3.8

Electric Mobility

Key findings

Demand trends

- The global stock of electric passenger cars (battery and plug-in electric hybrids) grew 40% in 2020 to more than 10 million vehicles (up from more than 7.2 million in 2019); this represented 1% of the 2020 total vehicle stock.
- More than 600,000 electric buses were in operation in 2020. As of 2019, 18% of the world's buses were powered through electric sources, including battery electric (6.3%), hybrid-electric (7.9%) and direct overhead wires and similar (3%).
- The global stock of electric two- and three-wheelers (excluding electric-assisted bikes) totalled 290 million in 2020. Around one-quarter of all motorised two-wheelers worldwide were electric that year.
- Electric-assisted bicycles (e-bikes) are by far the most popular electrified road transport mode in Europe and North America; e-bike sales in Europe surpassed 4.8 million units in 2020, three times the number of electric passenger cars sold in the European Union (EU) that year.
- Between 2010 and 2020, the average price of electric vehicle batteries dropped 88%, from around USD 1,200 per kilowatt-hour (kWh) to USD 137 per kWh, increasing the potential for more widespread uptake of electric vehicles.
- By the end of 2020, more than 170,000 electric vehicles (three-wheelers, light trucks and company cars) were deployed through company fleets. Around 31,000 electric trucks were operating worldwide by year's end, but they represented less than 1% of total truck sales.
- Public and private charging infrastructure for electric vehicles has scaled up rapidly in some countries, although charging point distribution and the ratio of electric vehicles to charging points vary widely.

Emission trends

- Electric vehicles contribute at least 22% fewer carbon dioxide (CO_2) emissions than internal combustion engines, even when the electricity used for charging is generated from fossil fuel sources. While electric vehicles are more energy efficient than conventional vehicles overall, they offer even greater potential for emission reductions if they are based on clean renewable energy.
- Life-cycle emissions and the impact of electric vehicle batteries must be considered when comparing the environmental footprints of electric versus conventional vehicles. Major concerns include the extraction of raw materials and the recycling of batteries. Policies to extend the useful life of electric vehicle batteries can help governments and manufacturers offset the production costs, impacts and emissions.

Policy measures

- Countries have adopted ambitious time-bound targets to increase the share of electric vehicles in their overall fleets. By the end of 2020, 19 countries or sub-national jurisdictions had set targets to phase out diesel and petrol passenger vehicles.
- In 2020, the first-of-its-kind Zero Emission Vehicle Transition Council was established, comprising ministers and representatives from the world's largest and most progressive car markets.
- In response to phase-out targets by countries, major automobile companies are halting the development of internal combustion engines and accelerating their electric vehicle ambitions towards the 2030/2035 time frame.
- Leapfrogging to electric mobility in Africa, Asia and Latin America can bring significant benefits to local environments and economies.
- Utilities are taking on a greater role in the mobility ecosystem, thereby merging the value chains for electricity generation and electric vehicle charging.

Impacts of the COVID-19 pandemic

- Despite temporary shutdowns of auto factories and disruptions in global supply chains due to the pandemic, more than 3 million electric cars were sold worldwide in 2020, surpassing projections of 2.4 million.
- Electric vehicle sales jumped to 4.6% of global vehicles sold in 2020.
- A number of governments have increased electric vehicle investments as part of their COVID-19 recovery packages.

Overview

Between 2019 and 2020, the global landscape of electric mobility shifted from "commitment-centric" to "implementation-minded." Many public and private players have set specific targets for electrifying their fleets and banning diesel and petrol vehicles in countries or cities by a certain year. Interest has also risen in electric two- and three-wheelers. Logistics businesses have increased investments in electric fleets, and electric freight vehicles (such as trucks and electric cargo bikes) are being deployed in **Europe**, **North America** and **Asia**.

Large-scale progress in electric mobility has been concentrated in **China** and **Europe**. However, these experiences have pointed to the need to identify partnerships, policies and new business models for implementing projects (such as creating broad charging infrastructure networks) and operating them viably and equitably. Key to sustainable electric mobility is maximising the intermodality among sustainable, low carbon transport modes (both passenger and freight). Governments, industry, civil society and citizens need to create an enabling environment for sustainable mobility. In developing countries, electrifying all transport modes, starting with motorcycles, public transport, and rail, can avoid fossil fuel dependency and the high costs associated with air pollution and private car ownership.

The COVID-19 pandemic accelerated the uptake of electric vehicles through increased purchase subsidies, which were included in economic stimulus packages (*see Box*).[1] Sales of electric passenger cars grew strongly in major markets in 2020, and in **North America** and **Europe** many commuters shifted to electric-assisted bicycles, leading to three-digit growth in e-bike sales.[2]

Demand trends

The global stock of electric passenger cars (battery and plug-in electric hybrids) grew 40% in 2020 to more than 10 million vehicles (up from more than 7.2 million in 2019); this represented 1% of the 2020 total vehicle stock (*see Figure 1*).[3] **China**, **Europe** and **the United States of America (USA)** remained the leaders in electric passenger car sales, followed by the **Republic of Korea**, **Australia** and **Canada**.[4]

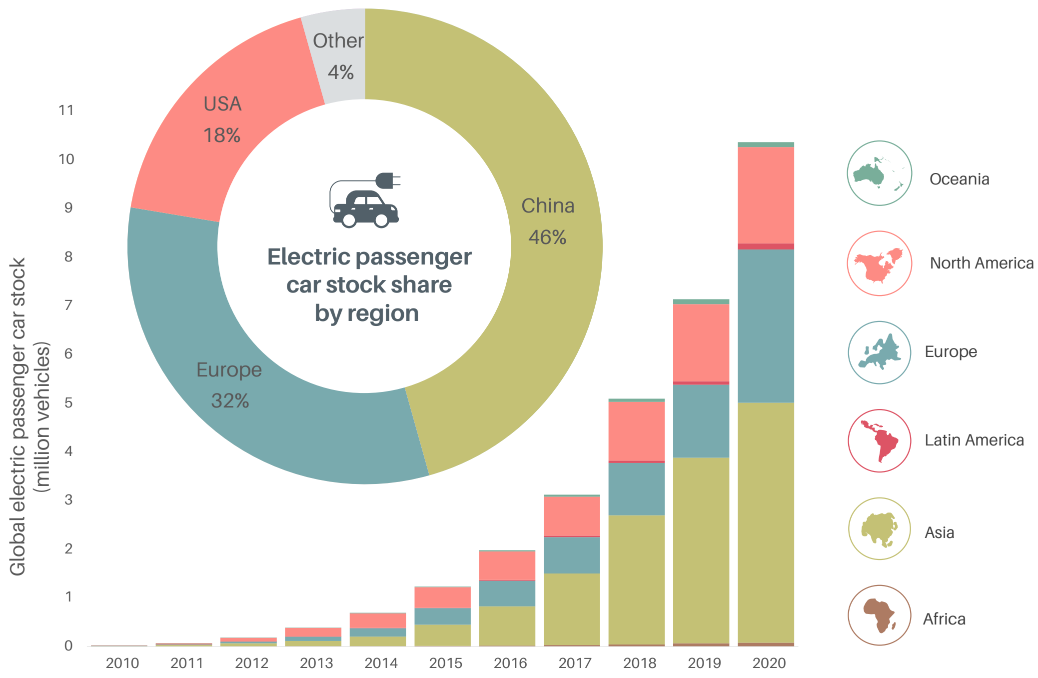
- The highest sales of passenger electric vehicles in 2020 were recorded in **China**, led by Shanghai followed by Beijing, Shenzhen, Hangzhou, Tianjin and Guangzhou.[5]
- In **Norway**, electric cars (battery and plug-in hybrids) accounted for more than 60% of new vehicle sales in 2019 and 69% of sales in the first six months of 2020.[6] Since January 2018, monthly sales of electric passenger cars have outnumbered any other drivetrain in Norway on average (*see Figure 2*).[7]

More than 600,000 electric buses were in operation in 2020.[8] **As of 2019, 18% of the world's buses were powered through electric sources, including battery electric (6.3%), hybrid-electric (7.9%) and direct overhead wires and similar** (*see Figure 3*).[9] Over 75,000 new electric buses were introduced each year in 2019 and 2020 (down 20% from 2018, when 93,000 units were sold).[10] **China** was home to more than 90% of the world's electric buses in 2020, followed by **North America** and **Europe**, whereas the buses are largely underrepresented in **Africa**.[11]

Electric buses can greatly improve the service quality of bus transport, bringing cleaner technology and resulting in less noise and more comfort, while improving air quality and having positive overall health benefits for citizens.[12] The advantages of electric buses have the potential to attract more people and to strengthen the use of sustainable transport modes.

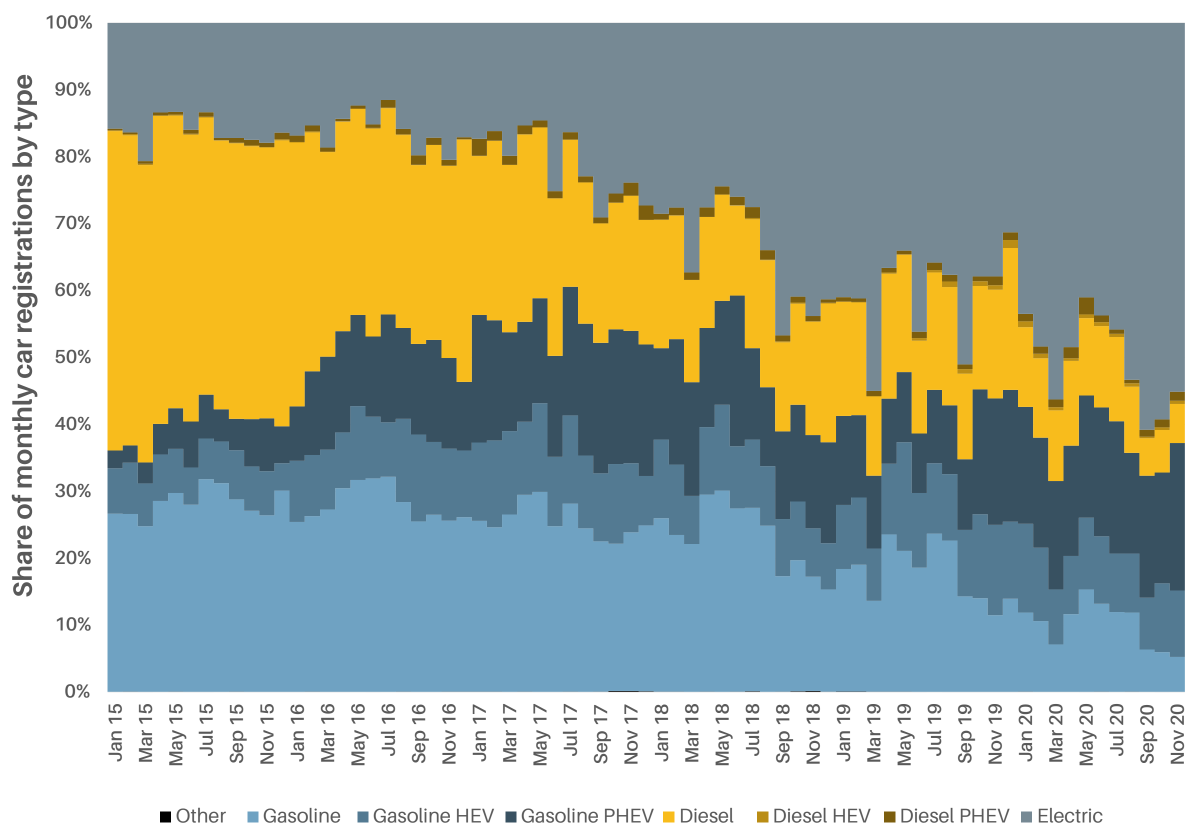
- In the **EU**, around 12% of newly registered buses in 2019 – or more than 1,600 units – were electric; this is more than the region's total electric bus fleet from 2012 to 2018 and a three-fold increase compared to 2018.[13]

Figure 1. Electric passenger car stock (battery and plug-in electric hybrids), by region, 2010-2020



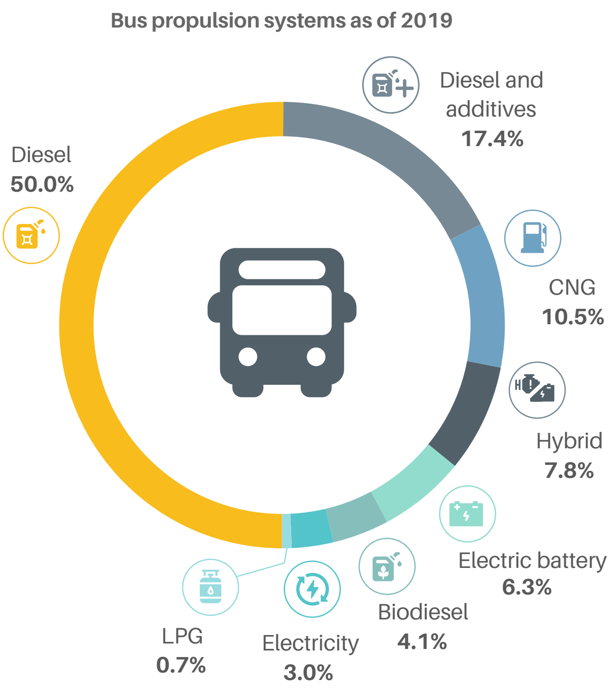
Source: See endnote 3 for this section.

Figure 2. New car registrations in Norway by vehicle type, 2015-2020



Source: See endnote 7 for this section.

Figure 3. Shares of bus propulsion systems globally, by type, 2019



Source: See endnote 9 for this section.

- As of March 2021, cities in **Latin America** had a total electric bus fleet of close to 3,000 buses.[14] **Santiago**, Chile and **Bogotá**, Colombia each had 400 electric buses, while **Brazil** and **Mexico** added around 250 electric buses each in 2019 and 2020.[15]
- The electrification of school buses has great potential in North America. The **USA** has a fleet of 480,000 school buses (representing 80% of all buses in the country) and the target is to electrify them by 2030.[16] **Canada** has committed to electrifying 5,000 buses between 2021 and 2025.[17]
- in December 2019, **Uganda** introduced its first electric buses, two units that were locally produced.[18]

The global stock of electric two- and three-wheelers (excluding electric-assisted bicycles) totalled 290 million in 2020.[19] Around one-quarter of all motorised two-wheelers worldwide were electric that year.[20] The majority of two-wheelers are in **China**, which is also one of the largest manufacturers of electric two-wheelers.[21] A rise in shared electric two-wheelers, particularly in **South Asia**, is attributed to their low operating costs and to long daily driving distances that are routine for last-mile connectivity and logistics businesses.[22]

- **India** has seen market-driven growth in electric three-wheelers, which are used for last-mile connectivity.[23] As of 2020, eight state governments in the country were offering rebates for three-wheelers as well as expedited permitting to vehicle owners who switch to electric three-wheelers powered by advanced batteries (lithium-ion over lithium-acid).[24]
- In its second Nationally Determined Contribution towards reducing emissions under the Paris Agreement, **Nepal** set a target for electric vehicle sales (passenger cars and two-wheelers) to represent 90% of all passenger vehicle sales (including two-wheelers) by 2030.[25]
- With support from the Department of Energy, 900 e-trikes started operation in **Metro Manila** in the Philippines as part of a larger national programme to support the introduction of 3,000 e-trikes.[26]

Electric-assisted bicycles (e-bikes) are by far the most popular electrified road transport mode in Europe and North America; e-bike sales in Europe surpassed 4.8 million units in 2020, three times the number of electric passenger cars sold in the EU that year.[27] If the trend continues, e-bike sales in Europe could reach 10 million units by 2024.[28] E-bikes can substitute car trips and serve as an important link to public transport. In the context of transport emissions, it is important to analyse where the shift to e-bikes comes from (*see Section 3.3 on Walking and Cycling*).

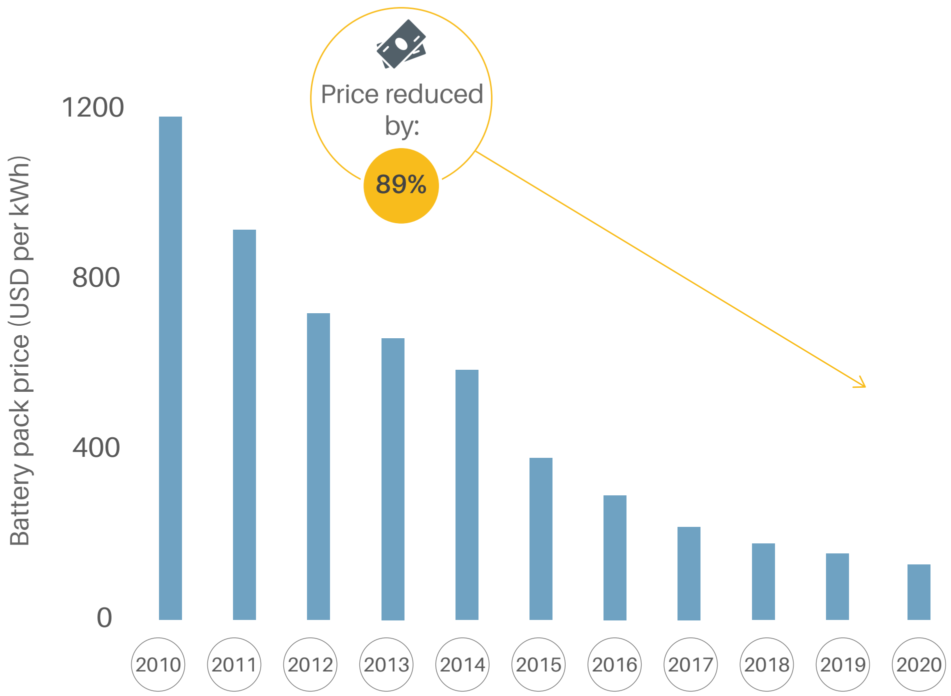
- E-bikes have entered the market in **Latin America and the Caribbean** mainly through bike-sharing services, as illustrated by examples from **Colombia** and **Ecuador** between 2015 and 2018.[29]
- In the **USA**, e-bike sales grew 145% between 2019 and 2020 as models became more affordable.[30] Bike-sharing services offering e-bikes are more popular and more widely used than services with regular shared bicycles.[31]

Between 2010 and 2020, the average price of electric vehicle batteries dropped 88%, from around USD 1,200 per kWh to USD 137 per kWh, increasing the potential for more widespread uptake of electric vehicles (*see Figure 4*).[32] Batteries represent 30-40% of the capital cost of an electric vehicle and play a key role in increasing the potential for more widespread uptake of affordable models.[33] Battery prices are projected to fall below USD 100 per kWh by 2024 as cumulative demand grows.[34] At this price point, electric vehicles could reach price parity with internal combustion engine vehicles, depending on the region and vehicle segment.[35]

Systems for swapping out electric vehicle batteries are seen as a solution to reduce costs and increase operational efficiency, due to faster recharging times. Battery swapping systems are increasingly relevant in markets with large shares of electric two-wheelers, such as **India** and **Chinese Taipei**.[36]

By the end of 2020, more than 170,000 electric vehicles (three-wheelers, light trucks and company cars) were deployed through company fleets.[37] Around 31,000 electric trucks were operating worldwide by year's end, but they represented less than 1% of total truck sales.[38] Freight and logistics companies, among other corporate fleets, are adopting electric vehicles for last-mile deliveries to increase performance and reduce operating costs. Urban deliveries have grown rapidly in past years and then skyrocketed during the COVID-19 pandemic. For long-distance

Figure 4. Average price of an electric vehicle battery pack, 2010-2020



Source: See endnote 32 for this section.

road freight, the electrification of trucks requires both high-capacity batteries and high-power charging infrastructure (to minimise the charging time).[39]

- **Amazon** is slated to begin using 10,000 electric delivery vehicles (three- and four-wheeler) in India from 2021 onwards.[40] The company invested in **Rivian**, an electric truck start-up that will deliver 100,000 electric trucks to Amazon by 2030.[41]
- In 2018, **IKEA** began goods delivery using solar-powered auto-rickshaws in **India**.[42] The company completed a transition to electric vehicle fleets in **Shanghai** in 2019 and will next target **New York**, **Los Angeles**, **Paris** and **Amsterdam**.[43] IKEA aims for all customer deliveries from stores worldwide to occur via electric vehicle by 2025.[44]
- The UK's **Royal Mail** trialled e-trikes in cities for a six-month period in 2019.[45]
- In 2020, **UPS** ordered more than 10,000 electric freight vehicles, which are being rolled out in the company's European and North American fleets to 2024.[46]

Public and private charging infrastructure for electric vehicles has scaled up rapidly in some countries, although charging point distribution and the ratio of electric vehicles to charging points vary widely. Creating a network of electric vehicle charging points (public or private) in a city is a capital-intensive and collaborative process. It requires adequate financing, land-use planning and real estate acquisition, local permitting, grid connection (and related pricing), equipment installation, and the implementation of safety and wayfinding measures for consumers, among other steps.[47] The ratio of electric vehicles to charging points is 3:1 in **China**, 25:1 in California, **USA** and 30:1 in **Norway**.[48]

- In **China**, more than 1.2 million charging points had been installed by the end of 2019.[49] The country has allocated USD 638 million for construction related to charging infrastructure, and many regions have amended their building codes to help create electric vehicle-ready buildings.[50]
- Among the 144,000 charging points in the **EU** by 2019, more than 26% were in the **Netherlands** (37,037), 19% in **Germany** (27,459), 17% in **France** (24,850) and 13% in the **UK** (19,076).[51]
- Policy tools for growing the charging infrastructure network in **Europe** include tax benefits and subsidies for individuals, housing co-operatives and businesses to install charging equipment.[52]
- In 2019, the first public electric vehicle charging stations in **Qatar** were installed, with 216 solar panels enabling the charging of 24 cars.[53]
- In the **USA**, the government-funded charging network programme ChargePoint collaborates with industry players to help expand the EV charging network in US cities.[54]

Emission trends

Electric vehicles contribute at least 22% fewer CO_2 emissions than internal combustion engines, even when the electricity used for charging is generated from fossil fuel sources.[55] **While electric vehicles are more energy efficient than conventional vehicles overall, they offer even greater potential for emission reductions if they are based on clean renewable energy.** In general, the energy loss associated with electric vehicles is lower than for vehicles with internal combustion engines.[56] Even in a carbon-intensive scenario (e.g., a battery produced in China and charged through a coal-heavy power grid, such as in Poland), electric vehicles emit 22% fewer life-cycle CO_2 emissions than diesel cars and 28% fewer emissions than petrol cars.[57]

- The electric bus fleet in **Latin America** saves an estimated 129,070 tonnes of CO_2 per year, while accounting for only 1.3% of public buses in the region.[58]
- The trial introduction of 60 electric buses in **Singapore** reduced CO_2 emissions by an estimated 7,840 tonnes annually, equivalent to the amount produced by 1,700 passenger cars.[59]
- In **Vietnam**, the electrification of motorcycles has the second highest potential for reducing CO_2 emissions from transport (after new fuel economy standards).[60]

Life-cycle emissions and the impact of electric vehicle batteries must be considered when comparing the environmental footprints of electric versus conventional vehicles.[61] **Major concerns include the extraction of raw materials and the recycling of batteries. Policies to extend the useful life of EV batteries can help governments and manufacturers offset the production costs, impacts and emissions.**[62] Electric vehicles are made from many different materials, including rare earth metals that are located in a small number of countries and are extracted via processes that lack environmental protection measures and reflect poor working conditions.[63] Automakers have formed partnerships with battery cell makers as well as state-owned mines to secure raw materials, including cobalt, lithium and graphite.

- Some regions have enacted policies supporting the reuse of electric vehicle batteries (for example, as stationary energy storage systems on telecommunication towers in **China**) as well as battery recycling (to recover scarce minerals, as through directives in **Europe** and **Japan**), in addition to safe disposal.[64]
- In 2020, a large-scale **EU**-funded research initiative released a roadmap for forward-looking battery research and approaches to identify safe, sustainable and affordable battery technologies.[65]
- Mining companies are investing in battery cell products, in a form of "vertical integration" (from extraction to manufacturing). One **Australian** company is following "cyclical integration", from extraction to manufacturing to recycling of cells.[66]

Policy measures

Countries have adopted ambitious time-bound targets to increase the share of electric vehicles in their overall fleets. By the end of 2020, 19 countries or sub-national jurisdictions had set targets to phase out diesel and petrol passenger vehicles (*see Figure 5*).[67] However, there is a strong need to consider how electric mobility projects around the world are (or are not) integrating wider socio-economic and environmental equity considerations into these formal targets.

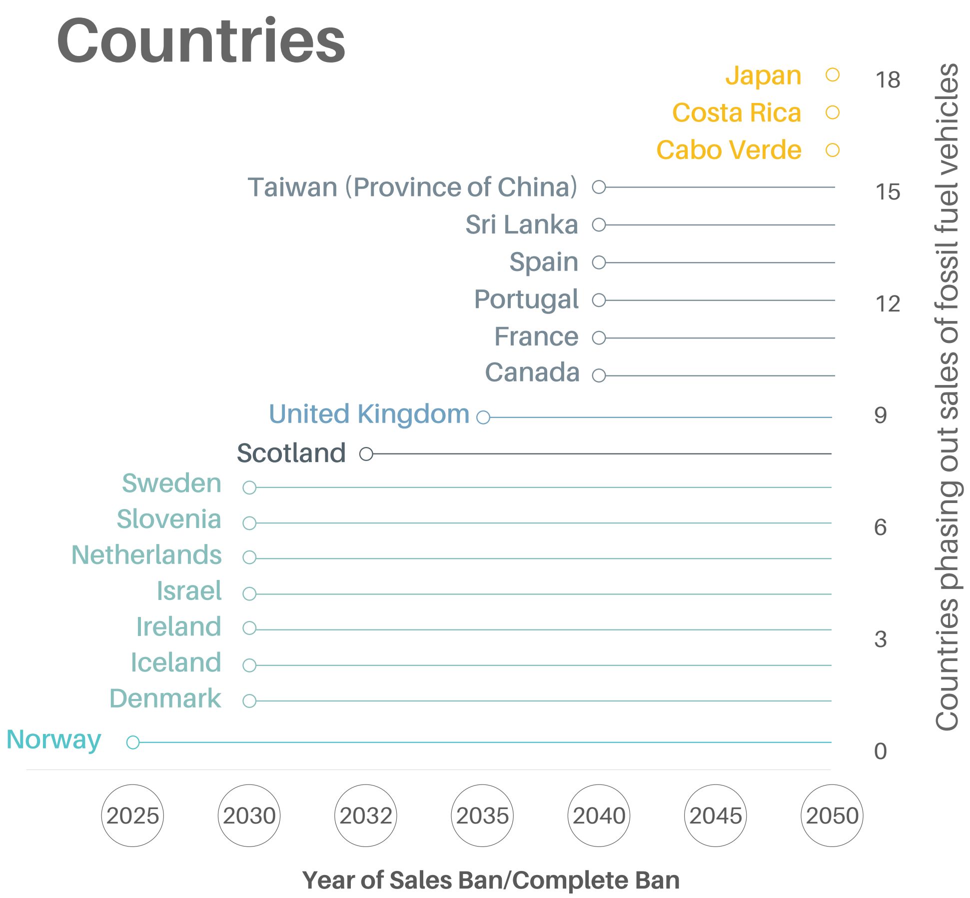
- In 2019, several countries announced that they would phase out sales of diesel and petrol cars, including **Sweden** by 2030, **Canada** and **France** by 2040 and **Cabo Verde** by 2050.[68] In 2020, the **UK** moved forward its phase-out target to 2035, while **Spain** announced a phase-out target for 2040.[69]
- Many sub-national entities have made commitments to ban fossil fuel vehicles. For example, **Amsterdam**, the Netherlands; **Brussels**, Belgium; and **San Francisco**, California, US aim to allow only zero-emission vehicles within their city centres by 2030.[70]
- **British Columbia**, Canada, under its CleanBC initiative, has funded a province-wide training programme with the British Columbia Institute of Technology to prepare an electric vehicle maintenance workforce.[71] The province also aims for 100% of light-duty vehicle sales to be electric from 2040.[72]

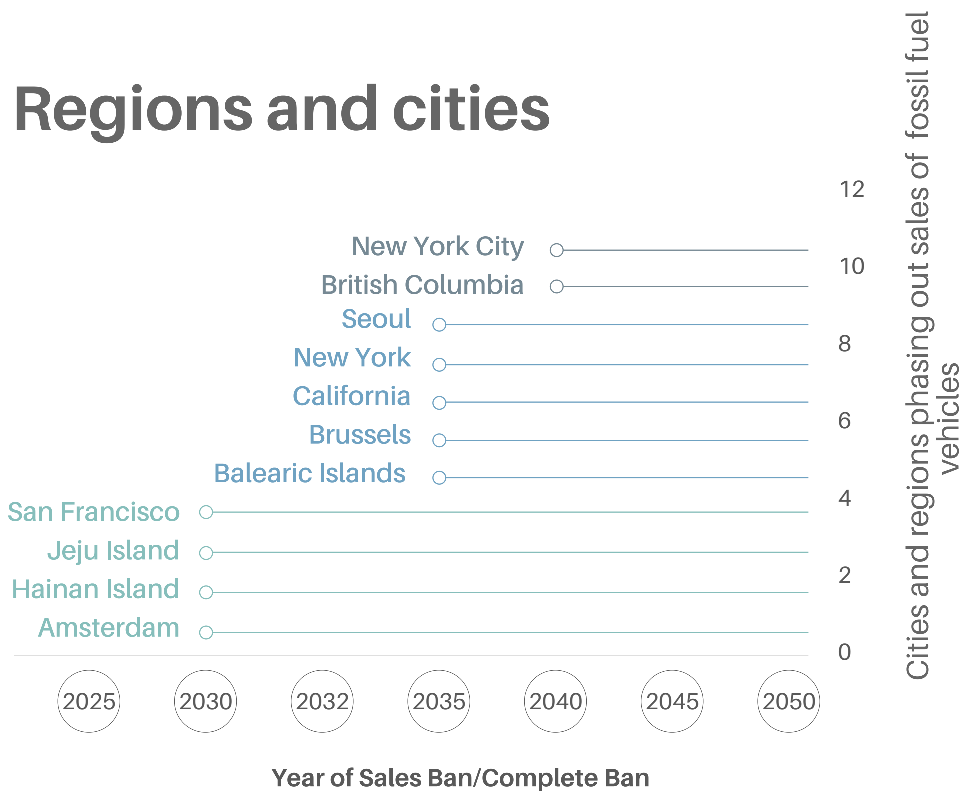
(*See the end of this section for an overview of electric mobility targets set by countries.*)

In 2020, the first-of-its-kind Zero Emission Vehicle Transition Council was established, comprising ministers and representatives from the world's largest and most progressive car markets.[73] Hosted by the UK presidency of the 2021 United Nations Climate Conference (COP26), the council includes representatives from California, Canada, Denmark, the EU, France, India, Italy, Japan, Mexico, the Netherlands, Norway, the Republic of Korea, Spain, Sweden and the UK.[74] It aims to co-ordinate efforts to overcome strategic, political and technical barriers to zero-emission vehicles, while accelerating their production.[75]

In response to phase-out targets by countries, major automobile companies are halting the development of internal combustion engines and accelerating their electric vehicle ambitions towards the 2030/2035 time frame. Automakers have started to revise their electric vehicle production and to shift research and investments from combustion engines to electric drivetrains. However, current plans still leave a gap between the electric vehicle demand required to support national targets for electric mobility by 2030 and the potential supply *(see Section 2.3 on Responses to Address Climate Change in the Transport Sector)*.

Figure 5. Countries, regions and cities with commitments to phase out fossil fuel vehicles, by target year





Source: See endnote 67 for this section.

- **BMW** announced a target to double its electric car sales starting from 2021.[76]
- **GM** set a goal in 2021 to sell only zero-emission vehicles after 2035.[77]
- At the end of 2020, **Hyundai** announced that it was suspending the development of diesel engines.[78]
- Since 2019, **Volkswagen** has offered its modular electric drive technology platform to other auto manufacturers, enabling global efforts to scale up the production of electric passenger cars.[79]
- In 2019, **Volvo** was the first European car company to divert from internal combustion engines, and in 2021 the company expressed its plan to produce only electric vehicles by 2030.[80]

Leapfrogging to electric mobility in Africa, Asia and Latin America can bring significant benefits to local environments and economies. Discussions and implementation strategies around electric vehicles do not fully incorporate the needs and perspectives of developing countries. Progress on e-mobility in low-and middle-income countries is being advanced through initiatives such as the Urban Electric Mobility Initiative (see below), but there is more room to guide and support the mobility and energy transitions.

- More than 3 million people in East Africa earn money as motorcycle taxi drivers.[81] Start-ups, such as Ecobodaa in **Kenya**, began rolling out electric motorcycles in 2020 through a "rent-to-own" model that helps taxi drivers improve their health and save money on fuel and maintenance.[82]

- **Rwanda** announced a plan in 2019 to replace all fossil fuel-powered motorcycles with electric two-wheelers in the coming years.[83]
- In 2019, a local vehicle manufacturer in **Vietnam** committed to selling 250,000 electric motorcycles a year.[84]
- The Urban Electric Mobility Initiative has produced electric vehicle-readiness assessments for cities across Africa, Asia and Latin America, including **Accra**, **Belo Horizonte**, **Cape Town**, **Kathmandu**, **Quito** and **Thimpu**.[85]

Utilities are taking on a greater role in the mobility ecosystem, thereby merging the value chains for electricity generation and electric vehicle charging.[86] Utilities are increasingly partnering with municipalities to plan battery charging and swapping networks, and with automakers to design vehicles that can be integrated with electricity grids for bi-directional flow of electricity and the feed-in of renewable energy. Electric vehicles can be seen as decentralised units in the energy system to store surplus electricity during periods of peak supply and release it during periods of peak demand.[87]

- The energy service company Enel X installed 80 charge points in **Chile** in 2019 and has worked closely with **Santiago** and **Bogotá** on their transitions to electric buses.[88]
- In **India**, three state-owned oil companies, accounting for 90% of the fuel retail market, have invested in electric vehicle battery charging and swapping infrastructure, in partnership with ride-hailing and metro rail companies whose parking lots will house battery swapping stations for three-wheelers.[89]
- **Stockholm**, Sweden, in its Charging Master Plan, aims to build 4,000 public charge points by 2022 and has worked with the grid operator **Ellevio**, the municipal planning department and local businesses to map priority areas for investment.[90]
- Utilities benefit from putting to use surplus power, and some have opened vehicle manufacturing subsidiaries; for example, **Thailand**'s second largest electric utility, Energy Absolute, created its Mine Mobility subsidiary to manufacture electric vehicles.[91]
- In some cases, utilities invest in electric vehicle chargers and stations, while in other cases private companies act as intermediaries (as with **ChargePoint**, **EVgo** and **Electrify America** in the USA).[92] Other companies, such as **EVBox**, provide both smart charging and related software.
- **Vancouver**, Canada has set a target to power its municipal transport fleet with 100% renewable energy by 2050.[93]

To accommodate the uptake of electric vehicles, the capacity of the grid must be increased. Ways to smooth electricity demand curves and increase alignment between the transport and energy sectors include smart charging, providing additional power through renewable energy, incentives for off-peak charging and vehicle-to-grid systems.

- In 2020, **Shanghai**, China completed its first pilot project using electric vehicles as a flexible energy source in the power grid.[94]
- As electric vehicle sales in **Stockholm**, Sweden increased, the city's power grid was unable to meet electricity demand during peak times in 2020 with other appliances also in heavy use.[95]

Initiatives supporting e-mobility

- **Action towards Climate-friendly Transport** (**ACT**) is the largest global coalition aiming to catalyse transport as an enabler of sustainable development in line with the 2030 Agenda for Sustainable Development and the Paris Agreement. The coalition connects innovative approaches with integrated, long-term planning, speeding up deployment of electric vehicles, creating a mass market for zero-emission freight vehicles and fostering global dialogue with and among the private sector.[96]
- The **EV30@30** campaign, launched at the Eighth Clean Energy Ministerial in 2017, set the collective aspirational goal of a 30% market share for electric vehicles among all passenger cars, light commercial vehicles, buses and trucks by 2030.[97]
- **EV100**, part of the Marrakech Partnership for Global Climate Action, is a transport initiative that aims to accelerate the transition to electric mobility by leveraging the role of corporate demand in driving electric vehicles uptake and the roll-out of charging infrastructure. The initiative was launched in 2017 with 10 member companies from various sectors in Europe and China.[98]
- The **International Zero-Emission Vehicle Alliance** (**ZEV Alliance**) is a collaboration of governments acting together to accelerate the adoption of zero-emission vehicles (electric, plug-in hybrid and fuel cell). The governments have committed to making all passenger vehicle sales in their jurisdictions ZEVs by no later than 2050 and to collaborating on policies and actions to achieve ZEV targets.[99]
- The **Taxi4SmartCities** coalition connects worldwide taxi companies that are committed to transitioning their vehicle fleets to low-emission vehicles by 2020 and 2030. More generally, the coalition defends a progressive and modern version of the taxi as a key actor in the Smart City.[100]
- The **Urban Electric Mobility Initiative** (**UEMI**) aims to boost the share of electric vehicles in individual mobility (two- and three-wheelers and light-duty vehicles) and to integrate electric mobility into a wider concept of sustainable urban transport that achieves a 30% reduction in urban greenhouse gas emissions by 2030.[101]

Key indicators

	2018*	2020*	% change
Policy Landscape Indicators			
Electric vehicle targets	61 (2017)	63	+3%
Internal combustion engine vehicle phase-out targets	7 (2017)	19	+171%
Electric vehicle incentives (subsidies, enabling legislation)	67 (2017)	73	+9%
Market development Indicators			
Electric vehicle market share (% of sold vehicles by year)	2.5%	4.6%	+84%
Electric vehicle stock (plug-in hybrids and battery passenger cars)	5,106,341	10,228,265	+100%
Public charging points (public and fast chargers)	(550,602	1,307,894	+98%
Public fast-charging points (charging power more than 22 kW)	145,461	263,802	+165%
Public slow-charging points (charging power below 22 kW)	405,140	922,215	+128%

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

Source: See endnote 102 for this section.

Box 1. Impacts of the COVID-19 pandemic on electric mobility

Despite temporary shutdowns of auto factories and disruptions in global supply chains due to the pandemic, more than 3 million electric cars were sold worldwide in 2020, surpassing projections of 2.4 million. While sales of electric vehicles increased, sales of new diesel and petrol cars fell around 14.5% below 2019 levels. Among all transport modes, electric-assisted bikes saw a spike in popularity, as manufacturers saw record sales and e-bike sales in the **USA** increased 145%.

Electric vehicle sales jumped to 4.6% of global vehicles sold in 2020. In the **EU**, the electric vehicle market share reached 9.9% in the third quarter of 2020, up sharply from 3% during the same period in 2019. In **Norway**, supported through subsidies and various incentives, the share of EVs sold in the first half of 2020 was higher than in 2019; fully electric vehicles accounted for 48% of all automobile sales in the country, and fully electric and plug-in hybrid vehicles represented 69% of sales – both of which were global records.

A number of governments have increased electric vehicle investments as part of their COVID-19 recovery packages (*see also Section 4 on Financing*). The long-term effects of the pandemic on the electric vehicle market are hard to predict. The International Energy Agency has projected a rebound in global energy use and CO_2 emissions, making "building back better" a sensible proposition.

However, policy measures remain indispensable to address the high initial capital costs of electric vehicles and to attract consumers and investors. Several countries have included electric vehicle purchase incentives and vehicle replacement programmes in national recovery packages, including the following:

- **China** promoted two programmes for electric mobility: one extending an existing programme that provides subsidies and tax breaks for 2 million new electric vehicles annually until 2022, and the other to implement 600,000 EV charging points, with a USD 1.45 billion investment.
- The **EU** agreed to the Next Generation EU recovery fund of EUR 750 billion (USD 900 billion), which supports transport decarbonisation through investments in cleaner, healthier and more affordable active and public transport.
- **France** created several programmes to encourage purchases of electric and plug-in hybrid vehicles, support research and development (R&D) in the automotive industry, provide relief during the pandemic and advance charging infrastructure, totalling USD 8.7 billion.
- **Germany** approved a EUR 50 billion (USD 60 million) investment package to support electric vehicle purchases, charging infrastructure, R&D for electric mobility and battery cell production, and innovation in the automotive industry.
- **Italy** approved programmes to deduct taxes for electric vehicles and charging infrastructure (110% tax deductions) and to subsidise new electric vehicles (EUR 6,000 (USD 7,300) per unit, up from EUR 4,000 (USD 4,800) previously).
- The **Republic of Korea** introduced a Green New Deal totalling USD 61 billion over five years, which includes plans to enhance the country's fleet to 1.33 million electric (including hydrogen-powered) vehicles.
- **Spain** advanced a USD 1.12 billion package for public transport and shared mobility, replacing government fleets with zero-emission vehicles, R&D in sustainable mobility and its associated industry, and subsidising the replacement of old vehicles for zero- and low-emission ones.
- The **US** has proposed USD 174 billion to build a national network of 500,000 electric vehicle chargers by 2030, to support manufacturing of batteries and electric vehicles, and to retool factories to compete globally. The plan would also replace 50,000 diesel transit vehicles; electrify at least 20% of the country's school bus fleets, and electrify the federal fleet, including postal vehicles.

Source: See endnote 1 for this section.

In Practice: Additional Policy Measures

Policy targets set

Phase-out targets

- **Amsterdam** aims to ban petrol and diesel vehicles completely by 2030, while at a country level the **Netherlands** plans to ban sales of new petrol and diesel cars from 2030.[103]
- **Pakistan**'s National Electric Vehicle Policy aims to have 90% of sales of passenger cars and heavy-duty trucks be electric by 2040, as well as 90% of sales of electric two- and three-wheelers and buses.[104]
- The Balearic Islands (Mallorca, Menorca, Ibiza and Formentera) of **Spain** announced a target for 100% renewable energy use by 2050 and a phase-out of sales of internal combustion vehicles by 2035.[105]
- In 2019, **Sweden** announced a sales ban on diesel and petrol cars by 2030.[106]
- **Ukraine** envisions that 75% of all motorised trips by 2030 will be via electric mobility.[107]
- In early 2020, the **UK** advanced its target for phasing out internal combustion vehicles from 2040 to 2035.[108]
- San Francisco, California, **USA** aims to ban sales of internal combustion vehicles by 2030, in an effort to achieve an emission-free transport system by 2040.[109]
- **Canada** announced deployment targets as well as various financial incentives for zero-emission vehicles such as electric vehicles.[110]

Electric fleets (private and shared)

- **Nepal** expressed in its second NDC that by 2030 the sales of electric vehicles should represent 90% of all passenger vehicle (cars and two-wheelers) sales and 60% of all four-wheeler public passenger vehicle sales.[111]
- In the first electric taxi deployment in **Panama**, the province of Colon plans to create a fleet of 1,500 electric taxis; as of 2019, 7 of the vehicles were already deployed through a partnership between BYD, Ensa Servicos and Traservi, which also installed a rapid charging station for the fleet.[112]
- In 2020, **Turkey** released a vision target to have 1 million electric cars and 1 million charging points by 2030.[113]
- Companies such as **Amazon**, **DHL**, **FedEx**, **IKEA** and **UPS** have established targets and pilot programmes to fully convert their fleets to electric.[114]
- By the end of 2020, at least 74 jurisdictions worldwide had some form of financial support in place for electric vehicles.[115]

Electric buses

- **São Paulo**, Brazil introduced its first 15 electric buses at the end of 2019 and aims to increase the fleet to 400 buses in the coming years, to support the city's vision of halving CO_2 emissions by 2027 and becoming carbon-free by 2037.[116]
- **Chile** aims to have a fully electric public transport system nationwide by 2040.[117] In 2019, the city of **Santiago** deployed 200 e-buses as part of a plan to cut emissions and reduce air pollution.[118]
- **Costa Rica**, as part of its economy-wide roadmap to achieve net zero emissions by 2050, committed to public procurement of electric buses and taxis and the provision of funds to create an electric train line.[119]
- In 2019, the president of **Colombia** signed a law targeting the complete electrification of mass transport by 2040.[120]
- **Ecuador** has committed to converting its entire bus fleet to electric by 2025 as part of its ordinance for the gradual decarbonisation of transport.[121] At the end of 2019, the first 20 electric buses and 50 taxis arrived in **Guayaquil**.[122]
- In the **EU**, the revised Clean Vehicles Directive of 2019 aims to accelerate the procurement of zero-emission vehicles and sets a target for the majority of procured public buses to be electric from 2026.[123]
- **Amsterdam**, the Netherlands aims to convert its municipal bus fleet to electric by 2025, and **Milan**, Italy has a similar target for 2030.[124]
- **India** plans to deploy 5,595 electric buses in 63 cities under its FAME II subsidy scheme launched in 2019.[125]
- In the USA, **New York City** plans to convert its bus fleet to electric by 2040, and **San Diego** and **San Jose** also plan to convert their fleets by 2040 to comply with a California state-wide mandate.[126]

EV charging infrastructure

- In **Germany**, the 2030 climate plan targets 1 million charging points by 2030, for which a masterplan is under way.[127]
- Since 2020, in the **EU**, new residential units or major renovations with more than 10 parking spaces are required to be 100% electric vehicle-ready, while 20% of space in new non-residential units must be electric vehicle-ready by 2025.[128]
- In **India**, the FAME II scheme as well as state policies have laid out subsidies to support 2,636 new charging stations in 62 cities.[129] The governments of **Delhi** and **Kerala** have enacted policies to support battery charging and swapping systems, and state-owned thermal power companies have partnered with metro rail companies to provide charging points and fuel retail in parking lots.[130]
- In 2020, the **UK** government announced the allocation of GBP 500 million (USD 700 million) over the next five years for electric vehicle charging infrastructure on national roads.[131]
- **Canada** announced nearly CAD 100 million (USD 76.5 million) in funding in 2019 to deploy new electric vehicle charging (and hydrogen fuelling) stations.[132]
- In 2019, **the Netherlands** committed to installing 2,000 charging points to support electrification of its national government fleet.[133]

Policy measures implemented

Electric fleets (private and shared)

- **China** enacted stricter standards for automakers to gain credits for zero-emission vehicles for 2021-2023 so that they would build vehicles that use even less fuel.[134]
- Local governments in **Shanghai**, China are providing subsidies to car-sharing companies to purchase electric vehicles and to build and buy charging infrastructure; so far, 39 cities in **China** have followed this policy implementation model, resulting in the addition of 50,000 electric vehicles in total.[135]
- **Shenzhen**, China adopted a regulation in 2019 that requires all newly registered ride-hailing vehicles in the city to be battery electric.[136]
- In 2019, **India** implemented the Faster Adoption and Manufacturing of Electric Vehicles in India Phase II (FAME Phase II) scheme, which includes a USD 1.4 billion budget over three years to reduce the purchase price of hybrids and electric vehicles through rebates.[137]
- In **Norway**, local governments have instituted the majority of electric vehicle incentives and policy support tools, such as planning zero-emission zones where the vehicles have priority access, providing incentives for purchasing vehicles and setting up charging infrastructure, developing building codes amenable to electric vehicle charging points and offering 50% reductions in parking charges. **Norway** also has exempted electric vehicles from weight, CO_2 and nitrogen oxide emissions taxes and value-added tax to the end of 2021.[138]
- In December 2019, the **California** Air Resources Board in the US amended its Clean Vehicle Rebate Project to increase rebates for low- to moderate-income communities while reducing rebates for electric vehicles above USD 60,000 and plug-in hybrids below 35-mile range.[139]

Electric buses

- As of 2020, **Brazil** had 247 electric buses (including electric trolley buses and 12-15 metro buses), and **Mexico** had 238 (electric trolley buses).[140]
- In 2019, the government of **Chile** helped launch an electric bus corridor with 411 buses through a partnership in which electric utility Enel X procures the buses and leases them to local operator MetBus, and provides charging services.[141] The corridor is further supported through policy measures related to air quality improvements, fuel efficiency labelling and green taxation.[142]
- **Shenzhen**, China diligently planned a charging network to support its growing electric bus fleet, allocating real estate, finances, charging technology and required electricity connections.[143]
- In Colombia in 2019, the city of **Cali** procured 26 electric buses with support from the energy company Celsia, and **Medellín** installed 64 electric buses following a successful single-bus pilot.[144] **Bogotá** was set to procure 483 electric buses to begin operations in September 2020, but this was postponed due to the COVID-19 pandemic.[145]

Electric two- and three-wheelers

- In **India**, state and central government policies have prioritised electric two wheelers, with the FAME subsidy scheme applicable to 86 different models of electric two-wheelers.[146]
- **Portugal** introduced an electric bicycle subsidy scheme in 2019 supporting the purchase of 1,000 e-bikes.[147]

Other

- **Thailand** began operating its first electric battery-powered commuter boats in Bangkok's canals in 2018; by 2020, the pilot proved so successful that the city planned to further expand the service.[148]

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.

Endnotes

3.8 Electric Mobility

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Annex: Methodological Note

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