provide a comprehensive snapshot of the transport sector in G20 member countries, including their decarbonisation ambitions to date. We elaborate on recent sector developments, highlight the countries' NDCs and national targets, and spotlight factors impacting domestic transportation needs.

Our mobility indicators provide insight into motorisation rates and transport volumes, while our energy-related indicators show fuel use, gasoline and diesel prices, and the status of electric vehicle adoption. Furthermore, the factsheets peek over the rim of the "transport box", providing some information regarding the closely linked energy sector.

Data availability in the transport sector is limited, and data quality is often poor. When available, we have used consistent datasets, such as those from the IEA, the World Bank, EDGAR, OECD, and the International Transport Forum. In some cases, we supplement these data with other sources, such as national data or international studies. Accordingly, the data are not necessarily fully comparable between countries. However, they effectively serve their main purpose: to enhance our understanding of the situation in individual countries, and to identify significant differences between countries.

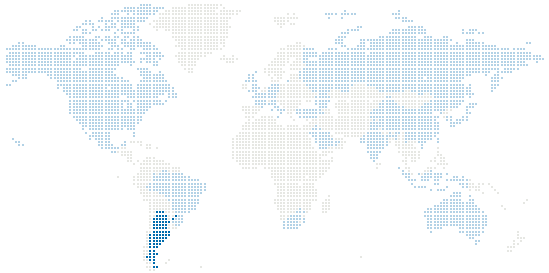
Information on all data sources can be found in annex I.

This report does not assess implemented measures with a view to their stringency or how far they are able to achieve stated goals or the objectives of the Paris Agreement. The factsheets present measures that from their design or intention could potentially contribute to mitigation.

National sources are not always available in English. Due to resource constraints, we were not able to analyse all potentially relevant documents, so additional measures may exist.

A core aim of the factsheets is to assess the level of ambition in each nation, including the steps taken to implement the measures we have identified. NDCs represent the internationally declared targets for climate action, and they often serve as a basis for ambition at the international level. The factsheets summarise each country's overall commitment, transport related targets included in the NDC, and mitigation measures and action relevant to transport. Additionally, the factsheets show the national targets that countries have set for the transport sector or individual subsectors, if they exist.

# ARGENTINA



**0.71%**
SHARE IN GLOBAL GDP (2020)

**6.23%**
TRANSPORT SECTOR SHARE GDP (2020)

**[NO DATA]**
EMPLOYMENT IN TRANSPORT (2020)

Source: UNSTATS

Argentina is characterised by long travel distances and a high level of urbanisation. Travel between cities relies almost exclusively on road transport, including well-developed and low-cost bus services. Air transport has also been growing in importance. Although the country has the 6th largest rail system in the world, rail transport is negligible. The government is aiming to revive the rail system, and re-nationalised the railway operator in 2015. Urban transport and cargo rely mostly on road transport, with the exception of Buenos Aires, which operates a metro system and tram lines.

Argentina revised its original NDC, reducing the absolute emission target from 483 Mt $CO_2$e to 349 Mt $CO_2$e by 2030 and has committed to net-zero emissions by 2050. It has not set any targets for the transport sector. Since January 2018, Argentina has a carbon price in place and it implemented a mandatory vehicle labelling scheme. Argentina is one of the few G20 countries that has not yet implemented $CO_2$ or energy efficiency standards.

## NDC

- ECONOMY-WIDE NET-ZERO TARGET BY 2050
- LIMIT GHG EMISSIONS TO 349 MT $CO_2$e BY 2030

## EV TARGETS

[NO DATA]

## POPULATION

**45 million people**
CURRENT POPULATION (2020)

**0.6%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 14.6% (2020–2050)

**16.58 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**31.6 years**
AVERAGE AGE (2022)


Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**92.1% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

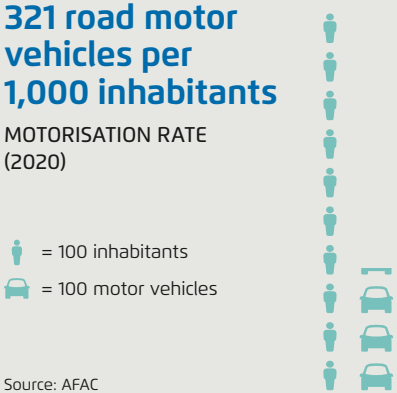
**41.8 million people**
TOTAL URBAN POPULATION (2020)

EXPECTED SHARE OF URBAN POPULATION: 95.2% (2050)

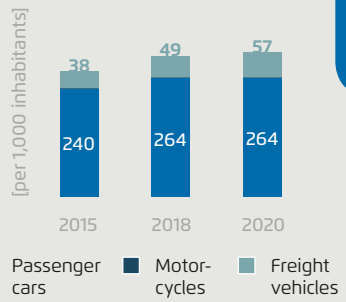
Source: World Urbanisation Prospects 2018

## MOBILITY

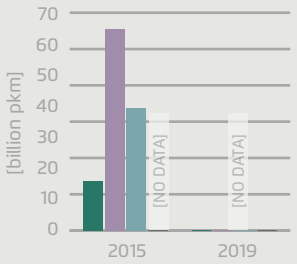
**321 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)




Source: AFAC

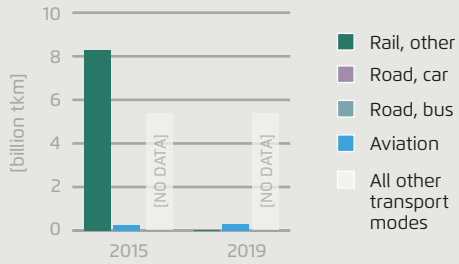



**[No Data] passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)



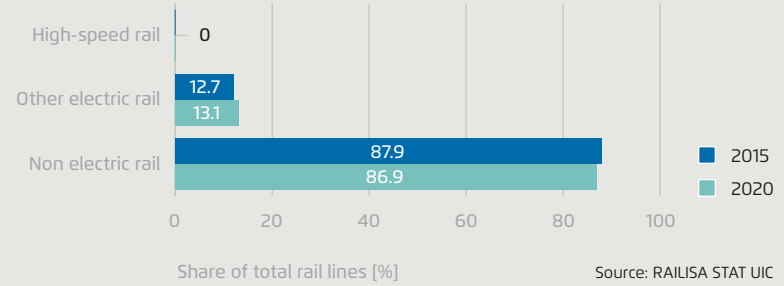

Source: ITF / OECD
* does not include all transport modes

**0.28 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: World Development Indicators, ITF / OECD
** does not include all transport modes

### Rail infrastructure




Source: RAILISA STAT UIC



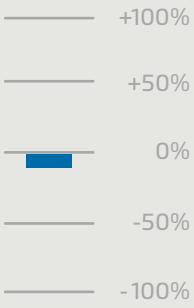
Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

Argentina's total $CO_2$ emissions from fuel combustion increased by 74% between 1990 and 2019, deacreasing by 6% in 2020. Emissions peaked in 2015. Emissions in the transport sector have increased by 67% between 1990 and 2019, also peaking in 2015 and decreased by 21% between 2019 and 2020. Under average business-as-usual, transport emissions are expected to grow 13% by 2030 and 39% 2050, compared to the 2020 level. Road transport is the subsector with the largest emissions.

**162.24 Mt $CO_2$**

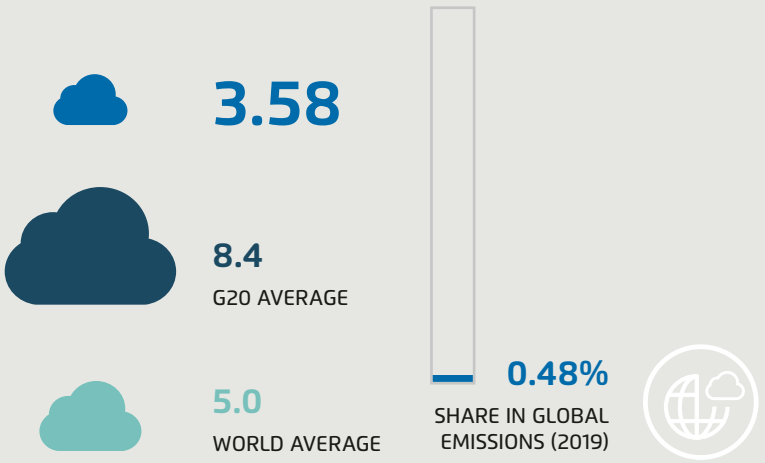
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)




**-9.7%**

CHANGE IN TOTAL EMISSIONS (2015–2019)

TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)



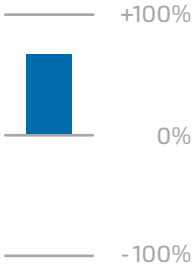

t $CO_2$ per capita

Sources: IEA, SLOCAT, UNDESA

# TRANSPORT SECTOR EMISSIONS

**47.64 Mt $CO_2$**

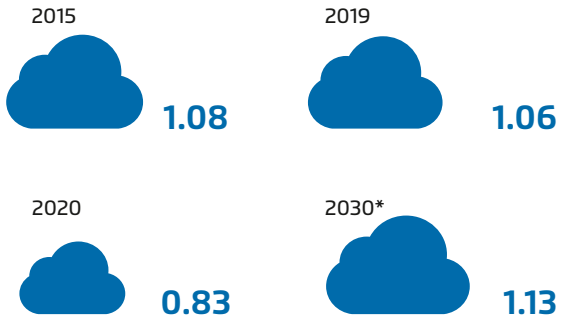
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)




**67.2%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)

TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

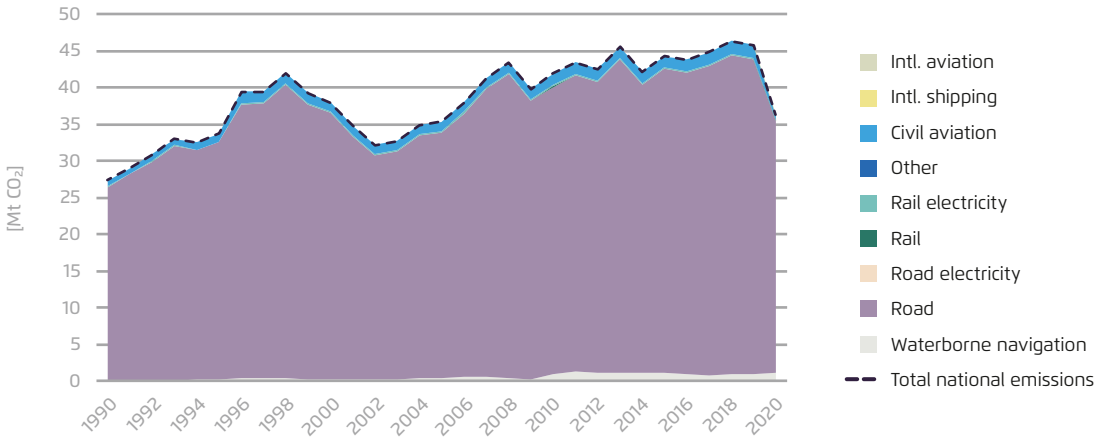
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

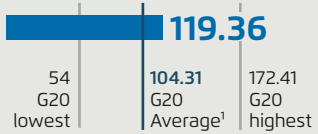
## Transport sector emissions by subsector




Source: IEA

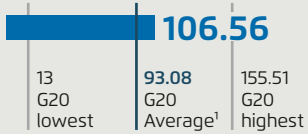
# ENERGY

GASOLINE PRICE (2020)
US cents/litre



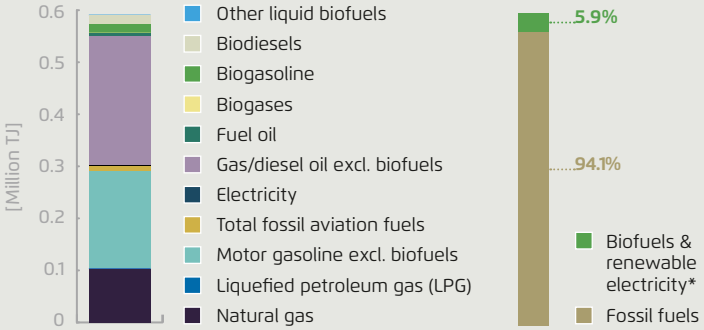

Source: Globalpetrolprices.com*

DIESEL PRICE (2020)
US cents/litre



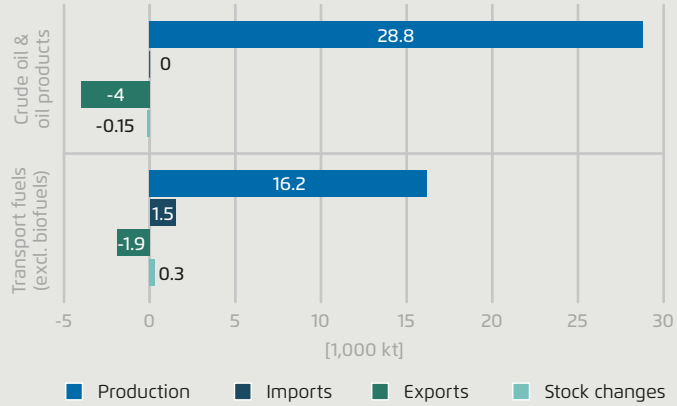

* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

[NO DATA] vehicles
TOTAL STOCK OF ELECTRIC CARS (2021)

[NO DATA]
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

[NO DATA]
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)


[NO DATA]
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

[NO DATA]
SLOW CHARGE
**28,789***
SLOW CHARGE G20 AVERAGE

[NO DATA]
FAST CHARGE
**43,927***
FAST CHARGE G20 AVERAGE

Source: IEA, 2021 *number of units

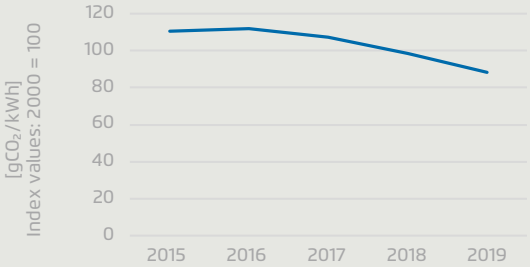
**Battery reuse and recycling**
- There is no regulation or policy in place that requires or promotes the re-use and recycling of batteries.

# LINKAGES TO THE ENERGY SECTOR

The majority of electricity in Argentina is generated using natural gas, and a third of power generation is from hydro. In 2019, generation from wind surpassed that from oil for the first time. The 2007 feed-in tariff law mandated the creation of a trust fund that pays a premium for electricity produced from renewables.

Between 2016 and 2018, the auctioning scheme 'RenovAr' conducted three auctioning rounds, leading to contracting of 4.5 GW of renewable electricity. The 'PERMER' program supports renewable energy solutions in rural areas not connected to the grid.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 16% by 2021
- 18% by 2023
- 20% by 2025
- 26% by 2030

Source: REN21

## The role of hydrogen

- Argentina passed a hydrogen law in 2006 and a hydrogen plan in 2014, foreseeing a national fund for the promotion of hydrogen. This has not yet been implemented.
- An update of the hydrogen law is ongoing.
- An interministerial hydrogen working group exists.

Source: IEA (2021); Oeko Institute (2022)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
- Economy-wide net-zero target by 2050
- Limit GHG emissions to 349 Mt $CO_2e$ by 2030

**Transport related NDC measures**
A range of planned measures, including:
- Energy efficiency labelling of vehicles
- Promotion of low-emission vehicles and alternative fuel vehicles
- Renovation of minibuses and trucks
- Improvement of rail freight infrastructure

**Future targets at national level**
- A reduction of transport sector emissions of 5.9 MT $CO_2e$ by 2030 compared with BAU, corresponding to a reduction of 7.6%
- Build 20 BRT corridors by 2030; 18 are already completed

**National ICE phase-out commitments**
- Ban on the sale of new ICE vehicles from 2041

# TRADE-OFFS

## Sustainability of biofuels

There are no specific environmental or social/ economic sustainability criteria for biofuels in Argentina. However, being a major exporter of biodiesel, the government of Argentina closely monitors other countries' criteria and regulations in order to avoid restrictions on its exports.

## Subsidies

**91.6 billion Pesos**

**~623 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

In Argentina, the already ongoing recession was exacerbated in 2020 through the pandemic, leading to a GDP decline of 9.9%. Growth resumed in 2021 with over 10%. Effects on transport emissions was moderate, with emissions decreasing by only 9% in 2020. Public transport ridership fell by 80% below pre-pandemic levels in the first wave, and remained at around half of previous levels throughout 2020. Ridership has been back to pre-pandemic levels since December 2021. After the lockdowns, walking has not only returned to previous levels, but has seen a substantial increase since December 2021.

Source: IMF 2022, UITP 2020

# IMPLEMENTATION

## Mobility

| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | Law N° 27.132 reactivated the passenger and cargo railways, the renewal and improvement of railway infrastructure and the incorporation of technologies and services that contribute to the modernization and efficiency of the public railway system. Additionally, 18 BRT lines had been put in place by the end of 2020. |
| ✔ **Measures to support low-carbon freight logistics** | • Law N° 27.132 reactivates the passenger and cargo railways.<br>• Road freight efficiency pilot programme as part of the 'Intelligent Transport Program'<br>• Green freight programme |
| **National-level measures to support new mobility services** | No measures at national level |
| **National measures to support non-motorised transport** | No measures at national level |

## Energy

| | |
|---|---|
| **Energy/carbon emission standards LDV** | No standard |
| **Energy/carbon emission standards for heavy duty vehicles (HDV)** | No standard |
| ✔ **Pricing instruments** | Carbon tax since January 2018 |
| ✔ **Mandatory vehicle labelling** | In May 2022, the new comparative labelling scheme was launched. |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | Reduced import tax for electric and hybrid cars from 35% down to 0–5% for models with manufacturing plants in the country, with a maximum cap on the number of vehicles that can receive the preferential tax |

Source: See national sources Argentina

# AUSTRALIA

**1%**
SHARE IN GLOBAL GDP (2020)

**7.40%**
TRANSPORT SECTOR SHARE GDP (2015–2016)

**5%**
EMPLOYMENT IN TRANSPORT (2020)

Source: Australian Bureau of Statistics

Transport in Australia is characterised by long travel distances. The country's population is concentrated along the eastern and southeastern coastlines, leaving large swathes of the country sparsely populated. Given the size of Australia and the concentration of the population in selected areas, air travel plays a large role. 95% of the large rail system outside urban centres is used for freight. Extensive urban sprawl and low-density suburban development lead to long commuting times and heavy reliance on personal vehicle ownership. In freight, rail transport leads in terms of tonne-km travelled, but coastal freight also captures significant transport volumes.

Australia's goal of reducing emissions 26–28% below 2005 levels by 2030 does not include a specific transport sector target. Transport targets and measures at the national level are scarce, largely focusing on electric vehicles. Australia is one of the few G20 countries that does not yet have energy or $CO_2$ related emission standards for light duty vehicles.

## NDC

- 26–28% REDUCTION IN GHG EMISSIONS IN 2030 COMPARED TO 2005
- ECONOMY-WIDE NET-ZERO TARGET BY 2050

## EV TARGETS

BY 2025–26:

- 25% OF NEW LIGHT PASSENGER & 30% OF NEW LIGHT COMMERCIAL VEHICLES SALES
- 20% OF NEW BUS SALES
- 50% OF NEW GOVERNMENT FLEET LEASES

## POPULATION

**26 million people**
CURRENT POPULATION (2020)

**0.3%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 25.4% (2020–2050)

**3.34 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**37.2 years**
AVERAGE AGE (2022)


Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**86.2% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

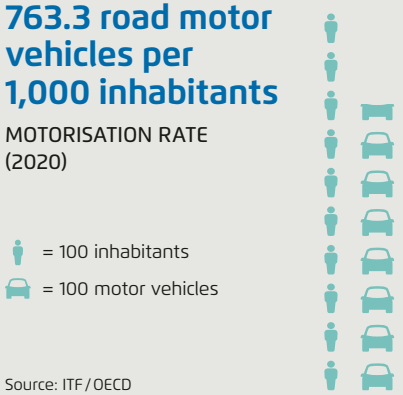
**22.2 million people**
TOTAL URBAN POPULATION (2020)

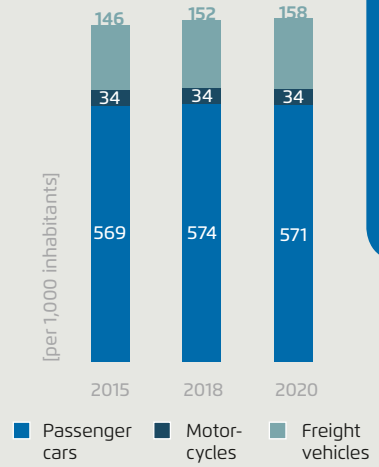
EXPECTED SHARE OF URBAN POPULATION: 91% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

**763.3 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)

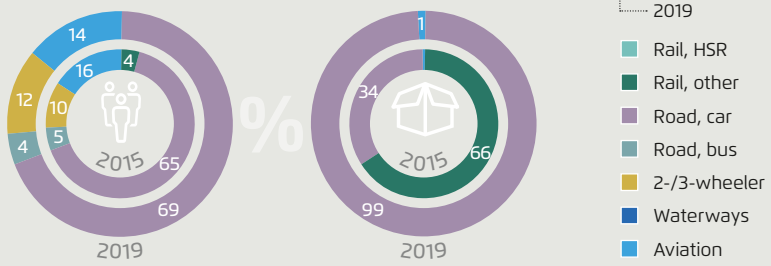



Source: ITF / OECD

**385.9 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

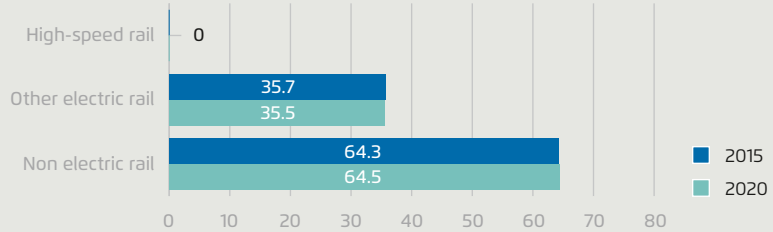
**220.8 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: BITRE
* does not include all transport modes

Source: World Development Indicators, ITF / OECD
** does not include all transport modes

### Rail infrastructure




Source: RAILISA STAT UIC



Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

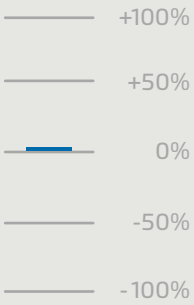
Australia's total $CO_2$ emissions from fuel combustion have increased by 50% between 1990 and 2019, remaining almost stable between 2009 and 2019, before dropping 4% in 2020. The country has one of the highest per capita emissions globally, 2.5 times the G20 average and almost three times the global average. Transport sector emissions are growing faster than the overall economy, increasing by 65% between 1990 and 2019, before dropping almost 7% in 2020. Emissions from the sector are projected to grow 6% by 2030, compared to the 2020 level, and then remain relatively stable. While road transport plays the most important role in generating emissions from the sector, domestic aviation has been increasing in importance and now is responsible for 7.3% of transport sector emissions.

**389.4 Mt $CO_2$**

TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**2.4%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)

**15.16**

**8.4**
G20 AVERAGE

**5.0**
WORLD AVERAGE

**1.16%**
SHARE IN GLOBAL EMISSIONS (2019)

t $CO_2$ per capita

Sources: IEA

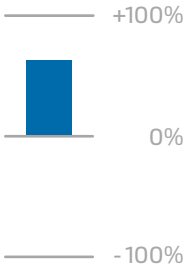
# TRANSPORT SECTOR EMISSIONS

**104,16 Mt $CO_2$**

TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**63.4%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR

2015 **4.16**

2019 **4.11**

2020 **3.79**

2030* **3.92**

t $CO_2$ per capita

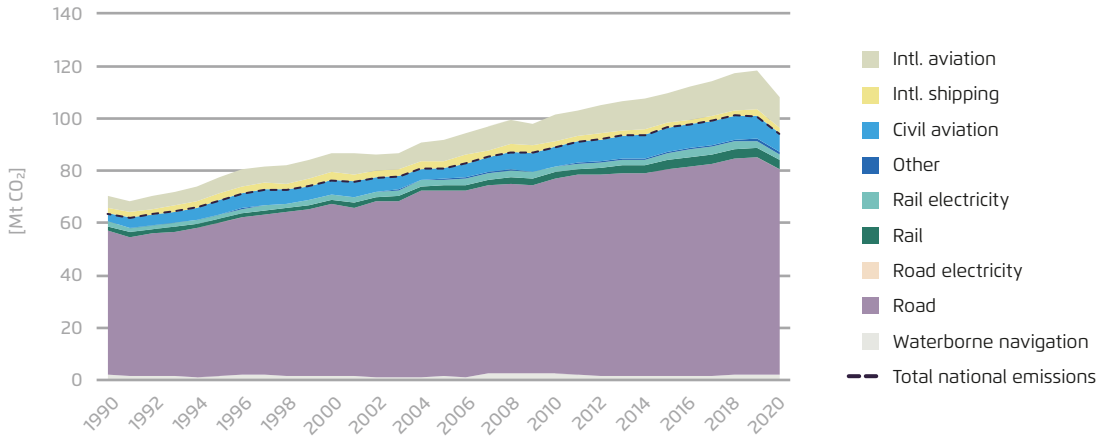
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

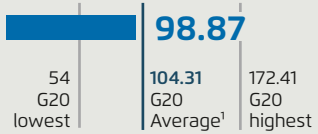
## Transport sector emissions by subsector




Source: IEA

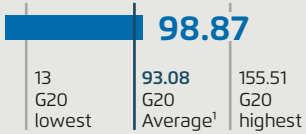
# ENERGY

GASOLINE PRICE (2020)
US cents/litre



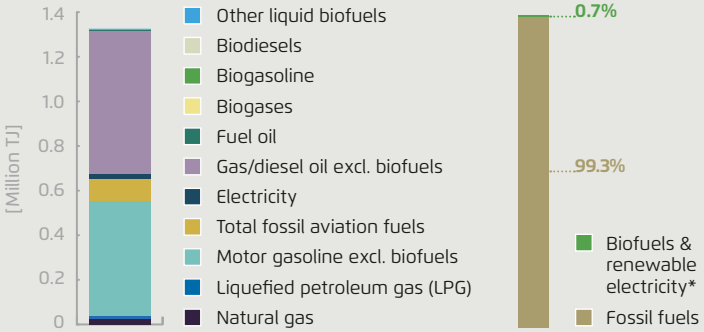

Source: Globalpetrolprices.com*

DIESEL PRICE (2020)
US cents/litre



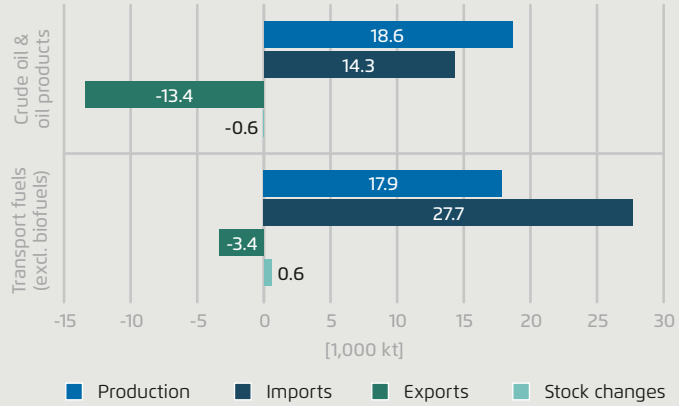

* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

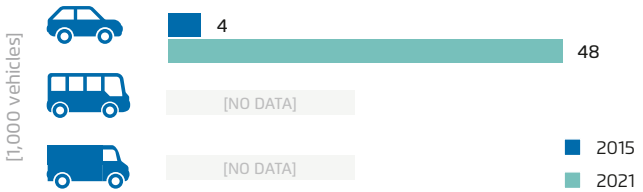
# ELECTRIC VEHICLES

**48,000 vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**0.39%**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**2.8%**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)




**+1,233.3%**
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**2,000***
SLOW CHARGE

**350***
FAST CHARGE

**28,789***
SLOW CHARGE
G20 AVERAGE

**43,927***
FAST CHARGE
G20 AVERAGE

Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**
- There is no regulation in place that requires the re-use and recycling of batteries.
- Voluntary battery stewardship scheme (B-Ccycle) under operation of the Battery Stewardship Council funded by a levy on battery imports with the aim to increase the recycling rate.

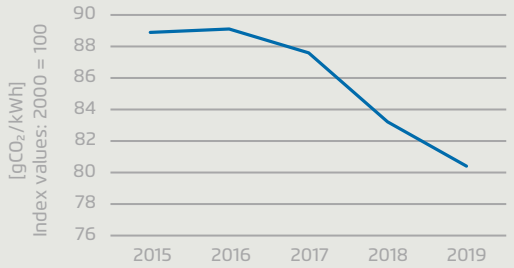
Source: ACCC (2020), Green Network (2022)

# LINKAGES TO THE ENERGY SECTOR

Coal is still the dominant fuel source for power generation in Australia, representing just over half of total generation, with an increasing share of natural gas and renewables. The renewable energy target set for 2020 was met in 2019 and the support instruments were extended to help achieve the 2030 targets:

- the Large-scale Renewable Energy Target (LRET), which requires high-energy users to acquire a fixed proportion of their electricity from renewable sources, and
- the Small-scale Renewable Energy Scheme (SRES), which provides subidies for the installation of small-scale renewable energy systems such as rooftop solar, solar water heaters, heat pumps, and small-scale wind and hydro systems.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

No mention

## The role of hydrogen

- Australia adopted a hydrogen strategy in 2019.
- AU$500 million committed to hydrogen since 2015.
- The 'Mission Innovation Renewable and Clean Hydrogen Challenge' aims to advance technology.

Source: COAG Energy Council, BR4

# AMBITION

## NDCs and national climate targets

**General NDC targets**
Committed to a 26–28% reduction in GHG emissions in 2030 compared to 2005

**Future targets at national level**
Construction of 1,749 km of high-speed rail (proposed)

**National EV deployment targets**
By 2025–26:

- 25% of new light passenger motor vehicle sales
- 30% of new light commercial vehicles sales
- 20% of new metropolitan bus sales
- 75% of all new Australian Government fleet leases
- deploy EV charging stations in over 400 businesses and 50,000 households and provide access to 1,000 public fast-charging stations

# TRADE-OFFS

## Sustainability of biofuels

There are no specific environmental or social/economic sustainability criteria for biofuels in Australia.

## Subsidies

A$

**8.42 billion AUD**

**~5,454 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

Australia experienced a moderate contraction of the economy of 2.2% in 2020, but growth resumed in 2021 with the growth rate doubled, compared to before the pandemic. In the first wave of the pandemic in April 2020, transit ridership in Australia fell to 20% of pre-pandemic levels. Ridership has recovered slowly, but was still below 80% in December 2021. By June 2022, public transport use was still 25% below baseline levels. Car use recovered much faster and largely returned to pre-pandemic levels by mid 2020.

Source: IMF 2022, Beck et al (2021), Google community mobility reports 2022

# IMPLEMENTATION

## Mobility

| | | |
|---|---|---|
| | **National programmes to support shift to public transport** | No measures at national level |
| ✔ | **Measures to support low-carbon freight logistics** | Inland rail projects to develop a 1,700 km rail system, building on existing infrastructure and including logistics and connection hubs, to shift freight from road |
| | **National-level measures to support new mobility services** | No measures at national level |
| | **National measures to support non-motorised transport** | No measures at national level |

## Energy

| | | |
|---|---|---|
| | **Energy/carbon emission standards for light duty vehicles (LDV)** | No standard |
| | **Energy/carbon emission standards for heavy duty vehicles (HDV)** | No standard |
| | **Pricing instruments** | No $CO_2$ or energy consumption based taxes |
| ✔ | **Mandatory vehicle labelling** | • Fuel consumption labelling standard (ADR81/02)<br>• Green Vehicle Guide website (planned) |
| ✔ | **Support mechanism for electric vehicles & charging infrastructure** | • Tax and import tariff exemptions for EVs<br>• Charging and hydrogen fuelling infrastructure support through the AU$250 million Future Fuels Fund<br>• Investment support to select fleets, such as public transport buses and commercial fleets<br>• Subsidies for smart charging technology in households<br>• Information programmes for customers |

Source: See national sources Australia

# BRAZIL

**2.38%**
SHARE IN GLOBAL GDP (2020)

**7.77%**
TRANSPORT SECTOR SHARE GDP (2020)

**5.10%**
EMPLOYMENT IN TRANSPORT (2019)

Source: UNSTATS, IBGE

Brazil is characterised by long travel distances, with most urban centres lying along its 7,500 km coastline. Inland areas are sparsely populated. Air transport plays an important role, with 4,000 airports in operation, the second largest number globally. Brazil has large highway and rail networks. Rail is mostly used for freight transport. Although Brazil has an extensive network of navigable rivers, just 14% of cargo is transported using inland navigation.

Brazil did not yet set any sector-specific targets for 2030 that would support its objective to achieve climate neutrality by 2050. Although Brazil has enacted a range of measures, particularly in the area of biofuels, there are still significant gaps in the promotion of public transport and new modes of transport. The 2018 'Rota 2030' regulation includes a mandatory efficiency improvement for vehicles of 11% by 2022 and tax reductions for electric vehicles.

## NDC

- 37% REDUCTION IN GHG EMISSIONS IN 2025, AND 50% REDUCTION IN GHG EMISSIONS IN 2030 COMPARED TO 2005
- CLIMATE NEUTRALITY BY 2050

## EV TARGETS

600,000 EV STOCK ACROSS ALL MODES BY 2030

## POPULATION

**213 million people**
CURRENT POPULATION (2020)

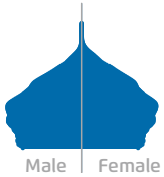
**2.7%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 8.3% (2020–2050)

**25.43 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**33.2 years**
AVERAGE AGE (2022)




Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**87.1% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

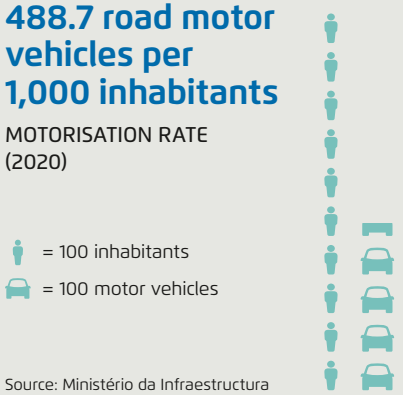
**185 million people**
TOTAL URBAN POPULATION (2020)

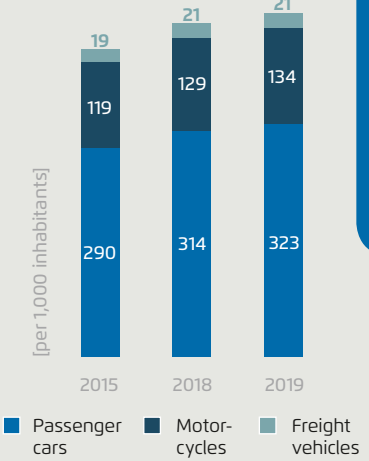
EXPECTED SHARE OF URBAN POPULATION: 92.4% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

**488.7 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)

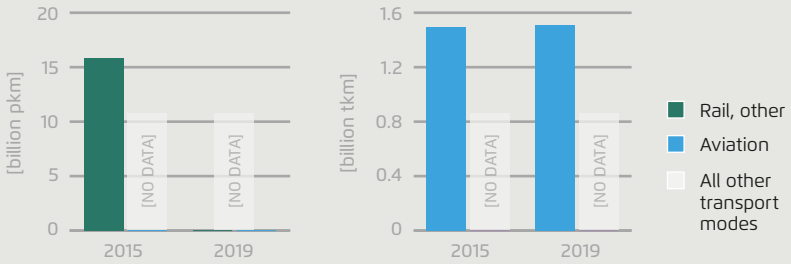



Source: Ministério da Infraestructura

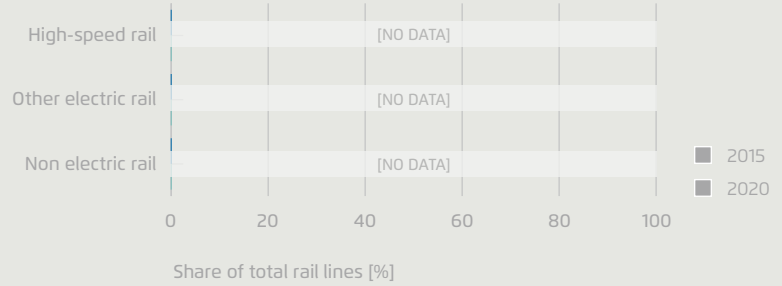
**[No Data] passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

**1.5 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: World Development Indicators, ITF / OECD

## Rail infrastructure






Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

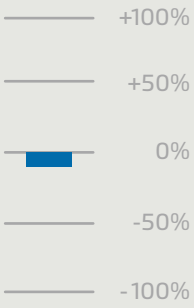
Brazil's total $CO_2$ emissions from fuel combustion have increased by 122% between 1990 and 2019, with the transport sector outpacing this development at 136%. Per capita emissions from transport are, nevertheless, still far below the G20 and world average. The transport sector is responsible for 42% of total emissions, the largest share within the G20. This high share is attributable to the extremely large percentage of electricity generation from renewables (84%). Emissions from the sector are projected to grow 18% by 2030 and 50% by 2050, compared to the 2020 level. Road transport is responsible for 91% of the emissions within the transport sector, followed by domestic aviation with just over 3%.

**410,99 Mt $CO_2$**

TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**-10.2%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)

**1.93**

**8.4**
G20 AVERAGE

**5.0**
WORLD AVERAGE

**1.22%**
SHARE IN GLOBAL EMISSIONS (2019)

t $CO_2$ per capita

Sources: IEA

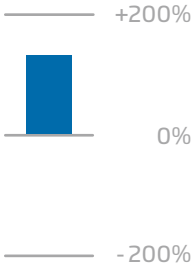
# TRANSPORT SECTOR EMISSIONS

**193.96 Mt $CO_2$**

TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**135.8%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR

2015 **0.98**

2019 **0.92**

2020 **0.86**

2030* **1.02**

t $CO_2$ per capita

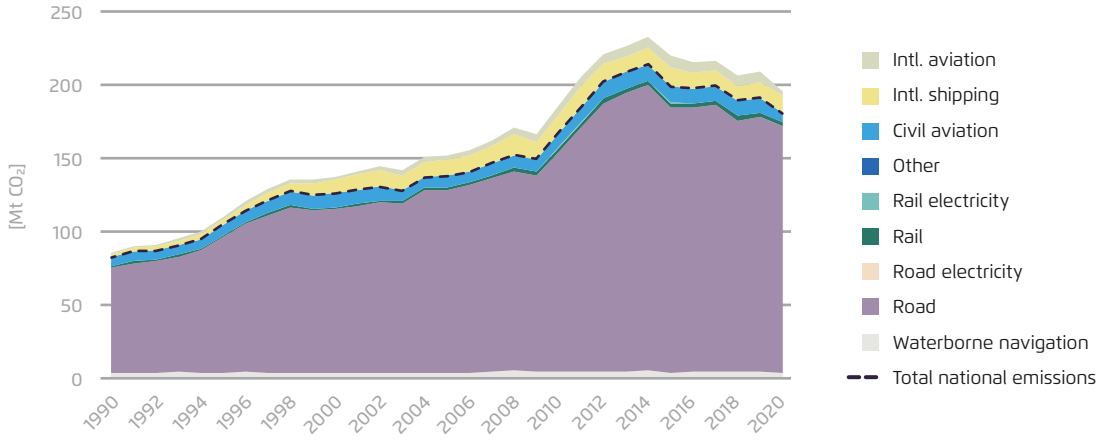
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

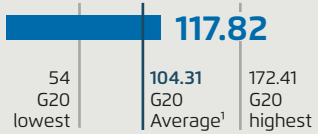
## Transport sector emissions by subsector



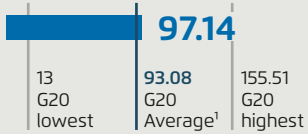

Source: IEA

# ENERGY

GASOLINE PRICE (2020)
US cents/litre



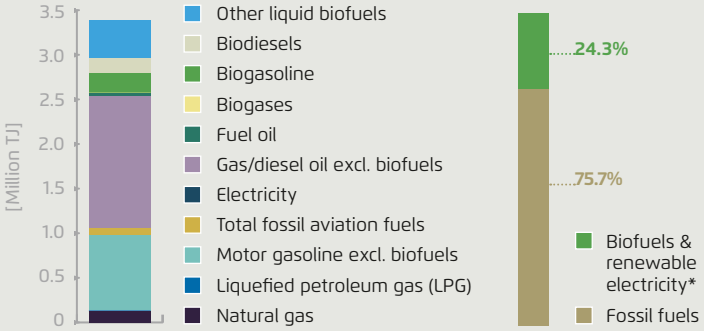

DIESEL PRICE (2020)
US cents/litre




Source: Globalpetrolprices.com*

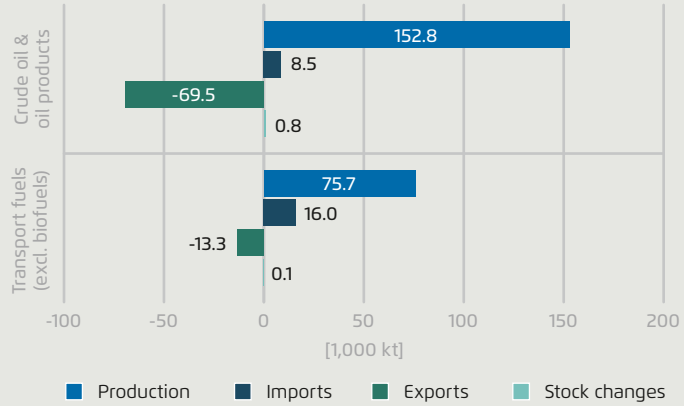
* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**12,700 vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**0.03%**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**0.47%**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)


**+8,481.1%**
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**450***
SLOW CHARGE

**5***
FAST CHARGE

**28,789***
SLOW CHARGE
G20 AVERAGE

**43,927***
FAST CHARGE
G20 AVERAGE

Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**

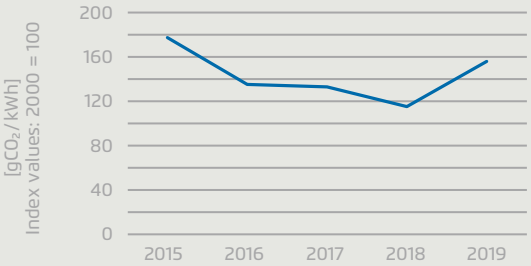
- The National Solid Waste Management Policy introduces the responsibility of producers, retailers, importers and distributers of batteries for the safe disposal and delegated it to industry to propose sector agreements specifying how industry should comply to the law.
- Importers and domestic manufacturers of batteries are required to prepare a Batteries Management Plan.

Source: IBAMA

# LINKAGES TO THE ENERGY SECTOR

Brazil already has a high share of renewable electricity generation due to abundant hydropower, and most fossil fuel-based generation relies on natural gas. Since 2002 the PROFINA programme encouraged renewable energy development by providing for 20-year power purchase agreements (PPAs) with the state-owned utility company Eletrobrás. Since 2005, concessions have been awarded using an auction model, providing renewable electricity at lower cost than the feed-in tariff offered through PROFINA. The programme is still in place, although there have been no auctions since 2016. Wind power sales and component imports are exempt from certain taxes and levies, and renewable energy technologies receive discounts on transmission and distribution tariffs.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 23% by 2030 (excluding hydro)

## The role of hydrogen

- New hydrogen policy-making process planned to be launched soon.
- Studies are ongoing.
- Brazil launched the Guidelines for National $H_2$ Program ($PNH_2$) in August 2021, with a strong focus on R&D and stakeholder governance.

Source: IEA (2021), Green Hydrogen Organisation

# AMBITION

## NDCs and national climate targets

**General NDC targets**
Committed to a 37% reduction in GHG emissions in 2025, and a 50% reduction in GHG emissions in 2030 compared to 2005

**National EV deployment targets**
600,000 EV stock across all modes by 2030

**National ICE phase-out commitments**
Ban sales of fossil fuel powered cars by 2060 (proposed in 2017; on hold as of late 2022)

# TRADE-OFFS

## Sustainability of biofuels

There are no environmental sustainability criteria in Brazil's biofuel mandates. Greenhouse gas emission reduction levels are not considered, nor is indirect change in land use.

## Subsidies

**22.5 billion BRL**

**~4,167 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

Brazil experienced a 3.9% contraction of the economy in 2020, following three years of low growth. In 2021, growth resumed at almost triple the growth seen before the pandemic. Rail ridership dropped 63% in March 2020 and public transport ridership in metropolitan areas around 70%. By May 2020, public transport ridership across the country was estimated to be 80% below pre-pandemic levels.

Source: IMF 2022, World Bank 2020

# IMPLEMENTATION

## Mobility

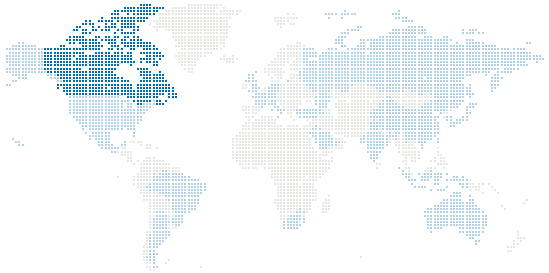
| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • National Urban Mobility Policy (PNMU)<br>• Big Cities Mobility: upgrading public transportation systems<br>• Mobility law (2012)<br>• Free public transport for seniors (65+ years) |
| **Measures to support low-carbon freight logistics** | • National Logistics Plan 2035: Increase annual freight transport on rail from 21.5% to 40% |
| **National-level measures to support new mobility services** | No measures at national level |
| **National measures to support non-motorised transport** | • National Urban Mobility Policy (PNMU)<br>• Mobility law (2012) |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for light duty vehicles (LDV)** | • Fuel effiency targets effectively set through the 'Innovar' programme expired end of 2017. The new regulation 'Rota 2030' was published on 6 July 2018 and includes a mandatory efficiency improvement for vehicles of 11% by 2022, corresponding to and efficiency standard of 127.8 g/km.<br>• Furthermore, there are emission standards for light duty vehicles (PROCONVE L7 & L8). |
| **Energy/carbon emission standards for heavy duty vehicles (HDV)** | There are emission standards for heavy duty vehicles (based on Euro VI). |
| **Pricing instruments** | No $CO_2$ or energy consumption based taxes |
| **Mandatory vehicle labelling** | Brazilian Vehicle Labeling Program (PBEV) voluntary labelling |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • Import tax exemption for EVs. Expansion and extension until 2025 are under development.<br>• Obligation for companies benefitting from tax reductions under the Rota2030 scheme to invest in research and development for electric mobility (under development) |

Source: See national sources Brazil

# CANADA



**1.39%**
SHARE IN GLOBAL GDP (2020)

**3.8%**
TRANSPORT SECTOR SHARE GDP (2020)

**8.2%**
EMPLOYMENT IN TRANSPORT (2020)

Source: Transport Canada, Canada Statistics

Canada is the second largest country in the world by area. Around 90% of Canadians live within 160 km of the US border. The country features large forests and extensive areas covered by continuous permafrost. Despite having the world's fourth largest rail system, passengers are mainly transported by road and increasingly by air. Nevertheless, railways are important for freight transport, and are interconnected with the US rail system. The Great Lakes are an important water route, both domestically and for freight transport to the US.

Canada has a national target of reducing transport sector emissions 6.5% below 2018 levels by 2030 and aims for 100% zero emission LDV vehicle sales by 2030. The country aims to achieve net-zero economy-wide emissions by 2050. Measures largely focus on improving the efficiency of vehicles and moving to zero-emission vehicles. However, there are substantial funds dedicated to investments in public transport infrastructure. Shifting freight away from road does not feature prominently in Canadian policies.

## NDC

- 40–45% REDUCTION IN GHG EMISSIONS IN 2030 COMPARED TO 2005
- ECONOMY-WIDE NET-ZERO TARGET BY 2050

## EV TARGETS

- 20% OF NEW LDVS SALES BY 2026 & 60% OF NEW LDVS SALES BY 2030
- 35% OF TOTAL MHDV SALES BEING ZEVS BY 2030
- 5 000 NEW ZEV TRANSIT & SCHOOL BUSES UNTIL 2026

## POPULATION

**38 million people**
CURRENT POPULATION (2020)

**0.5%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 21.1% (2020–2050)

**4.24 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**40.4 years**
AVERAGE AGE (2022)


Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**81.6% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

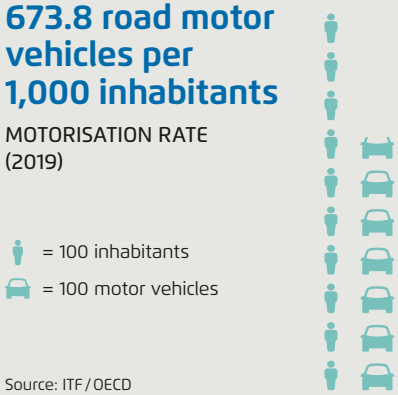
**31 million people**
TOTAL URBAN POPULATION (2020)

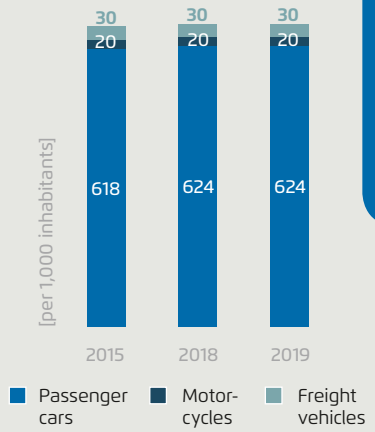
EXPECTED SHARE OF URBAN POPULATION: 87.3% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

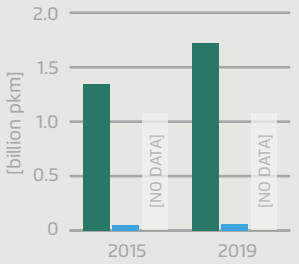
**673.8 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2019)



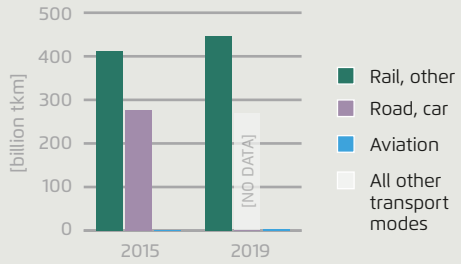

Source: ITF / OECD

**1.8 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)



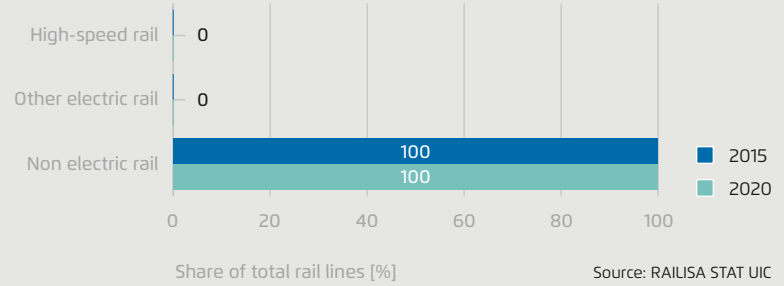

Source: Transport Canada 2021, ITF / OECD
* does not include all transport modes

**449.2 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: World Development Indicators, ITF / OECD
** does not include all transport modes

### Rail infrastructure




Source: RAILISA STAT UIC



Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

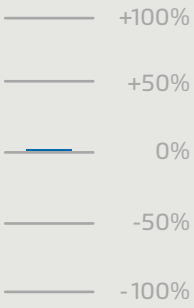
Canada's total $CO_2$ emissions from fuel combustion have increased by 36% between 1990 and 2019, with transport sector emissions increasing by 47% over the same period, dropping by almost 14% in 2020. Transport sector emissions represent 33% of total emissions, due to the high share of renewable electricity generation. Per capita transport emissions are among the highest globally, more than four times as high as the global average. Emissions from the sector are projected to remain largely stable up to 2030 and then decline 9% by 2050, compared to the 2020 level. Canada has an unusually high share of emissions from pipeline transport, which is the third largest contributor at over 5%, after road transport and aviation.

**556,78 Mt $CO_2$**

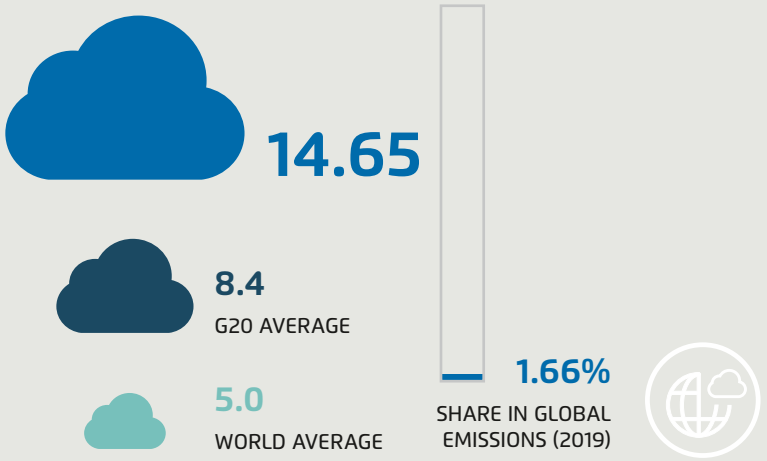
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**1.4%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

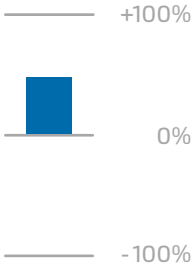
# TRANSPORT SECTOR EMISSIONS

**184.53 Mt $CO_2$**

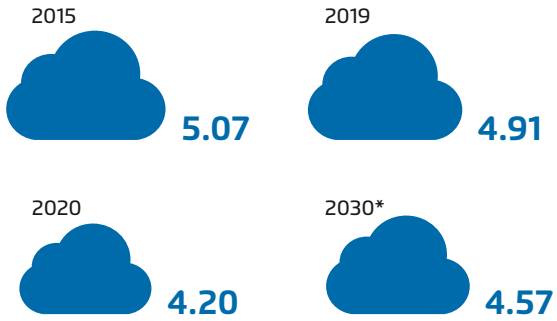
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**47.2%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

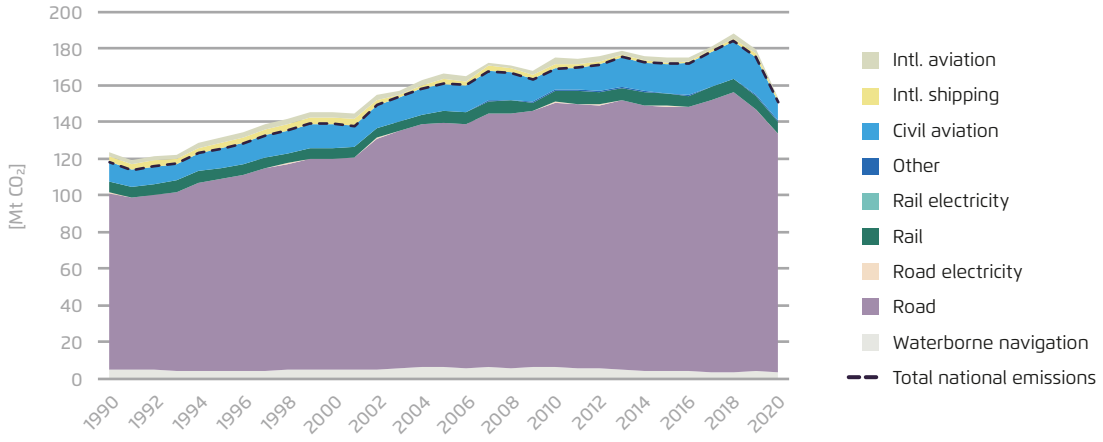
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

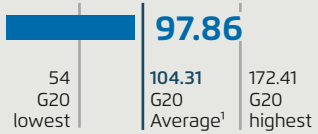
## Transport sector emissions by subsector



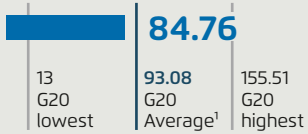

Source: IEA

# ENERGY

GASOLINE PRICE (2020)
US cents/litre



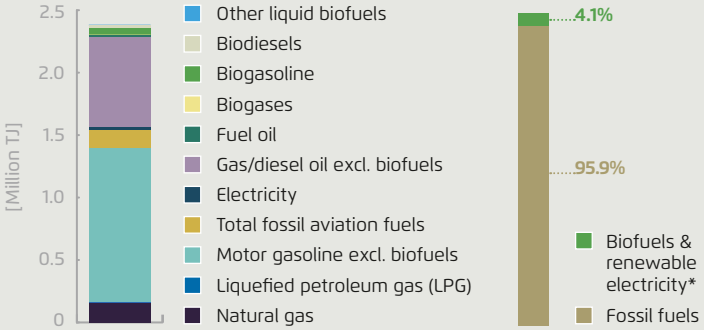

DIESEL PRICE (2020)
US cents/litre




Source: Globalpetrolprices.com*

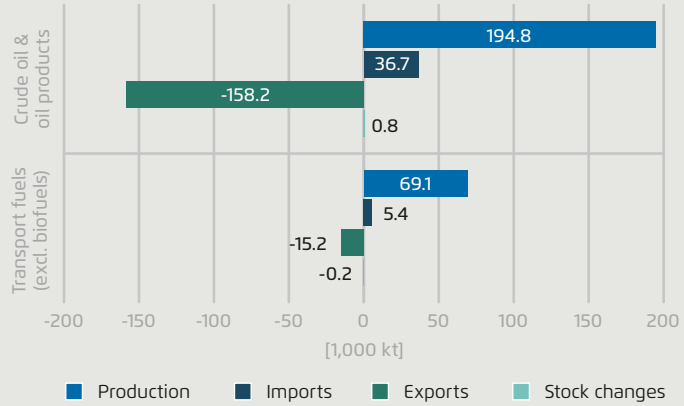
* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

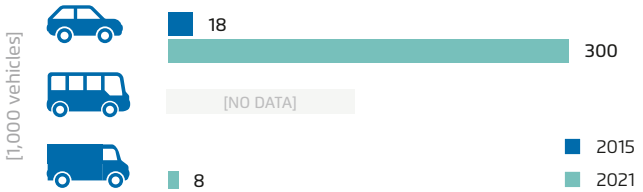
# ELECTRIC VEHICLES

**308,637 vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**1.2%**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**6.6%**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)




**+1,643.2%**
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**12,000 ***
SLOW CHARGE

**3,100 ***
FAST CHARGE

**28,789 ***
SLOW CHARGE
G20 AVERAGE

**43,927 ***
FAST CHARGE
G20 AVERAGE

Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**

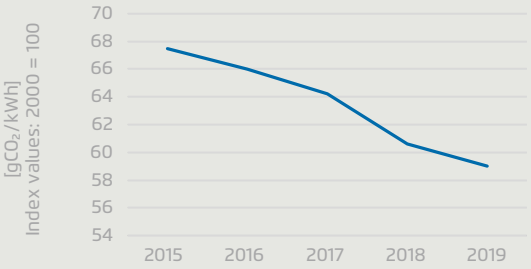
- There is no regulation in place at the national level that requires the re-use and recycling of batteries, apart from general safety regulation.
- Some provinces have regulation that makes producers accountable, but these do not apply to EV batteries.

Source: Canadian Battery Association

# LINKAGES TO THE ENERGY SECTOR

Canada already has a high share of renewable electricity generation due to abundant hydropower and the use of nuclear energy. Most fossil fuel-based generation relies on natural gas. In 2020 and 2021, Canada introduced a range of measures to support renewables at the national level, including funding for research and incentive schemes, such as the 'Smart Renewables and Electrification Pathways Program', the 'Greener Homes Initiative' and the 'Clean Energy for Rural and Remote Communities Program'.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

No mention

## The role of hydrogen

- Canada adopted a hydrogen strategy in 2020.
- Vision to supply 30% of energy through hydrogen by 2050 including more than 5 million FCEVs
- Development supported through the CA$1.5 billion Clean Fuels Fund
- Currently one 20 MW green hydrogen plant in operation

Source: IEA (2021); Oeko Institute (2022)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
- Committed to a 40–45% reduction in GHG emissions in 2030 compared to 2005
- Regirement of 100% zero emission vehicle sales by 2035

**Transport related NDC measures**
- Improvement of vehicle efficiency standards
- Investment in support to zero-emission vehicles & infrastructure, public transport, and active transport

**Future targets at national level**
A reduction of transport sector emissions of 6.5% below 2018 transport emissions by 2030

**National EV deployment targets**
- 20% of new LDVs sales by 2026 & 60% of new LDVs sales by 2030
- 35% of total MHDV sales to be ZEVs by 2030
- 5,000 new ZEVs in transit and school by 2026
- Add 50,000 charging and hydrogen stations to the charging network

**National ICE phase-out commitments**
- 100% LDV ZEV sales by 2035
- 100% MHDV ZEVs sales by 2040 (subset)

# TRADE-OFFS

## Sustainability of biofuels

Canada has defined a set of non-mandatory principles for sustainable biofuels.

## Subsidies

C$

**1.5 billion CAD**

**~1,083 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

Canada experienced a 5.2% contraction of the economy in 2020. Growth resumed in 2021 with the growth rate 150% higher than before the pandemic. Urban transit and bus trips dropped to 15% of the pre-pandemic level by May 2020 and despite recovery remained low at 53% in March 2022. Air transport also dropped sharply, with passenger load factors as low as 26% in April 2020 and remaining at around 50% at the end of the year.

Source: IMF 2022, Statistics Canada

# IMPLEMENTATION

## Mobility

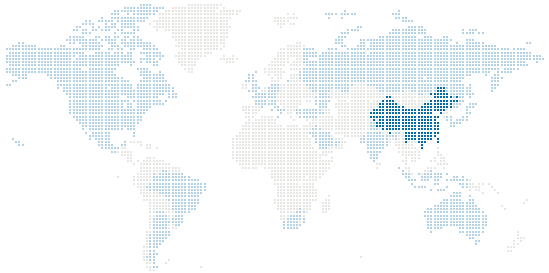
| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • Investing in Canada Plan: put forward CA$28.7 billion for public transit projects across the country that will create more affordable transportation options.<br>• Public Transit Infrastructure Fund with CA$3 billion per year from 2026 |
| **Measures to support low-carbon freight logistics** | No measures at national level |
| **National-level measures to support new mobility services** | No measures at national level |
| **National measures to support non-motorised transport** | No measures at national level |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for light duty vehicles (LDV)** | **Current (2022):**<br>• Passenger cars: 111 g/km<br>• Light commercial: 158 g/km<br>**Future (2025):**<br>• Passenger cars: 99 g/km<br>• Light commercial: 139 g/km |
| ✔ **Energy/carbon emission standards for heavy duty vehicles (HDV)** | • Heavy-duty Vehicle and Engine GHG Emission Regulations (from model year 2014)<br>• An update of the standards was approved in 2018 and will apply from model year 2021 |
| ✔ **Pricing instruments** | • Excise tax on fuel-inefficient vehicles<br>• The Pan-Canadian Framework on Clean Growth and Climate Change established carbon price benchmarks for provinces starting at CAD 10/t $CO_2$ in 2018 increasing annually to reach CAD 50/t $CO_2$ in 2022 with a target of at least CAD 170/t $CO_2e$ by 2030. |
| ✔ **Mandatory vehicle labelling** | EnerGuide Label for Vehicles |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • iZEV program with purchase subsidies since 2019, scheduled to run until 2025.<br>• Purchase incentive program for MDVs and HDVs since 2022<br>• Tax write-off for business investments in heavy-duty ZEVs<br>• Zero-emission transit fund for public transit and school buses<br>• Zero Emission Vehicle Infrastructure Program providing investment subsidies, scheduled to run until 2027 |

Source: See national sources Canada

# CHINA



**18.80%**
SHARE IN GLOBAL GDP (2022)

**4.90%**
TRANSPORT SECTOR SHARE GDP (2020)

**1.08%**
EMPLOYMENT IN TRANSPORT (2020)

Source: World Development Indicators, China Statistical Yearbook 2021

China is the world's most populous country and 4th largest by area. The majority of the population lives in the eastern half of the country; transport infrastructure is thus most developed along the eastern seaboard. While China has the world's largest high-speed rail network, and second-largest rail network overall, the majority of freight is transported by road. Furthermore, China has been rapidly motorising; there were 194 private cars per 1000 inhabitants in 2020, up from just 16 in 2005. This has led to substantial congestion and pollution problems in urban areas.

In 2021 China announced the 1+N policy system for $CO_2$ peaking and carbon neutrality, which aims to achieve $CO_2$ peaking before 2030 and carbon neutrality before 2060. A related action plan for transport is expected to be announced before the end of 2022. The country has already set and achieved targets for electric vehicles and 'new energy vehicles'.

## NDC

- PEAK $CO_2$ EMISSIONS BEFORE 2030
- ACHIEVE CARBON NEUTRALITY BEFORE 2060
- LOWER $CO_2$ EMISSIONS PER UNIT OF GDP BY OVER 65% FROM THE 2005 LEVEL

## EV TARGETS

- NEV SALES SHARE: 20% BY 2025 AND 40% BY 2030 (ACHIEVED IN 2021)
- 72% SHARE OF NEVS IN NATIONAL URBAN PUBLIC TRANSPORT

## POPULATION

**1,411 million people**
CURRENT POPULATION (2020)

**18.2%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: -7.9% (2020–2050)

**149.71 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**38.4 years**
AVERAGE AGE (2020)


Source: World Development Indicators

## URBANISATION

**61.4% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

**866.7 million people**
TOTAL URBAN POPULATION (2020)

EXPECTED SHARE OF URBAN POPULATION: 80% (2050)

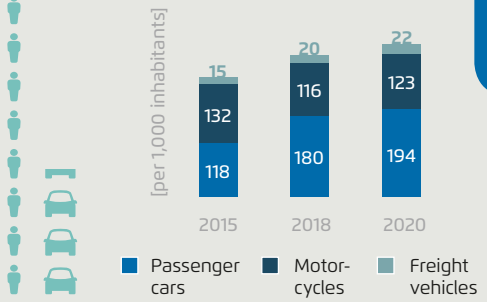
Source: World Urbanisation Prospects 2018

## MOBILITY

**338 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)

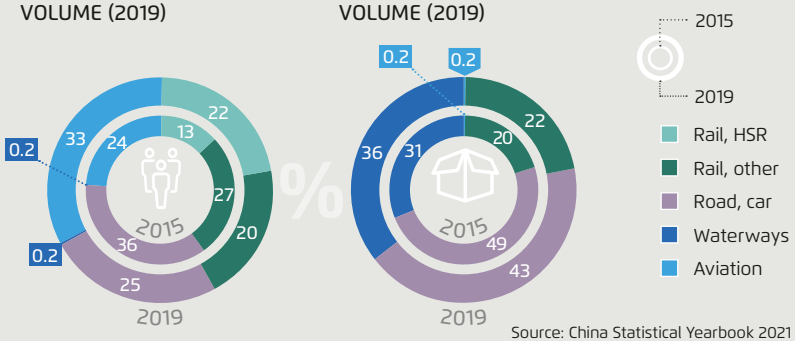
= 100 inhabitants
= 100 motor vehicles

Source: calculations based on China Statistical Yearbook 2021



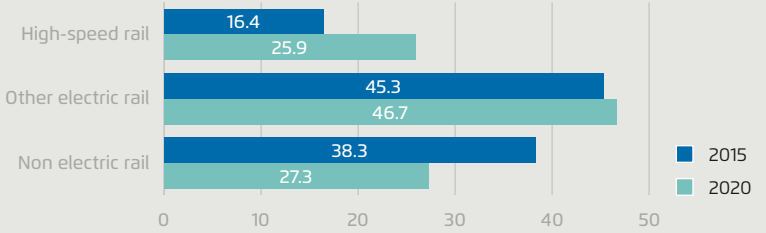

**3,534.9 billion passenger-km**
PASSENGER TRANSPORT VOLUME (2019)

**13,998.8 billion tonne-km**
FREIGHT TRANSPORT VOLUME (2019)




Source: China Statistical Yearbook 2021

## Rail infrastructure




Source: China Statistical Yearbook 2021

Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

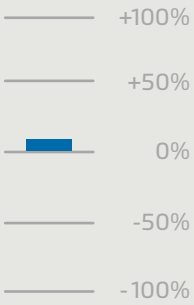
China is the world's largest emitter, releasing 10 billion tonnes of $CO_2$ in 2020, 32% of the global total. Despite the pandemic overall emissions grew by 2% in 2020. Transport sector emissions grew 944% from 1990 to 2019, due to rapid motorisation and greatly increased transport activity. Nevertheless, the sector only represents under 11% of total national $CO_2$ emissions, the lowest share within the G20. Emissions in the transport sector are projected to grow another 42% by 2030 and 70% by 2050, compared to 2020 levels. China is the only country with notable electricity-related emissions from road transport, representing 5% of the sector's emissions. This is due to the massive surge of electric vehicles in cities, combined with the high carbon intensity of electricity generation. The country also has the highest shares of emissions from domestic aviation and navigation within the G20 at 8% and 7.3%, respectively.

**9,932.10 Mt $CO_2$**

TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**8.7%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)

**7.04**

**8.4**

G20 AVERAGE[1]

**5.0**

WORLD AVERAGE

**29.58%**

SHARE IN GLOBAL EMISSIONS (2019)

t $CO_2$ per capita

Sources: IEA, SLOCAT, UNDESA

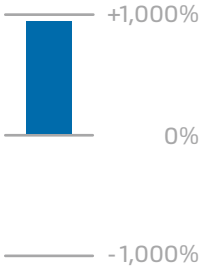
# TRANSPORT SECTOR EMISSIONS

**1,052.80 Mt $CO_2$**

TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**944.5%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR

2015 **0.65**

2019 **0.75**

2020 **0.72**

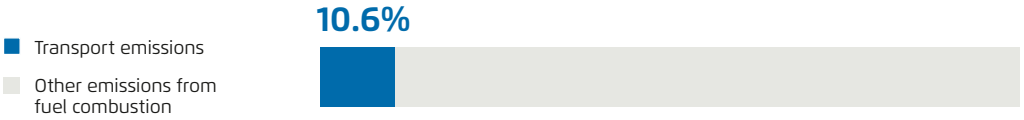
2030* **1.05**

t $CO_2$ per capita

Sources: IEA, SLOCAT, UNDESA

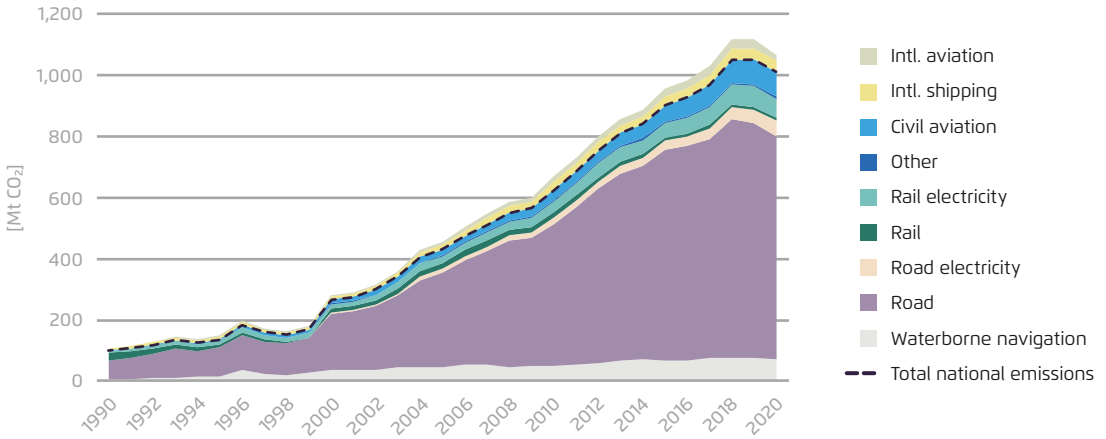
* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)




Source: IEA

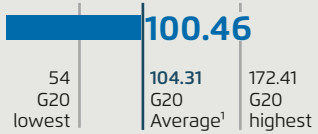
## Transport sector emissions by subsector




Source: IEA

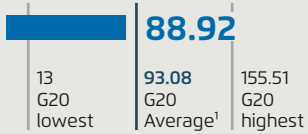
# ENERGY

GASOLINE PRICE (2020)
US Cents/litre



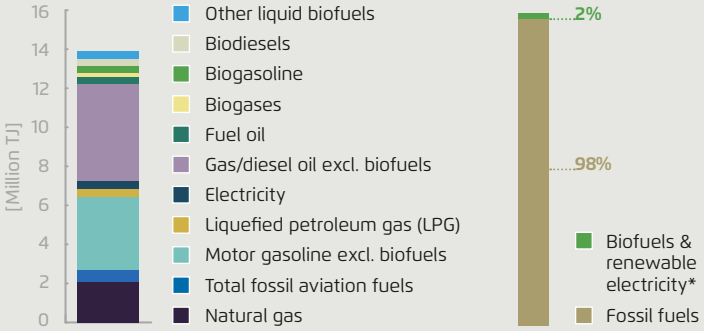

Source: Globalpetrolprices.com*

DIESEL PRICE (2020)
US cents/litre



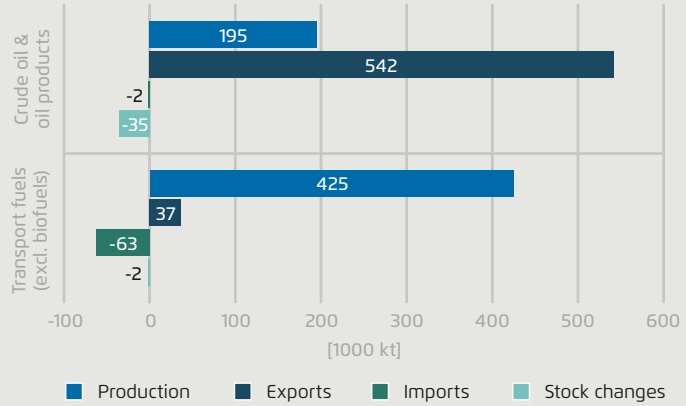

* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

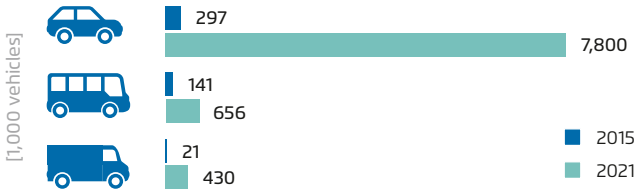
**8.89 million vehicles***
TOTAL STOCK OF ELECTRIC CARS (2021)

**3%**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**16.0%**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

*New sales for 2022 expected to reach 6 million vehicles

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)




**+1,835%**
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)



**680,000***
SLOW CHARGE

**470,000***
FAST CHARGE

**28,789***
SLOW CHARGE
G20 AVERAGE

**43,927***
FAST CHARGE
G20 AVERAGE

Source: IEA, 2021 *number of units

**Battery reuse and recycling**
- Mandatory traceability system with unique code for each battery
- Promotion of cascade use and recycling, with further legislation under development
- Manufacturers of EVs and related enterprises are responsible for battery recycling and must establish recycling service outlets.
- Pilot projects are under way for management system that allows battery tracking across the lifecycle.

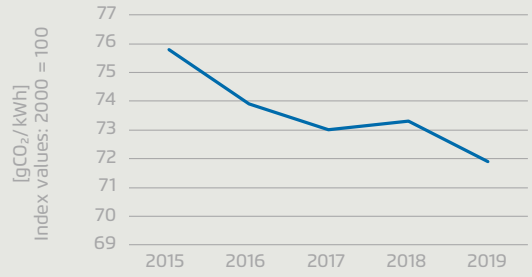
Source: Agora Verkehrswende

# LINKAGES TO THE ENERGY SECTOR

Coal is still the dominant fuel source for power generation in China, representing 64% of total generation (global avg.: 37%). In 2016, China launched a series of 5-year plans for RES, which set 2020 targets for individual technologies, all of which were met. Subsidies are provided to power suppliers through feed-in tariffs. In 2018 the Action Plan for a Smart Photovoltaic Industry was approved, aiming to strengthen the PV manufacturing industry.

In 2021, a budget increase for renewable power subsidies was approved. The China Development Bank has also established a special loan to support carbon peaking and carbon neutrality. In addition to projects with guaranteed remuneration at the national level, local authorities have the right to set on-grid tariffs and run auctions for renewable projects. In July 2021, China officially launched its national carbon trading market which operates with production-based allocation, not a cap.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 25% share of non-fossil fuels in primary energy consumption by 2030
- 1,200 GW of wind and solar by 2030

Source: REN21, NDC, IEA Energy Sector Roadmap China

## The role of hydrogen

- China has not yet announced a national hydrogen strategy.
- 95% of the hydrogen produced is currently fossil-fuel based.
- Public funding of US$20 billion dedicated to hydrogen projects
- Transport target: 1 million FCEVs by 2035

Source: Hydrogen Council 2021

# AMBITION

## NDCs and national climate targets

**General NDC targets**

- Aims to have $CO_2$ emissions peak before 2030 and achieve carbon neutrality before 2060
- Committed to reducing $CO_2$ emissions per unit of GDP by over 65% from the 2005 level

**Transport related NDC targets**

- Amongst new vehicle sales, achieve a 40% share for new energy and clean energy-powered vehicles by 2030
- By 2030, reduce the carbon emissions intensity of new commercial vehicles by 9.5% and of railways by 10% (from 2020 levels)
- Peak oil consumption in land transport by 2030

**Transport related NDC measures**

A wide range of measures are foreseen across all modes, including:

- Upgrade of energy efficiency standards and improved labeling
- Investment in large-capacity public transport infrastructure
- Investment in infrastructure for walking and cycling
- Support for clean energy road vehicles and the electrification of railways
- Measures to optimise freight and enhance the share of rail and water

# TRADE-OFFS

## Sustainability of biofuels

Subsidies for grain-based conventional ethanol were eliminated in 2016. The advanced cellulosic ethanol production subsidy has not changed since 2018. International investors are forbidden from investing in grain-based ethanol production.

## Subsidies

**166 billion CNY**

**~23.3 BILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

China experienced a slowdown in economic growth to 2.2% in 2020, yet the effects of the pandemic on GDP were less pronounced than in other countries. Overall economic growth recovered in 2021. Due to suspended public transport services in some cities during the early phase of the pandemic, there was an increase in car travel and cycling, including shared micromobility. By early 2021, public transport ridership was still estimated to be 50% below 2019 levels. Freight activity in 2020 is estimated to have dropped by 25% compared to forecast volumes. China is the only G20 member where transport sector emissions increased in 2020, by 2%.

Source: IMF 2022; ITF 2021

# IMPLEMENTATION

## Mobility

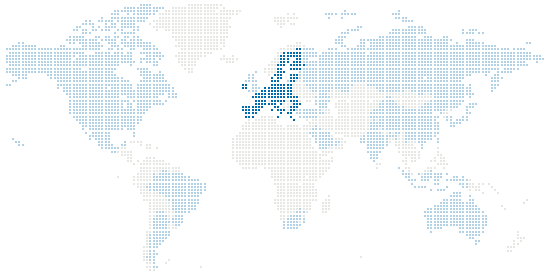
| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | 14th five-year plan includes a further increase in the urban rail, intercity rail and high-speed rail networks and for the first time does not include a target for the expansion of highways.<br>Busses and trolleycars are exempt from the 10% vehicle purchase tax. |
| ✔ **Measures to support low-carbon freight logistics** | The 2019 Outline for Building China's Strength in Transport establishes a strategic framework for a green and efficient logistics system.<br>The 14th five-year plan for the transport system, approved in January 2022, sets the objective of improving waterway transport facilities and building comprehensively integrated transport hubs. |
| ✔ **National-level measures to support new mobility services** | A range of guidelines regulate ride hailing, carsharing, and associated data collection. This includes minimum requirements and standards with the aim of promoting new energy vehicles and regulating parking and payments. |
| ✔ **National measures to support non-motorised transport** | A number of guidelines have been adopted to promote safety, control parking, and ensure safe and convenient payment methods. |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for light duty vehicles (LDV)** | Current phase IV fuel efficiency standard: 5l/100km<br>• Passenger cars: 117 g/km • Light commercial: 166 g/km<br>• Varying fuel efficiency standards for 2- and 3-wheelers<br>Fuel efficiency targets for passenger cars for:<br>• 2025: 4l/100km • 2030: 3.2l/100km |
| ✔ **Energy/carbon emission standards for heavy duty vehicles (HDV)** | Phase 4 fuel efficiency standards tighten fuel consumption standards by ~15% compared to stage 3 (takes effect January 1, 2025 for new type-approvals) and July 1 2026 for all new heavy duty vehicles. |
| ✔ **Pricing instruments** | The national ETS was launched in 2021. The scope is expected to be gradually expanded to include domestic aviation. There is no timeline yet for this expansion. Some of the provincial pilot ETS systems already cover domestic aviation; the Shanghai pilot system also covers shipping.<br>Discount on 50% for the annual vehicle and vessel tax for fuel efficient vehicles smaller than 1.6 L. |
| ✔ **Mandatory vehicle labelling** | Fuel economy labeling for vehicles under 3500 kg |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • New Energy Vehicle dual credit system: EV credit of 14–18% in 2021–23 for LDVs (under discussion for HDVs)<br>• NEV purchase subsidies extended to 2022, but with gradual reductions<br>• Acquisition tax and excise tax exemption, circulation and ownership tax exemption<br>• Further mechanism addressing vehicle supply equipment, charger installation, battery swapping and public charging infrastructure |

Source: Chinese national sources

# EUROPEAN UNION



**14.86%**
SHARE IN GLOBAL GDP (2020)

**[No Data]**
TRANSPORT SECTOR SHARE GDP (2020)

**3.63%**
EMPLOYMENT IN TRANSPORT (2019)

Source: European Union, Eurostat

After Brexit, the EU comprises 27 member states on the European continent, each of which have divergent transport systems and challenges. Air transport has been growing in importance for passenger travel, particularly since the rise of budget airlines. Nevertheless, road transport remains the most important mode for passenger and freight transport.

The EU does not have specific emission targets for the transport sector, but does have a 14% renewables target for transport by 2030. Additional targets for high-speed rail use, water transport and rail, as well as electric vehicles and charging infrastructure exist for 2030. The economy-wide long-term goal is to achieve net-zero emissions by 2050. Many measures related to the efficiency of vehicles are governed by EU legislation, including $CO_2$ emission standards for passenger cars, light- and heavy duty vehicles, as well as mandatory labeling requirements.

## NDC

- AT LEAST 55% REDUCTION IN GHG EMISSIONS IN 2030 COMPARED TO 1990
- ECONOMY-WIDE NET-ZERO TARGET BY 2050

## EV TARGETS

- 100% EV SHARE IN NEW SALES OF PASSENGER CARS AND VANS MANDATORY FROM 2035

## POPULATION

**448 million people**
CURRENT POPULATION (2020)

**5.8%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: -5.0% (2020–2050)

**111.69 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**44.1 years**
AVERAGE AGE (2021)


Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**75.0% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

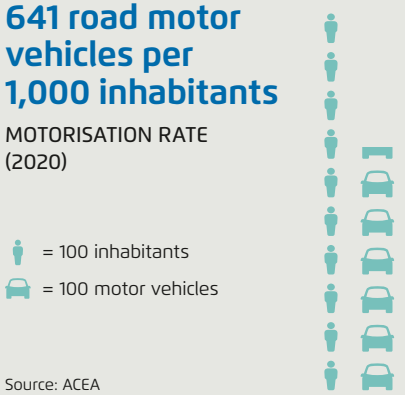
**335.43 million people**
TOTAL URBAN POPULATION (2020)

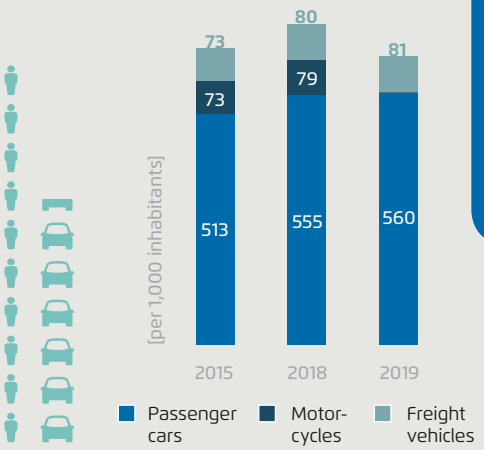
EXPECTED SHARE OF URBAN POPULATION: 84.4% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

**641 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)

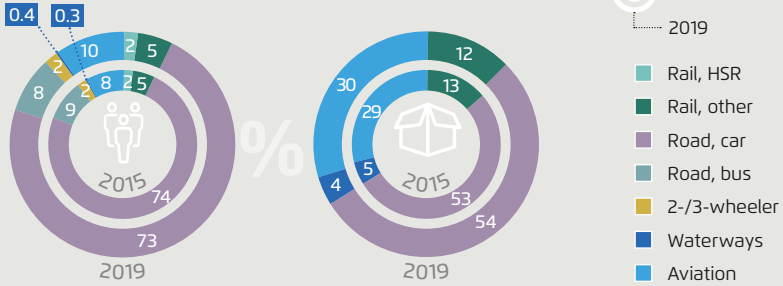



Source: ACEA

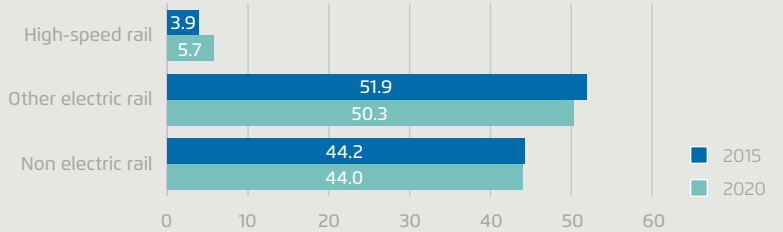
**5,951.3 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

**3,289.1 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: European Union
* does not include all transport modes
** does not include all transport modes

## Rail infrastructure




Source: European Union



Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

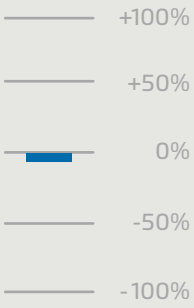
Total $CO_2$ emissions from fuel combustion in the European Union have decreased by 24% between 1990 and 2019. Transport sector emissions during the same period have increased by 22% reaching a share of 31% of total emissions. Emissions in the sector are projected to remain more or less stable up to 2050 under business-as-usual. Road transport is responsible for 94% of transport sector emissions, with rail generating only 2% of emissions, most of this from electricity use.

**2,655.88 Mt $CO_2$**

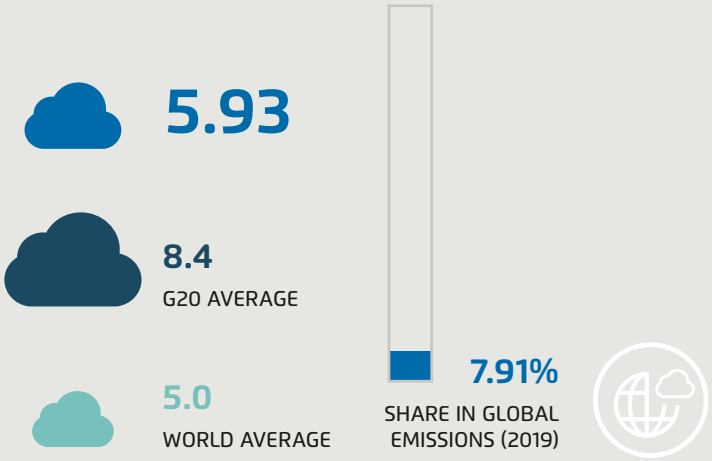
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**-6.0%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

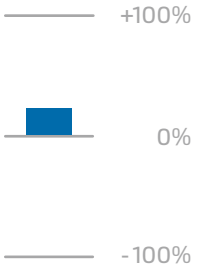
# TRANSPORT SECTOR EMISSIONS

**828.81 Mt $CO_2$**

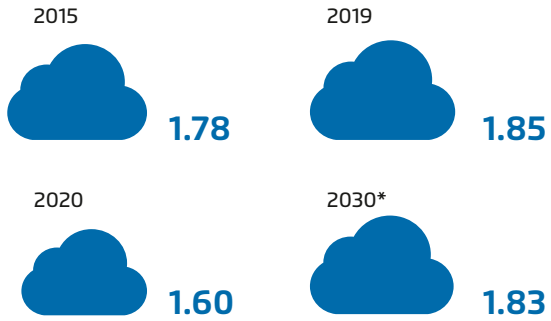
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**22.4%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

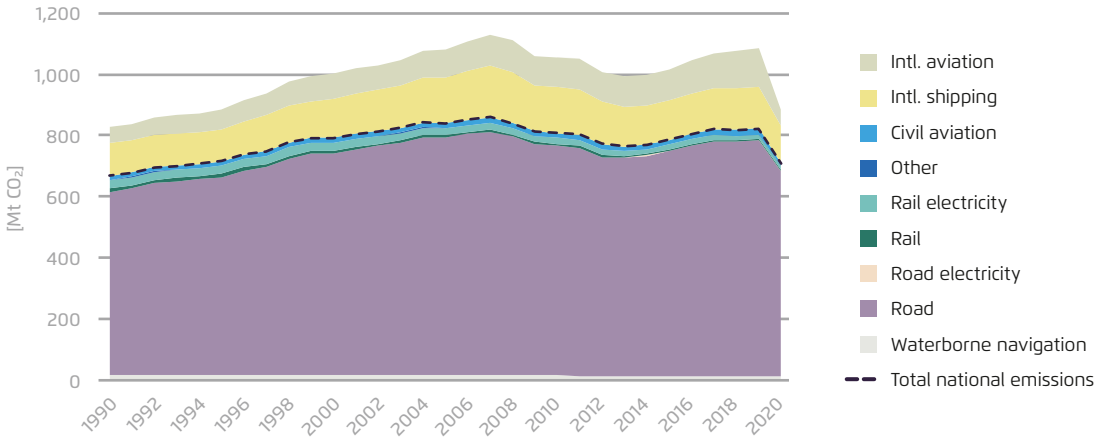
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

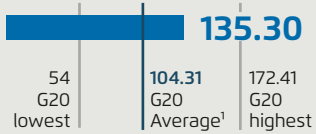
## Transport sector emissions by subsector



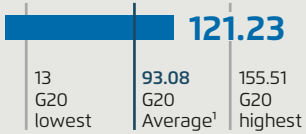

Source: IEA

# ENERGY

GASOLINE PRICE (2020)
US cents/litre

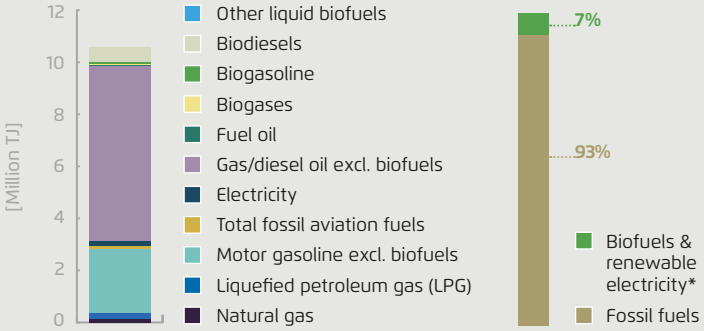



DIESEL PRICE (2020)
US cents/litre



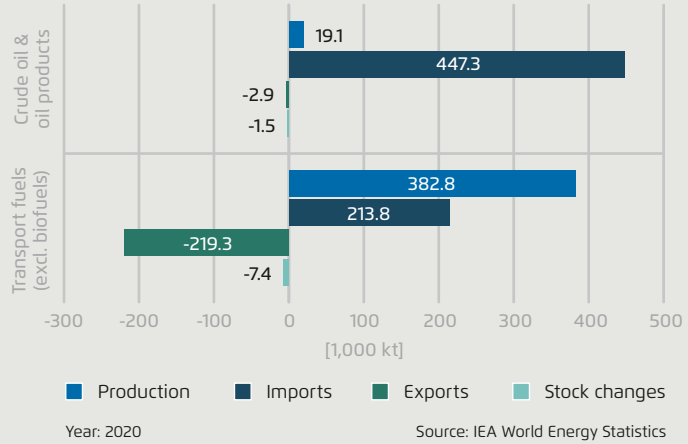

Source: European Commission

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

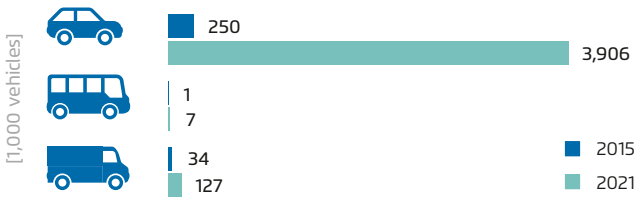
# ELECTRIC VEHICLES

**4,040,059 vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**1.5%**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**18%**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)




**+1,320.8%**
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer, ACEA, EEA

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)



**[No Data]**
SLOW CHARGE
**28,789***
SLOW CHARGE G20 AVERAGE

**[No Data]**
FAST CHARGE
**43,927***
FAST CHARGE G20 AVERAGE

Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**

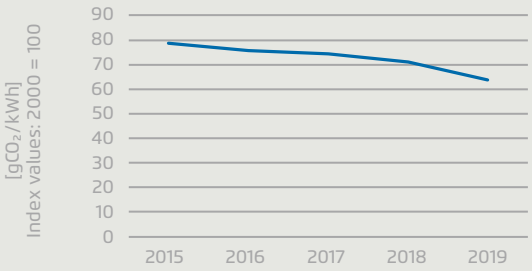
- The new EU Battery Regulation contains requirements to reduce and monitor the carbon footprint of EV batteries.
- The agreement sets binding minimum levels for the recycled content of cobalt, lead, lithium and nickel, supply chain due diligence requirements and material recovery targets.
- From a circular economy perspective, it also contains recycling efficiency targets for cobalt, copper, lead, lithium and nickel as well as requirements for minmum recycled contents for these raw materials.

Source: European Parliament

# LINKAGES TO THE ENERGY SECTOR

The EU has set renewable energy targets and requires member states to define action plans for meeting their obligations. It does not have any EU-wide support mechanisms, but has issued guidance for the design of support schemes.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 32% gross final energy consumption by 2030
- 60 GW offshore wind by 2030
- 300 GW offshore wind by 2050

## The role of hydrogen

- The EU adopted a hydrogen strategy in 2020.
- Target is to install at least 6GW of renewable electrolysers in the EU by 2024 and 40GW by by 2030.
- The project pipeline under the European Clean Hydrogen Alliance includes 750 projects, including 240 on mobility.

Source: European Commission

# AMBITION

## NDCs and national climate targets

**General NDC targets**
Committed to at least 55% reduction in GHG emissions in 2030 compared to 1990

**Transport-related measures**
Inclusion of aviation in the EU ETS; process for the inclusion of shipping also far advanced

**Future targets at national level**
Renewable Energy Directive recast:
- < 14% of final transport energy consumption by 2030
- New proposal to reduce greenhouse gas intensity of transport fuels by 13%–16% by 2030 across all modes

Sustainable & Smart Mobility Strategy:
- High-speed rail traffic to double by 2030, rail freight to double by 2050
- +25% water transport by 2030
- 90% emission decline by 2050 compared with 1990

**National EV deployment targets**
- See National ICE phase-out commitments
- 1 million public charging stations by 2025 and 3 million by 2030

**National ICE phase-out commitments**
100% EV share in passenger cars and vans from 2035

# TRADE-OFFS

## Sustainability of biofuels

The EU Renewable Energy Directive II from 2021 caps the use of 'high-risk indirect land use change (ILUC) biofuels' at 2019 levels until 2023 and requires a phase out of these until 2030. The REDII also sets a GHG emission savings threshold for biofuels to count towards the target of 65% for transport biofuels from 2021.

## Subsidies

**[No Data]**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

The EU does not provide direct subsidies for fossil transport fuels. Subsidies in the sector are defined at the members state level.

# COVID

Across the European Union, public transport ridership fell drastically by up to 90% and international rail passenger volumes dropped by almost 100% in the first pandemic wave in 2020. While car driving returned to 93% and active transport to 90% of pre-pandemic levels by October 2021, public transport usage is still at 77%. Overall, rail passenger-km decreased by 46% in the first half of 2020, compared to 2019, but have further decreased between October 2020 and January 2021, reaching a decrease of 68% below pre-pandemic levels. Levels remained at 24% below 2019 by March 2022.

Source: EU Parliament, CER

# IMPLEMENTATION

## Mobility

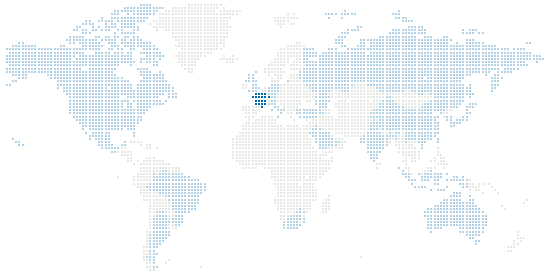
| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • Directive on Passenger Coach Services, to stimulate the development of bus connections over long distances across Europe<br>• European Local Energy Assistance (ELENA) providing grants also for public transport improvements<br>• EU 2021 Rail Corridor Initiative – Action Plan to boost passenger rail transport (planned). |
| ✔ **Measures to support low-carbon freight logistics** | • Combined Transport Directive<br>• Connecting Europe Facility (CEF) for Transport<br>• EU 2021 Rail Corridor Initiative – Revision of the Rail Freight Corridor Regulation (planned) |
| ✔ **National-level measures to support new mobility services** | • European Strategy on Cooperative Intelligent Transport Systems (revision planned)<br>• Legal framework on the approval of automated vehicles (to be completed)<br>• Assessment of regulatory action for multimodal digital service providers planned |
| ✔ **National measures to support non-motorised transport** | • Pan-European Master Plan for Cycling Promotion<br>• Support for the development of cycle infrastructure in eligible regions under the European Structural and Investment Funds |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for passenger cars and light duty vehicles (LDV)** | Targets for average $CO_2$ emissions from new passenger cars and LDVs:<br>• In 2025, 15% lower than in 2021 for passenger cars and LDVs<br>• In 2030, 55% lower than in 2021 for passenger cars and 50% lower for LDVs<br>• In 2035, 100% lower than in 2021 for passenger cars and LDVs |
| ✔ **Energy/carbon emission standards for heavy duty vehicles (HDV)** | Targets for average $CO_2$ emissions from new heavy duty vehicles:<br>• In 2025, 15% lower than in 2019<br>• In 2030, at least 30% lower than in 2019 |
| ✔ **Pricing instruments** | • Inclusion of domestic aviation in EU-ETS, inclusion of maritime proposed for 2024<br>• Participation in CORSIA first phase |
| ✔ **Mandatory vehicle labelling** | Car Labelling Directive 1999/94/EC |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • Standards for interoperability of charging infrastructure<br>• Super-credits for zero- and low-emission vehicles within the $CO_2$ emission standard<br>• The European Directive on the energy performance of buildings, mandates charging infrastructure for buildings with >10 parking spaces. A proposed revision would add additional requirements<br>• Direct investment in charging infrastructure<br>• The latest EU battery regulation promotes sustainable batteries over the entire life cycle |

Source: See national sources EU

# FRANCE



**2.27%**
SHARE IN GLOBAL GDP (2020)

**9.49%**
TRANSPORT SECTOR SHARE GDP (2020)

**4.81%**
EMPLOYMENT IN TRANSPORT (2019)

Source: UNSTATS, European Union, Eurostat

With 67 million inhabitants, France is the second most populated country in Europe. Nearly 20% of the population is clustered in the Paris region. The transport system is similarly centralised, with many roads and railway lines leading to and from the French capital. Road transport is by far the leading mode of transport for passengers and freight, despite the country's extensive rail and waterway systems.

France aims to reduce emissions from land transport to zero by 2050. This is to be supported by a ban on sales of fossil-fuel vehicles from 2040 onward. France has implemented a wide range of measures to promote low-carbon transport and energy sectors.

## NDC

- ACHIEVE AT LEAST A 55% REDUCTION IN GHG EMISSIONS IN 2030 RELATIVE TO 1990
- ACHIEVE ECONOMY-WIDE NET-ZERO TARGET BY 2050

## EV TARGETS

- 1.8 MILLION PASSENGER PHEVS, 3 MILLION PASSENGER BEVS AND FCEVS, AND 500,000 LIGHT COMMERCIAL BEVS AND FCEVS BY 2028
- PRODUCTION OF 2 MILLION EVS BY 2030

## POPULATION

**67 million people**
CURRENT POPULATION (2020)

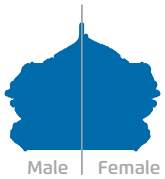
**0.9%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 2.1% (2020–2050)

**123.08 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**41.8 years**
AVERAGE AGE (2022)




Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**81% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

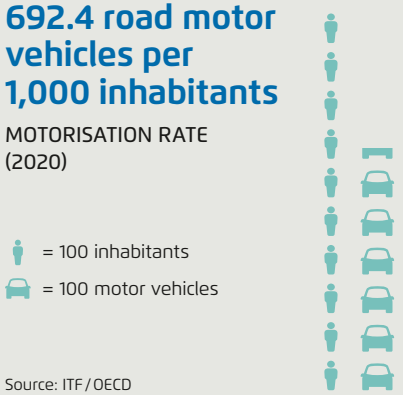
**54.6 million people**
TOTAL URBAN POPULATION (2020)

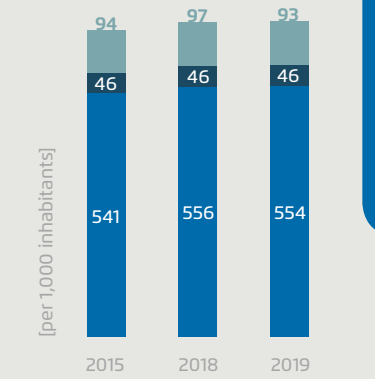
EXPECTED SHARE OF URBAN POPULATION: 88.3% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

**692.4 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)

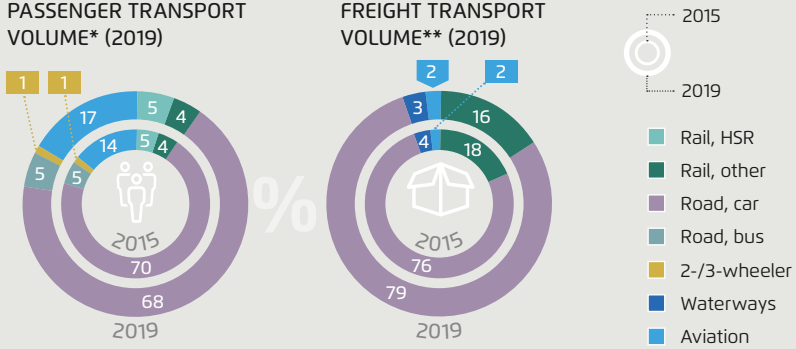



Source: ITF / OECD

**1,169.5 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

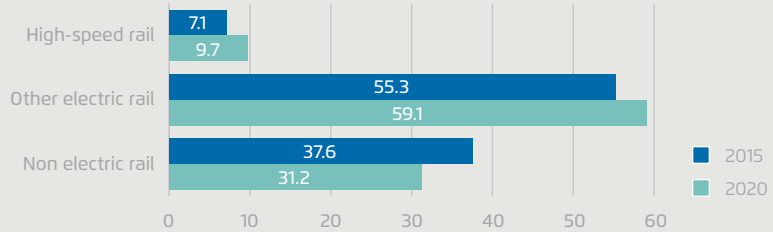
**214.6 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: ITF / OECD, Eurostat
* does not include all transport modes

Source: World Development Indicators, ITF / OECD
** does not include all transport modes

## Rail infrastructure




Source: ITF / OECD



Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

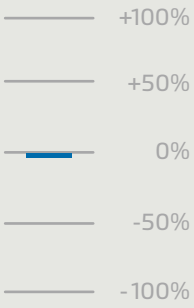
Total $CO_2$ emissions from fuel combustion in France decreased by 15% between 1990 and 2019 and per capita emissions are just below the world average. Over the same period, transport-sector emissions increased by 10%, but dropped by 15% in 2020. Under a business-as-usual scenario, sector emissions are projected to remain relatively stable through 2050. As the French energy sector relies heavily on nuclear power, energy-sector $CO_2$ emissions are relatively low. Accordingly, the transport sector in 2019 was responsible for 43% of the country's emissions.

**293.74 Mt $CO_2$**

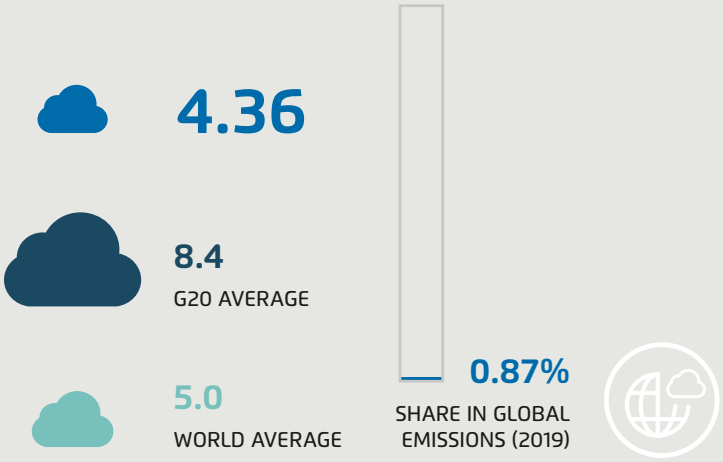
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**-3.5%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

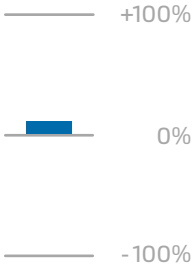
# TRANSPORT SECTOR EMISSIONS

**126.06 Mt $CO_2$**

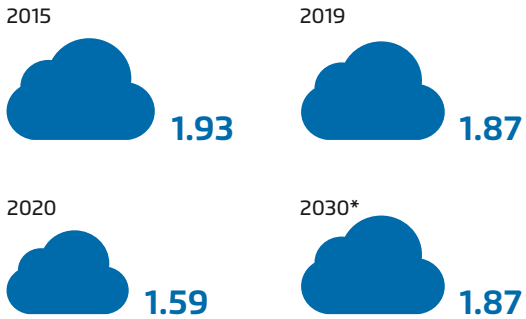
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**10.3%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

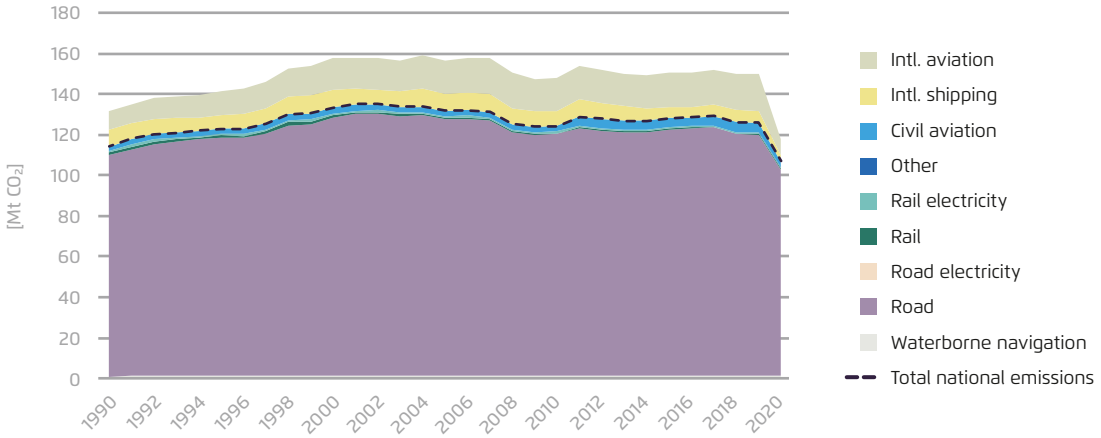
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

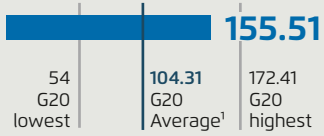
## Transport sector emissions by subsector



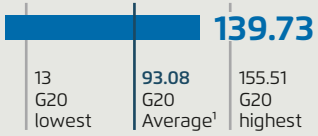

Source: IEA

# ENERGY

GASOLINE PRICE (2020)
US cents/litre



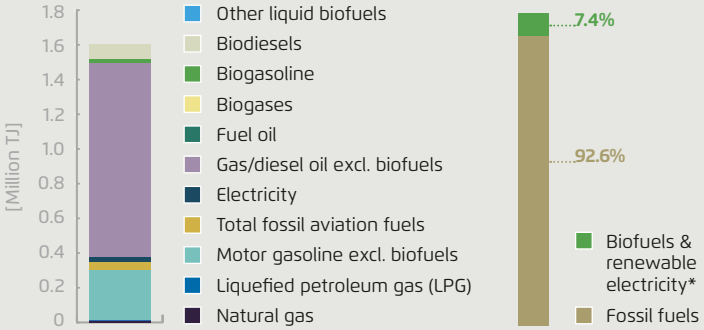

DIESEL PRICE (2020)
US cents/litre




Source: Globalpetrolprices.com*

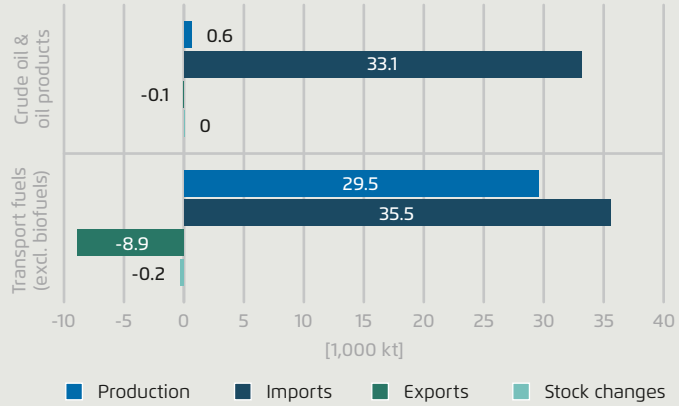
* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

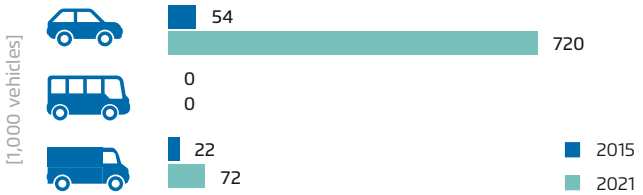
# ELECTRIC VEHICLES

**793,070 vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**2.20%**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**19%**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)




**+940.5%**
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**50,000***
SLOW CHARGE

**4,500***
FAST CHARGE

**28,789***
SLOW CHARGE
G20 AVERAGE

**43,927***
FAST CHARGE
G20 AVERAGE

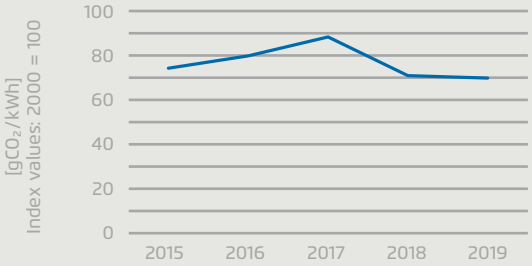
Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**
Battery use and recycling in France are governed by the EU Battery regulation.

# LINKAGES TO THE ENERGY SECTOR

Power generation in France is predominantly from nuclear, followed by renewables. Various policies promote RES development in France, with the most important being renewable power tenders, a feed-in tariff and a market premium. France pledged to ban coal-fired power generation.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 33–36% renewables in the electricity mix by 2028; 40% by 2030
- 101 to 113 GW by 2028

Source: REN21

## The role of hydrogen

- France adopted a hydrogen strategy in 2018. In 2022, its 2030 investment plan earmarked 1.9 billion euros for hydrogen.
- France aims to construct 100 stations supplied with locally produced hydrogen by 2023 and between 400 and 1000 stations by 2028.
- The country envisions 20,000–50,000 light commercial hydrogen vehicles and 800–2000 heavy hydrogen vehicles on the road by 2028.

Source: BR4, IEA (2022)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
Committed to at least a 55% reduction in GHG emissions in 2030 relative to 1990 levels

**Transport related NDC targets**
- Inclusion of aviation in the EU ETS
- $CO_2$ emission targets for road transport

**Future targets at national level**
- Triple share of bicycles in transport by 2024
- Carbon-free land transport by 2050

**National EV deployment targets**
- 500,000 passenger PHEVs, 660,000 passenger BEVs and FCEVs, and 170,000 light commercial BEVs and FCEVs by 2023
- 100,000 public EV charging points by 31 December 2023
- 1.8 million passenger PHEVs, 3 million passenger BEVs and FCEVs, and 500,000 light commercial BEVs and FCEVs by 2028
- Production target: 2 million EVs by 2030

**National ICE phase-out commitments**
Prohibits the sale or registration of fossil-fuel vehicles by 2040

# TRADE-OFFS

## Sustainability of biofuels

The EU's 2021 Renewable Energy Directive II (REDII) caps the use of 'high-risk indirect land use change (ILUC) biofuels' at 2019 levels until 2023 and requires a phase-out of these by 2030. REDII also sets a GHG emission savings threshold for biofuels to count towards the target of 65% for transport biofuels starting in 2021.

## Subsidies

**6.4 billion EUR**

**~6,290 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

France experienced an 8% contraction of its economy in 2020. Growth resumed in 2021 at almost triple the rate seen before the pandemic. Passenger-km dropped by 41% in 2020 relative to 2019, while occupancy decreased only by 26%, one of the lowest values in the EU. Rail freight dropped by 7% between 2019 and 2020. Overall, transport emissions decreased by 15% in 2020, a substantial drop compared with the 1% decrease in 2019.

Source: IMF 2022. EU Parliament

# IMPLEMENTATION

## Mobility

| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • Development of High Speed Railway Lines<br>• Expansion of exclusive-lane public transport systems<br>• 40% increase in transport investments in public and shared transport<br>• Obligation to investigate the feasibility of low-emission zones<br>• Half of the cost of the public-transit pass borne by employers |
| ✔ **Measures to support low-carbon freight logistics** | • VitalNodes Initiative for efficient, sustainable freight delivery across the TEN-T urban nodes<br>• GHG information scheme obligation for freight transport service providers<br>• Financial support scheme for combined transport service operators |
| ✔ **National-level measures to support new mobility services** | • Promotion of car sharing, on-demand services, and the provision of car-sharing vehicles<br>• Provision of improved multimodal information |
| ✔ **National measures to support non-motorised transport** | • Bicycle Plan, with fund to support local projects<br>• Bicycle milage allowance scheme (voluntary)<br>• Tax reductions for companies providing employees bicycles<br>• Obligation to create secure bicycle parking |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for light duty vehicles (LDV)** | **Current EU $CO_2$ efficiency standards:**<br>• Passenger cars: 95 g/km (2021) • Light commercial: 147 g/km (2020)<br>**Future standards (2030):**<br>• Passenger cars: 59 g/km • Light commercial: 101 g/km |
| ✔ **Energy/carbon emission standards for heavy duty vehicles (HDV)** | Targets for average $CO_2$ emissions from new heavy-duty vehicles:<br>• In 2025, 15% lower than in 2019 • In 2030, at least 30% lower than in 2019 |
| ✔ **Pricing instruments** | • Bonus-malus system based on $CO_2$ and weight<br>• $CO_2$-based component in the tax on business vehicles (annual)<br>• Carbon tax on fossil fuels not covered by the EU-ETS at EUR 44.6/t $CO_2$ in 2021<br>• Inclusion of domestic aviation in EU-ETS, inclusion of maritime proposed for 2023<br>• Participation in the first phase of CORSIA |
| **Mandatory vehicle labelling** | • National implementation of the EU Car Labelling Directive 1999/94/EC |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • France 2030 investment plan: EUR 2.5 billion support for the production of 2 million EVs and 300 million for charging infrastructure<br>• Conversion premium for scrapping of high-emission ICEs in combination with EV purchase<br>• Mandatory requirement for charging infrastructure in certain car parks |

Source: French national sources

# GERMANY



**3.4%**
SHARE IN GLOBAL GDP (2020)

**4.3%**
TRANSPORT SECTOR SHARE GDP (2020)

**5.2%**
EMPLOYMENT IN TRANSPORT (2019)

Source: World Development Indicators, Ministry of Transport

Germany is the most populous country in Europe. The country lies on the Baltic and North Seas, and has a well-established network of navigable waterways. Despite its comparatively small size, the country has the seventh-largest railway network and the twentieth-largest waterway system in the world. Nevertheless, road transport is by far the most important mode for passengers and freight. High levels of local congestion and air pollution are an issue, particularly in urban centres.

Germany has set an absolute target for domestic transport-sector emissions in 2030 of 85 Mt $CO_2$ and aims to be carbon neutral by 2045. While Germany has failed to achieve its target of putting one million electric cars on the road by 2020, it has set new targets for 2030 and aims to increase its share of rail freight. The country has also implemented a number of measures to enhance energy efficiency and reduce the carbon content of fuels.

## NDC

- AT LEAST 55% REDUCTION IN GHG EMISSIONS IN 2030 COMPARED TO 1990
- ECONOMY-WIDE NET-ZERO TARGET BY 2045

## EV TARGETS

- 15 MILLION ELECTRIC PASSENGER CARS BY 2030

## POPULATION

**83 million people**
CURRENT POPULATION (2020)

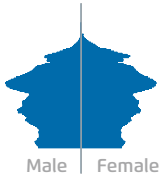
**1.1%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: -5.3% (2020–2050)

**238.25 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**44.9 years**
AVERAGE AGE (2022)




Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**77.5% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

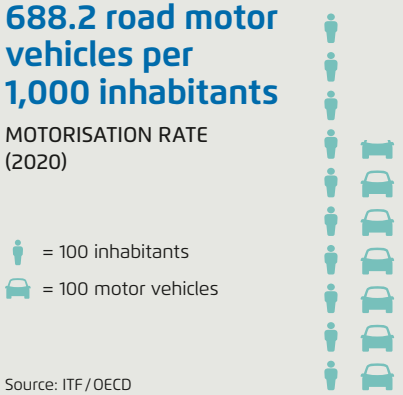
**64.4 million people**
TOTAL URBAN POPULATION (2020)

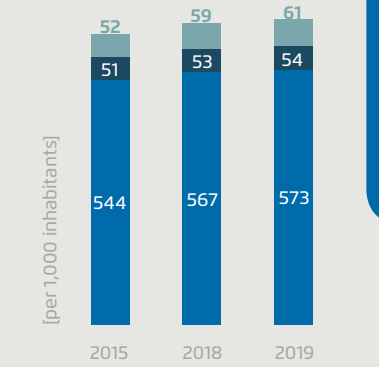
EXPECTED SHARE OF URBAN POPULATION: 84.3% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

**688.2 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)

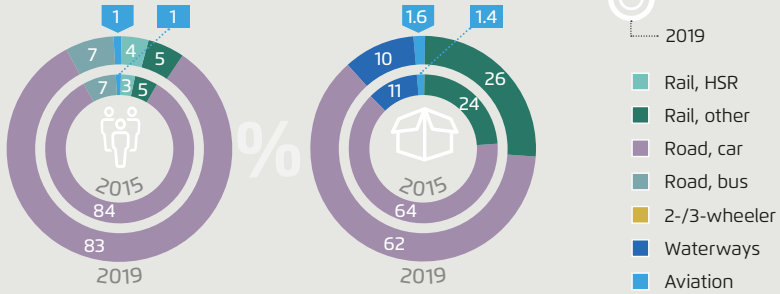



Source: ITF / OECD

**1,108.5 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

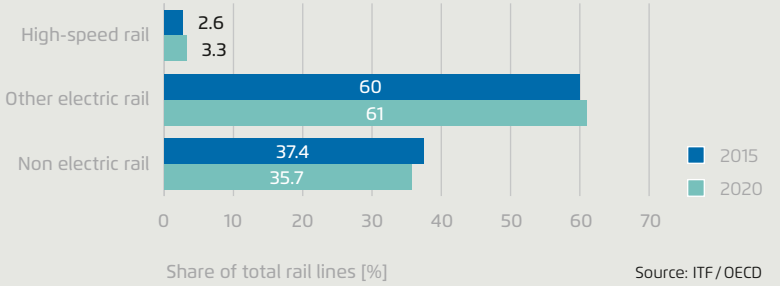
**499.7 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: Ministry of Transport
* does not include all transport modes

Source: World Development Indicators, ITF / OECD
** does not include all transport modes

## Rail infrastructure




Source: ITF / OECD

Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

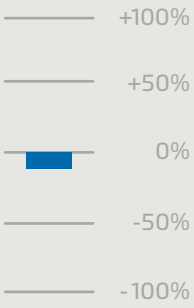
Germany's total $CO_2$ emissions from fuel combustion decreased by 33% between 1990 and 2019. Emissions in the transport sector increased through 1999, decreased until 2009, and have been slowly growing since then. Today, they are only 2% below 1990 levels. In 2020, emissions from transport dropped by 11%. Given current trends, transport sector emissions are projected to decrease by 8% by 2030 and 20% by 2050, relative to 2020 levels. Road vehicles are responsible for 95% of the emissions released in Germany's transport sector. The next highest emitter is rail, representing just over 3% of emissions, most of which is from electricity use.

**645.40 Mt $CO_2$**

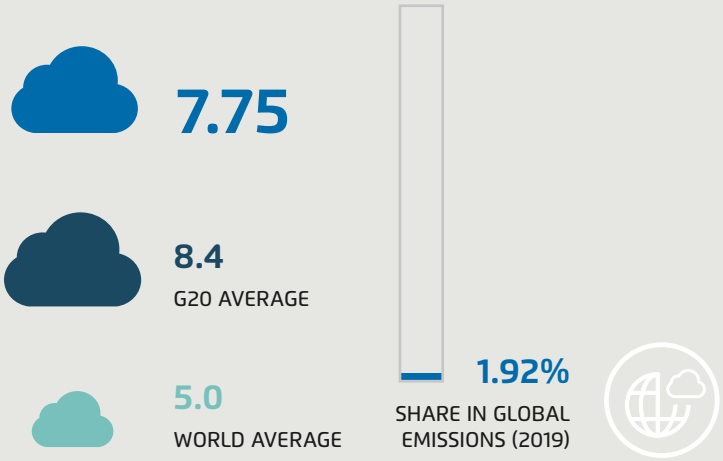
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**-11.6%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

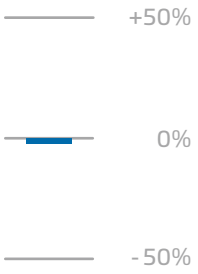
# TRANSPORT SECTOR EMISSIONS

**164.79 Mt $CO_2$**

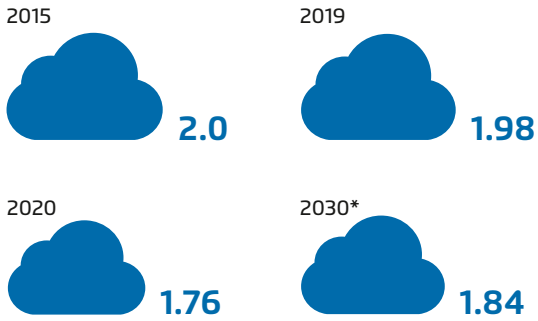
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**-2.1%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

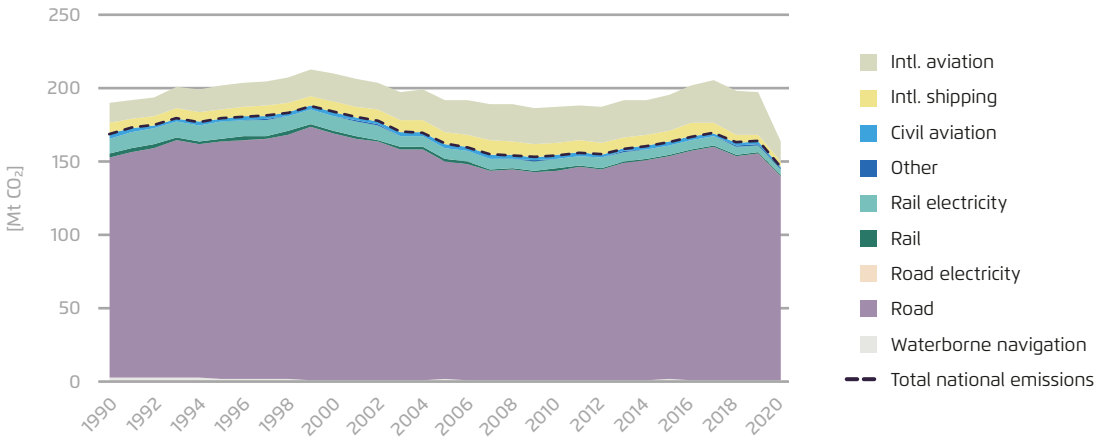
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

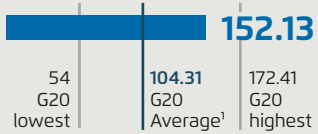
## Transport sector emissions by subsector




Source: IEA

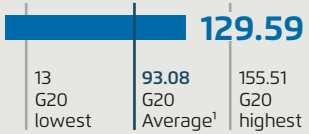
# ENERGY

GASOLINE PRICE (2020)
US cents/litre



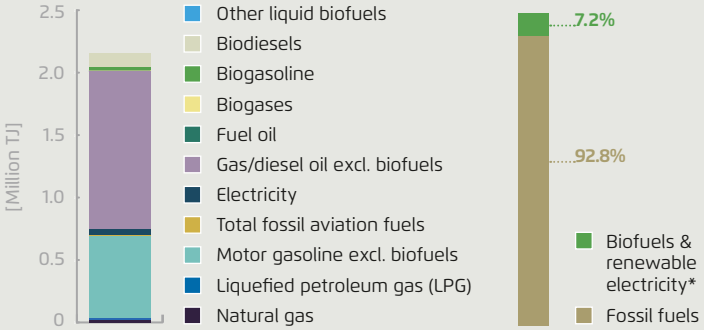

Source: Globalpetrolprices.com*

DIESEL PRICE (2020)
US cents/litre



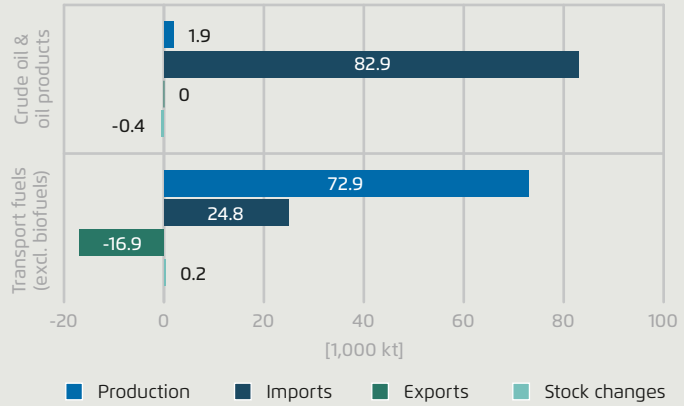

* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**1,322,760 vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**2.80%**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**26%**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)


**+2,405%**
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**42,000***
SLOW CHARGE

**9,200***
FAST CHARGE

**28,789***
SLOW CHARGE
G20 AVERAGE

**43,927***
FAST CHARGE
G20 AVERAGE

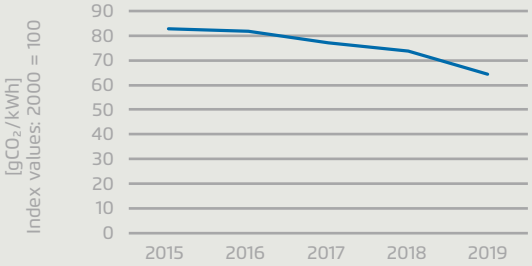
Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**
Battery use and recycling in Germany are governed by the EU Battery regulation.

# LINKAGES TO THE ENERGY SECTOR

Coal is still the largest fuel source for power generation in Germany, but the share declined from almost 50% in 2013 to around 25% in 2020. Germany has a renewable energy law (EEG) that regulates access for renewables and provides incentives. The law used to set fixed feed-in tariffs for individual technologies over a 20-year period. In 2017 an auction system was rolled out for solar, wind, and biomass. Small-scale rooftop PV installations still receive a fixed feed-in tariff. The 2021 revision of the law enhanced incentives for renewables in rented properties and for autoconsumption installations.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 2030: 65%
- 2050: 100%
- 98 GW PV by 2030
- 67–71 GW wind by 2030

Source: REN21, BMWK

## The role of hydrogen

- Germany adopted a hydrogen strategy in 2020 that includes 9 billion euros of funding.
- Germany has targeted for 5 GW of green generation capacity by 2030 (plus related onshore and offshore power generation) and an additional 5 GW by 2035 or 2040.

Source: Government of Germany)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
Committed to at least a 55% reduction in GHG emissions in 2030 relative to 1990 levels

**Transport related NDC targets**
- See the EU's: $CO_2$ emission targets for road transport
- 15 million BEVS by 2030

**Transport related NDC measures**
Inclusion of aviation in the EU ETS; process for the inclusion of shipping also far advanced

**Future targets at national level**
- The climate law sets an absolute target of 85 Mt $CO_2$ for 2030
- Increase of rail freight in total freight to 25% by 2030
- GHG quota (national implementation of EU Renewable Energy Directive) requiring a 25% reduction in transport until 2030

**National EV deployment targets**
- 15 million fully electric passenger cars on the road by 2030 (internal goal of government coalition)
- 50% share of electric urban buses by 2030
- 50,000 EV charging stations (20,000 of which are fast charging) by 2025
- 1 million EV charging stations by 2030

# TRADE-OFFS

## Sustainability of biofuels

The EU's 2021 Renewable Energy Directive II (REDII) caps the use of 'high-risk indirect land use change (ILUC) biofuels' at 2019 levels until 2023 and requires a phase-out of these by 2030. REDII also sets a GHG emission savings threshold for biofuels to count towards the target of 65% for transport biofuels starting in 2021.

## Subsidies

**0.9 billion EUR**

**~902 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

Germany experienced a 4.6% contraction of its economy in 2020 but growth resumed in 2021. The number of passengers using public transport by railways, trams, and buses decreased by 30% in 2020 relative to pre-pandemic levels and another 4% in 2021. Long distance bus transport was most heavily affected and decreased by 34% in 2020 and 53% in 2021 relative to 2019. Air transport has slightly increased in 2021, but was still 67.6% below pre-pandemic levels. Freight activity declined by 3.7% in 2020. Overall, transport emissions declined by 10% in 2020.

Source: IMF 2022, Destatis

# IMPLEMENTATION

## Mobility

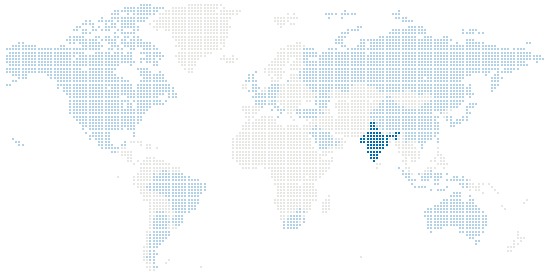
| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • Enhanced efficiency of rail infrastructure based on a unified rail timetable<br>• VAT reduction for public transport<br>• Funding program for pilot projects to strengthen public transport<br>• Tax exemption for public transport subsidies provided by employers |
| ✔ **Measures to support low-carbon freight logistics** | • Subsidies for the reactivation of old rail tracks and company rail sidings<br>• Funding for the improvement of inland waterways<br>• Funding for combined transport infrastructure |
| ✔ **National-level measures to support new mobility services** | • Legal framework for new mobility services<br>• Law on automated driving |
| ✔ **National measures to support non-motorised transport** | • Revised National Cycling Plan 2022<br>• Support for local cycle paths and parking<br>• Tax exemption for bicycles provided by employers |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for light duty vehicles (LDV)** | **Current EU $CO_2$ efficiency standards:**<br>• Passenger cars: 95 g/km (2021)<br>• Light commercial: 147 g/km (2020)<br>**Future standards (2030):**<br>• Passenger cars: 59 g/km<br>• Light commercial: 101 g/km |
| ✔ **Energy/carbon emission standards for heavy duty vehicles (HDV)** | **Targets for average $CO_2$ emissions from new heavy-duty vehicles:**<br>• In 2025, 15% lower than in 2019<br>• In 2030, at least 30% lower than in 2019 |
| ✔ **Pricing instruments** | • $CO_2$ pricing system for transport fossil fuels (Fuel Trade Emission Act)<br>• Circulation tax partly based on $CO_2$<br>• VAT discount for public transport<br>• Inclusion of domestic aviation in the EU ETS; inclusion of maritime proposed for 2023<br>• Participation in the first-phase of CORSIA |
| ✔ **Mandatory vehicle labelling** | • National implementation of the EU Car Labelling Directive 1999/94/EC |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • Purchase incentive for EVs were reduced by 1,500–2,000 EUR in 2023 (from previsouly 9,000 EUR).<br>• Differentiated plates for EVs, allowing for perks such as preferential parking<br>• Investment subsidy programmes for charging infrastructure<br>• Direct investment in 1,000 public fast-charging points<br>• Income tax rebates for electric company cars<br>• Tax exemption for charging at the workplace |

Source: German national sources

# INDIA



**6.77%**
SHARE IN GLOBAL GDP (2020)

**6.30%**
TRANSPORT SECTOR SHARE GDP (2020)

**5.45%**
EMPLOYMENT IN TRANSPORT (2019)

Source: IMF, UNSTATS, ILO

With 1.38 bn inhabitants in 2020, India is the second-most populated country in the world. The country's road network is the second largest in the world after the US and it has the fourth-largest rail network globally. The total number of road vehicles grew at an average of 10% per year between 2005 and 2012 and continues to grow strongly, which, together with increasing urbanisation, has led to high levels of traffic congestion and air pollution.

Despite the goal to achieve net-zero emissions by 2070 and an increase in the economy-wide target in its updated NDC, India still has no overall emissions or energy targets for the transport sector. India has measures in place to support public transport and low-carbon freight, as well as policies to enhance the energy and carbon efficiency of vehicles, including a fuel efficiency standard for heavy-duty vehicles in place since April 2018.

## NDC

- REDUCE GDP EMISSIONS INTENSITY BY 45% IN 2030 RELATIVE TO 2005 LEVELS
- ACHIEVE ECONOMY-WIDE NET-ZERO TARGET BY 2070

## EV TARGETS

- 30% SHARE OF ELECTRIC LDVS IN VEHICLE SALES BY 2030

## POPULATION

**1.38 billion people**
CURRENT POPULATION (2020)

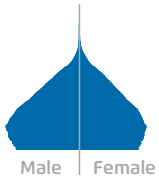
**17.8%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 19.6% (2020–2050)

**464.15 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**27.9 years**
AVERAGE AGE (2022)




Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**34.9% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

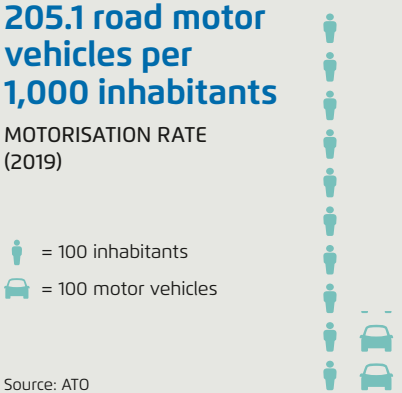
**493.2 million people**
TOTAL URBAN POPULATION (2020)

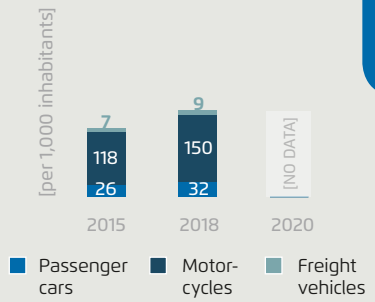
EXPECTED SHARE OF URBAN POPULATION: 52.8% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

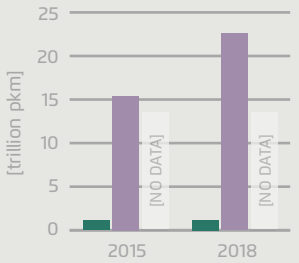
**205.1 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2019)



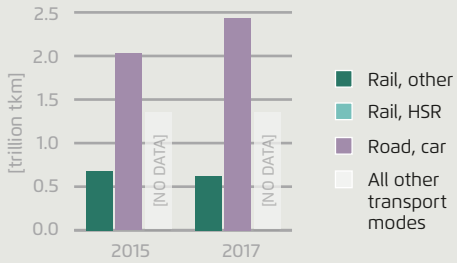

Source: ATO

**23,759.9 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2018)



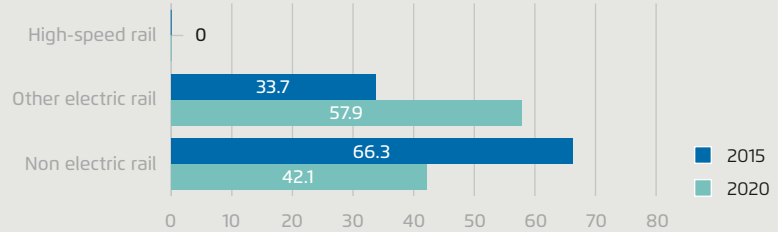

Source: ATO
* does not include all transport modes

**3,062.8 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2017)




Source: World Development Indicators, ITF / OECD
** does not include all transport modes

## Rail infrastructure




Source: ITF / OECD

Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

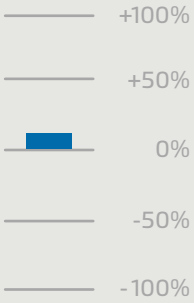
India's total $CO_2$ emissions from fuel combustion grew by 330% between 1990 and 2019. Transport-sector emissions grew 375% over the same period and represent an uncharacteristically low share – 14%. Among other reasons, the low share is due to the high carbon intensity of India's power generation. With 1.6 t $CO_2$ for total emissions and 0.2 t $CO_2$ for the transport sector, India's per capita emissions are the lowest in the G20. Nevertheless, transport-sector emissions could increase 65% by 2030 and 197% by 2050, relative to 2020 levels. Road transport is the main contributor to sector emissions, followed by rail transport. The nearly 7% of sector emissions from rail is one of the highest shares in the G20.

**2,277.63 Mt $CO_2$**

TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**11.9%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)

**1.65**

**8.4**
G20 AVERAGE

**5.0**
WORLD AVERAGE

**6.78%**
SHARE IN GLOBAL EMISSIONS (2019)

t $CO_2$ per capita

Sources: IEA, SLOCAT, UNDESA

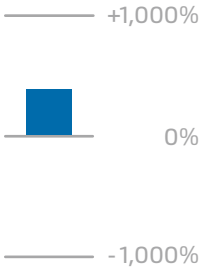
# TRANSPORT SECTOR EMISSIONS

**325.38 Mt $CO_2$**

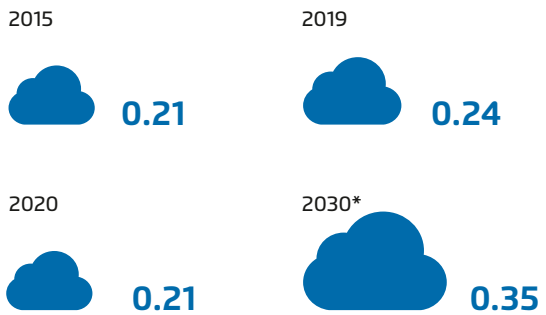
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**374.5%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

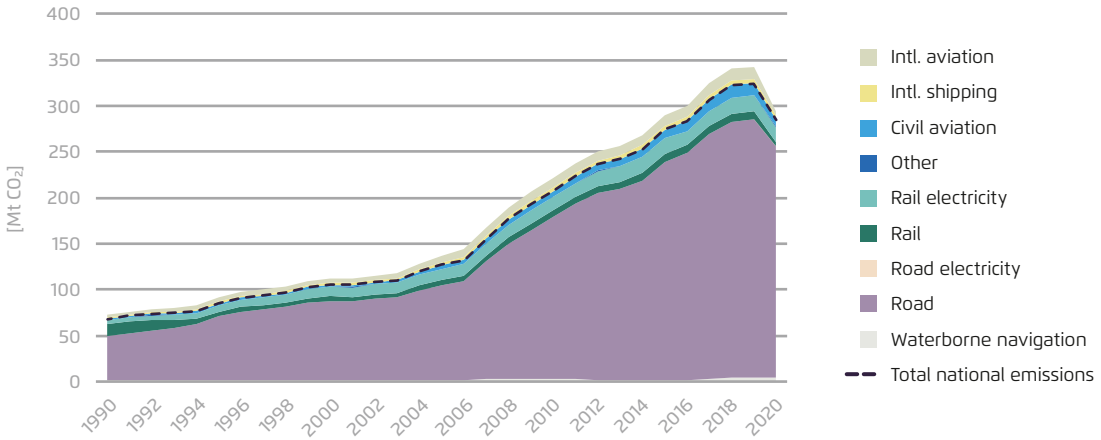
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

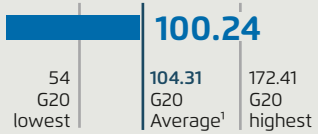
## Transport sector emissions by subsector




Source: IEA

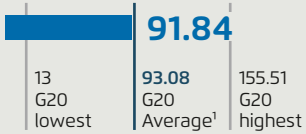
# ENERGY

GASOLINE PRICE (2020)
US cents/litre



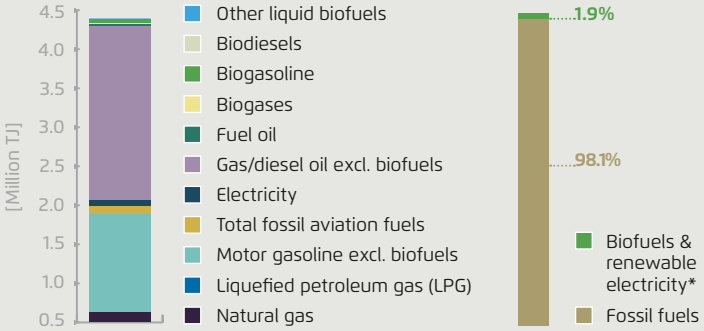

Source: Globalpetrolprices.com*

DIESEL PRICE (2020)
US cents/litre



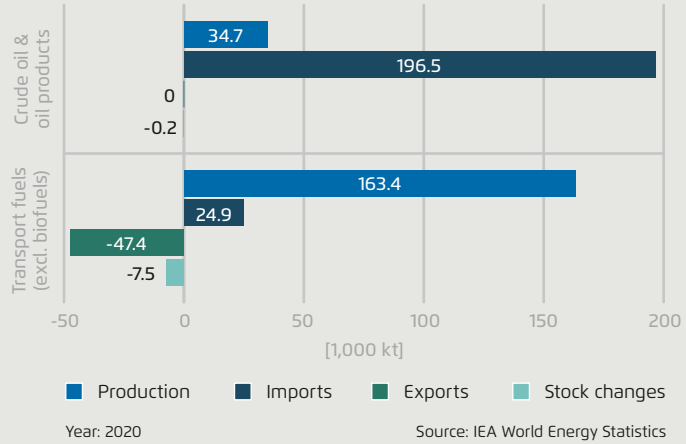

* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

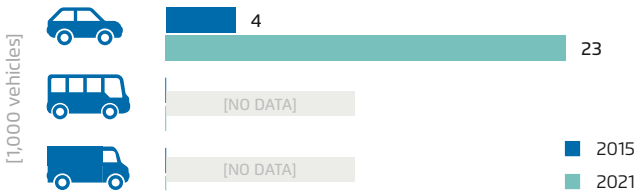
**23,091 vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**0.06%**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**0.38%**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

*incomplete data. Under FAME II about 200,000 electric 2&3 wheelers supported.

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)




**+424.8%**
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)



**910***
SLOW CHARGE

**28,789***
SLOW CHARGE G20 AVERAGE

**32***
FAST CHARGE

**43,927***
FAST CHARGE G20 AVERAGE

Source: IEA, 2021 *number of units

**Battery reuse and recycling**

- In 2020, draft regulations were published under the title 'Battery Waste Management Rules'. They aim to ensure accountability and include targets for more producer responsibility.
- A proposed 'Battery Swapping Policy' would lay the groundwork for unique battery codes, but only for the advanced chemistry batteries falling under the policy. It would also mandate the development of a re-use and recycling ecosystem.

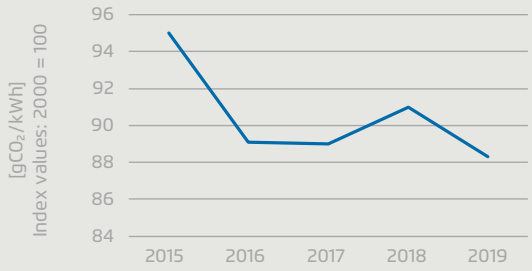
Source: UN PAGE, Niti Aayog

# LINKAGES TO THE ENERGY SECTOR

Coal is still the dominant fuel source for power generation in India, accounting for around 75% of total generation. A wide range of mechanisms support renewable energy in India. Renewable Purchase Obligations (RPO) for distributors mandate minimum quantities of renewables.

Since 2010, reverse auctions have been used to procure solar PV and solar thermal capacity; since 2017, these auctions have also been used for wind energy. Additional programmes support rooftop solar solutions and solar agricultural pumps through grant schemes. The solar cities programme aims to convert one city per state to run completely on solar power.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 50% share of renewables by 2030

Source: REN21, NDC

## The role of hydrogen

- India launched a National Hydrogen Mission in August 2021.
- Its target is to have 30 GW of electrolysis capacity by 2030 with related renewable power generation capacity, producing 5 million tonnes of green hydrogen per year.

Source: Ministry of New & Renewable Energy India, Ministry of Power India

# AMBITION

## NDCs and national climate targets

**General NDC targets**
- Committed to reducing the emissions intensity of GDP by 45% in 2030 relative to 2005 levels
- Economy-wide net-zero target by 2070

**Transport related NDC targets**
- Increase the share of railways from 36% to 45%
- Signed COP26 ZEV declaration for new car and van
- sales by 2040 (this also includes 2/3 wheelers)

**Transport related NDC measures**
- Promotion of hybrid and electric vehicles
- National policy on biofuels
- Passenger car fuel-efficiency standards
- Promote coastal and inland waterway shipping
- Construction of metro lines, urban transport, and Mass rapid transport projects

**Future targets at national level**
- 45% mode share for rail freight until 2030
- Double the share of freight transported by coastal shipping and inland waterways
- 7,987 km of high-speed rail (in stages up to 2051)

**National EV deployment targets**
- 30% share of EVs in passenger LDV sales by 2030
- 2,877 charging points in 25 states and 1,576 charging points across 9 expressways and 16 highways

# TRADE-OFFS

## Sustainability of biofuels

Biofuels are to be derived only from non-feed stock that is grown on degraded soils or wastelands not otherwise suited for agriculture, so as to avoid a possible conflict between fuel and food security. No biofuels may be produced from sugarcane or sugarcane juice.

## Subsidies

**586.597 billion INR**

**~7,039 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

India experienced a 6.6% contraction of its economy in 2020. Growth resumed in 2021 at a rate 140% higher than seen before the pandemic. During lockdowns all public transport came to a halt and after lockdowns were lifted public transport ridership fell by as high as 90%. The effects of lockdowns have also severely affected the constuction of public transport infrastructure, delaying many projects. However, emissions declined only by 9% in 2020, whereas they increased by 3% in 2019.

Source: IMF 2022, UITP 2020

# IMPLEMENTATION

## Mobility

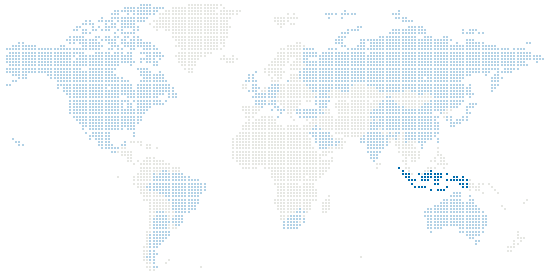
| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • Expansion of mass-transit and urban transport projects (incl. metro) under the National Urban Renewal Mission<br>• Upgrade of rail track quality to enhance speed and capacity<br>• Improved attractiveness through cleaner trains<br>• First high-speed rail line under construction; others planned for the long term |
| ✔ **Measures to support low-carbon freight logistics** | • Upgrade of rail track quality to enhance speed and capacity<br>• Establishment of the Dedicated Freight Corridor Corporation of India Limited (DFCCIL) to establish dedicated rail freight corridors<br>• Licensing relaxation for coastal shipping trade (Cabotage)<br>• Discounts on port charges to vessels carrying costal cargo<br>• Port improvement projects<br>• Logistics Efficiency Enhancement Programme (LEEP)<br>• Programme to develop multi-modal logistics parks<br>• Restrictions for road use and access to urban areas for trucks |
| **National-level measures to support new mobility services** | No measures at national level |
| ✔ **National measures to support non-motorised transport** | National Bicycle Sharing Scheme incl. various guidelines and toolkits |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for light duty vehicles (LDV)** | $CO_2$ efficiency standards for 2022:<br>• Passenger cars: 113 g/km<br>• Light commercial vehicles since 2019 |
| ✔ **Energy/carbon emission standards for heavy duty vehicles (HDV)** | • Fuel efficiency standards for HDV >12t since 1 April 2018<br>• Starting in 2021, on average 10.4% increase in efficiency required |
| **Pricing instruments** | No $CO_2$ or energy consumption-based taxes |
| ✔ **Mandatory vehicle labelling** | BEE Fuel Savings Guide label |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • FAME programme (includes several components, such as demand incentives and pilot projects); phase 2 was extended to 31 March 2024 with increased subsidy rates<br>• Reduced VAT rate for EVs (5% instead of 28%)<br>• Demand aggregation through a state-owned service company, aiming to procure 300,000 electric three-wheelers and at least 5,500 electric buses<br>• Subsidies for charging infrastructure through the FAME programme<br>• Guidelines for charging infrastructure<br>• Policy on battery swapping currently under consultation<br>• Exemption from permits for carrying passengers or goods via electric vehicles |

Source: Indian national sources

# INDONESIA



**2.49%**
SHARE IN GLOBAL GDP (2020)

**3.67%**
TRANSPORT SECTOR SHARE GDP (2020)

**4.21%**
EMPLOYMENT IN TRANSPORT (2019)

Source: World Development Indicators, Statistics Indonesia

Indonesia, an archipelago with more than 17,000 islands, relies heavily on inter-island transport links. While the larger islands of Java, Sumatra, and Sulawesi have extensive road-dominated transport systems, many of the smaller, less developed islands rely on incomplete, fragmented, and poorly maintained road networks for internal travel and underdeveloped infrastructure for inter-island shipping. Java and Sumatra both have rail networks, but they offer limited freight transport. The air sector is evolving rapidly, driven by discount airlines.

Indonesia does not have $CO_2$ targets for the transport sector, but some targets for mode share, rail infrastructure, and biofuel share exist. Additionally, Indonesia aims to develop an electric automotive industry and has set EV production and EV stock targets for 2030. In October 2021, a carbon tax was approved, but implementation has been postponed twice so far. Measures implemented to date concentrate on the expansion of rail infrastructure and some incentives for electric vehicles and biofuels.

## NDC

- UNCONDITIONAL EMISSION REDUCTION TARGET: 31.89%
- 29% UNCONDITIONAL, 41% CONDITIONAL REDUCTION IN GHG EMISSIONS IN 2030 COMPARED WITH BAU
- NET-ZERO BY 2060 OR SOONER

## EV TARGETS

- 600,000 CARS
- 2.45 MILLION TWO/THREE WHEELER EVs BY 2030

## POPULATION

**274 million people**
CURRENT POPULATION (2020)

**3.5%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 16.7% (2020–2050)

**145.68 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**29.6 years**
AVERAGE AGE (2022)


Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**56.6% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

**155 million people**
TOTAL URBAN POPULATION (2020)

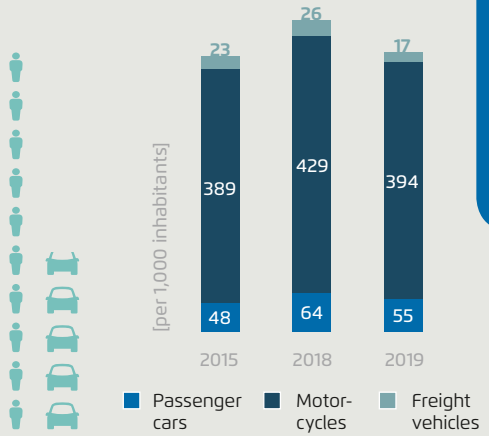
EXPECTED SHARE OF URBAN POPULATION: 72.8% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

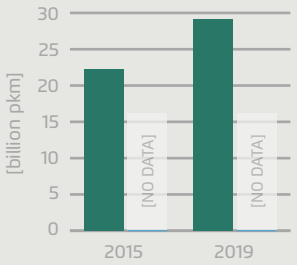
**485 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)

= 100 inhabitants
= 100 motor vehicles



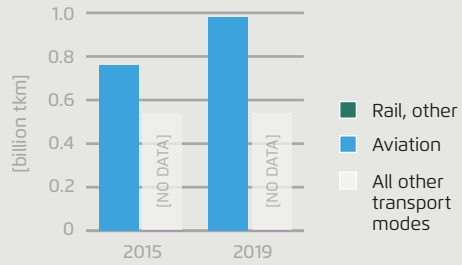

Source: ATO

**29.2 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)



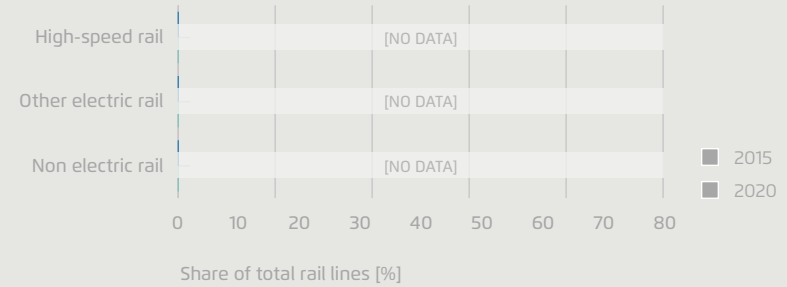

Source: World Development Indicators, ATO, ITF / OECD
* does not include all transport modes

**0.98 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: World Development Indicators, ITF / OECD, AJTP
** does not include all transport modes

### Rail infrastructure





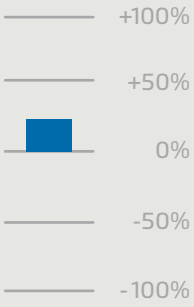

Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

Indonesia's total $CO_2$ emissions from fuel combustion grew by 336% between 1990 and 2019. Transport-sector emissions grew 365% over the same period, but dropped by over 15% in 2020. Per capita emissions, both total and in the transport sector, are among the lowest within the G20. Given current trends, transport sector emissions are projected to decrease by 22% by 2030 and 71% by 2050, relative to 2020 levels. Due to the geography of Indonesia, rail plays a very limited role. Road transport dominates sector emissions, although navigation and air transport do play an important role in connecting the country's islands.

**571.11 Mt $CO_2$**

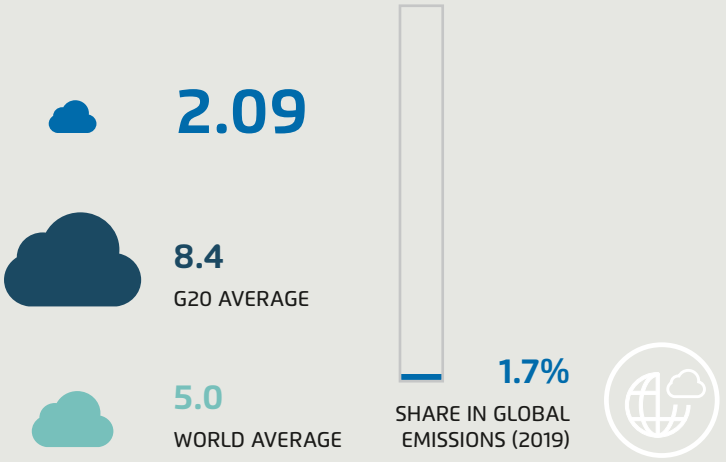
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)




**24.5%**

CHANGE IN TOTAL EMISSIONS (2015–2019)

TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)



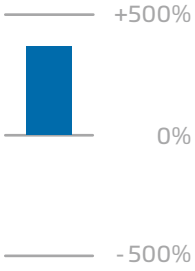

t $CO_2$ per capita

Sources: IEA

# TRANSPORT SECTOR EMISSIONS

**149.67 Mt $CO_2$**

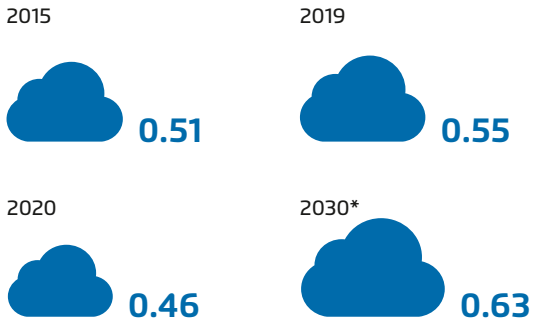
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)




**364.8%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)

TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

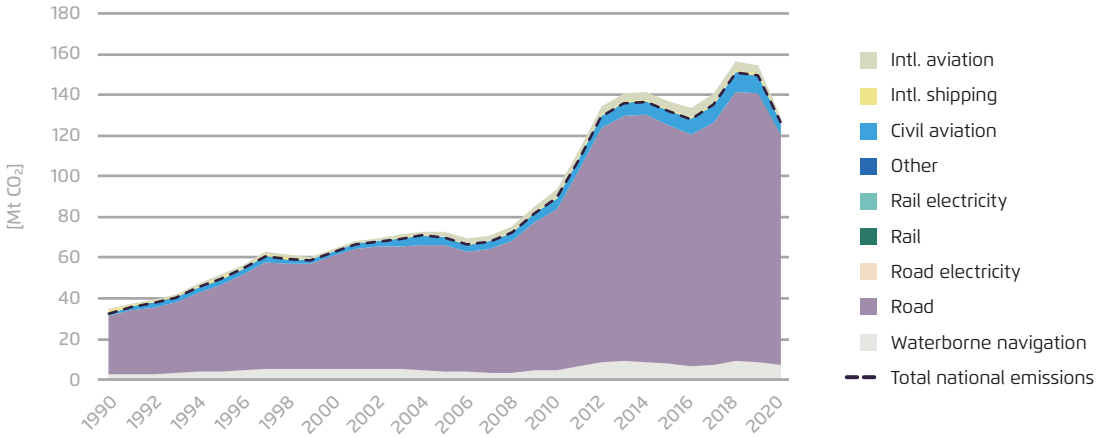
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

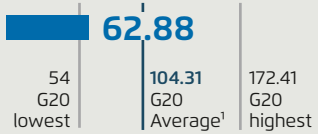
## Transport sector emissions by subsector



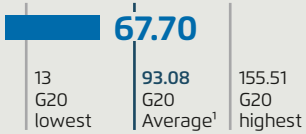

Source: IEA

# ENERGY

GASOLINE PRICE (2020)
US cents/litre



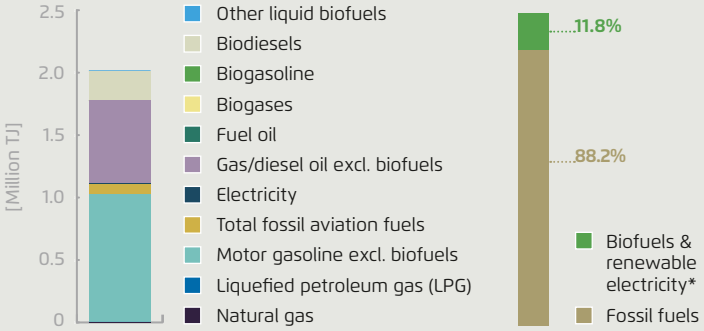

DIESEL PRICE (2020)
US cents/litre




Source: Globalpetrolprices.com*

* local currency prices converted using OECD annual exchange rates

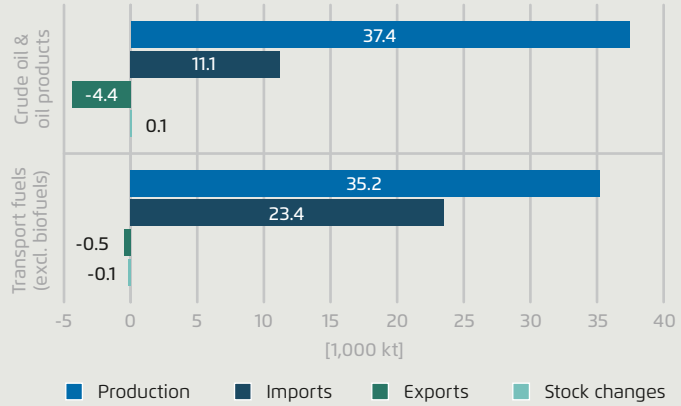
## Energy use in transport by fuel




*electricity split calculated based on share of renewables

Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**1,900 vehicles**

TOTAL STOCK OF ELECTRIC CARS (2021)

[NO DATA]

SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

[NO DATA]

MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)


[NO DATA]

TOTAL FLEET GROWTH (2015–2021)

Source: AHK IDN

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**54***
SLOW CHARGE

**28,789***
SLOW CHARGE
G20 AVERAGE

**130***
FAST CHARGE

**43,927***
FAST CHARGE
G20 AVERAGE

Source: IEA EV Data Explorer *number of units

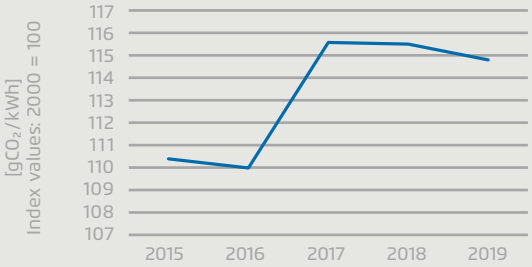
**Battery reuse and recycling**

- Indonesia's Battery Industrial Strategy, adopted in 2019, envisages a local production of 140 GWh of batteries by 2030, and specifies that batteries must be recycled by licensed companies.
- The strategy also enables the national government and regional administrations to provide fiscal and non-fiscal incentives for battery recycling.

# LINKAGES TO THE ENERGY SECTOR

Coal is the dominant fuel source for power generation in Indonesia, accounting for over 60% of total generation, and the share is increasing. Indonesia is using a feed-in tariff regime to support renewable energy. The regulation covers all renewable energy types and sets a price based on negotiations between independent power producers and the national electricity company PLN. Although PPAs were signed, installations remain limited. A draft bill aimed at promoting renewables is currently under discussion. In addition to incentives for hydro, wind, solar, and geothermal, it would also provide incentives for 'new energy', including coal bed methane, coal liquefaction, and coal gasification.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 2025: 23%
- 2030: 48%
- 12.6 GW geothermal by 2025
- 2 GW hydro by 2025
- 100 MW wind by 2025

Source: REN21

## The role of hydrogen

- A hydrogen roadmap by the Ministry of Energy is in preparation.
- It targets green hydrogen as an alternative energy for the transportation, industrial, and household sectors in the future.

Source: Green Hydrogen Organisation

# AMBITION

## NDCs and national climate targets

**General NDC targets**
- 29% unconditional, 41% conditional reduction in GHG emissions in 2030 compared with BAU
- unconditional emission reduction target: 31.89%
- net zero by 2060 or sooner

**Future targets at national level**
- 7–9% mode share by rail for passengers by 2030
- 11–13% mode share by rail for freight by 2030
- 712 km of high-speed rail
- 14% biofuel share in transport energy demand by 2025

**National EV deployment targets**
Vehicle stock targets:
- 2 million passenger EVs by 2030
- 13 million electric motorcycles by 2030

Production targets:
- LCEVs: 20% of annual vehicle production by 2025 and 30% in 2035
- Electric two-wheelers: 7,700,000 units in 2025
- Charging infrastructure:
- 30,000 charging stations by 2030
- 67,000 battery swapping stations by 2030

**National ICE phase-out commitments**
Only sell electric motorcycles by 2040 and only sell electric cars by 2050

**Annual EV production targets for 2030**
600,000 four-wheeled and 2.45 million two/three wheeled EVs

# TRADE-OFFS

## Sustainability of biofuels

Indonesia has no specific regulations for biofuel sustainability. However, there are several certification schemes available for biodiesel feedstocks and palm plantations. A presidential regulation mandates that all companies and smallholder growers adopt ISPO (Indonesia Sustainable Palm Oil) certification by 2025.

## Subsidies

**109,278.6 billion IDR**

**~6.557 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

Indonesia experienced a 2.1% contraction of its economy in 2020. Growth resumed in 2021, but did not return to pre-pandemic levels. In Jakarta, more people took up cycling during the pandemic. However, it is unclear if this trend will continue in the absence of secure bike lanes. Overall, transport sector emissions declined by 26% in 2020, the highest value in the G20.

Source: IMF 2022, CNA 2020

# IMPLEMENTATION

## Mobility

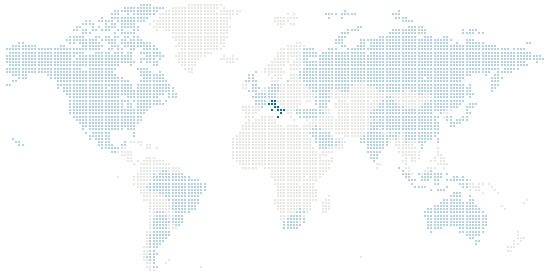
| | | |
|---|---|---|
| ✔ | **National programmes to support shift to public transport** | • Construction of railways<br>• Enhancement of mass road transport<br>• Investment in long-distance ferry services |
| | **Measures to support low-carbon freight logistics** | No measures at national level |
| | **National-level measures to support new mobility services** | No measures at national level |
| ✔ | **National measures to support non-motorised transport** | National non-motorised transport vision and guidelines for city governments |

## Energy

| | | |
|---|---|---|
| | **Energy/carbon emission standards for light duty vehicles (LDV)** | No standard |
| | **Energy/carbon emission standards for heavy duty vehicles (HDV)** | No standard |
| ✔ | **Pricing instruments** | • $CO_2$-based taxes on luxury vehicles<br>• In October 2021 a carbon tax was approved and set to start in April 2022, but was delayed due to the economic impact of high energy prices |
| | **Mandatory vehicle labelling** | No mandatory labelling |
| ✔ | **Support mechanism for electric vehicles & charging infrastructure** | • Reduced luxury tax (applicable at sale) for hybrid vehicles; full waiver of luxury tax for BEVS, PHEVS and FCEVS<br>• Export restrictions and domestic production requirements |

Source: Indonesian national services

# ITALY



**1.85%**
SHARE IN GLOBAL GDP (2020)

**5.03%**
TRANSPORT SECTOR SHARE GDP (2020)

**4.91%**
EMPLOYMENT IN TRANSPORT (2019)

Source: World Development Indicators, I.Stat

Italy's population is distributed fairly evenly throughout the country, with some coastal and urban high-density areas. The country has well-developed road and railway systems. Both transport demand and the importance of road transport have increased since 1990. After peaking in 2007, transport sector emissions have been on the decline, falling more than 22% between 2007 and 2019 mainly due to the economic crisis in combination with a greater penetration of energy-efficient vehicles. Atypically for Europe, Italy has a very large fleet of motorbikes and mopeds (117 vehicles per 1000 inhabitants in 2020).

Italy does not have specific transport-related carbon emission targets, but it has goals for electric vehicles and related infrastructure. It has implemented all EU directives at the national level, but has limited additional measures to supporting modal shifts and vehicle efficiency.

## NDC

- ACHIEVE AT LEAST A 55% REDUCTION IN GHG EMISSIONS IN 2030 RELATIVE TO 1990
- MEET ECONOMY-WIDE NET-ZERO TARGET BY 2050

## EV TARGETS

ELECTRIC VEHICLE FLEET NUMBERING 6 MILLION BY 2030

## POPULATION

**60 million people**
CURRENT POPULATION (2020)

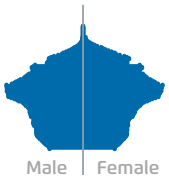
**0.8%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: -12.2% (2020–2050)

**200.03 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**47.3 years**
AVERAGE AGE (2022)




Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**71.0% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

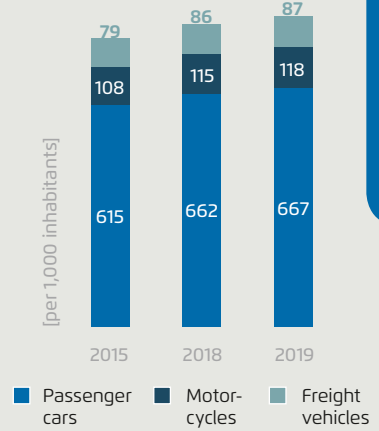
**42.2 million people**
TOTAL URBAN POPULATION (2020)

EXPECTED SHARE OF URBAN POPULATION: 81.1% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

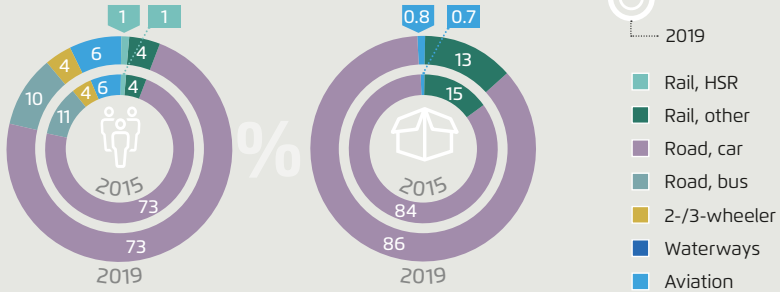
**871.7 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)


Source: ITF / OECD

**1,005.4 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

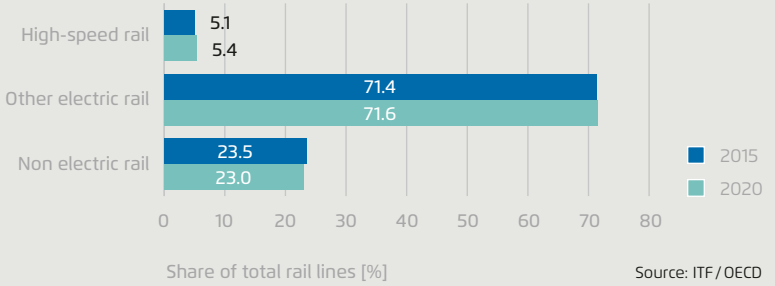
**160.7 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: ITF / OECD, Eurostat, Statista
* does not include all transport modes

Source: World Development Indicators, ITF / OECD, Eurostat
** does not include all transport modes

## Rail infrastructure




Source: ITF / OECD



Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

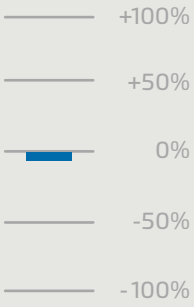
Italy's total $CO_2$ emissions from fuel combustion decreased by 21% between 1990 and 2019 and per capita emissions are just above the world average. Transport emissions have increased by 4% over the same period. After peaking in 2007, they decreased until 2013, increased in 2014 and have been declining since, with a 20% drop in 2020 due to the pandemic. At 34%, the share of transport sector emissions is above the world and G20 averages. Under a business-as-usual scenario, sector emissions are projected to decrease by 4% up to 2030 and then remain relatively stable until 2050. At 2.1%, waterborne navigation has the third-highest share in total transport emissions within the G20 countries.

**309.31 Mt $CO_2$**

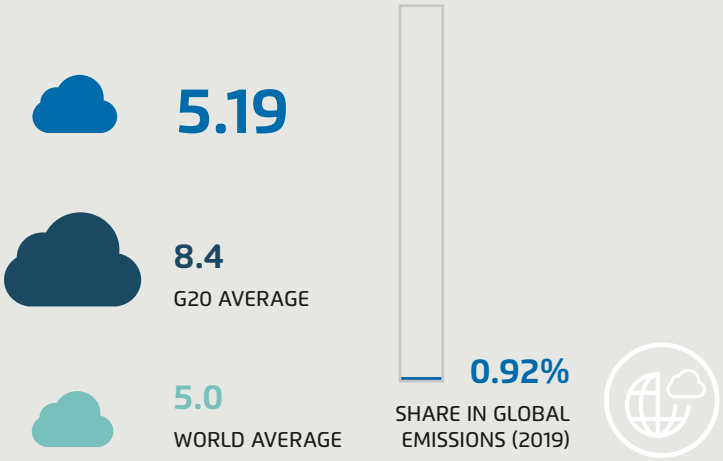
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**-6.2%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

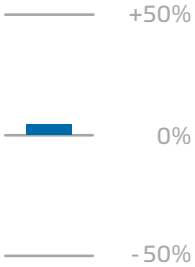
# TRANSPORT SECTOR EMISSIONS

**104.10 Mt $CO_2$**

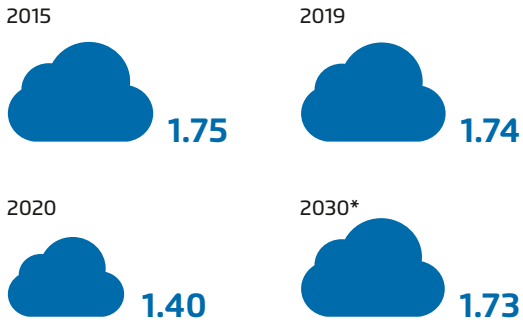
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**4.2%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

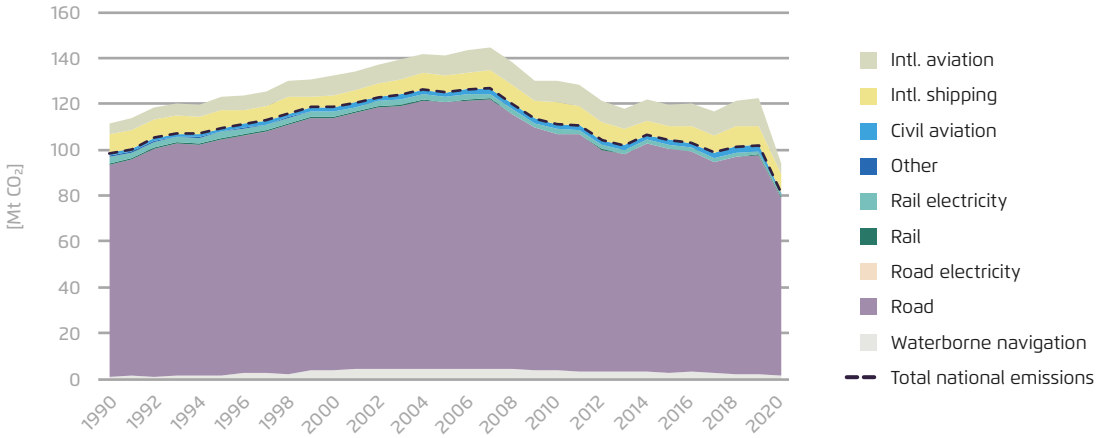
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

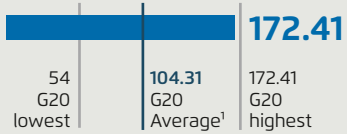
## Transport sector emissions by subsector




Source: IEA

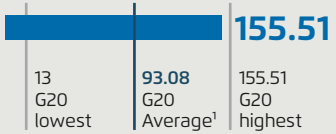
# ENERGY

GASOLINE PRICE (2020)
US cents/litre



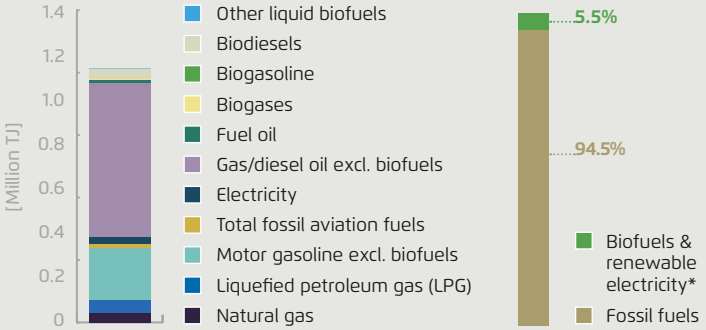

Source: Globalpetrolprices.com*

DIESEL PRICE (2020)
US cents/litre



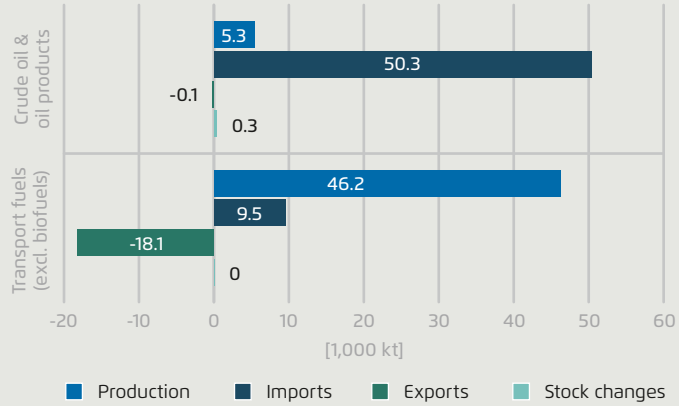

* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**240.607 vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**0.62%**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**9.5%**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)


**+2,983%**
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**20,000***
SLOW CHARGE

**2,200***
FAST CHARGE

**28,789***
SLOW CHARGE G20 AVERAGE

**43,927***
FAST CHARGE G20 AVERAGE

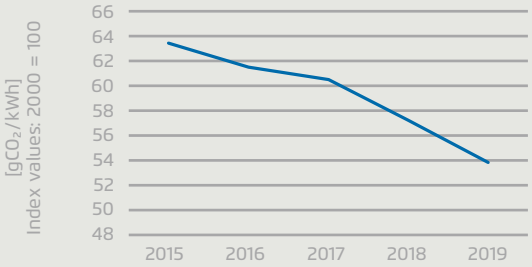
Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**
Battery use and recycling in Italy are governed by the EU Battery regulation.

# LINKAGES TO THE ENERGY SECTOR

Non-renewable electricity in Italy is mainly generated using natural gas, with a small share coming from coal and oil. Electricity from renewable sources is mostly promoted through a combination of premium tariffs, feed-in tariffs, and tender schemes. Tax regulation mechanisms are also in place for investment in RES-E plants. Interested parties can make use of net metering.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 55% by 2030

Source: REN21

## The role of hydrogen

- Italy's hydrogen strategy includes preliminary guidelines.
- Italy targets of 2% hydrogen by 2030 and 20% by 2050 in its national energy consumption.
- Its goal is to install up to 5 GW of green generation capacity by 2030.
- The initial priorities for hydrogen use are public transport, especially long-distance, freight, and non-electrified rail.

Source: Watson Farley & Williams (2021)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
Committed to at least a 55% reduction in GHG emissions in 2030 relative to 1990 levels

**Transport related NDC targets**
See the EU's: $CO_2$ emission targets for road transport (see emission standards)

**Transport related NDC measures**
Inclusion of aviation in the EU ETS

**National EV deployment targets**
- Increase of electric vehicle fleet to 6 million by 2030
- 21,400 fast- and ultra-fast-charging stations by the end of 2025
- Mandatory public purchase of 30% share of alternative fuel vehicles by 2022, 50% by 2025, and 85% by 2030 across all modes (proposed

# TRADE-OFFS

## Sustainability of biofuels

The EU's 2021 Renewable Energy Directive II (REDII) caps the use of 'high-risk indirect land use change (ILUC) biofuels' at 2019 levels until 2023 and requires a phase-out of these by 2030. REDII also sets a GHG emission savings threshold for biofuels to count towards the target of 65% for transport biofuels starting in 2021.

## Subsidies

**5.5 billion EUR**

**~5.391 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

Italy experienced an 9% contraction of its economy in 2020, the third largest within the analysed countries. Growth resumed in 2021 at 6.6%, substantially higher than the 0.5% growth seen before the pandemic. Emissions from Italy's transport sector decreased by 16% in 2020. Data indicates that there was a shift from public transport to driving, though walking levels remained high throughout the first quarter of 2022, almost doubling from those of pre-pandemic levels.

Source: IMF 2022, Google community mobility reports, Apple

# IMPLEMENTATION

## Mobility

| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • Programme for the rejuvenation of public transport<br>• Expansion of rail infrastructure<br>• National guidelines for the development of sustainable urban mobility plans (SUMPs) |
| **Measures to support low-carbon freight logistics** | • No specific measures |
| **National-level measures to support new mobility services** | • No measures at national level |
| ✔ **National measures to support non-motorised transport** | • First national cycling strategy under development<br>• Fund for the extension of cycling infrastructure<br>• The 2019 programme Experimental Good Mobility provides subsidies for electric cargo bikes and collective cargo bike use |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for light duty vehicles (LDV)** | **Current EU $CO_2$ efficiency standards:**<br>• Passenger cars: 95 g/km (2021)<br>• Light commercial: 147 g/km (2020)<br>**Future standards (2030):**<br>• Passenger cars: 59 g/km<br>• Light commercial: 101 g/km |
| ✔ **Energy/carbon emission standards for heavy duty vehicles (HDV)** | **Targets for average $CO_2$ emissions from new heavy-duty vehicles:**<br>• In 2025, 15% lower than in 2019<br>• In 2030, at least 30% lower than in 2019 |
| ✔ **Pricing instruments** | • Malus system with extra purchase taxes for vehicles with high $CO_2$ emissions<br>• Inclusion of domestic aviation in EU-ETS, inclusion of maritime proposed for 2023<br>• Participation in first phase of CORSIA |
| ✔ **Mandatory vehicle labelling** | • National implementation of the EU Car Labelling Directive 1999/94/EC |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • Purchase subsidies for EVs extended to 2026, incl. vans and trucks up to 12t<br>• Conversion premium for scrapping high-emission ICE in combination with EV purchase<br>• Subsidies for the conversion of vehicles to electric or hybrid, incl. buses and goods vehicles<br>• Fund for the exchange of 3,000 diesel buses with EVs<br>• Public administration required to purchase at least 50% EVs<br>• Change in public procurement regulation requiring the consideration of effects on energy use and the environment<br>• Regulation prohibiting the purchase of inefficient buses<br>• Investment in charging infrastructure |

Source: Italian national sources

# JAPAN

**4.03%**
SHARE IN GLOBAL GDP (2020)

**6.81%**
TRANSPORT SECTOR SHARE GDP (2020)

**7.31%**
EMPLOYMENT IN TRANSPORT (2019)

Source: World Development Indicators, Statistics Bureau of Japan

Japan is composed of four main islands and 6,848 smaller islands. Despite its comparatively small size, the country has the eleventh-largest railway network and the sixth-largest road network globally. Since the mid-1990s, passenger transport volumes and modal shares have remained almost constant. Motorisation rates continue to grow, but at a slow pace. Air traffic accounts for a small share. The growth in rail-based rail freight traffic has barely increased and is relatively small, while the share of rail passenger transport remains high.

Japan defines the contribution of each sector in its NDC and has targeted GHG reductions in transport of 35% below 2013 levels by 2030. Economy-wide, the country plans to be carbon neutral by 2050. Japan aims to have all LDVs sold be electric by 2035, with a range of intermediate targets for 2030. The country also has plans to improve the fuel efficiency of trucks, increase the share of bicycles in commuting and further expand the high-speed rail system.

## NDC

- ACHIEVE A 46% REDUCTION IN GHG EMISSIONS IN 2030 RELATIVE TO 2013
- ACHIEVE ECONOMY-WIDE NET-ZERO TARGET BY 2050

## EV TARGETS

- 20–30% SHARE OF BEVS AND PHEVS, 30–40% SHARE OF HEVS, AND A 3% SHARE OF FCEVS IN PASSENGER LDV SALES BY 2030
- EV RANGE TARGET OF 1000 KM BY 2030

## POPULATION

**126 million people**
CURRENT POPULATION (2020)

**1.6%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: -17.1% (2020–2050)

**345.23 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**48.7 years**
AVERAGE AGE (2022)


Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**91.8% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

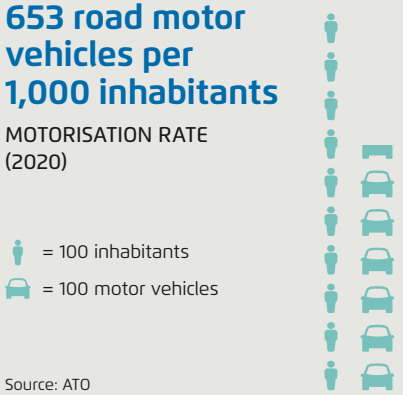
**115.9 million people**
TOTAL URBAN POPULATION (2020)

EXPECTED SHARE OF URBAN POPULATION: 94.7% (2050)

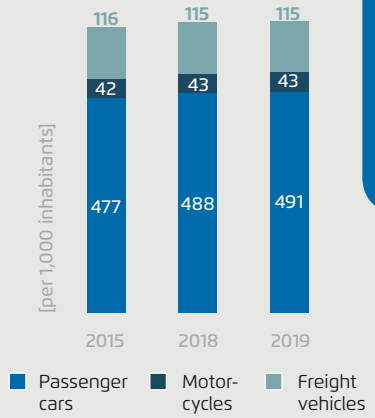
Source: World Urbanisation Prospects 2018

## MOBILITY

**653 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)

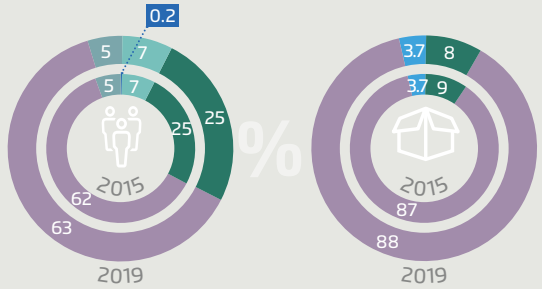



Source: ATO




**1,344.8 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

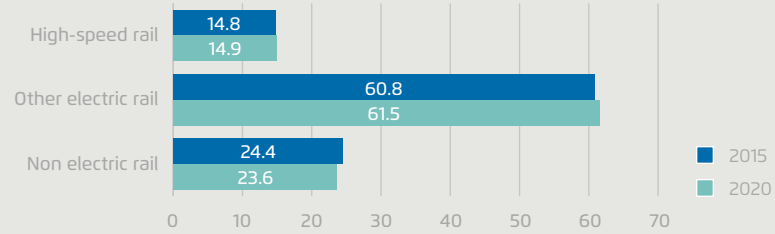
**242.8 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: World Development Indicators, ATO, ITF / OECD
* does not include all transport modes

Source: World Development Indicators, ITF / OECD,
** does not include all transport modes

### Rail infrastructure




Source: ITF / OECD

Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

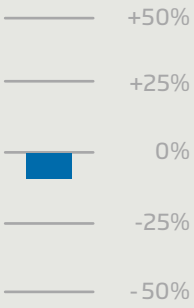
Japan's total $CO_2$ emissions from fuel combustion decreased by 0.3% between 1990 and 2019, with transport sector emissions decreasing by 5% over the same period. After peaking around 2000, emissions in the transport sector have decreased fairly constantly, supported by a variety of measures to enhance vehicle efficiency, though they dropped by 10% in 2020 due to the pandemic. Under a business-as-usual scenario, sector emissions are projected to decrease by 13% by 2030 and 30% by 2050 relative to 2020 levels. At 5.1%, waterborne navigation has the highest share in the G20.

**1,048.32 Mt $CO_2$**

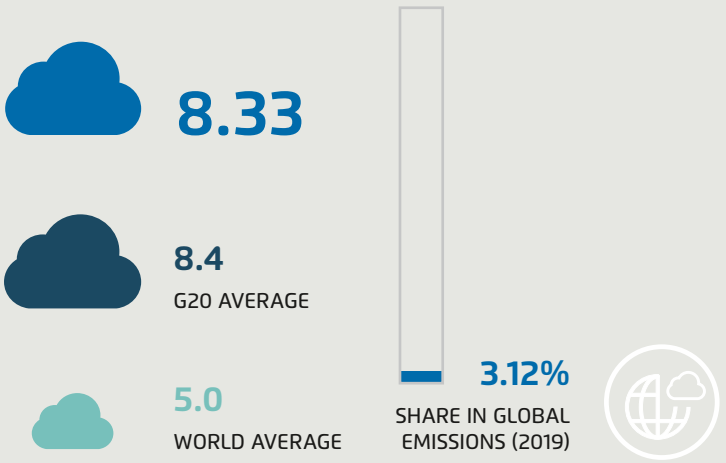
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**-9%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

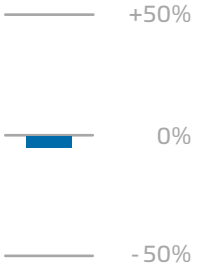
# TRANSPORT SECTOR EMISSIONS

**209.63 Mt $CO_2$**

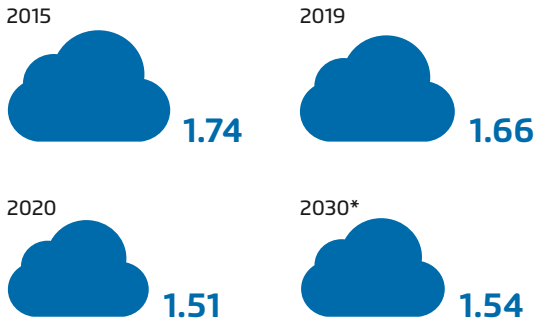
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**-4.9%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

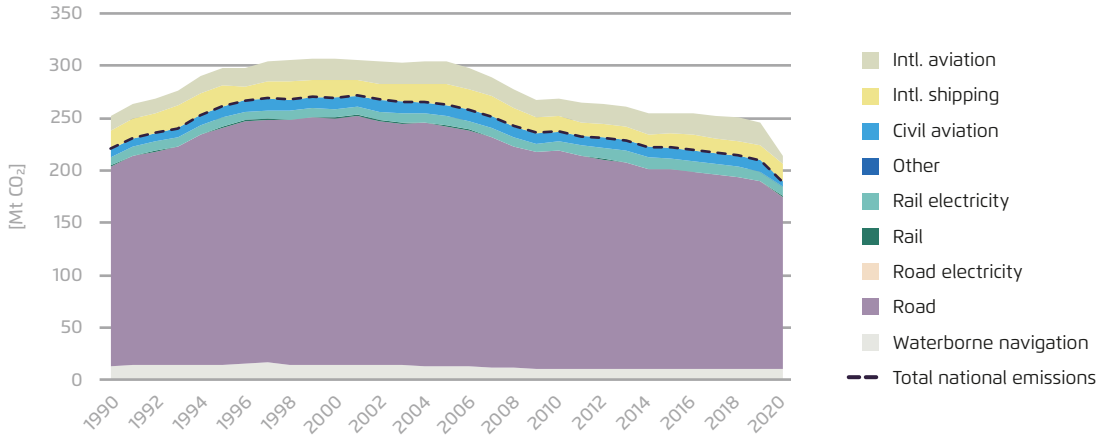
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

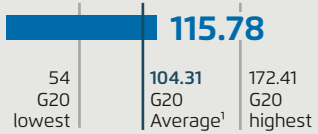
## Transport sector emissions by subsector



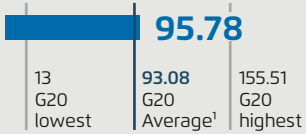

Source: IEA

# ENERGY

GASOLINE PRICE (2020)
US cents/litre



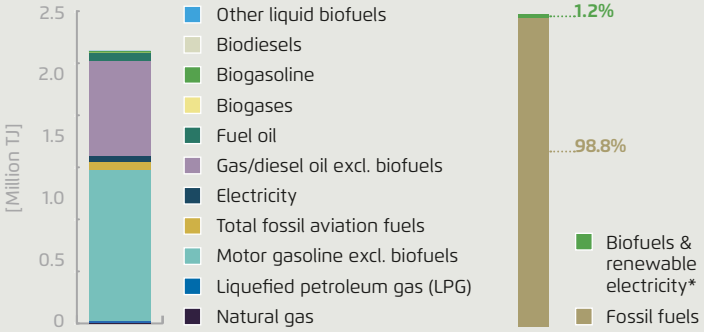

DIESEL PRICE (2020)
US cents/litre




Source: Globalpetrolprices.com*

* local currency prices converted using OECD annual exchange rates

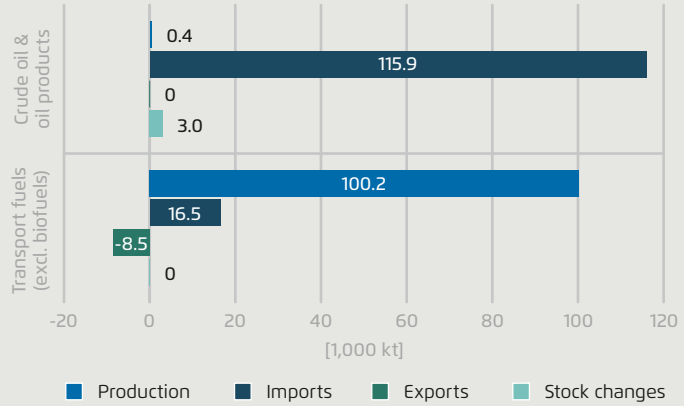
## Energy use in transport by fuel




*electricity split calculated based on share of renewables

Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**357,657 vehicles**

TOTAL STOCK OF ELECTRIC CARS (2021)

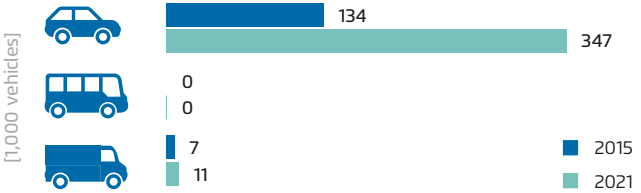
**0.53%**

SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**1.0%**

MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)




**+153.1%**

TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**21,000***

SLOW CHARGE

**28,789***

SLOW CHARGE G20 AVERAGE

**8,000***

FAST CHARGE

**43,927***

FAST CHARGE G20 AVERAGE

Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**

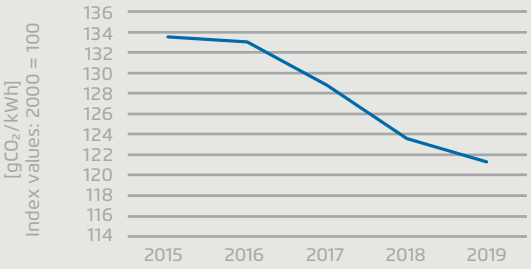
- All manufacturers and importers of rechargeable batteries and equipment containing rechargeable batteries are required to implement a system to recover them.
- A nonprofit organization (JBRC – Japan Portable Battery Recycling Center) manages the collection of batteries, including from hybrid vehicles, which are purchased for recycling.

Source: ACS Energy Letters (2022); ABRI (2014)

# LINKAGES TO THE ENERGY SECTOR

Non-renewable electricity in Japan is mostly generated using natural gas (38%), coal (3%), and oil (5%). Nuclear power generation has resumed after the shutdown of plants following Fukushima, but it is still below 4%. Japan has operated a feed-in tariff (FIT) since 2012 that varies by technology. Guaranteed price levels have decreased over time. In April 2017 Japan introduced a reverse auction system and by late 2020 had conducted five PV and two biomass auctions. The size of solar PV systems eligible for the FIT decreased continuously between 2017 and 2020. By 2020, only projects under 250 kW were still eligible. Offshore wind auctions are planned.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 36–38% by 2030
- 1.5 GW ocean power by 2030

Source: REN21

## The role of hydrogen

- Japan adopted its Basic hydrogen Strategy in 2017.
- Japan's goal is to produce 3 million tonnes of hydrogen by 2030 and 20 million tonnes by 2050.
- There are also targets of 200,000 FCVs by 2025 and 800,000 by 2030, along with 320 fueling stations by 2025 and 900 by 2030.

Source: IEA (2019); Energytracker (2022); CSIS (2021)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
46% reduction in GHG emissions by 2030 relative to 2013 levels

**Transport related NDC targets**
Transport sector emissions 35% below 2013 levels (146 Mt $CO_2$) by 2030

**Future targets at national level**
- 420 km of high-speed rail by 2027 and an additional 540 km by 2046
- Enhance the fuel efficiency by approximately 13.4% for trucks and other heavy vehicles and by approximately 14.3% for buses by 2025 based on the fuel-efficiency standards from 2015
- Increase the use of bicycles in commuting to 18.2% by 2025 versus 15.2% in 2015

**National EV deployment targets**
- 20–30% share of BEVs and PHEVs, 30–40% share of HEVs, and 3% share of FCEVs in passenger LDV sales by 2030
- EV range target of 1000 km by 2030
- 150,000 EV charging points (including 30,000 fast chargers) and 1,000 hydrogen refuelling stations by 2030

**National ICE phase-out commitments**
100% electrified vehicles in passenger LDV sales by 2035

# TRADE-OFFS

## Sustainability of biofuels

The GOJ established an environmental sustainability standard for biofuels in 2010 that required that bioethanol not compete with the food supply, and that biofuels reduce greenhouse gas (GHG) emissions by at least 55%from gasoline emissions, based on a life-cycle assessment (LCA). The act is currently under revision.

## Subsidies

**153.5 billion YEN**

**~1,059 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

In Japan, the already ongoing recession was exacerbated in 2020 by the pandemic, leading to an economic contraction of 4.5%. Growth resumed haltingly in 2021, amounting to only 1.6%. Emissions from Japan's transport sector decreased by 11% in 2020. Japan has seen a clear move from public transport to cars and walking. Car use has been up since the beginning of the pandemic, with a few exceptions during lockdowns, and is still increasing. Based on Google data, public transport ridership was still below pre-pandemic levels in August 2022.

Source: IMF 2022, Google community mobility reports, Apple

# IMPLEMENTATION

## Mobility

| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • Low Carbon City Act (Eco-City Act) requires local governments to develop low-carbon development plans and promote the use of public transportation, incl. national support for the formulation of these plans<br>• Expansion of public transport network<br>• Acceleration of digitalisation using integrated circuit cards |
| ✔ **Measures to support low-carbon freight logistics** | • Construction of terminals for combined transport<br>• Better distribution system efficiency through improved truck transport and improved port terminal facilities<br>• Measures supported by the Act on Advancement of Integration and Streamlining of Distribution Business |
| **National-level measures to support new mobility services** | No measures at national level |
| **National measures to support non-motorised transport** | No measures at national level |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for light duty vehicles (LDV)** | **2030 fuel-efficiency standards:**<br>• Passenger cars: 73.5 g/km<br>**2022 fuel-efficiency standards:**<br>• Light commercial: 135 g/km |
| ✔ **Energy/carbon emission standards for heavy duty vehicles (HDV)** | Enacted in 2019 to come into force by 2025, with fuel economy improvements of 3.7% to 18.3% depending on the type of vehicle against a 2015 baseline using a 'well-to-wheel' approach (incl. electricity) |
| ✔ **Pricing instruments** | • Fuel efficiency-based environmental performance tax on new vehicles<br>• Carbon tax<br>• Benefits for more efficient vehicles for the annual automobile tax |
| ✔ **Mandatory vehicle labelling** | Fuel Efficiency Labelling System based on the 'top runner' standard |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • Hybrids, plug-in hybrid electric, electric, fuel-cell vehicles qualify for breaks exempt from automobile tax, weight tax, and environmental performance tax<br>• Range-based subsidies, doubled in 2021<br>• Subsidies for charging and hydrogen-fueling infrastructure |

Source: Japanese national sources

# MEXICO

**1.83%**
SHARE IN GLOBAL GDP (2020)

**7.69%**
TRANSPORT SECTOR SHARE GDP (2020)

**5.50%**
EMPLOYMENT IN TRANSPORT (2019)

Source: World Development Indicators, UNSTATS, ILO

Most of the population of Mexico lives in the centre of the country, with approximately a quarter of inhabitants living in and around Mexico City. Large parts of the country, particularly in the south, are mountainous and hard to access. Railways only connect major centres, and buses are the main mode of passenger transport between cities. Mexico has the third-largest number of airports globally. The majority of transport is by road. The focus on road transport is less pronounced in freight. Mexico faces a particular challenge when it comes to its vehicle fleet, which is largely composed of old, inefficient vehicles from the US.

Mexico has no national or international GHG emission targets for the transport sector, but it has set goals for the sales of electric vehicles, including 100% of new vehicles sold being electric by 2050. Existing policy measures focus on expanding public transport infrastructure and vehicle efficiency, and there is limited support for low-carbon vehicles and fuels.

## NDC

- ACHIEVE A 22% REDUCTION IN GHG EMISSIONS AND A 51% REDUCTION IN BLACK CARBON BY 2030
- NO NET-ZERO TARGET

## EV TARGETS

- 5% OF NEW VEHICLE SALES TO BE EVS BY 2030
- 50% OF NEW VEHICLE SALES TO BE EVS BY 2040

## POPULATION

**129 million people**
CURRENT POPULATION (2020)

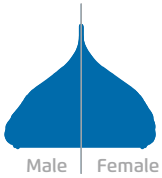
**1.7%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 14.1% (2020–2050)

**66.33 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**29.4 years**
AVERAGE AGE (2022)




Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**80.7% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

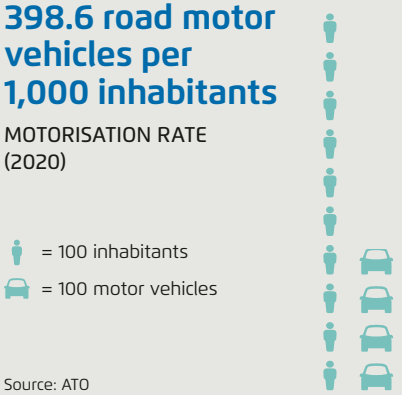
**104.1 million people**
TOTAL URBAN POPULATION (2020)

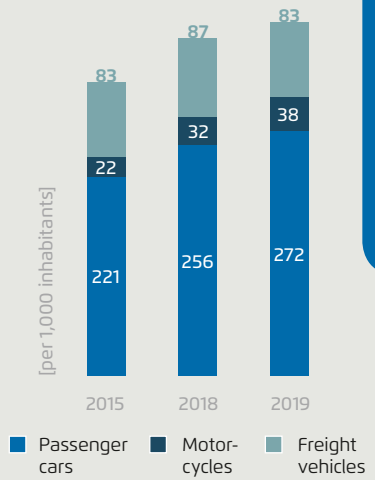
EXPECTED SHARE OF URBAN POPULATION: 88.2% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

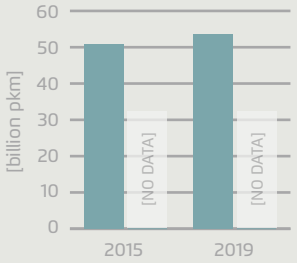
**398.6 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)



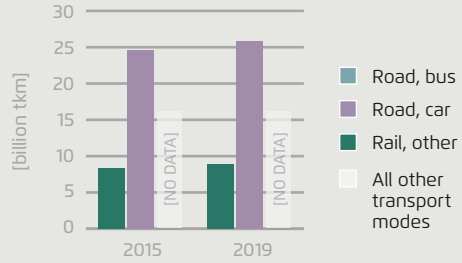

Source: ATO

**537.3 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)



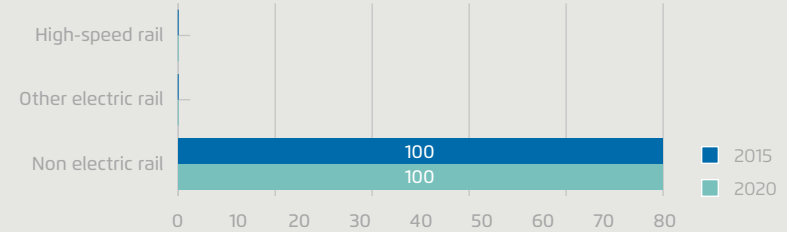

Source: ITF / OECD
* does not include all transport modes

**348.8 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: World Development Indicators, ITF / OECD
** does not include all transport modes

## Rail infrastructure




Source: RAILISA STAT UIC

Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

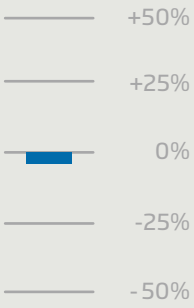
Mexico's total $CO_2$ emissions from fuel combustion increased by 65% between 1990 and 2019. Over the same period, transport-sector emissions increased by 143%, though in 2020 it dropped by 29% due to the pandemic. Today, transport is responsible for 37% of total emissions in Mexico. Emissions from the sector are projected to remain largely stable up to 2030 under business-as-usual and then decline to 7% below 2020 levels by 2050. Road is responsible for 97% of transport-emissions, while emissions from rail and domestic navigation are minor by comparison.

**423.31 Mt $CO_2$**

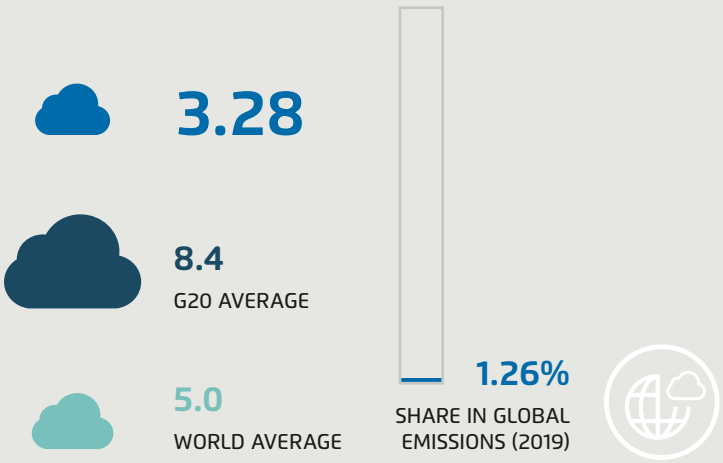
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**-4.3%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

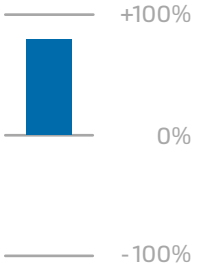
# TRANSPORT SECTOR EMISSIONS

**150.68 Mt $CO_2$**

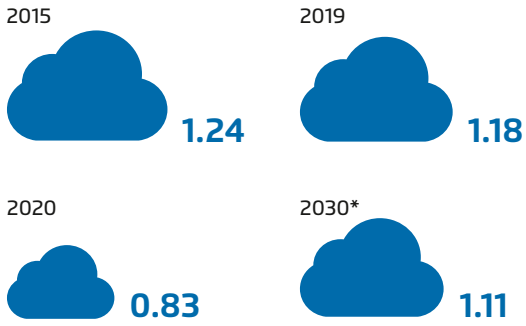
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**79.4%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

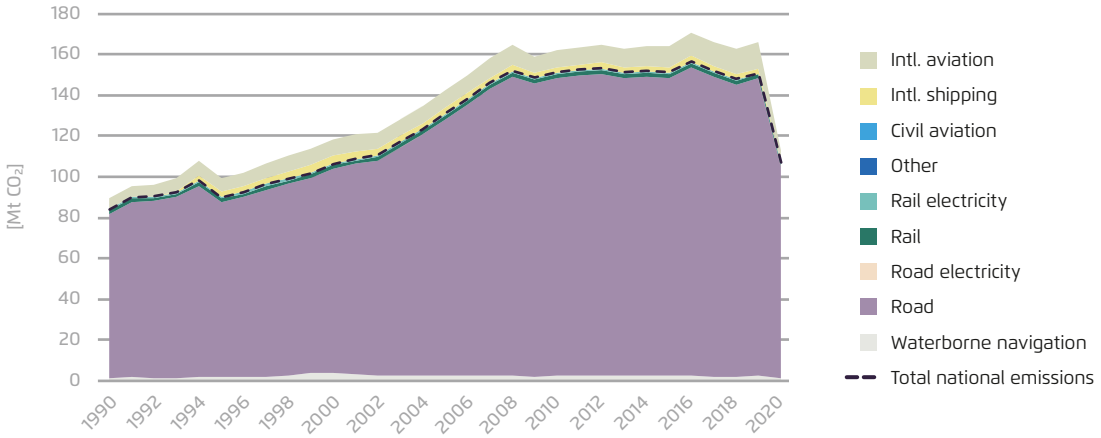
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

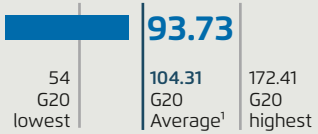
## Transport sector emissions by subsector



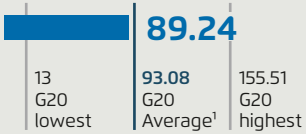

Source: IEA

# ENERGY

GASOLINE PRICE (2020)
US cents/litre



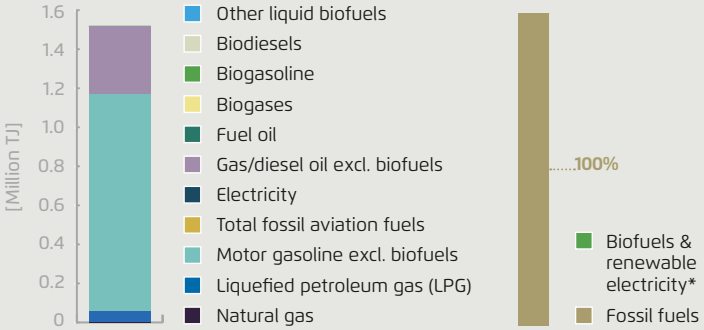

DIESEL PRICE (2020)
US cents/litre




Source: Globalpetrolprices.com*

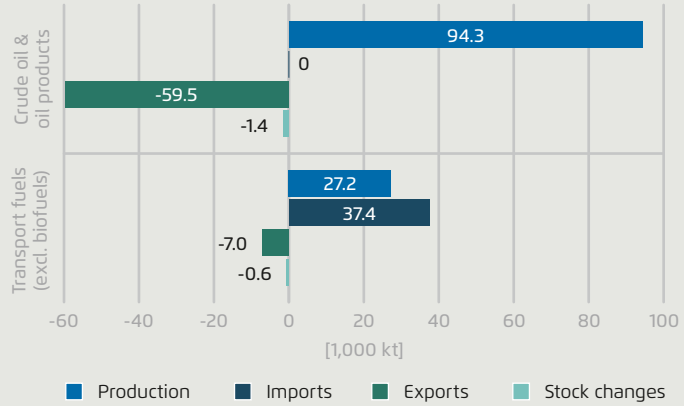
* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**11,500 vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**0.06%**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**0.50%**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)


**+4,555.9%**
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**1,200***
SLOW CHARGE

**92***
FAST CHARGE

**28,789***
SLOW CHARGE G20 AVERAGE

**43,927***
FAST CHARGE G20 AVERAGE

Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**

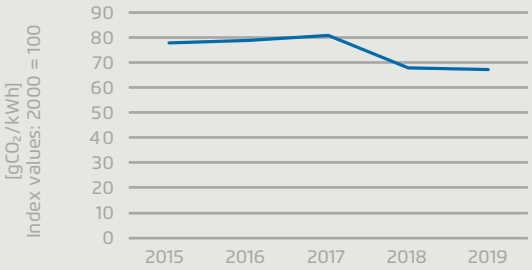
- Producers, importers, and distributors of batteries must formulate management plans for the prevention of waste and for recycling, including the reduction of recycling costs.

Source: SEMARNAT

# LINKAGES TO THE ENERGY SECTOR

Natural gas has largely replaced oil as the main fuel source for power generation in Mexico. The country's energy sustainability goals are to be met with a quota system based on clean-energy certificates (CEC). These efforts are supported by the country's Energy Reform bill, which started liberalizing the energy market in 2013–2014. Retail suppliers are required to have a given share of their electricity from clean sources. In practice, they must buy CECs to demonstrate that they have complied with the quotas. This obligation is set on an annual base, and increases every year. The quota for 2022 is 13.9%. Three rounds of renewable energy auctions were held, but then halted. Energy reforms currently under discussion could reverse incentives and encouragechanges in dispatch regulation.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 2024: 35%
- 3035: 40%
- 2050: 50%

Source: REN21, NC6

## The role of hydrogen

- Studies are ongoing and focus on market potential
- Mexico is implementing priority projects

Source: IEA (2021)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
Committed to a 22% reduction in GHG emissions and a 51% reduction in black carbon by 2030; with international support, committed to a 36% reduction in GHG emissions and a 70% reduction in black carbon by 2030, all compared with the BAU scenario

**Transport related NDC measures**
- Urban planning for efficient public transport systems
- Encouraging alternative transport systems
- Development of a National Electric Mobility Strategy
- Strengthening vehicle regulations

**National EV deployment targets**
- 5% of new vehicle sales to be EVs by 2030
- 50% of new vehicle sales to be EVs by 2040

**National ICE phase-out commitments**
100% of new vehicle sales to be EVs by 2050

# TRADE-OFFS

## Sustainability of biofuels

No measures to ensure the sustainability of biofuels could be identified.

## Subsidies

Mex$

**330,2 billion MXN**

**~16.551 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

In Mexico, the already ongoing recession was exacerbated in 2020 by the pandemic, leading to an economic contraction of 8.2%. Growth resumed in 2021 with 4.8%. In Mexico, emissions from the transport sector decreased by 24% in 2020, the second highest drop in the G20. Overall mobility in 2020 remained well below pre-pandemic levels for all transport modes. In 2021 mobility by car and walking started to recover and rose substantially above levels before the pandemic. Public transport only managed to recover previous levels in late 2021.

Source: IMF 2022, Google community mobility reports, Apple

# IMPLEMENTATION

## Mobility

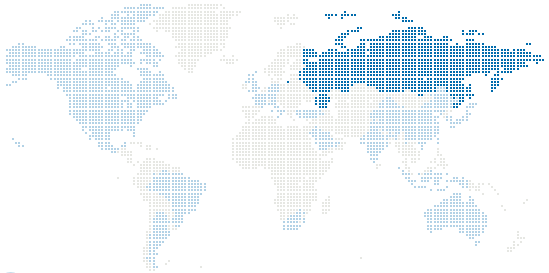
| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | Expansion of passenger rail infrastructure |
| **Measures to support low-carbon freight logistics** | No measures at national level |
| **National-level measures to support new mobility services** | No measures at national level |
| **National measures to support non-motorised transport** | No measures at national level |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for light duty vehicles (LDV)** | **Currently applicable standards:**<br>• Passenger cars: 145 g/km (2018)<br>• Light commercial: 196 g/km (2018)<br>**Fuel economy targets 2025:**<br>• Passenger cars: 35% below 2016 levels |
| **Energy/carbon emission standards for heavy duty vehicles (HDV)** | No standards |
| ✔ **Pricing instruments** | • Carbon tax on fossil fuels (except natural gas) of USD 3.5 per t $CO_2$<br>• Mexican-origin CERs to be used to meet 20% of the carbon tax obligation<br>• 2022 gasoline and diesel exemptions to the carbon tax |
| **Mandatory vehicle labelling** | No mandatory labelling |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | Government-led electric taxi programmes in Mexico City and Aguascalientes<br>Programme to develop charging infrastructure in several large cities. |

Source: Mexican national sources

# RUSSIAN FEDERATION



**3.08%**
SHARE IN GLOBAL GDP (2020)

**7.70%**
TRANSPORT SECTOR SHARE GDP (2020)

**[No Data]**
EMPLOYMENT IN TRANSPORT (2019)

Source: World Development Indicators, UNSTATS

Russia is the world's largest country by area. Its population is heavily concentrated to the west of the Urals. The transport infrastructure is densest in the European part of Russia, while some parts of Siberia and the Far East lack good transport access. The majority of roads in Russia are not suitable for heavy vehicles: less than 30% of federal and regional roads are designed to handle standard modern axle loads of 10 tonnes or more. As a result, the road transport share is relatively low, with the majority of freight being transported by rail. Buses, including in particular private minibuses, are the main mode of transport, with rail capturing most of the remaining share.

Russia does not have a specific GHG emission target for the transport sector, but it aims to increase the number of rail passengers by 33% and achieve a 10% share of EVs by 2030. Measures to promote modal shift and efficiency are very limited.

## NDC

- REDUCE EMISSIONS BY UP TO 70% BY 2030 RELATIVE TO 1990 LEVELS
- ACHIEVE ECONOMY-WIDE NET-ZERO TARGET NO LATER THAN 2060

## EV TARGETS

- LOCAL MANUFACTURING OF AT LEAST 25,000 EVS BY 2024
- 10% EV SHARE OF TOTAL VEHICLE MANUFACTURING BY 2030

## POPULATION

**144 mio people**
POPULATION CURRENT (2020)

**1.9%**
SHARE IN GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: -8.6% (2020–2050)

**8.8 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**38.95 years**
AVERAGE AGE (2022)


Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**74.8% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

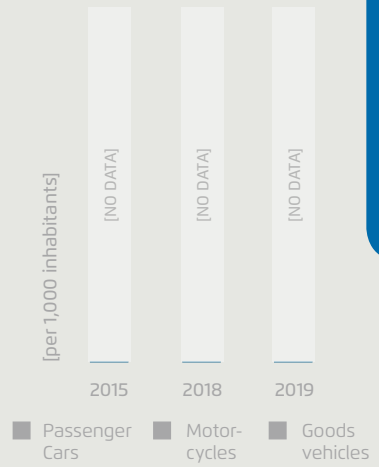
**107 million people**
TOTAL URBAN POPULATION (2020)

EXPECTED SHARE OF URBAN POPULATION: 83.3% (2050)

Source: World Urbanisation Prospects 2018

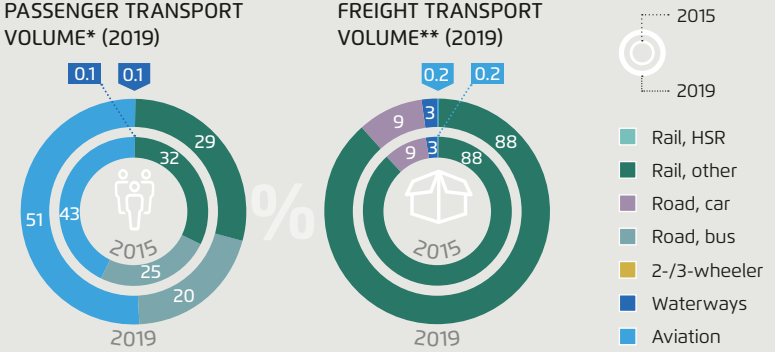
## MOBILITY

**[No Data] vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)


**634,500 mio passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

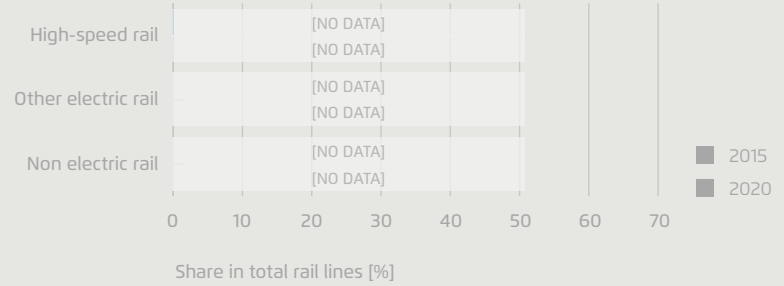
**2,950,400 mio tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: Federal State Statistics Service Russia
* Does not include private car transport nor non-motorized transport modes

Source: Federal State Statistics Service Russia
** Does not include pipeline transport

**[No Data] Rail infrastructure**






Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines, which include 2020.

# TOTAL EMISSIONS

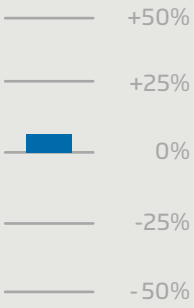
Total $CO_2$ emissions from fuel combustion in Russia decreased by 24% between 1990 and 2019. Transport-sector emissions only decreased by 16% over the same period. The share of transport emissions in total emissions is low compared with the G20 and global averages. Transport-sector emissions arise mostly from pipeline operations, representing a quarter of its emissions in 2019. At around 55%, road transport has the lowest share in total sector emissions in the G20.

**1,640.33 Mt $CO_2$**

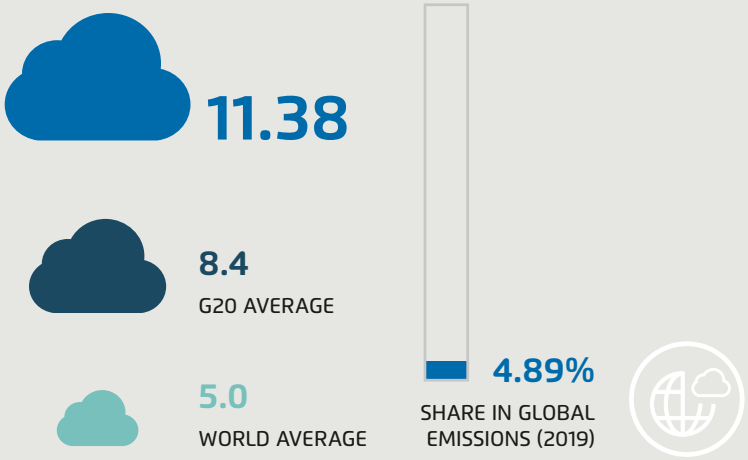
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**7%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

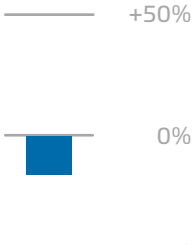
# TRANSPORT SECTOR EMISSIONS

**292.94 Mt $CO_2$**

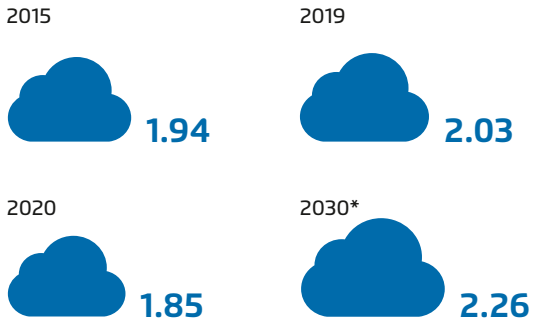
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**-16.1%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2020)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

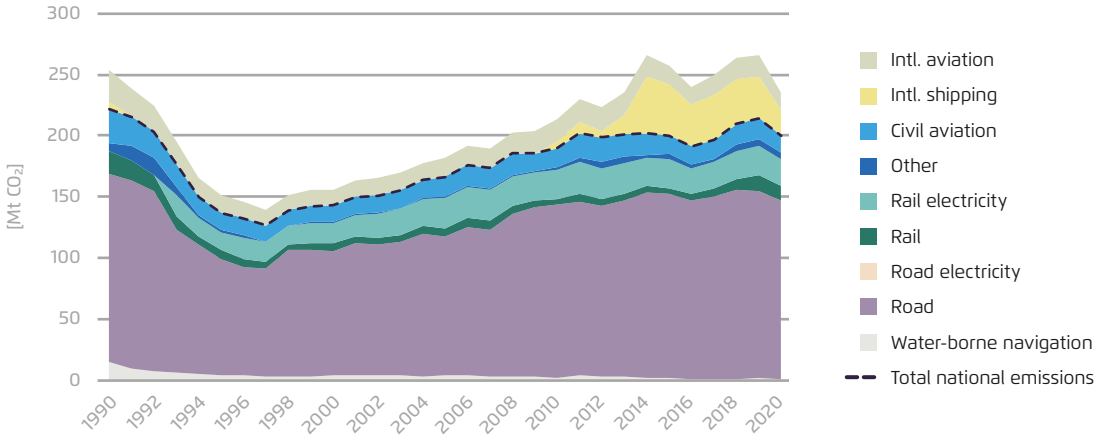
Sources: IEA, SLOCAT, UNDESA

* Projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

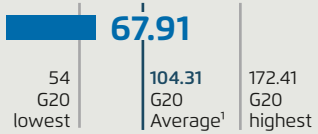
## Transport sector emissions by subsector




Source: IEA

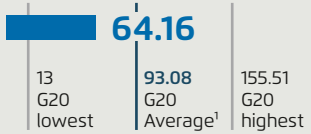
# ENERGY

## GASOLINE PRICE (2020)
US Cents/Litre



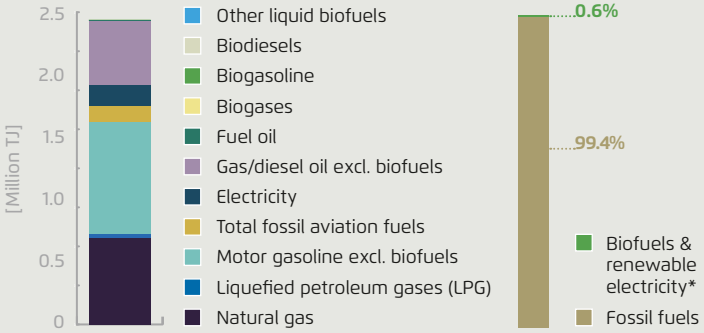

Source: Globalpetrolprices.com*

## DIESEL PRICE (2020)
US Cents/Litre



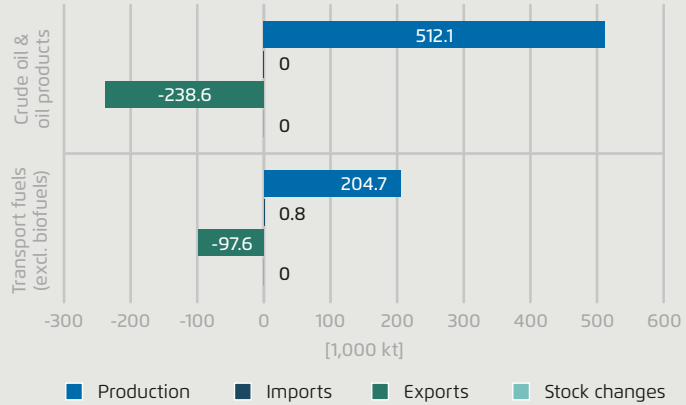

* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**[NO DATA] vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**[NO DATA]**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**[NO DATA]**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)


**[NO DATA]**
TOTAL FLEET GROWTH (2015–2021)

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**[NO DATA]**
SLOW CHARGE

**28,789***
SLOW CHARGE
G20 AVERAGE

**[NO DATA]**
FAST CHARGE

**43,927***
FAST CHARGE
G20 AVERAGE

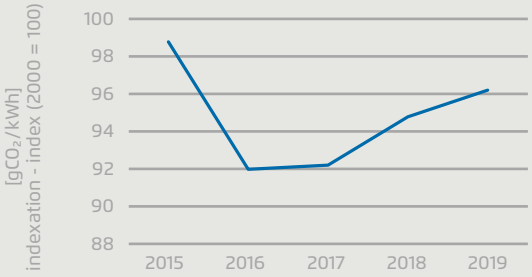
Source: IEA, 2021 *number of units

**Battery reuse and recycling**
- There is no regulation or policy in place that requires or promotes the re-use and recycling of batteries.

# LINKAGES TO THE ENERGY SECTOR

Natural gas is the dominant fuel source for power generation in Russia, providing over 42% of power. Nuclear and increasingly hydro provide the majority of the remaining generation at almost equal shares. The main support mechanism for renewable energy is a capacity auction system that guarantees capacity payments over 15 years. Various other measures were adopted in 2009 to promote renewables, including a 5% renewables quota for power loss compensation, and coverage of grid connection costs. In 2021, Russia introduced net metering for solar and other renewable power under 15 kW.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 4.5% by 2024 (excl. large hydro)
- 20% by 2024 (including large hydro)

Source: REN21

## The role of hydrogen

- Russia adopted its energy strategy in 2020 aiming to export 0.2 million tonnes of hydrogen by 2024 and 2 million tonnes by 2030.
- Focus is on local production using natural gas, but also renewables and nuclear power.
- Russia's hydrogen roadmap until 2024 outlines high-priority pilot projects, including a hydrogen-run rail transport prototype.

Source: IEA, Baker McKenzie (2021)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
- Reduction of up to 70% by 2030 relative to 1990 levels

**Future targets at national level**
- 33% increase in rail passengers between 2008 and 2030

**National EV deployment targets**
- 9,400 charging stations by 2024 (of which 2,900 fast charging)
- Local manufacturing of at least 25,000 EVs by 2024
- 72,000 charging stations by 2030
- 10% EV share of total vehicle manufacturing by 2030

# TRADE-OFFS

## Sustainability of biofuels

No focus on supporting biofuels, and hence no measures to ensure sustainability.

## Subsidies

**627.20 billion RUB**

**~10,663 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

Russia experienced a 4.6% contraction of its economy in 2020 but growth resumed in 2021. In Russia, emissions from the transport sector decreased by 6% in 2020. However, the reduction in mobility was less pronounced than in many other countries. Public transport ridership only fell by around 50% in March 2020 compared with pre-pandemic levels, but it had recovered by August. After another lockdown, public transport ridership began to fall again in October, reaching almost 30% in January 2021. Since May 2021, ridership has normalised, although driving and walking have remained above pre-pandemic levels.

Source: IMF 2022, Google, Apple

# IMPLEMENTATION

## Mobility

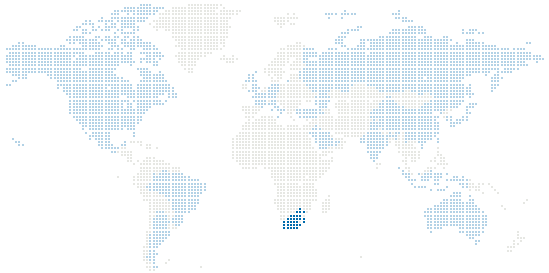
| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • Expansion of passenger rail infrastructure<br>• Expansion of public transport infrastructure and services |
| ✔ **Measures to support low-carbon freight logistics** | • Digital platform Freight Transportation (in test mode)<br>• Expansion of freight rail infrastructure |
| **National-level measures to support new mobility services** | No measures at national level |
| **National measures to support non-motorized transport** | No measures at national level |

## Energy

| | |
|---|---|
| **Energy/carbon emission standards LDV** | No standard |
| **Energy/carbon emission standards HDV** | No standard |
| **Pricing instruments** | No $CO_2$ or energy consumption-based taxes |
| **Mandatory vehicle labelling** | No mandatory labelling |
| **Support mechanism for electric vehicles & charging infrastructure** | The national strategy for automotive development, adopted in March 2018, aims at supporting domestic vehicle production, including electric vehicles. The 'Concept for the production and use of electric vehicles until 2030', adopted in 2021, envisages incentives for the local production of EVs and for consumer stimulus, including financial and non-financial incentives. Import taxes for EVs were suspended on 31 December 2021. |

Source: Russian national sources

# SOUTH AFRICA



**0.6%**
SHARE IN GLOBAL GDP (2020)

**7.91%**
TRANSPORT SECTOR SHARE GDP (2020)

**6.30%**
EMPLOYMENT IN TRANSPORT (2019)

Source: World Development Indicators, Statistics South Africa

South Africa's transport sector is dominated by road travel, but the country has good port and rail infrastructure and a growing airline industry. The country is the most urbanised in Africa, with over two-thirds of the population living in urban areas. Domestic travel patterns are characterised by large distances between places of residence and employment. A large share of passenger transport takes place on foot or by bicycle. Some major metropolitan areas are adopting Bus Rapid Transport (BRT) systems and the Metrorail system operates in four regions.

South Africa's Green Transport Strategy includes an objective to reduce GHG emissions from the transport sector by 50–80% by 2050 relative to 1990 levels. It also contains mode shift targets for passengers and freight and an interim target for vehicle efficiency by 2030. These targets were adopted before South Africa announced its ambition to achieve a net-zero economy by 2050. Vehicles are taxed at registration based on their $CO_2$ emissions, and a general $CO_2$ tax was introduced in 2019.

## NDC

- KEEP ANNUAL GHG EMISSIONS AT 398–510 MT $CO_2e$ FROM 2021–2025 AND AT 350–420 MT $CO_2e$ FROM 2026–2030
- ACHIEVE NET-ZERO BY 2050

## EV TARGETS

CONVERT 5% OF THE PUBLIC AND NATIONAL VEHICLE FLEET TO CLEANER ALTERNATIVE FUELS AND EFFICIENT TECHNOLOGY BY 2025, WITH ANNUAL INCREASES OF 2% THEREAFTER

## POPULATION

**59 million people**
CURRENT POPULATION (2020)

**0.8%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 25% (2020–2050)

**48.89 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**27.4 years**
AVERAGE AGE (2022)


Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**67.4% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

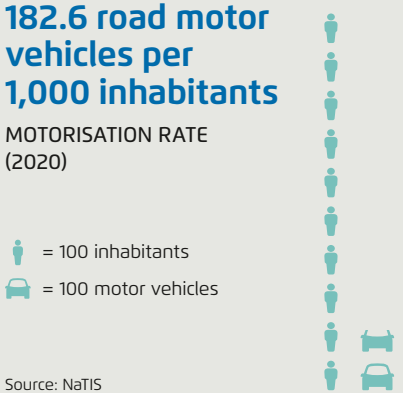
**39.9 million people**
TOTAL URBAN POPULATION (2020)

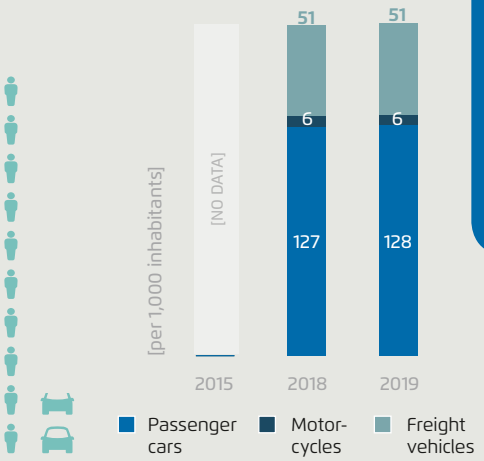
EXPECTED SHARE OF URBAN POPULATION: 79.8% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

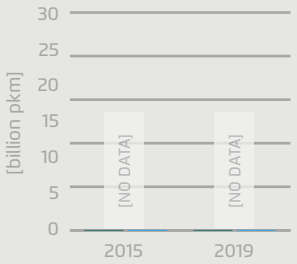
**182.6 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)



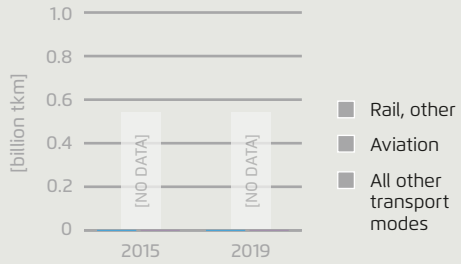




Source: NaTIS

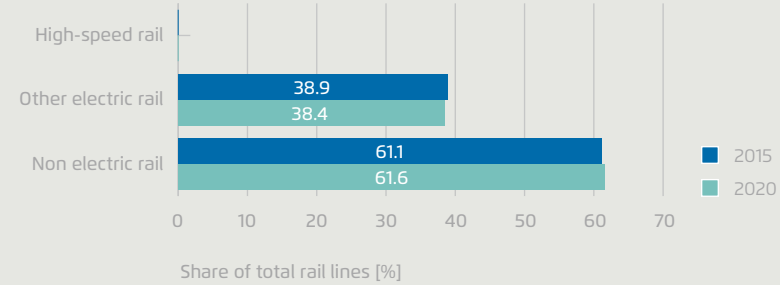
**[No Data] passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)




**[No Data] tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




## Rail infrastructure




Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

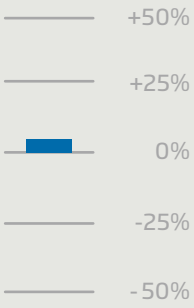
South Africa's total $CO_2$ emissions from fuel combustion increased by 81% between 1990 and 2019. Transport-sector emissions increased by 70% over the same period, but dropped by 16% in 2020 due to the pandemic. Emissions from the sector are projected grow by 18% by 2030 and 53% by 2050, relative to 2020 levels. 4.6% of sector emissions are from aviation and 4.8% from rail. Transport-sector emissions represent only 13% of national emissions owing to the high carbon intensity of the power sector, which dominates South Africa's emissions.

**441.12 Mt $CO_2$**

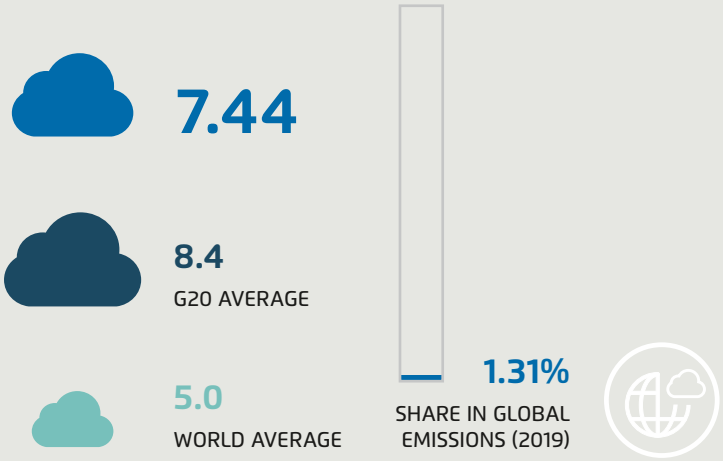
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**5.1%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

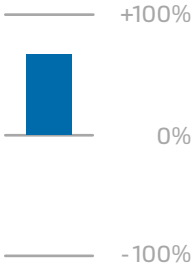
# TRANSPORT SECTOR EMISSIONS

**56.93 Mt $CO_2$**

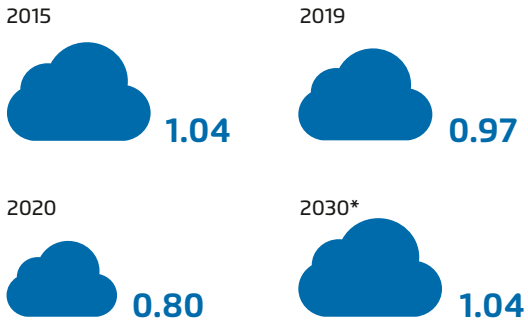
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**66.9%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

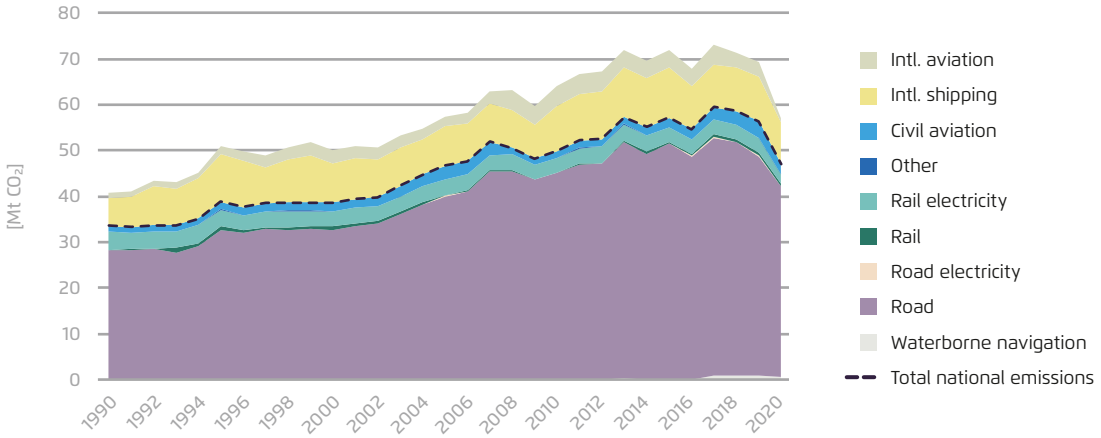
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

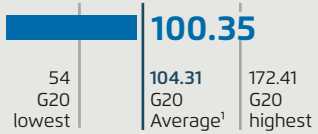
## Transport sector emissions by subsector



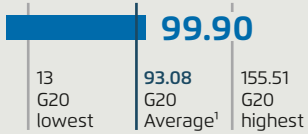

Source: IEA

# ENERGY

GASOLINE PRICE (2020)
US cents/litre



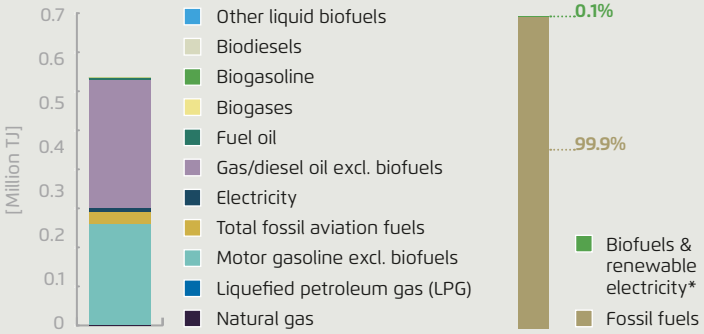

DIESEL PRICE (2020)
US cents/litre




Source: Globalpetrolprices.com*

* local currency prices converted using OECD annual exchange rates

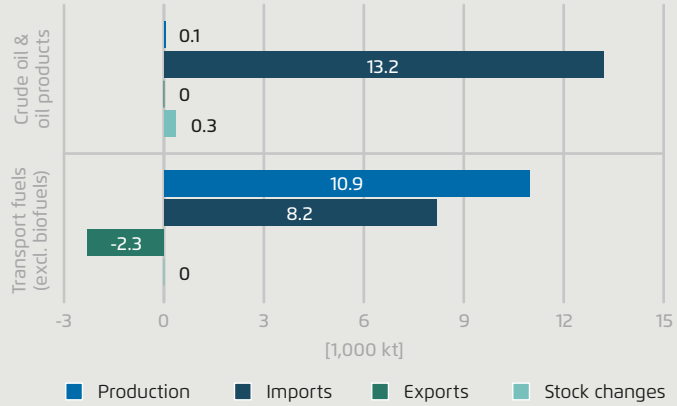
## Energy use in transport by fuel




*electricity split calculated based on share of renewables

Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**1,740 vehicles**

TOTAL STOCK OF ELECTRIC CARS (2021)

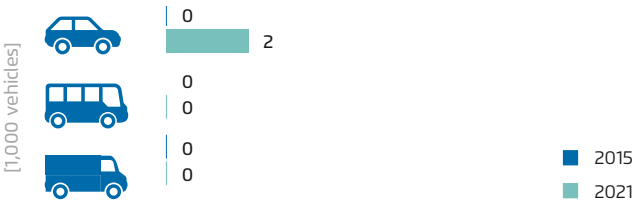
**0.09%**

MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

**0.03%**

SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)




**+521.4%**

TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**140 ***

SLOW CHARGE

**28,789 ***

SLOW CHARGE G20 AVERAGE

**160 ***

FAST CHARGE

**43,927 ***

FAST CHARGE G20 AVERAGE

Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**

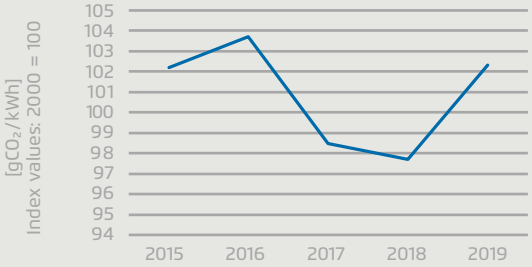
- There is no regulation or policy in place that requires or promotes the re-use and recycling of batteries.
- Voluntary efforts by industry associations aim to collect and recycle household and vehicle (lead-acid) batteries.

Source: Department of Environment, Forestry and Fisheries

# LINKAGES TO THE ENERGY SECTOR

Coal is the dominant fuel source for power generation in South Africa, representing 88% of generation. Between 2009 and 2011, a feed-in tariff was the main policy mechanism for promoting renewable energy. The tariff was replaced by a competitive bidding process, known as REIPPP, in 2011. Since 2011, six reverse auctions were held for the construction of renewable energy capacity. The sixth round is currently ongoing. Additionally, since 2017, a changed registration regulation has aimed to support medium-scale (1–100 MW) private-sector embedded solar generation, i.e. capacity connected to distribution networks, by easing licencing and registration.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 8% by 2030

Source: REN21

## The role of hydrogen

- South Africa adopted its Hydrogen Society Roadmap in 2021.
- The country aims to deploy close to 12 GW of electrolysis capacity and produce about 500 kt of hydrogen annually by 2030, with 40 GW capacity by 2040.
- In 2021 the president announced a Green Hydrogen Export Economic Zone.

Source: Department of Science and Innovation; CSIS (2022)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
Annual GHG emissions in a range from 398–510 Mt $CO_2e$ from 2021–2025 and in a range from 350–420 Mt $CO_2e$ from 2026–2030.

**Transport related NDC measures**
- Electric and hybrid vehicles
- Mode shift and enhanced public transport

**Future targets at national level**
- 50–80% reduction of transport emissions by 2050 relative to 1990 levels
- 20% reduction in the average vehicle energy intensity of the road vehicle fleet by 2030 relative to 2015 levels
- 30% shift of freight transport from road to rail by 2050
- 20% shift of passenger transport from private cars to public transport and eco-mobility transport by 2050

**National EV deployment targets**
Convert 5% of the public and national vehicle fleet to cleaner alternative fuels and efficient technology by 2025, with annual increases of 2% thereafter

# TRADE-OFFS

## Sustainability of biofuels

The Biofuels Feedstock Protocol prohibits the use of staple crops for biofuel production and aims to support production of fuel crops on under-utilised land. The Protocol also envisages the move to advanced biofuel production as soon as possible.

## Subsidies

**32.98 billion ZAR**

**~1,847 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

South Africa experienced a 6.4% contraction of its economy in 2020 after already very low growth in 2019. Growth resumed in 2021 at 4.9%. In South Africa, emissions from the transport sector decreased by 13% in 2020. Mobility by car, public transport, and walking fell by 80% below pre-pandemic levels in spring 2020, but car travel recovered much faster. By October driving was more or less back to normal, while public transport ridership only recovered in spring 2022.

Source: IMF 2022, Google community mobility reports, Apple

# IMPLEMENTATION

## Mobility

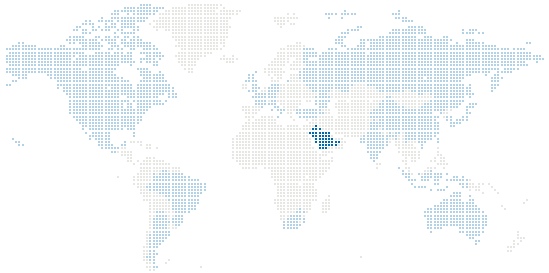
| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | Implementation of BRT systems in major cities |
| ✔ **Measures to support low-carbon freight logistics** | Transnet Road-to-Rail programme |
| **National-level measures to support new mobility services** | No measures at national level |
| **National measures to support non-motorised transport** | No measures at national level |

## Energy

| | |
|---|---|
| **Energy/carbon emission standards for light duty vehicles (LDV)** | No standard |
| **Energy/carbon emission standards for heavy duty vehicles (HDV)** | No standard |
| ✔ **Pricing instruments** | • Registration tax based on $CO_2$<br>• Carbon tax in place since 2019; The rate is planned to increase from the current level of just under USD 10/t $CO_2e$ to reach USD 20/t $CO_2e$ by 2026, USD 30/t $CO_2e$ by 2030, and USD 120/t $CO_2e$ beyond 2050 |
| ✔ **Mandatory vehicle labelling** | South African Fuel Economy Label |
| **Support mechanism for electric vehicles & charging infrastructure** | • No measures at national level yet<br>• Proposed measures include tax reductions and elimination of duties on EV components. Additionally, some support is provided for local EV development. |

Source: South African national sources

# SAUDI ARABIA



**1.23%**
SHARE IN GLOBAL GDP (2020)

**5.83%**
TRANSPORT SECTOR SHARE GDP (2020)

**[No Data]**
EMPLOYMENT IN TRANSPORT (2019)

Source: General Authority for Statistics

Most of Saudi Arabia's population is concentrated in a wide band across the middle of the peninsula. Saudi Arabia has good access to maritime shipping, with extensive coastlines on the Persian Gulf and Red Sea. Road transport is the most important mode of transport, and the country is rapidly motorising. The vehicle fleet is estimated to have grown from around 4 million vehicles in 2005 to over 10 million by 2018.

The Kingdom aspires to achieve a net-zero economy by 2060. It does not have specific GHG emission targets for the transport sector, but its "Vision 2030" sets out qualitative objectives to increase public transportation use and improve the efficiency of vehicles and railways. Saudi Arabia has started to expand public transport and rail infrastructure, and has also implemented a fuel efficiency standard for light-duty vehicles. The government is also investing in production capacity for electric vehicles. Only a few additional measures have been enacted to support a modal shift or low-carbon vehicles.

## NDC

- REDUCE GHG EMISSIONS BY 278 MT $CO_2e$ BY 2030 RELATIVE TO 2019 LEVELS
- ACHIEVE ECONOMY-WIDE NET-ZERO TARGET BY 2060

## EV TARGETS

NO EV DEPLOYMENT TARGETS OR OBJECTIVES

## POPULATION

**35 million people**
CURRENT POPULATION (2020)

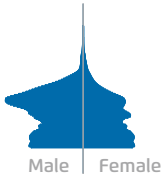
**0.4%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 34.4% (2020–2050)

**16.19 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**30.2 years**
AVERAGE AGE (2022)




Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**84.3% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

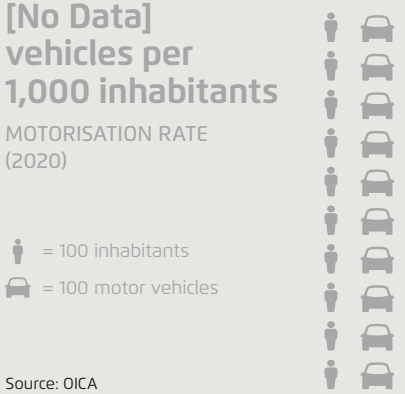
**29.3 million people**
TOTAL URBAN POPULATION (2020)

EXPECTED SHARE OF URBAN POPULATION: 90.4% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

**[No Data] vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)



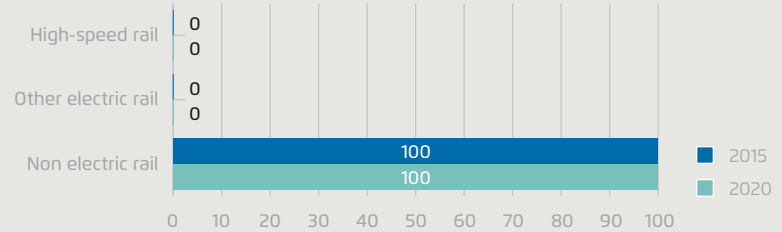

Source: OICA

**[No Data] passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

**[No Data] tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)


Source: World Development Indicators, ITF / OECD
* does not include all transport modes

## Rail infrastructure




Source: RAILISA STAT UIC



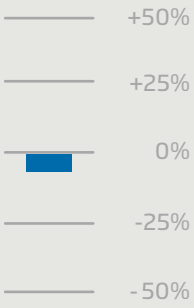
Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

Total $CO_2$ emissions from fuel combustion in Saudi Arabia increased by 230% between 1990 and 2019. Emissions in the transport sector grew more slowly, with an increase of 177% over the same period. In 2015, transport-sector emissions peaked and have declined steadily since then. Transport is responsible for just over 27% of total emissions, but per capita sector emissions are almost three times as high as the G20 average. Under a business-as-usual scenario, sector emissions are projected to decrease by 27% up to 2030 and 29% by 2050 relative to 2020 levels. The emission profile in the transport sector is unusual, with no reported emissions for rail, pipeline, or navigation. Road transport generates 98% of sector emissions, despite the high emissions that are likely from pipeline transport.

**498.15 Mt $CO_2$**

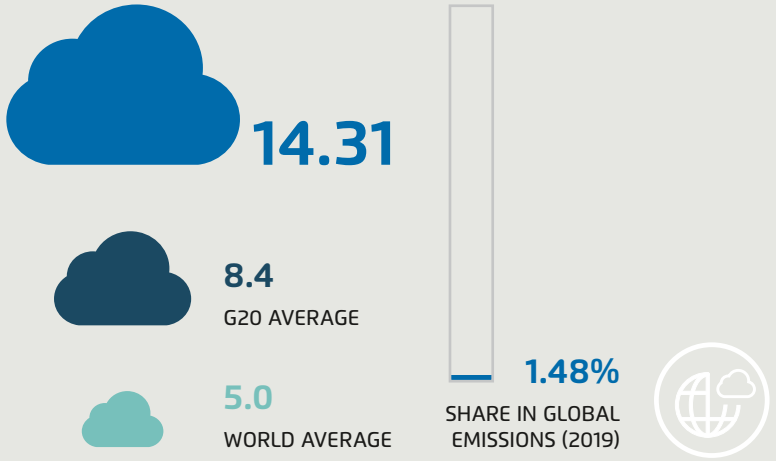
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)




**-6.3%**

CHANGE IN TOTAL EMISSIONS (2015–2019)

TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)



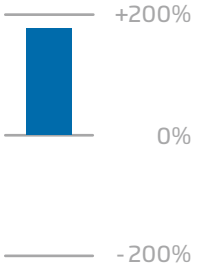

t $CO_2$ per capita

Sources: IEA

# TRANSPORT SECTOR EMISSIONS

**136.68 Mt $CO_2$**

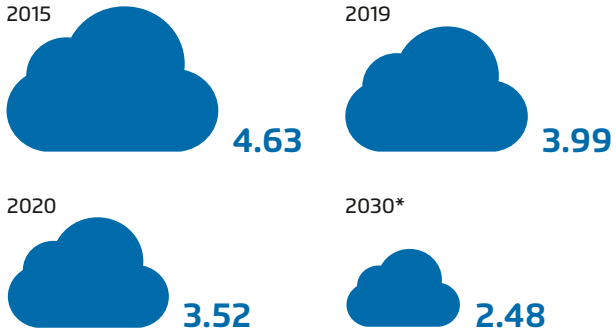
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)




**176.7%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)

TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

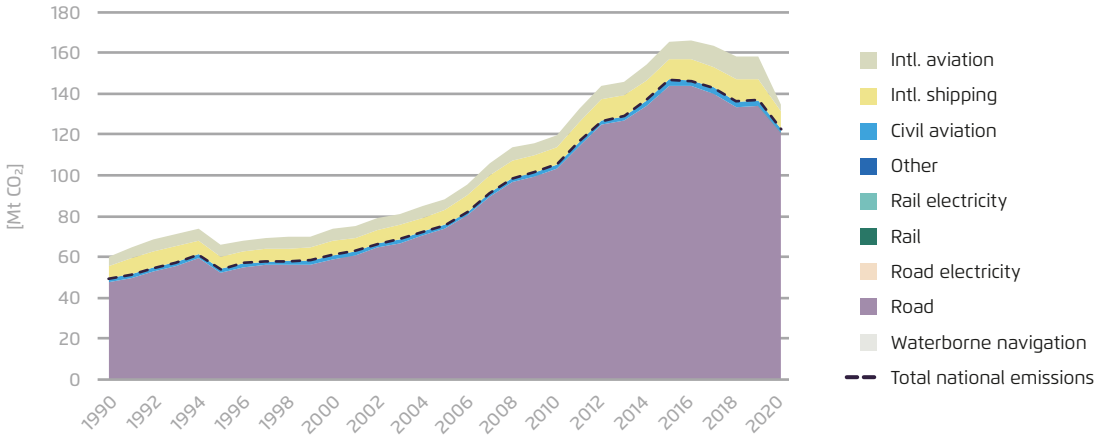
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

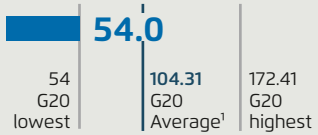
## Transport sector emissions by subsector




Source: IEA

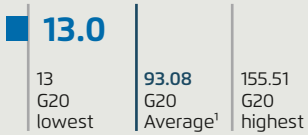
# ENERGY

## GASOLINE PRICE (2020)
US cents/litre



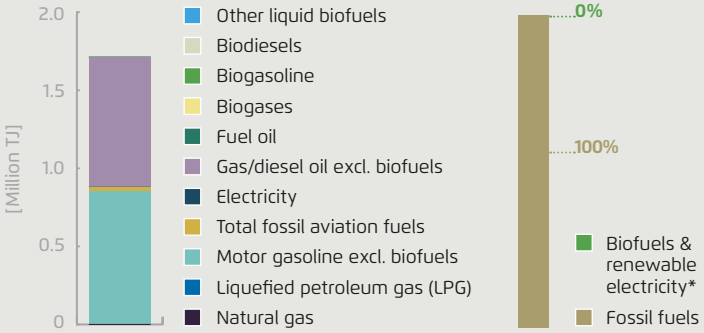

Source: Globalpetrolprices.com*

## DIESEL PRICE (2020)
US cents/litre



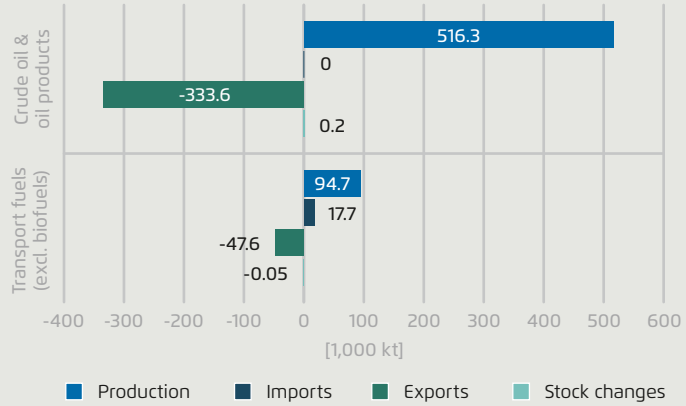

* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**[NO DATA] vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**[NO DATA]**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**[NO DATA]**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)


**[NO DATA]**
TOTAL FLEET GROWTH (2015–2021)

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**[NO DATA]**
SLOW CHARGE
**28,789***
SLOW CHARGE
G20 AVERAGE

**[NO DATA]**
FAST CHARGE
**43,927***
FAST CHARGE
G20 AVERAGE

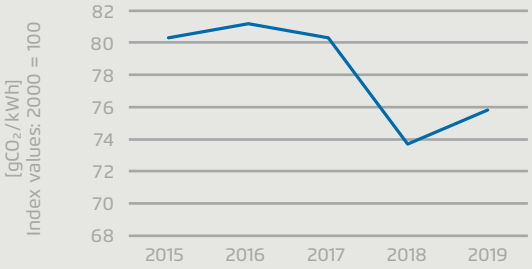
Source: IEA, 2021 *number of units

**Battery reuse and recycling**
- There is no regulation or policy in place that requires or promotes the re-use and recycling of batteries.

# LINKAGES TO THE ENERGY SECTOR

Saudi Arabia completely relies on natural gas and oil to generate electricity. The National Renewable Energy Program ran a number of tenders for projects. In 2021, the Saudi Green Initiative investment programme was announced to support the renewable targets for 2030. The initiative awarded seven contracts for a combined capacity of 3.7 GW of solar.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 40–50% by 2030
- 27.3 GW by 2023
- 58.7 GW by 2030

Source: REN21, IHS

## The role of hydrogen

- Saudi Arabia is currently developing a hydrogen strategy.
- It has planned more than US$36 billion in investments through 2030.
- Saudi Arabia has set clean hydrogen production targets of 2.9 million tons per year by 2030 and 4 million tonnes per year by 2035.
- In a first demonstration, 40 tonnes of blue ammonia were shipped to Japan in 2020.

Source: World Energy Council (2021); Zawya (2022); CSIS (2022)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
Committed to removing GHG emissions by 278 Mt $CO_2e$ by 2030 relative to 2019 levels

**Future targets at national level**
Saudi Arabia does not have transport specific national targets, although the Vision 2030 sets out qualitative objectives to increase usage of public transportation and improve efficiency of vehicles and railways.

# TRADE-OFFS

SR

## Sustainability of biofuels

No mandates or support mechanisms are in place and the use of biofuels is very limited. No sustainability regulation in place.

## Subsidies

**5.2 billion SAR**

**~5,244 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

Saudi Arabia experienced a 4.1% GDP decline in 2020 after very low growth in 2019. Growth resumed in 2021 with 3.2%. In Saudi Arabia's transport emissions decreased by only 2% in 2020. This is likely due to the fact that after an initial drop in car use in March 2020, driving returned to pre-pandemic levels by early May 2020 and has remained at normal levels since. Public transport ridership decreased by up to 80% in the first wave in April 2020 and recovered much more slowly, reaching pre-pandemic levels only in March 2022.

Source: IMF 2022, Google community mobility reports, Apple

# IMPLEMENTATION

## Mobility

| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • Expansion of high-speed rail infrastructure<br>• Expansion of rail infrastructure<br>• Expansion of public transport in all major cities<br>• The NEOM smart city initiative |
| ✔ **Measures to support low-carbon freight logistics** | • Expansion of rail infrastructure |
| **National-level measures to support new mobility services** | No measures at national level |
| **National measures to support non-motorised transport** | No measures at national level |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for light duty vehicles (LDV)** | **Currently applicable standards:**<br>• Passenger cars: 142 g/km (2020)<br>• Light commercial: 186 g/km (2020) |
| **Energy/carbon emission standards for heavy duty vehicles (HDV)** | No standard |
| **Pricing instruments** | No $CO_2$ or energy consumption-based taxes |
| ✔ **Mandatory vehicle labelling** | Fuel economy labelling requirements |
| **Support mechanism for electric vehicles & charging infrastructure** | **No support measures for general uptake, but:**<br>• Investment in national EV production capacity<br>• Purchase of vehicles for the government fleet |

Source: Saudi national sources

# SOUTH KOREA



**1.75%**
SHARE IN GLOBAL GDP (2020)

**8.11%**
TRANSPORT SECTOR SHARE GDP (2020)

**[No Data]**
EMPLOYMENT IN TRANSPORT (2019)

Source: World Development Indicators, UNSTATS

South Korea is located on the southern half of the Korean Peninsula. The population is primarily concentrated in lowland areas, where urban density is quite high. With some 82% of the population living in cities, subway transport captures an unusually large share of passenger transport. South Korea boasts a well-developed railway system, including a number of high-speed trains that have diverted travel from air to rail (while inducing additional travel demand).

In contrast to its 2020 commitment, Korea does not provide dedicated transport-sector targets for 2030 in its updated NDC. In line with its net-zero commitment for 2050, Korea's updated NDC moved from a reduction below the BAU target to a 40% reduction below 2018 levels. Plans and intermediate targets for each sector are currently under development. The country has already set fuel-efficiency targets for passengers and heavy-duty vehicles. Korea has measures in nearly all relevant areas, with the exception of road pricing.

## NDC

- ACHIEVE A 40% REDUCTION IN GHG EMISSIONS IN 2030 COMPARED TO 2018
- ACHIEVE ECONOMY-WIDE NET-ZERO TARGET BY 2050

## EV TARGETS

- 1.13 MILLION BEVS & 200,000 FCEVS BY 2025
- 51% SHARE OF EVS IN NEW VEHICLE SALES BY 2025 AND 83% BY 2030
- 40,000 FCEV URBAN BUSES & 30,000 FCEV TRUCKS BY 2040

## POPULATION

**52 million people**
CURRENT POPULATION (2020)

**0.7%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: -11.7% (2020–2050)

**530.97 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**43.9 years**
AVERAGE AGE (2022)


Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**81.4% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

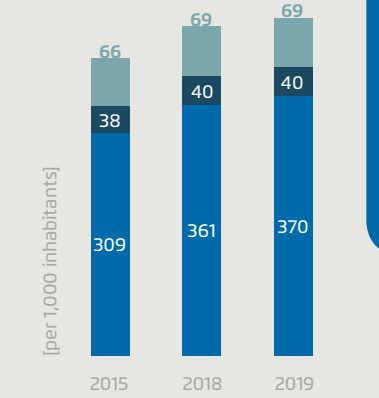
**42.2 million people**
TOTAL URBAN POPULATION (2020)

EXPECTED SHARE OF URBAN POPULATION: 86.4% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

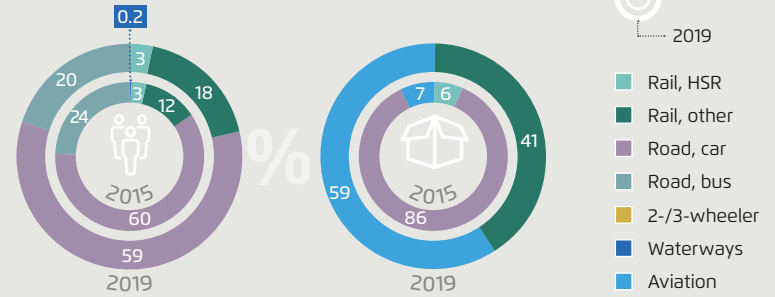
**480.2 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)


Source: Asian Transport Outlook (ATO) 2022

**492.3 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

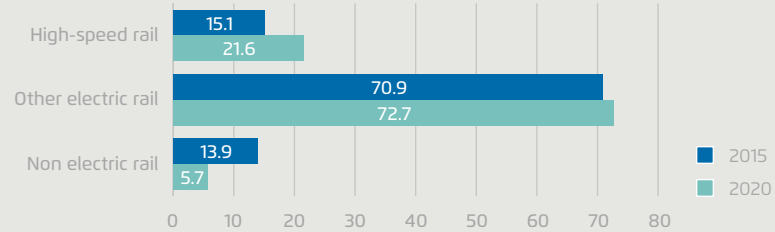
**18 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: ATO, ITF / OECD
* does not include all transport modes

Source: World Development Indicators, ITF / OECD, ATO,
** does not include all transport modes

## Rail infrastructure




Source: ITF / OECD



Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

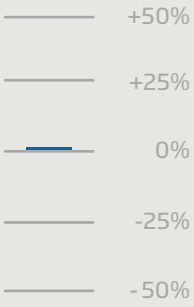
Total $CO_2$ emissions from fuel combustion in the Republic of Korea increased by 153% between 1990 and 2019. Transport-sector emissions grew more slowly, registering a 143% increase over the same period, though they dropped 7% in 2020. Per capita sector emissions are almost double the world average. Under a business-as-usual scenario, sector emissions are projected to decrease by 15% through 2030 and then slowly decline to 11% above 2020 levels by 2050. Road transport is by far the main contributor, with a 94% share, followed by rail with 4.4%, mostly from electricity use.

**587.20 Mt $CO_2$**

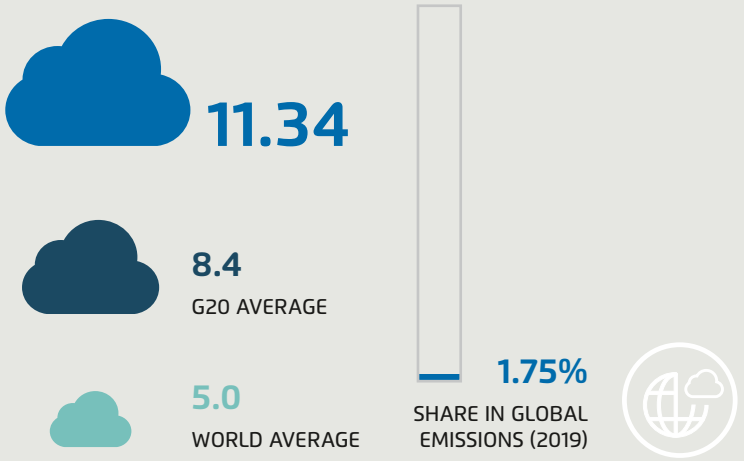
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**0.9%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

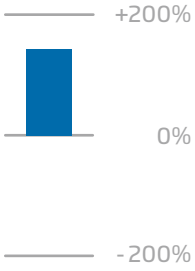
# TRANSPORT SECTOR EMISSIONS

**107.94 Mt $CO_2$**

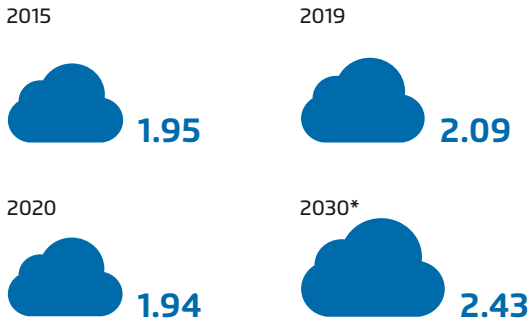
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**143.4%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

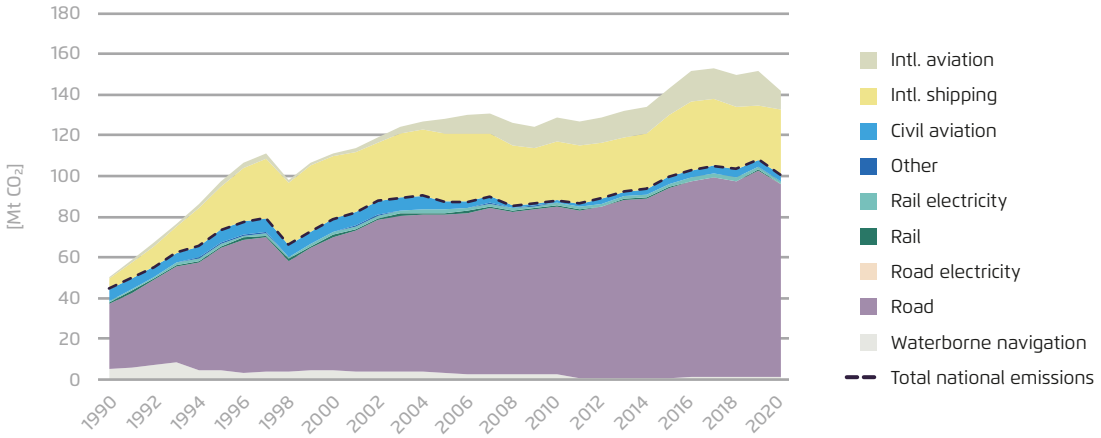
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

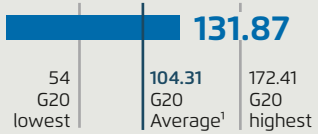
## Transport sector emissions by subsector



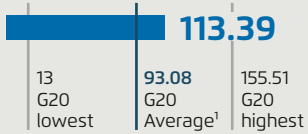

Source: IEA

# ENERGY

GASOLINE PRICE (2020)
US cents/litre



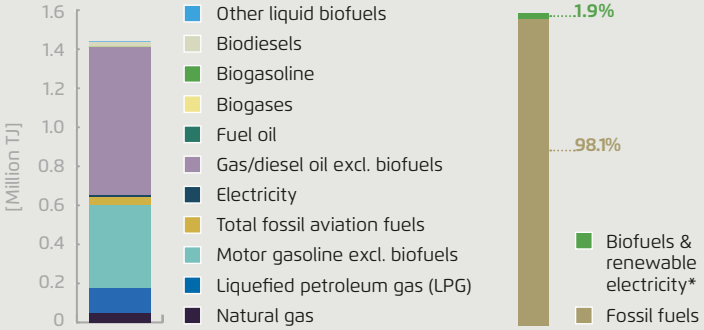

DIESEL PRICE (2020)
US cents/litre




Source: Globalpetrolprices.com*

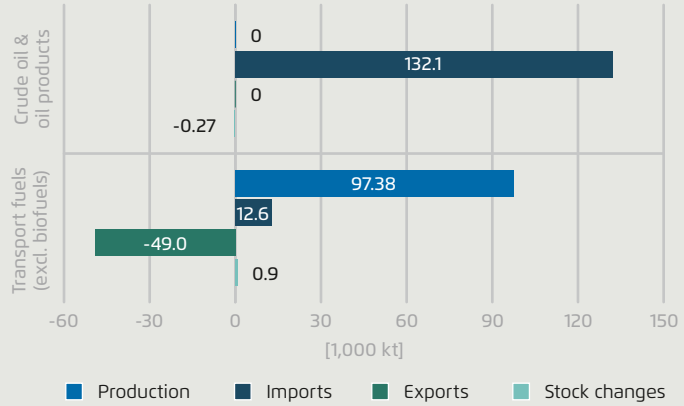
* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**19,300 vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

[No Data]
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

[No Data]
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)


[No Data]
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

[No Data]
SLOW CHARGE

**28,789***
SLOW CHARGE
G20 AVERAGE

[No Data]
FAST CHARGE

**43,927***
FAST CHARGE
G20 AVERAGE

Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**

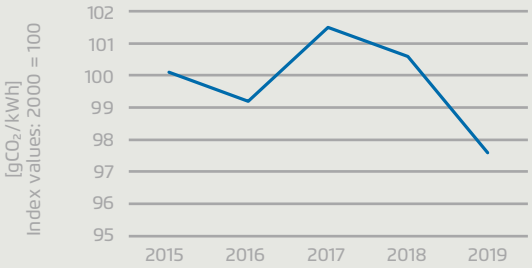
- Distributors are required to collect EV batteries. These are processed in central collection centres operated by the Korea Environment Corporation.
- Producers must to consider recyclability in product design and actively promote recycling.
- Recycling under the Waste Control Act includes re-use for storage or in e-bicycles and the utilisation of raw materials contained in the batteries.

Source: Enviliance Asia (2021)

# LINKAGES TO THE ENERGY SECTOR

The main energy sources for power generation in South Korea are coal (39%), nuclear power (27%), and natural gas (26%). In 2012, a Renewable Portfolio Standard (RPS) replaced a feed-in tariff system to accelerate Korea's renewable energy deployment and create a competitive market environment for the sector. The RPS programme requires the 13 largest power companies to steadily increase the share of power generation from renewables. By 2022, the mandatory supply rate under the RPS system is 10% (versus 3.0% in 2015).

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 20% by 2030
- 35% by 2040
- 63.8 GW renewable generation capacity by 2030

Source: REN21

## The role of hydrogen

- Korea adopted a hydrogen strategy in 2019.
- In 2020, a hydrogen law was passed, stipulating research and development subsidies, loans, and tax exemptions.
- The New Deal sets targets for the production of 6.2 million FCEVs and 1200 fueling stations for 2040.
- Overseas investment for green hydrogen production is also planned.

Source: IEA (2020), CSIS (2021)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
40% reduction in GHG emissions in 2030 relative to 2018 levels

**Transport related NDC targets**
Enhanced target for deployment of zero-emission vehicles (target value not provided)

**Transport related NDC measures**
- Improvement of public transport services
- Enhancing operational efficiency of aircraft and ships

**Future targets at national level**
- Replacement of all diesel passenger locomotives with a new bullet train by 2029
- Average fuel efficiency for vehicles of 35 km/l for passenger vehicles by 2035
- Average fuel efficiency for heavy-duty vehicles 7.5 km/l by 2040

**National EV deployment targets**
- 1.13 million BEVs and 200,000 FCEVs by 2025
- 3 million FCEVs, including 2.9 million domestically manufactured
- 51% share of EVs in new vehicle sales by 2025 and 83% by 2030
- 40,000 FCEVs in urban bus stock and 30,000 FCEVs in truck stock by 2040
- 430,000 charging stations in residential apartments, 146,000 charging stations in commercial areas, and 12,000 fast chargers along highways by 2025

# TRADE-OFFS

## Sustainability of biofuels

No measures to ensure the sustainability of biofuels could be identified.

## Subsidies

**1,256 billion KRW**

**~879 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

Korea experienced only a moderate contraction of its economy of 0.9% in 2020. Growth resumed in 2021 at a rate 80% higher than before the pandemic. In Korea, emissions from the transport sector decreased by only 5% in 2020, the third-lowest value after China, which increased emissions during 2020, and Saudi Arabia.

According to data from Google and Apple, all travel remained below pre-pandemic levels, including driving cars and walking. Public transport has seen some phases of recovery but overall remains lower than before the pandemic.

Source: IMF 2022, Google community mobility reports, Apple

# IMPLEMENTATION

## Mobility

| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • Support provided by the Act on the Promotion of Smart City Development and Industry<br>• Act on the support and promotion of utilisation of mass transit<br>• Nation-wide unified fare-collection system<br>• Integrated railway and public transportation information system (planned) |
| ✔ **Measures to support low-carbon freight logistics** | • Transportation transition support project subsidies under the Sustainable Transportation Logistics Development Act<br>• Digital Logistics Complex Development Project |
| **National-level measures to support new mobility services** | Autonomous vehicles have temporary operating permission to use BRT lines for testing and research purposes |
| ✔ **National measures to support non-motorised transport** | • Korean Bicycle Master Plan<br>• Master plan for a national bike network<br>• Incentives via 'carbon points' or the reimbursement of public transport expenses for those who walk or bike at the local level |

## Energy

| | |
|---|---|
| ✔ **Energy/carbon emission standards for light duty vehicles (LDV)** | **Currently applicable standards:**<br>• Passenger cars: 97 g/km (2020)<br>• Light commercial: 181 g/km (2020) |
| **Energy/carbon emission standards for heavy duty vehicles (HDV)** | No standard |
| ✔ **Pricing instruments** | Domestic aviation covered in the ETS |
| ✔ **Mandatory vehicle labelling** | Rational Energy Utilization Act |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • Central purchase subsidies for EVs<br>• Reduced highway toll fees and public parking fees<br>• Priority in public procurement<br>• Investment subsidies for charging infrastructure |

Source: Korean national sources

# TURKEY



**1.91%**
SHARE IN GLOBAL GDP (2020)

**7.90%**
TRANSPORT SECTOR SHARE GDP (2020)

**5.44%**
EMPLOYMENT IN TRANSPORT (2019)

Source: World Development Indicators, TURKSTAT, ILO

Turkey is located between the Black Sea and the Mediterranean. The most densely populated area is found around the Bosphorus. The majority of transport is road-based, with diesel playing a major role and LPG having an uncharacteristically high share in sector fuel use. International aviation plays an important role in the tourism sector, but domestic aviation has also seen substantial growth.

Turkey's Climate Change Action Plan for 2011–2023 sets quantitative targets for increasing the share of rail and navigation in passenger and freight transport and outlines qualitative ambitions for 2030. These were set before Turkey announced its commitment to achieving a net-zero economy by 2053. Electrification targets concentrate on new truck and bus sales, with the goal of 100% sales by 2040. The measures implemented so far focus predominantly on achieving this modal shift; only a few measures are in place to encourage vehicle efficiency. Some tax incentives exist for electric vehicles, and the government actively supports EV manufacturing.

## NDC

- ACHIEVE A 21% REDUCTION IN GHG EMISSIONS BY 2030 RELATIVE TO BAU
- ACHIEVE ECONOMY-WIDE NET-ZERO TARGET BY 2053

## EV TARGETS

30% OF ZEVS IN NEW TRUCK AND BUS SALES BY 2030

## POPULATION

**84 million people**
CURRENT POPULATION (2020)

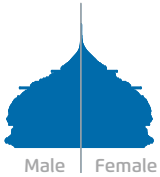
**1.1%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 13.9% (2020–2050)

**109.58 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**31.3 years**
AVERAGE AGE (2022)




Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**76.1% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

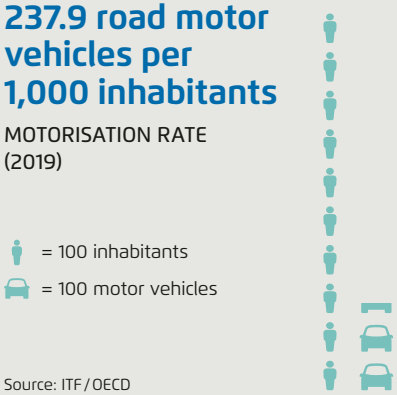
**64.2 million people**
TOTAL URBAN POPULATION (2020)

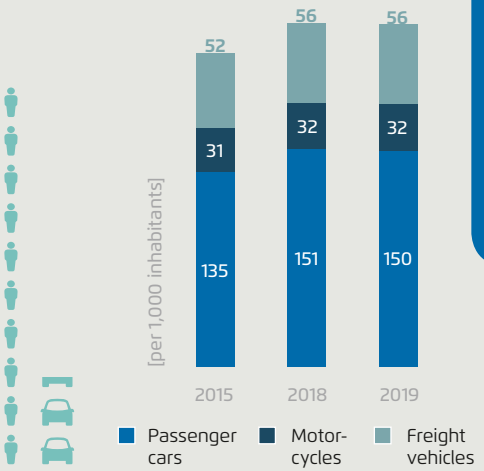
EXPECTED SHARE OF URBAN POPULATION: 86.0% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

**237.9 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2019)

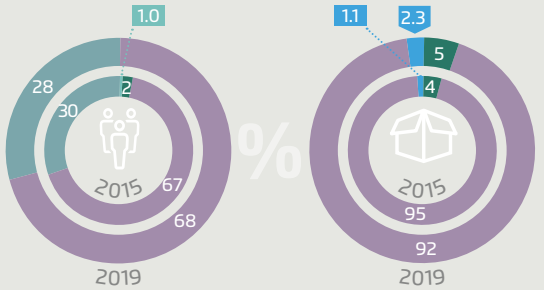



Source: ITF / OECD

**353.9 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

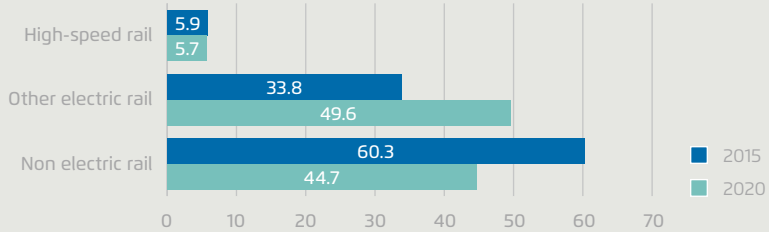
**289.1 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: ITF / OECD, UNECE
* does not include all transport modes

Source: World Development Indicators, ITF / OECD
** does not include all transport modes

## Rail infrastructure




Source: ITF / OECD

Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

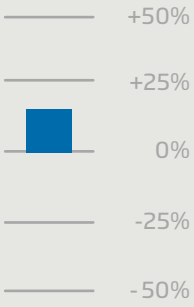
Turkey's total $CO_2$ emissions from fuel combustion increased by 185% between 1990 and 2019, but per capita emissions are still below that of the G20 and just over the global average. Transport-sector emissions increased by 200% over the same period and are projected to grow a further 24% by 2030. Afterward, they are expected to decrease, falling to 8% above 2020 levels by 2050. Road transport represents 87% of transport emissions. Rail is responsible for 5.8% of sector emissions, mostly from electricity use, followed by aviation at 4.6%.

**366.42 Mt $CO_2$**

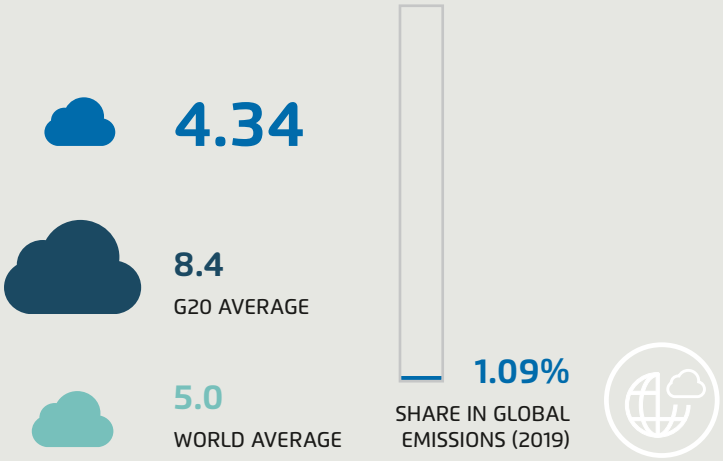
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**14.9%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

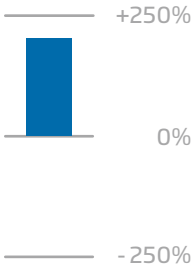
# TRANSPORT SECTOR EMISSIONS

**84.32 Mt $CO_2$**

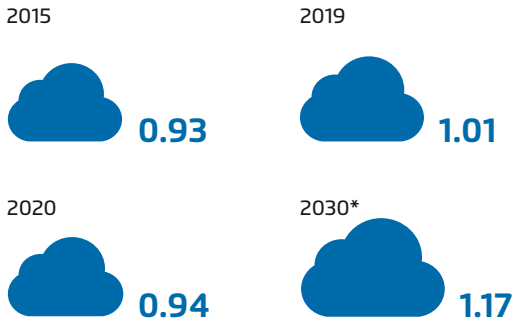
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**200.1%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

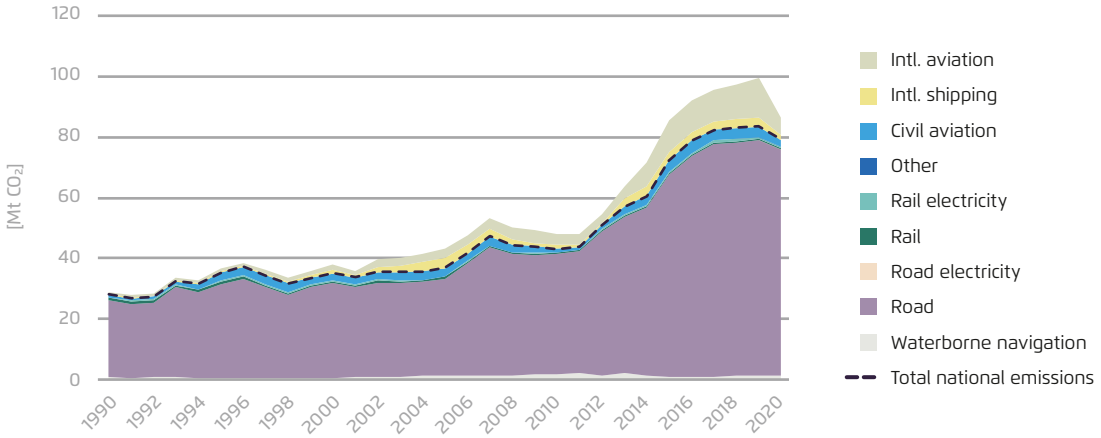
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

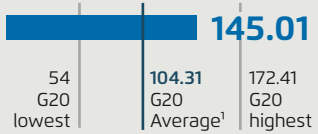
## Transport sector emissions by subsector



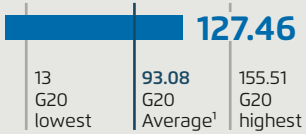

Source: IEA

# ENERGY

GASOLINE PRICE (2020)
US cents/litre



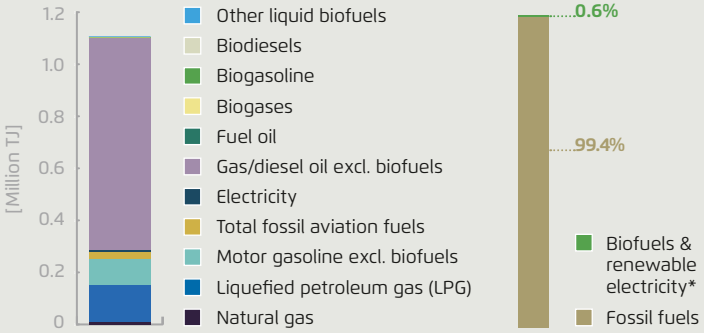

DIESEL PRICE (2020)
US cents/litre




Source: Globalpetrolprices.com*

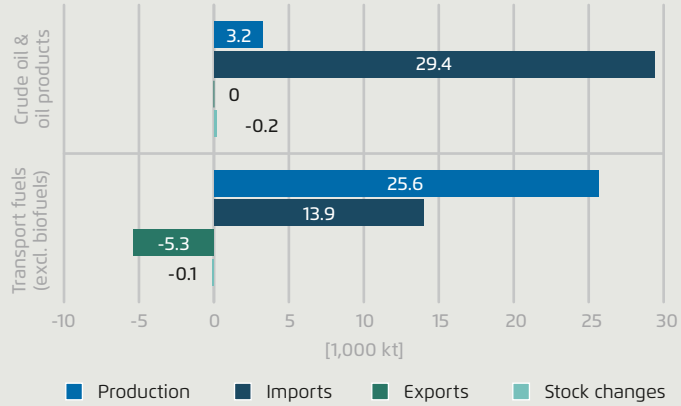
* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**[NO DATA] vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**[NO DATA]**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**[NO DATA]**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)


**[NO DATA]**
TOTAL FLEET GROWTH (2015–2021)

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**[NO DATA]**
SLOW CHARGE

**28,789***
SLOW CHARGE
G20 AVERAGE

**[NO DATA]**
FAST CHARGE

**43,927***
FAST CHARGE
G20 AVERAGE

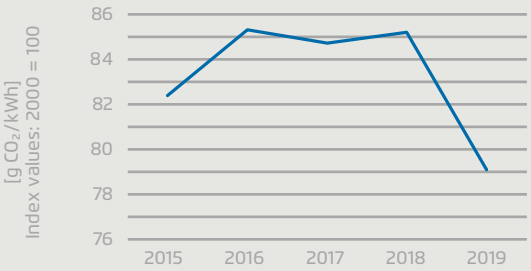
Source: IEA, 2021 *number of units

**Battery reuse and recycling**
- There is no regulation or policy in place that requires or promotes the re-use and recycling of batteries.

# LINKAGES TO THE ENERGY SECTOR

Non-renewable electricity in Turkey is mostly generated using coal and natural gas. In Turkey, renewable electricity production is mainly promoted through a guaranteed feed-in tariff set by the Turkish Renewable Energy Resources Support Mechanism (YEKDEM). The feed-in tariff is limited to 10 years and is scheduled to expire at the end of 2022; a follow-up system is under discussion. The system also includes purchase guarantees, connection and dispatch priorities, lower license fees, license exemptions in exceptional circumstances and various practical conveniences in project preparation and land acquisition. Since 2016, the right to develop 'Renewable Energy Resource Areas' (YEKA) is granted through reverse auctions.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 30% by 2023

Source: REN21

## The role of hydrogen

- Turkey does not yet have a hydrogen strategy in place, but it is currently under development.
- The draft strategy focuses on hydrogen production from renewable energy and coal.
- A number of technical initiatives and commercial studies are ongoing, mainly driven by the private sector.

Source: EnergyNews (2022), SWP (2022)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
21% reduction in GHG emissions in 2030 compared with BAU

**Transport related NDC measures**
A range of planned measures, including:
- Mode shift from road to rail and maritime
- Promotion of alternative fuels and clean vehicles
- Investment in rail infrastructure
- Replacement of old vehicles
- Reduction of fuel consumption measures

**Future targets at national level**
The Climate Change Action Plan for 2011–2023 has set the following targets:
- An increase in the share of rail freight from 5% (2009)
- to 15% and in the share of passenger transport from 2% (2009) to 10% by 2023
- A decrease in the share of highways in freight transport from 80% of tonne-kilometres in 2009 to below 60%, and in passenger transport from 90% of passenger-kilometres in 2009 to 72%

**National EV deployment targets**
30% of ZEVs in new truck and bus sales by 2030

**National ICE phase-out commitments**
100% of ZEVs in new truck and bus sales by 2040

# TRADE-OFFS

## Sustainability of biofuels

No measures to ensure sustainability of biofuels were found.

## Subsidies

**5.9 billion TRY**

**~319 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

Turkey already experienced low growth in 2019 with 0.9% and achieved higher growth in 2020 than 2019 at 1.8%. This picked up further in 2021 (+11%). Despite this, emissions from the transport sector decreased by 9% in 2020. Public transport ridership dropped by around 70% below pre-pandemic levels in spring 2020. Since July 2021, public transport ridership has been 20–40% above pre-pandemic levels. Car driving only saw a very short reduction in the first wave, and has been up to 100% above pre-pandemic levels in 2020 and up to 200% in 2021.

Source: IMF 2022, Google, Apple

# IMPLEMENTATION

## Mobility

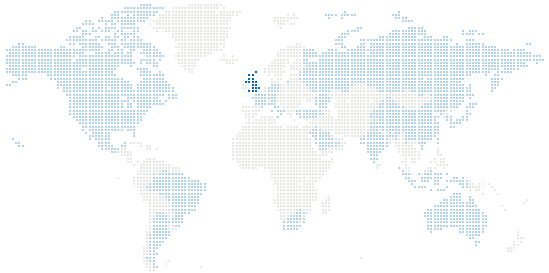
| | | |
|---|---|---|
| ✔ | **National programmes to support shift to public transport** | 2012 EE Strategy and Climate Change Action Plan to develop efficient transport systems and to increase the share of maritime and rail transport |
| ✔ | **Measures to support low-carbon freight logistics** | 2012 EE Strategy and Climate Change Action Plan to develop efficient transport systems and to increase the share of maritime and rail transport |
| | **National-level measures to support new mobility services** | No measures at national level |
| ✔ | **National measures to support non-motorised transport** | Climate Change Action Plan to develop and improve bicycle and pedestrian transport |

## Energy

| | | |
|---|---|---|
| | **Energy/carbon emission standards for light duty vehicles (LDV)** | No standard |
| | **Energy/carbon emission standards for heavy duty vehicles (HDV)** | No standard |
| | **Pricing instruments** | No $CO_2$ or energy consumption based taxes |
| ✔ | **Mandatory vehicle labelling** | Energy Label similar to EU regulation |
| ✔ | **Support mechanism for electric vehicles & charging infrastructure** | • Tax incentives for electric vehicles, incl. exemption from the new vehicle registration tax (SCT)<br>• Support to EV car manufacturing |

Source: Turkish national sources

# UNITED KINGDOM



**2.28%**
SHARE IN GLOBAL GDP (2020)

**4.92%**
TRANSPORT SECTOR SHARE GDP (2020)

**4.86%**
EMPLOYMENT IN TRANSPORT (2019)

Source: Office for National Statistics, UK Statistical Data

In the UK a large share of the population lives in and around London, but significant urban clusters are also located in central Britain, the Scottish lowlands, southern Wales, and the east of Northern Ireland. The UK is connected to mainland Europe via the Channel Tunnel, and also lies along important sea lanes. Road transport is the most important mode of passenger and freight transport.

The UK has a national target to reduce GHG emissions from transport by 34–45% below 2019 levels by 2030 and achieve net-zero emissions in the sector by 2050, in line with its target to become a net-zero economy by 2050. The country has set additional targets for 2030 for sustainable aviation fuels and aims to end the sales of new petrol and diesel cars and vans by that year, followed by other vehicle categories over the next decade.

## NDC

- ACHIEVE AT LEAST A 68% REDUCTION IN GHG EMISSIONS BY 2030 RELATIVE TO 1990 LEVELS
- ACHIEVE ECONOMY-WIDE NET-ZERO TARGET BY 2050

## EV TARGETS

- 30% OF ZEVS IN NEW TRUCK AND BUS SALES BY 2030
- 300,000 PUBLIC CHARGING STATIONS BY 2030

## POPULATION

**67 million people**
CURRENT POPULATION (2020)

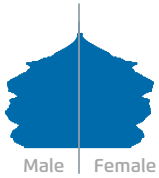
**0.9%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 6.9% (2020–2050)

**277.83 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**39.8 years**
AVERAGE AGE (2022)




Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**83.9% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

**56.3 million people**
TOTAL URBAN POPULATION (2020)

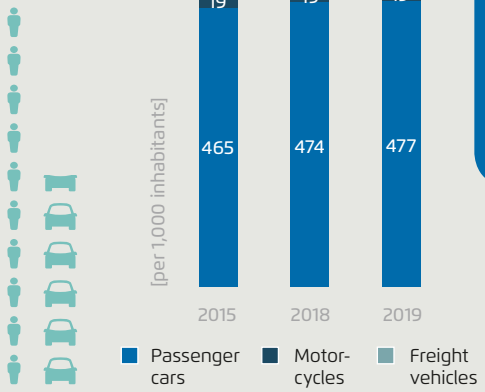
EXPECTED SHARE OF URBAN POPULATION: 90.2% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

**562.8 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2020)

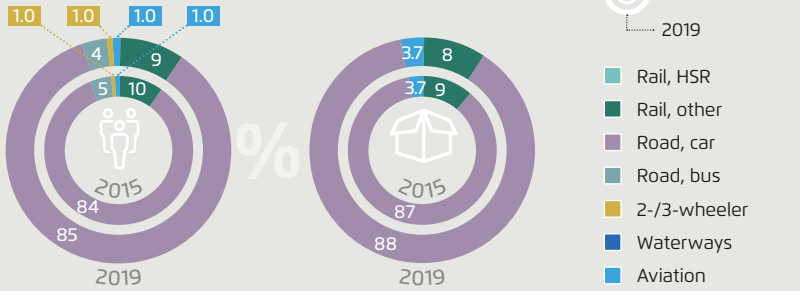
= 100 inhabitants
= 100 motor vehicles




Source: UK Statistical Data

**865.2 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

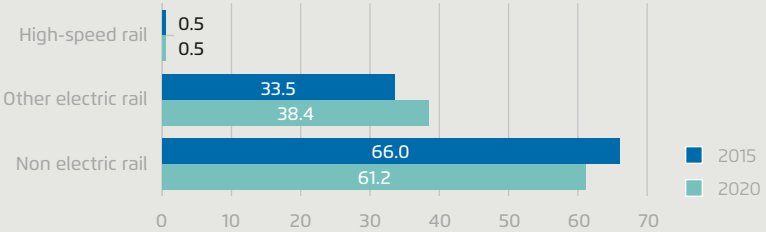
**186.6 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2019)




Source: World Development Indicators, ATO, ITF / OECD
* does not include all transport modes

Source: World Development Indicators, ITF / OECD,
** does not include all transport modes

## Rail infrastructure




Source: ITF / OECD

Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

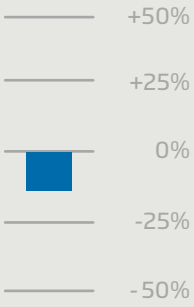
Total $CO_2$ emissions from fuel combustion in the UK decreased by 38% between 1990 and 2019. Emissions in the transport sector increased by 1% over the same period, but dropped just over 20% in 2020. As a result, the transport sector was responsible for over 35% of total emissions in 2019. Emissions from the sector increased between 1990 and 2007 and started declining afterwards. Between 2013 and 2017 transport emissions rose and then decreased again. Under a business-as-usual scenario, sector emissions are projected to decrease another 6% by 2030 and then increase again around 27% above 2020 levels by 2050.

**339.25 Mt $CO_2$**

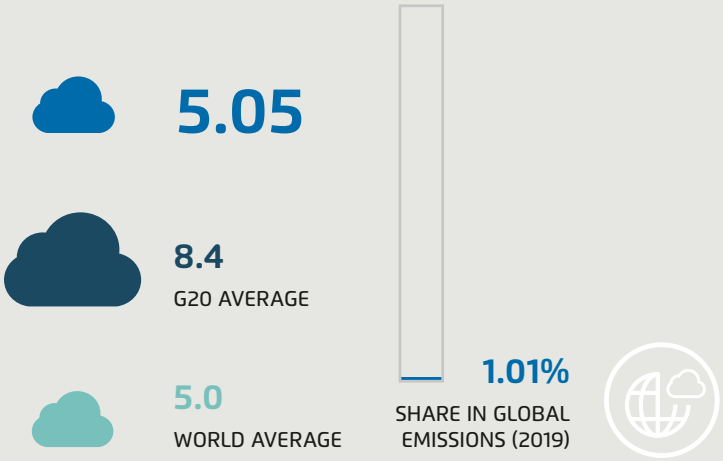
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**-13.9%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

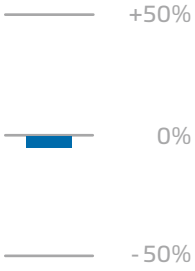
# TRANSPORT SECTOR EMISSIONS

**209.63 Mt $CO_2$**

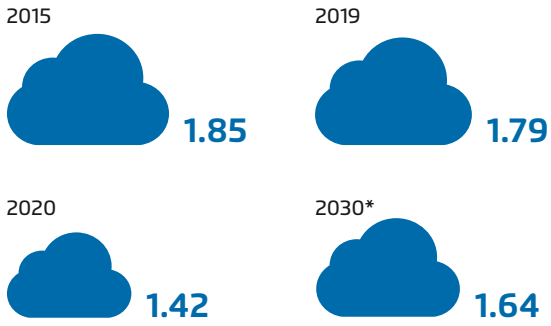
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**-4.9%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

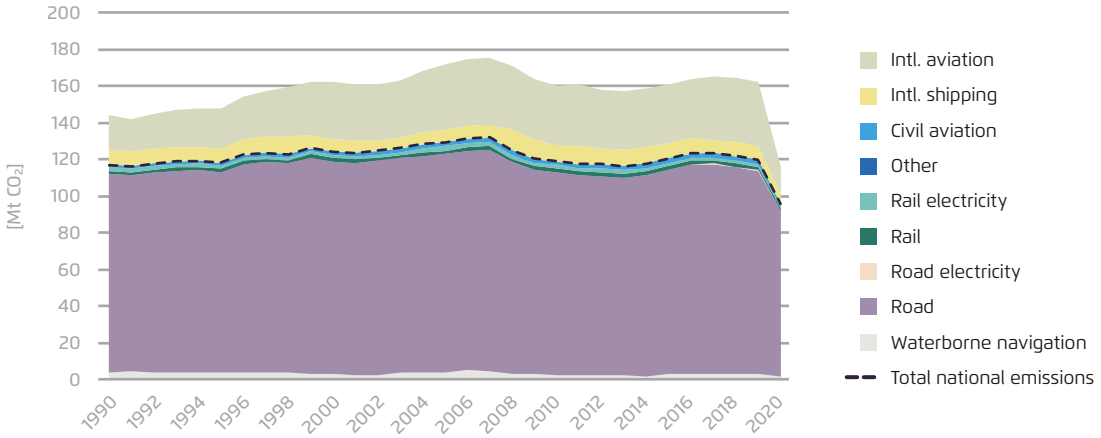
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

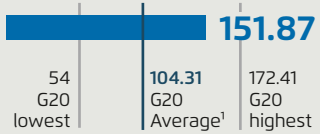
## Transport sector emissions by subsector




Source: IEA

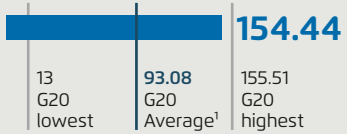
# ENERGY

GASOLINE PRICE (2020)
US cents/litre



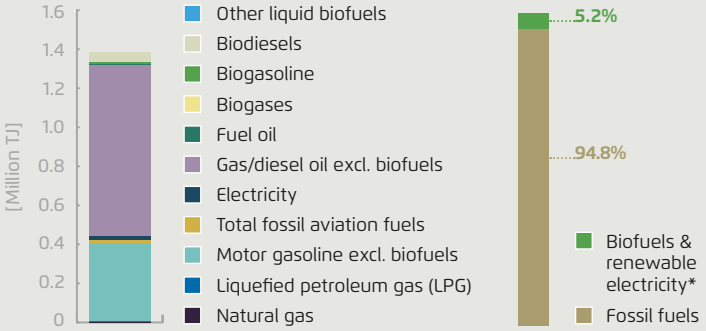

Source: Globalpetrolprices.com*

DIESEL PRICE (2020)
US cents/litre



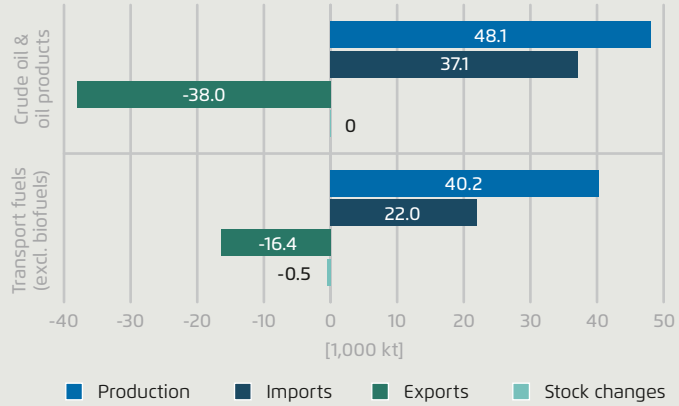

* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

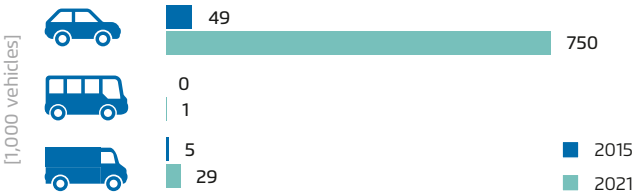
# ELECTRIC VEHICLES

**781,100 vehicles**
TOTAL STOCK OF ELECTRIC CARS (2021)

**2.3%**
SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

**19%**
MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)




**+1,338.2%**
TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)

**29,000***
SLOW CHARGE

**7,700***
FAST CHARGE

**28,789***
SLOW CHARGE
G20 AVERAGE

**43,927***
FAST CHARGE
G20 AVERAGE

Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**

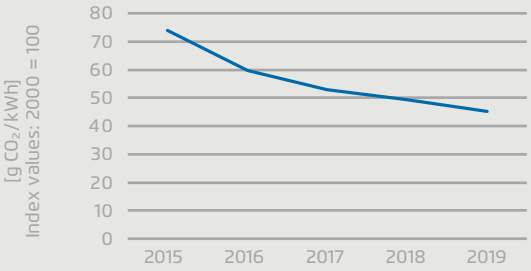
- Producers required to collect/take back and recycle batteries and accumulators (including those used in electric vehicles)
- Batteries may not be incinerated or dumped in landfill sites
- Approval is required for the collection, treatment, recycling, and export of batteries
- Batery producers must pay for collection, treatment, recycling, and disposal

Source: UK Government

# LINKAGES TO THE ENERGY SECTOR

Non-renewable electricity generation in the UK is mostly generated using natural gas and nuclear. Renewable electricity sources are supported mainly through the 'Contracts for Difference' scheme. The latest auction round, in December 2021, aimed to secure 12 GW of capacity, more than the three previous rounds combined. Previous schemes, such as the Renewables Obligation scheme and the feed-in tariff, were closed in 2017 and 2019, respectively. Since 2020, small-scale generation has been supported through a smart export guarantee regime, enabling market access for small producers.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 40 GW of offshore wind by 2030
- 1 GW of utility-scale solar by 2030

Source: REN21

## The role of hydrogen

- The UK released a hydrogen strategy in 2021.
- The UK aims to introduce 10 GW of low-carbon hydrogen production by 2030.
- In 2022, the Hydrogen Investor Roadmap was released with £240 million in funding up to 2025.
- Up to 2030, the focus will be on buses; afterwards, it will be on increasing hydrogen use in HDVs, shipping, and aviation.

Source: UK Government (2021, 2022), Ricardo

# AMBITION

## NDCs and national climate targets

**General NDC targets**
Committed to reduce economy-wide GHG emissions by at least 68% by 2030, relative to 1990s levels

**Future targets at national level**
- 34–45% reduction in transport emissions by 2030 relative to 2019 levels
- Make 10% of aviation fuels sustainable by 2030
- Net-zero emissions in transport by 2050

**National EV deployment targets**
- 30% of ZEVs in new truck and bus sales by 2030
- 300,000 public charging stations by 2030

**National ICE phase-out commitments**
- End the sale of new petrol and diesel cars and vans by 2030
- All new cars and vans must be zero emission at the tailpipe starting in 2035
- 100% of ZEVs in new truck and bus sales by 2040
- 100% zero-emission road vehicles by 2040, from motorcycles to buses and HGVs (under discussion)
- 100% zero-emission HDVs by 2035 (<26t) and 2040 (>26t) (under discussion)
- Deliver a net-zero rail network by 2050, with the ambition to remove all diesel-only trains by 2040

# TRADE-OFFS

## Sustainability of biofuels

Renewable fuels must meet an emissions-saving threshold that depends on the fuel type and when the production installations were built. Biofuels from feedstocks from forest biomass and residues and wastes from agriculture have additional criteria regarding the type of land allowed for feedstock.

## Subsidies

**3.73 billion GBP**

**~4,136 MILLION USD**

LEVEL OF FOSSIL-FUEL-SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

The UK experienced a 9.3% contraction of its economy in 2020 but growth resumed in 2021 at 7.4%. Some of this effect may also be due to the UK leaving the EU. National rail and the London tube saw ridership decreases of up to 95% by May 2020. Ridership recovered to around 40% of pre-pandemic levels by the end of 2020, before dropping again. Over 2021 and early 2022 ridership recovered slowly. Overall, emissions from the transport sector decreased by 23% in 2020, the third-highest value in the G20.

Source: IMF 2022, Google community mobility reports, Apple

# IMPLEMENTATION

## Mobility

| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | • National Bus Strategy, to improve bus services and mode integration<br>• Improvement of rail connectivity with other modes<br>• Integration of GHG emission reduction for transport investment allocation<br>• Clean air zone framework to support local low-emission zone implementation |
| ✔ **Measures to support low-carbon freight logistics** | • Expansion and upgrade of freight rail infrastructure<br>• Grants for intermodal hubs<br>• Mode shift revenue support scheme<br>• Funding for developing and piloting new solutions for urban freight<br>• 40% increase in transport investments in public and shared transport |
| **National-level measures to support new mobility services** | • Guidance for local governments on how to promote shared car ownership<br>• Mobility as a service code of practice (planned)<br>• 'Commute Zero' programme (planned) |
| ✔ **National measures to support non-motorised transport** | • Cycling and walking plan for England (2020) and investment strategy<br>• Employee benefit scheme for bicycles and safety equipment<br>• Subsidies for electric cargo bikes<br>• National funding for cycling infrastructure |

## Energy

| | |
|---|---|
| ✔ **Energy / carbon emission standards for light duty vehicles (LDV)** | **Current EU $CO_2$ efficiency standards:**<br>• Passenger cars: 95 g/km (2021) • Light commercial: 147 g/km (2020)<br>**Future standards (2030):**<br>• Passenger cars: 59 g/km • Light commercial: 101 g/km |
| ✔ **Energy / carbon emission standards for heavy duty vehicles (HDV)** | • The UK transitioned EU regulation to UK law<br>**Targets for average $CO_2$ emissions from new heavy duty-vehicles:**<br>• In 2025, 15% lower than in 2019 • In 2030, at least 30% lower than in 2019 |
| ✔ **Pricing instruments** | • First-year special registration tax based on $CO_2$<br>• Company car taxation based on $CO_2$<br>• Circulation tax based on $CO_2$<br>• Vehicle Excise Duty based on $CO_2$ |
| ✔ **Mandatory vehicle labelling** | National implementation of the EU Car Labelling Directive 1999/94/EC |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • $CO_2$/km, size, and range-based purchase subsidy scheme for passenger vehicles<br>• Purchase subsidies for all-electric and hydrogen buses<br>• Automotive Transformation Fund: 500 GBP to support EVs<br>• Consultations in progress to move to ZEV mandates by 2024<br>• Reduced taxation for company cars<br>• Support for charging infrastructure deployment, including for residential charging<br>• Proposed legislation would require charging infrastructure for new buildings and renovations |

Source: UK national sources

# UNITED STATES

**15.81%**
SHARE IN GLOBAL GDP (2020)

**4.20%**
TRANSPORT SECTOR SHARE GDP (2020)

**4.69%**
EMPLOYMENT IN TRANSPORT (2019)

Source: Bureau of Economic Analysis, U.S. Bureau of Labor Statistics

The US features large urban clusters on its western and eastern seaboards, while inland areas are less densely populated. The large distances between cities make air travel an increasingly important mode of transport, accounting for 15% of passenger transport volume in 2019. Mass transit and rail travel play a minor role in passenger transport, with a share below 1%, the lowest in the G20. However, rail plays an important role in freight, accounting for just over 40% of freight volume in 2017.

In the long term, the US aims to reduce GHG emissions from aviation to or below 2019 levels by 2030 and to set a related sustainable aviation fuel target. Half of LDV sales are to be electric by 2030 and the government aims to replace its complete fleet with electric vehicles by 2035. Tax incentives to support the electrification targets are strongly enhanced in the new 'Inflation Reduction Act'.

## NDC

- ACHIEVE A GHG EMISSION REDUCTION OF 50–52% BY 2030 RELATIVE TO 2005 LEVELS
- ACHIEVE ECONOMY-WIDE NET-ZERO TARGET BY 2050

## EV TARGETS

- 50% LDVS IN NEW SALES BY 2030
- 100% SHARE OF ZEVS IN GOVERNMENT PROCUREMENTS BY 2035, INCLUDING 100% ZEVS IN LIGHT-DUTY VEHICLE ACQUISITIONS BY 2027

## POPULATION

**329 million people**
CURRENT POPULATION (2020)

**4.2%**
SHARE OF GLOBAL POPULATION (2020)

EXPECTED POPULATION GROWTH: 11.7% (2020–2050)

**36.02 people/km²**
POPULATION DENSITY (2020)

**60 people/km²**
WORLD AVERAGE

**37.9 years**
AVERAGE AGE (2022)


Source: World Development Indicators, World Population Prospects 2022

## URBANISATION

**82.7% of total**
URBAN POPULATION (2020)

**61.6%**
G20 AVERAGE

**56.2%**
WORLD AVERAGE

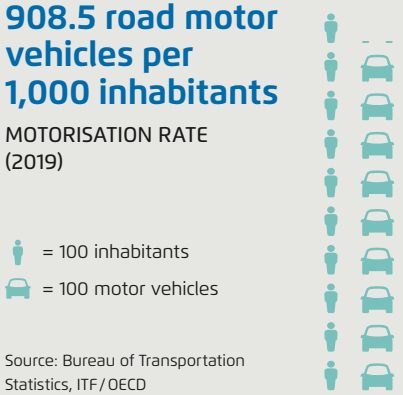
**274 million people**
TOTAL URBAN POPULATION (2020)

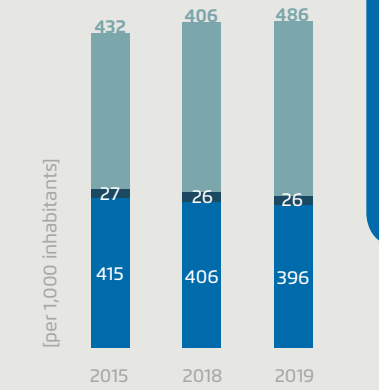
EXPECTED SHARE OF URBAN POPULATION: 89.2% (2050)

Source: World Urbanisation Prospects 2018

## MOBILITY

**908.5 road motor vehicles per 1,000 inhabitants**
MOTORISATION RATE (2019)

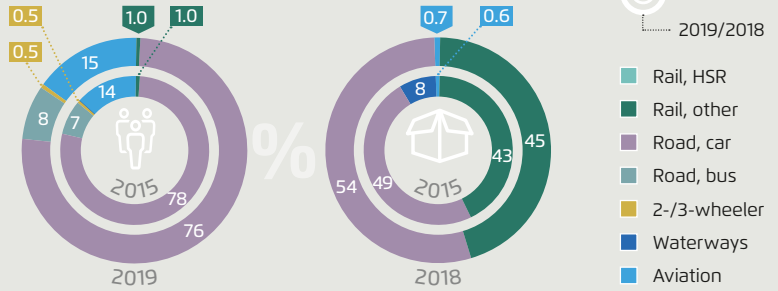



Source: Bureau of Transportation Statistics, ITF / OECD

**7,989.1 billion passenger-km**
PASSENGER TRANSPORT VOLUME* (2019)

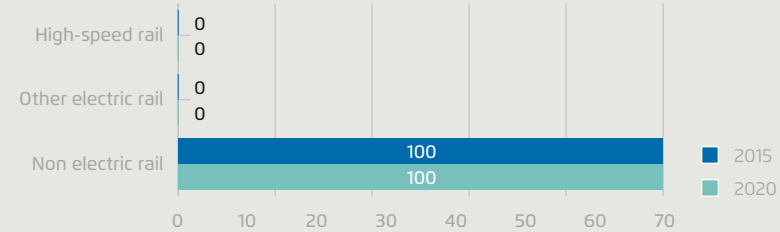
**5,589.2 billion tonne-km**
FREIGHT TRANSPORT VOLUME** (2018)




Source: Bureau of Transportation Statistics
* does not include all transport modes

Source: World Development Indicators, ITF / OECD
** does not include all transport modes

### Rail infrastructure




Source: RAILISA STAT UIC

Due to the effects of the COVID-19 pandemic, emissions data from 2020 might show a misleading declining trend. We therefore show 2019 data, unless we show timelines that include 2020.

# TOTAL EMISSIONS

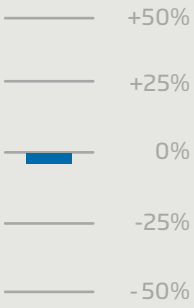
Total $CO_2$ emissions from fuel combustion in the US decreased by 1% between 1990 and 2019. Emissions from the transport sector increased by 23% over the same period, and now account for just over 37% of total emissions. Per capita transport emissions are the highest in the G20. Aviation plays an important role in domestic transport, representing 7.4% of sector emissions, the second-highest share in the G20. Under a business-as-usual scenario, sector emissions are projected to decrease 11% by 2030 and 17% by 2050 relative to 2020 levels.

**4,744.45 Mt $CO_2$**

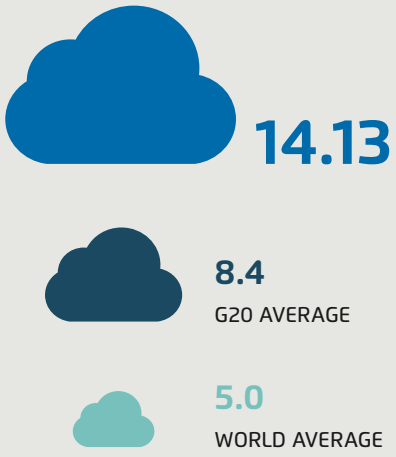
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)

**-3.7%**

CHANGE IN TOTAL EMISSIONS (2015–2019)




TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION PER CAPITA (2019)




t $CO_2$ per capita

Sources: IEA

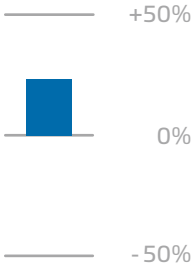
# TRANSPORT SECTOR EMISSIONS

**1,763.18 Mt $CO_2$**

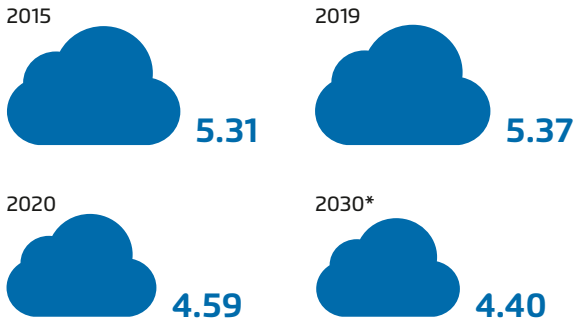
TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION IN THE TRANSPORT SECTOR (2019)

**23.3%**

CHANGE IN TRANSPORT SECTOR EMISSIONS (1990–2019)




TOTAL $CO_2$ EMISSIONS PER CAPITA IN THE TRANSPORT SECTOR




t $CO_2$ per capita

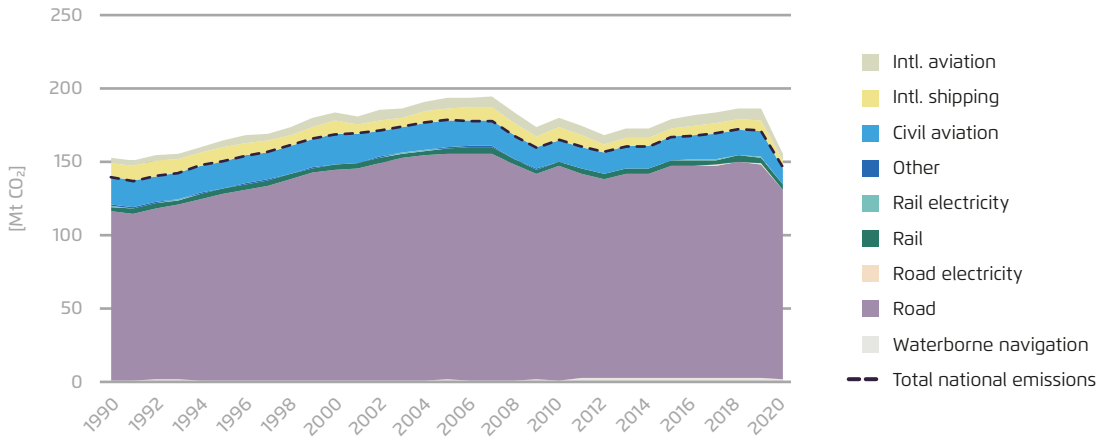
Sources: IEA, SLOCAT, UNDESA

* projected emissions under an average business-as-usual scenario

SHARE OF TRANSPORT EMISSIONS IN TOTAL $CO_2$ EMISSIONS FROM FUEL COMBUSTION (2019)


Source: IEA

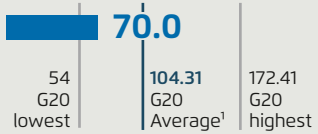
## Transport sector emissions by subsector




Source: IEA

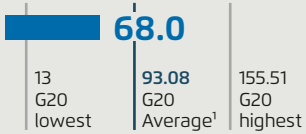
# ENERGY

GASOLINE PRICE (2020)
US cents/litre



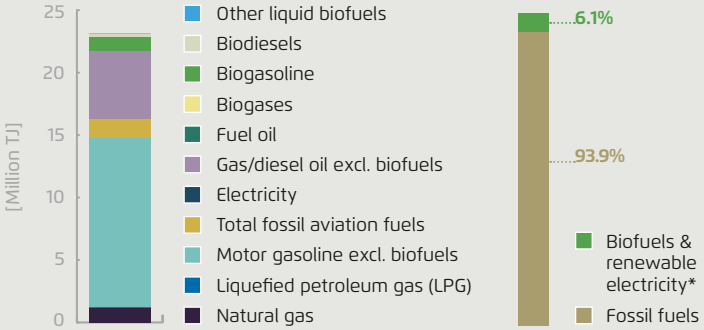

Source: Globalpetrolprices.com*

DIESEL PRICE (2020)
US cents/litre



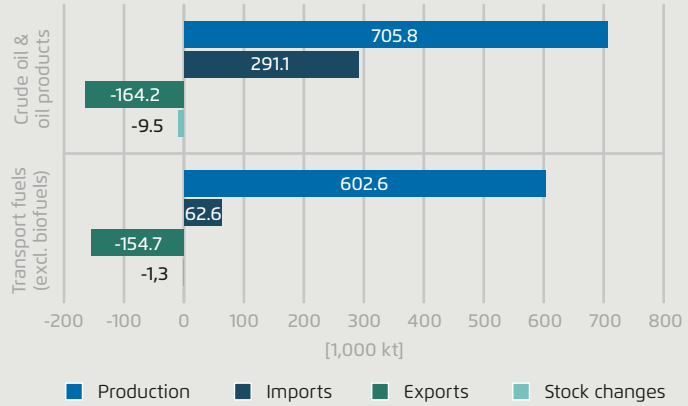

* local currency prices converted using OECD annual exchange rates

## Energy use in transport by fuel




*electricity split calculated based on share of renewables
Year: 2020 Source: IEA World Energy Statistics

## Fuel supply and use




Year: 2020 Source: IEA World Energy Statistics

# ELECTRIC VEHICLES

**2,032,300 vehicles**

TOTAL STOCK OF ELECTRIC CARS (2021)

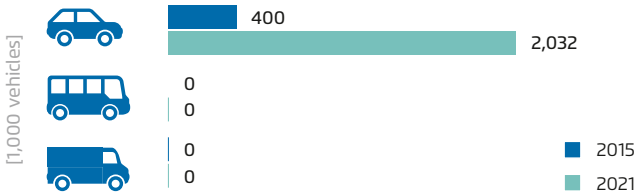
[NO DATA]

MARKET SHARE OF ELECTRIC CARS IN NEW SALES (2021)

[NoData]

SHARE OF ELECTRIC CARS IN TOTAL PASSENGER CAR STOCK (2021)

ELECTRIC CAR FLEET BY VEHICLE TYPE (2015 VS. 2021)




[NoData]

TOTAL FLEET GROWTH (2015–2021)

Source: IEA EV Data Explorer

PUBLICLY ACCESSIBLE CHARGING INFRASTRUCTURE (2021)



[NoData]
SLOW CHARGE

**28,789***
SLOW CHARGE
G20 AVERAGE

[NoData]
FAST CHARGE

**43,927***
FAST CHARGE
G20 AVERAGE

Source: IEA EV Data Explorer *number of units

**Battery reuse and recycling**

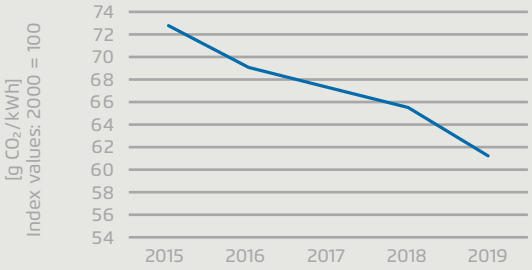
- There is no regulation in place that requires the re-use and recycling of batteries.
- The Infrastructure Investment and Jobs Act provides funding for research and local government programmes.
- The proposed Battery and Critical Mineral Recycling Act, introduced into Congress in 2021, would create incentives for re-use and recycling and establish a task force on producer requirements.

Source: ACS Energy Letters (2022), U.S. Congress

# LINKAGES TO THE ENERGY SECTOR

In the US, natural gas and coal are the primary fuels for power generation, followed by nuclear. One of the main policies for supporting renewables was the Renewable Electricity Production Tax Credit (PTC). Electricity from wind, closed-loop biomass, and geothermal sources that commenced construction before December 31, 2021 received the PTC, which expired for all renewables after this date. A second policy for supporting renewables is the Business Energy Investment Tax Credit (ITC), which, depending on the technology, applies corporate tax credits at varying rates. The Residential Renewable Energy Tax Credit allows US residents to claim a credit for qualified expenditures for their personal taxes. The credit rate is decreasing and the programme is scheduled to expire at the end of 2023. The current credit rate is 26%. The 2022 Energy and Climate Bill introduces further support, mostly in the form of tax credits.

## $CO_2$ intensity of power




Source: IEA

## Existing targets for renewable electricity generation

- 100% carbon pollution-free electricity by 2035

Source: US LCDS 2021

## The role of hydrogen

- The hydrogen strategy in place focuses on R&D.
- The Infrastructure Investment and Jobs Act of 2021 contains a $9.5 billion budget to boost clean-hydrogen development.
- Hydrogen Earthshot initiative aims to reduce the cost of hydrogen by 80% to $1 per 1 kilogramme in the next decade ("111 Goal").

Source: US Department of Energy, US Congress; WEF (2022)

# AMBITION

## NDCs and national climate targets

**General NDC targets**
Committed to reduce GHG emissions by 50–52% by 2030 relative to 2005 levels

**Transport related NDC measures**
- Tailpipe emission and efficiency standards
- Incentives for zero-emission personal vehicles
- Funding for charging infrastructure
- Investment in transport infrastructure to support the shift to public and active transport modes

**Future targets at national level**
- Reduce greenhouse gas emissions from aviation to or below 2019 levels (216 Mt $CO_2$) by 2030
- Production of 3 billion gallons of sustainable aviation fuel by 2030
  National EV deployment targets
- 50% of LDV sales by 2030
- 100% share of ZEVs in federal government vehicle procurement by 2035, including 100% share of ZEVs in light-duty vehicle acquisitions by 2027
- Build a national network of 500,000 EV chargers by 2030

# TRADE-OFFS

## Sustainability of biofuels

To meet environmental objectives, lifecycle greenhouse gas emissions need to show a minimum reduction against a petroleum baseline. Thresholds are defined for different combinations of feedstock, production processes and fuels, and range from 20 to 60%.

## Subsidies

**3.65 billion USD**

**3,650 MILLION USD**

LEVEL OF FOSSIL-FUEL SUBSIDIES IN THE TRANSPORT SECTOR (2020)

Source: OECD

# COVID

The US economy contracted by 3.4% in 2020, but growth resumed in 2021 at a rate 150% higher than before the pandemic. Public transport ridership in the twenty-largest metropolitan areas fell by 40–85% between March and April 2020. While ridership increased again slightly later in 2020, levels remained substantially below pre-pandemic levels in early 2021. Commuter rail agencies reported that ridership remained 59% below pre-pandemic levels by September 2021. Overall, emissions from the transport sector decreased by 12% in 2020.

Source: IMF 2022, GAO, Yi et al (2021)

# IMPLEMENTATION

## Mobility

| | |
|---|---|
| ✔ **National programmes to support shift to public transport** | Various funds that support investment in public transport infrastructure, integrated mobility innovation, and service quality |
| ✔ **Measures to support low-carbon freight logistics** | • Capital investment grants for heavy rail<br>• Inflation Reduction Act: 1 billion funding for the support of heavy duty vehicle electrification |
| ✔ **National-level measures to support new mobility services** | • Federal Automated Vehicles Policy<br>• 2021 comprehensive plan for automated vehicles<br>• Shared-use mobility centre |
| ✔ **National measures to support non-motorised transport** | • Bicycle and Pedestrian Program<br>• Funding programmes for active mobility infrastructure and planning<br>• Active transportation funding and finance toolkit |

## Energy

| | |
|---|---|
| ✔ **Energy / carbon emission standards for light duty vehicles (LDV)** | **Currently applicable standards (2022):**<br>• Passenger cars: 116 g/km<br>• Light commercial: 169 g/km<br>**Future standards (2026):**<br>• Passenger cars: 1.8 g/km<br>• Light commercial: 157 g/km<br>**Standards are currently under revision and proposed to increase by 1.5%** |
| ✔ **Energy / carbon emission standards for heavy duty vehicles (HDV)** | • Phase 1 (2014–2018): 6–23% fuel savings compared with 2010 baseline<br>• Phase 2 (2018–2027): 16–30% fuel savings compared with 2010 baseline |
| **Pricing instruments** | No $CO_2$ or energy consumption-based taxes |
| ✔ **Mandatory vehicle labelling** | EPA Motor Vehicle Fuel Economy Label |
| ✔ **Support mechanism for electric vehicles & charging infrastructure** | • Tax credits for EV purchases and additional rebates under the new climate and energy bill, including for used vehicles; linked to some 'place-of-origin' requirements<br>• US$5.5 billion earmarked for charging infrastructure investment, including in rural areas<br>• Support for domestic production facilities for EVs and critical minerals<br>• Inflation Reduction Act 2022:<br>1. EV tax credit for vehicles (new & used) and charger credit<br>2. Promotes production of EV components within the US or in countries with trade agreements |

Source: U.S. national sources

# 05

# SUMMARY AND RECOMMENDATIONS

# 05 | Summary and recommendations

The economies of the G20 are responsible for the lion's share of global economic activity, and, by extension, for the preponderance of global GHG emissions. Given the role of transport as a backbone for economic activity, international climate action must give adequate attention to the sector – not least because transport is the only sector in which notable reductions have not been achieved since 1990. Quite to the contrary: **transport emissions have been spiking on the back of increasing motorisation around the globe.**

The G20 confirmed its steadfast commitment to the Paris Agreement at the 2022 summit in Bali. In the official statement from this summit, the G20 underlined the "urgency to rapidly transform and diversify energy systems" and declared its dedication to "accelerating and ensuring clean, sustainable, just, affordable, and inclusive energy transitions" while also encouraging the "flow of sustainable investments".

Due to the pandemic and growing geopolitical tensions, the international commitment to climate action is currently facing challenges with even the strong economies of the G20 coming under significant pressure. The fact that climate action is not being accorded the necessary attention is apparent in the specific content of the Bali G20 declaration, including lack of reference to the importance of decarbonizing and reshaping transport. Individual G20 members face divergent challenges when it comes to socioeconomic transformation in general and the remaking of the transport sector in particular. China and India still have relatively low per capita emissions, but absolute transport-related emissions have increased dramatically in recent years. The transformation of the energy sector towards renewable energy is a difficult task for most countries, in part because of the need for robust change in core economic sectors, such as vehicle manufacturing. In addition, current tectonic shifts in geopolitics mean greater economic competition between China, India, and Indonesia, on the one hand, and the US, Western Europe, and Japan, on the other.

Divergent challenges to effective climate action are also evident in the disparity between industrialised and emerging economies. All international actors need to expand their ambition. But while emerging economies need to address rapid motorisation and staggering growth rates in the transport sector, industrialised countries, by contrast, need to bring down high per capita emissions, and, by extension, total emission levels. COP26 has seen an unprecendeted number of new transport related commitments, yet policies thus far have not resulted in an observable slowing of existing trends. Regretably, COP27 has also failed to trigger accelerated action in transport. On a positive note, there was no retreat from existing commitments.

During the G20 presidency of India, experts hope that transport and the decoupling of emissions from economic growth will play a more central role in the nation's agenda. By providing insight into national decarbonisation trends, this report aims to serve as a basis for discussion as well as an impetus for policy direction.

Having a clear and ambitious vision for the future of the transport sector is crucial for bringing about radical change in the movement of people and goods. In this regard, an important first step is formulating a Nationally Determined Contribution (NDC) and setting corresponding targets in national energy policy. However, setting targets is a futile endeavour in the absence of clear policies and measures that will bring about their attainment. Legislators must pass laws that encourage the testing and implementation of new ideas and concepts. Yet they must also promote the accelerated expansion of proven low carbon systems and ensure policies take a holistic approach, addressing the linkages to other sectors, such as energy and land use.

Public transport infrastructure, for example, will be key not only to reducing GHG emissions in passenger transport, but also to improving the quality of urban life by reducing congestion, air pollution and traffic fatalities.

The broader changes needed to transform the transport sector are illustrated with the aid of the diagram shown in figure 5.1. The "mobility transition" is about changing how people get around. Its goal is decreasing final energy consumption in the transport sector

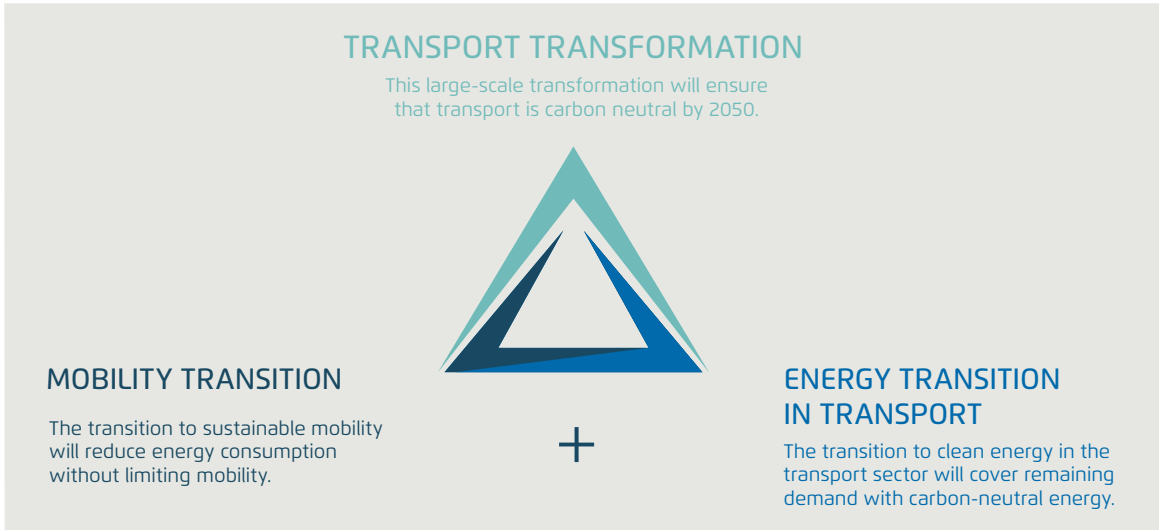
without restricting individual mobility. The "energy transition in transport" refers to the technological transformation needed to serve mobility demand more efficiently while generating lower emissions (Agora Verkehrswende 2017a). The success of the "transport transformation" as a whole thus rests on both a "mobility transition" and an "energy transition in transport".

The model is a further elaboration of the "Avoid, Shift and Improve" strategy, which is at the core of the transport transformation. Avoid–Shift–Improve approaches are critical for achieving a just energy transition in transport. Fortunately, G20 countries have already begun this important work.

Fossil fuel subsidy reform can realign market signals to avoid unnecessary vehicle trips and accelerate the uptake of renewable electricity for low-carbon mobility. From 2014 to 2017, India incrementally reduced oil and gas subsidies by 75%, while increasing funding for renewable energy six-fold. Indonesia has reallocated some fossil fuel subsidies for education, health, and infrastructure projects, including renewables and public transport.

Increasing investments to more energy-efficient means of passenger and freight transport can also help shift consumer demand toward lower-carbon transport. Saudi Arabia has launched high-speed rail to boost development and relieve congestion. Turkey is developing 16 new high-speed rail lines to triple its network length by 2023. France has banned short domestic flights that can be easily replaced by rail. Brazil aims to double the share of its freight transported via rail by 2035, and India has set a target to move at least 50% of goods via rail by 2030 and fully electrify its rail system by 2024. Argentina is adopting new freight technologies to reduce transport emissions by 8.4% by 2030.

The geometry of the Transport Transformation — Figure 5.1




**Agora Verkehrswende (2023)** | Source: Authors's illustration based on Agora Verkehrswende (2017a)

Though not a silver bullet for transport decarbonisation, electric vehicles can improve energy efficiency by producing about 20% less $CO_2$ emissions than internal combustion engines. Private companies such as Audi and Jaguar (supported by GridCars) are installing public charging stations in South Africa in major hubs and along frequently travelled routes. In India, two- and three-wheelers are the most widely used modes of transport. The country's 2030 electrification target for these modes will help to lower carbon emis-

sions. Lastly, Brazil, in order to meet the growing demand for electric buses, has launched a domestic manufacturing and assembly industry with various companies, including BYD, Daimler, and Eletra.

Going forward, it is important that countries continue to focus on avoid and shift measures in addition to direct electrification. This will lower energy demand in the transport sector while increasing the supply of renewable energy for other uses.

## More rapid action is needed

**Delayed action will require more painful changes later**

While there were promising policy developments in some countries over the last years, far more ambition is needed in the transport sector to achieve the objectives of the Paris Agreement and to uphold the commitments from COP26. The year-over-year growth in transport-sector emissions showed a marginal decrease of -0.15% in 2019 and some G20 countries in fact have witnessed a reduction in emissions since 2015. However, overall G20 transport emissions grew by almost 6% in 2015–2019.

**Only a few countries are moving forward with new action**

Despite some positive trends in the area of fuel efficiency, ICE phase out, emission standards, and EV policy support, new large-scale measures to support the rapid decarbonisation of the transport sector are still lacking.

## A focus on fuel standards and electrification is not enough

**Not enough focus on changing mobility patterns**

Since 2018 many countries have taken steps towards the electrification of road transport, setting objectives for EV penetration, sales, and charging infrastructure, although with varying degrees of ambition. In many cases, these objectives are backed up with specific support policies.

A sole focus on vehicle technology will not be sufficient for decarbonisation given a growing population, increasing motorisation rates, and growing vehicle sizes. Indeed, more efficient transport systems are essential for achieving a decarbonisation pathway in the transport sector. Measures that support a shift to more efficient, less carbon-intensive modes of transport remain too few and far between. While all countries are investing in public transport infrastructure, this investment has often failed to keep pace with rising demand. Greater efforts are needed to develop new mobility services and make public transport, low-carbon freight alternatives, and non-motorised transport more attractive.

**Measures that reduce transport demand without compromising mobility are needed**

The G20's 2019 Energy Efficiency Leading Programme (EELP) recognised the importance of "behavioral change". While such recognition was a welcome first step, little has been achieved since then, and the 2022 Bali summit has not provided any impetus for action in the transport sector. Further, the pandemic and geopolitical shifts appear to have dampened national ambitions. Countries need to implement policies that reduce transport demand. Modern communication technologies are an important catalyser of change in this area, for they enable optimised traffic routing and provide alternatives to travel, such as videoconferencing.

In this regard, it is important to remember that harnessing the power of information technology to lower transport demand necessitates broad access to reliable, high-speed communication infrastructure.

**Ongoing efficiency efforts must be complemented by measures to reduce vehicle weight**

One development undermining efforts to augment the energy efficiency of light duty vehicles is the trend toward larger, heavier vehicles such as SUVs, even for battery electric vehicles. To ensure that efficiency gains ultimately achieve envisaged carbon reductions, measures need to be tailored in a way that encourages the use of smaller, lighter vehicles.

## Electricity used in the transport sector needs to come from renewables

**Support measures that target electrification or power-to-X technologies should be linked to renewable requirements**

Greater electrification of land-based transport and the expansion of power-to-X fuels for aviation and shipping will only encourage decarbonisation assuming

that there is a greater reliance on zero or low carbon electricity. Grid emission factors allow us to observe progress in the energy transition of the power sector. In G20 countries, however, this statistic is not declining at the required pace. While most countries show at least moderate improvement in grid emission factors, four G20 countries – namely, Brazil, Indonesia, Japan, and South Africa – now have higher GHG emissions per kWh in relation to 1990.

**Market ramp-up of power-to-X fuels requires intensified collaboration and investment**

While the direct use of electricity is the most efficient means of lowering the GHG emissions of road transport, long-haul aviation and maritime shipping will remain dependent on energy dense fuels. So-called power-to-X fuels provide a pathway for the replacement of conventional fossil energy carriers with carbon-neutral alternatives. However, to achieve the desired impact of lowering net-$CO_2$ emissions, green power-to-X fuels must be produced in substantial quantities – and as of 2022, the industry is still in a nascent state.

G20 member states should take a leading role in the market-ramp up of power-to-X by adopting ambitious policies that increase available funding while also providing guarantees for investors. Cooperation between member states can be enhanced by fostering Just Energy Transition Partnerships and by introducing support for power-to-X technologies in partnership agreements. In third countries with favorable production potential, G20 countries can act as enablers by setting up partnerships on equal terms as part of projects for direct foreign investment and technology transfer.

**Fossil-fuel subsidies should be eliminated**

Many countries have started to reduce fossil-fuel subsidies, such as India, which phased out price controls for transport fuels in late 2014. However, overall subsidy levels are still distorting the market, giving carbon-intensive modes of transport an undue advantage.

Revenues spent or forfeited to finance fossil-fuel subsidies could instead be used to enhance the availability and cost-competitiveness of public transport and to support both the electrification of vehicles and the market uptake of electricity-based zero carbon fuels for aviation and shipping.

Eliminating effects that distort the price of fossil fuels would also support a higher share of renewables in the power mix. As electrification is an important tool in many countries for addressing local air pollution, a shift towards fully renewable power generation would help to reduce GHG emissions in the power sector while also supporting zero-carbon transport options.

## G20 activities should reflect the need for integrated system approaches

**Thinking "outside-of-the-box" is required**

Many of the necessary developments in the transport sector, such as electrification and digitalisation, require close integration with other sectors. The organisational structure of G20 working groups and task forces should reflect this fact. To date, the G20 has yet to establish a work stream dedicated to transforming transport. By pooling expertise of IT, transport, and power grid experts, it should be possible to identify measures that can promote greater integration between the power and transport sectors, and, by extension, guide the decarbonisation of the transport sector and energy economy as a whole.

# 06

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# 07

# ANNEX: DATA SOURCES FOR FACTSHEETS

# 07 | Annex: Data sources for factsheets


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