A NEW DESIGN FOR A FUTURE-PROOF MOBILITY

The way to a greener and smarter Europe

Policy Brief
March, 2021

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Abstract

The transport sector is undergoing a time of great changes. The traditional concept of mobility has been upset, on the one hand, by the exponential growth of the global trade in goods and, on the other, by the growing number of people moving to and within urban areas. The sustainable transition is one of the main challenges facing this sector in the coming decades. Transport accounts for almost a quarter of Europe's greenhouse gas emissions and is one of the most difficult sectors to decarbonise. Over recent decades, emissions from the EU transport sector have not been decreasing in line with other sectors, and certainly not enough to limit its environmental and climate impacts. Therefore, reducing transport pressures on the environment and climate is key to achieving the EU's long-term vision of zero net emissions by 2050. At the same time, work is needed to be carried out on the resilience and recovery of the transport industry, starting with the security of supply chains, interrupted during the Covid-19 pandemic. Digital transformation can profitably contribute to both sustainability targets and the technological innovation of mobility and transport. Both goals, however, require a considerable amount of investment and a broad spectrum of integrated policy measures.

In the first part of this paper, we analyse the composition and trends of the European transport system, highlighting its evolution in recent years and its environmental impacts. In the second part, we focus on energy transition policies in the mobility sector, above all, on the Sustainable and Smart Mobility Strategy, defining its objectives, flagships and actions. Lastly, we underline the need to support European strategic autonomy with adequate measures in sectors that are key to the decarbonisation and flexibility of the transport and mobility systems such as the hydrogen and electric battery industries.

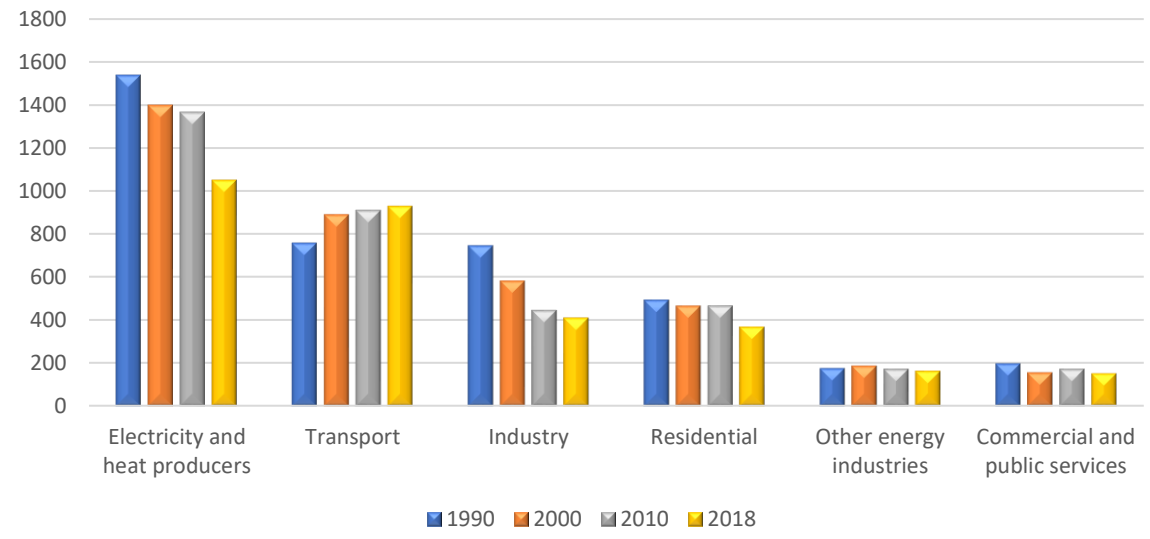
1. The mobility and transport system in Europe: an overview

The mobility sector is undergoing **drastic changes** because of the changes in people's behaviour, as well as other external factors. From a social point of view, several recent trends are requiring an adaptation in the mobility sector. These trends are due to the growing number of people moving to (and within) urban areas, the shift towards an even more individual and personalised mobility - due to the growing number of single-person households and the longer life expectancy - and the increase in tourism flows. In the last 50 years, the percentage of the population moving to urban areas has significantly increased in every part of the world.

One of the most important challenges facing the transport sector is to reduce the **environmental impact**. Reducing the pressures of transport on the environment and climate is critical to achieving the long-term vision of EU zero emissions by 2050. Over the last decades, emissions from the EU transport sector have not been dropping enough to limit its environmental and climate impacts. Observing the data published by the IEA relating to EU CO2 emissions in the period from 1990 to 2018 (Fig.1.1), it is clear that, out of the most polluting sectors, the transport sector is the only one not to have reduced its emissions. Nowadays, it accounts for **almost a quarter of Europe's greenhouse gas emissions** and is the main cause of air pollution in urban areas, posing a health and environmental threat.

Demand for passenger and freight transport in the EU saw a sustained period of growth until 2007-2008. After the peak, in the period 2009-2012, demand for passenger transport remained quite stable with only a slight overall reduction. In contrast, demand for freight transport decreased by up to 11% (between 2008 and 2009) as a result of the economic recession. Since then, demand for passenger and freight transport has been growing. The modal split in passenger transport did not change much in the decade 2010-2019. **Passenger cars largely dominated (83%)** and accounted for most of the increase in inland passenger transport volumes, followed by aviation. The shares of rail transport and bus and coach services in the passenger modal split remained low (8% and 9%, respectively), not greatly changing between 2005 and 2017 (+1% and -1.4%, respectively). Road freight and waterborne transport (inland waterways and maritime) were responsible for over 85% of total freight transport volumes, followed by rail (11%). During the period 2000-2017, among the other freight transport modes, road freight transport increased the most (by 24%).

Fig. 1.1: CO2 emissions by sector, EU28 (Mt CO2)



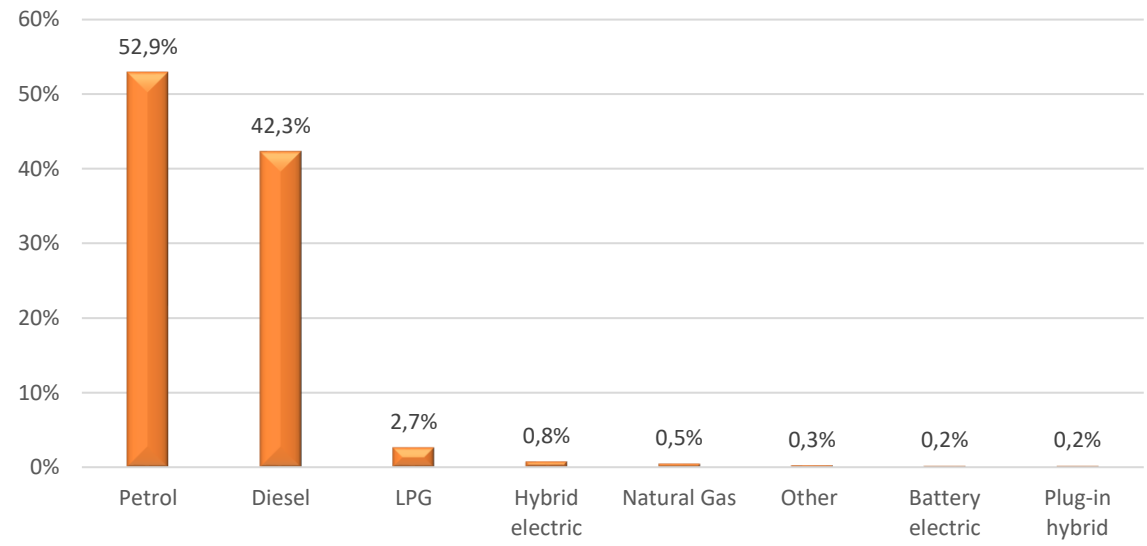
Source: IEA

According to the European Environment Agency (EEA), **the share of greenhouse gas emissions from the transport mode (2017) sees road transport in first place (71.7%)**, followed by aviation (13.9%), maritime (13.4%) and rail (0.5%). Although it is important that all transport modes should become more sustainable, it is clear that particular attention must be placed on road transport. The latest version of the ACEA "Vehicles in use, Europe" report (January 2021) highlights how in 2019 the European (UE27) car fleet grew by 1.8% compared to the previous year, reaching 242.7 million vehicles on the road. The highest growth was recorded in Romania (7%), whereas the French car market contracted slightly (-0.3%). The average age of cars on EU27 roads is 11.5 years, meaning that more than half of the cars currently used by European citizens were purchased before the introduction of the Euro 5 emission standard (January 2011). Lithuania, Estonia and Romania have the oldest fleets, with vehicles older than 16 years. The newer cars can be found, instead, in Luxembourg (6.5 years) and Austria (8.3 years). Despite an increase in registrations in recent years, alternatively-powered cars make up just 4.6% of the total EU car fleet. Only 0.8% of all cars on Europe's roads are hybrid electric, while both battery electric and plug-in hybrids each account for only 0.2% of the total (Fig.1.2). In 2019, almost 60% of all new cars registered in the European Union ran on petrol (58.9%, compared to 56.6% in 2018), while diesel accounted for 30.5% of registrations (35.9% in 2018).

As for other types of road vehicles, more than 28 million vans are in circulation throughout the EU. With 6 million vehicles, France has by far the largest van fleet, followed by Italy (4.2 mln), Spain (3.8

mln) and Germany (2.8 mln). Diesel-powered light commercial vehicles make up almost 90% of the EU van fleet, while battery electric vans account for only 0.3%. There are 6.2 million medium and heavy commercial vehicles on the EU's roads. Numbering almost 1.2 million trucks, Poland has the largest fleet, followed closely by Germany (1,010,742) and Italy (946,393). Again, diesel-powered vehicles are the most numerous on European roads, with 97.8% of all trucks running on diesel, while petrol fuels 1.3% of the fleet. 0.04% of trucks on the EU roads are zero-emissions. Around 692,207 buses run throughout the EU, with almost half found in three countries alone - Poland, Italy and France. Diesel buses still account for 94.5% the EU fleet, with only 0.6% being battery electric.

Fig. 1.2: Passenger cars in use by fuel type, EU27 (2019)



Source: ACEA

2. Energy transition policies in the mobility sector

2.1 The sustainable and smart mobility strategy

In December 2019, the European Commission released the communication on the **European Green Deal**, a strategy aimed at countering the threat of climate change by making the European economy and energy systems technologically sustainable, resource efficient and innovative. The main goal is to achieve, as established by the European Climate Law, **climate neutrality by 2050**, reducing net greenhouse gas emissions to zero and achieving the full decoupling of economic growth and polluting emissions.

The European Green Deal provides a very dense roadmap of strategic documents and programming plans that include multiple and transversal areas. It includes the need to **decarbonise transport**, a sector that makes up 5% of the EU's GDP and directly employs about 10 million workers. If the initiative of the Single European Sky, which reduces the fragmentation of European airspace, making the management of the 27,000 flights ordinarily crossing Europe every day more efficient, is expected to reduce emissions by up to 10%, high impact measures need to be taken in order for the Green Deal target to be achieved. For these reasons, the "**Sustainable and Smart Mobility Strategy**", released by the Commission last December, defines a roadmap of objectives to be achieved in the coming decades. Specifically, it is expected that by 2030:

- at least 30 million zero-emission vehicles will be on European roads;
- 100 European cities will be climate-neutral;
- high-speed rail traffic will double;
- planned collective journeys of less than 500 km should be carbon neutral within the EU;
- automated mobility will be widespread on a large scale;
- zero-emission ships will be ready for the market.

Instead, by 2035:
- large zero-emission aircraft will be ready for the market.

And finally, by 2050:
- almost all new cars, vans, buses and heavy duty vehicles will be carbon neutral;
- rail freight traffic will double;
- high-speed rail traffic will triple;
- the multimodal trans-European transport network (TEN-T), equipped for sustainable and intelligent transport with high-speed connectivity, will be operational for the global network.

In order to achieve these goals, to reduce transport dependence on fossil fuels and to build a sustainable, smart and resilient mobility system, the Commission envisages the following three pillars of action: 1) **Make all modes of transport more sustainable**; 2) **Make sustainable alternatives widely available in a multimodal transport system**; 3) **Introduce the right incentives to drive the transition**. These three pillars involve measures to significantly reduce current dependence on fossil fuels (e.g., replacing fleets with low and zero-emission vehicles and promoting the use of renewable and low-carbon fuels), tools for orienting activities towards more sustainable transport modes (e.g., increasing the number of passengers traveling by rail and commuters using public transport and active modes of transport and moving a considerable amount of freight on rail, inland waterways and short sea shipping), and the internalisation of external costs by applying the 'polluter pays' and 'user pays' principles through carbon pricing and pricing mechanism tools.

The "Sustainable and Smart Mobility Strategy" is divided into **10 flagships**, key areas of intervention, which, in turn, involve **82 actions**. Overall, in order to support the sustainable transition of transport, the action plan of the European strategy envisages strengthening the adoption of zero-emissions, renewable fuel and low-carbon vehicles, ships and airplanes and related infrastructures by, for example, installing **3 million public charging points by 2030**. It also considers building zero-emission airports and ports and promoting initiatives to foster sustainable aviation and marine fuels. The aim is to make urban and interurban mobility as environmentally friendly as possible, including doubling high-speed rail traffic and developing cycling infrastructure to a significant extent in the next decade. Sustainability measures will also be taken for freight transport, doubling rail freight traffic by 2050. Where tax leveraging is concerned, it is proposed to determine the price of carbon and provide incentives for users, establishing a set of tools to provide fair and efficient prices on all means of transport.

Digitisation will markedly change how passengers and freight move. Here, the goal is to develop connected and automated multimodal mobility by, for example, allowing passengers to purchase tickets for multimodal travel and goods switching easily from one mode to another. In addition, the Commission wishes to promote innovation and the use of **data and artificial intelligence for mobility**, supporting the spread of unmanned aerial vehicles and drones and implementing further actions to build a common European data space on mobility. Finally, the European institutions are considering to make those transport systems strongly hit by the Covid-19 emergency, more resilient. The Single Market will be strengthened by, for example, increasing investments to complete the trans-European transport network (TEN-T) by 2030 and by mobilising both public and private financial resources for the modernisation of fleets in all transport modes. The commitments also include support for mobility safety, also reducing the number of victims to almost zero by 2050. Finally, it is envisaged to make mobility fair for all, promoting passenger accessibility in all regions (including those with reduced mobility), and to make the transport sector more attractive to workers.

2.2 Hydrogen and electric batteries to foster the transition

In addition to the Sustainable and Smart Mobility Strategy, the transformation of mobility and transport systems also finds its place in other strategic papers from the European Green Deal - e.g. "**A Hydrogen Strategy for a climate neutral Europe**" aims to boost clean hydrogen production in Europe. Specifically, it is expected that from 2025 to 2030 hydrogen will become an intrinsic part of our integrated energy system, with **at least 40GW of renewable hydrogen electrolysers and the production of up to 10 million tonnes of renewable hydrogen in the EU**. From 2030 onwards, hydrogen will be then deployed at a large scale across all hard-to-decarbonise sectors.

Hydrogen can offer alternatives for transport system sectors where it is not easy to reduce emissions, in addition to electrification and other renewable and low-carbon fuels. In the short term, it can be adopted quickly for restricted uses, such as city buses, commercial fleets (e.g., taxis) or certain sections of the railway network that cannot be electrified. Hydrogen filling stations can be easily powered by local electrolysers. At the same time, the use of hydrogen cells in heavy vehicles, including, given the high CO2 emissions, coaches and special purpose vehicles and for road freight transport over long distances should be encouraged. The 2025 and 2030 targets set out in the CO2 Emissions Performance Regulation will help create a market for hydrogen-based solutions as soon as fuel cell technology is sufficiently mature and cost-efficient. The **IPCEI "Fuel Cells and Hydrogen"** funded by Horizon 2020 seeks to accelerate European technological progress in this area. On commercial rail lines that are difficult to electrify, or where this option is economically inefficient, hydrogen cell trains could be put into operation - currently around 46% of the main network is still run-on diesel. Some railway applications of hydrogen cells (e.g., multiple units) can already compete with diesel in terms of cost. Hydrogen could also be a low-emission alternative fuel in short sea shipping and inland waterways, also considering that the Green Deal also emphasises the need to set a price for CO2 emissions in this sector.

After 2030, hydrogen and its **carbon-neutral CO2-based synthetic fuels** could penetrate a wider range of economic sectors, from shipping to aviation. For longer-range and deep-sea shipping, fuel cell power will need to be increased from one to more megawatts and renewable hydrogen used to produce higher energy density synthetic fuels - methanol or ammonia. In the long term, the possibility of exploiting hydrogen to decarbonise the aviation and maritime transport sector through the production of liquid synthetic kerosene or other synthetic fuels cannot be ruled out. Although these are "drop in" fuels compatible with existing aviation technologies, the implications in terms of energy efficiency still need to be considered. The aviation sector could also include hydrogen jet engines or hydrogen fuel cells, which would require a different aircraft design. In order for these hypotheses to become reality, a roadmap must be defined for the considerable R&D efforts and investments required. In the road transport sector, for example, opening an additional 400 small hydrogen refuelling stations, in addition to today's 100, could require investments of between € 850 million and € 1 billion[1]. It will also be necessary to act on the demand side so that the use of hydrogen spreads and extends to other applications.

The European Commission is also pushing for the development of **electric batteries**, key enabling technology for the ecological transition and central to European automotive competitiveness. To this end, in 2017, the Commission had already launched the **European Battery Alliance (EBA)** in agreement with the European Investment Bank, EU countries, industry and the scientific

[1] European Commission, Asset study (2020). Hydrogen generation in Europe: Overview of costs and key benefits.

community. The goal is to promote a clean and digital transformation and make Europe a global leader in sustainable battery production and use. Specifically, in line with the European Green Deal, the Circular Economy Action Plan and the Industrial Strategy, the European Battery Alliance plans to develop an innovative, competitive, circular, safe and **sustainable battery value chain in the European market**, starting from securing access to raw and processed materials, to supporting cell, cell component, battery pack and electric vehicle design and manufacturing and to recycling and disposal in a circular economy.

Recently, the Commission approved a **second IPCEI** to support research and innovation in the battery value chain prepared jointly by 12 Member States[2] for a total value of € 2.9 billion in funding until 2028. This should mobilise € 9 billion in private investments, contributing to EU autonomy in the sector. The European institutions expect that by 2025, the actions undertaken under the EBA will help create an industry capable of powering at least six million electric cars each year and producing improvements in performance, safety and environmental impact. 42 companies will benefit from the funding, including SMEs and startups, as well as companies active in various sectors such as Tesla, BMW, Fiat Chrysler Automobiles, Enel X, Solvay, Arkema, and Borealis.

The transformation of the transport system also finds its place in the **Recovery and Resilience Facility**, the extraordinary plan introduced to accelerate European economic recovery. For instance, the European Commission encourages Member States to propose flagship investment and reform initiatives aimed at promoting future-proof clean technologies to support the use of sustainable, accessible and smart transport, charging and refuelling stations and the extension of public transport. At the same time, the adoption of projects to build up the full hydrogen value chain is urged, including renewable hydrogen production, infrastructures (e.g., pipelines), and deployment in industry and mobility. While it is true that the EU's hydrogen industries are competitive, they nevertheless require substantial support in order to maintain their technological leadership at this early market phase, and develop to create climate neutral solutions and jobs. Similarly, the electric battery supply chain requires restructuring, starting from the first steps, where the EU risks being exposed to the dependence on raw material supplier states. Consider, for example, the extraction of primary REE ores and recovery from mining waste, rare earth refining, magnet development, as well as the development of battery-grade lithium refining capacity and of metals and critical raw material capacities.

[2] Austria, Belgium, Croatia, Finland, France, Germany, Greece, Italy, Poland, Slovakia, Spain and Sweden

Conclusions

From the end of the economic crisis until the beginning of 2020, the European transport sector experienced a marked growth. The demand for goods and passenger flows increased significantly. This trend was then abruptly interrupted by the **Covid-19 pandemic**; however, this crisis can become an opportunity to revolutionise the sector, making it more fit to face future challenges. Once the pandemic is over, the European transport sector cannot return to the same point interrupted at the beginning of 2020. Mobility in Europe must use this moment to accelerate the sustainable transition, keeping in mind that changes in the transport sector are usually picked up more slowly than in other sectors. We must make a move now to meet the European **emissions reduction targets for 2030 and 2050**.

In order to improve the sustainability, security, efficiency, reliability and comfort of transport, a wide set of measures is required. The decarbonisation of transport and the achievement of environmental objectives is a long process, not achievable in the short time, and calls for several **hundreds of billions in investments**. Here, the Sustainable and Smart Mobility Strategy provides an important policy direction, as well, the **Connecting Europe Facility** and Recovery and Resilience Facility are key EU funding tools.

Furthermore, for this mode of transport to spread effectively, a **single European transport area** without barriers and restrictions needs to be created. This is particularly true for the railways, which represent a large part of the flows, however, it is also valid for air transport, road transport, indeed, for all modes. Many European states maintain regulatory constraints that prevent access to foreign operators in the sector, hindering the development of rail passenger and goods transport in the Union. If the rail market in the EU does not work well, then it cannot be seen as a real alternative to other modes of circulation. On the contrary, efficiency can be increased and transport emissions reduced by breaking down the barriers that divide internal systems and markets within the EU. Freedom of movement of goods and people is also one of the fundamental freedoms of the common European project.

Digitisation and smart solutions can be an important resource for improving transport sustainability and safety. Transport safety is and must also be one of the main objectives of the European institutions in the future, setting the goal of bringing the number of fatalities close to zero. The European Union has played a leading role in innovation in the transport sector in recent decades, and in order to maintain this leadership, incentives for investments and research in new digital solutions related to mobility are highly important. Digitisation is a fundamental transformation driver for mobility systems as well as the spreading of **Cooperative Intelligent Transport Systems (C-ITS)**. Functions with high added value and tasks with a low rate of innovation coexist in the

transport and mobility chain. We need to fuel competition to drive innovation while maintaining a high level of ambition.

Another key issue is that of infrastructures both for connection and support for new types of mobility. For example, electric charging stations are fundamental for spreading the uptake of fully electric vehicles, as well as **facilities for hydrogen and alternative fuels**. In this area, we need to accelerate. The risk of not meeting the charging infrastructure targets for electric vehicles is high. **Modal switch infrastructures** and smart solutions are also very important to encourage the use of public transport and light mobility within urban areas. Furthermore, it would be appropriate to support the spread of measures (such as cold ironing and, in this case too, multimodality) aimed at making **port infrastructures** more sustainable and reducing emissions from ships in port, which have a significant environmental impact. At the same time, social objectives must be achieved and a significant demand for low-cost transport must be met.

Transport is also an industry of important proportions, with a substantial economic and productive impact. In the European Union, it reaches high levels of technology and manufacturing. The pandemic has tested the resilience of the system by disrupting **supply chains**. Therefore, as we have learnt from this great lesson, the functioning of supply chains even in the most difficult conditions need to be ensured. On the other hand, internalising supply chains would be a factor damaging to the competitiveness of European companies. Consequently, we must support initiatives aimed at shortening value chains, giving rise to European production chains. In this context, the automotive sector is a privileged sector in which to strengthen European strategic autonomy, starting with the development of integrated supply chains for electric batteries and the nascent hydrogen industry, as well as **Cooperative, Connected and Automated Mobility (CCAM)**.