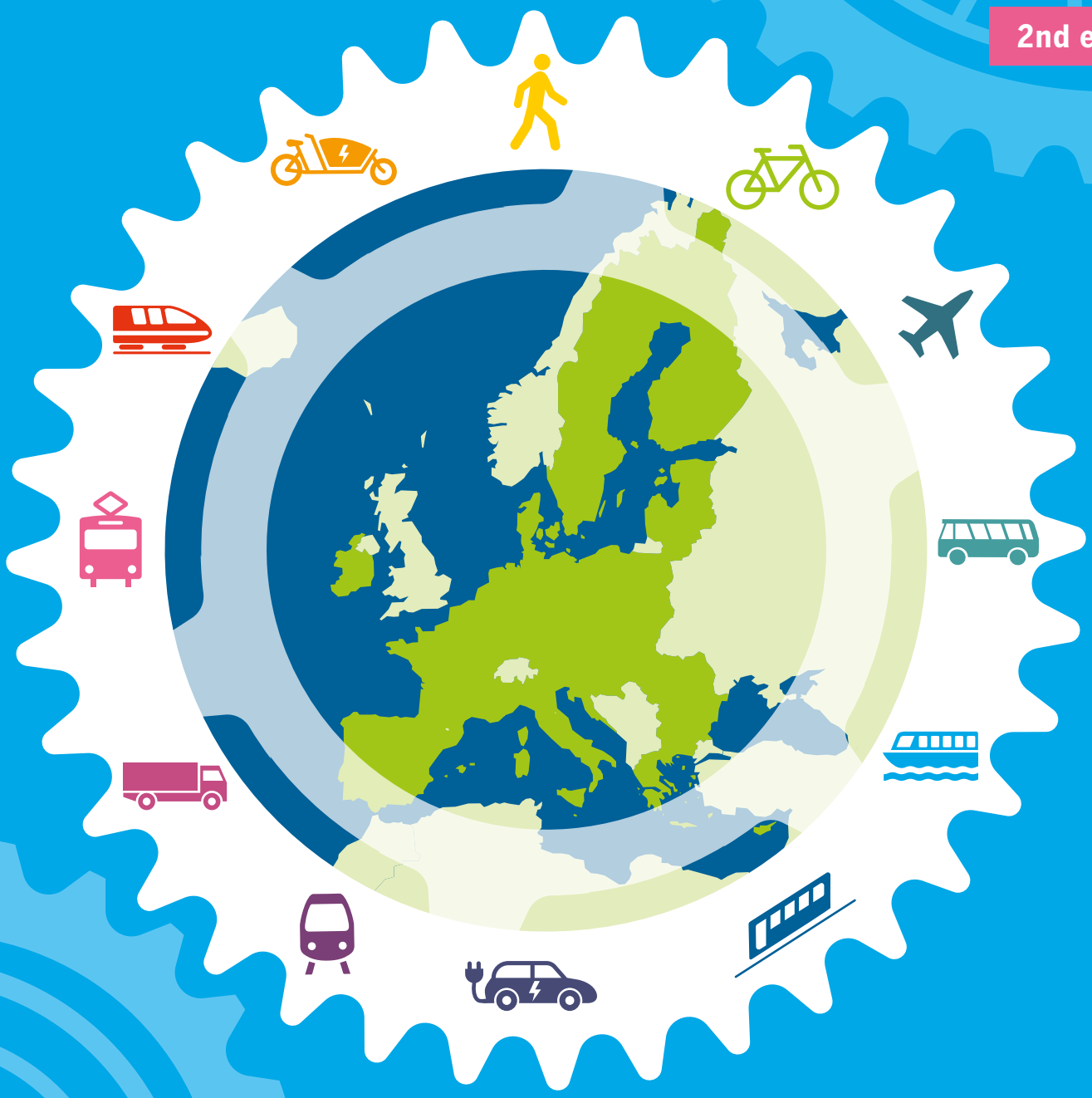
EUROPEAN MOBILITY ATLAS

Facts and figures about transport and mobility in Europe 2021

2nd edition



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PREFACE

Europe is the continent where multiple forms of transportation have been invented or brought to technological maturity. The free movement of persons has made Europe grow together and led to an ever-stronger sense of cohesion. Cross-border mobility is a prerequisite for a united EU and the experience of inter-connectedness on all levels.

The democratisation of modern means of transport after the first half of the 20th century led to enormous benefits for many individuals, enhancing their mobility, social permeability and comfort to a great extent. However, ever increasing levels of fossil fuel consumption and greenhouse gas (GHG) emissions became the other side of the coin.

However, transport today accounts for nearly 30 percent of the CO_2 emissions within the European Union. While it is imperative to reduce these emissions to fight climate change, our joint efforts must aim at creating and maintaining jobs in a sector transformed by electrification, other alternative fuels, digitalisation and automation. At the same time, a transition in the field of mobility and transport can only be truly sustainable if it is socially equitable and just.

These challenges can only be tackled in a joint effort on all levels: the EU institutions, Member States, as well as local authorities and communities. It is upon all of us to address these issues to tackle the climate crisis that we are facing. The European Green Deal as the overarching political framework needs to be at the forefront of this battle. It aims to make Europe climate neutral by 2050 and entails significant steps for the transport sector: The Sustainable and Smart Mobility Strategy will need to deliver on boosting passenger rail, multimodal ticketing, but also highly important infrastructure investment as with the revision of the Trans-European Transport Network (TEN-T) regulation. These plans can only be achieved with the necessary funding. As finance is key, the orientation of the EU's multiannual budget for 2021-2027 and recovery instrument "Next Generation EU" will thus be decisive to direct investment into the right transport infrastructures and mobility segments.

The Covid-19 pandemic has limited the freedom of movement extensively and shows the vulnerability of Europe as a place of constant movement. While air traffic decreased and the use of bicycles increased, there has also been a strong negative shift from shared transport to individual transport. If this change prevails, a great deal of earlier efforts to reduce GHG emissions in the transport sector will be nullified.

With more and more people being mobile, Europe is a continent that needs to remain innovative in order to achieve the relevant climate goals. We need new technologies to align our mobility infrastructure and behaviour with the pressing challenges of the upcoming years. To save our climate, the European Green Deal has to be Europe's first priority.

Recovery packages to overcome the effects of the Covid-19 pandemic must be accompanied by a commitment to transformation: they need to include sustainability criteria that avoid further carbon lock-in with a transport sector still largely powered by fossil fuels. A recovery of the EU's economy will not be a lasting one, if the focus is not going to be on future-oriented investments. For European mobility, that implies investments into a better rail infrastructure, helping public transport companies to survive the crisis, bailing out airlines only under strict climate conditions and, most importantly, creating a transparent polluter-pays principle across all means of transport.

It is good news that EU institutions agreed to make 2021 the 'European Year of Rail'. Railways, by nature, are and need to become even more the strong backbone of a sustainable and resilient European transport architecture. This can be achieved by overcoming the predominance of current national frameworks, as well as the limits imposed by them, in favour of one new, cross-border integrated network spanning the continent.

We therefore decided to complement the European Mobility Atlas 2021 with a folding map which provides an overview of sustainable green transport projects across Europe and, most importantly, highlights competitive rail projects such as night trains and high-speed lines. There are lots of best practices we can build on!

Our European Mobility Atlas seeks to contribute to the efforts towards sustainable and just mobility in Europe. Thus, it covers a multitude of transport-related aspects relying on evidence-based research and highlighting concrete, tangible mobility solutions from across our continent.

We would like to thank the chief executive editors, Martin Keim and Philipp Cerny, for their excellent work and efforts in devising and compiling this Atlas. We hope that this publication and endeavour will help its readers to get insights and new perspectives on European mobility.

Berlin and Brussels, February 2021

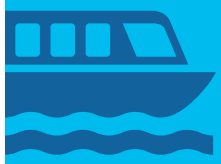
DR. ELLEN UEBERSCHÄR
President / Heinrich-Böll-Stiftung

EVA VAN DE RAKT
Director / Heinrich-Böll-Stiftung European Union

12 BRIEF LESSONS

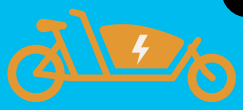
ON MOBILITY IN EUROPE

1. European mobility as it has developed has empowered many people and implies self-determination; but these **ACHIEVEMENTS** also generate social and ecological **STRESSES.**



2. Mass tourism and trips on aircraft and cruise ships are particularly harmful to this **ENVIRONMENT.** The European single market has a **DECISIVE ROLE** to play in this regard and therefore Europeans have a fair share of **RESPONSIBILITY.**

3. Motorised **MASS TRANSPORT** has reached its limits. A European transport sector dominated by **FOSSIL FUELS** adds to global warming, pollution and stress.



4. Cars occupy too much space. The **LIMITED AVAILABLE PUBLIC SPACE** should be used **MORE EFFICIENTLY** for cycling, walking and various forms of public transport, especially in towns and cities.

5. Climate-friendly means of transport and fossil fuels are incompatible. Sustainable **ENERGY AND MOBILITY TRANSITIONS** go hand in hand.

6. **TRAINS** and railways will essentially be the backbone of a climate-compatible European transport system, but are today often limited to individual countries. Investments to extend and **REACTIVATE RAIL ROUTES** within and across borders are necessary.

7 With its Trans-European **TRANSPORT NETWORK CORRIDORS**, the EU has set up a system for a Europe-wide transport infrastructure. It is crucial that policies implemented within the European Green Deal follow this **TRANS-EUROPEAN IDEA.**

8 **DIGITALISATION** of European transport brings along **OPPORTUNITIES** by linking different forms of transport in one single **APPLICATION.** The accessibility and availability of such technologies for everyone is a **CHALLENGE.**

9 Transport industries are manifold. The **EUROPEAN AUTOMOTIVE SECTOR** is undergoing thorough **CHANGES.** Bicycle production reinforces regional value creation and strengthens European small and medium-sized businesses.

10 **AVOID – SHIFT – IMPROVE** is the strategy to make mobility in Europe more sustainable. The Covid-19 pandemic has forced people to adapt their mobility behaviour and has created the need to **RETHINK** conventional practices.

11 The external costs of cars and planes as the most polluting modes of transport are not reflected in what we pay for using them. So far the implementation of the **POLLUTER-PAYS PRINCIPLE** is deeply flawed and needs to be tackled by EU policies such as taxation, carbon pricing or road tolls.

12 The **EUROPEAN MOBILITY OF THE FUTURE** entails interlinked, attractive, resource-efficient and climate-friendly means of transport within a European framework and contributes to a **HIGH QUALITY OF LIFE** in cities and **WELL-CONNECTED** rural areas.

A STRUGGLE FOR DIRECTIONS

It took until the late 1980s to make transport part of EU policy. Since then, steps have been taken towards a more ambitious transport policy. Reluctance in EU Member States to enforce the rules keeps being the biggest obstacle.

In 1983, the European Parliament (EP) introduced a complaint against the then Council of the European Communities (now Council of the EU) because of its inactivity in Transport and Mobility Policy. The European Court of Justice consequently urged the Council to start developing a common transport policy. At its Milan summit in June 1985, the EU heads of state confirmed that European Transport and Mobility Policy should become an official part of EU competence. Over the following years, EU policy was focused on borderless liberalisation and growth of the European internal transport market.

With the 1993 White Paper on Growth, Competitiveness and Employment, the European Commission (EC) tried to boost cross-border transport infrastructure. But it was not until ten years later that a stronger legal base was set up for EU co-financing of the Trans-European Transport Networks (TEN-T) through the Connecting Europe Facility (CEF).

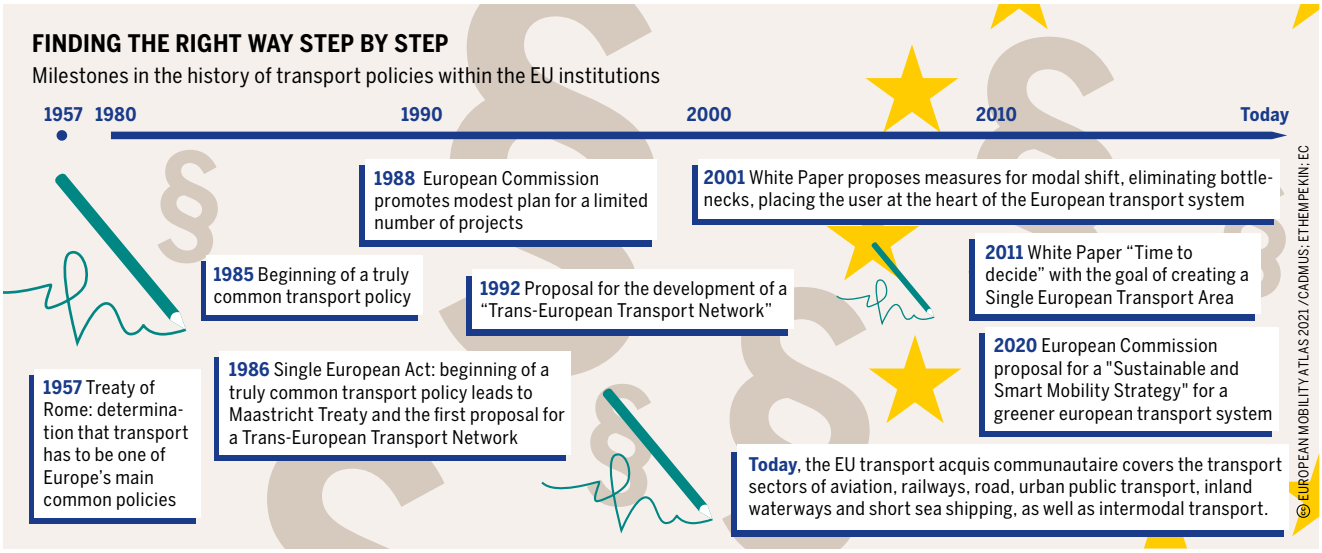
Harmonisation of rules in favour of transport safety, with a focus on roads, has been partly but still insufficiently realised. As an example, in January 1987, the EC published a communication on speed limits on EU roads. Mainly the United Kingdom and Germany blocked any European initiative on speed limits, although transport safety is partially a field of EU competence.

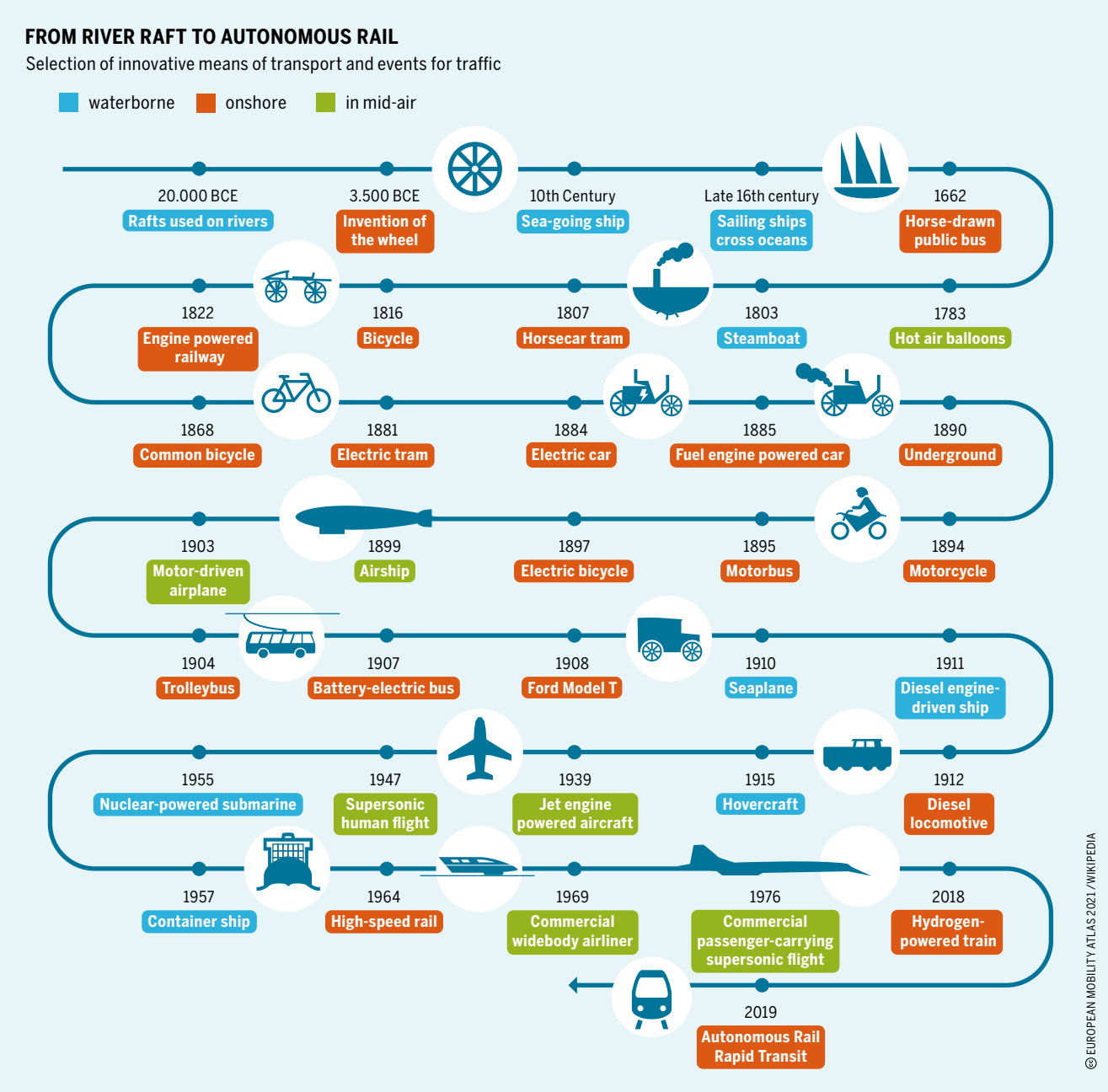
Over the last decade, under pressure from the EP, the EU intensified its actions and decisions towards a more ambitious transport and mobility policy. This includes the fields of road charging for trucks, standards of weights and dimensions of trucks and better passenger rights. On top of that came a more sustainable infrastructure legislation through the CEF, stronger cross-border integration of the different transport modes based on interoperability, intermodality and interconnectivity as a new set of policies. With its 2011 White Paper: 'Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system', the EC aimed high. By 2050 it wants no more conventionally-fuelled cars in cities; 40 percent use of sustainable low-carbon fuels in aviation; at least a 40 percent cut in shipping emissions and a 50 percent shift of medium distance intercity passenger and freight journeys from road to rail and waterborne transport. All of which will contribute to a 60 percent cut in transport emissions by the middle of the century.

But the largest problem remains unsolved: the lack of enforcement by the Member States and the limited activity by the Commission in overseeing the application of EU legislation and decisions.

Another historical challenge stems from transnational coordination and shared responsibilities. Switzerland and Austria, for instance, have invested hugely in a better infrastructure with the construction of the cross-border base tunnels of Brenner, Gotthard and, most recently, Ceneri. The hinterland connection in other Member States, specifically Germany, is still lacking far behind, due to the country's transport policy focus on roads.

There is a never-ending conflict between sustainable transport and mobility policies on the one hand and the European Commission's fixation on the single market on the other.





Getting the prices right and applying the polluter-pays principle by internalising external costs was already proposed by the Greens in the EP during the 1990s and is now a recognised principle in the Eurovignette directive for trucks.

As far back as in 1991, the EU intended to open rail markets and to separate operational matters from the infrastructure network. Over the following decades, four railway packages fixed rules for the European Union Agency for Railways (ERA), further opening the rail market, improving the interoperability and safety of national networks and developing a European rail transport infrastructure. The Europeanisation of railways remains the most crucial aspect, as considerable investments are still missing. The introduction of a Europe-wide digital railway controlling system (ERTMS) and the retrofitting of rail freight wagons for noise reduction are promising initiatives, but insufficiently enforced by the Member States.

Military use, entrepreneurial spirit or simply the desire for new ideas – many motives provided for the development of mobility.

There is a never-ending conflict between sustainable transport and mobility policies on the one hand and the EC's prioritisation of a competitive internal market on the other. Despite all efforts, there is still a long way to go to complete a comprehensive EU transport policy concept on avoidance and reduction of transport volumes.

FEAR OF FALLING BY THE WAYSIDE

Liberalisation and social harmonisation have barely gone hand in hand in the transport sector. Some EU rules exist, but without proper enforcement, the current employment situation is often unsatisfactory.

Transport not only connects people and business across Europe and beyond, but is also a workplace for millions of people. These jobs are often burdened by precariousness, social dumping and unsatisfactory working conditions.

There are several factors which have contributed to the current employment situation in the transport sector. One of them is the introduction of competition in transport sectors that were historically state-owned. Conceived as a way to provide better and more efficient transport within the EU internal market, it pushed for lowering prices of transport services. This in consequence put a downward pressure on workers' wages and working conditions. It brought a rise in non-standard, precarious forms of employment such as bogus self-employment, where workers are asked by their employers to register as independent subcontractors despite being fully dependent on the employer, and zero-hour contracts, where the employer is not obliged to provide minimum working hours. The Covid-19 pandemic further exposed the health and social risks that are linked to precarious forms of employment. Workers are more likely to continue work if they have no alternative source of income.

The lack of convergence in wages, social protection, collective bargaining and labour regulations among EU Member States also contributed to the increase of social dumping across Europe. This has been especially visible in the road transport sector, where many drivers come from Eastern European countries. Current EU regulations allow road transport companies to operate under certain conditions. There are for example rules on cabotage (the national carriage of goods for hire or reward carried out by non-resident hauliers on a temporary basis in a host Member State), drivers' work and rest time, compliance with local wages or posting of workers (employees sent by their employers to carry out a service in another EU Member State on a temporary basis). However, due to an insufficient number of inspections, these regulations have not been properly enforced. A more recent phenomenon is the increase in drivers from non-EU countries, who are more at risk of labour abuses.

There are good examples of workplaces with decent working conditions. They are usually in countries with strong social dialogue practices and a high rate of collective bargaining. However, in the reality of the EU internal market, such companies are under pressure from entities that do not follow the same standards.

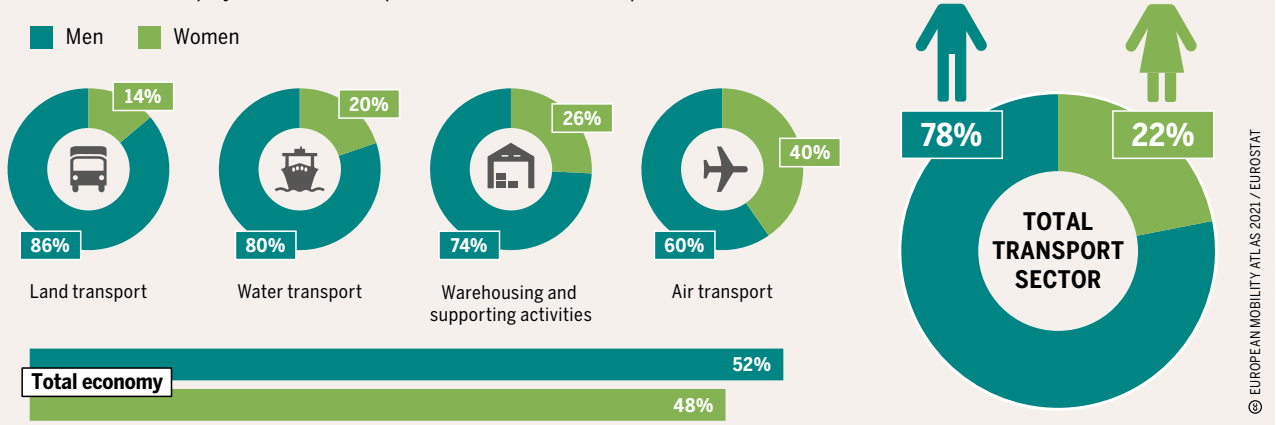
The emergence of new business models and increasing digitalisation in transport also impact working conditions in the sector. Technology as such can enable better working conditions, give more flexibility to workers and improve occupational health and safety. It can also make transport work more attractive to women, who currently form only a small percentage of transport workers, a situation that also fosters an insufficient consideration of the specific transportation needs of women.

However, digitalisation and automation also may have negative impacts as they can facilitate circumvention of labour laws, which has been the case with platform work,

Women are underrepresented in technical jobs and management roles. Increased female employment could mitigate labour shortages and better respond to the needs of women as users.

WOMEN ON THE MOVE

Gender structure of employment in the transport sector, EU-28, 2016, in percent



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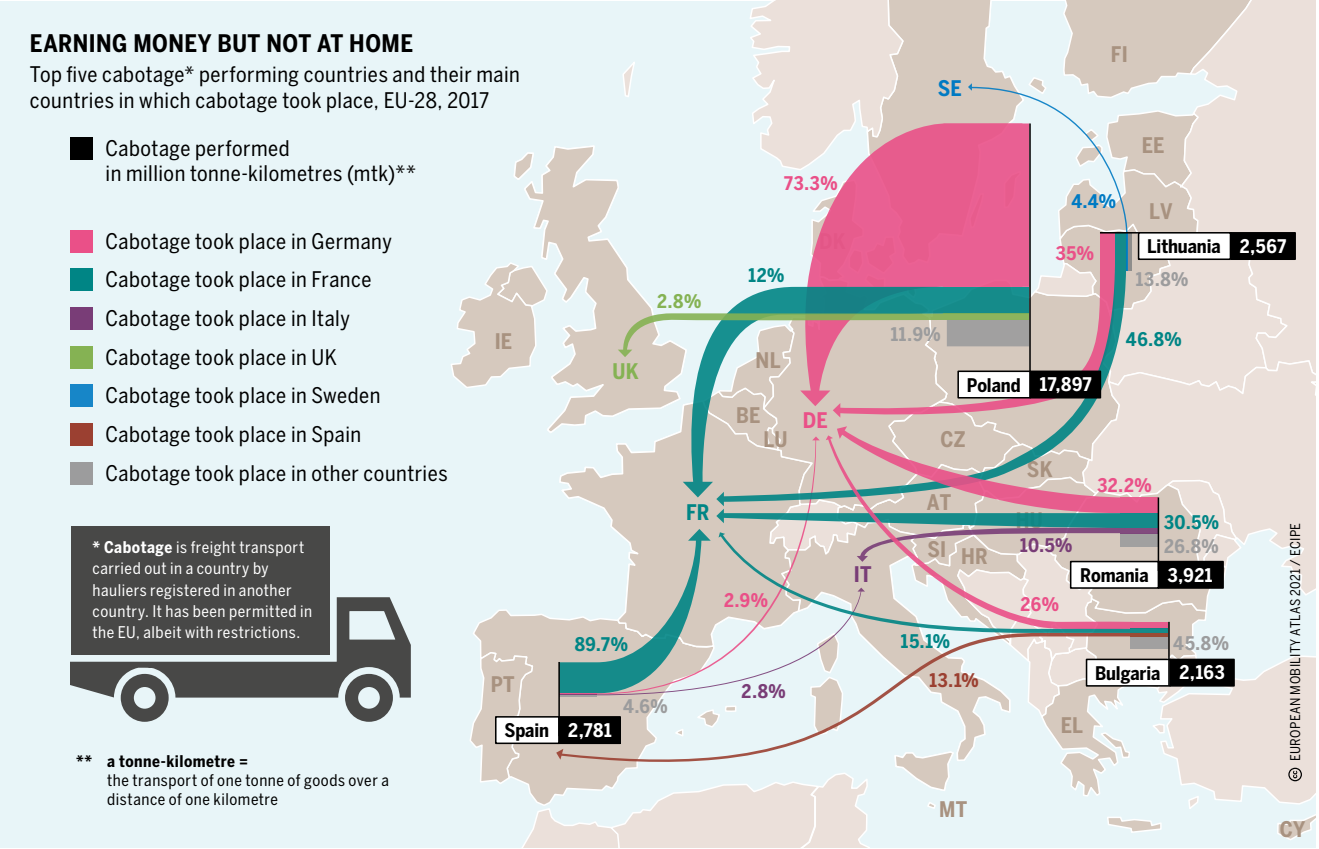
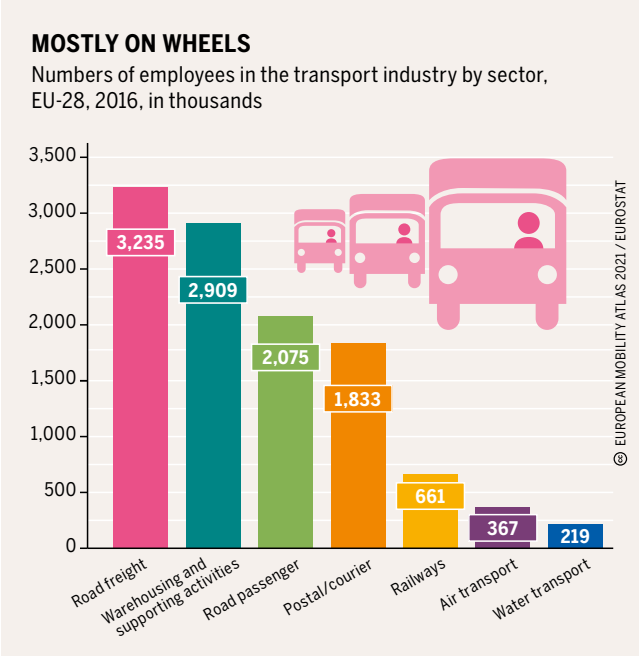


Thanks to cabotage, fewer vehicles run empty. But the added competitive pressure, combined with different labour costs and employment conditions, can lead to social dumping.

where the workers are engaged through an online platform to provide services such as food delivery or person transport. Due to the 'invisibility' of the employer, as the workers are deemed to be independent contractors, and not employees of the online platform, the workers are also unable to enter into a dialogue regarding their working conditions. There is also an emerging question of job relocation to non-EU countries, as possibilities of remotely-controlled operations appear. Another issue concerns the surveillance of workers and the use of algorithms for benchmarking workers' performance, as already observed in some logistics companies, for example. Lastly, increased digitalisation and automation in transport raise the issue of potential job losses. Although some studies indicate that new, higher-skilled jobs will replace old ones, it will be essential to provide reskilling or upskilling opportunities for the current workers.

In addition to targeting the employment issues that have been persistent for years, it is crucial to deal with the Covid-19 effects on transport with the social dimension in mind. Otherwise, a repetition of the situation after the 2008 crisis can be expected. Although the pandemic increased society's awareness of the role that transport workers play in supply chains, this appreciation has to be backed by appropriate supportive measures. As a rule, the European and national policies should therefore incorporate the social dimension from the beginning, not as a corrective action – which has typically been the case until now. Priorities include implementing measures aimed at maintaining jobs, ensuring health and safety for the workers, acting against further precarisation in the sector and better enforcement of the existing rules at the European and national level. Finally, a strong social dialogue is also beneficial for ensuring fair working conditions in transport, and it will be even more important during the Covid-19 aftermath.

Of a total of 11.3 million employees in the transport industry, just over a quarter work for the road freight sector, the biggest freight transport sector in the EU.



FLYING GREEN—A NICE DREAM

Suddenly, the skies were blue. The Covid-19 lockdown grounded the majority of flights, and analysts say that it could take years for aviation to get back to normal.

The commonplace occurrence of flying is being increasingly questioned for climate reasons: a single long-haul flight generates more emissions than many people around the world produce in a whole year. Aviation is the mode of transport with the biggest climate impact, and who flies and who doesn't is very unevenly distributed.

According to the industry, aviation accounts for only 2 percent of global CO_2 emissions. However, this omits several key factors. Due to flight emissions taking place at altitude, the overall climate impact of aviation is much stronger than the effect of the CO_2 alone, depending on flight altitude, distance, kerosene and aircraft type. Aviation is therefore estimated to be responsible for 5-8 percent of global climate impact. If unmitigated, aviation emissions are expected at least to double by 2050 and thus consume up to one quarter of the global carbon budget under a 1.5 degree scenario.

Furthermore, compared to other sectors, these emissions are produced by a very small part of the world population: over 80 percent of the global population has never taken a flight. There are various reasons for this: while people with European passports can travel to almost 190 countries without a visa, a Somali or Nepalese citizen, for instance, is allowed to fewer than 40. But it is mostly income disparities that lead to this injustice. In total, the top 10 percent of the global income spectrum uses 75 percent of air transport energy. In response to growing pressure for climate measures, the UN aviation agency ICAO (International Civil Aviation Organisation) has announced its intention to make international aviation greener in the future. The proclaimed goal is carbon neutral growth from 2020 onwards, defined in the CORSIA programme (Carbon Offsetting and Reduction Scheme for International Aviation). This programme consists of two main elements: modernised and efficient technologies and operations, and carbon offsetting.

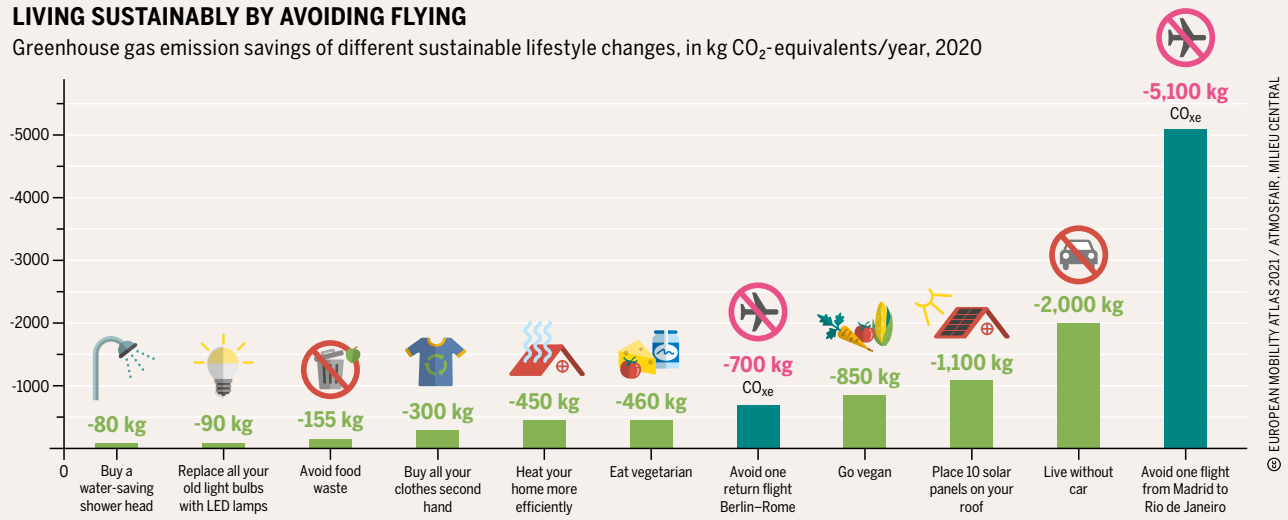
By using better technology in new aircrafts, the industry is aiming for fuel efficiency gains of around 1.5 percent. Given that annual growth rates are estimated at about 4 percent, efficiency savings are overall negligible. Step-changes in aviation technology are uncertain. For example, there is as yet no viable option for electric commercial jets, as batteries simply weigh too much. One proposed solution is therefore to switch fuels: biofuels are on the rise, with palm oil being the cheapest and easiest option. This, however, raises the issue of accelerated deforestation, biodiversity loss and human rights abuses. The other alternative could be synthetic fuel made from electricity. While this is technically feasible, the issue is in the sourcing of the energy: if all planes currently operating were to fly with e-fuels, this would consume more than the existing renewable electricity supply in the world, leaving nothing for other sectors.

As technological solutions are limited, the aviation industry turns instead to emissions offsetting. Such compensation projects are usually located in the global South, involving for example reforestation projects or hydro-electric dams that claim to lead to emissions savings. Offsetting schemes are often criticised for their potential to serve as a

Even if you transform yourself into a person with a very sustainable lifestyle, just one overseas flight would significantly increase your personal climate footprint.

LIVING SUSTAINABLY BY AVOIDING FLYING

Greenhouse gas emission savings of different sustainable lifestyle changes, in kg CO_2-equivalents/year, 2020



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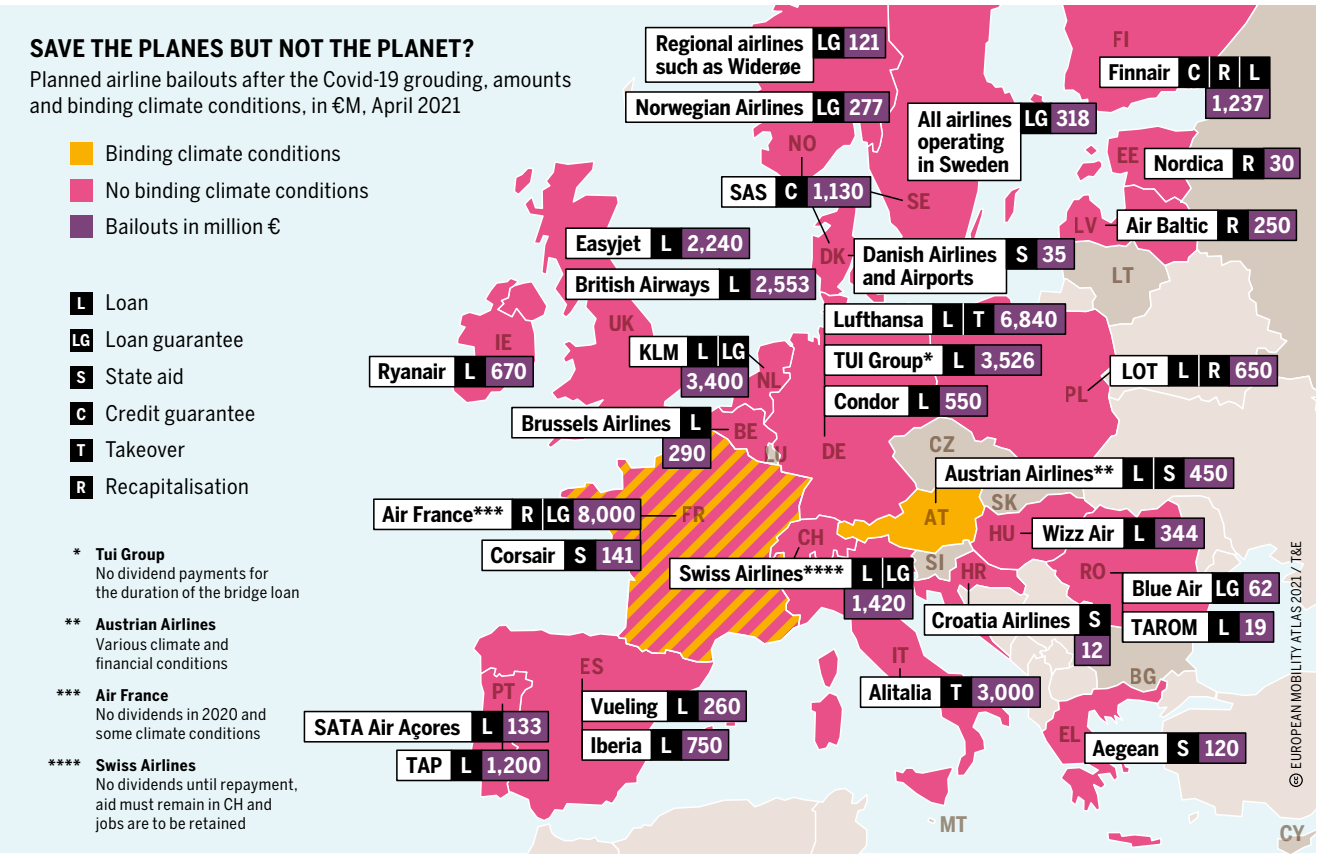


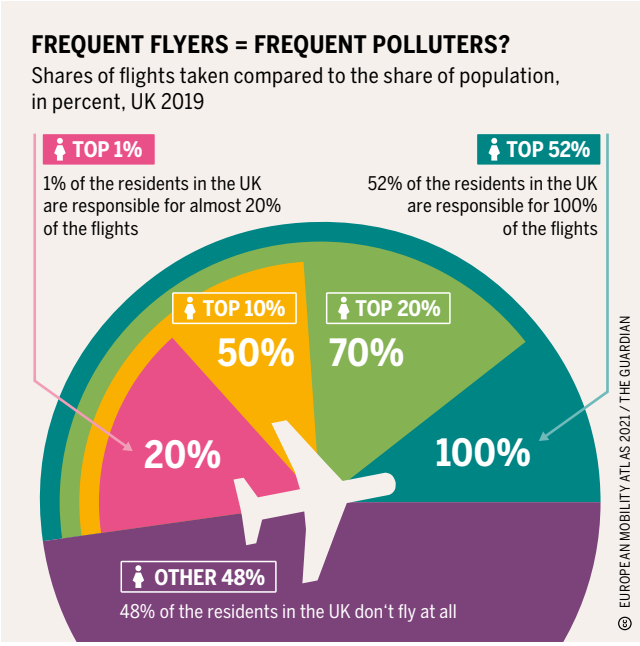
European airlines – some of the EU's biggest polluters – have sought an unprecedented 37.8 billion euros in government bailouts since the beginning of the Covid-19 crisis.

cheap licence to continue polluting. Aside from often being subjected to misleading calculations, many offsetting projects lead to side effects including land grabbing and displacement of local communities.

Given that there are no solutions on the horizon to effectively green aviation, climate scientists and growing civil society movements like the global Stay Grounded network point out that the only way to reduce aviation's emissions is to reduce air traffic. They propose limits for short-haul flights, a moratorium on airport expansion projects and a frequent flyer levy, which would allow a levy-free flight every couple of years, but make every other flight taken more expensive. A key demand is to stop aviation's regulatory advantages over more sustainable forms of transport and eliminate its tax exemptions: kerosene is the only fossil fuel apart from maritime heavy oil that is not taxed in almost any country and flight tickets are exempt from value-added tax. In the European Union alone, the losses in state revenue due to these aviation subsidies amount to 30 to 40 billion euros annually.

This doesn't include the billions of euros given to the industry as bailouts due to the Covid-19 crisis: taxpayer-backed money in general without any meaningful environmental or social conditions attached. Securing jobs in these times of crisis has been a key goal for employees, trade unions and NGOs alike – the question is whether and how jobs could be shifted to climate-just sectors such as railway and public transport. This demand for a just transition is gaining more traction now that going back to the normality of flying will take time – the normality for a wealthy world minority, which is increasingly questioned.

A frequent flyer levy could change flying habits: every citizen could fly tax-free once per year. Taxes would apply (progressively) for any additional flight.



THE TRANSFORMATION OF A KEY INDUSTRY

For more than 100 years, the automotive industry has relied on cars with internal combustion engines. Today, transformation is irrevocable. The Covid-19 pandemic makes it a truly Herculean task.

About 13.8 million Europeans, representing 6.1 percent of total EU employment, work in the automotive sector. The industry is responsible for 7 percent of the EU's total gross domestic product and is thus a major economic factor.

At the same time, the negative consequences of mass motorisation for the environment and health are obvious. Stricter regulations prompted by climate change and air pollution are intended to spur manufacturers to build cars that emit fewer pollutants and greenhouse gases. The transition to zero-emission cars is not only necessary from a climate perspective, it is also an economic imperative. Numerous countries are setting increasingly stringent emissions standards for cars, introducing electric quotas or aiming to ban the sale of internal combustion engines on their markets. Various countries across the EU have already announced plans to phase out new cars with internal combustion engines between 2025 and 2040.

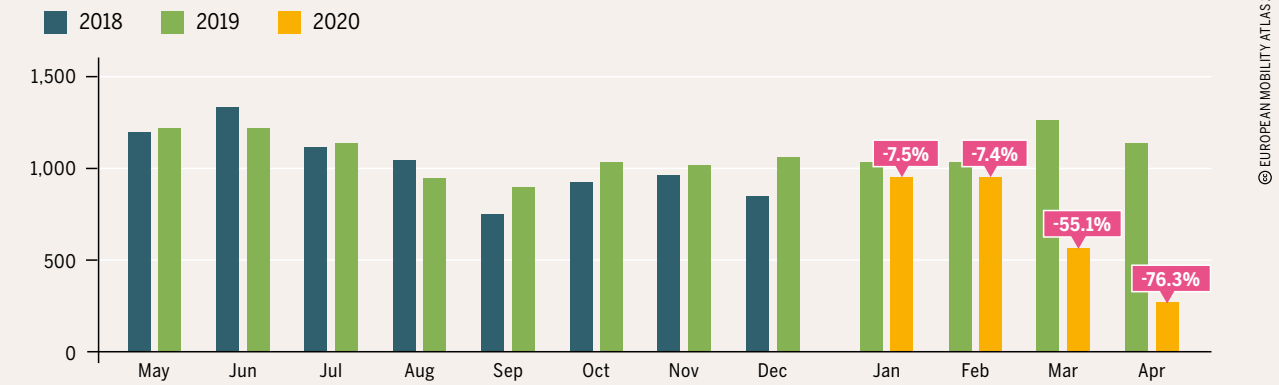
A major change is digitalisation. With the help of artificial intelligence (AI), the car is evolving from a human-driven to a self-driving vehicle. For years, the automobile used to be a status symbol and an independent, private means of transportation. That is currently changing as the car takes its place as one part of a networked and shared mobility system. Competition on world markets is becoming much tougher. If European car manufacturers do not rise to the challenges, they will lose market share. They are not well positioned in the field of electric vehicles. Of the 20 best-selling electric car models worldwide, only four come from European manufacturers. US and Asian manufacturers (e.g. Tesla, BAIC) are leading the field. The European car industry also has some catching up to do in the field of autonomous driving. Google's autonomous cars are technically so advanced that a safety driver – a human who can intervene during test drives – only needs to act every 17,732 km. In the autonomous cars from Mercedes, an intervention is necessary every 2.41 km. Investments in the fields of the future are imperative for Europe to benefit from the transformation of the automobile and for the industry to remain successful, especially with regard to zero-emission mobility and AI. Manufacturers are increasingly directing their research and development spending toward automated driving and battery-powered electric vehicles that are expected to meet climate policy requirements. It will be more necessary than ever to support workers affected by the transformation with qualification and training measures and to understand that such measures will be an ongoing part of working life in the future.

The Covid-19 pandemic, however, has made the much-needed transformation of the automotive sector a truly Herculean task. The European car industry relies heavily on its existing business model of selling fossil-fuel powered cars to finance the transformation and invest in new production

April 2020 was the first full month with Covid-19 restrictions and resulted in the largest monthly drop in car sales since records began.

(NOT) BUYING A CAR IN TIMES OF CRISIS

New passenger car registrations in the EU, 12-month trend, in thousands, 2018–2020



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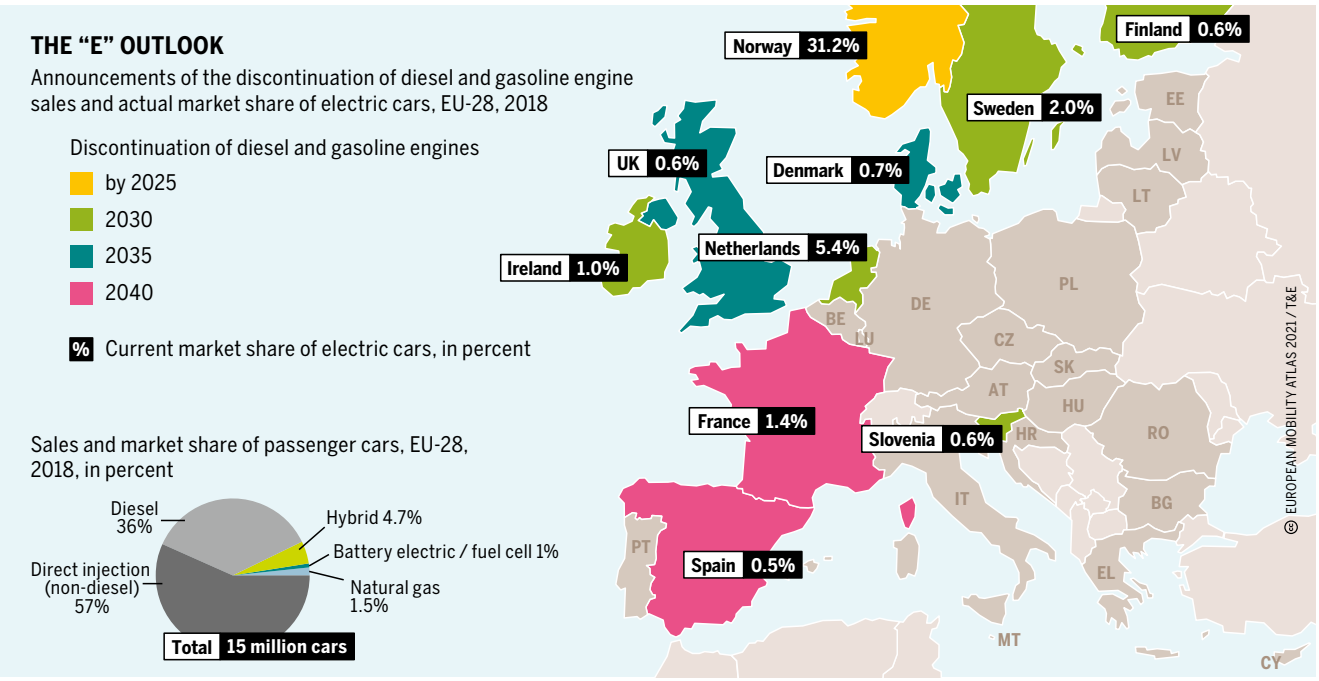


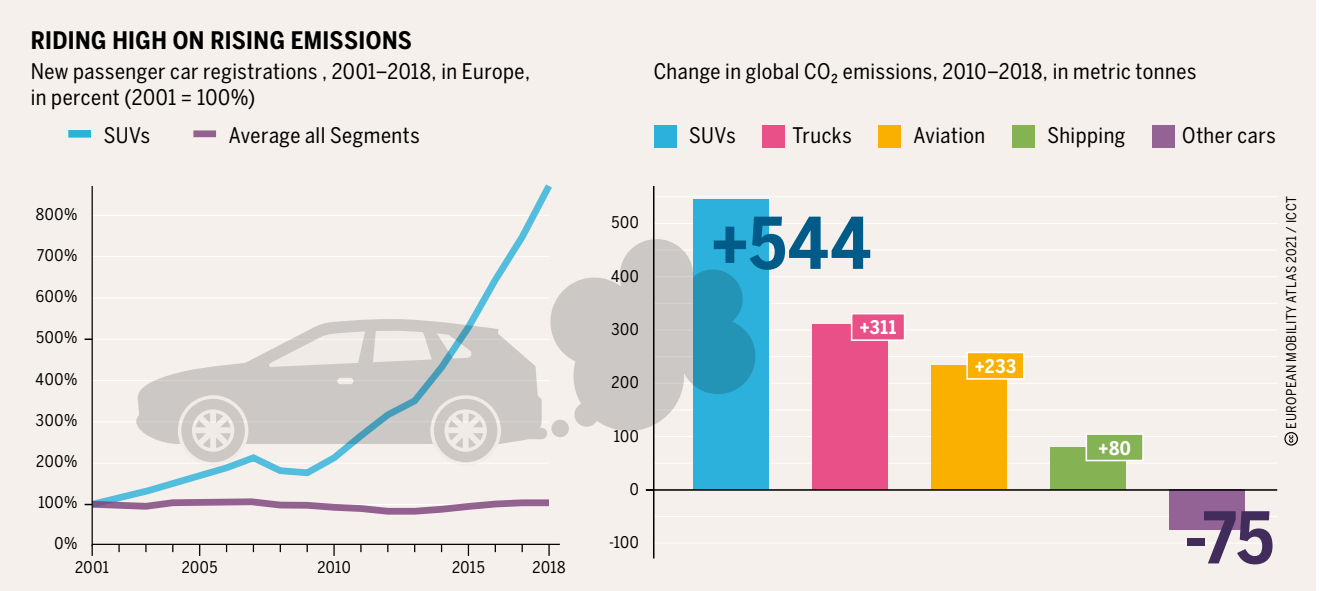
Will the end really come quickly for new cars with combustion engines?

lines for electric vehicles. However, the pandemic brought the European car industry to a standstill. Global supply lines were disrupted and car sales plummeted. This massive loss in sales threatens many jobs in the car industry as well as the car manufacturers' ability to transform. It is therefore unsurprising that a range of European Member States have unveiled stimulus packages, aimed at reviving the car industry particularly by boosting sales of electric cars. The German government, for example, intends to invest in more charging stations for electric cars and has doubled incentives to buy electric vehicles. Consumers buying an electric car with a list price of up to 40,000 euros will be eligible for a grant of 6,000 euros.

France, on the other hand, has unveiled an 8 billion euros stimulus package for its automotive industry, which includes a bonus of 3,000 euros for consumers buying a new diesel or petrol car that is cleaner than their previous one. This has an ecological as well as an employment component, given that more workers are engaged in the production of diesel and petrol cars than in electric cars.

However, whether these measures will have the necessary effect of boosting the European automotive industry while simultaneously supporting it on the transformative road towards a sustainable, non-fossil-fuel driven future remains to be seen.

SUVs doubled their global market share from 17 percent in 2010 to 39 percent in 2018, although they are significantly more dangerous for the environment and public health.



CHALLENGES OF A SINGLE EUROPEAN RAILWAY AREA

European transport infrastructure reflects the complexity of Europe's cross-border management tasks and its historic path dependency. Railway infrastructure is a prominent example of this.

The European Union (EU) as a geographical entity is a relatively young historical phenomenon and the idea of a Single European Railway Area is even younger. A European railway system is thus far from being realised. Railway infrastructure reflects the settlement structure of each individual country. France's focus on the Île-de-France and a small number of other metropolitan areas and the long distances in between them is one of the reasons for the development of a high-speed network that is almost not used at all for 'classical' trains. While bigger cities such as Marseille, Bordeaux or Nantes are well-connected to Paris, there is little to no connection in between them. Furthermore, stations on high-speed lines are often located away from the cities that they aim to serve.

Until the 1980s and early 1990s, 'through coaches' (passenger cars that are re-marshalled during the course of their journey) were a common phenomenon in European trains. Nowadays, aerodynamically optimised high-speed trains and push-pull trains outside of the high-speed lines make this concept almost impossible.

Countries with a population that is more spread over the territory and with shorter distances in between more densely populated areas, such as Belgium or the Netherlands, tend to prioritise a schedule with a higher frequency of trains as opposed to a focus on a high-speed network. Countries such as the Czech Republic or other Central Eastern European states historically had a stronger focus on public transport and therefore also a denser rail network. Germany is a mix of both systems. A clock-face schedule, a timetable system under which public transport services run at consistent intervals, is still far from reality in most Member States.

Running railways is a highly complex undertaking, with the Forum Train Europe (FTE) (92 railway undertakings in 31 European countries) and the RailNetEurope (RNE) (36 railway infrastructure members in 25 different European countries) coordinating the timetables and the infrastructure in Europe. The strategic alignments of the different companies make this a challenging task: rail freight slots have to be coordinated with passenger trains. Night trains have to fit with the schedule of high-speed trains and local and regional railway undertakings have to be put in the position to both feed long-distance trains and provide a reliable service for daily commuters.

In varietate concordia (Unity in diversity), the official motto of the EU, is also an accurate description of the European railway landscape. When it comes to developing a European railway policy, it is important to bear in mind the different situations across the continent. Nevertheless, a comprehensive legal framework helps both service providers and customers by defining both tasks and services.

Despite all difficulties, investments in rail infrastructure and services have always had the advantage of long-term reliability if well maintained. While roads have to be renewed and repaired comparatively frequently, rail infrastructure and rolling stock are built to last for decades and therefore also have to be planned with a long-term vision.

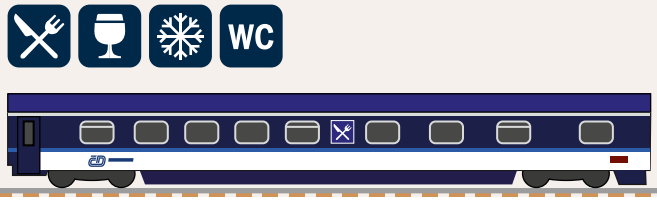
The EU is addressing the challenges for a unified European Railway Area with its four railway legislative packages to date, the creation of the European Union Agency for Railways (ERA) and the development of the European Rail Traffic Management System (ERTMS), among other things.

An important principle is the liberalisation of the European rail market. The general trend towards privatisation can also be seen in European railway undertakings. But states usually hold the majority of shares of the formally privatised companies.

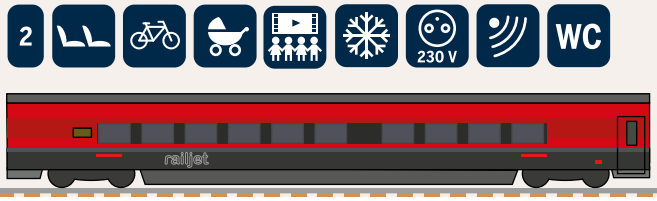
SERVICE IN TRAINS

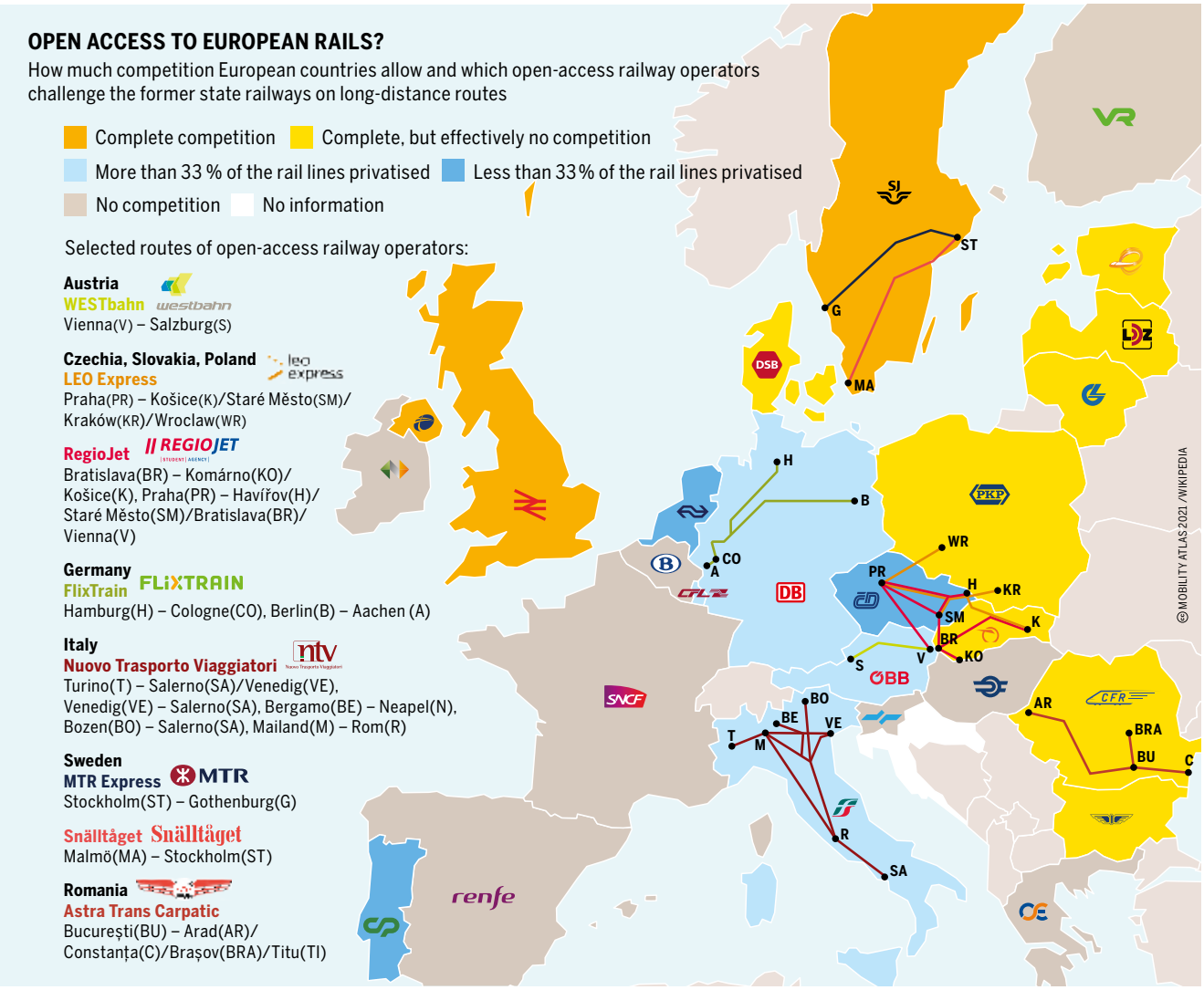
Modern trains provide an ample selection of services onboard

Czech Republic: ČD/dining car



Austria: ÖBB/Seating car Railjet



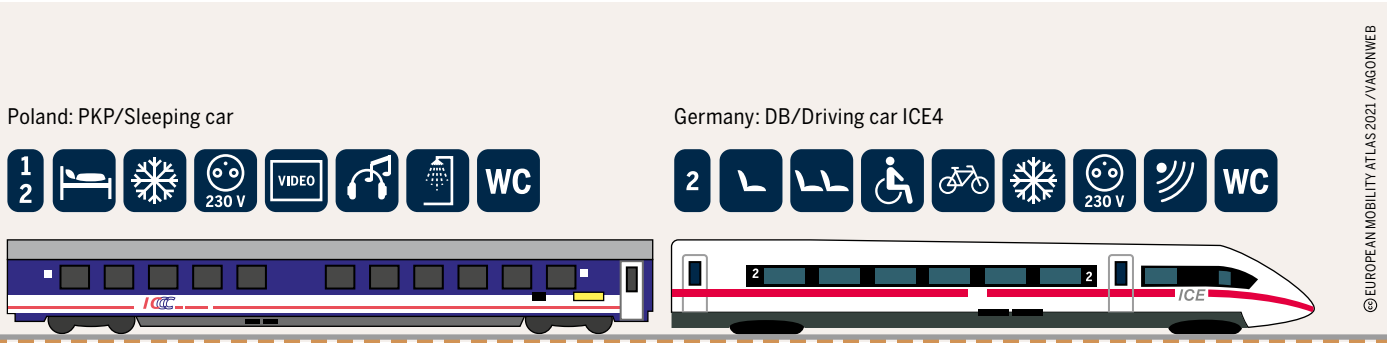


The railway infrastructure across Europe is relatively dense and provides ample opportunity for competitive and attractive services.

Competition in European railway markets has led to many of the national companies becoming active in other Member States, competing with their national counterparts in their respective home countries. For example, in the form of its subsidiary Arriva, Deutsche Bahn AG has won the tenders to operate local trains in 13 EU Member States and the UK.

Open-access railway operators such as Regiojet (CZ/SK), Westbahn (AT) or Nuovo Trasporto Viaggiatori (IT) run their services as real competitors to the often parallelly operating state-owned railway undertakings at their own financial risk. Open-access operators mainly operate routes that are highly profitable or where they see a niche to operate in.

It is up to the legislators to define both minimum services and infrastructure in order to improve access in marginalised regions and create the best framework for this green mode of transport.



CROSS-BORDER MOBILITY

CLOSING THE GAPS

A well-connected cross-border railway system is the backbone of European transnational mobility. Yet many cross-border points still look like a patchwork reflecting a myriad of different national systems.

European railways have a chequered history. The invention of the railway in the first half of the 19th century made it possible to transport people and goods in large quantities over long distances fast and cost-efficiently – the basis for the industrialisation. The railway developed into the means of mass transportation par excellence. The Second World War marked a turning point.

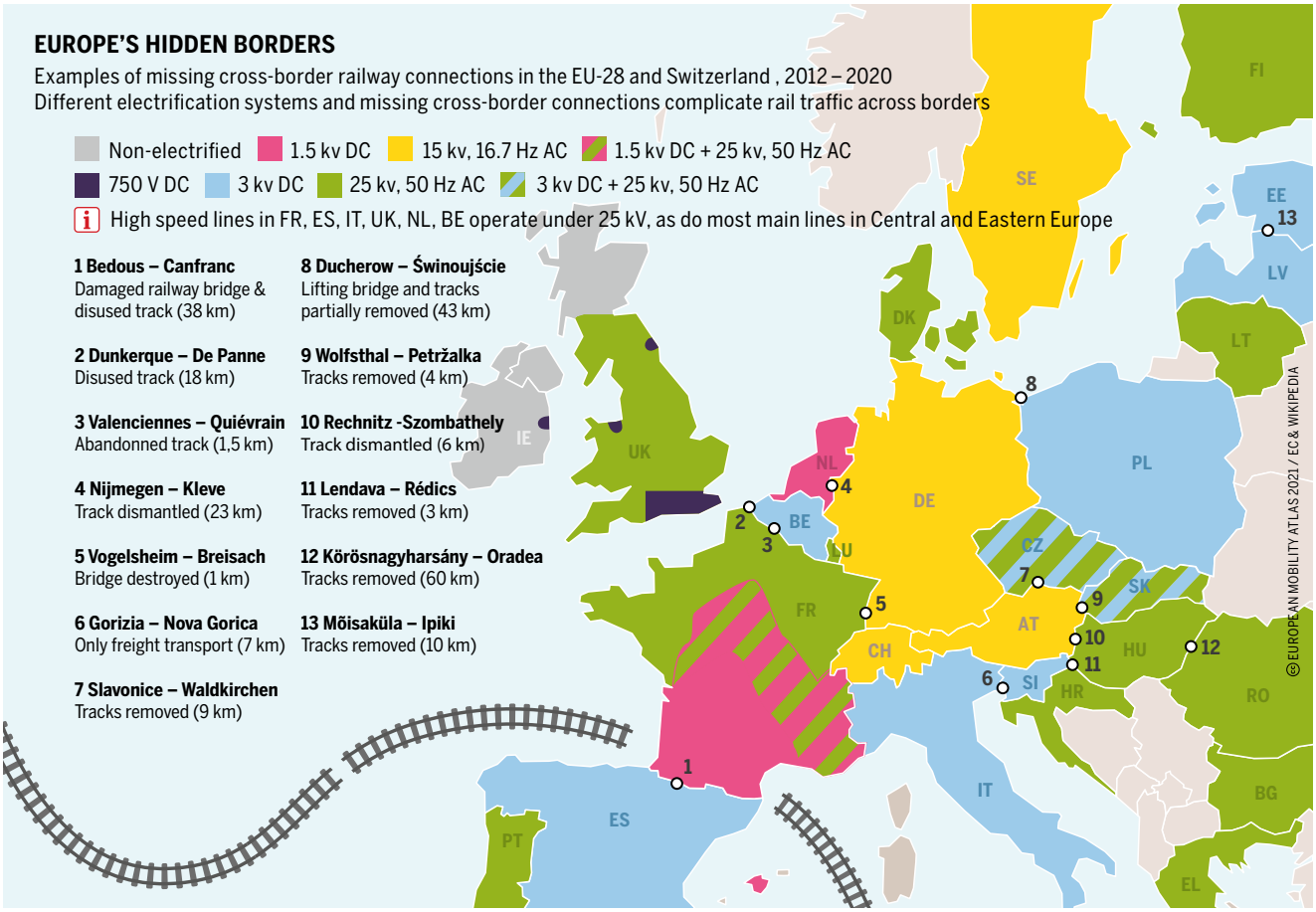
A significant part of the cross-border infrastructure was destroyed and not rebuilt. The Iron Curtain divided the continent for several decades. Meanwhile, road transport has been increasingly favoured in transport policy, as the conversion of cities to 'car cities' has shown. The degree of motorisation increased continuously.

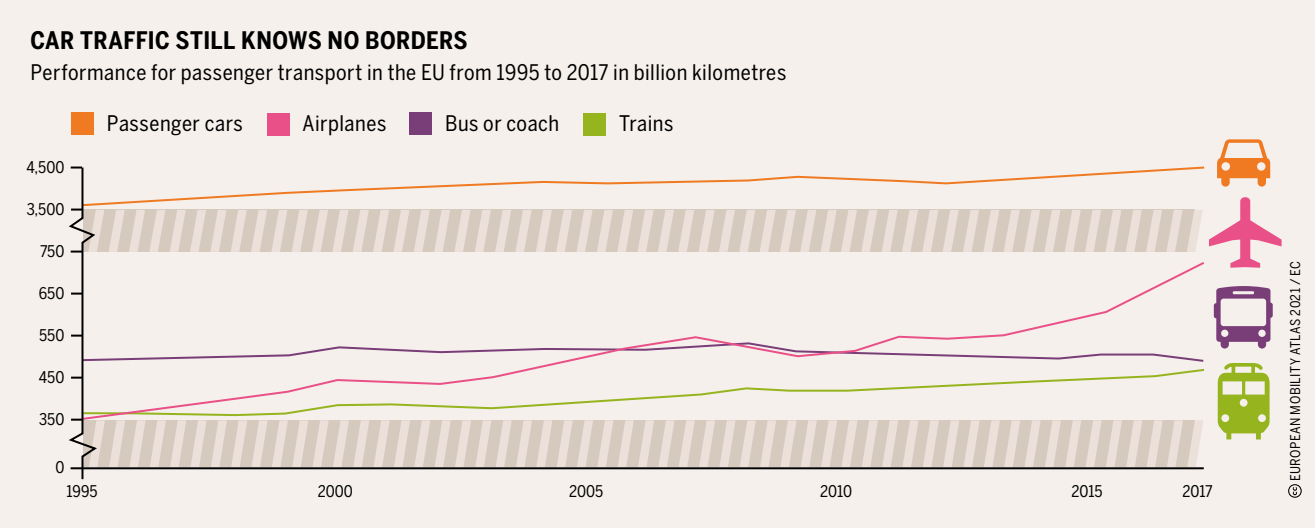
Today, the share of passenger rail in land transport in the European Union is just 7.8 percent (2017), with national transport predominant, representing more than 80 percent of the total passenger numbers (2018).

The European Commission has proposed to make 2021 the European Year of Rail. The idea is driven by the objective of achieving a climate-neutral European Union (EU) by 2050. As an environmentally friendly transport mode, rail has the opportunity to play a significant role in helping cut transport emissions. Rail accounts for just 2 percent of total EU energy consumption in transport. So far, however, the required modal shift to rail has not been achieved, but cross-border rail transport in particular has a big catch-up potential.

Already in the early days of rail transport, international agreements, such as the International Convention concerning the Carriage of Goods by Rail (COTIF) from 1890, were signed in order to open up Europe to cross-border rail transport. Nevertheless, the railway systems that have grown na-

149 of 365 of European cross-border rail connections are non-operational.





The gap between cars and trains is more than 4,000 billion kilometres wide, ten times more passengers use roads instead of rails.

tionally often differ in many aspects, such as gauge, signalling, power systems or regulations. These technical barriers mean that trains cannot operate in every country. The EU aims at harmonising European railways. A core element of this EU policy is the introduction of a single EU-wide railway signalling system which goes under the name 'European Rail and Traffic Management System (ERTMS)'. However, its deployment in EU Member States is at a low level so far and its current state is more of a piecemeal solution.

ERTMS is also promoted within the Trans-European Transport Networks (TEN-T). A key element of the EU Policy on TEN-T is to implement and develop a Europe-wide network of rail. It consists of a core and comprehensive network and should be established with the help of financial instruments of the EU, such as the Connecting Europe Facility. EU funding of rail infrastructure has a focus on the needs of cross-border transport and the removal of bottlenecks.

But a gap exists between the number and size of projects and the available financing. With a focus on expensive major projects such as the Lyon-Turin rail tunnel, little money is left for other projects.

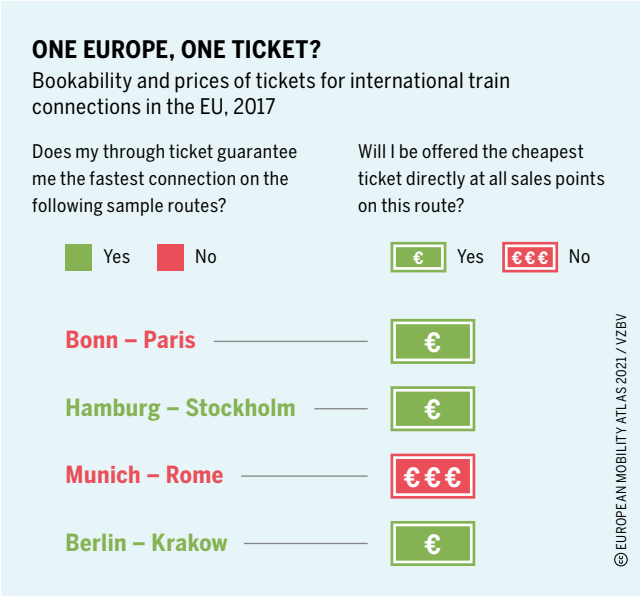
Member States tend to focus on projects that they anticipate will improve their national network. The European Court of Auditors stated that a considerable amount of co-funding for infrastructure has not helped to improve the European rail network enough. A major concern was that funds were directed to national high-speed projects with limited cross-border interconnectivity.

In a nutshell, the EC's capacity to align certain policies with the common interest which would bring added value to cross-border connections is often limited and tied to a relatively small budget.

Off the TEN-T network and consequently with a limited access to EU funding, many small-scale cross-border projects can be found. Often, just a few kilometres of rail infrastructure are missing. Additionally, these projects are slowed down by different national interests: between Colmar (France) and Freiburg (Germany), the bridge over the river Rhine has been destroyed. To this day there are ongoing discussions about who should bear the financing for rebuilding, despite the fact that everyone has an interest in it. The dispute arises primarily over whether the project also has a supra-regional significance.

In conclusion, the European railway network remains a patchwork full of gaps at the national borders. This is remarkable as 40 percent of the EU's territory consists of border regions, which also represent one-third of the Union's population.

Purchasing cross-border train tickets in Europe is often neither easy nor transparent.



SETTING SAIL: CHALLENGES FOR SEA TRANSPORT

Maritime transport is the most important, most efficient, but also dirtiest way of shipping goods. Not covered by the Paris Agreement, the industry is trying to set guidelines for a more environment-friendly maritime transport.

Transporting cargo is a vital aspect of international trade and maritime logistics are a primary function of shipping on a global scale. Cargo ships carry billions of tonnes of commodities along maritime trade routes. Maritime shipping is the most efficient low-cost, but also the dirtiest transportation method, and over 90 percent of world trade and 94 percent of developing country trade is handled by maritime shipping. Most ships still burn dirty heavy fuel oil, especially when they are in international waters. Shipping is not covered by the EU's Energy Taxation Directive.

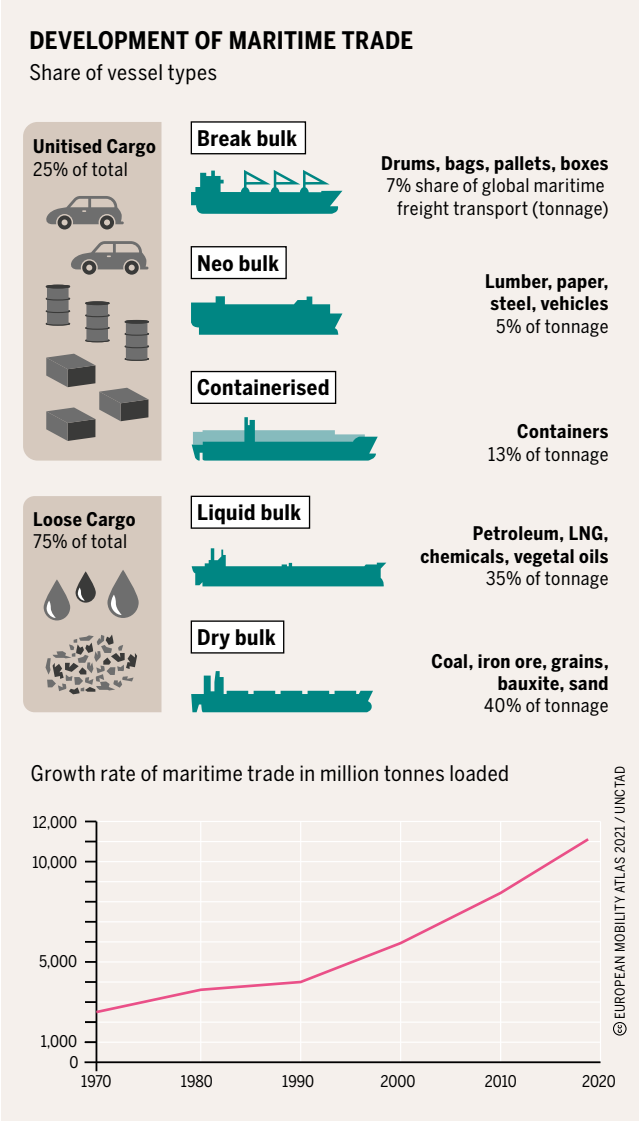
The shipping sector is also not covered by the 2015 Paris Agreement. Even so, the Paris Agreement contains non-binding targets for reducing gross annual shipping greenhouse gas (GHG) emissions by at least 50 percent by 2050 relative to 2008, starting as soon as possible. In addition, the new 0.5 percent global sulphur emission cap which entered into force on 1 January 2020 will apply to about 70,000 ships worldwide.

Another major problem is the use of flags of convenience. Shipowners register their vessels in countries other than the country in which they themselves are registered. That way, they can avoid (higher) taxes and circumvent national labour and environmental regulations.

Positive aspects of shipping include the 'greening' of port handling by reducing their GHG emissions. Many larger port authorities are currently undertaking projects to improve cargo handling equipment and techniques.

Shore-to-ship power offers ships in harbour the possibility to shut down their fossil-fuel engines and run vital equipment on shore-based electricity. Burning crude oil in order to keep the ships' systems running has been banned in most European ports.

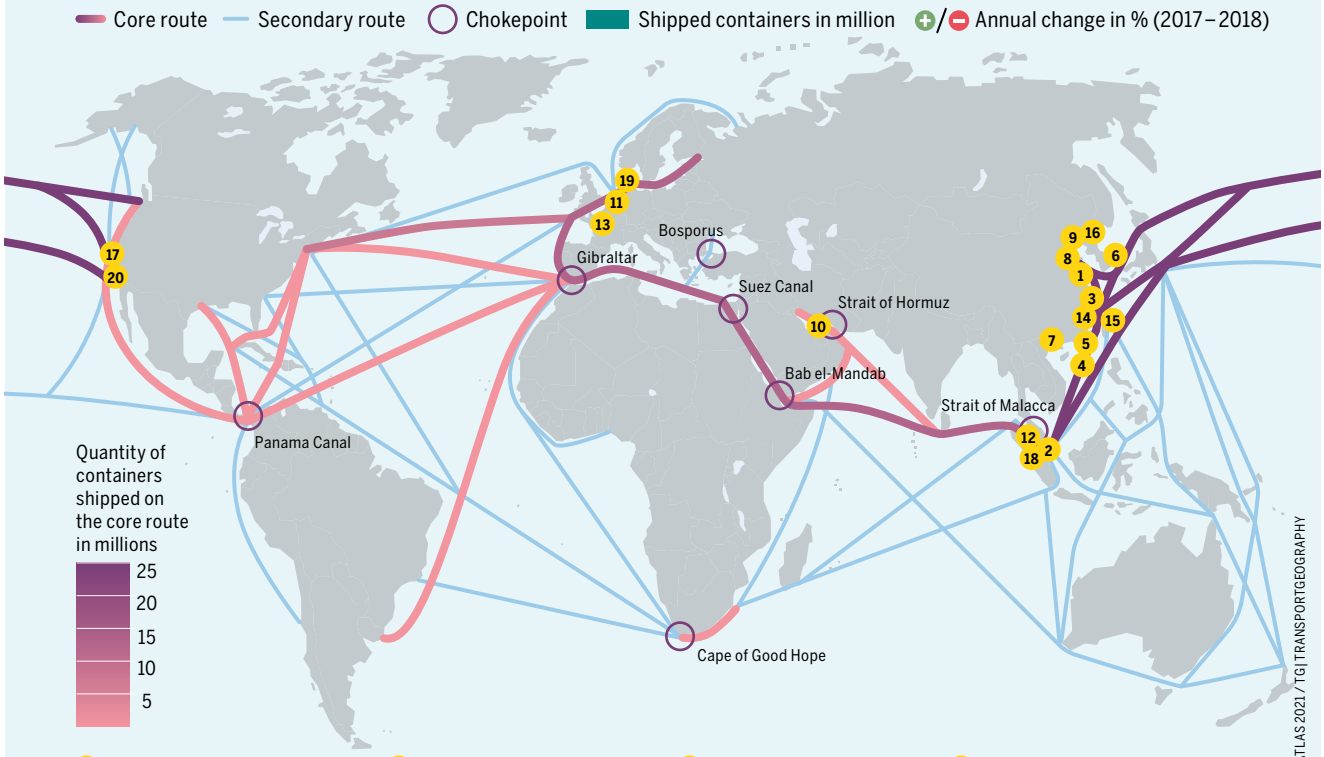
Countries with a big shipping sector are in a strong position to renew their logistics and transportation services, making them smarter, more efficient, and environmentally friendly. The Greek-owned fleet is the biggest among European nations. Greece is the top ship-owning economy of the world, owning 10.2 percent (in terms of commercial value) of total global ships, 53 percent of all European ships and 17.8 percent of global total dead-weight tonnage. The vast majority (85.2 percent) of Greek ships are registered under a foreign flag. Taxing shipowners in Greece has not been a priority of Greek governments in the last century. Maritime shipping in Greece represents almost 7 percent of gross domestic product (GDP).



Maritime transport plays an important role in the world's economy. While container ships are booming, 75 percent of tonnage is still dry and liquid bulk.

MARITIME SHIPPING ROUTES AND THEIR MAIN DESTINATIONS

Worldwide shipping routes and the biggest container ports in 2018



1 Shanghai	42	+4.4	6 Busan	21.7	+5.5	11 Rotterdam	14.5	+5.7	16 Dalian	9.8	+0.6
2 Singapore	36.6	+8.7	7 Hong Kong	19.6	−7.6	12 Klang	12	−0.4	17 Los Angeles	9.5	+1.3
3 Ningbo	26.4	+6.9	8 Qingdao	19.3	+5.5	13 Antwerp	11	+6.2	18 Tanjung Pelepas	8.8	−6.4
4 Shenzhen	25.7	+2.1	9 Tianjin	16	+6.2	14 Xiamen	10.7	+3.1	19 Hamburg	8.8	−0.2
5 Guangzhou	21.9	+7.6	10 Dubai	15	−2.9	15 Kaohsiung	10.5	+1.8	20 Long Beach	8	+3.7

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High traffic on transatlantic and transpacific shipping routes mirrors the interdependency of these markets. Asia is clearly dominating the market when it comes to container shipping.

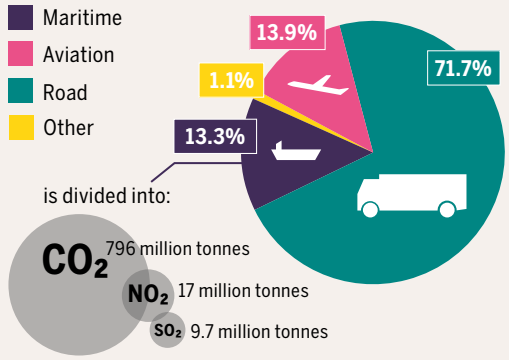
The majority of operations in Europe pass through the ports of Rotterdam, Antwerp and Hamburg. The advantage of these ports is their relatively good infrastructure connection to the most important markets and industrial sites. Southern European ports face the disadvantage of geographical barriers such as the Alps and an unfavourable hinterland connection with the need to cross the entire Balkans in order to reach central Europe.

The Marine Environment Protection Committee adopted mandatory requirements in October 2016 for ships to record and report their consumption of fuel oil with the Guidelines for the development of a Ship Energy Efficiency Management Plan (SEEMP). This International Maritime Organisation (IMO) consumption data collection system came into effect in March 2018, requiring ships of 5,000 gross tonnage and above to submit annual reports on fuel oil consumption to their administrations. To accelerate the transition to zero GHGs shipping, A.P. Møller-Mærsk, Europe's biggest shipping company and a global tycoon in maritime trade, set a new and optimistic target in 2018 to emit zero CO_2 emissions from its activities by 2050. But the company has also been found to have out-flagged older vessels in order to cheaply scrap them on South-Asian beaches. While the relevance of maritime trade will continue to grow, it is even more important to green this sector and to enhance and enforce international rules and regulations. An example of this is the recent push by the European Parliament to include shipping in the European Emissions Trading System (EU ETS).

Maritime shipping is the lowest emitter of CO_2 per tonne of products transported per kilometre.

SHIPPING'S SHARE OF GREENHOUSE GAS EMISSIONS

In relation to European transport emissions



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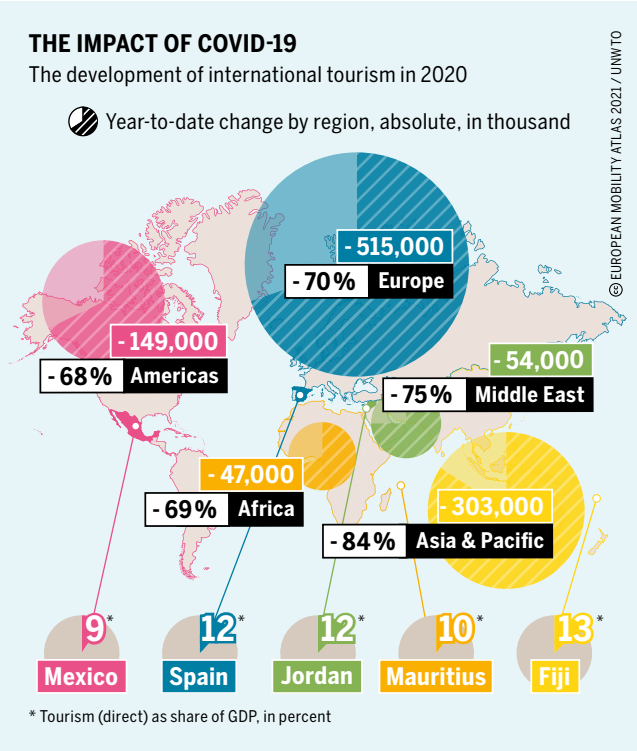
TRAVELLING SUSTAINABLY OR WITH THE CROWD?

Tourism is a major economic sector in Europe. But its negative impacts on the environment and local communities raise concerns. Sustainable travel is growing, yet Covid-19 could change everything.

Over the past few decades, tourism trips have become an increasingly important part of the lives of many Europeans. In 2017, 62 percent of the adult EU population made at least one tourism trip. Of the 1.2 billion trips that were taken that year, the majority were domestic, representing three quarters of the trips, with 20 percent to other EU Member States, leaving almost six percent to destinations outside the Union.

Europe is the world's most popular tourism destination and the continent's tourism industry has enjoyed sustained growth. It is currently estimated that it contributes 10.3 percent of the EU's GDP and employs over 27 million people.

In recent years, however, there has been increasing awareness of some of the challenges that have been created by this growth, particularly in terms of the negative impact that it can have on the environment and communities located in or close to the most popular touristic destinations. The concept of 'overtourism' has become a growing concern. Venice received more than 25 million international tourists in 2018, in a city with a population of less than 55,000. Popular tourist destinations are therefore increasingly focusing on 'destination management' rather than 'destination promotion'. This is likely to take on even greater significance following the Covid-19 pandemic.

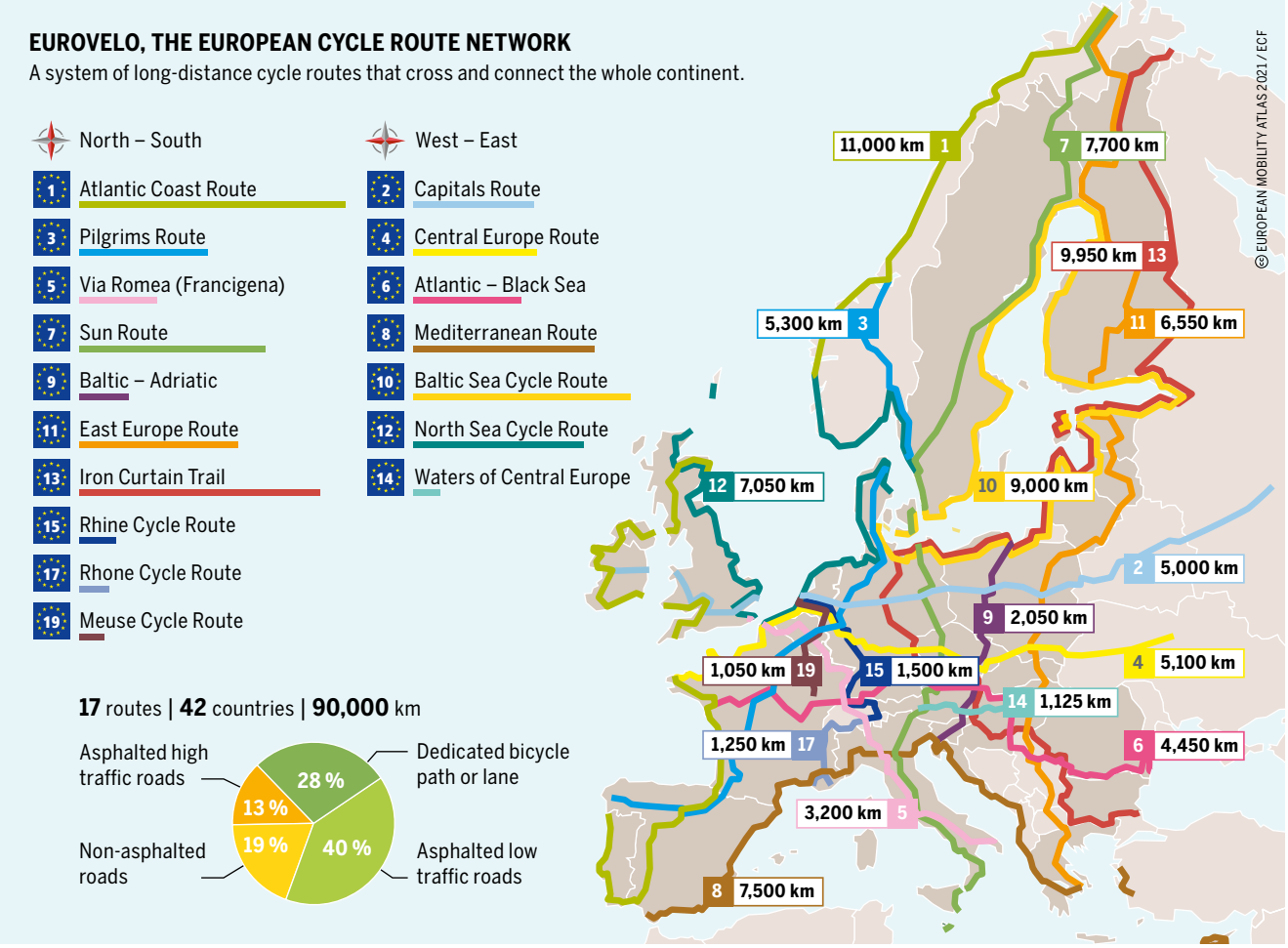


One of the main challenges when dealing with increasing numbers of tourists is how they move around. Tourism goes hand in hand with travel, even for domestic tourism trips. Unfortunately, the growth of the tourism industry in recent years has largely been built on unsustainable travel patterns. To take the example of air travel, between 2012 and 2017 tourist air travel grew by 15 percent. While the airline industry is keen to stress that air travel is now cheaper, safer and open to more people than ever before, there is no hiding its negative impact on the environment. This coincided with the overall environmental impacts from aviation increasing – 10 percent for carbon dioxide, 12 percent for nitrogen oxide and 14 percent for noise between 2014 and 2019.

To change that, EU citizens are going to have to adapt how they go on holiday. Sustainable forms of tourism have always existed and in recent years, more of these options have started to make their way onto the market. It is promising that consumers are increasingly taking sustainability into consideration when choosing their holidays. In a recent study, 50 percent of the respondents stated that deciding an environmentally-friendly holiday option was important to them, with the figure rising to 56 percent for those born in the mid-to-late 1990s. This is reflected in the growing numbers of people taking more sustainable holidays. For example, approximately 5.5 million Germans went on a cycling tourism trip in 2018, representing 8 percent of the total population.

Coinciding with this growing recognition of the importance of sustainability, the Covid-19 pandemic may prove to be a pivotal moment for the tourism sector. The travel patterns that have developed in recent decades have been abruptly halted and at the time of writing, it is not clear when they will be able to return to anything like the situation prior to the pandemic. This disruption is forcing millions of Europeans to rethink their holiday plans and to seriously consider their options for travelling to planned destinations.

The decrease in international travel due to the Covid-19 pandemic has especially harsh consequences for countries with a high dependency on tourism.

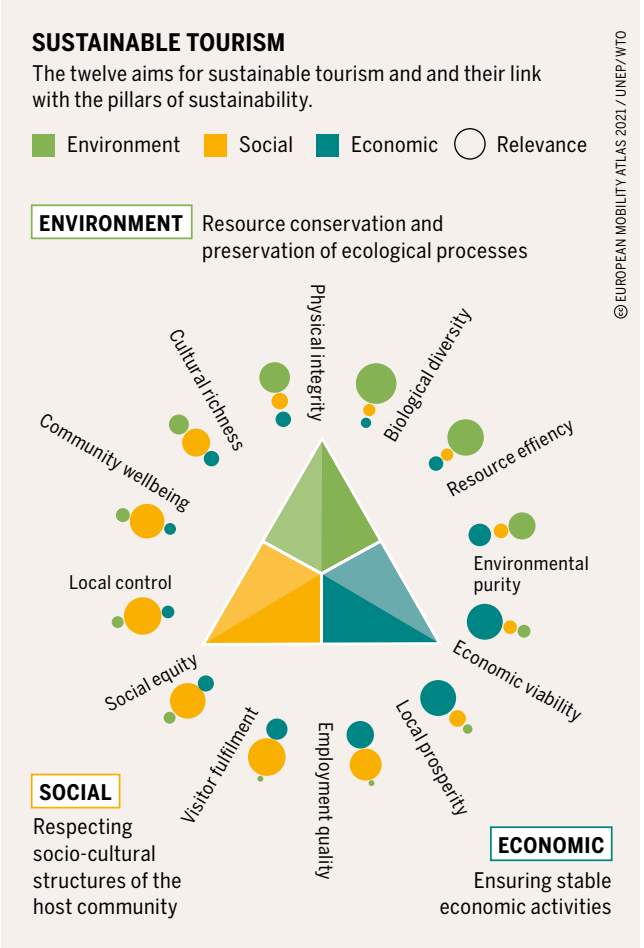


The routes can be used by cycle tourists as well as by local people making daily journeys and leisure trips.

Encouragingly, the tourism sector also appears to acknowledge that this is a watershed moment and is not simply attempting to restore 'business as usual', despite the devastating short-term economic impact. As the EU Tourism Manifesto Alliance, the voice of the European travel and tourism sector, noted in its recent statement to the European Commission: "This crisis creates a downturn, but also an opportunity for change, for a new beginning in tourism across Europe."

It is a positive development that tourism trips are increasingly open to a larger percentage of the European population, helping to break down barriers and enabling people to better understand each other. Tourism can continue to make a significant contribution to the European economy while preserving and enhancing the continent's valuable cultural heritage and natural environments that are so attractive to visitors. However, all stakeholders – the industry, public authorities, transport operators, tourists and the local communities – need to develop clear recommendations and guidance for the consumers. That should start with the journey to the destination.

Truly sustainable tourism needs to respect the conservation of the natural foundations for life in a global perspective.



BICYCLE INDUSTRY

GROWING AT SPEED

Unlike many industries, the manufacture of bicycles keeps on growing. This is mainly driven by the sale of e-bikes. The ever-increasing demand for them seems to be helping the industry to recover rapidly from the impact of Covid-19.

In 2015, commuters spent on average between 45 (Paris) and 101 (London) hours in congestion. Moreover, 70 percent of transport emissions derive from road transport. One alternative solution to these problems is the bicycle, a carbon-neutral and affordable transport alternative that can easily be combined with other transport modes.

The European bicycle industry (including pedal assist e-bike manufacturers and the components and parts industry) is active in 23 out of 27 EU Member States. It consists of about 900 small and medium enterprises employing directly and indirectly 120,000 workers and investing more than one billion euros annually in research & development. This industry sells about 20 million bicycles annually. In the year 2019, sales of pedal assisted e-bikes (pedelecs) had reached 3.4 million. By 2030, the pedelec market is expected to grow to 13.5 million units sold annually, if favourable legislation can be upheld. This shows a tremendous growth of the bicycle industry, increasing from an annual turnover of around 5 billion euros 20 years ago, to nearly 14 billion euros in 2019.

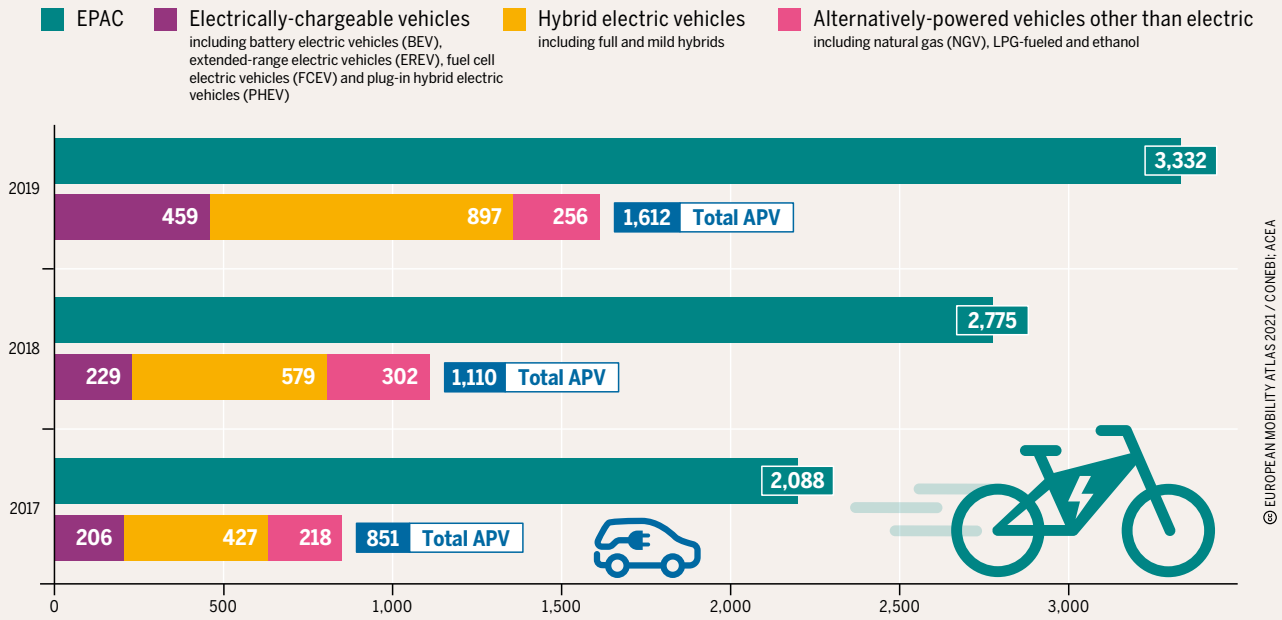
In comparison, the European automotive industry sold 15.2 million passenger cars in 2018, out of which 150,000 were pure electric vehicles. Car production in the EU amounted to 16.1 million units in 2018. This shows that the number of pedelecs on the market far outweighs the number of e-cars; in Germany in 2018, even more e-cargo bikes than e-cars were sold.

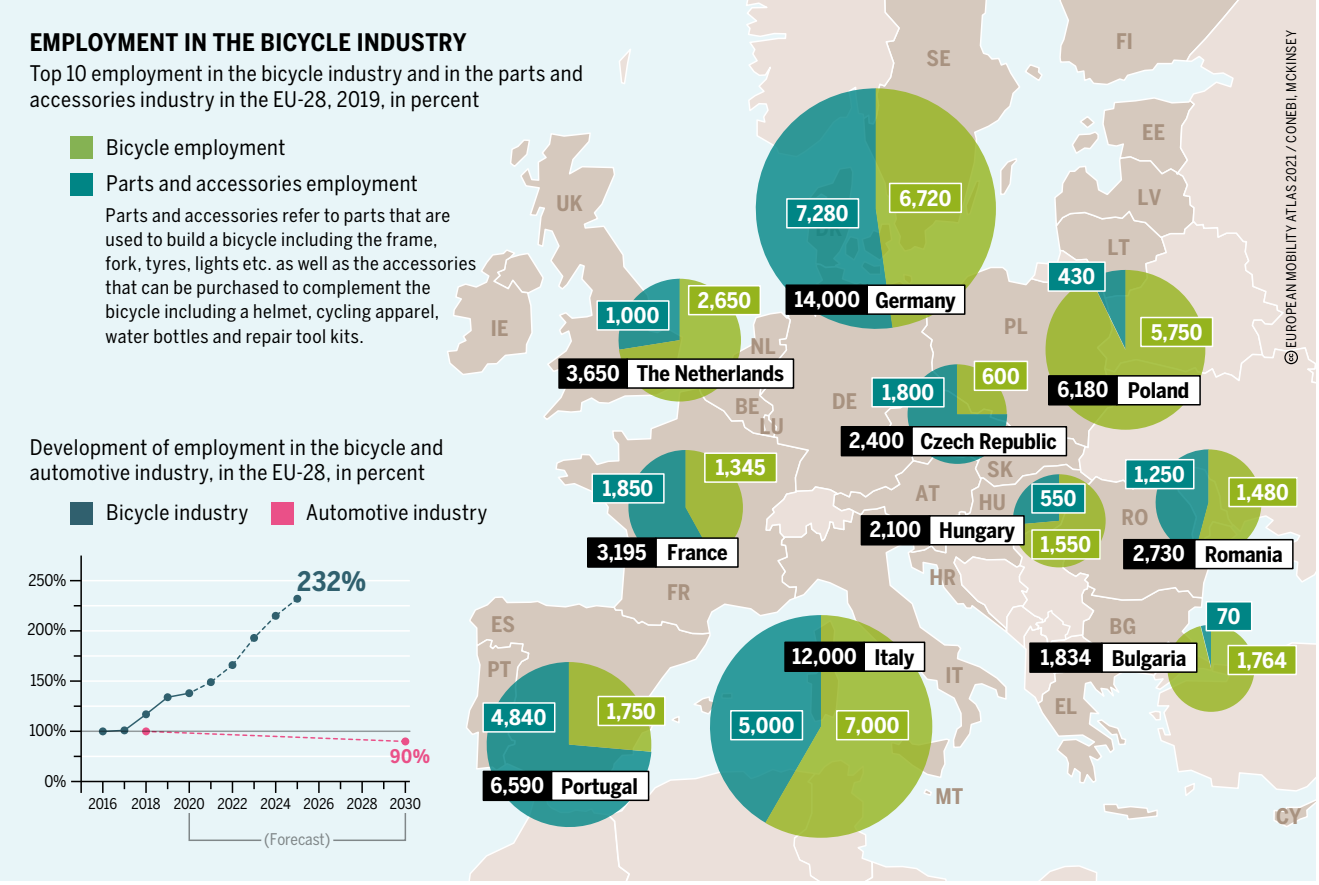
The biggest trend in the bicycle industry in recent years has been the development and increasing uptake of pedelecs. They currently represent about 17 percent of EU bicycle sales, going up to 50 percent in some countries. Pedelecs have a promising potential to substitute motor vehicle usage over short journeys, while having all the benefits of conventional bicycles. A recent study shows that pedelec users move even more than traditional cyclists, which is mainly due to longer distances travelled by pedelec users. Other benefits of cycling are the efficiency, reliability and accessibility of bicycles due to their low purchase and maintenance costs, as well as the fact that bicycle usage is beneficial to a neighbourhood's or community's micro-economy as riders tend to frequent businesses and services located within a smaller radius from their homes.

Since 2006, the sales figure in the EU-28 has increased decisively: from 98,000 up to 3,332,000 units in 2019. A growth rate the car industry can only dream of.

IN THE FAST LANE

Sales figures of Electrically Power Assisted Cycles (EPAC) compared to new passenger car registrations of alternatively-powered vehicles (APV) in the EU-28, 2017, 2018 and 2019, in 1,000 units





About 60 percent of the bicycles and Electrically Power Assisted Cycles (EPAC) sold in the EU are also produced here. In 2019, there were more than 60,000 direct jobs in the European bicycle industry.

Moreover, the cost to construct and maintain quality bicycle paths is much lower than the cost of constructing new motor roads and/or widening existing ones.

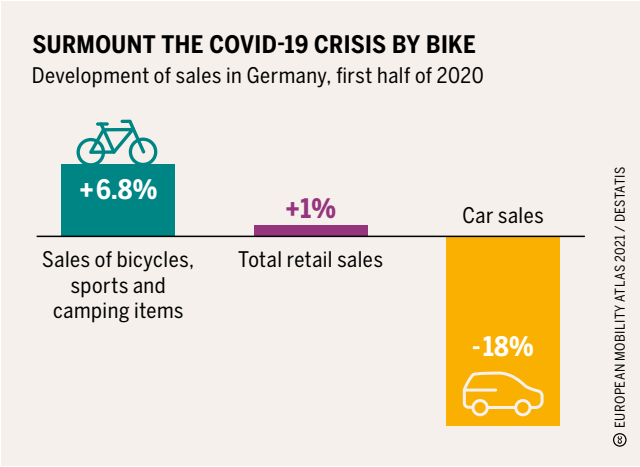
The growth of the pedelec market also means more skilled jobs for the European bicycle industry, as four to five jobs are generated for the production of 1,000 pedelecs per year. In comparison, only two to three skilled workers are needed to produce 1,000 traditional bicycles per year. Closely linked to this are investments in large scale frame manufacturing in Europe, shortened supply chains and creating 'Bicycle Valleys' where bicycle assemblers and parts producers are all settled in one region.

The Covid-19 pandemic has also hugely affected the European bicycle industry. In March and April 2020, factories stopped or slowed down their production. This was necessary due to impacts on the supply chain, national guidance to stop all non-essential work as well as the need to adapt to increased safety and protective measures.

Reactions of national governments have differed widely. Some countries have implemented bailout funds and special unemployment benefits, whilst companies in other countries are not able to benefit from such measures and have been forced to let some of their employees go.

In some of the most affected countries, a loss in turnover in comparison to the year before is expected. In early summer, however, sales started to pick up again once lockdown measures were lifted, as cycling has been actively encouraged by government officials as a way to stay active whilst maintaining social distancing. To further promote cycling, special subsidy schemes have been implemented in some countries. Whether this increase in sales can be sustained is not yet clear, but a considerable part of the lockdown-induced losses recovered by the end of the year of 2020.

The bicycle industry has not only been growing since the Covid-19 crisis: from 2015 to 2019, the industry's turnover already increased by almost a third.



CARGO BIKES

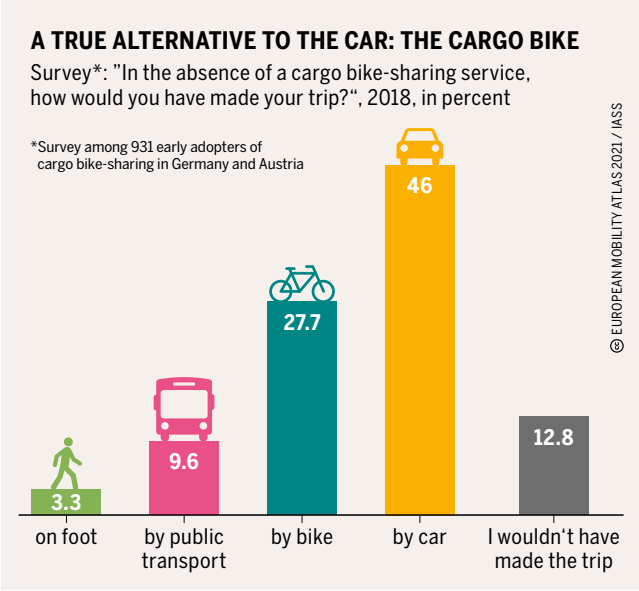
SUSTAINABLE AND RESILIENT TRANSPORT

Cargo bikes play a big role in avoiding motorised transport of goods. Many European cities operate successful cargo bike subsidy schemes. Commercial use, private ownership, sharing – all forms of cargo bike use are on the rise.

Thanks to modern cargo bikes and bike trailers, about half of all motorised trips for the transport of goods within European cities could be shifted to bicycles. This objective was already proclaimed by EU transport ministers in their 2015 'Declaration on Cycling as a climate friendly transport mode'. Based on a study by the EU funded 'Cyclelogistics' project, this potential of shiftable goods transports is divided into 69 percent private and 31 percent commercial trips. A study on the private use of cargo bikes in the US shows that cargo bike owners reduce their car trips by 41 percent after the purchase of a cargo bike.

In response to the Covid-19 pandemic, there is an increasing need for invidualised transport that is beneficial for both the environment and human health. Using a cargo bike to transport goods or children fulfills both functions.

While cargo bikes have a long continuous history in postal delivery in many parts of Europe, their current revival originates in the alternative culture of the 1980s and in kids' transport. The three-wheeler Christiania Bike from Copenhagen has become a symbol for this revival. Starting from Denmark and the Netherlands, cargo bikes designed to transport kids have increasingly spread across other European countries since the turn of the millennium. Small innovative start-ups as well as big international logistics companies increasingly test and use cargo bikes as a fast, cost-efficient, zero-emission transport option mainly in dense urban areas. In the logistics sector, this requires infrastructure in delivery areas ('Micro Hubs' or 'City Hubs') to effectively reload goods or parcels from larger vehicles to cargo bikes.



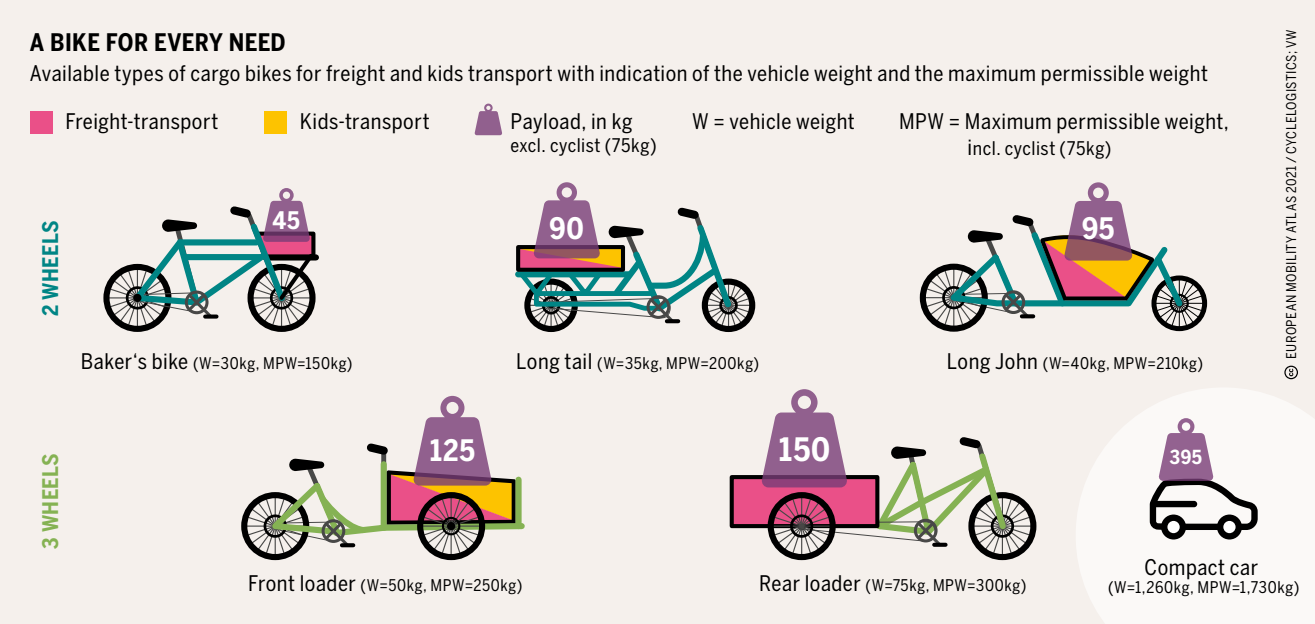
Modern cargo bikes – especially with electric assist – offer transport capacity between 40 and 250 kg for goods and persons. These cargo bikes legally remain bicycles across the European Union as long as their electric assist cuts-off at 25 km/h, has an average power of max. 250 watts and they do not exceed possible limits for dimensions and weights of bicycles in national street codes. There is a broad and increasing variety of mainly two- and three-wheel but also four-wheel cargo bikes for private and commercial use. Their joint characteristics and the best definition of cargo bikes is: they are bicycles that are specifically developed for transporting goods or people and not mainly their rider.

In 2011, the Austrian city of Graz started to subsidise commercial cargo bikes and jointly-used private cargo bikes with up to 1,000 euros. Meanwhile, there are numerous cargo bike subsidy schemes across Europe. Many focus on commercial cargo bikes and are often part of broader e-mobility schemes. In addition, specific subsidy schemes for private cargo bikes recently had overwhelming success in Vienna, Oslo, Hamburg and Cologne. The city of Stuttgart, capital of the German car industry, even pays an extra bonus of 500 euros if families have stayed car-free or reduced the number of cars in their household for a period of three years after their e-cargo bike purchase.

In Germany and Austria, cargo bike-sharing has spread mainly through civil society grassroots movements since 2013. Today, a network of currently more than 70 Commons cargo-bikesharing initiatives exists across Germany and Austria. Commons cargo bikes are rented via a jointly developed booking software and without a fee. The biggest Commons sharing initiative 'fLotte Berlin' operates a fleet of 120 cargo bikes in the city.

A survey of 931 Commons cargo-bikesharing users showed that 93 percent of users intend to use a shared car-

Cargo bike-sharing has a high potential to reduce car usage: cars, rather than conventional bikes, are replaced by cargo bikes.



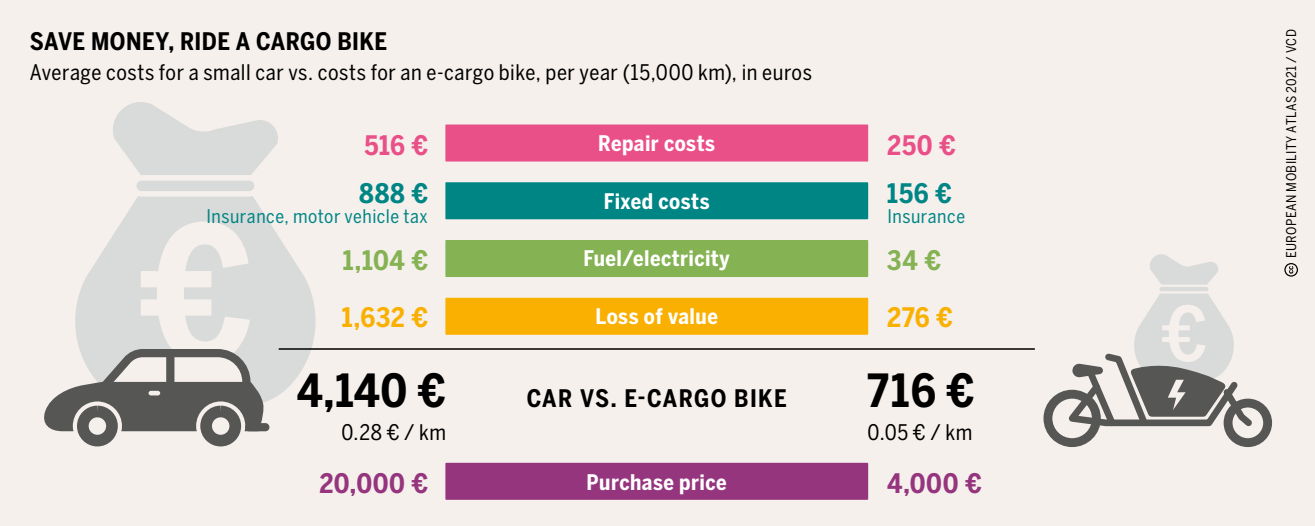
While cars usually can load less than half of their own weight, a cargo bike can carry at least three times its own weight.

go bike again while a third (35 percent) of users intend to buy their own cargo bike. There is a continuous demand for shared cargo bikes, while sharing systems also stimulate private sales. The positive environmental effects are evident: about half of the users (46 percent) avoided a car trip by using a shared cargo bike. To foster these environmental benefits, an increasing number of European cities (such as Grenoble, Strasbourg, Hamburg and Stuttgart) are integrating cargo bikes into their conventional bike-sharing fleets. In Switzerland, the commercial cargo bike-sharing system carvelo2go currently runs over 300 e-cargo bikes in more than 70 cities.

In sum, all three forms of cargo bike use – commercial use, private ownership, sharing – are on the rise and have a considerable potential to reduce motorised traffic. However, this potential is not recognised enough. Subsidy programmes, sharing systems and test events for cargo bikes can make an important difference. But exploiting the full potential of cargo bikes also needs more space and better infrastructure (wide bike lanes, secure parking) for bicycles of all shapes and sizes.

The Covid-19 pandemic increases pressure on municipal governments in Europe to give enough space to modes of transport that are good for human health and for the environment: cycling and walking. They reduce the risk of infection, but only if cycle paths exist and are wide enough for cargo bikes. A few European cities implemented pop-up infrastructure for cycling and walking, most prominently Berlin. There, the city government already had a full plan to transform the urban landscape into a cycling city with protected bike lanes: the Berlin Mobility Act. The implementation of this plan might now be accelerated, which will also provide best practices for cycling infrastructure that is ready for cargo bike usage.

Usually, a mileage of 4,000 km per year is assumed for commercial cargo bikes. The car value of 15,000 km is used here for better comparability.



CYCLING COPENHAGEN

THE MAKING OF A BIKE-FRIENDLY CITY

Providing people with the options to safely walk, bike or use public transportation is paramount not only in creating a green and sustainable city, but also a liveable, people-friendly city.

Over the last 60 to 70 years, cities have been designed around the car, trying to get as many cars as possible into and through our cities. Nowadays, the vehicle that was supposed to provide freedom in mobility is stuck in traffic, taking up a lot of space in cities, polluting the air, contributing to climate change and making people sick from both noise and lack of exercise.

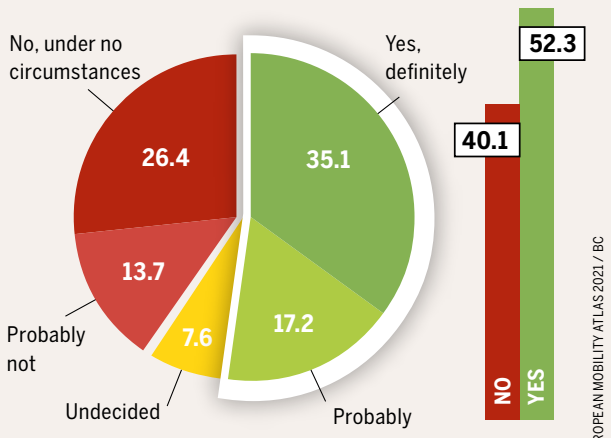
Cities are realising that we need to change the paradigm and focus on allowing as many people as possible to live and move through our cities in a sustainable way. This means redesigning streets and cities, and prioritising public transport, cycling and walking.

Copenhagen is known for being a city of cyclists. Its residents do not ride bicycles because they have some special cycling gene or because they care more about the environment than other people. They ride because it's safe, fast and easy to get around by bike in the city in their daily lives. They do it because Copenhagen is designed and built for cycling.

CAR-FREE AND CAREFREE

Survey* in Germany, 2020, in percent

"Would you advocate the creation of car-free zones in the centres of major cities to make more space for pedestrians and bicycles?"



* 2,502 respondents, statistical error: 3.4 %

This is linked to the fact that Copenhagen has had, and still has today, politicians with visions of a liveable, people-friendly, sustainable and CO_2-neutral city and who have thus invested accordingly in cycling infrastructure and facilities and have created policies that favour bicycles.

In the 1970s, Copenhageners demonstrated outside City Hall in Copenhagen, demanding that cycling also be prioritised after the car had become more and more dominant during the 1950s and 60s. Authorities and planners listened and the bicycle subsequently began to be an important part of traffic planning in the city.

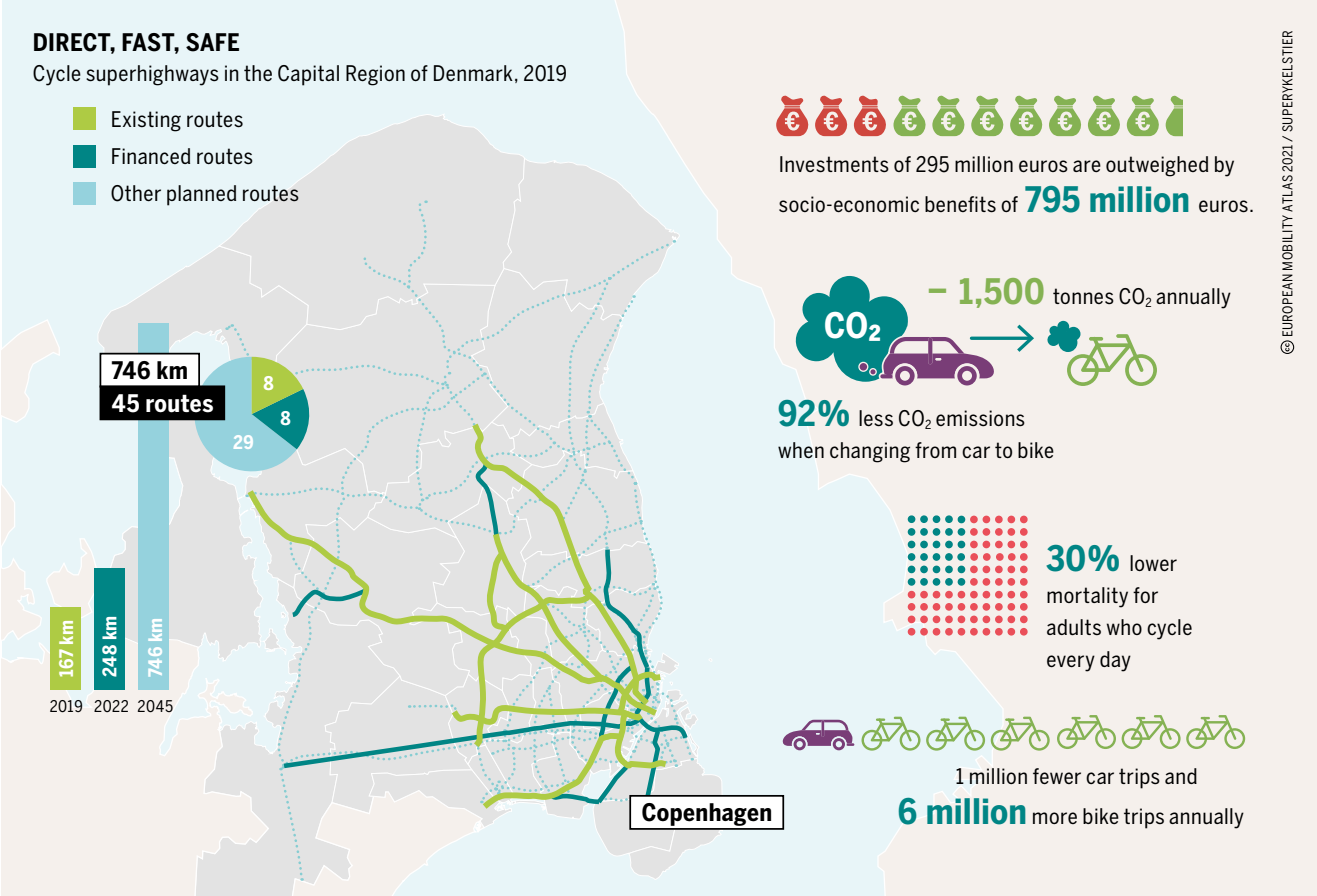
This has resulted in a steady increase in cycling over the ensuing decades. The goal is for 50 percent of all trips to work and education in Copenhagen to be made by bike by 2025. In 2018, they reached 49 percent. Out of all trips made to, from and in the City of Copenhagen, 28 percent were in 2018 made by bicycle (32 percent by car, 21 percent walking and 19 percent public transport). In the inner city, bicycles outnumbered cars in 2016.

The backbone of a city designed for cycling is a network of protected bike lanes. In Denmark, unidirectional bike lanes are separated from both the pavements and the road by a kerb. Protected bike lanes are a must when the volume and speed of vehicle traffic is high. Without them, women and children are less likely to cycle, meaning cycling will never be for everybody.

Every cycling trip ends with a parked bicycle and thus it's very important to make sure bicycle parking is available everywhere in the city. The facilities can vary in quality depending on how long the bicycles are parked at a specific location. The longer, the more cover and service needed.

The bicycle and public transportation are a match made in heaven. Bikes bring people to and from public transport and public transport adds distance to your reach as a cyclist. To make the match successful, it's important to make the transition from one mode to the other easy and pleasant.

Copenhagen is leading the way, but citizens everywhere are starting to push for car-free cities as well.



Small design features like footrests at intersections, tilted garbage bins, cyclist counters and bicycle air pumps cater for cyclists in the urban space and make cyclists feel welcome. Waves of successive green traffic lights and other Intelligent Transport System (ITS) solutions make for smoother, faster and more enjoyable cycling through a city.

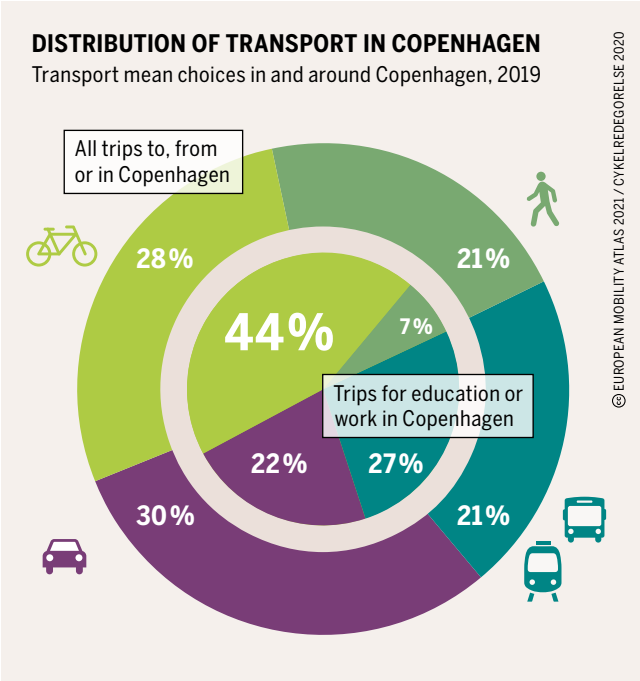
The Covid-19 pandemic in 2020 turned out to be a window of opportunity for cycling. Cities and transport providers around the world are redesigning the streets and public transportation to adapt to the new situation in which we have to keep our distance to avoid spreading the virus.

In order to avoid 'carmageddon' and provide people with alternatives to public transportation, cities around the world are widening the pavements and closing streets to cars to make space for pedestrians and people queuing outside. So-called pop-up bike lanes have been rolled out across the world to provide people with the option of cycling for transportation.

In just three weeks, the City of Berlin put in 12 km of new protected bike lanes. They are designed like road works, which makes it possible to avoid the normal administration processes. Met with overall positive feedback at an early stage, time will tell if these efforts can be maintained and made permanent in the future.

The bicycle has become the most important means of transport in the Capital Region of Denmark and numbers keep on growing.

Cycle superhighways, as an add-on to local cycling infrastructure, are beneficial on various levels: decreasing congestion, lowering the amounts of CO_2 and NO_x and improving health.



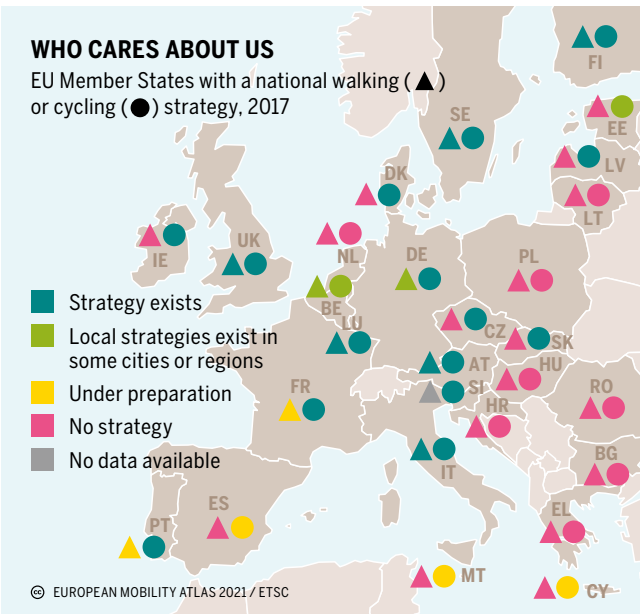
WANTED: STRATEGIES TO PROTECT THE WEAKEST

Cyclists and pedestrians run a high risk of being killed in road traffic. At national and EU levels, a variety of initiatives aims to protect them better. However, more is needed to ensure effective pedestrian and cyclist safety.

The European Union (EU) faces a multitude of interconnected demographic, public health and environmental challenges: the climate is changing; road deaths are not falling as fast as one would hope for – although the 'Covid-19 effect' is noticeable due to less traffic; urbanisation is increasing, air pollution is worsening, obesity is rising and the population is ageing.

There is an increasing recognition at local, but also national and EU level, that boosting active mobility, particularly walking and cycling, can play an important role in overcoming many of these challenges. Being the most vulnerable road users, at least 51,300 pedestrians and 19,450 cyclists were killed on EU roads between 2010 and 2018. In 2018 alone, total road deaths were 25,058, including 5,180 pedestrians and 2,160 cyclists. The total in 2019 was 22,800.

Deaths among pedestrians and cyclists accounted for 29 percent of all road deaths across the EU. These groups are also the least likely to harm other road users. There are no silver bullets for improving the safety situation. Several governments have started to put in place strategic planning to improve pedestrian and cyclist safety, including ambitious targets and priority areas for action. A proactive approach, involving all relevant stakeholders in the preparation and execution of the plans, clear deadlines and an appropriate budget for implementation are some of the crucial elements for success. Some governments have developed and are implementing national walking and cycling strategies, but the level of detail and ambition on safety differ.



A number of local authorities in the EU have started working on preparing and implementing Sustainable Urban Mobility Plans (SUMP), but improvements are needed to ensure that these plans are closely linked to road safety priorities, particularly for pedestrians and cyclists.

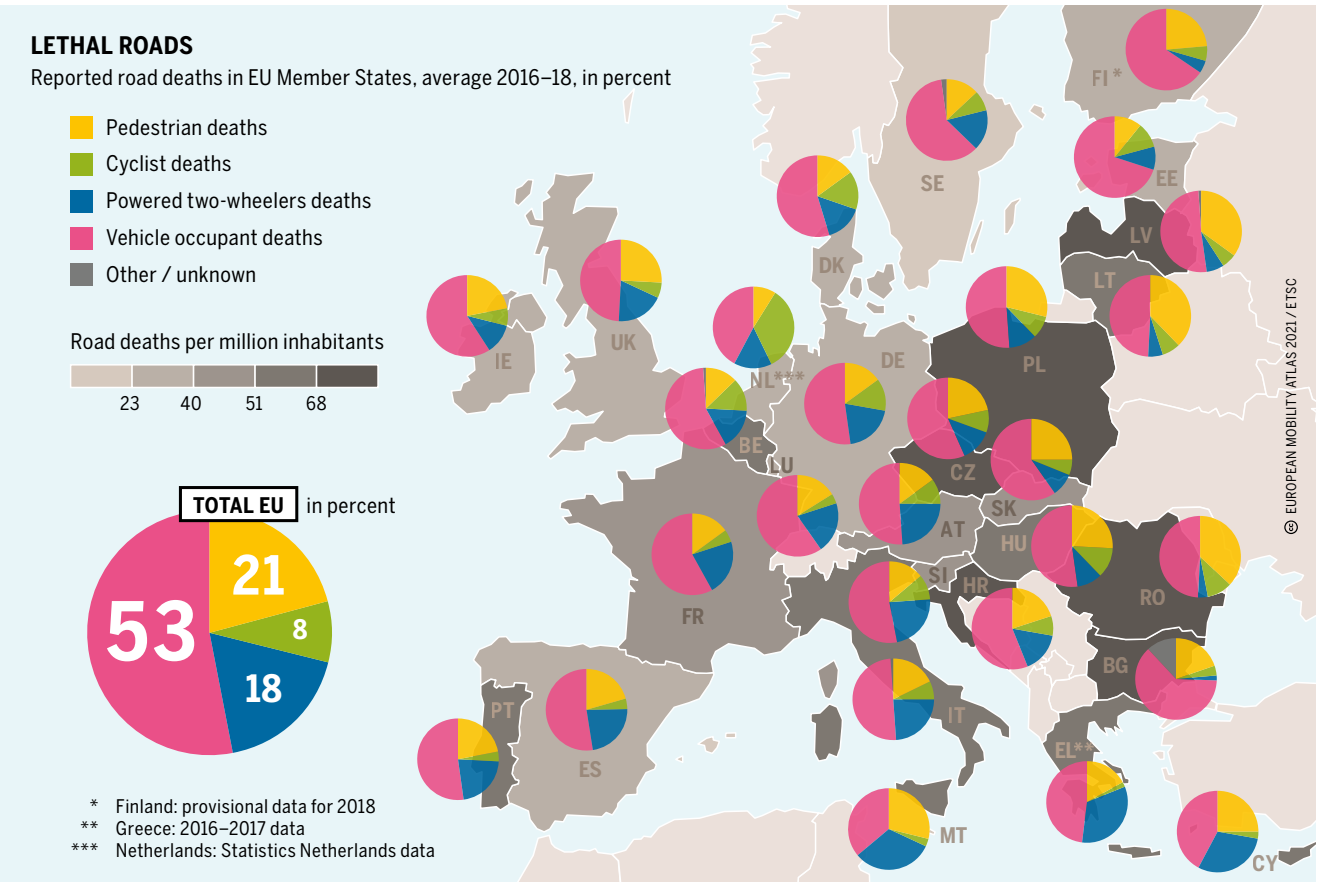
The EU road safety policy framework 2021-2030 includes a list of key performance indicators (KPI), developed in cooperation with Member States. The KPI on speed, protective equipment and vehicle safety are related to pedestrian and cyclist safety. Tracking the progress for each KPI will help decision-makers to develop well-informed and more targeted policies. Over the last years, the European Parliament, the Committee of the Regions and the European Transport Safety Council and other stakeholders that are working on reducing the numbers of deaths and injuries in transport have called for the European Commission to come forward with a cycling strategy for the EU. An EU-wide safe active mobility strategy, to encourage a coordinated European response to the challenge of making walking and cycling as safe as possible, could also be useful.

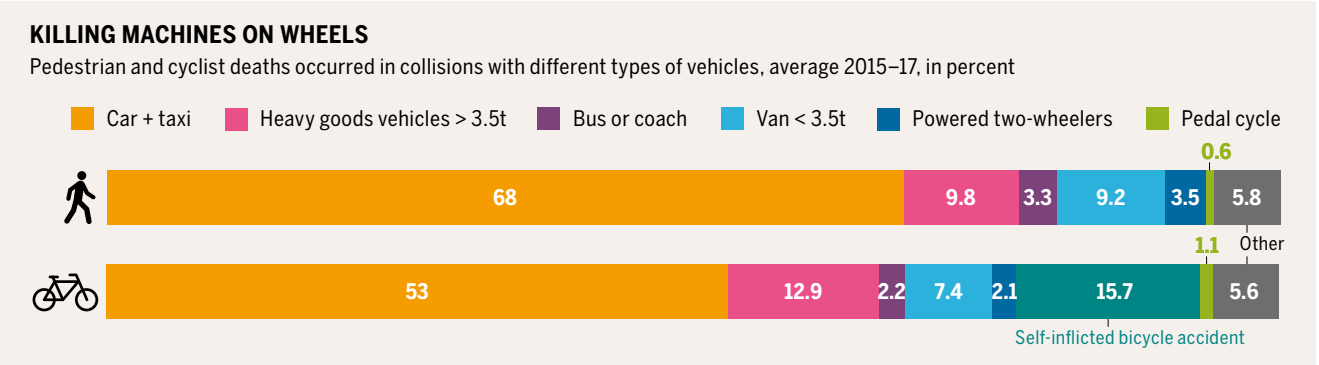
Infrastructure can contribute to reducing speeds and separating pedestrians and cyclists from motorised vehicles. This can reduce both pedestrian and cyclist deaths and severe injuries when collisions do occur, or even prevent those collisions from happening.

At the EU level, the revised EU Road Infrastructure Safety Management (RISM) directive mandates, for the first time, to systematically take vulnerable road users, including pedestrians and cyclists, into account in all infrastructure safety management procedures on the roads covered by the directive. Pedestrians and cyclists mostly travel on urban roads.

EU Member States are encouraged to extend the safety management principles of the RISM directive to their urban roads. At speeds of below 30 km/h, cyclists can mix with motor vehicles in relative safety. Traffic calming measures

The development of recommendations for action to protect the most vulnerable members in traffic could help to decrease the number of fatalities.





Not only are vehicle drivers more likely to be involved in fatal car accidents, but they are also responsible for well over half of all pedestrian and cyclist deaths.

in 30 km/h zones are essential to discourage drivers from exceeding the speed limit. Enforcement on roads limited to 30 km/h also has a contribution to make where engineering measures by themselves are insufficient to bring drivers to safer speeds.

Efforts should also be made to keep cyclists and pedestrians separate, by giving each of them, where possible, enough space so that they do not intrude on each other's space. Increasingly, urban planning must also take into account new personal modes of transport such as e-scooters, particularly how to keep their riders, as well as pedestrians and cyclists sharing space with them, out of harm's way.

Following an agreement reached in 2019, the revised EU General Safety Regulation and Pedestrian Safety Regulation have been updated with improved passive and active safety requirements for all new vehicles sold in the EU. Many of those new vehicle safety requirements, such as Intelligent Speed Assistance (ISA), Automated Emergency Braking (AEB) with vulnerable road user detection, enlarged head impact protection zones, direct vision requirements and Blind Spot Detection Systems for heavy goods vehicles will contribute to improving pedestrian and cycling safety.

To accelerate the market penetration of safe vehicles, Member States and local authorities can introduce public procurement requirements and urban access regulations to promote safer vehicles. With a comprehensive approach, strategic planning and cooperation between all levels of government as well as with road safety stakeholders, many of the challenges in improving pedestrian and cycling safety can be met.

UNITE RURAL AND URBAN AREAS

The 'last mile' is often a key problem in public transport. Smartly planned intermodal intersections and digitalisation offer a range of possibilities to close that gap in the transportation chain – even with solutions for individual mobility.

In the past, Public Transport Organisations (PTOs) have organised bus and regional train services. Their tasks included the configuration of attractive ticket prices and ended there. PTOs have been reasonably successful, as the numbers of passengers in public transport have been rising for years, and buses and trains have been operating at full capacity.

Nevertheless, traditional efforts to encourage people to leave their cars at home and use public transport, such as establishing bus lines and giving away free tickets, are reaching their limits and further incentives are needed. The rural population is particularly in need of solutions for their daily mobility.

The purchase of tickets is one of the key factors and the option of buying tickets online should be natural in our digital age. Tickets can be made available on smartphones and shown to the driver upon entering the vehicle. Protection against forgery has long been an issue, but has been solved by means of security features such as real digital tickets instead of ones in a file format, or QR-codes which can be read and verified by any ticket inspector.

When observing user habits, for example in Austria, a generational gap becomes apparent. Up to 71 percent of people under 24 years of age use their smartphones regularly to retrieve information about the public transport timetable, but only 21 percent of those over 55 use their phones for this purpose. While 17 percent of young people buy their tickets via an app, the 6 percent figure for people above 55 is still low.

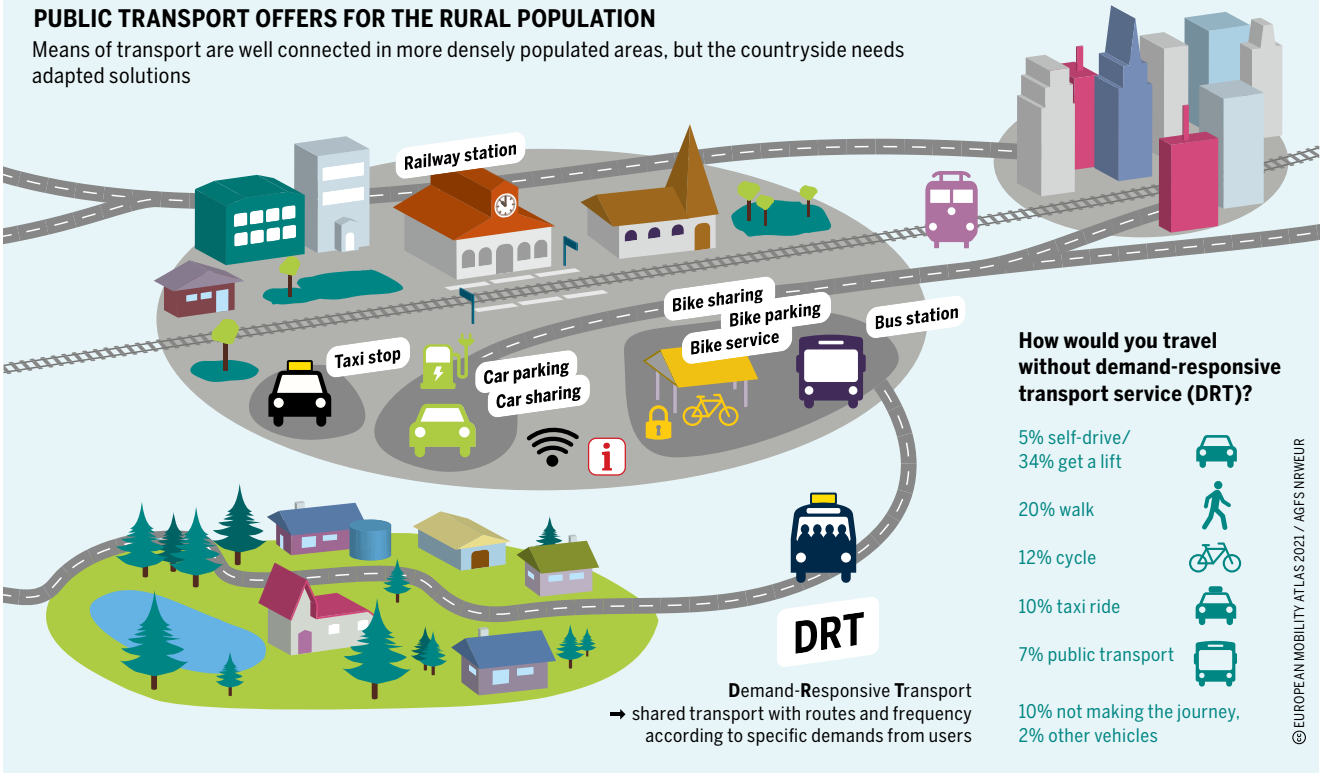
In Austria, the national government plans to introduce a so-called 1-2-3-ticket: 1 euro per day for one state, 2 euros per day for two states and 3 euros for the whole federal territory. Some states, such as Vorarlberg and Vienna, have already introduced the 365€-Ticket (1 euro per day) and have seen a clear increase of users of public transport.

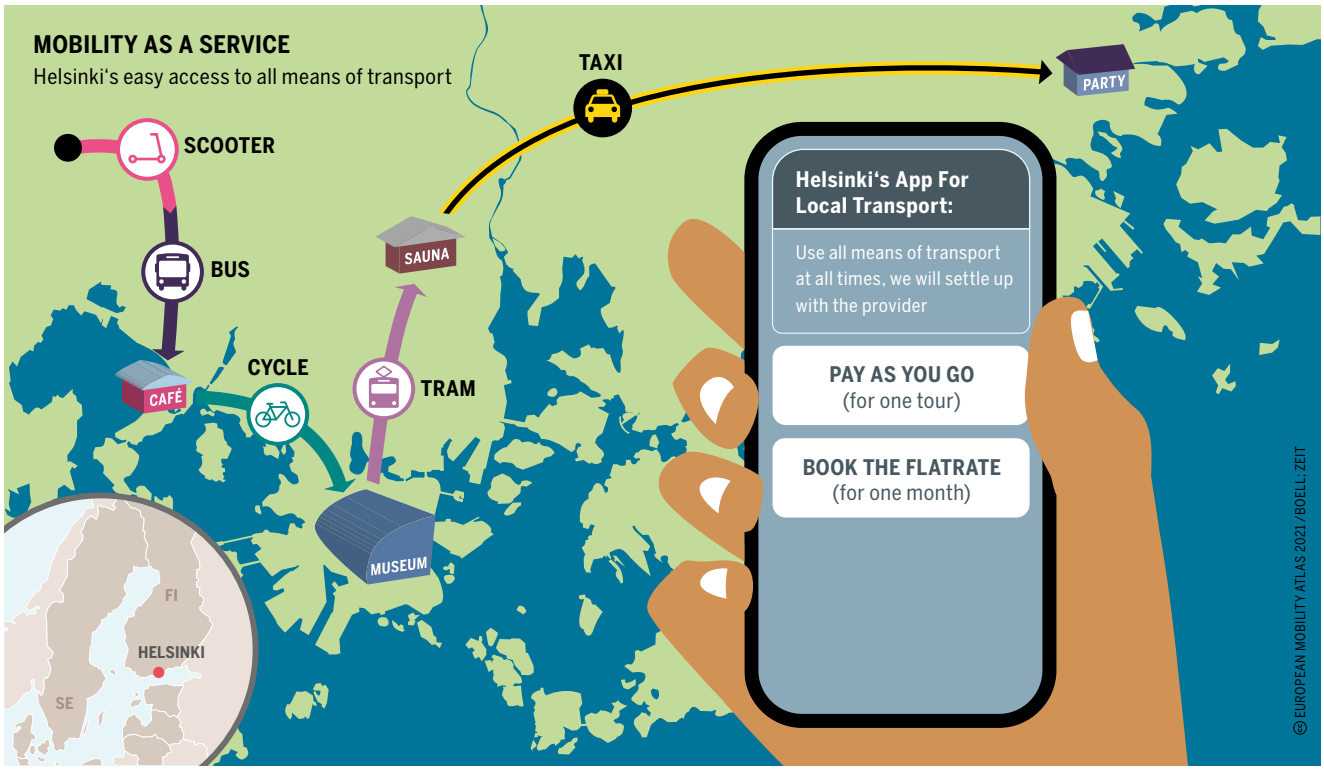
The so-called 'last mile' is often a problem for those who live far from city centres. How can people get home late at night when they take the last train, but there is no connecting bus service? As PTOs cannot provide buses at any time of the day and to any hamlet, other solutions have to be developed to cover the 'last mile'.

The provision of public transport in this manner emphasises its functions as a social service rather than creating a viable movement network.

PUBLIC TRANSPORT OFFERS FOR THE RURAL POPULATION

Means of transport are well connected in more densely populated areas, but the countryside needs adapted solutions





The use of different public transport means in Helsinki is facilitated with an overarching digital approach. Seamless links between e-scooter, bicycles, public transport and more are made possible by Finland's principle of Open Data.

As people have different habits, the solutions to the issue of the 'last mile' must also offer various possibilities. Small buses which run only on demand can cover longer distances. People can use car-sharing for a more individual mobility. And bike-lanes help to make it possible for people to reach public transport with their own bike.

To be able to use public transport more easily, important junctions of public transport have to be transformed into intermodal intersections. Modern intermodal intersections have different infrastructures available to change from private transport to buses and trains. Park & Ride and Bike & Ride facilities are the basic configurations. As electric bikes become more popular, more closed bike-boxes will be integrated. Infrastructure for charging electric cars and bikes should be provided. As infrastructure has a long-term planning horizon, it is crucial to develop a strategic plan for the building of intermodal intersections. The counting of passengers, passenger potential and surveying the available infrastructure and their utilisation build the basis of such strategic plans. These are set up for 10 years and closely adhered to.

In order for the intermodal intersections to function properly, collaboration with other stakeholders is a determining factor. Train companies often own property at stations, and regions and communities have to build bike lanes and paths that lead to the intersections.

Moreover, car- and bike sharing is quickly becoming an imaginable alternative for many people and is a useful supplement to public transport.

Some PTOs have already begun to present their own car-sharing options or take over the management for bundle offers of private car-sharing companies. An upgrade to an annual ticket can complete the offer of the public transport system. Areas with car-sharing vehicles and intermodal intersections follow similar selection criteria: places where many people enter the public transport system meet the requirements for a successful car-sharing station.

Car-sharing can prevent families from buying a second or third car which is not often used. One car-sharing vehicle can replace up to 20 cars and saves precious space as car parks are no longer necessary. In Austrian communities with less than 10,000 inhabitants, up to 38 percent of the households have more than one car, whereas in Vienna only 9 percent of households own more than one car.

Bike sharing can be a good addition to the public transport system in towns of all sizes where the 'last mile' can be powered by the traveller's own muscular strength. In many cities in Europe, those systems are already in use, but they could also be extended to private companies to help employees to use bikes more easily to get to work.

In all of these solutions, digitalisation is an important success factor. On digital platforms, customers can easily access multimodal mobility and for PTOs, the platform can make the customer handling easier.

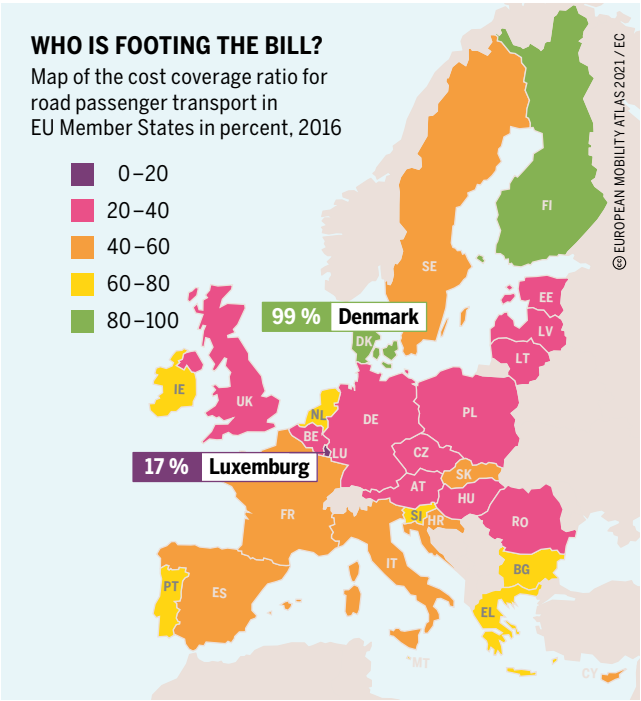
In order for public transport to play a major part in the mobility transition, it has to be thought about beyond its boundaries. Alternative offers and multimodal concepts are not only shaping the future, but are also already a fixed element of public transport systems. In addition, the so-called 'last mile' causes problems which prevent people from using buses or trains instead of their own cars. This calls for more flexible and demand-driven solutions.

THE COSTS OF TRANSPORT

Inefficiencies in the transport system are caused by false prices. A high amount of costs is passed from the polluter to the general public. This 'externalisation' prevents fair competition in transport and must be changed.

Traffic causes high consequential costs that are passed on to the general public. These include damage caused by climate change, air pollution, traffic accidents and noise. These so-called external costs do not appear on either the fuel bill or the air ticket and they vary according to the means of transport. Passing on the external costs is contrary to the polluter-pays principle, whereby the damage is paid for by whoever caused it. In the EU-28 (including the United Kingdom), these costs can be calculated at almost 716 billion euros in 2016. Accidents account for the largest subsection, at 282 billion euros.

How are external costs calculated? Experts have agreed on certain rules for this. For the calculation of accident damage, the "Handbook of external costs in transport" of the European Commission provides so-called damage cost rates. For each EU Member State, the handbook contains amounts for fatalities as well as light and serious injuries, which are adjusted to the price level of the country. The damage cost rates take into account, among other things, medical care, the deployment of police and ambulances and absence from work, and they also 'value' the pain and suffering of the accident victims and their families.



The climate costs of transport in EU-28 in 2016 amounted to around 140 billion euros. The underlying losses, mainly due to global warming, are also converted into money on the basis of cost rates. The European Commission's above-mentioned handbook uses avoidance costs. The cost rate determines the least-cost option to meet the 2-degree target of the Paris Agreement. The handbook recommends the cost rate of 100 euros per tonne of CO_2 equivalent.

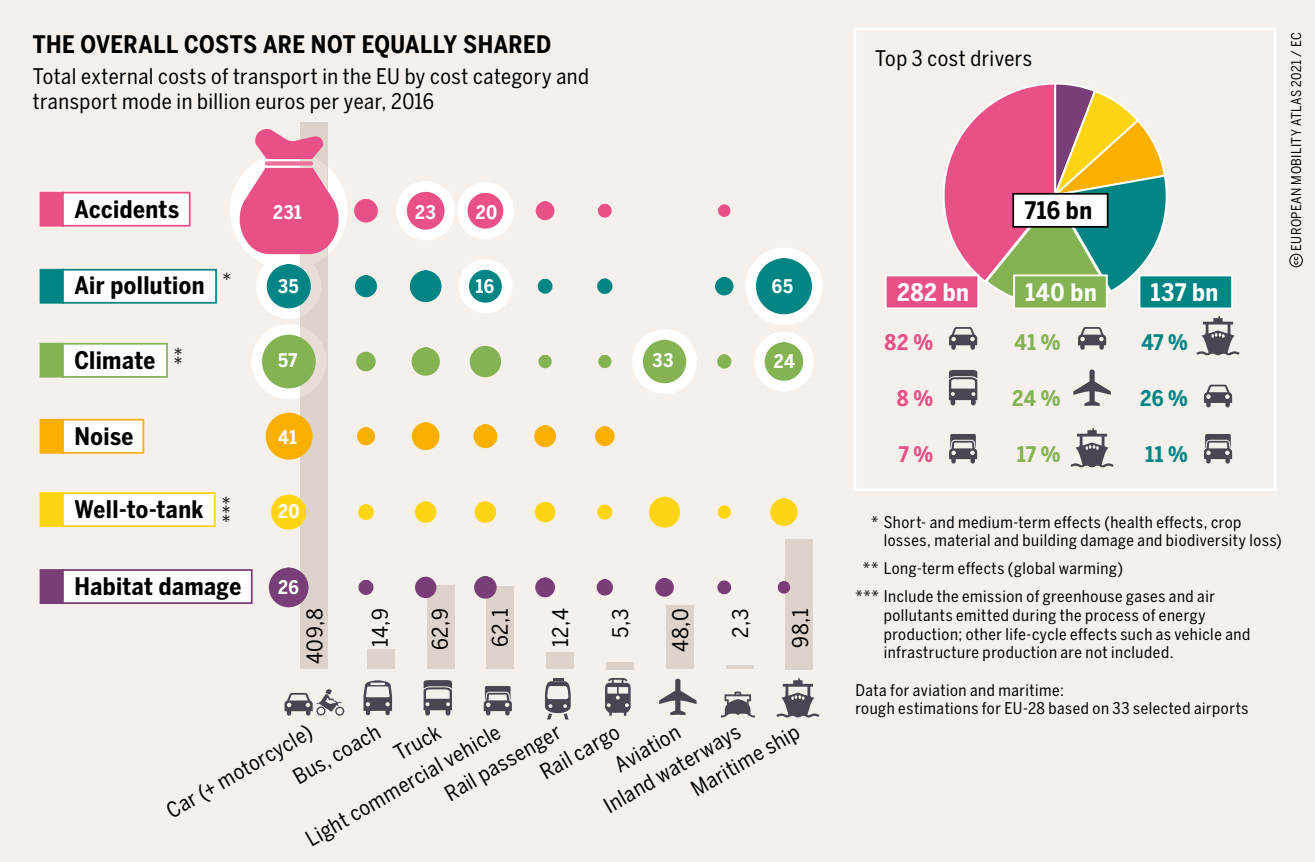
From an economic point of view, the externalisation of costs prevents fair competition among modes of transport. Some pass on parts of their costs to the environment and people, others try to avoid this and make sustainable offers. For this reason, many economists believe that the state should intervene and ensure that the costs that have traditionally been externalised are internalised.

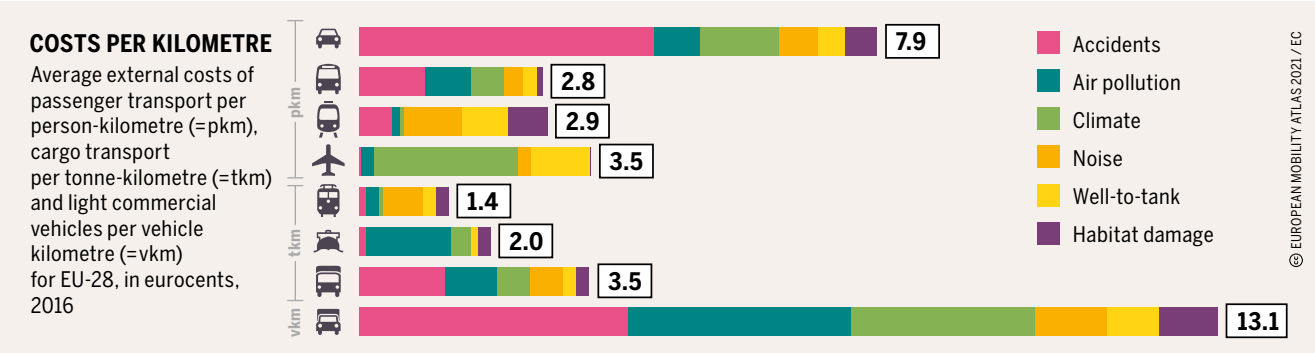
Most users of motorised transport in Europe already pay taxes and charges. Energy taxes are levied, taxes for purchasing or owning a vehicle are common and VAT is charged on all transport services except international aviation. Some countries have additional charges such as distance-based tolls, time-based vignettes or urban road pricing systems and parking fees. However, when comparing all revenues, taxes and charges with all external costs and infrastructure costs for road passenger transport, only 45 percent of the costs are covered in EU-28. This cost factor significantly varies between Member States, from 17 percent in Luxemburg to 99 percent in Denmark due to e.g. different tax rates.

For climate protection in transport, the way in which the previously externalised climate costs are internalised is critical. The choice is between a direct CO_2 tax or emissions trading with CO_2 certificates, which would be technically and legally challenging. Moreover, it would take several years to be embedded in the transport sector – lost time for climate protection. Furthermore, the potentially low prices for certificates do not provide a strong incentive to switch to climate-friendly technologies. This would be expensive for the economy and for people, because the connection to global developments would be missed.

Because emissions trading is difficult to implement, many experts currently consider a CO_2 tax to be the better option. The CO_2 tax could be introduced at national level in the short term and added to existing energy tax rates. Petrol, diesel and other fossil fuels would quickly become noticeably more expensive. The CO_2 tax would have to be set so high and increase so much over the years that the car

The highest vehicle purchase tax is applied in Denmark, whereas Luxembourg applies very low taxes and charges to road transport.





industry would be under constant pressure to innovate and to enable consumers to plan their (car) investments and to choose their means of transport according to prices that are also ecologically true.

Accident costs from road transport dominate. The external costs of energy production are often overseen.

Because not everyone can afford to quickly get out of the significantly more expensive individual car traffic, many CO_2 price concepts include social compensation components. For example, tax revenues could be handed back to the citizens through per capita payments or a compensation fund. However, there is also a discussion about whether the revenue from the CO_2 tax should be channelled into the rail or cycling network and other infrastructure – necessary for a transition of the transport system. Overall, an effective CO_2 tax is a central component of a climate-friendly mobility policy.

Since climate effects are only one of the external costs, further incentives to foster the change of behaviour are needed. Twenty-four countries of the EU-28 already apply distance-based road tolls or vignettes. Distance-based systems are most fair, since intense users are charged most and the pricing schemes can vary by road, amount of traffic, time or emission level to encourage efficient behaviour. Seven cities across the EU-28 already use urban road pricing to intelligently reduce car traffic and congestion, improve environmental qualities and increase quality of life.

The goal of increasing the costs of transport is not to punish people, to generate revenues or to impede mobility. The current transport system is inefficient due to false prices, resulting in a high congestion level and severe environmental effects. With true prices, more environmentally friendly modes of transport will become more attractive as an adequate alternative for many car trips.

CHARGING AHEAD

The path going forward is clear: for road vehicles, electricity and alternative fuels will soon replace petrol and diesel. The climate protection potential of this move is high, but some problems still need to be solved along the way.

At the beginning of the automobile age in the 1880s, various drive technologies competed with one another. Manufacturers used both electric motors and combustion engines in their vehicles. Around 1913, Henry Ford revolutionised car manufacturing by introducing assembly line production. Ford, and most of the rest of the industry, used petrol engines. Oil was abundant and cheap – a decisive advantage for the internal combustion engine.

Today, its potential has been all but fully realised, with an overall efficiency of 35 percent for petrol and around 40 percent for standard diesel engines. 'Overall efficiency' refers to the proportion of energy used that is converted into the movement of the vehicle. The impact on health and the environment from the exhaust gases of cars burning diesel and petrol is high – in some places, higher than permitted. Stricter requirements for climate protection and global competition are prompting manufacturers to invest more in electric vehicle technology.

For road use, these include battery-powered vehicles with electric motors, as well as so-called plug-in hybrids – vehicles with two drive systems, both a conventional internal combustion engine and fuel tank and an electric motor with a battery that can be charged using AC power (hence 'plug-in'); other hybrids charge their batteries using braking energy. Plug-in hybrids are considered to be a transitional solution between the internal combustion engine and a purely electric car. Another drive technology is the fuel cell, in which the electricity for the car is generated from a reaction of hydrogen and oxygen.

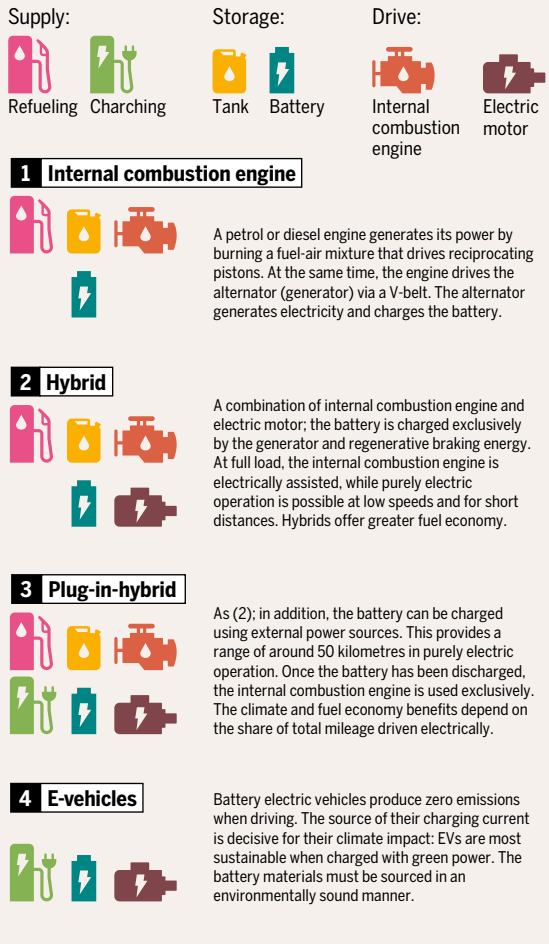
The use of synthetic fuels – so-called e-fuels – is controversial. In these products, water is broken down into hydrogen and oxygen; the addition of CO_2 turns the hydrogen into methane. The final fuels, which are obtained through further processing, are chemically identical to conventional petrol, diesel and kerosene, and can thus be used in internal combustion engines.

What are the pros and cons of the various systems? The use of electrical power directly without intermediate steps is the most efficient. The overall efficiency of an electric car is around 69 percent, as compared to around 26 percent for a car with fuel cell technology. An internal combustion engine burning synthetic fuels only reaches around 13 percent. The values for fuel cells and synthetic fuels are so low because a great deal of energy is lost in the conversion processes: an internal combustion engine running on synthetic fuels requires five times as much electricity for the same distance as an electric car.

E-fuels are currently only being produced on a laboratory scale and will not be available for general use in the foreseeable future. Because of the vast amounts of electricity required, synthetic fuels – as well as hydrogen for fuel cells – will tend to be produced in sunny regions in the future. The demand for green power is growing everywhere. Electricity-based fuels should therefore only be used in applications that do not have climate-neutral alternatives: These would include intercontinental air travel, as batteries would be much too heavy for use in aircraft. Experts agree that synthetic fuels will always be more expensive than either electrical power used directly or conventional

AUTOMOTIVE DRIVE TECHNOLOGIES

From the combustion engine to hybrids to the pure electric motor



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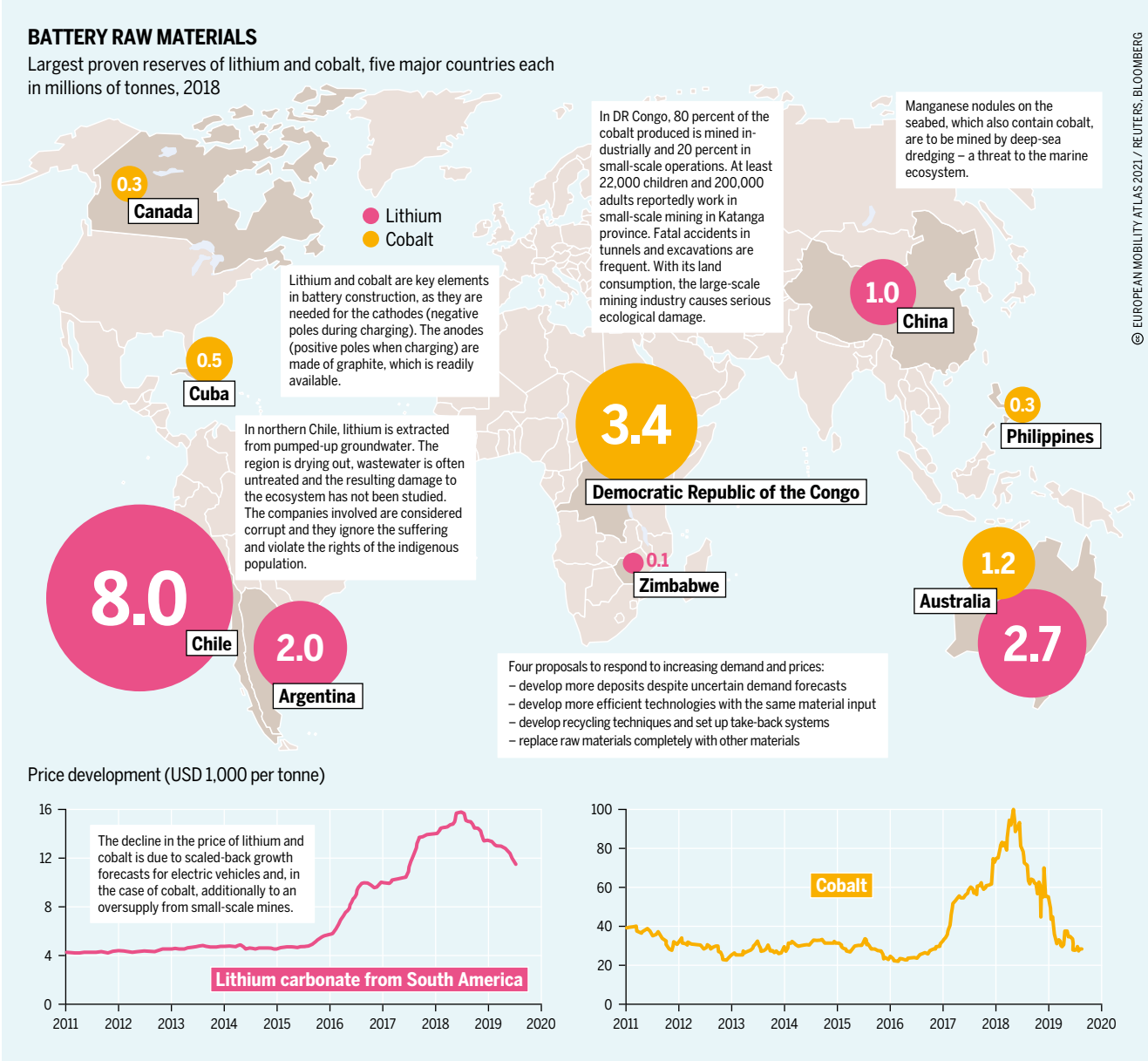
Experts consider hybrid vehicles to be transitional models. They will become obsolete as soon as the range, charging time and charging station coverage issues of electrical vehicles have been solved.



fuels. Either way, the production of synthetic fuels should be subject to strict, effective sustainability criteria and close monitoring. Germany does not yet have an import strategy for e-fuels.

According to the Paris Agreement, the transportation sector must become climate-neutral by 2050. The electrification of passenger and freight transportation on land, water and in the air could increase the electricity demand from today's 600 terawatt hours (TWh) by an additional 540 to 900 TWh by 2050. The production of green power – currently 216 TWh – must be increased rapidly and the grid upgraded to handle the much higher demand.

Electric cars have a range of several hundred kilometres. Most people drive less than 60 kilometres a day, so the currently available range is enough for day-to-day commuting. Cars can be charged at work and at home. This takes two to six hours at a modern wall charger and eight to 14 hours using a regular household outlet.

Germany's Federal Network Agency has registered over 9,600 public charging stations in the country, most of which have two charging points. The charging stations are mainly located in urban areas, however, and many sparsely populated regions are still underserved. Depending on a vehicle's battery capacity and performance, recharging at standard public charging stations takes two to four hours, or 20 to 30 minutes at fast charging stations.

Aid organisations – but also opponents of the transition to renewable energy – have been speaking out against human rights violations and environmental destruction.

On average, a fast charging station can be found every 60 kilometres on European motorways. Coverage varies from country to country. In central and southeastern Europe, it is not yet adequate for driving long distances. Numerous websites and apps can be used to find charging stations in Europe.

Finally, fuel cell vehicles not only have a low overall efficiency, there is also a lack of a hydrogen infrastructure throughout Europe. The refueling process for 500 to 800 kilometres takes only about three minutes. However, a mere 70 hydrogen filling stations are currently available in Germany, and their number is increasing only slowly.

THE DIESELGATE SCANDAL HAS NOT BEEN SOLVED

Detected five years ago, 'Dieselgate' remains partly unsolved, although national governments and the European Commission have offered a wide range of responses. Consumers criticise the scandal-handling by car manufacturers.

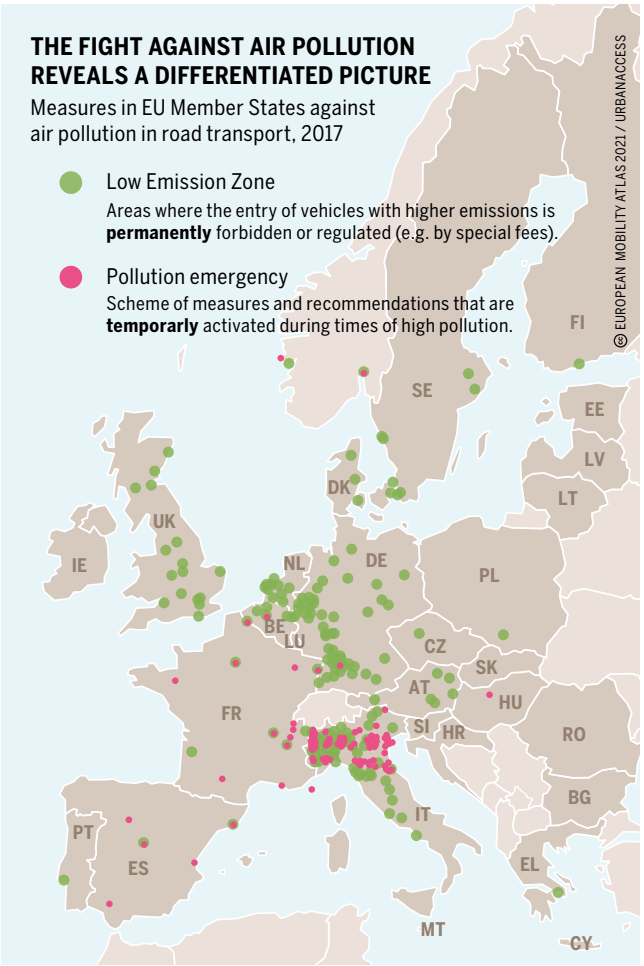
More than four years have passed since systematic cheating on emissions tests of diesel cars was first uncovered. What started with the Volkswagen Group in the United States became a global scandal, dubbed 'Dieselgate'.

Europe quickly moved to the centre of attention as it was not only the world's largest diesel market, accounting for 7 in 10 diesel cars sold, but also home to the leading manufacturers of these engines. Besides Volkswagen vehicles, cars of many other manufacturers were subsequently also found to exceed by far the legal limits for nitrogen oxide (NO_X) emissions when driven on the road. A large number of investigations are still ongoing and new cases of emissions cheating have emerged. Meanwhile, policymakers across the European Union adopted measures to respond to the scandal.

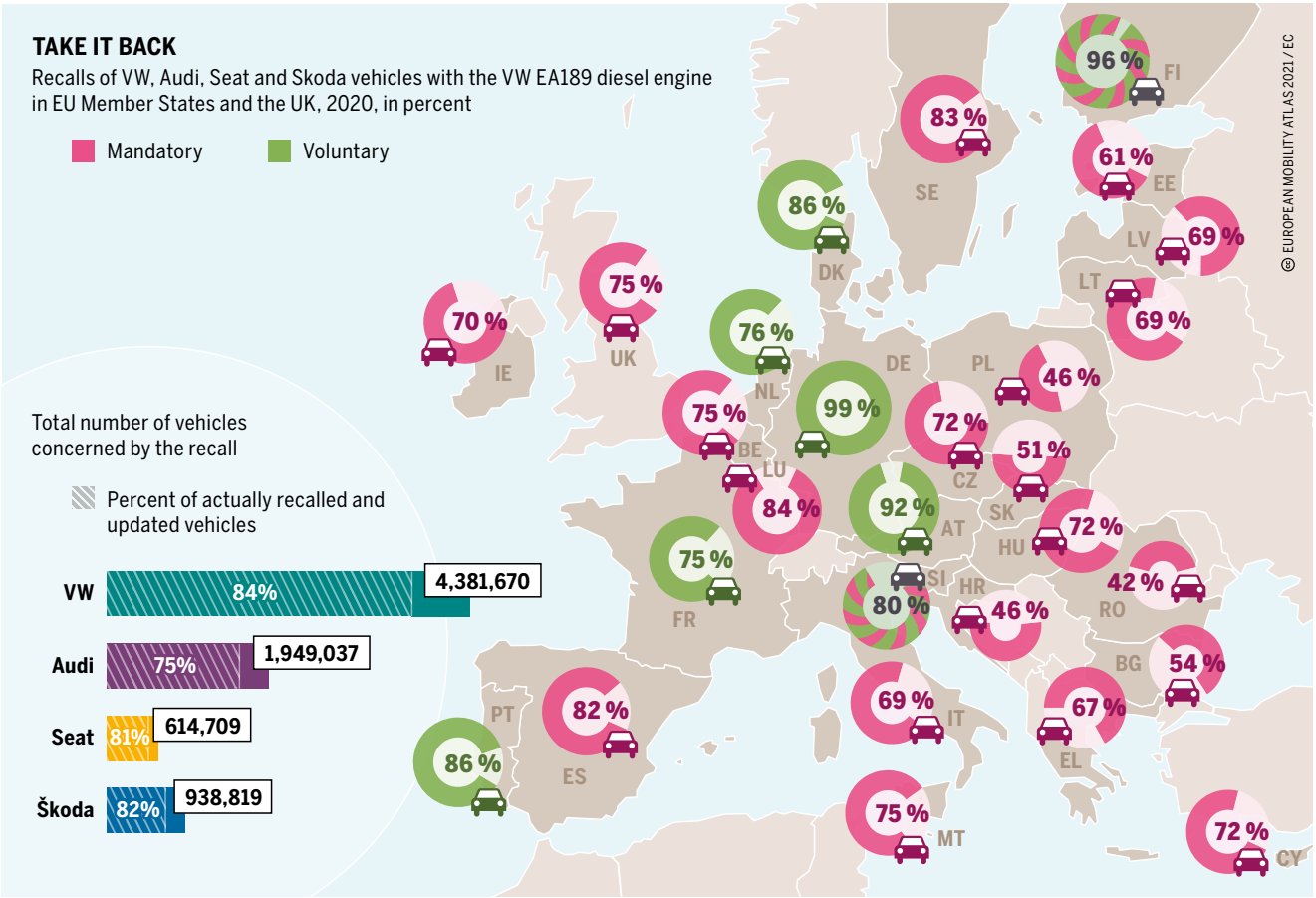
First, authorities and consumers tried to hold carmakers financially and legally accountable. Fines were imposed in several Member States and prosecutors pressed charges against current and former executives. The European Commission initiated a cartel investigation against BMW, Daimler and VW for colluding to restrict the development of emissions control technology. Car owners and consumer groups across Europe took Volkswagen to court. To date, only car owners in Germany have been offered compensation. Unlike what VW agreed with the United States, manipulated cars will not be bought back and the volume of compensation – a total of 830 million euros in Germany – remains a fraction of the ten billion US dollars deal on the other side of the Atlantic.

Secondly, various efforts have been made to clean up the highly emitting cars and vans that are on Europe's roads and have been estimated to total 51 million vehicles. Only a minority of these cars has been officially recalled and progress is often slow. In most cases, only software fixes for emission control systems were required, although they reduce NO_X emissions by only around 25 percent compared to reductions of 60-95 percent achieved with hardware solutions. Reacting to slow progress in cleaning up cars and pressure from court cases, many cities decided to restrict access to city centres for some of these polluting cars. Low-Emission Zones currently exist in more than 250 cities across the continent.

The third type of response to Dieselgate aimed at making new cars cleaner. Most importantly, on-road tests for pollutant emissions were introduced. They allow for less predictable testing and therefore make cheating harder. Recent research, however, indicates that loopholes remain, as cars can still emit high levels of pollution when driven outside the boundary conditions of the test. Moreover, NO_X-limits for on-road tests are less strict than in the laboratory. The EU has also overhauled vehicle approval procedures, above all to avoid a situation in which national regulators are competing for the market by lax application of laws.



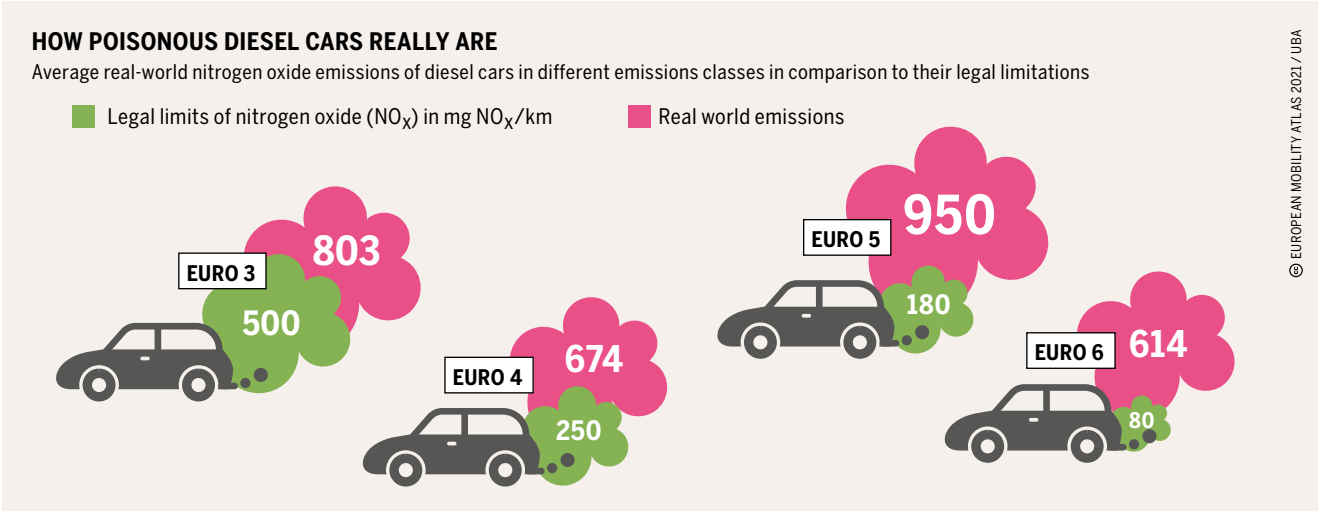
The introduction of Low Emmission Zones in cities might be a faster solution to pollution by dirty diesel engines. A legal solution to the scandal is still pending.



The VW Group has been hit hard by Dieselgate. Will its focus on a greener mobility help to improve its credibility? The inconsistency of the compensation schemes is problematic.

Since September 2020, the European Commission has been empowered to review the work of national authorities, test vehicles in circulation and issue EU-wide recalls or impose fines. The above overview shows a wide range of responses to Dieselgate, but also highlights that the scandal has not been fully resolved. Many cities continue to exceed nitrogen dioxide (NO_2) limits, most European consumers are still waiting for compensation or an effective fix of their car and a large number of legal proceedings are pending. Two out of three Europeans think that car manufacturers are not doing enough to promote good air quality, which highlights a divide with one of the continent's largest industries at a critical time marked by profound technological changes and the consequences of the global Covid-19 pandemic.

The Dieselgate scandal has brought to the fore the stark contrast between legal requirements and the considerably higher actual emissions of diesel cars. Sustainable transport policy needs to address this gap.



END-OF-LIFE VEHICLES

FINAL DESTINATION

Increasing mobility and trade as well as the shortening of a vehicle's average life have led to a growing number of vehicles that have reached the end of their useful life in Europe.

Managing this waste is a technical and economic challenge and illegal scrapping and dumping are still common, with significant impacts on the environment and public health.

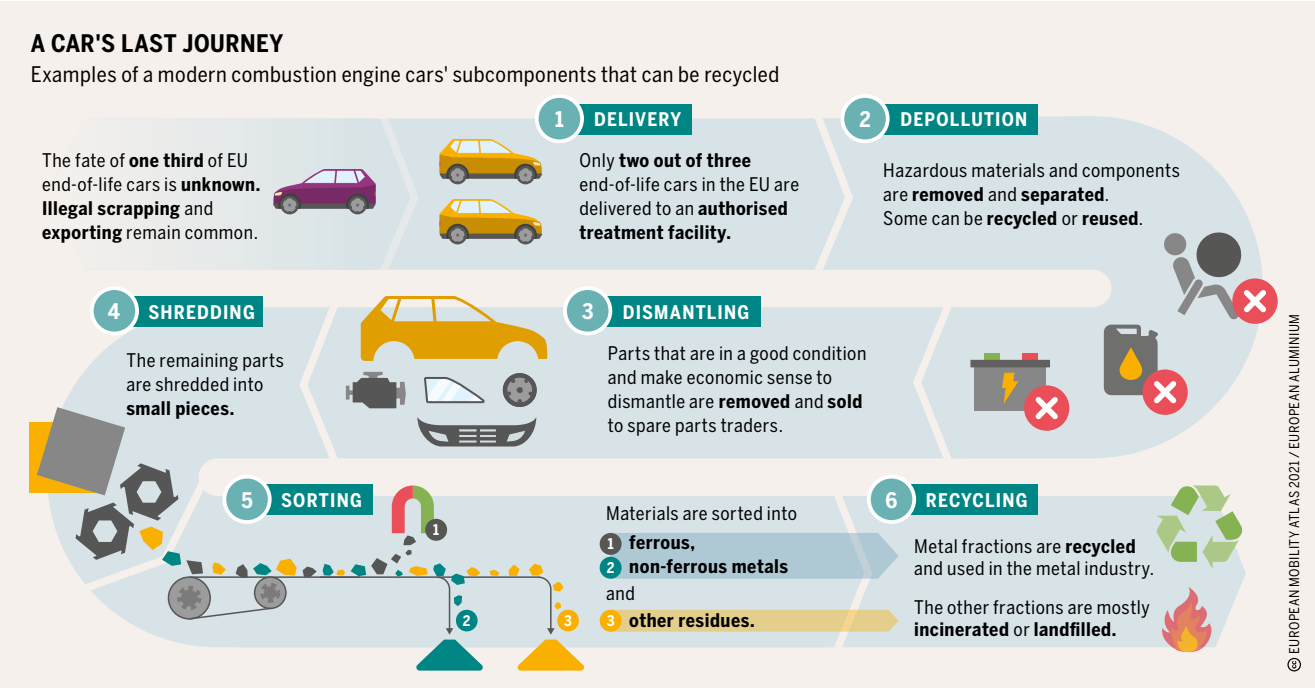
Economic growth and globalisation have dramatically increased the number of trains, planes, ships and cars worldwide. It is therefore becoming increasingly crucial to find economically and ecologically sound ways to treat vehicles that have reached the end of their life. They contain valuable parts and materials that can be reused or recycled, but also hazardous substances that can cause environmental and human health concerns.

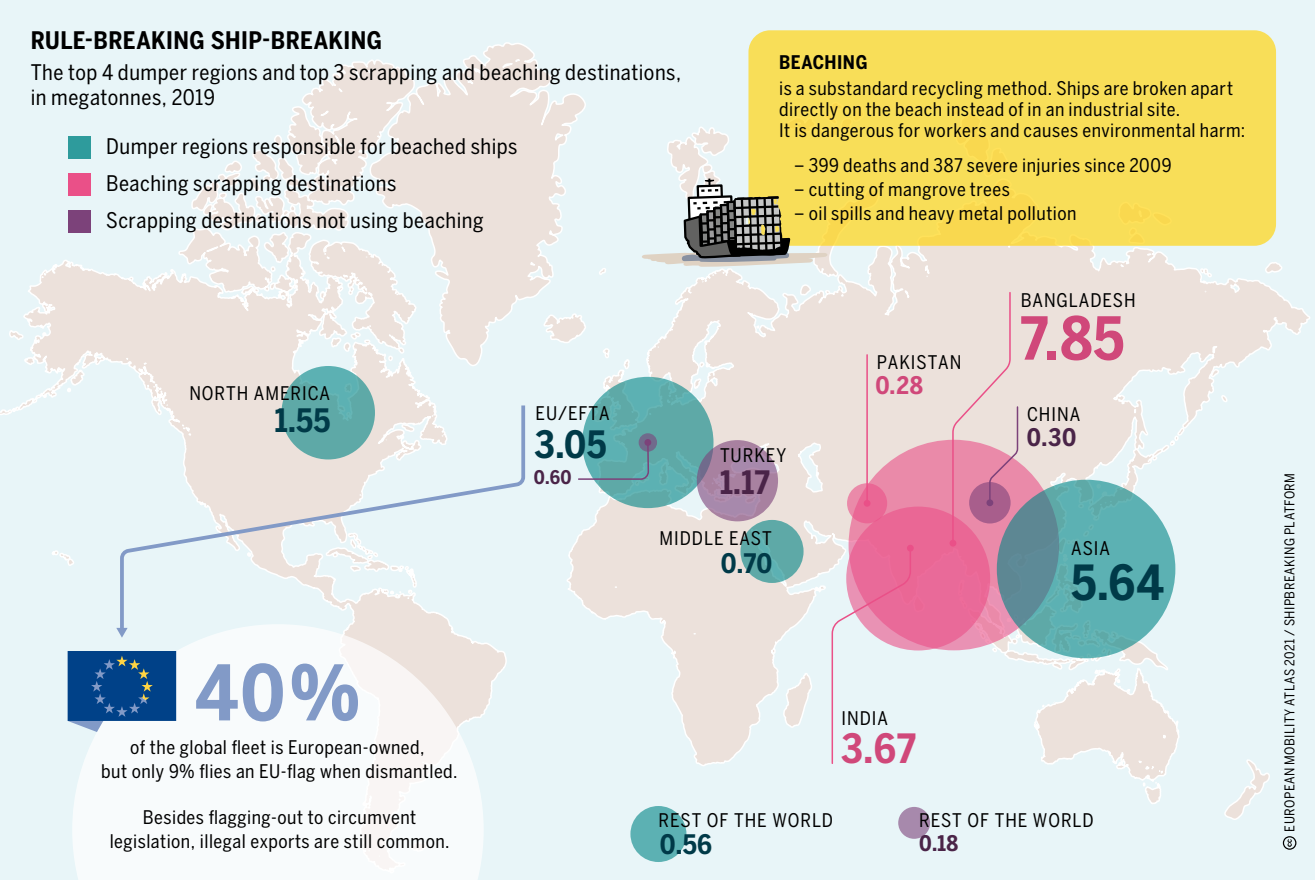
Trains and planes are massive vehicles whose waste management is a technological challenge. As they need very specific infrastructure to function and generally last for a long time, they have not been the number one priority concern when it comes to safe and efficient recycling and waste disposal. The situation for cars and ships is more problematic.

Every year, around 12 million cars leave European roads due to total loss after an accident, economic write-off, non-compliance with new safety or emissions standards or a change in design preferences. Up to two thirds of them are handled in authorised recycling facilities. About one million are exported as used vehicles to non-EU countries. EU legislation puts responsibility for managing the end-of-life of a car on the actors that place them on the market and requires clunkers to be stripped of all hazardous substances by authorised dismantlers in safe surroundings and 85 percent of the car's weight to be reused or recycled. Traditionally, the high value of metals and reusable pieces ensured a high recovery rate. Price fluctuations of metals and the changing composition of vehicles is a challenge for scrappers. Plastics and nanomaterials, for instance, have improved fuel efficiency, but are not recyclable and are incinerated or landfilled. Finding safe ways to handle a growing amount of electric cars is also imperative, as rare earth metals and batteries are associated with environmental and human problems.

There are about four million cars of 'unknown whereabouts' annually, meaning they are deregistered without information available indicating that the vehicle has been handled in an authorised recycling facility or has been exported. The bulk of the missing cars get lost in Europe's still flourishing market of illegal dismantling. Not following the EU's safety and environmental rules distorts fair business practices by compliant scrappers and has a significant envi-

EU law stipulates that 85 percent of the weight of a vehicle is recycled or reused. Most countries officially reach that objective, but important challenges remain.





The EU has a particular responsibility to find solutions to the ship-breaking crisis. European recycling facilities in line with the standards exist, but operate well below capacity.

ronmental impact as up to 55 million of litres of hazardous liquids, such as oil and air conditioner fluid, go unaccounted for every year. Some of the cars of unknown whereabouts are also exported to third countries. As end-of-life vehicles are considered hazardous waste, their export from the EU to non-OECD countries is forbidden. In practice, however, it is difficult to distinguish between a used vehicle whose export is legal and an end-of-life car. Even though the trade in these vehicles can create economic opportunities, uncontrolled substandard scrapping and the continued use of high emission vehicles in ever-growing cities pose environmental and health risks to local ecosystems and communities.

Just like cars, ships too become waste when they reach the end of their service. Up until the 1970s, commercial vessels were dismantled mainly in Europe and the United States, but as social and environmental protection laws became stricter, the industry shifted to areas where legal frameworks are weaker. In 2019, almost 90 percent of the world's end-of-life tonnage was broken up in India, Bangladesh and Pakistan without proper infrastructure, equipment and procedures to prevent accidents and pollution. The ship-breaking method used is called 'beaching' and entails the ships' grounding on an intertidal mudflat at high tide. As ships contain numerous toxic materials, such as asbestos, oil residues, heavy metals and toxic paints, this pollutes coastal and maritime ecosystems. Local communities that depend on them suffer. Furthermore, ship-breaking has been declared the most dangerous job in the world by the International Labour Organisation. Fires, handling hazardous waste, inhaling toxic fumes and falling steel plates can injure or even kill workers. Ship-breakers include many migrants and teenagers.

Cleaner and safer methods of ship recycling are available. European shipping companies control around 40 percent of the world fleet and are therefore crucial in finding sustainable solutions. To stop these companies from using the low-cost and substandard method of beaching, the EU has passed legislation that requires vessels registered under the flag of an EU Member State to be recycled at a facility included on an official list of facilities that operate in line with the standards for ship recycling set by the EU. However, over two thirds of ships of European owners continue to be beached because older vessels are often either sold or re-flagged to avoid regulation.

When speaking about end-of-life vehicles, it is important to recall that the most easily manageable waste is waste that is not generated in the first place. Mobility as a service with less individual ownership and more sharing concepts as well as reducing transport whenever possible are therefore priority actions to take. Eco-designing vehicles, including their longevity, repairability and recyclability, enforcement and improvement of existing laws as well as research into better recycling technologies can also help to reduce waste from end-of-life vehicles.

THE IMPACT OF COVID-19

SHAKEN AND SHIFTED

Europe and the world have been hit by transnational crises before the Covid-19 pandemic. And almost all of them had a severe impact on mobility and transport.

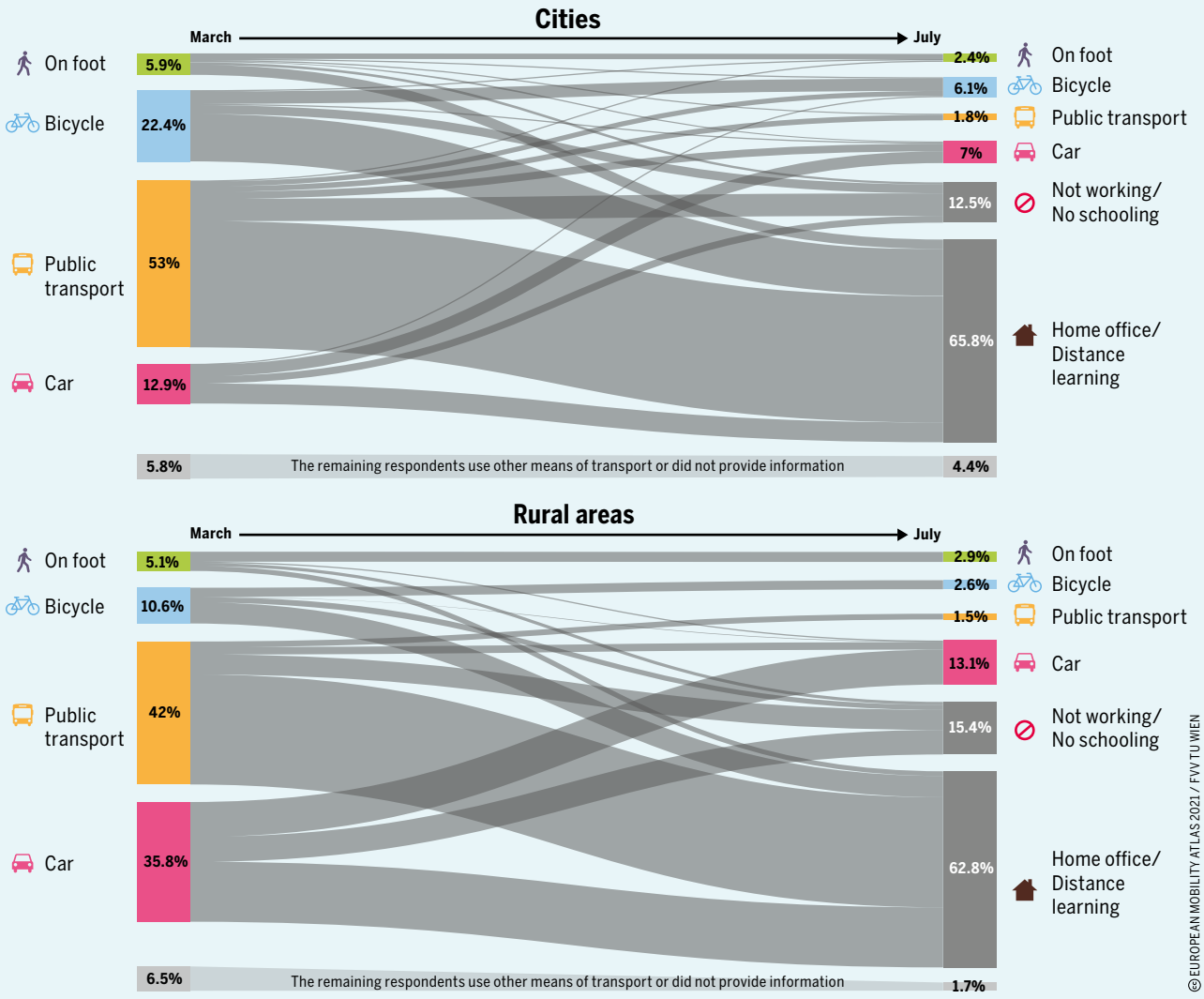
By no means can the pandemic be compared to the monstrosity of the two World Wars, which also elude any comparison as to their effects on mobility. At the end of the Second World War, Europe and the world were split up into two blocs, which resulted in the creation of parallel transport industries and infrastructure. Infrastructure would usually end or at least be obstructed at the blocs' borders. Travelling from one side of the border to the other would usually only be possible indirectly, if at all.

The Covid-19 pandemic is more comparable to crises such as the 1970s energy crisis or 9/11. The 1970s energy crisis, with its strong increase of global oil prices, resulted in halts of automobile traffic all over the world. Some western European countries introduced temporary speed-limits and car-free days. For the Netherlands, the crisis was the kick-starter for becoming one of the most bicycle-friendly nations in the world. 9/11 resulted in a temporary crash of the aviation market. While the general dependency on oil continues to exist, the Covid-19 crisis is more comparable to

During the first phase of the Covid-19 pandemic, usual standard mobility patterns were massively changed due to lockdown and home office measures.

STAY AT HOME CAMPAIGNS WORKED OUT

Change in transport habits during the Covid-19 crisis in Austria, 2020



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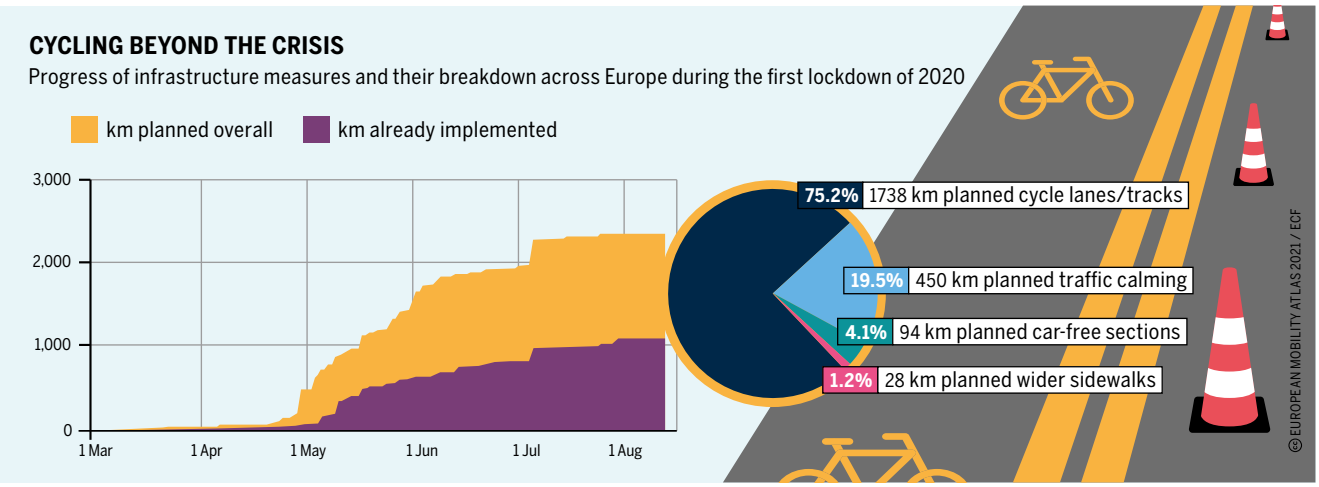


The Covid-19 lockdown gave the bicycle the opportunity to prove that it is the safest, most efficient urban mode of transport. As a result, European, national, and local authorities have started to put in place many permanent (and temporary) cycling measures in their cities and regions.

9/11, in terms of its effects on the world economy and more specifically to mobility and transport.

The pandemic has already led to a crash in the aviation market. In April 2020, air traffic across Europe plummeted to ten percent of normal levels. Airlines are trying to reboost their business during holiday seasons by claiming that, despite the impossibility of applying distancing rules on board aircraft flying does not entail a higher risk of a Covid-19 infection. These desperate claims are accompanied by 34.4 billion euros in state aid and counting.

While air traffic was almost grounded at the beginning of the pandemic, nearly all rail companies kept their services up and running to provide essential transport. Trains were partially limited to borders and the number of trains was reduced in some countries, while in others, normal services were maintained in order to allow for better distancing. Public transport has suffered a substantial decrease of passengers, which in the medium term will lead to a serious impact on its financing.

One of the few clear winners of the pandemic is the bicycle. Sales have sky-rocketed during the lockdown, since people seem to consider the bicycle to be a safe alternative to public transport, with which distancing and keeping fit come naturally.

For longer journeys, the car became the most popular means of transport (again). Yet sales of cars have suffered heavily, due both to an interruption of car manufacturing supply chains and the economic uncertainty felt by the consumers and potential buyers.

The Covid-19 pandemic also had a strong impact on public space. Obviously, shopping streets have been hit hard by the immediate effects of the pandemic, especially the lockdown. They will continue to suffer from distancing rules. Public space is literally gaining ground in terms of an increased use for exercise, play and recreation. In general, the need for increased public space exceeding the pre-existing political demands has emerged as a result of the pandemic.

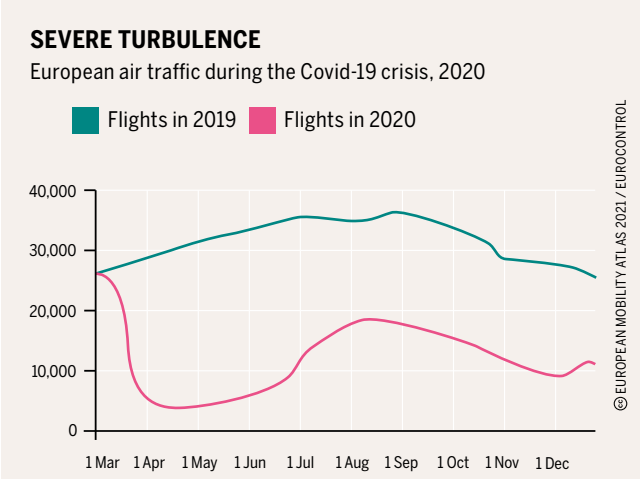
Although the immediate impact of the pandemic on mobility goes further than the conventional means of transport, those are among the main aspects that citizens experience in their everyday lives.

In the long run, the economic crisis that came with the pandemic and the national and international recovery measures will be more decisive. Climate change is looming, therefore governments need to take comprehensive decisions, combining solutions for the economy, the people and the planet.

The EU is focusing its Multiannual Financial Framework and the Next Generation EU funds on the recovery from the Covid-19 crisis. EU Member States have taken up a range of measures (such as the aforementioned bailouts for airlines) in order to overcome the most negative impacts of the pandemic. As the draft proposals show, transport is only a minor aspect of these recovery efforts. Yet the efficiency and the focus of the measures taken in this regard will shape societies for a long time to come.

Positive signs are the green conditionality of the airline bailouts in Austria and the German rejection of the so-called *Kaufprämie* (buyers premium) for conventional cars.

Air traffic was abruptly grounded in the wake of the Covid-19 crisis. Now, planes are flying less, but on more efficient routes. The challenge is to keep flying greener as traffic recovers.



ON THE ROAD TO INTEGRATED SERVICES

Digitalisation has already changed urban micro-mobility. The next step is the development of a single app for all mobility services.

The ongoing transitions in the automotive sector and in the new emerging mobility alike rely on hyper-connectivity via the internet of things (IoT), which means an interconnectedness of tools and services.

Car ownership in the EU-28 area increased considerably between 2000 and 2017, growing from 411 cars per thousand inhabitants to 516. However, the industry is now expected to reduce its carbon emissions in line with the Paris Agreement. The question remains whether the classic fossil-fuel car will be replaced by another service or another type of car, either electric, powered with hydrogen, leased or as a service, whether public, private or collaborative.

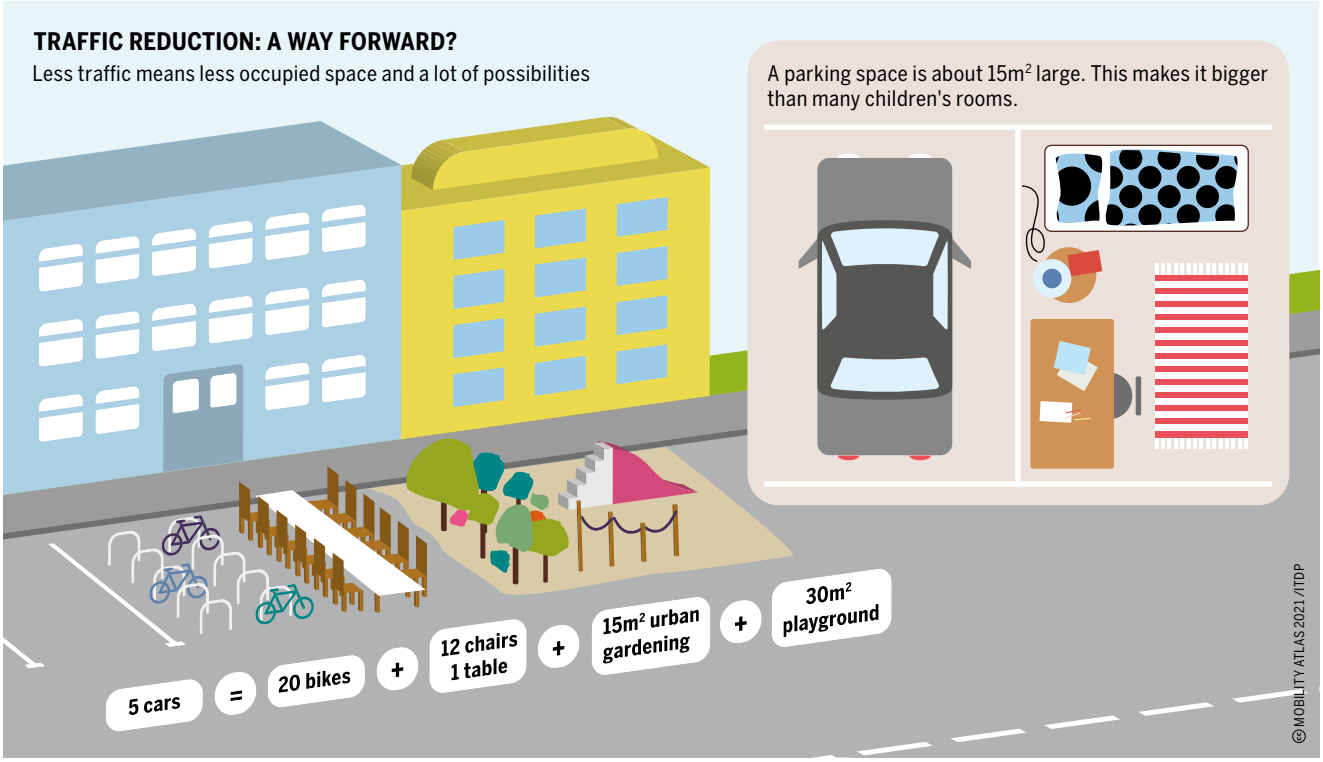
A new emerging and connected mobility is changing the urban micro-mobility: bikes, shared bikes, e-scooters, for passengers and for the delivery of the last miles, ride-sharing, car-sharing, either in parking or in free-floating. They have changed short-distance journeys in the city centres and, above all, have revolutionised trips from suburbs to city-centres and inter-suburb journeys, thereby offering a new territorial network.

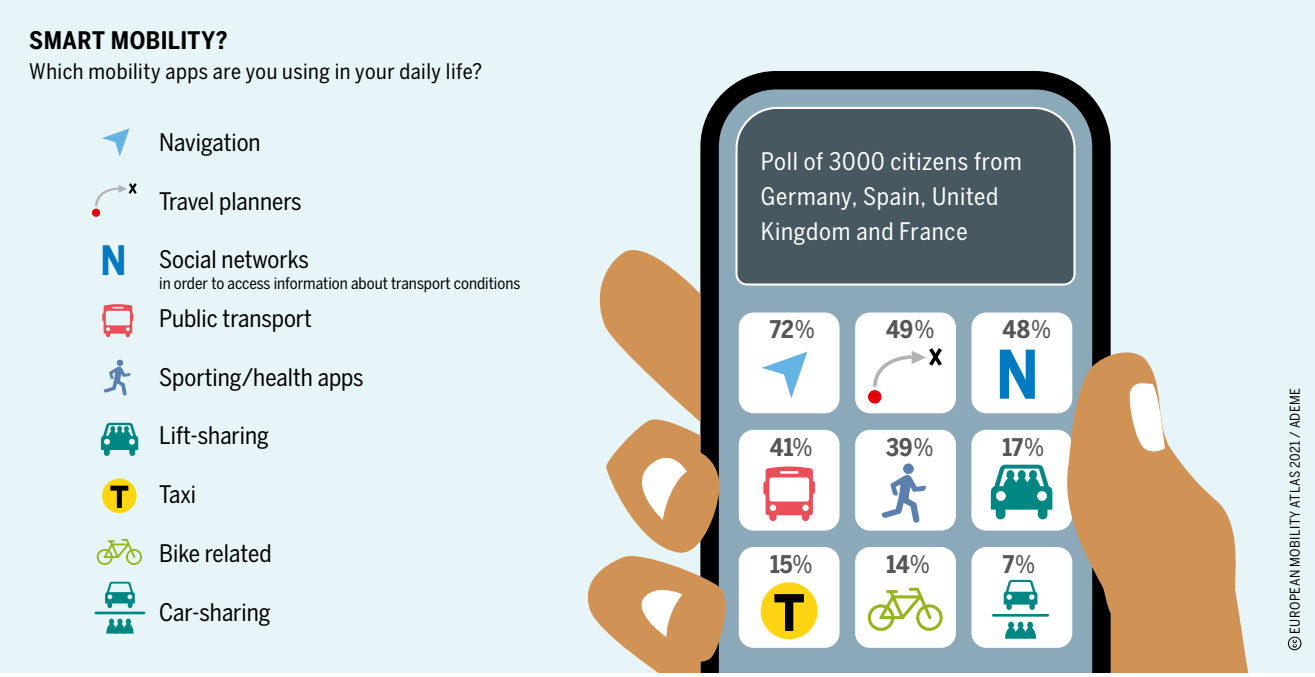
All these highly-connected business-to-consumer (B2C) services are developing apps in order to connect service providers with clients. The inflation of apps is an issue for service providers. In particular, independent private chauffeurs and messengers have to work on several platforms at the same time if they want to have access to a higher demand.

The social impact of this transition is important. Platforms such as Uber only provide the software for independent drivers, who cannot rely on any basic income.

To counterbalance this phenomenon, aggregation of services is most likely to be the next step of the mobility revolution. This new reality falls under the definition of Mobility as a Service (MaaS). MaaS aims to create a simplified and unique marketplace where many mobility services will be offered through a single app or equivalent. According to

Shared mobility frees up space in cities. This is space that everybody can benefit from and that is currently very unevenly distributed in favour of cars.





Mobile phones play an important role in the future of mobility. People are already using their phones in many different ways in order to plan journeys.

a recent survey, 59 percent of Europeans are interested in using a MaaS-type app. A few stakeholders dominate the MaaS-market: the car industry, big tech companies, transportation companies and public authorities. They all wish to be the unique marketplace for mobility.

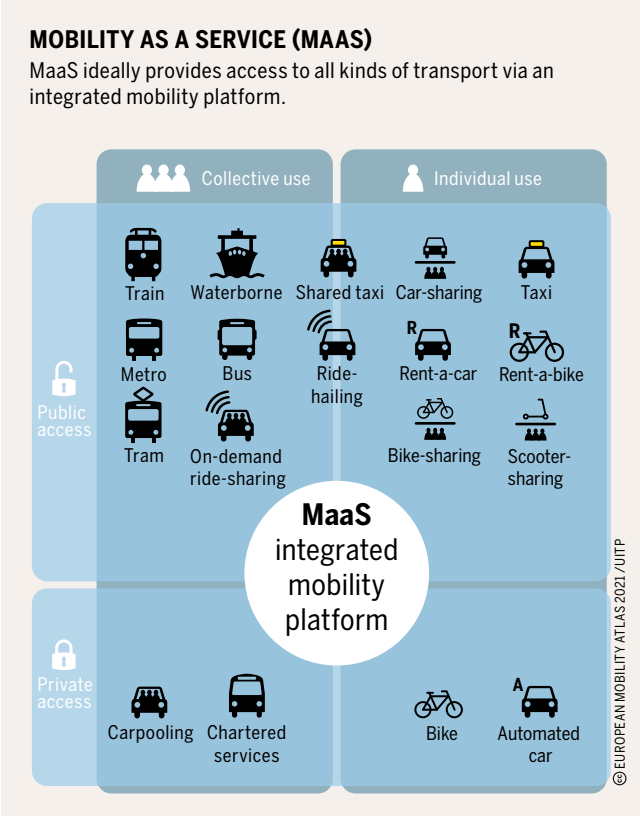
The internet of things is fuelled by data, from both service-providers and customers. As a consequence, data interfaces and ownership are key political issues. Anonymous data concerning mobility might reveal the identity of their owner, as they might show a pattern that can easily be tracked.

Autonomous driving is one of the big question marks in the picture. If successfully applied on a larger scale, it will revolutionise the mobility sector (from private cars to the logistic chain) in the next ten years. In view of the technological costs and the amount of data and energy needed to power a vehicle, they will have to be shared and on demand. Based on this assumption, the future of private cars, but also taxis, ride-hailing, metros, tramways and mass transportation, is uncertain.

Transportation, sharing and the collaborative economy were not prepared for a global health crisis that recommends social distancing for all. Uber and BlaBlaCar will have to overcome consumers' misgivings over sharing the same air in a small and confined vehicle.

If the years to come were expected to bring a shift from a highly carbon-consuming, expensive, inefficient transport sector to a low-carbon, inclusive, safer, connected service, the Covid-19 pandemic has brought some uncertainty to this development.

MaaS ideally provides access for everybody to all kinds of mobility services. It is a serious challenge to leave no customer and no provider behind. However, there are no simple answers to issues such as data privacy and market regulation.



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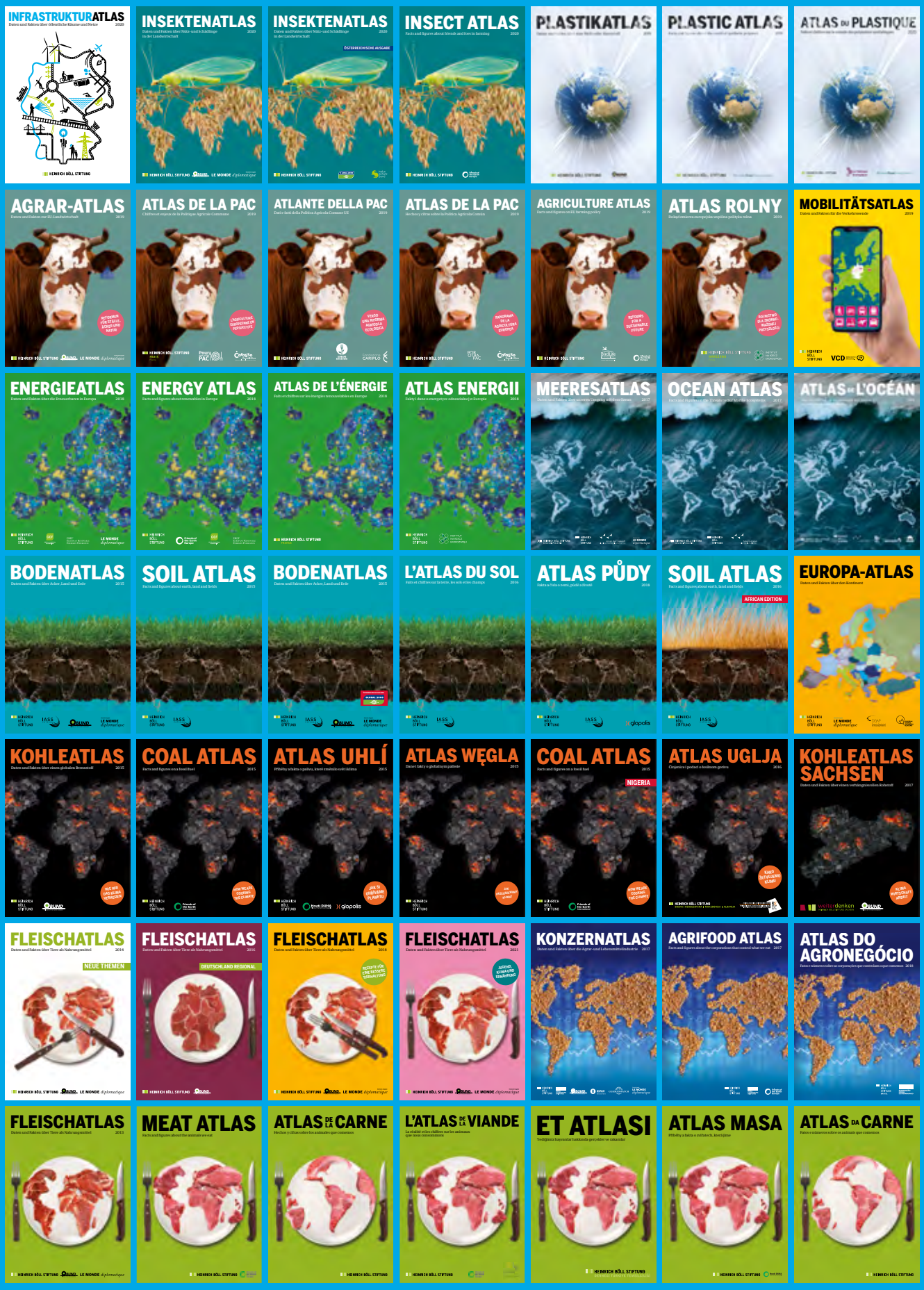

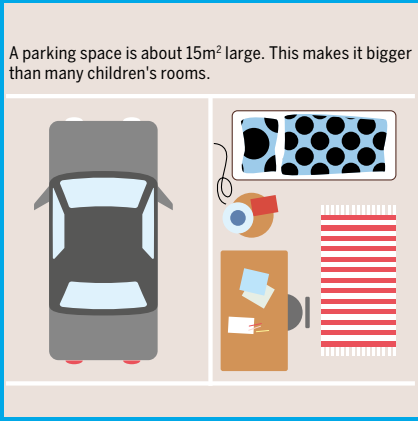

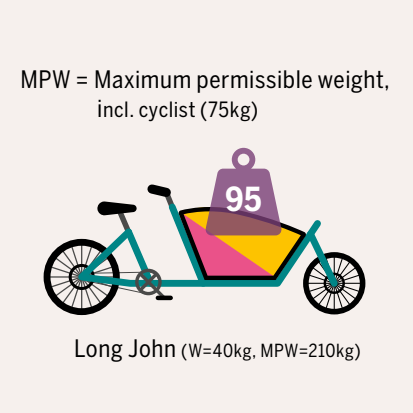

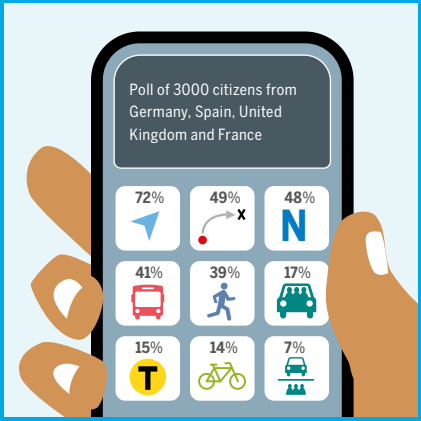

A well-connected cross-border railway system is the backbone of European transnational mobility. Many cross-border points still look like a patchwork reflecting a myriad of different national systems.

From: CLOSING THE GAPS, page 20

Providing people with the options to safely walk, bike or use public transportation is paramount not only in creating a green and sustainable city, but also a liveable, people-friendly city.

From: THE MAKING OF A BIKE-FRIENDLY CITY, page 30

Inefficiencies in the transport system are caused by false prices. A high amount of costs is passed from the polluter to the general public. This 'externalisation' prevents fair competition in transport and must be changed.

From: THE COSTS OF TRANSPORT, page 36

The path going forward is clear: for road vehicles, electricity and alternative fuels will soon replace petrol and diesel. The climate protection potential of this move is high, but some problems still need to be solved along the way.

From: CHARGING AHEAD, page 38