3.7

Fuel Economy

Key findings

Demand trends

- Fuel economy improvements slowed in 2017 to an annual rate of just 0.2% in advanced economies and 2.3% in emerging economies, well below the target rate of 3.7% set by the Global Fuel Economy Initiative (GFEI).
- Average fuel economy in the European Union (EU) has worsened and is falling short of standards needed to meet the region's 2021 efficiency target, due in part to a 5-15% decline in the market share of diesel vehicles (which are more efficient) since 2014 and to a slow scale-up of electric vehicles.
- The market share of sport utility vehicles (SUVs) increased 15% between 2014 and 2019, offsetting the overall positive impacts of efficiency improvements in vehicles. SUVs were the second largest contributor to the increase in global carbon dioxide (CO_2) emissions among all energy sectors.
- Rising vehicle sales in developing and emerging markets also affected the global fuel economy average, with sales in emerging markets increasing 2% over those in advanced markets between 2015 and 2017.
- The used vehicle market is a major share of vehicle sales in the Global South. Africa imported the largest number of used vehicles (40%) during 2015-2018, followed by Eastern Europe (24%), Asia-Pacific (15%), the Middle East (12%) and Latin America (9%).

Emission trends

- Improving the efficiency of passenger transport saved the equivalent of 2.5 exajoules of energy from 2015 to 2018; however, this resulted in only halving the increase in transport energy use. Other factors contributing to increases in transport energy use include: increased vehicle activity; a shift towards private vehicles in developing countries; older, larger and more polluting vehicle types; and low occupancy rates (such as large vehicles with spare capacity or vehicles returning empty) as well as the shift from diesel vehicles.
- Achieving a fuel economy of 4.4 litres of gasoline-equivalent (lge) per 100 kilometres for new light-duty vehicles (compared to the current level of 7.2 lge in 2017) could save around 359 billion lge and avoid 844 million tonnes of CO_2 emissions from 2005 to 2030. This would result in a 16% reduction in business-as-usual emissions by 2030.
- Adding a shift to electric vehicles alongside improvements in internal combustion engines could achieve further CO_2 emission reductions of 3 million to 5 million tonnes per year, depending on how electricity grids are decarbonised.

Policy measures

- As of 2020, 54 countries had established fuel economy policies, such as labelling schemes that help consumers compare vehicle choices and understand tax implications over the lifetime of the vehicle.
- By 2019, 89 developing countries across Asia, Africa, Latin America and Eastern Europe had made national and regional commitments to improve fuel economy.
- Complementary "Avoid" and "Shift" strategies must be adopted to achieve the additional 2-5 million tonnes of annual CO_2 emission reductions from road transport needed to meet Paris Agreement goals.
- A number of emerging economies and regions are setting roadmaps and targets to accelerate the transition to more efficient vehicles through fuel economy improvements.
- In 2019 and 2020, no new national fuel economy mandates were adopted for trucks and other heavy-duty vehicles. **Canada**, **China**, the **EU** (including the United Kingdom, **UK**), **India**, **Japan** and the United States (**US**) remain the only entities with fuel economy standards for heavy-duty vehicles.
- Fuel economy policy is increasingly being integrated into wider frameworks for promoting the transition to electric vehicles.

Impacts of the COVID-19 pandemic

- In the wake of the pandemic, there has been pressure on regulators to ease future vehicle fuel economy and emission standards, which are critical to addressing the climate crisis and the health impacts of air pollution.
- Following the pandemic, many national and local trends point towards a short-term exodus from public transport and a shift to greater passenger car use, highlighting the need to maintain robust fuel economy standards.

Overview

Road transport is a major air polluter, contributing significant emissions of fine particulate matter and black carbon. Overall, transport is responsible for 25% of human-caused black carbon emissions, of which three-quarters are produced by diesel-powered heavy-duty vehicles.[1]

The average fuel economy of passenger vehicles in 2017 was 7.2 litres of gasoline-equivalent (lge) per 100 kilometres.[2] Between 2018 and 2019, overall fuel consumption increased in Europe but declined in China, the Republic of Korea and the US.[3] Improving the efficiency and fuel economy of all vehicles (particularly internal combustion engine vehicles) can result in a projected savings of 5 million tonnes of CO_{2eq} emissions annually by 2050, compared with current policies.[4] Such actions continue to be vital for decarbonising transport.

To maximise emission reductions, a switch to vehicle technologies with zero tailpipe emissions is also needed. This could save another 5 million tonnes of CO_{2eq} emissions annually by 2050, especially if combined with bans on internal combustion engine vehicles by 2030.[5] These steps will be especially important in the wake of the COVID-19 pandemic, when many national and local trends point towards a shift to greater passenger car use (*see Box 1*).[6]

The Global Fuel Economy Initiative (GFEI) is a partnership of six leading transport and energy organisations[i].[7] It serves as a global reference point on the improvement of fuel economy standards and has set a target to double the average fuel economy of light-duty vehicles by 2030, reducing CO_2 emissions 90% by 2050 (compared to 2005).[8] Meeting this target requires a 3.7% annual improvement in fuel economy, which countries are not yet close to meeting, as they have only achieved a 1.5% annual improvement.[9] The GFEI has also set reduction targets for two- and three- wheeled vehicles, heavy-duty vehicles and buses (*see Figure 2*).[10]

Demand trends

Fuel economy improvements slowed in 2017 to an annual rate of just 0.2% in advanced economies and 2.3% in emerging economies, well below the target rate of 3.7%.[11] This is in part because of rising vehicle sales in less-regulated markets, a trend towards larger vehicles, and fewer sales of (more efficient) diesel vehicles in **Europe**; meanwhile, growing sales of electric vehicles have yet to reach a significant share of the total market.

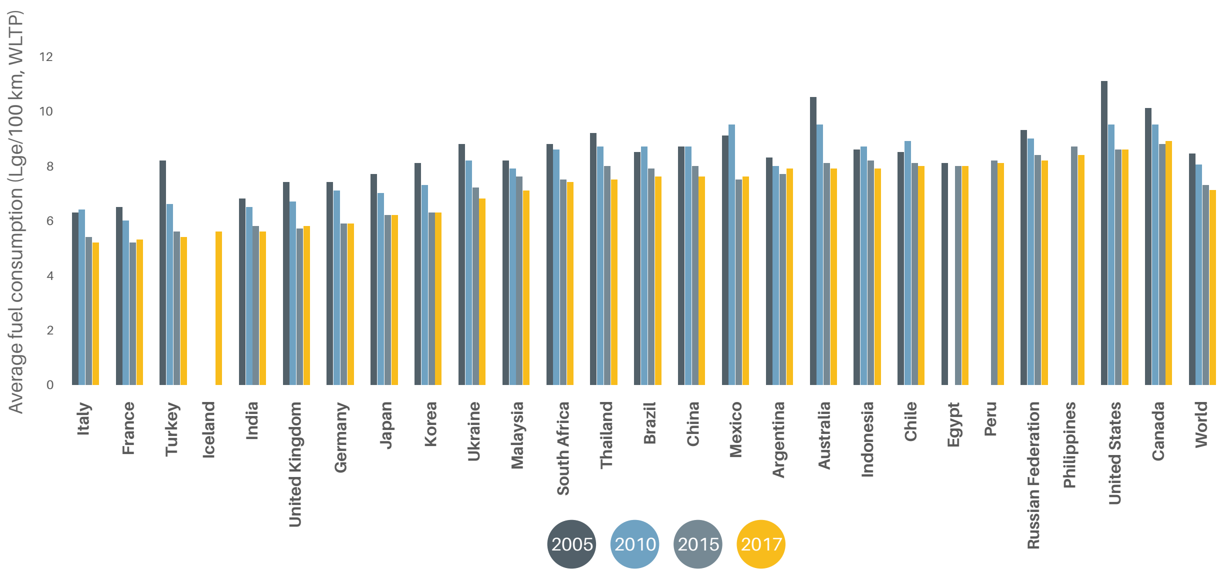
Overall, the average fuel economy of light-duty vehicles improved in all regions between 2005 and 2017, although absolute levels and trends differ widely among countries and regions (*see Figure 1*).[12] However, progress in improving fuel economy around the world is still well below the rate needed to achieve the GFEI target for 2030.[13]

Average fuel economy in the EU has worsened and is falling short of standards needed to meet the region's 2021 efficiency target, due in part to a 5-15% decline in the market share of diesel vehicles (which are more efficient) since 2014 and to a slow scale-up of electric vehicles.[14]

- In recent years, sales of diesel vehicles have declined in the largest EU markets.[15] The market share of diesel vehicles in Europe fell from 44% in 2017 to 31% in 2019 and 28% in 2020.[16]

i The FIA Foundation, the International Council on Clean Transportation, the International Energy Agency, the International Transport Forum, the Institute of Transportation Studies at the University of California at Davis and the United Nations Environment Programme.

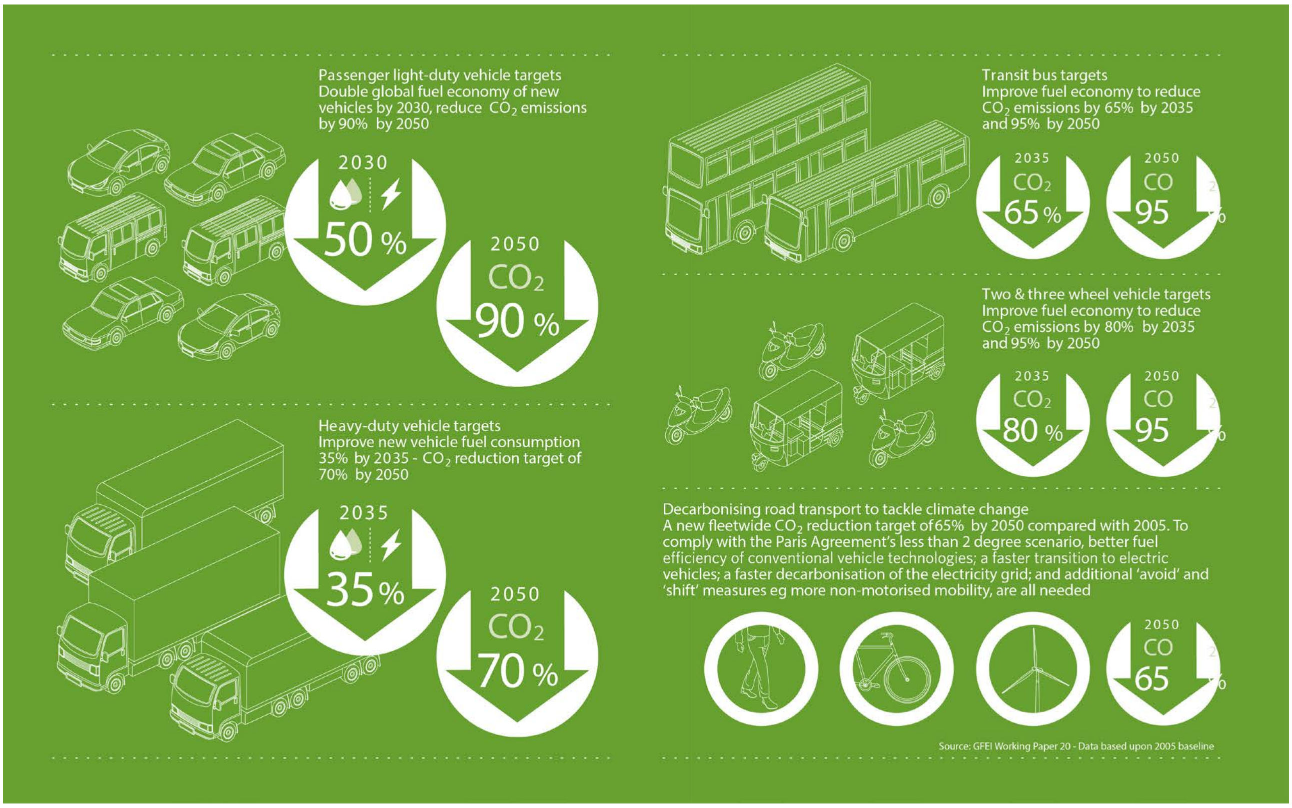
Figure 1. Light-duty vehicle fuel economy by country, 2005-2017



Note: Fuel economy is measured in litres of gasoline-equivalent per 100 kilometres; LDV = light-duty vehicle; L = litre

Source: See endnote 12 for this section.

Figure 2. Updated GFEI fuel economy targets (reductions from 2005 baseline)



Source: See endnote 42 for this section.

- While electric vehicle sales in the **EU** have grown, they still had only a 3% market share as of 2019.[17]
- For new cars registered in the **EU** in 2019, average emissions were 30% higher than the emissions target set for 2021. New-car emissions in 2019 reached 122 grams of CO_2 per kilometre (New European Driving Cycle, NEDC) compared to the targeted 95 grams (NEDC) or 109 grams (Worldwide Harmonised Light Vehicle Test Procedure).[18]

The market share of SUVs increased 15% between 2014 and 2019, offsetting the overall positive impacts of efficiency improvements in vehicles.[19] The largest increase has been in the small SUV segment (including many "crossover" vehicles), which consume more fuel on average than any other passenger car type.[20] As a consequence, **SUVs were the second largest contributor to the increase in global CO_2 emissions among all energy sectors.**[21] Emissions from the world's SUV fleet increased by nearly 0.55 gigatonnes (Gt) of CO_2 between 2010 and 2019, to roughly 0.7 Gt of CO_2.[22]

- **North America** and **Australia** have particularly high market shares of large vehicles.[23] In the **USA**, the market share of SUVs (both cars and trucks) reached 51% for model year 2019.[24]
- The market share of SUVs in the **EU** increased from 25% in 2017 to 38% in 2019.[25]

Rising vehicle sales in developing and emerging markets also affected the global fuel economy average, with sales in emerging markets increasing 2% over those in advanced markets between 2015 and 2017.[26] Developing countries have historically had less-efficient vehicles. Although emerging economies such as **China** and **India** have adopted fuel economy standards, in general developing countries remain well short of the 3.7% annual improvement needed to reach the GFEI's targeted average fuel economy of 4.4 lge per 100 kilometres for new vehicles by 2030.[27]

The used vehicle market is a major share of vehicle sales in the Global South.[28] **Africa imported the largest number of used vehicles (40%) during 2015-2018, followed by Eastern Europe (24%), Asia-Pacific (15%), the Middle East (12%) and Latin America (9%).**[29]

- As much as 70% of exported used light-duty vehicles head to developing countries.[30]
- In **Africa**, 60% of annual registrations were of used vehicles in 2020.[31]

Differences in regulations, even among neighbouring countries, can greatly impact the average fuel consumption and CO_2 emissions of a country's vehicle fleet.

- For example, the average fuel consumption and CO_2 emissions of vehicles in **Rwanda** are about a quarter higher than **Kenya's**.[32]

Emission trends

CO_2 emissions are directly correlated to vehicle efficiency (such as fuel economy or fuel consumption) and therefore are linked to the overall market shares of different types of vehicles sold. The growing consumer preference for larger and less efficient vehicles (such as SUVs) is negatively impacting average fleet emissions.

Improving the efficiency of passenger transport saved the equivalent of 2.5 exajoules of energy from 2015 to 2018; however, this resulted in only halving the increase in transport energy use.[33] **Other factors contributing to increases in transport energy use include: increased vehicle activity; a shift towards private vehicles in developing countries; older, larger and more polluting vehicle types; and low occupancy rates (such as large vehicles with spare capacity or vehicles returning empty) as well as the shift from diesel vehicles.** Thus, improving efficiency alone is not enough to reduce overall energy use in transport.

- In the **USA**, emission regulations for light-duty passenger vehicles and trucks are projected to cut 6 billion metric tonnes of CO_2 emissions over the life of vehicles sold in model years 2012-2025, and allow manufacturers flexibility in meeting the standards.[34] For heavy-duty vehicles, current federal regulations are projected to reduce CO_2 emissions by around 270 million tonnes over the life of vehicles, saving around 530 million barrels of oil.[35]
- In the **EU**, the increase in average CO_2 emissions for new passenger cars between 2017 and 2019 was affected by two main market trends: the continuing shift from diesel to petrol cars (the diesel car share decreased 5%), and the shift towards larger and heavier SUVs powered by petrol.[36] In 2019, as in 2017 and 2018, far more petrol cars (comprising nearly 63% of the new fleet) were sold than diesel cars (32%), and the shift also continued towards SUVs.[37]
- Because diesel cars are generally more fuel-efficient than petrol cars of comparable size, and smaller cars are more fuel-efficient than larger ones, these market trends negatively affected the average CO_2 emissions of the fleet.[38] Despite the efficiency advantages of diesel vehicles, consideration of their wider public health impacts, such as nitrogen oxide and particulate matter emissions, also must be factored in.[39]

Achieving a fuel economy of 4.4 litres of gasoline-equivalent (lge) per 100 kilometres for new light-duty vehicles (compared to the current level of 7.2 lge as of 2017) could save around 359 billion lge and avoid 844 million tonnes of CO_2 emissions from 2005 to 2030.[40] **This would result in a 16% reduction in business-as-usual emissions by 2030.**[41] The GFEI has defined targets for reducing energy consumption and CO_2 emissions, based on current vehicle trends and in line with Paris Agreement targets (*see Figure 2*).[42] Meeting these targets would require substantially decarbonising the electricity grid (to reduce emissions associated with electric vehicles), as well as increasing the use of Avoid and Shift measures, including more non-motorised transport trips.[43]

Adding a shift to electric vehicles alongside improvements in internal combustion engines could achieve further CO_2 emission reductions of 3 million to 5 million tonnes per year, depending on how electricity grids are decarbonised.[44] Assuming aggressive decarbonisation, improvements in electrification and fuel consumption for passenger vehicles could contribute around half of the annual reductions (more than 5 million tonnes) needed to meet the Paris Agreement's commitment to limit the global average temperature increase to "well below" 2 degrees Celsius; meanwhile, electrification of freight would contribute around 4 million tonnes, and electrification of buses and two- and three-wheelers would contribute less than 1 million tonnes each.[45]

Policy measures

Fuel economy improvements help to lessen dependence on fossil fuels and, when linked to more stringent vehicle emission standards, can reduce emissions of short-lived climate pollutants such as black carbon while also improving air quality, helping to prevent premature deaths.[46] Motor vehicles contribute between 25% and 75% of urban air pollution worldwide, depending on the pollutant and the location.[47] Policy measures aimed at improving fuel economy can increase these health and economic benefits.

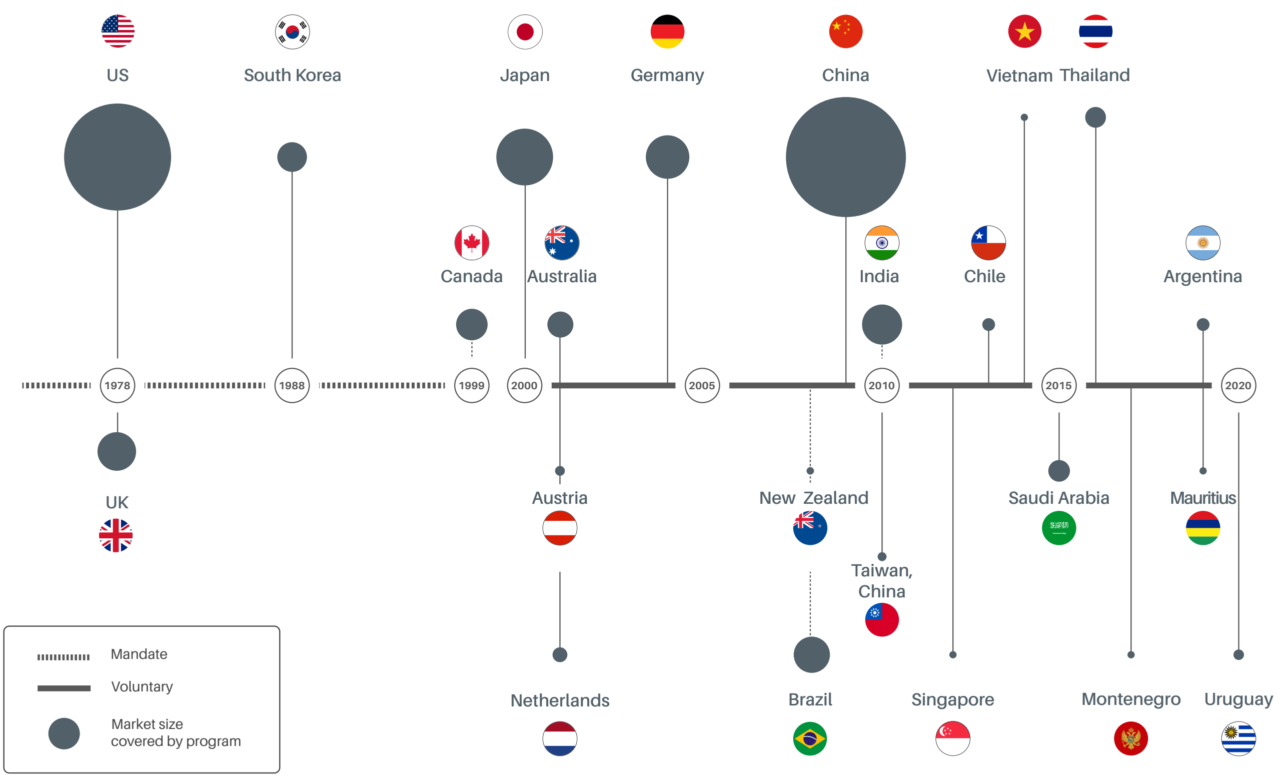
As of 2020, 54 countries had established fuel economy policies, such as labelling schemes that help consumers compare vehicle choices and understand tax implications over the lifetime of the vehicle (*see Figure 3*).[48]

- Between 2018 and 2020, **Argentina, Mauritius, Montenegro and Uruguay** all introduced fuel economy labelling schemes.[49]
- **The Philippines** plans to introduce new energy efficiency ratings for vehicles in 2021.[50]
- **Vietnam** introduced a mandatory fuel economy label for motorbikes in 2020.[51]

By 2019, 89 developing countries across Asia, Africa, Latin America and Eastern Europe had made national and regional commitments to improve fuel economy.[52] Most vehicles sold globally are now subject to some form of fuel economy policy, with a number of emerging economies and markets setting roadmaps and targets to accelerate the transition to more efficient vehicles. Multi-stakeholder collaboration is key to helping policy makers understand their existing fuel economy levels (including setting a baseline) and evaluate options for developing new policies. Recent efforts include the following:

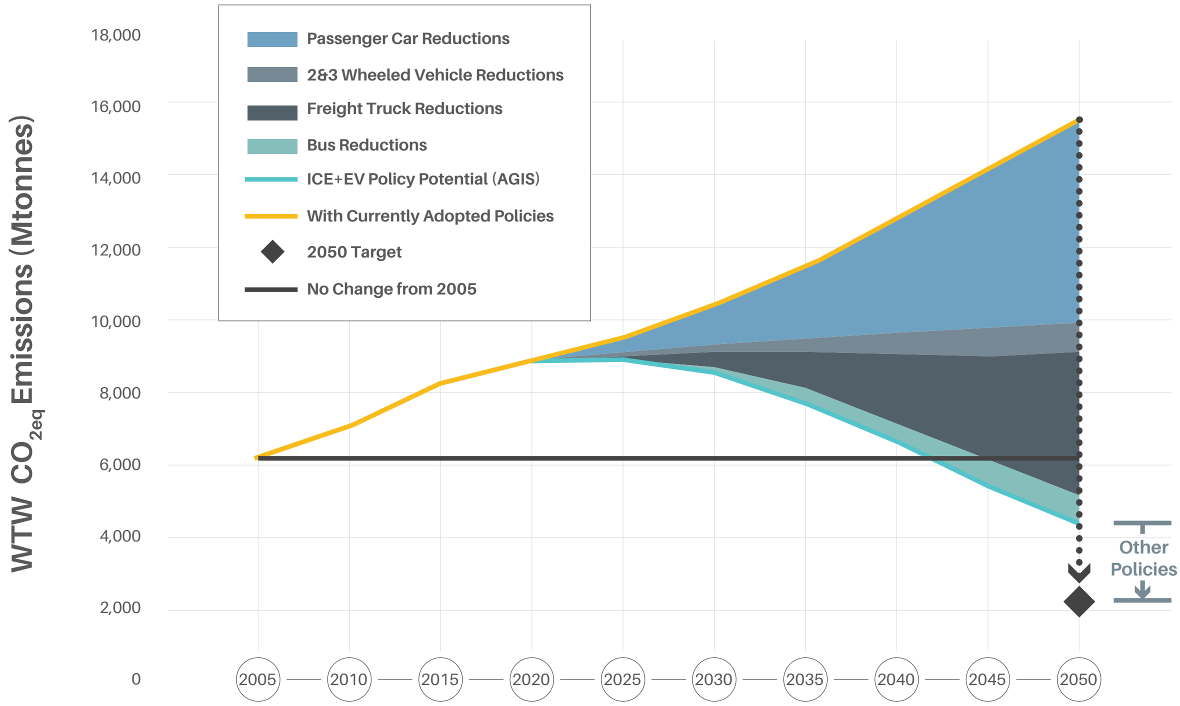
- In 2018, **Malaysia** announced its own fuel economy test cycle (to measure the volume of emissions produced) consistent with the Worldwide Harmonised Light Vehicle Test Cycle Procedure and taking into account the environment.[53]
- **Namibia** estimated the country's average fuel economy to be 6.7 litres per 100 kilometres in 2018, an improvement from 8.3 litres

Figure 3. Implementation of vehicle fuel economy labelling programmes in selected countries, 1978-2020



Source: See endnote 48 for this section.

Figure 4. Projected emissions reductions through vehicle efficiency-related measures by 2050



Source: See endnote 58 for this section.

in 2005. Recommendations to further improve the country's fuel economy include fiscal measures and programmes targeted at citizens to support the transition.[54]

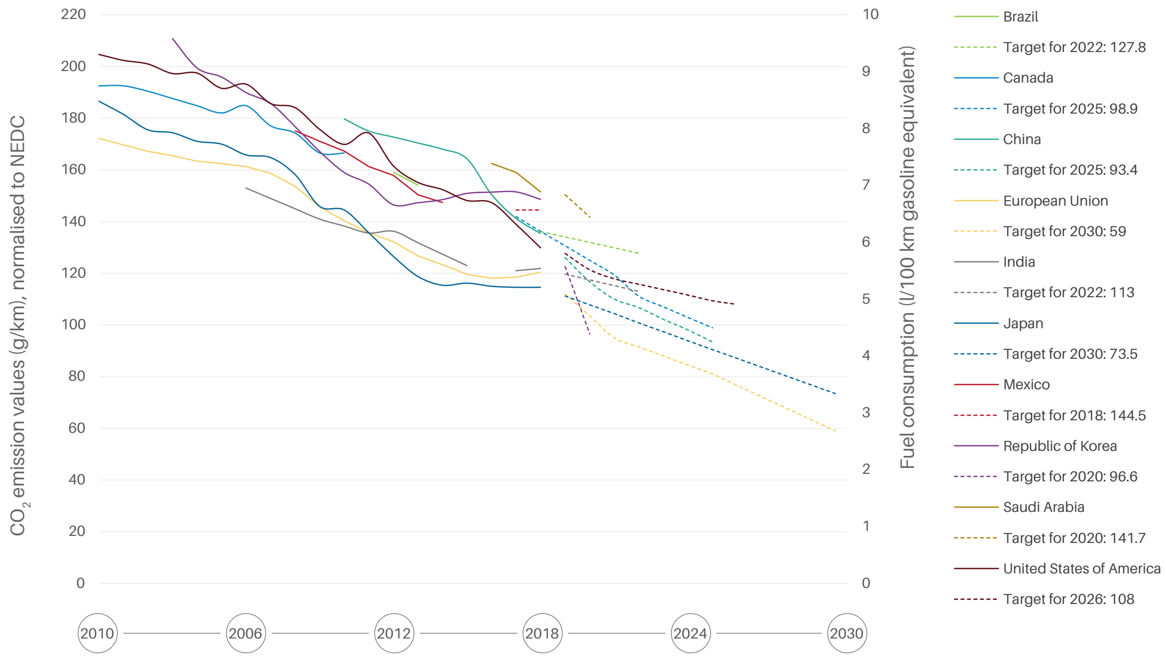
- **North Macedonia** introduced CO_2-based vehicle taxation starting in 2020, incentivising people to choose fuel-efficient vehicles due to higher tax levels.[55]
- In 2019, **South Africa** launched its first Green Transport strategy, which includes a commitment to promote fuel economy norms and standards as well as regulations that encourage improved efficiency in fossil fuel-powered vehicles.[56]
- In 2018, **Zambia** proposed a review of its carbon tax system for vehicles to include fuel economy as a consideration in order to promote a more efficient fleet.[57]

Complementary "*Avoid*" and "*Shift*" strategies must be adopted to achieve the additional 2-5 million tonnes of annual CO_2 emission reductions from road transport needed to meet Paris Agreement goals. Despite significant CO_2 savings projected from fuel economy improvements by 2050, emissions would remain 57% above 2005 levels and nearly five times higher than Paris Agreement targets (*see Figure 4*).[58] Thus, in addition to increasing the efficiency of light-duty and heavy-duty vehicles, complementary measures to reduce unnecessary journeys and to spur a shift to more efficient modes of transport (such as public transport, cycling and walking) are urgently needed.

A number of emerging economies and regions are setting roadmaps and targets to accelerate the transition to more efficient vehicles through fuel economy improvements. Southeast Asia and **West Africa** launched new regional roadmaps that aim to accelerate progress and co-ordinate measures among countries.[59]

- The Fuel Economy Roadmap of the **Association of Southeast Asian Nations (ASEAN)** aims to reduce the average fuel consumption of new light-duty vehicles 26% between 2015 and 2025.[60]
- In 2019, **Malaysia** was considering lowering fuel consumption to 5.3 litres per 100 kilometres by 2025 under the National Automotive Policy 2020 and in line with the **ASEAN** Fuel Economy Roadmap.[61]
- **West Africa**'s first ever Fuel Economy Roadmap, adopted in 2020, aims to improve fuel economy 34% by 2025 (compared to 2015 levels), setting an average fuel economy target of 5 litres per 100 kilometres by 2025 for member countries of the **Economic Community of West African States (ECOWAS)**.[62]
- In 2019, **China** published its fuel economy targets for 2025, which propose reducing the average fuel consumption of new passenger cars to 4 litres per 100 kilometres (NEDC).[63]
- In 2017, **India** set fuel economy standards for 2022, although estimates suggest that by 2018, the vehicle fleet was already only 8.7% away from achieving these levels.[64]

Figure 5. CO_2 emissions and fuel consumption of passenger cars in selected countries, 2000-2018 and future targets



Source: See endnote 65 for this section.

Passenger CO_2 emissions and fuel consumption standards in **Canada**, **China**, **the EU**, **India**, **Japan**, the **Republic of Korea**, **Mexico**, **Saudi Arabia** and the **USA** directly or indirectly influence the efficiency of vehicles sold in other markets, as many vehicles produced in these countries are exported (*see Figure 5*).[65]

- **Japan**'s new fuel economy standards, adopted in 2019, equate to a 32.4% improvement from 2016 levels by 2030.[66] The standards require an average gasoline-equivalent fuel economy of 25.4 kilometres per litre by 2030, second only to the EU's target in absolute fuel economy and emissions.[67]
- In 2020, the **USA** weakened and rolled back existing plans for fuel economy improvements, reducing the country's annual efficiency improvements from 5% to 1.5% and projecting no increase in the electric vehicle share by 2026.[68] The fuel economy standards are to be reviewed in 2021.[69]
- **Canada**, which previously aligned to the USA standards, has decided to maintain its existing targets, as this has proven to have wider economic and environmental benefits.[70]
- In its Climate Change Mid-Century Strategy, adopted in 2016, **Mexico** includes steps to increase the energy efficiency of public and private passenger and freight transport by establishing official standards and logistic and technological improvement programmes, including multi-modality and low-emission vehicles.[71]

In 2019 and 2020, no new national fuel economy mandates were adopted for trucks and other heavy-duty vehicles. Canada, China, the EU (including the UK), India, Japan and the USA remain the only entities with fuel economy standards for heavy-duty vehicles.[72] Fuel economy policies focusing on heavy-duty vehicles such as trucks are highly cost-effective because trucks travel much longer distances on average.[73]

- Phase III standards in **China**, the world's largest heavy-duty vehicle market, took effect in July 2019, helping to raise the efficiency of new buses and trucks sold in the country.[74]
- The **EU** adopted its first-ever CO_2 emission standards for heavy-duty vehicles in 2019, setting targets for 2025 and 2030 aimed at reducing the average emissions from new trucks.[75]
- In 2018, **India** put in place new fuel economy standards for heavy-duty vehicles.[76]
- In March 2019, **Japan** updated its fuel efficiency standards for trucks and buses, mandating improvements of 13.4% for trucks and 14.3% for buses by 2025 (compared with 2015).[77]
- **Brazil**, **Mexico** and the **Republic of Korea** are in various stages of developing policies to improve the efficiency of their heavy-duty vehicle fleets.[78]
- As of 2019, 39 countries had implemented soot-free standards for new heavy-duty vehicles (such as Euro VI or equivalent), and 5 more (**Brazil**, **China**, **Colombia**, **India** and **Mexico**) were preparing such policies.[79]

Fuel economy policy is increasingly being integrated into wider frameworks for promoting the transition to electric vehicles. This is being done through zero-emission vehicle (ZEV) mandates and through standardised accounting of average CO_2 emissions (such as NEDC).[80] Some regulations also include additional "credits" for electric vehicles to incentivise a rapid transition to electrified fleets, although such measures can risk weakening overall efficiency improvements by allowing car manufacturers to continue to produce conventional vehicles.

- **China** introduced a form of mandate for zero-emission vehicles for 2019 and 2020, requiring a minimum production level for "new energy vehicles".[81]
- The **EU's** planned fuel economy targets are the equivalent of reducing emissions from new cars and vans in the region 15% by 2025 and 37.5% by 2030 (31% for vans), compared to 2021 levels; they are expected to significantly boost the market for hybrid and electric vehicles.[82]

Box 1. Impacts of the COVID-19 pandemic on fuel economy

In the wake of the pandemic, there has been pressure on regulators to ease future vehicle fuel economy and emission standards, which are critical to addressing the climate crisis and the health impacts of air pollution. Some European countries are offering financial support to auto manufacturers, but to ensure overall emission reductions, these and other economic recovery policies for the transport sector must be linked to rapidly accelerating the transition to electric and efficient vehicles.

Following the pandemic, many national and local trends point towards a short-term exodus from public transport and a shift to greater passenger car use, highlighting the need to maintain robust fuel economy standards. In addition to policies focused on new vehicles, some governments have considered measures to increase fleet turnover and to remove older vehicles from the roads through "scrappage" schemes. The aim is often to boost demand for vehicles in the wake of post-pandemic economic shocks; however, research indicates that a vehicle replacement programme would achieve the largest environmental benefit if it was limited to sales of new battery electric vehicles.

This also highlights the need to greatly improve the energy efficiency of personal and commercial fleets in the context of broader sustainable transport planning, using a balanced *Avoid-Shift-Improve* framework.

Source: See endnote 6 for this section.

Initiatives supporting fuel economy and related areas

- **Below50** is a global collaboration that brings together the entire value chain for sustainable fuels, or fuels that produce at least 50% fewer CO_2 emissions than conventional fossil fuels. The initiative aims to create a critical mass of players (developers, users and investors) to grow the global market for the world's most sustainable fuels.[83]
- The **Climate and Clean Air Coalition's Heavy-Duty Diesel Vehicles and Engines Initiative** works to catalyse major reductions in black carbon through the adoption of clean fuel and vehicle regulations and supporting policies, with a focus on diesel engines in all economic sectors.[84]
- The **Global Fuel Economy Initiative** assists governments and transport stakeholders in improving vehicle fuel economy and reducing CO_2 emissions, and aims to double the average fuel economy of new light-duty vehicles globally by 2030, and all vehicles by 2050.[85] The initiative works to secure real improvements in fuel economy and the maximum deployment of vehicle efficiency technologies across the full range of vehicle sizes and technologies, including hybrid and fully electric vehicles.[86]
- The **Global Strategy for Cleaner Fuels and Vehicles** aims to virtually eliminate fine particle and black carbon emissions from new and existing heavy-duty diesel vehicles and engines through the introduction of low-sulphur fuels, as well as vehicle emission standards by 2030.[87]
- The **Partnership for Clean Fuels and Vehicles** is a global public-private partnership working with developing and transitional countries to reduce air pollution from vehicles through the promotion of cleaner fuels and vehicles.[88]

Key indicators

	2017*	2019*	% change
Policy Landscape Indicators			
GFEI fuel economy benchmarking (# of countries)	38	66	+73%
Fuel economy labelling schemes for light-duty vehicles (# of countries)	50	54	+8%
Fuel economy standards for light-duty vehicles (# of countries)	37	37	0%
Fuel economy standards for heavy-duty vehicles (# of countries)	33	33	0%
Green freight schemes (# of countries)	20	26	+30%
Market Development Indicators			
Average fuel economy of light-duty vehicles (litres of gasoline-equivalent per 100 kilometres)	7.4 (2015)	7.2 (2017)	+3%

(*) Data are for the indicated year unless noted otherwise.

Source: See endnote 89 for this section.

In Practice: Additional Policy Measures

Policies

- In 2018, the **Bangladesh** Road Transport Authority expressed the intention to develop appropriate policies and instruments to improve the average fuel economy of the national light-duty vehicle fleet in favour of EURO VI by 2025.[90]
- In 2020, **France** lowered the CO_2 emission threshold over which new cars are subjected to a penalty to 110 grams per kilometre, 7 grams lower than the 2019 threshold.[91]
- **Ghana** disseminated draft motor vehicle emission standards and regulations in 2018.[92]
- **Turkey** enacted new laws in 2019 to improve energy efficiency in the transport sector.[93]
- In 2019, the USA state of **California** signed an agreement with four major automakers to ensure that new vehicles would have an average fuel consumption of 15 kilometres per litre (36 miles per gallon) in real-world driving by 2026.[94]

Fuel economy trends

- The average fuel economy in **Bangladesh** improved from 8.98 litres per 100 kilometres in 2005 to 6.9 litres in 2017, a 23% improvement.[95]
- **Costa Rica** is in the process of transitioning its vehicle emission standards to Euro 6 in 2022, from Euro 3 in 2017 and Euro 4 in 2018.[96]

Fuel quality

- As of 2020, 63 countries had standards for ultra-low-sulphur diesel (less than 15 parts per million of sulphur), and 6 more (**Argentina, Colombia, India, Saudi Arabia, Thailand** and **Vietnam**) aim to transition to such standards by 2023.[97]

Annex: Methodological Note

Data usage

Time period for data:
The report strives to utilise the most recent publicly available data and information just prior to the time of publication (as of 31 May 2021). The figures in the report were developed between September and December 2020 using the most recent data available.

Secondary data:
SLOCAT relies on secondary data and information collected and provided by SLOCAT partners and other entities and does not make use of any internal modelling tools.

Data on sustainable mobility: A call to action

The report benefits directly from data collected by a wide range of stakeholders working in different areas of transport.

Data are important for providing a comprehensive picture of the status of sustainable, low carbon transport and are essential for both policy and investment decision making. In these times of change, it is critical to upgrade data and policy collection and interpretation capacities to better understand progress and the hurdles that must be addressed.

The data limitations mentioned below are not new. Obtaining regular, reliable and public data across regions and transport modes remains an outstanding issue. When an increasing number of stakeholders are collecting data and policy information, more and better open-access data and capacity building efforts for data interpretation are supported by many multi-stakeholder partnerships in the sustainable, low carbon movement.

If you share our passion for open-access data and knowledge towards greater impact on policy and investment decision making worldwide and/or would like to contribute data or knowledge to our collective efforts on this report, **please reach out to the research team in the SLOCAT Secretariat at tcc-gsr@slocatpartnership.org**.

Specific data used in this report

Data on emissions

The data in this edition of the report point to the direct carbon emissions from transport activity; they do not cover the indirect emissions and land-use impacts associated with certain modes of transport. The report primarily utilises CO_2 emission data compiled in the Emissions Database for Global Atmospheric Research (EDGAR) from the Joint Research Centre of the European Commission, as this represents the most recent, comprehensive dataset on transport CO_2 emissions. However, this global dataset does not convey in full detail the unique situations of individual countries.

EDGAR provides estimates for fossil CO_2 emissions from all anthropogenic activities with the exception of land use, land-use change, forestry and the large-scale burning of biomass. The main activities covered are CO_2 emissions emitted by the power sector (i.e., power and heat genertion plants), by other industrial combustion (i.e., combustion for industrial manufacturing and fuel production) and by buildings and other activities such as industrial process emissions, agricultural soils and waste. Transport activities covered within EDGAR include road transport, non-road transport, domestic aviation, and inland waterways on a country level, as well as international aviation and shipping.[1]

For the world, regions and countries, the CO_2 emission data (provided by EDGAR) span through 2019. In a few places in the report, CO_2 data for 2020 are shown to illustrate the impact of the COVID-19 pandemic; however, these data are based on a different methodology than the EDGAR dataset and should not be compared directly with the data from previous years.

The latest CO_2 emission data for individual transport modes are for 2018 and have been compiled only at the global level. For passenger and freight transport, the data on global CO_2 emissions are for 2017, as this is the latest year with robust data. Data on passenger activity (passenger-kilometres) and freight activity (tonne-kilometres) – provided mainly in the country fact sheets – are based on the latest available year, as indicated in the report analysis.

Information on greenhouse gas emissions – provided in CO_2 equivalent (CO_{2eq}) – include not only CO_2 but also methane, nitrous oxide, and industrial gases such as hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride.[2] These data are less up-to-date. As of 31 May 2021, data on greenhouse gas emissions were not readily available for the period 2019-2020. In some cases, additional data sources were used to provide detailed information about other climate pollutants besides CO_2.

All data on CO_2 and other greenhouse gas emissions, as well as CO_{2eq}, are provided in metric tonnes.

Data on car ownership

Information on car ownership rates is based on a global dataset from the International Organization of Motor Vehicle Manufacturers (OICA), with the latest release (as of 31 May 2021) dating from 2015.[3] Although newer information is available for some individual countries, using these data would hinder accurate global comparisons. Data on passenger and commercial vehicle sales were available only up to 2019.

Policy landscape data

The policy-related information presented in this report is not intended to be comprehensive. The data for the policy landscape indicators provided in Section 3 were gathered through desk research unless otherwise indicated. Barriers to accessing such information include language and limited availability of information through online media (e.g., websites, press releases and news articles).

Data in country fact sheets

Information in the fact sheets is based on desk research and on contributions from the national focal points. The data were collected to the best of the authors' knowledge and based on data availability, and thus may not be complete or show the most recent status. When no information was available for a given indicator, the term "Not available" is used.

Data gaps

Major data gaps exist in areas where there is no globally accepted data collection methodology. For example, the mapping of cycling and walking infrastructure is not currently done in all regions. Also, the modal share can be surveyed through different methods, leading to inconsistencies in available data. In addition, data on paratransit (informal transport), a predominant form of transport in many parts of the world, are largely lacking. This results in an incomplete picture of the impact of transport on climate change and sustainable development.

Methodological approach

Countries and regions

The report follows the M49 Standard of the United Nations Statistics Division.[4] In total, 196 countries have official United Nations membership and are also party to the United Nations Framework Convention on Climate Change. The available data have been put in a common structure for the United Nations member countries, regions and income groups to enable a consistent assessment. Income groups are based on the World Bank's classification of 2019.[5]

Economic calculations

The per capita and gross domestic product (GDP) calculations are based on the United Nations World Population Prospects 2019 and on World Bank GDP data using constant 2010 USD.[6]

Spatial and temporal scales

The geographic scale (global, national, city-level, etc.) as well as time scale (annual, monthly, daily) used in this report depends largely on the available dataset, as noted in the relevant figures and text. The detailed data forming the basis of the calculations and analysis are provided in the SLOCAT Transport Knowledge Base.[7]

Criteria for selection

The report covers policies, targets, emission reductions (achieved or envisioned) and market measures. To merit inclusion in the analysis, the policies, projects and trends must have been announced or completed between 2018 and 2020. Significant developments from January through May 2021 were included when deemed relevant, with the understanding that the next edition of the *Transport and Climate Change Global Status Report* will cover a period starting in 2021.

Pre- and post-COVID-19 pandemic trends

The year 2020 was pivotal for the world, and the COVID-19 pandemic has had substantial impacts on many of the transport trends monitored in this report. This edition attempts to differentiate between long-term trends and impacts due to the pandemic. To the extent possible, the analysis notes "pre-pandemic" (up to the end of 2019 or latest by February 2020) and "during pandemic" trends (starting in March 2020 until the end of 2020), as in some cases the pandemic led to reversals in long-term trends, at least for a specific period of time. In each section, a box describes the impacts that the pandemic has had on specific regions and sub-sectors.

Assembling the report

Global Strategy Team

This edition of the report was guided by a global strategy team consisting of 20 experts in the field who provided inputs over the span of six meetings between September 2019 and October 2020. Additionally, small group consultations were organised in February 2021, following the peer review process.

Authors and contributors

The report was collaboratively drafted by 22 authors and contributors from 16 organisations, led by the SLOCAT Secretariat. This includes additions and high-level inputs from the copy editor and from the special advisor who also co-authored the Executive Summary. Authors researched and compiled relevant facts and figures for the five sections of the report, including the Focus Features, with supporting review and inputs from several other organisations.

Peer review: A peer review process was carried out from 18 December 2020 to 20 January 2021 with 1,700 comments received from 74 reviewers. Each comment was individually reviewed by the SLOCAT Secretariat and considered in finalising the report.

National focal points: The report benefited from the contributions of voluntary national focal points, or experts from various regions and countries who have been essential to overcome language and information barriers. A public call for participation to provide information on policies and data resulted in several hundred initial registrations. Out of these registrations, 78 national focal points provided inputs through a first survey from 24 January to 3 February 2020; and through a second survey (focused on the country fact sheets) from 6 to 30 August 2020. All national focal points that contributed to the surveys are listed in the Acknowledgements.

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3.7 Fuel Economy

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