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Delegations will find attached document COM(2021) 560 final.

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**COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN
PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL
COMMITTEE AND THE COMMITTEE OF THE REGIONS**

**A strategic rollout plan to outline a set of supplementary actions to support the rapid
deployment of alternative fuels infrastructure**

1 Introduction

The European Commission's sustainable and smart mobility strategy¹ lays the foundation for how the EU transport system can achieve its green and digital transformation and become more resilient to future crises. As outlined in the European Green Deal², the outcome should be a 90% cut in transport greenhouse gas (GHG) emissions by 2050, in line with the requirement to achieve climate neutrality in the EU by 2050. The sustainable and smart mobility strategy therefore makes it a key priority to boost the uptake of zero- and low-emission vehicles, renewable and low-carbon fuels and related infrastructure for all modes of transport, without further delay. In this context, it is imperative that no EU region or territory is left behind and that regional disparities in the deployment of alternative fuels infrastructure are duly addressed, in particular in less developed regions or regions with specific needs and circumstances³.

Boosting the uptake of renewable and low-carbon fuels must go hand-in-hand with the creation of a comprehensive network of recharging and refuelling infrastructure to fully enable the widespread uptake of low- and zero-emission vehicles in all transport modes. The sustainable and smart mobility strategy enhances the ambition set out by "Recharge and refuel" European flagship under the Recovery and Resilience Facility⁴, that by 2025, at least 1 million out of up to 3 million publicly accessible recharging points and 500 out of the 1 000 hydrogen refuelling points that will be needed by 2030 should be installed on the road. It also notes the ambition to support ports and airports in their transition to zero- and low-emission, multimodal transport, to support transport hubs and to encourage the use of renewable and low-carbon fuels.

The Commission's proposal for a new Regulation on the deployment of alternative fuels infrastructure is a key policy initiative to achieve the ambition set out in the sustainable and smart mobility strategy. This plan is published alongside the legislative proposal and outlines **a set of supplementary actions to support the rapid rollout of alternative fuels infrastructure.**

Rollout can really accelerate by improving better planning and permitting procedures, by providing targeted public support and by quickly resolving the remaining technical issues that cast doubt over investment. The Commission has frontloaded financial support under the EU budget to roll out such infrastructure. Progress in implementing the Recovery and Resilience Facility should greatly help market development while contributing to the recovery after the COVID crisis. Efficient planning and permitting will also be a factor at both national and local levels. This communication calls for better cooperation among national and local authorities and the multiple stakeholders to spread cases of good practice quickly throughout the EU. The Commission has already begun supporting this collaborative work: in drafting this plan, the Commission drew on expertise provided by the Sustainable Transport Forum (STF)⁵, which brings together key public and private-sector market players.

1 COM(2020) 789 final.

2 COM(2019) 640 final.

3 Such as rural and sparsely populated, remote and outermost, island and mountainous regions.

4 https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en. The Recovery and Resilience Facility, the EU's recovery package centrepiece, combines grants and loans for a total of EUR 672.5 billion that will be distributed to Member States to aid reforms and investments.

5 https://ec.europa.eu/transport/themes/urban/stf_en

2 Where do we stand today?

The Commission report on the application of Directive 2014/94/EU of the European Parliament and of the Council on the deployment of alternative fuels infrastructure provides a comprehensive assessment of the state of play of alternative fuels infrastructure rollout in the EU⁶. It shows that market maturity varies considerably, depending on the mode of transport. Although some Member States have raised their ambition, the EU still lacks a comprehensive and complete network coverage of easy-to-use infrastructure, for all modes of transport. In its recent special report⁷ on infrastructure to charge electric vehicles, the European Court of Auditors has also stressed the significant differences between Member States in deploying charging infrastructure and it urged them to step up action.

In **road transport**, there is now considerable market momentum for electric vehicles. Registrations of new electric vehicles accelerated in many EU markets in 2020, driven by increasing model availability, extended purchase support and the requirement for manufacturers to meet CO₂ emission performance standards for cars and vans. By the end of 2020, there were 2.24 million battery-electric vehicles and plug-in hybrid electric vehicles in the Member States. Buses and trucks accounted for 0.3% and 0.03% of the total electric vehicle fleet, respectively⁸. However, vehicle uptake remains highly concentrated in a few markets. At individual Member State level, the plan and target share to achieve by 2030 ranges from less than 1% to over 40% of electric cars in the total car fleet⁹.

Similar to the uptake of electric vehicles, the deployment of publicly accessible recharging infrastructure is also highly concentrated. By the end of 2020, there were over 226 000 publicly accessible recharging points across the Member States, 89% of which were normal power recharging points (with power equal to or less than 22 kW) and 11% were high power recharging points (greater than 22 kW)¹⁰. However, three Member States shared 70% of that infrastructure: the Netherlands, France and Germany¹¹. The level of ambition has increased in some Member States, but the planned rollout of infrastructure continues to vary greatly across the EU.

For CNG (compressed natural gas) vehicles, which is a mature technology, the current fleet of 1.2 million vehicles is not expected to increase significantly over the coming years¹². The existing infrastructure, comprising some 3 642 refuelling points in 2020¹³, seems largely sufficient to meet future demand. The same applies to current LPG (liquefied petroleum gas) infrastructure: Member States do not anticipate a notable increase in the current fleet by 2030¹⁴. In 2020, there were around 332 LNG (liquefied natural gas) refuelling points in the EU that served the main TEN-T transport corridors and a fleet of up to 6 000 LNG trucks.¹⁵

6 COM(2021) 103 final.

7 https://www.eca.europa.eu/Lists/ECADocuments/SR21_05/SR_Electrical_charging_infrastructure_EN.pdf

8 EAFO/ICCT study: <https://www.eafo.eu/sites/default/files/2021-03/EAFO%20Europe%20on%20the%20electrification%20path%20March%202021.pdf>

Increases of new vehicle registrations ~200% and higher were recorded in 8 markets, while market increases ~100% and higher were recorded in 11 markets. EAFO is the European Commission's observatory gathering all kinds of data on alternative fuels, vehicles, infrastructure and support policies in the EU.

9 COM (2021) 103 final.

10 <https://www.eafo.eu/sites/default/files/2021-03/EAFO%20Europe%20on%20the%20electrification%20path%20March%202021.pdf>

11 <https://www.eafo.eu/>

12 SWD(2020) 331 final.

13 <https://www.eafo.eu/>

14 COM (2021) 103 final.

15 <https://www.eafo.eu/>

Although some gaps persist, the refuelling infrastructure already provides an advanced network connectivity. The challenge remains to decarbonise natural gas.

Hydrogen-powered vehicles remains a niche market because of still high vehicle and fuel costs and insufficient overall vehicle efficiency¹⁶. Although some Member States have set a high level of ambition for rollout, many lack a rollout strategy. In 2020, 125 hydrogen stations were in operation, highly concentrated in a few Member States, and an overall fleet of ~2000 vehicles¹⁷. Some manufacturers have announced series production of hydrogen fuel-cell trucks for the second half of this decade.

Only a few Member States have dedicated infrastructure for biofuels (e85, ED95) to be used in dual fuel vehicles. The volume of registrations of these vehicles remains stable, at a very low level.¹⁸

Concerning **waterborne transport**, there is limited data availability on the uptake of biofuels, alternatively sustainably fuelled vessels and onshore power supply (OPS)¹⁹ for ships at berth²⁰. 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 number of electric vessels (including hybrids) in operation worldwide is similarly low: in 2019, 160 ships were in service and a further 104 were under construction, but market interest is growing. The deployment and use of OPS remains low. At the beginning of 2021, around 50 inland and maritime ports in the EU had at least one OPS connection point²¹. The main objective of the forthcoming FuelEU Maritime initiative is to stimulate demand for alternative fuels in shipping as part of a package to bring the sector in line with the EU's ambition of climate-neutrality by 2050. The growth trend in alternative fuel usage and zero- or low-emissions ships is therefore expected to accelerate over the coming years.

In terms of the use of alternative fuels in **rail**, around 60% of the network serving 80% of all traffic volume is electrified and electrification of rail infrastructure is further progressing. Complementarily, the first market orders of hydrogen fuel-cell trains have recently been placed in several Member States²².

Concerning the use of alternative fuels in **aviation**, sustainable aviation fuels (advanced biofuels and renewable synthetic fuels) can already today be blended for up to 50% with kerosene and can use the existing refuelling infrastructure. Ongoing R&I work could further raise the maximum share for blending. However, due to cost barriers production and use remains marginal, accounting for 0.05% of total jet fuel use²³. The forthcoming ReFuelEU Aviation initiative aims to address this challenge. The airline and airports industry in the EU is supporting and investing in increasing the use of sustainable aviation fuels and in renewable energy supply respectively. Many initiatives have been already undertaken by airports for reducing the impact of airport-level aviation (stationary aircraft electricity supply at gates and outfield positions).

16 State of the art on alternative fuels transport systems in the European Union, Joint Research Center, <https://op.europa.eu/en/publication-detail/-/publication/fd62065c-7a0b-11ea-b75f-01aa75ed71a1>

17 <https://www.eafo.eu/>

18 <https://op.europa.eu/en/publication-detail/-/publication/fd62065c-7a0b-11ea-b75f-01aa75ed71a1/> and SWD(2021) 49 final.

19 Onshore power supply (OPS) or shore side electricity.

20 SWD(2021) 631.

21 COM (2021) 103 final.

22 Idem.

23 Idem.

The aviation industry is also investing heavily in new electric, hybrid and hydrogen aircraft technologies. A first small fully electric aircraft was certified by European Aviation Safety Agency (EASA) in 2020²⁴ and zero CO₂ emissions aircraft for short haul commercial flights are expected over the next years. In addition to these developments, new concepts for fully autonomous aircraft (drones) are coming on stream, providing new solutions for cargo, but potentially also passenger transport²⁵. Rolling out these types of aircraft will require a sufficient renewable energy supply and investment in refuelling and recharging infrastructure at airports. This is particularly necessary for the production and supply of hydrogen²⁶.

Investment needs

The European Green Deal projects that a more than four-fold increase in electric recharging infrastructure will be needed by 2025 to serve the expected increase in the electric vehicle fleet. This illustrates the challenge for the EU in terms of rolling out recharging points over the coming years, and the need to invest in grid connectivity.

For road transport, the total investment costs between 2021 and 2030 following the proposal for a new Regulation on the deployment of alternative fuels infrastructure amount to approximately €1.5 billion annually. For maritime ports, total OPS infrastructure costs are estimated to range between €1.2 billion and €6.5 billion relative to the baseline cost for the period 2025-2050 while €3.4 billion should be spent on LNG bunkering in maritime transport (if ship-to-ship technology is used). For inland ports, the total infrastructure costs regarding OPS installations are estimated to range between €65 million and €412 million above the baseline cost. The impact assessment accompanying the proposal for a new Regulation on the deployment of alternative fuels infrastructure includes a detailed assessment of the costs and investment needs²⁷.

3 Accelerate the rollout of alternative fuels infrastructure

The rollout can be accelerated by improving the overall framework for planning, permitting and procuring such infrastructure in the EU and by both increasing and better targeting public support. Moreover, common technical specifications for vehicles, infrastructure and infrastructure use services are essential for scaling up market action, as they create certainty for market investment. Achieving an early common understanding on how to bridge the remaining standardisation gaps will facilitate such action. This plan finds a great potential to support the proposal for a new Regulation on the deployment of alternative fuels infrastructure by taking supplementary measures.

3.1 Better plan, permit and procure

The distribution of recharging and refuelling points that are actually commercially viable is unevenly spread across the EU. Public authorities at all levels of governance play an important role in developing this market. By adjusting their concession or licence award

²⁴ EASA certifies electric aircraft, first type certification for fully electric plane world-wide | EASA (europa.eu).

²⁵ Commercialization of electric schooling planes was reported by several companies (small, electric two-seater aircrafts). Such niche markets do not dramatically reduce CO₂ or air pollution, but enable interesting high-tech development chances for European industries on the world markets.

²⁶ On this point, a recent announcement from Airbus moved the target for widely used hydrogen planes forward (>2050): <https://www.reuters.com/business/aerospace-defense/airbus-tells-eu-hydrogen-wont-be-widely-used-planes-before-2050-2021-06-10/>.

²⁷ SWD(2021) 631.

procedures, public procurement procedures or grant award procedures, public authorities can help shape market developments in this area:

- Public support to install recharging and refuelling points remains necessary in many cases. The authorities will have to plan these works properly, while also stipulating the right minimum requirements and service standards that allow for market competition, positive user experience and that avoid locking in specific technology solutions.
- Planning and permitting are also important factors that influence the overall speed and scale of infrastructure rollout: already today, charge-point operators face difficulties in finding suitable locations in some instances. The time needed to get permits to install the infrastructure can vary considerably by location, particularly for grid connections. Where the rollout with private investments is not taking place due to market failures, State aid rules allow Member States to cover some of the costs for obtaining the necessary permits.
- Concession procedures can be a further constraint. Consultations in the Sustainable Transport Forum underlined that licencing, concessions and public procurement processes for recharging stations often favour larger (for large-scale investments/concessions) or regional players (for local investments). This is in particular true for concession practises (especially on highways but also in urban areas) where a lack of transparency and competition in the award procedure and an inappropriate duration of concessions were considered to be the most pressing issues²⁸.
- Public authorities must also consider how to allocate in an optimal way increasingly scarce space among competing demands (e.g. for walking or cycling, recreation or recharging vehicles). The deployment of recharging and refuelling infrastructure has to be considered as part of the overall sustainable urban mobility planning.

If these procedures are done properly, public authorities are in a powerful position to stimulate and accelerate the deployment of future-proof, state-of-the-art, cost-efficient, energy-efficient, grid-beneficial, truly interoperable and user-friendly solutions with high service standards. In this context, it is important to learn from the experience of frontrunners, avoid mistakes and borrow the practices that have proven to be successful.

To address this need, the Sustainable Transport Forum has already drawn up a set of Recommendations for public authorities for procuring, awarding concessions, licences and/or granting support for electric recharging infrastructure for passenger cars and vans (the 2020 STF recommendations for recharging point tenders)²⁹, as well as a summary Handbook³⁰.

The Recommendations are designed as practical guidelines for public authorities that are either looking to procure recharging infrastructure or to award concessions for their rollout and/or operation, possibly linked to the granting of government support. The Recommendations include off-the-shelf best practice examples, ready for use by national, regional and local authorities.

A dedicated STF sub-group has been established early 2021 to function as a platform for exchange between public authorities on all matters to promote and facilitate the development

28 2019 Stakeholder consultation | Mobility and Transport (europa.eu).

29 https://ec.europa.eu/transport/sites/default/files/sustainable_transport_forum_report_-_recommendations_for_public_authorities_on_recharging_infrastructure.pdf

30 https://ec.europa.eu/transport/sites/default/files/stf_handbook.pdf

of high quality recharging infrastructure. This “sub-group on best practices of public authorities to support the deployment of recharging infrastructure” shall, amongst others, update the Recommendations and summary Handbook at regular intervals, and discuss possible approaches to harmonization and simplification of permitting and grid connection procedures. It shall also propose additional recommendations, for instance to deploy recharging infrastructure for specialised and captive fleets, and develop a European toolbox grouping best practices on a thematic basis. First deliverables are expected in the course of 2022 and will be made available on a new dedicated Knowledge Platform for public authorities as part of the European Alternative Fuels Observatory (‘EAFO’).

Good practice in Member States on planning, permitting and procurement

In **the Netherlands**, Metropolitan Region Amsterdam-Electric (MRA-Electric) supports municipalities in the provinces of North-Holland, Flevoland and Utrecht in developing and implementing EV policies. The municipalities share experience and knowledge, develop demonstration projects, develop standard documents/templates for use by all, and jointly procure/manage recharging infrastructure. The cooperation has created an interoperable recharging network in the main cities and in the surrounding municipalities (hinterland). In early 2020, MRA-E announced the selection of the concessionaire of the biggest EU tender for recharging infrastructure thus far: 20,000 new recharging points! For details, see <https://www.mra-e.nl/>

In **Belgium**, the Flemish Region organises an annual tender for and on behalf of interested municipalities through the distribution system operator. The regional concession ensures that the infrastructure meets the same requirements and prevents smaller closed networks (interoperability). Participation is voluntary: larger cities such as Leuven, Ghent and Antwerp have chosen to organise their own tenders.

In **Germany**, the federal government created an online tool to plan recharging infrastructure called the “StandortTool”, which shows with high spatial resolution (zones) whether there is a low or high need for additional recharging infrastructure. The tool combines data on the existing vehicle fleet, the existing recharging infrastructure stock and the transport patterns of German drivers. For each zone, the StandortTool also provides information on how to connect to the medium-voltage grid. In doing so, potential investors can get a first idea of the potential costs of connecting a recharging station to the grid at any given location. The StandortTool can also project future expected needs (with a time horizon of 2022 and 2030).

The European Commission encourages Member States to cooperate further on these matters and invites them to make use of the recommendations of the STF. Where necessary, Member States are invited to reinforce their policy frameworks to ensure better planning, permitting and procurement.

3.2 Make best use of national recovery and resilience planning

The Annual Growth Strategy 2021 (AGS 2021) identified investment in sustainable transport as one of the key priorities for the national recovery and resilience plans (RRPs), packages of reforms and investments that will be prepared by Member States in the context of the Recovery and Resilience Facility. It calls in particular to include in the RRPs reforms and investments to boost demand for zero- and low-emission vehicles and to accelerate the rollout of recharging and refuelling infrastructure in order to contribute to the green transition.

The AGS 2021 also proposed creating under the Recovery and Resilience Facility a European flagship initiative named ‘Recharge and refuel’³¹, with the aim of promoting future-proof

³¹ https://ec.europa.eu/info/files/example-component-reforms-and-investments-clean-smart-and-fair-urban-mobility_en

clean technologies to accelerate the use of sustainable, accessible and smart transport, charging and refuelling stations and to expand public transport. Moreover, the ‘Power up’ flagship lays the foundation for hydrogen lead markets in Europe and the related infrastructure, which will also contribute to sustainable mobility.

In response, many Member States are planning to include investments and reforms that contribute to those priorities in the transport and energy components of their national RRP. Of particular relevance in this context are measures to accelerate the renewal of public transport and private fleets with zero- and low-emission vehicles, rolling stock and vessels and to support the deployment of alternative fuels recharging and refuelling infrastructure, both for roads and for ports. Furthermore, the RRP offer the opportunity to include specific requirements on streamlining permitting for charging and hydrogen refuelling infrastructure, contributing to address administrative barriers. Many good examples can be found amongst the RRP already submitted by Member States, underlying the value added of RRP investment for the transition to a sustainable and smart mobility system. In most Member States, the measures are due to be implemented in cooperation with regional and local authorities and/or in partnership with private operators to maximise leverage effects.

All Member States have been encouraged to make full use of all the funding made available to them, be it under the form of non-repayable support or loans. As with electricity-related projects, cross-border interlinkages of alternative fuels infrastructure projects are encouraged. Contacts during the planning and implementation process can strongly contribute to maximising the benefits of RRF-supported investment. **This process of exchanging best practices may be aided by the Commission’s Technical Support Instrument (TSI)³², which has a budget of €864 million EUR for 2021-2027.** Under this instrument, Member States can request technical support *inter alia* to implement their national recovery and resilience plans, including in aspects linked to the green transition. In addition, in the context of the TSI financing cycle for 2022, Member States may request support in line with a proposed Flagship technical support project on “Recharge and Refuel”, which focuses on measures enhancing the rollout of alternative fuels infrastructure, including in the context of sustainable urban mobility.

Clear descriptions of priorities and objectives together with well-designed investments and reform projects provide the necessary clarity and ensure high impact and value added. **The extent to which RRP support the development of alternative fuels infrastructure will be taken into consideration by the Commission when assessing whether the plans contribute to the green transition, which is part of the assessment criteria set by the RRF Regulation.**

State aid rules also apply to projects funded by the Facility where due to market failures the market left on its own does not yield the required investments to support the switch to clean mobility. The Commission has provided specific guidance for State aid for recharging and refuelling infrastructure for road vehicles, which should be duly considered³³. The State aid rules cover investment in deploying infrastructure to supply electricity, hydrogen or, where necessary as a transitional solution, gas to vehicles, including electric two-wheelers, cars, vans, trucks, buses or vessels (recharging or refuelling infrastructure), irrespective of whether

32 Regulation (EU) 2021/240 of the European Parliament and of the Council of 10 February 2021 establishing a Technical Support Instrument.

33 https://ec.europa.eu/competition/state_aid/what_is_new/template_RRF_electric_and_hydrogen_charging_stations.pdf

the infrastructure is for the beneficiary's own use, semi-public infrastructure or publicly accessible infrastructure³⁴.

Depending on the project in question, several State aid instruments are available to Member States³⁵. **The General Block Exemptions Regulation should be amended in due time to allow certain support for recharging and refuelling infrastructure and to simplify the implementation of such projects. Work is also ongoing to revise the energy and environmental State aid guidelines to include specific rules for assessing aid schemes for recharging and refuelling infrastructure³⁶.**

3.3 Reinforce and better target funding at EU level, attract private investment and increase capacity

The EU is already indirectly and directly mobilising additional public investment to help unlock private funds for the deployment of alternative fuels infrastructure. Under this MFF financing period 2014-2020, the Connecting Europe Facility (CEF) has been instrumental in supporting the rollout of 20 450 recharging and refuelling points: 19 236 EV recharging points, 130 hydrogen refuelling points, 1 050 road LCNG refuelling points (809 CNG and 241 LNG) and LNG refuelling points or/and OPS in 7 inland and 27 maritime ports³⁷. The EU's multiannual budget for 2021-2027 provides a substantial increase in support for the rollout of alternative fuels infrastructure. Member States and other stakeholders can draw on a wide range of complementary funds and financial instruments.

Fully in step with the European Green Deal, the Connecting Europe Facility Programme 2021-2027 (CEF II) will address climate change and contribute 60% of its overall budget to co-financing initiatives that support climate objectives and accelerate the transition to zero-emission mobility. To this end, CEF II will create an Alternative Fuels Facility (AFF). It will fund alternative fuels infrastructure for renewable and low-carbon fuels by the combination of CEF grants with financing from finance institutions to achieve a higher impact of the investment. The European Investment Bank (EIB) will not be the sole implementing partner; other national promotional banks can also facilitate the blending operation.

The new facility intends to adjust to market developments, reflecting the specific needs for heavy-duty recharging and refuelling infrastructure. In this respect, the Commission also intends to define an appropriate fixed co-funding rate for electricity³⁸ and hydrogen alternative fuels infrastructure projects for all modes of transport³⁹ both under the CEF general envelope and under the Cohesion envelope with a proportionally aligned co-funding rate⁴⁰. The Commission will support only recharging points of 150 kW or over, particularly in the parts of the TEN-T road network that have not yet reached a sufficient infrastructure

34 Separate rules exist for supporting the purchase of electric or other zero- or low-emission road vehicles.

https://ec.europa.eu/competition/state_aid/what_is_new/template_RFF_premiums_acquisition_low_emission_vehicles.pdf.

35 These include, for example, the provisions of the General Block Exemption Regulation (GBER), aid compatible directly under Article 107(3)(c) TFEU, Environmental and Energy Aid Guidelines, Regional Aid Guidelines or rules related to compensation for carrying out a public service obligation.

36 Public consultation on the revised Climate, Energy and Environmental Aid Guidelines (CEEAG): https://ec.europa.eu/competition-policy/public-consultations/2021-ceeag_nl.

37 These indicative figures do not yet include the CEF grants under preparation following the Blending Facility (4th cut-off) call.

38 E.g. bus depots infrastructure or supply infrastructure and ground operations in TEN-T maritime and inland ports and airports.

39 Under CEF II, the costs related to vehicles or vessels will not be eligible, except in the case of inland waterway and short sea shipping, if an initial number of vessels is needed to kick-start the use of the supported recharging/refuelling infrastructure.

40 The ratio of AFF co-funding rates vs the maximum co-funding rate of 50% under the general envelope was proportionally applied for the cohesion AFF co-funding rate vs the maximum co-funding rate of 85% under the cohesion envelope.

coverage. In order to simplify the management and implementation of the Facility, for the funding of ultra-fast recharging points⁴¹, the Commission will use unit contributions, including the grid connection cost⁴², as simplified form of funding.

On the TEN-T road network insufficient availability of ultra-fast recharging points is proving a key challenge in enabling cross-border travel over longer distances. Only a few parts of the network have at least one fast recharging point every 60 km. Similarly, the supply on the road network of hydrogen refuelling stations is fragmented. Equipping inland and maritime ports with sufficient sustainable alternative fuels infrastructure remains another key priority. In order to enable a geographically targeted deployment of ultra-fast recharging points, the Commission will provide an infrastructure gap analysis for alternative fuels infrastructure on the basis of the TEN-Tec maps⁴³. In the future this analysis will include implementing routing and identifying hotspots/seasonal peaks based on historical traffic flow.

In many cases, due to the high concentration of potential users, urban areas are expected to attract more private investment than other areas. Therefore, recharging infrastructure for the public transport fleet is a key priority for public funding, complementing the deployment of zero-emission buses in cities. For example, this would cover recharging infrastructure in depots, opportunity-based charging devices and related energy storage facility systems.

To maximise the impact of private investments, the Commission will actively seek synergies with Horizon Europe partnerships and missions, in particular the proposed Mission on Climate Neutral and Smart Cities⁴⁴, which aims to make 100 cities climate neutral by 2030, as part of the European Green Deal. Stimulating sustainable urban transport and mobility will be key aspect of the mission, which will offer opportunities for cities who want to invest in zero emissions public transport and associated infrastructure.

Investment made under this mission can make a positive contribution to the rollout of recharging infrastructure in cities. This process would include setting both publicly accessible recharging points and ducting and wiring buildings and parking lots for private vehicle recharging. Likewise, Horizon Europe partnerships with industry and Member States through the Clean Energy Transition partnership, provides funding opportunities for research and development in these areas. The 2Zero and Batteries Partnerships and the Clean Hydrogen Joint Undertaking⁴⁵ include specific focus on recharging and refuelling infrastructure development, in areas such as V2G and pervasive on-road recharging infrastructure or protocols for fast truck charging and hydrogen refuelling. The Commission has also launched a flagship initiative on batteries, with an additional € 200 million to support European battery development and innovation ('Battery 2030+'). The Innovation Fund will support innovative and low-carbon technologies and will help businesses bring to the market industrial solutions to support the transition to climate neutrality.

41 Considering the rapid decrease of costs for the electro-mobility market segment, as well as the low level of information in the literature analysis on the costs of recharging points with power capacity of 350 kW, the level of co-funding rate is more conservative. However, in terms of value (EUR) the unit contribution for a recharging point of minimum 350 kW is double the unit contribution of a recharging point of minimum 150 kW.

42 The unit contribution of the grid connection will be conditional on the deployment of a minimum four recharging points (noting that 350 kW can count for 2 of 150 kW).

43 https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/site/index_en.htm

44 https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/missions-horizon-europe/climate-neutral-and-smart-cities_en

45 https://ec.europa.eu/info/files/european-partnership-towards-zero-emission-road-transport-2zero_en;
<https://bepassociation.eu/about/batt4eu-partnership/>; <https://www.fch.europa.eu/>.

Cohesion policy will play a central role in helping all regions in their transition towards a greener, climate neutral Europe and ensuring that no region is left behind. The European Regional Development Fund and the Cohesion Fund are available to support investment in research, innovation and deployment, in particular in the less developed Member States and regions. Cohesion policy will offer support, covering all transport modes and all levels of the transport system, from TEN-T to local mobility, in line with the specific requirements and priorities identified in the national and regional programmes.

The InvestEU programme⁴⁶, notably through its Sustainable Infrastructure window, can bolster future-proof investment across the European Union, help mobilise private investment and provide advisory services to project promoters and operators working in sustainable infrastructure and mobile assets. InvestEU guarantee can support financing of more risky project promoters such as SMEs and innovative companies in the areas of smart and sustainable transport. It can also support measures to promote skills, education, training and related services under the InvestEU ‘Social investment and skills’ window. Moreover, it will also be possible to combine CEF grant with (InvestEU) guarantee under InvestEU blending operation.

In recent years, the EIB Group has also ramped up its support to accelerate newer technologies such as e-mobility and digitalisation under the Cleaner Transport Facility⁴⁷. The EIB Group will continue providing a range of financing structures to help accelerate the deployment of cleaner mobile assets.

Lastly, the Commission has taken major steps to make the financial system more sustainable, notably by adopting in 2020 the Taxonomy Regulation⁴⁸, which established a classification system for green economic activities. This will facilitate the scaling up of green financial products, such as green bonds and green securitisation, suitable to promote investment in the deployment of alternative fuels infrastructure for all modes of transport.

3.4 Identify outstanding technological challenges and accelerate standardisation

Standardisation is an essential way to create economies of scale and a mature internal market for this sector. Under Directive 2014/94/EU on the deployment of alternative fuels infrastructure, major sets of common technical specifications for electricity, hydrogen and natural gas supply for road, maritime transport and inland navigation have been adopted. This is the result of the work carried out by European standardisation organisations, following a Commission standardisation request in 2015 (Mandate 533)⁴⁹. Despite the progress achieved and the support to the market growth, there are still many outstanding needs, particularly as a result of new technological developments and higher digital and communication requirements in all modes of transport.

It is important that from today the EU has a ‘future-proof’ alternative fuels infrastructure network. To ensure the deployment of recharging and refuelling infrastructure in a coherent

⁴⁶ https://europa.eu/investeu/investeu-fund/about-investeu-fund_en

⁴⁷ <https://www.eib.org/en/projects/sectors/transport/cleaner-transport-facility>

⁴⁸ Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088.

⁴⁹ Commission Implementing Decision C(2015) 1330 final of 12.3.2015 on a standardisation request addressed to the European standardisation organisations, in accordance with Regulation (EU) No 1025/2012 of the European Parliament and of the Council, to draft European standards for alternative fuels infrastructure.

manner, it is crucial to have a common understanding of the specific technological needs that are to be addressed for the different fuels in every mode of transport. To this respect, there is an urgent need to conclude the technological approach for the deployment of hydrogen refuelling infrastructure for heavy-duty vehicles, in particular, on the final standard form of the fuel (liquefied or compressed, and pressure level). Therefore, the definition of a common market direction on the rollout of alternative fuels infrastructure, taking into account vehicle, infrastructure and production/distribution aspects, will be determining for a timely deployment in a holistic manner.

The adaptation of alternative fuels infrastructure to the needs of disabled persons has also been high on the agenda. The Accessibility Act⁵⁰ already sets minimum requirements at EU level, but they need to be properly enforced. These include requirements on payment terminals, certain transport services and infrastructure, including recharging stations⁵¹. The Commission will prepare guidelines and exchange good practices, together with the Sustainable Transport Forum, to promote these requirements in the rollout of alternative fuels infrastructure.

For **road transport**, standardisation work has focused on electro-technical issues, such as plugs, outlets and electrical safety specifications. To achieve full interoperability across all parts of the electric vehicle recharging ecosystem, there is now an urgent need to further standardise communication interfaces and develop new data models to integrate electric vehicles into the grid, including building's energy management systems, and to foster the development of EU-wide e-roaming networks. In particular, electric recharging and hydrogen refuelling points for heavy duty vehicles are priority for standardisation. **The Commission will work together with the European standardisation organisations and bodies to adopt a new standardisation request:**

- to ensure full interoperability of the electric vehicle recharging ecosystem, including communication among all parts of this ecosystem (vehicle manufacturers, recharging point operators, mobility service providers, e-roaming platforms and distribution system operators);
- to help bringing to market emerging technologies such as smart recharging and vehicle-to-grid (V2G) services, which will be also the subject of R&D and demonstration projects under the new Horizon Europe programme (including the adopted Work Programme of the European Commission Joint Research Centre) and the Mission on Climate Neutral and Smart Cities;
- to formulate specific requirements for recharging heavy-duty vehicles, including high-amperage plugs, outlets, cooling technologies, and communication interfaces built on the basis of the European technical specifications already developed for light-duty vehicles; a special effort in view of pre-normative research and testing methodology developments will be needed in order to support the competitiveness and reliability of EU R&D and industry in these technologies;
- to cover the development of standards for electric road systems, designed to transmit electrical energy to vehicles while moving;

⁵⁰ Directive (EU) 2019/882 of the European Parliament and of the Council of 17 April 2019 on the accessibility requirements for products and services.

⁵¹ Here the foundation heights added to a charging columns should be considered in order to correctly adapt this component of infrastructure to the needs of disabled persons.

- to facilitate the introduction of wireless recharging technology, both in static and dynamic form, achieving power transfers sufficient to meet the different vehicle types and user needs; particular attention will be necessary to ensure sufficient electromagnetic compatibility of these technologies with existing communication bands under reasonably and realistically defined conditions;
- to formulate technical specifications for hydrogen refuelling points dispensing liquefied and compressed hydrogen for heavy-duty vehicles.

In this context, it is important to build consensus between the many stakeholders that form part of the recharging ecosystem on the future design of a governance framework for vehicle-to-grid communication. The framework should be based on open and transparent principles and result in a European ecosystem that is easily accessible for all parties. The Commission will coordinate to ensure the process of developing this framework is effective and transparent.

For the **rail** sector⁵², the European Agency for the Railways is leading the development of technical requirements and specifications in cooperation with operators, rolling stock manufacturers and fuel-cell manufacturers. To achieve this, it is crucial to factor in safe installation and performance testing. Considering these technical requirements, the Agency issues authorisations for putting rail vehicles into service and facilitates the commercialisation of rail vehicles and trains across Member States. Over the coming years, three specific technological barriers need to be overcome before hydrogen fuel-cell technology can be considered for trains as commercially viable. These barriers are:

- large-scale demonstration of multiple-unit train fleets;
- development, engineering and prototype operation of shunters or mainline locomotives;
- technology development for optimised hydrogen storage system for Fuel Cell Hydrogen (FCH) rail applications.

These three high-priority topics will be the focus of R&I work, possibly by stepping up coordination between future European Partnership for transforming Europe's rail system and European Partnership for Clean Hydrogen.

Most of the remaining technological barriers concern the optimisation potential required to enable FCH technology to better compete with diesel or electric trains. Concretely, the optimisation potential depends directly on the FCH train itself, however, there is also much room for improvement and development in the corresponding hydrogen refuelling infrastructure as well as in the service and maintenance systems.

In addition, technological development in the rail sector faces a fragmented regulatory environment in terms of both European (technical specifications for interoperability) and national (NNTR – notified national technical rules) technical requirements. This has a high impact, especially since several types of trains are required to cover the whole European market. Pending the development of European technical requirements and specific standards, FCH powered trains could face market fragmentation leading to higher fixed costs, penalising the front runners if a new regulatory environment is designed for all types of use.

New ideas may render the rollout of electric vehicle recharging infrastructure and advanced rail technology synergistically. For example, in possible future open car-transportation

⁵² <https://shift2rail.org/publications/study-on-the-use-of-fuel-cells-and-hydrogen-in-the-railway-environment/>.

wagons, specific converter components, adapted to the different, and somewhat variable voltage and frequencies of electric trains on the one hand, and the standardised recharging technology on the EVs' side, are needed, as well as safe cabling solutions, in accordance with rail safety standards.

For **maritime transport** and **inland navigation**, the development of standards is fundamental to move from high-level action, such as the work under the International Maritime Organisation Conventions/Codes⁵³ and operational or technical implementation. The importance of international standards in ports, in particular for the ship-shore interface in international maritime ports, is directly related to the promotion of safety and confidence in the development of sustainable alternative fuels (alcohols, ammonia, hydrogen, other) or electrification solutions (such as OPS and battery charging). It is also important in promoting local availability, which could create additional storage, distribution and therefore limited infrastructure needs of same kind (e.g. for advanced biofuels), particularly relevant when several fuel solutions will co-exist in combination with fuel-flexible engines.

In that context, and as part of the Commission's 2015 standardisation request (Mandate 533)⁵⁴, interoperability standards for maritime and inland navigation have been developed, notably for onshore plugs. The European Maritime Safety Agency (EMSA) has also developed in cooperation with Member States and industry the 'Guidance on LNG Bunkering for port authorities and administrations'⁵⁵. Similarly, **EMSA is currently developing guidance on OPS**. Both guides complement existing standards, guidelines and industry best practice, with the aim of providing best practice recommendations.

The upcoming standardisation needs identified for waterborne transport can be classified in two strands:

- 1) the development of further specifications for electricity supply, including shore-side battery recharging points, port-to-grid communication interface in automated OPS for each technical category of vessels and battery swapping and recharging at onshore stations for inland waterways vessels;
- 2) the development of new standards for sustainable hydrogen, ammonia and methanol fuel bunkering for maritime and inland waterways vessels. These are a medium-to-long-term technological development in line with greenhouse gas reduction targets, expected to be ready by the mid-2020s.

For air transport, standardisation work is focusing on new European standards to support an interoperable infrastructure for electricity supply for general aviation⁵⁶ and aircraft with specific applications such as electric vertical and take off landing (eVTOL)⁵⁷. These standards are expected to be adopted by the end of 2021 and 2022, respectively. Generally, new standards should draw on existing expertise and technological developments led by recent type certification of small electric aircraft. For hydrogen, there are currently no standardisation activities ongoing for refuelling points as hydrogen-powered aircraft are still in very early stages projects of certification. The EASA is contributing to this process with EU and non-EU standardisation bodies and other specialised bodies. The standards for eVTOL and general aviation are being drawn up in cooperation with industry

⁵³ Interim Guidelines on Safe Operation of On-shore Power Supply (OPS) Service in Port for Ships Engaged on International Voyages prepared in the framework of International Maritime organisation.

⁵⁴ Commission Implementing Decision C(2015)1330 final of 12.3.2015.

⁵⁵ <http://www.emsa.europa.eu/publications/inventories/item/3207-guidance-on-lng-bunkering-to-port-authorities-and-administrations.html>

⁵⁶ SAE AS6968 Conductive Charging Standard for Light Electric Aircraft.

⁵⁷ High level charging requirements SC VTOL 2430.

and international aviation organisations to ensure the interoperability of connections in airports outside the European Union. No standardisation activities are ongoing for large airplanes as, unlike for eVTOL and general aviation, there are no ongoing projects of electric or hybrid large airplanes for certification yet.

3.5 Development of a data and governance framework to make the electro-mobility ecosystem work effectively

Particularly in electro-mobility, the availability of and accessibility to high-quality data is becoming essential for new services and product features supporting mass-market use. In a market comprising millions of vehicles and charging points, it is essential to connect users and infrastructure efficiently by providing seamless, user-centric solutions.

The Commission is aiding a Programme Support Action on “Data collection related to recharging/refuelling points for alternative fuels and the unique identification codes related to e-mobility actors” (PSA IDACS) with Member States to improve data collection on alternative fuels infrastructure, to identify other potential needs and to improve the creation of new digital services by facilitating business-to-government (B2G), business-to-business (B2B) and business-to-consumer (B2C) data interactions.

At present, basic data regarding alternative fuels infrastructure, such as their location and availability, are often not shared or available. These data must be created, when necessary, and made available in an easy manner and at no cost, through a common data architecture. In consequence, the recharging and refuelling infrastructure must be capable of handling the necessary data requirements through an interoperable data infrastructure that endorses data sharing for the public interest. On this basis, advanced digital services can be provided to consumers, so as to allow new business opportunities to emerge and user experiences to improve hand in hand. This is evident for data on prices: users of an electric vehicle should know what they will pay at any given recharging point before they actually drive to it, so they can make an informed decision that meets their needs. Transparent sharing of data on prices will moreover support the development of fair prices for e-roaming across the EU.

The creation of new services that will improve the overall quality and user-friendliness of the alternative fuels infrastructure will strongly depend on the openness of the data generated (e.g. access to in-vehicle data) in the whole ecosystem, and the potential connectivity with data from other sectors, such as e-commerce, insurance, banking or telecommunications.

The European Alternative Fuel Observatory (EAFO) already makes available online important data on alternative fuels infrastructure⁵⁸, including by displaying these on an interactive map, with a focus on policy monitoring. Its functionality will be improved in the future, amongst others by including a new Knowledge Platform for public authorities (see section 3.2 above) and a consumer information section. In addition, EAFO has the potential to become the common European access point for the accessibility and reuse of real time data on alternative fuels infrastructure.

Importantly, the electro-mobility data ecosystem also includes private recharging infrastructure, namely recharging points in residential and office buildings, airports or bus depots. It is crucial to put in place proper systems to monitor and exchange data between

⁵⁸ www.eafo.eu

public and private recharging infrastructure and the electricity grid, creating a consistent technological framework, particularly in view of enabling smart and bidirectional (V2G) recharging, which is essential for integrating electric vehicles into the grid.

As a result, there is an urgent need to ensure that the new alternative fuels infrastructure deployed in Europe is capable of transmitting real time information, facilitating new digital services and the integration of electric vehicles into the grid. To this end, it is necessary to create a European level playing field, based on a common set of technological features and market governance rules underpinning an agile and resilient data-driven ecosystem.

The essential elements for the creation of a smart data ecosystem and its governance framework include:

- digitally-connected recharging infrastructure that can provide smart and bidirectional (V2G) recharging services and is easily upgradeable to this end;
- recharging infrastructure equipped with the necessary hardware and software component, and compliant with the relevant standards, enabling an interoperable flow of information to back-end structures and to other market players;
- availability of essential, defined data types to enable the development of new services expected to meet users' needs for different vehicle types (e.g. LDVs vs HDVs), including seamless localisation, booking, payment and fair billing processes;
- implementation of harmonised and user-friendly payment solutions, including ad hoc and contract-based payment options, considering specific needs for electro-mobility service providers (EMSPs)⁵⁹ as enablers of e-roaming⁶⁰ networks that meet daily user needs;
- specifying the data dimensions required (aggregation, quality, sharing, reusability, etc.) to enable the creation of advanced digital services, and a map of the roles and responsibilities of the different market players within the ecosystem.

In a similar manner, it will also be important to develop data ecosystems for other alternative fuels (clean H₂, bio-LNG bio-methane, renewable and low-carbon fuels and other advanced biofuel solutions) that fulfil specific market demands, in particular when using the same fuel-pipeline as chemically identical fossil fuel solutions. Overall, demand for data and the quality and frequency of information flows will depend on the intrinsic characteristics of the recharging and refuelling process and the data needed to ensure the adequate use of infrastructure for each fuel and vehicle type.

In coordination with ongoing work streams to develop the mobility data space (MDS) and the Programme Support Action for the coordination mechanism to federate the national access points, the Sustainable Transport Forum will discuss technical specifications and policy requirements for the development of an open data ecosystem that ensure the free access and reuse of data for electro-mobility and other alternative fuels by 2023 and 2025, respectively. To this respect, the Sustainable Transport Forum will work on the particular static and dynamic data types needed to create new services, building

⁵⁹ 'electromobility service provider' means a commercial actor who provides services to an end user, including the sale of a recharging service.

⁶⁰ 'e-roaming' means the exchange of data and payments between the operator of a recharging point and a mobility service provider from which an end user purchases a recharging service.

on the outcomes of the PSA IDACS, as a basic input to work on a possible delegated act, planned for 2022.

4 Ensure broad collaboration to work towards a common aspiration

Transitioning the transport sector to a sustainable and clean power supply cannot be easily charted and implemented. The rapid rollout of recharging and refuelling infrastructure poses significant challenges: for planning and permitting processes, for planning energy system integration, for building up interoperable seamless user services and for developing an open, competitive market ecosystem. It requires broad-based cooperation between all public and private-sector market players throughout the whole value chain, bringing together automotive and energy sectors to provide digitised user services. It should be a shared goal for both public authorities and industry.

This is why the Commission has closely involved the Sustainable Transport Forum in preparing this rollout plan, building on the close collaboration with the Forum over the past years. The Forum is the Commission's main expert group working on alternative fuels infrastructure. It brings together representatives from all Member States and from key interest organisations and industry players. Members of the Forum were invited to share their views and information on key problem areas and actions of this plan in two meetings and in written exchanges.

The Commission will continue this process of broad stakeholder cooperation. It has set up a number of new expert sub-groups under the auspices of the Sustainable Transport Forum to accompany the process of fact-finding and decision-taking in key areas of data governance, communication protocols and interfaces, planning, permitting and concession practice. The findings will feed into future policy development. The Commission will also closely follow the installation of recharging and refuelling points in other relevant fora and processes, not least in the context of the Renovation Wave for buildings⁶¹. The Commission will support the need for additional research and innovation (R&I) activities, in particular through Horizon Europe and its partnerships with private side (institutionalised and co-programmed partnerships) and with Member States (co-funding).

What is needed now is **effective and efficient cross-border and cross-sector cooperation between all public and private-sector stakeholders** on developing an open, transparent and interoperable infrastructure with seamless infrastructure services. The Commission encourages all Member States to engage all public authorities and market players at all levels of governance in the discussion about further policy needs and opportunities.

5 Conclusions

Building up the recharging and refuelling infrastructure for a sustainable mobility system provides a unique opportunity to stimulate the recovery after the impact of the COVID-19 pandemic. Related investment will create jobs that cannot easily be outsourced and often are rooted in local economies. There is great potential to build a new market economy on

⁶¹ COM(2020) 662 final.

recharging and refuelling services that consumers value and that support new business models, while generating considerable social and environmental benefits.

Accelerating the rollout of recharging and refuelling infrastructure is a key policy priority to ensure that the market uptake of zero- and low-emission vehicles is not impeded by a lack of infrastructure, as significant growth is expected over the coming years. Importantly, this infrastructure will need to future-proof, including the relevant technical components to support data exchange in real time and the creation of advanced digital services, so as to allow new business opportunities to emerge and user experiences to improve.

This plan identifies a number of supplementary measures to support the accelerated rollout of alternative fuels infrastructure in the EU. They are closely linked to policies **to tackle issues related to alternative fuel vehicles, vessels and aircraft, infrastructures, the energy production, networks, data and user services together**. They support the policy initiatives under the “Fit for 55” package, particularly the proposal to revise the CO₂ emission performance standards for passenger cars and light-duty commercial vehicles and the proposal for a new Regulation on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU of the European Parliament and of the Council, and moreover the proposals for the RefuelEU Aviation and FuelEU Maritime initiatives. They also link to important industrial policy initiatives, such as the Battery Alliance, the Clean Hydrogen Alliance and the upcoming Renewable and Low-Carbon Fuels Value Chain Alliance.. The Commission is also working on a proposal to revise the Energy Performance of Buildings Directive and will address aspects of rolling out alternative fuels infrastructure in its upcoming review of the Regulation on the TEN-T guidelines and its new urban mobility package later in 2021.

The Commission is ready to support the accelerated rollout of alternative fuels recharging and refuelling infrastructure, including through investments in research and innovation. A swift agreement on the proposal for a new Regulation on the deployment of alternative fuels infrastructure can be underpinned by extensive support for the market rollout of infrastructure under the many funds and financial instruments available at EU level. The Commission calls on Member States to make support for infrastructure rollout a key priority in planning measures under the Recovery and Resilience Facility. It underscores the benefits of updating related policies and regulations for planning and permitting at national and local levels. It is also working together with stakeholders to identify technological challenges, do the requisite standardisation work and set up a well-functioning governance of the ecosystem for battery-electric and fuel-cell electric vehicles. Altogether, this will make the EU's transport sector more competitive, ensure no consumers or regions are left behind, and it will drive forward the transition to sustainable and smart mobility.PAR