Technology Watch Newsletter

E-mobility and Energy Transition – The sustainable mobility revolution

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Technology Watch is the Elettricità Futura initiative to monitor global technology trends having the power sector at their heart. In our quarterly newsletter you will find an article with our analysis on a specific technology trend, an article by CESI, our partner for the initiative, and technology news from all over the world selected by Elettricità Futura.
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Decarbonising the transport sector: a paramount challenge for the next decade

Author: Elettricità Futura

On July 14th the European Commission published the "Fit for 55" package which contains 5 new Regulations or Directives and 8 revision proposals for already existing legislation aimed to enable the EU and its Member States to reach the main goal of the EU Green Deal: the reduction of greenhouse gas emissions by -55% for 2030 (compared to 1990 levels), a first milestone towards carbon neutrality in 2050. Many of the targets set by the Fit for 55 focus on the transport sector and for a good reason: the decarbonization of transport is one of the toughest and most important challenges the EU and its Member Stats will have to overcome to achieve the -55% emissions goal.

Decarbonizing the transport sector is paramount because while the energy, industry or agriculture sectors have been able to reduce their emissions in the last years, transport is still struggling. According to the EU Commission's data, the greenhouse gas emissions from the transport sector have risen in 2018 and 2019 by respectively 1% and 0,9%. In 2019 – when they reached 1.106,2 MtCO2e – the GHG emissions from transport were responsible for more than one quarter of the total GHG emissions of the EU. The main culprit is road transport, which is responsible for around

71% of the emissions of the transport sector, followed by maritime (14,1%) and air transport (13,4%)[1].

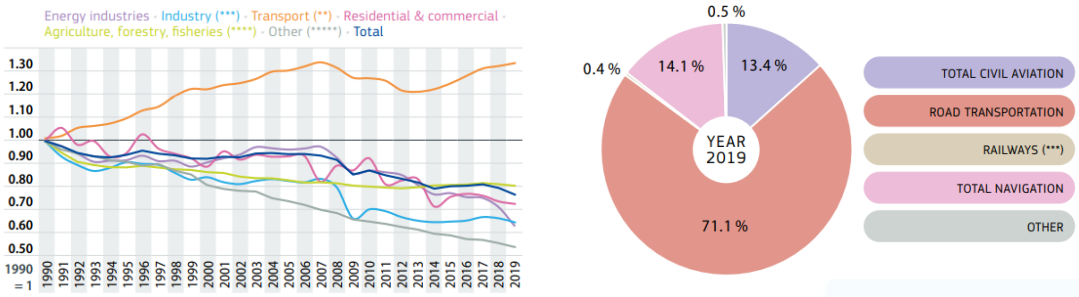

Fig.1 - EU transport in figures (Source: EU Statistical pocketbook 2020 – Mobility and transport)

Transport emissions in Italy mirror those in the EU. In its 2021 National Inventory Report, ISPRA shows that in the last few years GHG emissions for the transport sector started to rise again after a steady decline from 2005: starting from 2017, GHG emissions climbed back from 99,74 MtCO2e to reach 105,5 MtCO2e [2]. That amount accounts for 25% of the total 418 MtCO2e GHG emissions in Italy in 2019 from all sectors combined. If other sectors are set on the right path and – not without difficulty – are reducing their emissions, the transport sector needs to change course.

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019
CO_2 Mt CO_2eq	100.30	111.53	121.42	126.60	114.17	105.04	103.63	99.74	103.13	104.28
CH_4 Mt CO_2eq	0.90	1.02	0.77	0.51	0.31	0.21	0.22	0.20	0.20	0.21
N_2O Mt CO_2eq	0.99	1.75	1.60	1.14	1.08	0.99	1.00	0.98	1.01	1.03
Total, Mt CO_2 eq.	**102.21**	**114.29**	**123.82**	**128.26**	**115.56**	**106.26**	**104.84**	**100.92**	**104.34**	**105.51**

Fig.2 – Trend of GHG emissions in the transport sector in Italy ($MtCO_2e$)(Source: ISPRA)

The causes that lead to producing such an increase of the transport sector GHG emissions are many, first among them the steady increase in the number of circulating vehicles, in particular Heavy-Duty Vehicles (HDVs). Moreover, GDP growth, growing demand of public or private mobility solutions within and to-and-from cities and, finally, a strong expansion of the logistics sector spearheaded by the growth of e-commerce and the need of rapid delivery times had s significant effect. In Italy, the main contributing factors to the rise of GHG emissions in transports are the growing number of circulating vehicles and the significant increase in journey times (vehicle/km ratio increased by 22% from 1990 to 2019) and, consequently, fuel usage.

Decarbonizing the transport sector by reversing the actual trend and reducing its emissions is a tough challenge but it must be overcome to achieve a successful energy transition and to reach the Green Deal targets in the next decade. The EU and its Member States must increase the use of RES generated electricity and low or zero-emissions fuel in transports and employ new sustainable technologies for public and private mobility.

In this context, the electrification of transportation represents the best and most effective solution to reduce the dependency from fossil fuels and consequently reduce GHG emissions in the transport sector. As of now, electric vehicles offer the highest energy transfer efficiency in comparison to other types of vehicles and can also help in balancing the electric grid thanks to Vehicle Grid Integration technology (V1G and V2G). The electric vehicle market is already growing rapidly, particularly for cars, Light Duty Vehicles (LDVs) and buses, driven by continuous improvements in the vehicles performances and a steady reduction of battery costs. In addition to increasing the number of circulating EVs it will be crucial to build an adequate recharge infrastructure on the main road arteries and local roads.

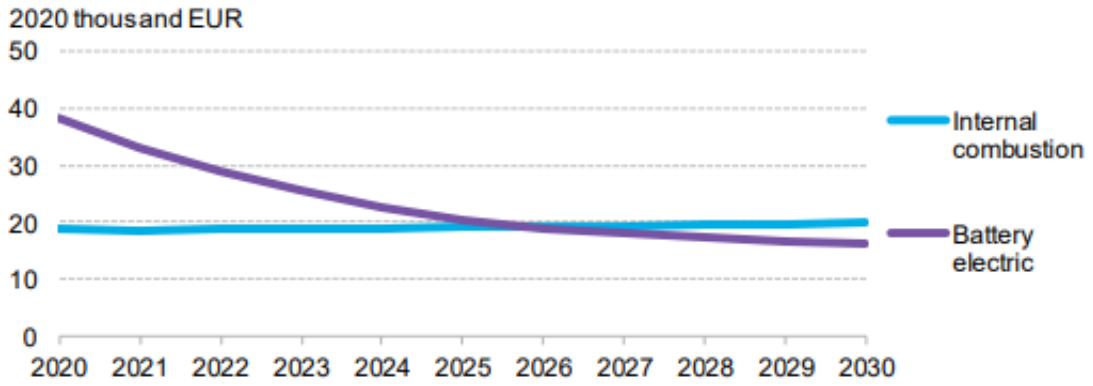

Fig.3 – EV price evolution estimates towards price parity with ICE vehicles (Source: Transport & Environment)[3]

The specific objectives set by the EU Green Deal for the next 30 years are very ambitious: -90% GHG emission reduction by 2050, about 1 million public recharging and refuelling stations for the 13 million zero- and low-emission vehicles excepted across all EU in 2025, promotion of multimodal mobility and improvements in the overall efficiency of the whole transport sector. That said, what the EU and its Members States already have at their disposal or plan to implement in next few years to achieve those objectives?

The EU already has in place several normative and regulatory tools that direct its actions in current years and the Fit for 55 package is set to enhance them [4]. As of now, the Smart and Sustainable Mobility Strategy and the Clean Vehicle Directive are shaping the path for Members States to follow and set specific objectives to achieve the EU Green Deal goals. The national emission reduction objectives are set by the Effort Sharing Regulation (ESR), but they will be strengthened to be in line with the 2030 -55% target with the revision of the ESR. If the proposal of the Commission will come to fruition, the new emissions reduction target in transport for Italy would be set at -43% by 2030, -10% more than the actual target (-33%). Another major Commission initiative is to create a separate Emission Trading System (ETS) for road transport and buildings, which will be in line with the -43% emission reduction target set by the ESR. Moreover, the Renewable Energy Directive revision aims to increase the ambition level of renewables in transport by setting a 13% greenhouse gas intensity reduction target. A new Regulation will set EU fleet-wide CO_2 emission reduction targets for new passenger cars – -55% from January 1st 2030 and -100% from January 1st 2035 – and vans – -50% from January 1st 2030 and -100% from January 1st 2035 – as compared to the 2021 target. Finally, the Alternative Fuels Infrastructure Regulation will strengthen the European recharge infrastructure by ensuring minimum coverage of publicly accessible recharging points dedicated to LDVs and HDVs along the TEN-T Core and Comprehensive Networks.

For Italy, the path to be followed to reform the transport sector is mainly laid out in the Piano Nazionale Integrato Energia e Clima 2020 (PNIEC) that aims to cut transport emissions by 37%, a 22% use of RES in transport and 6 million electric vehicles – 4 million BEVs and 2 million PHEVs – all by 2030. The PNIEC also foresees a 2% coverage of the RES target from renewable electricity used in the rail transport sector and a 1% coverage from the use of hydrogen in hard-to-abate sectors. The PNIEC is currently under revision to be aligned to the Green Deal targets, therefore all the above-mentioned targets – both for RES usage in the transport sector and the number of expected circulating EVs by 2030 – are subject to change and will be strengthened. In addition to the PNIEC, the Piano Nazionale Infrastrutturale per la Ricarica dei veicoli alimentati ad Energia elettrica (PNIRE) and the Piano Strategico Nazionale della Mobilità Sostenibile (PNSMS). The first, currently under revision too, sets specific targets for the deployment of the recharge infrastructure on the Italian road network, while the second regulates how to use the funds allocated to the renewal of the regional and public bus fleets.

A strong support to the efforts to decarbonize the transport sector will come from the Italian National Recovery and Resilience Plan (PNRR) which plans to allocate 25,36 billion € to the

"Green Revolution and ecological transition" that also covers the initiatives on sustainable mobility and energetic transition. These include testing the use of hydrogen for road and rail transport, deployment of 31.500 public recharge points and the purchase of zero- or low-emission buses and trains.

References:

[1] European Commission, *EU Statistical pocketbook – Mobility and transport*, September 2021

[2] ISPRA, *Italian Greenhouse Inventory – National Inventory Report 2021*, April 2021

[3] Transport & Environment, *Hitting the EV inflection point*, May 2021

[4] European Commission, *Delivering the European Green Deal*, 2021

Note: weblinks last accessed in October 2021

Better connected and more sustainable: The future of transportation

Author: CESI

The transport industry is one of the backbones of modern economies, as well as one of the fields in which the environmental impact of fossil fuels is most noticeable. Data from the World Energy Agency, for the pre-pandemic period, report that in 2019, road passenger transport alone contributed 3.6 billion tons to global CO_2 emissions, whereas the transport of goods and material added an extra 2.4 billion tons.

The International Energy Agency (IEA), in its *Global Energy Review, CO2 Emissions in 2020*, underlines how "the decline in CO_2 emissions from oil use in the transport sector accounted for well over 50% of the total global drop in CO_2 emissions in 2020, with restrictions on movement at local and international levels leading to a near 1,100 Mt drop in emissions from the sector, down almost 14% from 2019 levels." Although COVID-19 caused car market sales to decrease over last year, therefore cutting down emissions even further, the risk of transport emissions rebounding in 2021 and in the coming years is right around the corner.

In this respect, the International Monetary Fund (IMF) projects the global economy will grow by 6% in 2021, more than compensating for the 3.5% drop in 2020. A positive estimate, but one that also requires the world to switch its production models in order to achieve the 2050 global decarbonization goals.

Decarbonizing the transport industry holds a highly strategic value to achieve an effective and functional energy transition in our complex economic systems. For example, EV adoption will be crucial for President Biden's goal of cutting USA emissions in half by 2030. In this respect, BCG data shows that EV sales are projected to rise from 12% of the global market in 2020 to 47% in 2025, in the United States. However, as the report claims, "if half of new cars sold around the world in 2035 are zero-emission vehicles, 70% of the vehicles on roads will still be burning gasoline or diesel."

In Europe, the transport sector currently accounts for well over 25% of CO_2 emissions in Europe. Unlike the energy, industrial, agricultural, and residential-commercial sectors in the EU and in Italy, where a progressive reduction in greenhouse gases into the atmosphere is becoming a reality, the opposite is happening in the transport sector. According to data from the European Environmental Agency, greenhouse gas emissions from the transport sector increased by 0.9% in the EU in 2018 and 2019. On the other hand, 2020 marked a sharp decline, but it was a temporary effect linked to the pandemic.

Increasing the environmental sustainability of the transport sector is, therefore, crucial to accomplishing the energy transition. Technological development plays an important role in this regard, thanks to innovations, such as Vehicle-to-grid (V2G) and digitalization, EVs and charging infrastructure will become fundamental elements for an ever greater decarbonization and for the intelligent and flexible management of electricity demand.

In order to understand why it is so important for the transport sector to switch to electricity, it could be useful to mention the recent study *Life Cycle Analysis of the Climate Impact of Electric Vehicles*, realized by Transport & Environment (T&E). According to this study, the CO2 emissions produced by an electric car during its life cycle (calculating a distance of 200,000 km, an energy mix equal to the European average and a 30 kWh battery) are less than half compared to a diesel car of identical size, even if we take into account the considerable amounts of toxic emissions caused by the production of batteries, based on a life distance traveled of 150,000 km.

Only in the, very unlikely, scenario in which electricity was produced entirely from coal, could an electric car emit more greenhouse gases than diesel or petrol vehicles. For example, even in the case of Poland, where 70% of the energy comes from coal and lignite, electric cars are less polluting. In Italy, where 37% of electricity comes from renewable sources (and 40% from gas) the advantage is clear. Electric mobility stands out mostly in Sweden and France thanks to an energy mix that uses little carbon-fossil fuel in favor of renewable energy and nuclear energy, respectively.

Currently, about 70% of the environmental impact of an EV comes from the way electricity is produced, whilst the remaining 30% from the production of batteries and vehicle components. However, as evidenced by previous paragraphs, this ratio is bound to vary with an increasing production of electricity from renewable sources. The impact of battery production, which will play an increasingly important role, could be reduced by using renewable sources also to supply the electricity needed for the production process. The recycling of car batteries would also mitigate the impact, as it would reduce the use of raw materials needed to produce new batteries. The extraction process linked to the materials for the creation of batteries, in fact, is particularly polluting and wasteful. In this respect, the use of a material recycling process, combined with the use of renewable energy during production, could lead to a 35% reduction in the original impact.

Yet, there is another crucial aspect related to the role that EV can play in terms of energy transition: the integration of electric vehicle service equipment into the network, which would allow a two-side advantage for both the power grid and efficiency of the vehicle. In order to guarantee such service, KEMA Labs (the Testing, Inspection, and Certification Division of CESI Group) is participating in a research project coordinated by a Dutch Consortium that aims, by October 2022, to scientifically evaluate EVSE supraharmonic emission levels. Indeed, creating models on the presence of supraharmonics will allow KEMA Labs to monitor the operation and reliability of any network, as well as to formulate proposals for the improvement of regulations and standards.

Furthermore, the collected data will be fed directly into an analytical model developed by TU Eindhoven that aims to quantify the impact of these effects on the quality of energy during the simultaneous charging of a given number of vehicles on the public electric grid. During the next measurement campaign, which will be completed before the end of this year, further tests will be conducted on the interaction amongst battery chargers to examine system stability and any

undesired interaction by control devices (and if possible, even the immunity of battery chargers to high frequency distortions).

In addition, through its KEMA Labs Division, CESI can conduct specific tests to evaluate the operation of components in extreme conditions and provide a wide range of inspection and certification services thanks to its offices and representatives around the world. KEMA Labs verify the reliability of EVs, charging systems, and their interaction with the grid, guaranteeing high quality standards for the many products and services being developed by the market.

In this respect, to integrate public lighting with charging infrastructure, Enel X has developed JuiceLamp, a smart LED lighting system that not only guarantees high efficiency and remote management, but also charges two vehicles simultaneously (up to 22kW each) either via digital app or through credit card payment. The JuiceLamp system also provides video surveillance, air quality monitoring, and fiber or Wi-Fi urban connectivity services. CESI supported Enel X on the JuicePole project, in order to address its technological complexity. The tests conducted in KEMA Labs (the Testing, Inspection, and Certification Division of CESI) facilities measured the performance levels of the JuicePole 2.0 to identify any critical issues caused by high operation temperatures. Testing addressed the natural cooling design and the ergonomics of the stations, two fundamental factors that preceded the campaign for the installation of the new JuicePoles by Enel X.

Technology News Worldwide

HIGHLIGHT:

Electric vehicles: the revolution is finally here

After years of talk from carmakers, the industry is rapidly being transformed as companies stake their future on EVs.

LINK

- **#E-Mobility:** Swiss technology company ABB has announced the launch of the 'world's fastest electric car charger' – a 360kW charge point that can provide a 100km boost in just three minutes.
  Link

- **# Batterie EV:** Electrification is inevitable, but we're going to need better batteries and much more of them – fast. In fact, electric vehicles (EVs) are projected to make up 90% of battery demand over the next two decades. Reaching a limit with chemistry-based solutions, automakers are now eyeing battery physics and architecture as the next big battery breakthrough.
  Link

- **# Batterie EV:** The EU executive's proposal, put forward in December last year, is the world's first sustainable battery law to ensure materials for batteries are sourced ethically and sustainably will push up global standards. It aims to tackle issues in the battery supply chain, including human rights abuses, and will apply to all companies in the industry operating on European soil.
  Link

- **#Solar:** Researchers have identified a key mechanism responsible for the lower efficiencies of organic solar cells and shown a way that this hurdle might be overcome.
  Link

- **#Wind:** The world's first gigawatt-capacity floating offshore wind farm remains a little way off, but advances across the industry are bringing it ever closer and when commercial floating wind arrives, the UK's offshore renewable energy development agency (ORE Catapult) expects the weighted average cost of capital to still be 30% higher than for fixed-bottom offshore farms.
  Link

Note: weblinks last accessed in October 2021

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