Federal Foreign Office

Energie wende
Switch to the Future

EXHIBITION

ENERGY IN TRANSITION – POWERING TOMORROW

SOURCES AND REFERENCES

RENEWABLE ENERGY

MOBILITY

FIND
SOURCES
↓

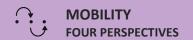| When people in rural areas flock to the cities every day: Commuting is commonplace. Worldwide.	Source
45% of the global population live in rural areas.	*European Commission (2019): Atlas of the Human Planet, JRC Science for Policy Report, [access 2020].*
Most employees commute between their home and workplace. The working population in the United Arab Emirates spends a lot of time travelling to work – over 1.5 hours a day on average. Commuting in Japan is very quick: just 39 minutes on average.	*Statista (2017): This is how long people commute to work worldwide, [access 2020].* *Statista (2016): Weekdays average time spent on commuting to and from work or school among people in Japan from 1976 to 2016, [access 2020].*
Global car production has grown hugely – now over 67 million per year.	*Statista (2020): Production of passenger cars worldwide from 1998 to 2019, [access 2020].*
1.3 billion cars worldwide On average, one in six people now owns a car. Ownership rates are highest in the US, where 8 out of 10 people have one. In many other countries, however, owning a car is less common.	*Statista (2017): Number of passenger cars and commercial vehicles in use worldwide from 2006 to 2015, [access 2020].* *Statista (2018): Number of motor vehicles registered in the United States from 1990 to 2018, [access 2020].* *United States Census Bureau (2020): U.S. and World Population Clock, [access 2020].*
Asia has the highest number of cars, but it is also home to 60% of world's population. 1/3 of all cars in Asia.	*UN (2020): World Population Dashboard, [access 2020].* *Statista (2020): Largest automobile markets worldwide in 2019, based on new car registrations, [access 2020].*
45% of the global population live in rural areas.	*European Commission (2019): Atlas of the Human Planet, JRC Science for Policy Report, [access 2020].*

In urban centres, many people need to get from A to B quickly.	Source
More than half of the world's population now live in cities, and this trend is rising. […] The number of people living in urban areas is expected to double by 2050.	*UN (2018): 68% of the world population projected to live in urban areas by 2050, says UN, [access 2020].*
Most of the world's greenhouse gas emissions are generated in conurbations – the result of high energy consumption, building use and road traffic.	*IEA (2016): Cities are in the frontline for cutting carbon emissions, new IEA report finds, [access 2020].*
These are the most popular means of transport worldwide: Bus 63% Metro/underground 32% Tram 5%	*UITP (2017): Urban Public Transport in the 21st Century, [access 2020].*
Example Ethiopia: The Ethiopian capital Addis Ababa, for example, has had a tram system for several years.	*IFRI (2018): The Change of Urban Mobility. A Case Study of Addis Ababa Light Rail, Ethiopia, [access 2020].*
Bus rapid transit (BRT) systems are in use in many emerging countries, transporting over 30 million passengers a day.	*Daimler: Bus Rapid Transit. News Independence in Urban Transport, [access 2020].*
The cities leading the way in car sharing worldwide are Tokyo (19,800 cars), Moscow (16,500) and Beijing (15,400).	*Statista (2019): Leading cities for car-sharing worldwide in 2018, by fleet size, [access 2020].*
Underground CO_2 emissions over 10 km: 0.6 kg **E-scooter** CO_2 emissions over 10 km: 1 kg	*Quarks (2019): CO2-Rechner für Auto, Flugzeug und Co., [access 2020].* *Joseph Hollingsworth et al 2019 Environ. Res. Lett.14 084031: Are e-scooters polluters? The environmental impacts of shared dockless electric scooters, [access 2020]*

By 2021, more than 20 million bikes could be available around the world as part of bike sharing systems.	Statista (2018): Entwicklung der weltweiten Anzahl der Fahrräder in Bike-Sharing-Systemen in den Jahren 2010 bis 2021, [access 2020].
City centres as pedestrian zones **Example Denmark:** The Danish capital Copenhagen is a pioneer in urban cycling. 45% of the inhabitants commute by bike. Phased traffic lights save cyclists 5-6 stops at lights and up their pace by 21%. There are 368 km of cycle lanes in the city centre (2015). Copenhagen's cyclists cover 1.27 million km per day.	*The City of Copenhagen (2011): Good, better, best. The City of Copenhagen's Bicycle Strategy 2011-2025, [access 2020].* *Cam Cycle (2012): Study Tour of Copenhagen, Newsletter 103, [access 2020].* *The City of Copenhagen (2015): Copenhagen. City of Cyclists. The Bicycle Account 2014, [access 2020].* *The City of Copenhagen (2013): Copenhagen. City of Cyclists. The Bicycle Account 2012, [access 2020].*
Example Colombia: Bogotá is promoting cycling to combat its daily traffic chaos. 120 km of the road network is closed to cars from 7:30 to 14:00 on Sundays and public holidays. During these times, up to two million people get around the city centre by bike or on foot.	*National Geographic (2019): The City bans Cars every Sunday – and People love it. Spurred by environmental concerns, an experiment in Bogotá, Colombia, is spreading worldwide, [access 2020].*

Off on holiday!	Source
There are more and more tourists all over the world. In 2018, a total of 1.4 billion people travelled abroad as tourists.	*UNWTO (2019): International Tourist Arrivals Reach 1.4 billion Two Years Ahead of Forecasts, [access 2020].*
Buses are the main means of transport in South America, for instance. Passenger numbers are constantly rising and will soon hit 40 million a year.	*Latin America Economic Review (2019): Urban transport systems in Latin America and the Caribbean: lessons and challenges, 28/2019, [access 2020].*
Four in five European tourists went on holiday in their own region in 2018.	*The Guardian (2019): Global tourism hits record highs - but who goes where on holiday?, [access 2020].*
Air transport There were 47 million flights worldwide in 2019.	*Statista (2020): Anzahl der Flüge in der weltweiten Luftfahrt von 2014 bis 2019, [access 2020].*
In 2018, people across the world travelled just under 8.2 billion kilometres by air. This figure had doubled in 10 years. *Number of annual air kilometres worldwide, in billions of kilometres.	*Statista (2020): Entwicklung des weltweiten Passagierflugverkehrs von 2009 bis 2039, [access 2020].*

Legislation to support climate change mitigation in the EU	Source
Transport sector Greenhouse gas emissions in the transport sector rose by 29% between 1990 and 2018. General greenhouse gas emissions in the EU fell by around 23% in the same period.	*European Environment Agency (2020): Transport: increasing oil consumption and greenhouse gas emissions hamper EU progress towards environment and climate objectives, [access 2020].* *European Commission (2019): EU greenhouse gas emissions down 23% since 1990, still implementation will have to be further accelerated to reach current 2030 targets, [access 2020].*
Climate neutrality goal The EU aims to be climate-neutral by 2050. That means its greenhouse gas emissions should be zero.	*European Commission (2019): Going Climate-Neutral by 2050, [access 2020].*
CO_2 emissions from new passenger cars and light commercial vehicles must be reduced by 30% by 2030.	*European Union (2019): REGULATION (EU) 2019/631 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 April 2019 setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles, and repealing Regulations (EC) No 443/2009 and (EU) No 510/2011, [access 2020].*

How is the Bolivian government managing to solve acute traffic problems and boost local transport?	Source
The urban population in Latin America and the Caribbean has grown from 57 % of the overall population in 1970 to 80 % in 2017.	*Inter-American Development Bank: Getting a Lift: The Impact of Aerial Cable Cars in La Paz Bolivia, 2018 [access 2020]*
Example Bolivia: Bolivia's administrative capital La Paz has close links with the neighbouring city of El Alto. This region is home to 2.8 million people – 1 million in El Alto.	*Inclusive Infrastructure: Case Study: Mi Teleférico Cable Car, Bolivia, [access 2020].*
Mi Teleférico Most of the energy required comes from hydropower plants. Solar panels on the cabin roofs generate electricity for the lighting, door mechanisms and Internet.	*Inclusive Infrastructure: Case Study: Mi Teleférico Cable Car, Bolivia, [access 2020].*
During the planning phase, some 800 events were held with around 4,500 participants – residents, organisations and authorities.	*IDB (2018): Getting a Lift: The Impact of Aerial Cable Cars in La Paz Bolivia, [access 2020].*
A total of 11 lines connect El Alto and La Paz, and more districts in La Paz are being opened up.	*Inclusive Infrastructure: Case Study: Mi Teleférico Cable Car, Bolivia, [access 2020].*
243,000 passengers a day were transported on average in 2017. Between 2014 and 2018, a person using the yellow line 30 times a month would have saved a total of 17 hours of travel time.	*Inclusive Infrastructure: Case Study: Mi Teleférico Cable Car, Bolivia, [access 2020].*
Over 2,200 people with disabilities in El Alto and La Paz benefit from the cable car. There is a 50% discount for the elderly, students and people with disabilities. Furthermore, the company reported a surplus of over EUR 5 million in 2018.	*La Paz Life (2015): Mi Teleferico: La Paz's Cable Car System, [access 2020].* *Inclusive Infrastructure: Case Study: Mi Teleférico Cable Car, Bolivia, [access 2020].*

Cable cars feature in local transport in many Latin American countries.	Source
Example Colombia The Colombian city of Medellín has had a cable car linking poorer districts to the centre since 2004.	*Centre for Public Impact (2016): The Metrocable: transport by urban cable car in Medellín, [access 2020].*
Example Mexico In Mexico City, cable cars have been transporting people safely through the city since 2016 – faster than taxis or minibuses.	*Intertraffic (2019): Speeding up the Mobility Transition, Victor Jasso, Mexicable, [access 2020].*

The automobile and components industry is one of the most important segments in the mobility sector.	Source
In 2018, the complete value chain around the automobile industry posted turnover worth around EUR 5 trillion worldwide.	*McKinsey & Company (2016): Disruptive trends that will transform the auto industry, [access 2020].*
New vehicle sales and automobile suppliers generate two-thirds of global turnover in the automobile industry.	*Bertrandt: Challenges and Trends in the Automotive Industry 2019, [access 2020].*
68 million new vehicles (cars) were sold worldwide in 2018.	*OICA (2020): Sales of New Vehicles 2005 – 2019, [access 2020].*
Policymakers are shaping the mobility transition by passing laws and regulations. Many countries are promoting e-mobility through legislation: Norway is aiming to switch completely to electric vehicles by 2025; China and India from 2030 onwards.	*Reuters (2019): Electric vehicle push in Norway could add $1.3 billion to power bills by 2040: study, [access 2020].* *BBC (2019): India turns to electric vehicles to beat pollution, [access 2020].*
The average range of electric cars is currently around 260 km. The world record stands at 1,600 km.	*Electric Vehicle Research (2017): Record for longest range of an electric vehicle, [access 2020].*
Modern cars are already a kind of computer on wheels. For each hour of driving, a car collects around ten gigabytes of data.	*Axel Schmidt, Managing Director, EALA Automotive Lead, Accenture (2015): Always at your service - the battle for the vehicle cockpit has begun (Supplement of "Automobilwoche"), [access 2020]*
The market for mobility services in Europe, the USA and China could grow to USD 1.4 trillion by 2030.	*Next Mobility: How the Shared Mobility concept can pay off, 2019, [access 2020]*
Autonomous transport services have great market potential. In Germany, for example, autonomous transport fleets could generate turnover of up to EUR 17 billion annually.	*Deloitte: Urban mobility and autonomous driving in 2035, 2019 [access 2020]*

Mobility trends in the world's most innovative cities.	Source
By 2050, nearly 70 per cent of people around the globe will live in cities. Cities consume around 80 per cent of the energy generated worldwide. Cities emit up to 70 per cent of the world's greenhouse gases.	*UN (2018): 68% of the world population projected to live in urban areas by 2050, says UN, [access 2020].* *UN Habitat (2019): The Strategic Plan 2020-2023, [access 2020].* *UN Habitat (2019): The Strategic Plan 2020-2023, [access 2020].*
Urban trends: In Paris, people mainly travel on foot. Only a few Parisians get around by car. 85 per cent of all journeys are on foot, bicycles or public transport.	*IFMO (2016): Mobility Trends in Cutting-Edge Cities. Final Report, [access 2020].*
Urban trends: Cycling is in fashion in Santiago de Chile. Bikes have become the no. 1 mode of transport in this major city – replacing the car as the status symbol of the urban elite. Local inhabitants cycle an average of 5.3 km a day.	*IFMO (2016): Mobility Trends in Cutting-Edge Cities. Final Report, [access 2020].*
Urban trends: The metro is at the heart of Tokyo's urban mobility. Millions of people use the metro every day – making 8,500,000 million journeys a day. Using a car to get to work is becoming less and less popular.	*IFMO (2016): Mobility Trends in Cutting-Edge Cities. Final Report, [access 2020].*
Transforming transport: How are we to achieve the global climate goals? In the Paris Declaration, the international community agreed to limit global warming to well below 2 degrees. Transport is responsible for 24 per cent of greenhouse gases worldwide.	*UN: The Paris Agreement. Essential Elements, [access 2020].* *Statista (2017): Distribution of carbon dioxide emissions from fuel combustion worldwide in 2017, by sector, [access 2020].*

Where do most emissions arise?	Source
Car usage In emerging economies especially, mobility is changing – by 2050 use of cars could double. **Air traffic** Increasing air travel could cause CO_2 emissions in this sector to almost double by 2050.	OECD (2019): ITF Transport Outlook 2019, [access 2020]. EESI (2019): The Growth in Greenhouse Gas Emissions from Commercial Aviation. Part 1 of a Series on Airlines and Climate Change, [access 2020].
Global CO_2 emissions differ greatly, depending on the mode of transport. Rail 0.1 gigatons Shipping 0.9 gigatons Aviation 0.9 gigatons Road freight vehicles 2.4 gigatons Passenger road vehicles 3.6 gigatons CO_2 emissions in gigatons; 2018	IEA (2019): Transport sector CO2 emissions by mode in the Sustainable Development Scenario 2000-2030, [access 2020].
Hyperloop – high-speed trains are revolutionising transport. These high-speed trains could zip through a tube system at up to 1,200 km/h. The hyperloop powertrain was first tested successfully in 2016 in Nevada, USA.	https://www.sciencealert.com/elon-musk-just-shared-footage-of-a-hyperloop-accelerating-to-200mph-and-holy-crap https://eu.rgj.com/story/money/business/2017/04/06/worlds-first-hyperloop-site-completed-nevada-las-vegas/100108838/
Hydrogen power for ships – for a green future at sea Around 90 per cent of global freight is transported by sea. Shipping emissions look set to double by 2050 – to around 10 per cent of global emissions. Maritime transport is responsible for 3 per cent of global greenhouse gas (GHG) emissions. By way of comparison, a fuel cell is around 100 times more expensive than conventional heavy crude oil.	APA News (2019): 90 percent of world trade is by sea- Official, [access 2020]. ICCT (2017): Green House Gas Emissions from Global Shipping 2013-2050, [access 2020]. ICCT (2017): Green House Gas Emissions from Global Shipping 2013-2050, [access 2020].

HySeas III: The world's first ocean-going ferry powered by a hydrogen fuel cell. Starting in 2021, the shuttle service between the Scottish islands of Orkney and Shapinsay is to be operated with a vessel powered exclusively by renewable energy sources.	*BIGHIT: Building Innovative Green Hydrogen Systems in Isolated Territories, [access 2020].*
RH2INE: Hydrogen-powered inland shipping As of 2024, these ships are to operate on the most important trade routes between Rotterdam and Genoa. To this end, hydrogen refuelling stations are scheduled for construction.	*RH2INE: Rhine Hydrogen Integration Network of Excellence, [access 2020].*