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**REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND
THE COUNCIL**

**on the application of Directive 2014/94/EU on the deployment of alternative fuels
infrastructure**

{SWD(2021) 49 final}

1 Introduction

The European Union is committed to achieving the highest levels of climate and environmental protection. As a result, ramping up the production, deployment and use of sustainable alternative fuels is a key priority of European transport, energy and climate policies. Building-up a dense, widespread, reliable and easy-to-use alternative fuels infrastructure network across all modes is a key element to reach the climate neutrality target by 2050 and to contribute to the zero-pollution ambition as set out in the European Green Deal.¹ This network will be an important enabler for the market uptake of zero- and low-emissions vehicles, vessels and aircraft.² For road transport, the European Green Deal sets the objective of having at least 1 million publicly accessible recharging and refuelling stations in place by 2025 that establishes a springboard for the necessary much larger roll-out of such infrastructure until 2030, as projected in the Sustainable and Smart Mobility Strategy.³ The strategy sets important and ambitious milestones for the ramp up of production, deployment and use of sustainable alternative fuels in all modes of transport by 2030 and 2050, including, where necessary, for the roll-out of needed infrastructure.

This report presents the results of the assessment of action taken by Member States in the implementation of Directive (EU) 2014/94 on the deployment of alternative fuels infrastructure (AFID) and the development of markets for alternative fuels and alternative fuels infrastructure in the Union. It follows the provisions of Article 10(3) of that Directive, which requires the Commission to submit a report on the application of the Directive every three years with effect from 18 November 2020.

The reporting draws on an extensive information base. The Commission has made an in-depth assessment of the national implementation reports as received from the Member States under this Directive⁴, building on interactions with Member States in the design of that assessment. The Commission has also carried out an external support study in the context of the ongoing evaluation of that Directive.⁵ Moreover, the Commission has updated its report on the state of art on alternative fuels transport systems in the EU⁶. These assessments are published alongside this report.

These assessments show that full implementation of planned targets and measures by Member States would lead to an infrastructure roll-out by 2030 that – looking at the aggregated numbers - could potentially support a fleet of alternative fuels vehicles that is in line with projections under a pathway meeting a 40%⁷ overall greenhouse gas emission reduction in the EU. However, the current deployment is not leading to a comprehensive and complete network coverage of easy-to-use infrastructure throughout the Union as large differences between Member States' plans continue to persist, and modes other than road are either excluded or underrepresented. Moreover, the 2030 Climate Target Plan⁸ raises the

¹ COM(2019) 640 final

² In the remainder of this communication, where no otherwise specified, the term vehicles refers, as relevant in the give context, to all types of vehicles, including, inter alia, cars, lorries, buses, coaches, trains, aircrafts, ships, ferries, etc.

³ COM(2020) 789 final

⁴ SWD NIRs

⁵ Evaluation support study

⁶ <https://op.europa.eu/en/publication-detail/-/publication/fd62065c-7a0b-11ea-b75f-01aa75ed71a1>

⁷ Defined under the 2030 Climate and Energy Framework

⁸ COM(2020) 562

ambition by increasing the 2030 EU greenhouse gas emissions reductions target to 55%, hence requiring a considerably higher increase in the number of zero- and low-emissions vehicles and the appropriate roll-out of infrastructure.

This report points to the benefits of stepping up action in the further implementation of the national policy frameworks of Member States and the further development of the policy framework at European level. This finding corresponds to earlier conclusions raised by the Commission in the Communication “Action Plan: towards the broadest use of alternative fuels infrastructure in the EU”⁹ and conclusions raised by the European Parliament in its report on deployment of alternative fuels infrastructure¹⁰. The publication of the in-depth assessments of the individual national implementation reports provides a basis for further discussion on how Member States can support the quick build-up of a sufficient alternative fuels infrastructure. In this context, the synergies between the national recovery and resilience plans under the Next Generation EU recovery instrument and the opportunities linked to an investment agenda for sustainable mobility are apparent.

2. State of play: Technological progress and the development of the markets

Since the adoption of the Directive in 2014, the markets for the various alternative fuels have developed differently with respect to vehicle uptake and infrastructure deployment within and between modes.

Table 1: Number of alternatively fuelled passenger cars registered 2014 - 2020 in the EU

	2014	2015	2016	2017	2018	2019	2020	Increase 2014 - 2020
Battery Electric	75,067	119,222	164,681	244,231	376,534	616,644	904,262	1105%
Plug in Hybrid	56,758	126,032	191,561	254,249	349,181	474,724	755,282	1231%
Hydrogen	53	192	362	531	714	1,187	1,492	2715%
Compressed Natural Gas	999,044	1,058,992	1,089,701	1,113,714	1,161,118	1,193,806	1,207,069	21%
Liquefied Petroleum Gas	6,906,769	7,089,523	7,232,050	7,264,118	7,628,053	7,714,409	7,707,823	12%
Total Alternative Fuels Cars	8,037,691	8,393,961	8,678,355	8,876,843	9,515,600	10,000,770	10,575,928	32%
Alternative Fuels Cars in %	2.99%	3.12%	3.23%	3.30%	3.59%	3.72%	3.93%	

Source: European Alternative Fuels Observatory, January 2021 (www.eafo.eu)

Compared to the market situation at the time of the adoption of the Directive, the market of **electric vehicles** has strongly matured, particularly for light-duty electric vehicles and buses (both battery-electric and plug-in hybrid). Especially electric cars have seen a rapid increase in terms of total vehicle registrations and growth in available models in the period 2010-2020. In the 3rd quarter of 2020, shares increased to 9.9% of all car sales, compared to 3% in the year before¹¹. While the car stock shares are still low, further acceleration of vehicle uptake is expected, driven also by the need to comply with legal requirements under the CO₂

⁹ COM/2017/0652 final, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2017:0652:FIN>

¹⁰ (2018/2023(INI)) https://www.europarl.europa.eu/doceo/document/A-8-2018-0297_EN.html

¹¹ www.acea.be

emission performance standards for light-duty vehicles¹², the Clean Vehicles Directive¹³ and the pressure to comply with air quality legislation. Model availability for cars and vans, but also for buses, has strongly improved over the last years. Following technical developments and increases in battery capacity, ranges of electric vehicles are significantly above the average daily driven distance in the EU and enable long distance travel, which is contributing to increased user acceptance. For trucks, maturity of markets has developed at much slower pace since 2014. The stock of vehicles (including retrofitted ones) is still at a very low level. Trucks are now starting to enter the market for distribution trucking, and manufacturers have announced new models (including with longer ranges) to come into the market over the coming years. A further market uptake in this segment is expected until 2025, also in view of the need to comply with the legal requirements of the CO₂ emission performance standards for heavy-duty vehicles¹⁴. Electric buses, and here especially public transport buses in urban areas, have seen a significant uptake and the number of registered buses has more than doubled in 2019. Moreover, many cities have set very ambitious targets for electrifying their bus fleets, pointing at a likely acceleration of this trend.

Compared to the market situation at the time of the adoption of the Directive, the market of **hydrogen fuel cell vehicles** has developed with a significant growth rate albeit from a very low starting point. While fuel cell cars, vans and buses are technologically mature, their registration rates remain very low. Model availability of light-duty fuel cell vehicles has made incremental progress only: for example, in 2020, four fuel cell car models were on offer in the EU, but not in all Member States. European OEMs have not announced significant investment into hydrogen fuel cell cars and vans. The situation is slightly better for buses: different European manufacturers have started production and a number of cities and regions have started to deploy hydrogen fuel cell bus fleets. While the market did not record much momentum for trucks, the situation is currently changing. With the new CO₂ emissions standards in place, different OEMs are now starting to invest strongly into hydrogen fuel cell truck solutions, in view of their series production for long-distance road haul post 2025. With the European Clean Hydrogen Alliance¹⁵, the EU is setting up a strong impulse for better coordinating action of market actors through a full value-chain approach that should also elevate the development of the fuel cell trucks market, and furthermore the market for coaches.

Compared to the market situation at the time of the adoption of the Directive, the overall market development of **natural gas vehicles** differs per segment. The technology for natural gas vehicles and components is fully mature for both compressed natural gas (CNG) and liquefied natural gas (LNG) of both fossil and biological origin. The fleet of passenger cars in 2020 was approx. 1.2 million cars. Vehicle models are for sale in the EU market in all segments. However, the number of brands providing CNG vehicles has contracted in recent years.¹⁶ Natural gas trucks have shown a more steady growth, in particular in the LNG segment.

¹² 2019/631/EU <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R0631>

¹³ 2019/1161/EU <https://eur-lex.europa.eu/eli/dir/2019/1161/oj>

¹⁴ 2019/1242/EU <https://eur-lex.europa.eu/eli/reg/2019/1242/oj>

¹⁵ https://ec.europa.eu/growth/industry/policy/european-clean-hydrogen-alliance_en

¹⁶ The decreasing demand for new natural gas vehicles is confirmed in the volume of natural gas used in road transport: this has more than doubled between 2008 and 2015, but has remained broadly stable since then.

Already before the adoption of the Directive, a fleet of around 7 million **LPG** vehicles existed in the market. Since the adoption of the Directive, vehicle uptake increased slowly. Three quarters of those vehicles were registered in just two Member States; hence, a strong geographic concentration of those vehicles persists in the EU. Fleets of LPG buses exist in several cities. However, the number of new acquisitions or replacements of LPG buses are decreasing.

In addition, **renewable liquid fuels and synthetic fuels** – including e-fuels – can be produced to meet the current fuel standards for diesel and petrol; they can therefore be distributed through existing infrastructure and used in standard vehicles. Dedicated infrastructure for biofuels (e85) to be used in dual fuel vehicles exists only in a few Member States and registration of such vehicles remains stable at a very low level. A main question regards the potential for future production capacity of sustainable alternative biofuels. In view of feedstock availability, overall efficiency of the production process and overall costs – for both biofuels and synthetic fuels – use of biofuels needs to particularly serve transport modes that are more difficult to decarbonise (aviation, waterborne).

Concerning **waterborne transport**, data availability on the uptake of biofuels, alternatively fuelled **vessels and Onshore Power Supply (OPS)** for ships at berth is limited. The total number of commissioned LNG ships worldwide was about 300 in 2019. Only half of those ships were in operation. The other half remains on order. The amount of electric vessels (including hybrids) in operation worldwide is similarly low, but has been growing recently: in 2019, 160 ships were in service and a further 104 were under construction¹⁷. At the end of 2019, around 50 inland and maritime ports in the EU had at least one OPS connection point¹⁸.

Concerning the use of alternative fuels in **rail**, around 60 percent of the network serving 80 percent of all traffic volume is electrified¹⁹. First market orders of hydrogen fuel cell trains have started recently. Concerning the use of alternative fuels in **aviation**, biofuels and e-fuels can already today be blended with kerosene. However, the use of liquid biofuels is still marginal with 0.05% of air transport energy use. Aircraft manufacturers have also started to invest in the development of electric, hybrid and hydrogen aircraft.

3 Implementation of the Directive

Transposition

Member States had to transpose the Directive by 18 November 2016. There have been delays in the transposition in many Member States. The Commission opened 24 infringement cases for non-transposition in 2017 and 2018. The Commission closed most cases in the course of 2018 and closed the remaining cases in 2019 and 2020. At the end of 2020, there are no open infringement cases against Member States for non-transposition of the Directive.

Status of National Policy Frameworks

¹⁷ <https://safety4sea.com/352-confirmed-ships-are-using-battery-installations/>

¹⁸ <https://eafo.eu/shipping-transport/port-infrastructure/ops/data>

¹⁹ Electrification of the Transport System: <https://ec.europa.eu/programmes/horizon2020/en/news/electrification-transport-system-expert-group-report>

The Directive requires each Member State to adopt a national policy framework (NPF) for the development of the alternative fuels market in the transport sector and the deployment of its relevant infrastructure. In particular, the NPFs had to comprise national targets and objectives for the deployment of alternatives fuels infrastructure, taking into account national, regional and union-wide demand. In addition, Member States had to provide the necessary measures to reach national targets and the objectives set out in the NPFs. Member States had to notify their NPFs to the Commission by 18 November 2016.

In its 2017 assessment of the NPFs and in its 2019 update²⁰, the Commission concluded that the NPFs are not fully coherent from an EU-wide perspective in terms of the priorities they set. Member States' ambition with regard to the uptake of alternative fuels and their infrastructure varied significantly. It also concluded that not all NPFs set clear and sufficient targets and objectives, supported by comprehensive measures.

Action Plan on Alternative Fuels Infrastructure

To support the implementation of NPFs and in accordance with Article 10(6) of the Directive, the Commission adopted an EU Action Plan for Alternative Fuels Infrastructure on 8 November 2017²¹. It supports the establishment of an alternative fuels infrastructure backbone with full coverage of the TEN-T network by 2025, and ramp up of investment into infrastructure. The plan announced an additional support of EUR 800 million from the Connecting Europe Facility (CEF)²² and NER 300 programme²³ to spur investment. The Action Plan also noted the need to increase the level of policy ambition in Member States plans, particularly regarding infrastructure roll-out in urban and cross-border areas and action on improving use services.

Submission of National Implementation Reports

The Directive requires that Member States submit to the Commission by 18 November 2019 a national implementation report (NIR) on the execution of its national policy framework (NPF) in the period from submission of the NPF until at least 31 December 2018. These reports shall cover the information listed in Annex I of the Directive, including, where appropriate, relevant argumentation on the level of attainment of the national targets and objectives referred to in Article 3(1). By 1 May 2020, the Commission had received 25 NIRs. By 1 October 2020, the Commission had received the reports from all but one Member State. The findings of the Commission assessment are presented in this report and the Staff Working Document that accompanies this report.

Aspects of the Directive that required direct action by the Commission

Fuel labelling

²⁰ SWD(2019) 29 final: <https://ec.europa.eu/transport/sites/transport/files/legislation/swd20190029.pdf>

²¹ COM/2017/0652 final, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2017:0652:FIN>

²² <https://ec.europa.eu/inea/en/connecting-europe-facility/cef-transport>

²³ https://ec.europa.eu/clima/policies/innovation-fund/ner300_en

The Directive requires that Member States shall ensure that relevant, consistent and clear information is provided to consumers on the compatibility of their vehicles with the fuels placed on the market. The supply of information shall be based on the labelling provisions regarding fuel compliance under standards of the European Standardisation Organisations setting the technical specifications of fuels. In that respect the European Commission requested the European Committee for Standardisation (CEN) and the European Committee for Electrotechnical Standardisation (Cenelec) to adopt the corresponding standards to this end. Subsequently, CEN and Cenelec adopted the standard EN 16942 ‘Fuels - Identification of vehicle compatibility - Graphical expression for consumer information’ which came into force on 12 October 2018 and the standard EN 17186 ‘Identification of vehicles and infrastructures compatibility - Graphical expression for consumer information on EV power supply’ that will come into force on 20 March 2021. Consistent data on the application of those standards in the markets of Member States is limited. The Commission is verifying the situation with Member States. Information up to date suggests that fuel labels are quite commonly applied at fuel stations in Member States.

Fuel price comparison

The Directive establishes that, when fuel prices are displayed at a fuel station, a comparison between the relevant unit prices should be displayed for information purposes, in particular for natural gas and hydrogen. The Commission Implementing Regulation (EU) 2018/732 of 17 May 2018 enacts a common methodology for alternative fuels unit price comparison. In response to the COVID-19 crisis, Member States agreed to the Commission proposal to delay the date of application of the Regulation until 7 December 2020.²⁴ Under the methodology adopted, fuel prices are expressed as amounts of applicable currency per 100 km. The display of the comparison of the fuel prices at the fuel stations should be based on transparent samples of passenger cars that are comparable, at least in view of their weight and their power. A Programme Support Action (PSA) under the CEF issued recommendations for a harmonised implementation of the provision by Member States, including when making use of digital tools.

Data accessibility

The Directive sets out that data indicating the geographic location of the refuelling and recharging points accessible to the public are available on an open and non-discriminatory basis to all users. To assist Member States, a PSA under the CEF was established with 15 participating Member States. It focuses on a format for e-mobility identification codes for charging point operators (CPOs) and e-mobility service providers (EMSPs), laying down the foundations for a structure cross-referencing exchange of information among Member States. It provides suggestions on how Member States can develop and implement their national IT infrastructure from which the data will be gathered and made available through the National Access Points (NAPs) under Directive (EU) 2010/40 on Intelligent Transport Systems.

Standardisation of alternative fuels infrastructure

The Directive was supplemented and amended by Commission Delegated Regulation (EU) 2019/1745. The Regulation sets out the technical specifications applying to recharging points

²⁴ Commission Implementing Regulation (EU) 2020/858 of 18 June 2020

for L-category motor vehicles, shore-side electricity supply for inland waterway vessels, hydrogen supply for road transport and natural gas supply for road and waterborne transport. It amends Annex II of the Directive by specifying standards that were recommended by CEN and Cenelec in response to a standardisation request by the Commission.

Action to respond to Annex II requirements regarding technical specifications for wireless recharging points for motor vehicles, battery swapping for motor vehicles and recharging points for electric buses is still outstanding. However, technical specifications for wireless recharging points and recharging points for electric buses will be subject to planned Delegated Regulations in 2021.

4 Analysis of Actions taken by Member States

The Directive requires Member States to set targets for alternative fuels infrastructure and develop corresponding measures for reaching those targets under their national policy frameworks. While the Directive clearly specifies the overall needs for road infrastructure and ports, it does not provide a common methodology to inform target setting and measure development.

The assessment shows that there has been progress in the quantity and quality of data provided in most NIRs compared to the NPFs. However, many reports do not fully and satisfactorily address the reporting requirements of the Directive. There is still significant divergence among Member States concerning target setting and measure description. This divergence aggravates a coherent assessment of Member States' ambition towards the development of a network of alternative fuels infrastructure in the EU.²⁵

Member State estimates on vehicle uptake and targets for infrastructure deployment

An aggregation of Member State vehicle estimates and infrastructure targets under the NIRs at the EU level shows that these are slightly more ambitious compared to those under the NPFs in 2016. Significant differences between Member States continue to exist.

Member States estimate a rapid uptake of **electric vehicles**, albeit with very strong regional differences. Member State projections suggest that there could be around 2.5 million electric vehicles in 2020, more than 7 million in 2025 and more than 30 million in 2030²⁶. While at the end of 2020 around 1.8 million electric vehicles were registered, many Member States have revised the ambition on targets and corresponding measures. They are likely to support an accelerated vehicle uptake and infrastructure deployment in those Member States post 2020. For 2030, the estimates would represent an overall share of electric cars of around 15% of the total current car stock. However, at single Member State level, planning and ambition for 2030 ranges from less than 1% to more than 40% of electric cars in the total car stock.

²⁵ Most Member States have provided estimates for the uptake of electric vehicles and provided targets for the deployment of electric rechargers for the year 2020. However, only around two thirds provided data on targets for 2025 or 2030. Target setting for other alternative fuels infrastructure is more limited. Around half of the Member States provide targets for CNG and for LNG. Only around one third of Member States have set targets for LNG bunkering and Onshore Power Supply (OPS) for both maritime and inland waterways. Finally, around half of the Member States opted for setting targets for road hydrogen infrastructure.

²⁶ These figures are based on data from 25 Member States.

At the end of 2020 around 213,000 publicly accessible rechargers were deployed in the EU²⁷, of which approx. 10% were fast chargers (>22 kW and up to 350 kW). This is higher than the aggregated target of Member States of more than 180,000 recharging points by 2020. Most Member States with reported targets plan a recharging point to vehicle ratio of around 1 to 12 for 2030. Using this ratio also for Member States that have not reported a target would suggest that Member States currently target a total number of recharging points of 2.7 million in 2030. However, the distribution of those recharging points is expected to be very uneven across Europe with gaps in the network expected especially in Southern and Eastern Europe where large parts of the TEN-T core network do not have recharging points installed every 60 km²⁸.

With respect to electric vehicles and their infrastructure, 2019 and 2020 saw a much stronger increase in electric vehicle registrations than in publicly accessible recharging infrastructure deployment. This trend continued in 2020. In fact, in 2019 electric vehicle registrations increased by 50% and in 2020 by 52% in comparison to the previous year, while the increase in recharging infrastructure was only 38% and 30% respectively²⁹. While the deployment of faster recharging technology can help to address part of the increased vehicle uptake, continuation of this trend would still imply a serious risk that infrastructure deployment will not go hand in hand with electric vehicle uptake in the years to come. This could lead to important shortcomings that can undermine the overall uptake of those vehicles.

The 16 Member States that provide estimates on **CNG vehicles** suggest a doubling of vehicles by 2025 and a further increase by 2030 in those Member States. However, even with that increase and taking into account the existing vehicle stock of Member States that did not report growth estimates, CNG vehicles are expected to represent only a share of around 1% of the total vehicle stock in the EU by 2030. The existing infrastructure of approx. 3,600 refuelling points in 2020 seems largely sufficient to cover the future demand. The same is true for current **LPG infrastructure** as Member States do not estimate a relevant increase of the current fleet by 2030.

Estimates by the 11 Member States that reported on LNG suggest that **the LNG heavy-duty vehicle fleet** could increase significantly by 2030. However, even with that increase, those vehicles will still represent only approximately 1% of EU's truck fleet. In 2020, there were around 310 LNG refuelling points in the EU that served the main TEN-T transport corridors. While some gaps persist, the existing refuelling points already largely provides a sufficient network connectivity.

Hydrogen fuel cell mobility is still a niche market. Some Member States report great ambition with respect to uptake of **hydrogen fuel cell vehicles**. Those ambitions could lead to around 300,000 vehicles in the EU by 2030. However, around half of the Member States have not provided any estimates and many Member States do not seem to have a hydrogen strategy in place yet. In 2020, 125 hydrogen stations were in operation while Member States' targets point to around 600 stations by 2030. Since around half of the Member States do not

²⁷ www.eafo.eu

²⁸ SWD(2017) 365 final

²⁹ Eafo.eu, January 2021

plan any infrastructure, current implementation of the Directive would result in limited connectivity for hydrogen vehicles in the EU.

Data provided by Member States on **maritime and inland waterway** vessels estimates and infrastructure deployment was very scarce. It does not allow drawing a coherent assessment of the current and planned development of LNG bunkering and Onshore Power Supply across the EU. Directive 2014/94/EU does not contain specific provisions covering rail and aviation.

Policy and legal measures on national level

Member States have reported a variety of measures to support the uptake of alternatively fuelled vehicles and achieve their infrastructure targets. All Member States have implemented one or more legal and policy measures to promote electric vehicles. Around three quarters of Member States also established measures to promote electric vehicles and related infrastructure in public transport. More than half of the Member States also reported legal and policy measures to support the uptake of vehicles and infrastructure deployment in the areas of natural gas and hydrogen. However, only a few Member States reported on specific measures in relation to waterborne transport.

According to the limited information from 22 NIRs, Member States allocated a total of around €6.7 billion during the period 2016-2019. Budget allocations among Member States varied greatly from only €3 million to close to €2.7 billion. Member States directed the largest share to the implementation of various policy support measures (for example support of vehicle purchase and infrastructure deployment), followed by support for research, technological development and demonstration, and manufacturing support. The largest share of Member States' budgetary support went to electric vehicles and recharging infrastructure, followed by hydrogen for road transport and support for natural gas for road transport. The amount allocated to waterborne transport was much more limited and below 5% of the total financing.

On average, the measures reported by Member States seem to be suited to accelerate vehicle uptake and infrastructure deployment in line with the overall vehicle and infrastructure estimates and targets set by Member States. This is particularly true for electric vehicles and their infrastructure.

5 Assessment of the effects of the Directive

Article 10 (3) of the Directive requires reporting on its effect on the uptake of alternative fuels vehicles and the deployment of the related infrastructure. This chapter summarises findings of the work carried out under the ongoing evaluation of the Directive. Findings reported here do not pre-empt any conclusion of the evaluation of the Directive, which is planned for publication by summer 2021 and will present in more detail the results of the evaluation in terms deployment and infrastructure quality, including with regards to user information.

Uptake of alternatively fuelled vehicles and deployment of infrastructure

The analysis has shown that the directive had a considerable impact in combination with other legislative initiatives such as the Regulations on CO₂ emission performance standards for light-duty and heavy-duty vehicles and the Energy Performance of Buildings Directive³⁰ on both, the uptake of alternatively fuelled vehicles and their infrastructure. The share of alternatively fuelled vehicles in total vehicle sales in 2020 is slightly higher with the Directive in place than in a hypothetical situation without the Directive. This positive impact of the Directive increases significantly towards 2030 when the sales of zero- and low-emission vehicles will further increase.

The Directive also directly impacted the number of electric recharging points which is projected to be around twice as high in 2030 compared to a situation without the Directive. A similar impact is expected for hydrogen and LNG refuelling points. For CNG infrastructure, a lower impact of the Directive is expected, as a network of infrastructure was already available before the Directive was adopted.

The impact of the Directive on the uptake of alternative fuels and onshore power supply for shipping and inland waterways is difficult to assess. From available data it can be concluded that investments in alternative fuels infrastructure for LNG bunkering and onshore power supply (OPS) in ports have been limited in most Member States. However, especially in those areas the Directive is likely to have an important impact closer to the target dates for their deployment in 2025 or 2030.

Effects of the Directive in terms of infrastructure quality³¹

The Directive also had a considerable impact on the interoperability of alternative fuels infrastructure. However, a number of shortcomings still prevail, that make it cumbersome for users to travel in a seamless manner across borders, specifically with electric vehicles.

In order to ensure **interoperability**, the Directive and subsequent Commission Delegated Regulation (EU) 2019/1745 set technical specifications for the physical connection between the recharging/refuelling point and the vehicle. The ability to adopt delegated acts under the Directive has helped to transpose technical specifications into European law in a targeted manner, building on the expertise of European Standardisation Organisations. However, the Directive is not well suited to address the need for further technical standards regarding communication interfaces, for recharging heavy-duty vehicles and vessels, as well as for methanol and ammonia bunkering, refuelling liquid hydrogen and ensuring full interoperability in the hydrogen refuelling ecosystem.

The Directive aims at establishing an **easy-to-use infrastructure**. This objective has only been partially achieved. Weaknesses in the user experience, specifically in the area of cross border electro-mobility, can be summarised as follows.

Easy access to information on the location and availability of all recharging and refuelling points is essential. However, this is currently not always the case. Such data are not

³⁰ Directive 2010/31/EU,

³¹ Information based on Evaluation Support Study and the Report by the Sustainable Transport Forum on the analysis of stakeholder views on key policy needs and options for action in Alternative Fuels Infrastructure deployment and consumer services, <https://ec.europa.eu/transport/sites/transport/files/2019-stf-consultation-analysis.pdf>

systematically available in many Member States. Data quality varies, which is not always supportive to the development of comprehensive new user services.

While the Directive requires **transparent prices**, many users still have limited information on the final price of a recharging session. Prices are often not clearly displayed at a recharging point and are often also not accessible through apps. In addition, many different price components exist which makes it difficult to compare end user prices.

The Directive sets provisions on **ad hoc payment** to ensure that no user gets stranded due to difficulties of payment. However, different digital solutions have emerged in the markets. A simple unified ad hoc payment method (such as credit/debit bank card payment) across Europe is not available. Contract based recharging does not work uniformly across the Union, as not all electro-mobility service providers or roaming platforms offer their services at each recharging point. There is an increasing number of consumer complaints about lack of price transparency and user-friendliness of the recharging infrastructure, particularly for payments, which is considered to be a barrier specifically to smooth longer-distance trips.

With respect to the **integration of electric vehicles into the electricity system**, the current provisions of the Directive ensure alignment of the rules between the electro-mobility and the electricity markets. However, future mass vehicle uptake will require smart and bidirectional charging to ensure an efficient integration of electric vehicles into the electricity system. The recent recast of the Electricity Directive (2019/944/EU) already provides a framework for the development of competitive electricity services that – if transposed swiftly³² and correctly in Member States – would lay down the foundations to allow smart charging and vehicle-to-grid services to develop in the market, especially if smart charging infrastructure was deployed. Smart charging infrastructure includes the recharging point, the communication between the recharging point and the vehicle and the vehicle itself. However, the Directive at current does little to support smart charging infrastructure and for facilitating that smart and bidirectional recharging services can be developed. NPFs and NIRs of Member States contain little information on this topic.

6 Coherence of Member States planning with the implications of the overall increase of ambition for the 2030 EU climate target

The assessment of the national implementation reports of Member States indicates that their current overall ambition with respect to the uptake of zero- and low-emission vehicles in the road sector is largely in line with projections of needed road transport contribution to meet the previously set EU's 40% greenhouse gas emission reduction target by 2030. However, strong regional differences exist. These will not guarantee a coherent network of alternative fuels infrastructure throughout the EU, and could create a risk of continued market fragmentation.

The recently adopted Climate Target Plan sets a considerably higher ambition of at least 55% greenhouse gas emission reduction by 2030. It will therefore require a significantly accelerated uptake of sustainable alternative fuels and zero- and low-emission vehicles.

³² Transposition deadline of related articles in 2019/944/EU: 31.12.2020

Depending on the scenario presented in the Impact Assessment accompanying the Climate Target plan³³, the share of **zero- and low-emission cars** (including battery electric, fuel cells and plug-in hybrids) in the total car fleet would need to increase significantly compared to a current policy scenario.

Under the higher ambition, the corresponding recharging infrastructure deployment would also need to increase more than currently planned by Member States. The need to ensure good network coverage throughout the Union would require intensification of effort in all Member States, while it would necessitate significant effort in those Member States with currently relatively low ambition. Next to electric recharging infrastructure, sufficient hydrogen infrastructure needs to be built up in the period post 2025, particularly to support accelerated uptake of hydrogen fuel cell trucks post 2030.

The impact of the higher 2030 climate target ambition on the need for additional refuelling infrastructure for **CNG and LNG** compared to the current planning of Member States is less evident. While an accelerated uptake of CNG and LNG vehicles can be expected until 2030 especially in the heavy-duty segment, the planned infrastructure appears to be already largely sufficient. This is especially true for CNG infrastructure, also considering that the share of CNG vehicles is expected to decrease significantly after 2035. LNG infrastructure already today covers the core TEN-T transport network corridors and can mostly serve the expected growth in the fleet.

The European Green Deal also highlights the great need for decarbonisation in the **shipping** sector. The scenarios underpinning the 2030 Climate Target Plan reaching at least 55% economy-wide greenhouse gas emissions reductions project a high share of alternative fuels such as renewable and low carbon liquid fuels. Other alternative fuels to be used particularly post 2030 will be hydrogen or hydrogen carriers, such as ammonia, as well as bio-LNG, electricity, methanol and e-fuels that with the exception of e-fuels require distinct infrastructure.

The FuelEU Maritime initiative³⁴ to be adopted in 2021 will further analyse decarbonisation and pollution reduction pathways for the maritime sector. It is clear that considerable and long-term effort is needed to ensure adequate infrastructure provision for such fuel supply. Current planning of Member States in this area is well behind what will be required to meet the short and medium-term GHG and pollutant emission reduction requirements related to the implementation of the European Green Deal. Furthermore, substantial additional investments are needed for providing the required recharging and refuelling infrastructure especially for zero emission vessels and infrastructure in ports. Those resources are not currently earmarked in the Member States' planning as reported in the National Implementation Reports and additional financing may be needed to deliver on the climate objective.

While not explicitly covered under the provisions of the Directive, the aviation and rail transport sectors will equally need to increase their efforts to meet the ambition of the Climate Target Plan. With regards to aviation, the RefuelEU initiative is aiming to boost the supply and demand for sustainable aviation fuels in the EU³⁵. This in turn will reduce

³³ SWD/2020/176 final <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020SC0176>

³⁴ <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12312-FuelEU-Maritime->

³⁵ <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12303-ReFuelEU-Aviation-Sustainable-Aviation-Fuels>

aviation's environmental footprint and enable it to help achieve the EU's climate targets. In addition, further efforts are required to also accelerate the electricity supply at airports for stationary aircraft and to decarbonise ground movements. Regarding rail, further effort is needed to further electrify railway lines and to establish hydrogen as an alternative for those parts of the rail network that are difficult to electrify.

7. Conclusion

The Alternative Fuels Infrastructure Directive has been instrumental in triggering the development of policies and measures for roll-out of alternative fuels infrastructure in Member States. Member States have transposed the Directive and developed their National Policy Frameworks (NPFs). With differences across Member States, those policy frameworks have started to help building a long-term forward-looking perspective on infrastructure for electricity, natural gas and hydrogen until 2030. Member States have equally reported on the implementation of those policy frameworks in their first National Implementation Reports in 2019.

The Directive has had a positive impact on the uptake of alternatively fuelled vehicles and their infrastructure. The Commission's services analysis shows that the markets would have been less developed in a scenario without the Directive. However, the shortcomings of the current policy framework are also clearly visible: as there is no detailed and binding methodology for Member States to calculate targets and adopt measures, the level of ambition in target setting and supporting policies in place varies greatly between Member States. For example, the share projected by Member States for electric cars in the total car fleet for 2030 varies between less than 1% and more than 40%. The corresponding infrastructure targets reflect the different level of ambition, meaning that the planned deployment of infrastructure varies greatly between Member States. Moreover, the policy frameworks often do not display sufficient detail on the state of play and on the implementation of existing and planned policy measures. This corresponds to findings of earlier assessments of the Commission as well as to the conclusions of the European Parliament Own Initiative Report on alternative fuels infrastructure from 2018.³⁶

The current infrastructure deployment level is sufficient to serve the rather low number of alternatively fuelled vehicles currently on the road, the two being correlated. However, a comprehensive and complete network of alternative fuels infrastructure does not exist across the Union. For example in the area of electric recharging, large parts of the TEN-T core network do not have recharging points installed every 60 km as recommended. It is therefore unlikely that under the current legislative framework the needed network would develop across Europe in the coming years even if all Member States attained their targets. This is equally true for other alternative fuels infrastructure, especially for waterborne transport.

The Commission has proposed to reduce the EU's greenhouse gas emission by 2030 by at least 55% compared to the previous 40% reduction target. This has a relevant impact on the required uptake of sustainable alternative fuels, vehicles and infrastructure.³⁶ In order to

³⁶ (2018/2023(INI)) https://www.europarl.europa.eu/doceo/document/A-8-2018-0297_EN.html

achieve these ambitious targets, the uptake of zero-emission vehicles and the related infrastructure needs to accelerate significantly in all market segments of light-duty and heavy-duty vehicles. Efforts will need to be considerably higher than the efforts reported by Member States under the Directive. This does not only relate to road transport but equally and particularly to other transport modes such as waterborne transport and aviation. Uptake of sustainable alternative fuels and electricity supply for ships at berth and stationary aircraft has to be accelerated.

While **technical specifications** developed under the Directive have proven to be highly relevant, new needs for technical specifications under the Directive have emerged. These concern particularly the interoperability and transparent exchange of information among the different players within the electric vehicle charging ecosystem. Standards for recharging heavy-duty vehicles and refuelling liquid hydrogen are required. In addition, maritime transport and inland navigation will also benefit from further common technical specifications to facilitate and consolidate the entry on the market of alternative fuels, especially in relation to fuel supply for electricity and hydrogen.

From a **consumer perspective**, using alternative fuels infrastructure needs to be as easy as the use of conventional refuelling infrastructure. This requires that information on the location as well as prices to be charged are available and that the payment is seamless. The current policy framework has shortcomings and consumers can face problems particularly when travelling across borders.

Finally and in line with the Commission's Communication COM/2020/299³⁷, the cost-efficient integration of an increased number of electric vehicles in the **electricity system** must be ensured. To avoid grid congestion and to limit costly investments into grid infrastructure smart charging of electric vehicles is key. A smart integration of electric vehicles and bi-directional charging will also provide flexibility for the overall management of the energy system and thus help to integrate increased shares of variable renewable energy production. While the Electricity Directive³⁸ and the Electricity Regulation³⁹ adopted in 2019 provide the legislative framework on the electricity market side, additional requirements concerning the recharging point and the communication between the recharging point and the vehicle might be required to fully enable smart and bi-directional charging.

In addition, during the transition towards alternative fuels and rather limited uptake of alternative vehicles, **investments** in infrastructure may not be profitable. This is particularly the case for locations with low demand and a more difficult business case, for example in rural areas or areas with little vehicle uptake. In addition, the roll-out of ultra-fast recharging points and of hydrogen stations alongside the TEN-T core and comprehensive network might require further support. Here, public financing for publicly accessible recharging or refuelling points needs to be continued and be focused on those parts of the network where private investments will not be profitable to achieve the Commission's objectives of having at least 1 million publicly accessible recharging and refuelling points deployed by 2025.

³⁷ Commission's Communication COM/2020/299 Powering a climate-neutral economy: An EU Strategy for Energy System Integration

³⁸ 2019/944/EU

³⁹ 2019/943/EU

Against this background, the Commission announced revisions of related legislation for example the CO₂ emission standards for light-duty vehicles in 2021 and the review of CO₂ emission standards for heavy-duty vehicles in 2022, the upcoming FuelEU and ReFuelEU initiatives for maritime and aviation, and the revision of the Renewable Energy Directive⁴⁰ that will strengthen the measures for the uptake of renewable fuels, hydrogen and electricity in the transport sector. Further action at EU level is also required to ensure that the **deployment of interoperable and user friendly recharging and refuelling infrastructure**⁴¹ goes hand in hand with the need for an accelerated uptake of vehicles and fuels in all transport modes.

This requires a strengthening of the current policy framework at EU level to achieve the increased climate ambition of the European Green Deal and to avoid further barriers to market growth. The Commission is in the process of carrying out an Impact Assessment for the revision of the Alternative Fuels Infrastructure Directive and will duly consider the findings of this report as well as those of the ongoing evaluation of the Directive in this context.

⁴⁰ 2018/2001/EU

⁴¹ While publicly accessible infrastructure will be addressed in the revision of the Directive on the deployment of alternative fuels infrastructure, private recharging infrastructure in residential and non residential buildings will be addressed in the revision of the Energy Performance of Buildings Directive.