Sustainable Transport Forum

Report

Analysis of stakeholder views on key policy needs and options for action in Alternative Fuels Infrastructure deployment and consumer services

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1 Introduction

1.1 *Context of this report*

Demand for alternatively fuelled vehicles is quickly growing these days, particularly for battery-electric passenger cars. It corresponds to an increasing number of vehicle models available on the market[1], but also to increasing public health concerns and growing awareness about climate impacts. In order to reach its obligations under the Paris Climate Agreement, the EU has moreover legislated new CO2 emission performance standards for manufacturer vehicle fleets by 2025 and 2030. As a result, vehicle manufacturers have now also started to invest heavily in low- and zero-emission alternatives. In view of this, a rapid and wide market deployment and uptake of these low- and zero-emission vehicles is expected in the next years.[2]

The deployment of alternative fuels infrastructure must keep pace with these developments; it should not become a barrier for market development. Moreover, the infrastructure must not only be physically there, it must also be easy to use. In this context, new questions with regard to market design, quality requirements, interoperability and customer services arise and need answers. They affect a broad range of public and private stakeholders. Inevitably, these questions trigger a broad range of opinions and viewpoints. They concern in their essence the governance of the transition from a niche to a mass market in alternatively fuelled mobility.

1.2 *Rationale of this report*

To support the creation of the broadest possible information base for a sound reflection process, the Commission turned to the Sustainable Transport Forum, the formal expert group that assists the Commission on the implementation of the Alternative Fuels Infrastructure Directive.[3] Its members, together with the European Commission, decided to embark on a fact-finding mission, in order to gather a comprehensive overview of positions and viewpoints on needs and requirements for a future-proof policy framework for alternative fuels and infrastructure at EU level. As such, this process should also feed into future policy developments around the Directive on the Deployment of Alternative Fuels Infrastructure (Directive 2014/94/EU), particularly in view of helping to identify shortcomings of the current Directive in view of recent market and technology developments.

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[1] Transport&Environment, Report 'Electric surge: Carmakers' electric car plans across Europe 2019-2025' (Brussels), available here: https://www.transportenvironment.org/publications/electric-surge-carmakers-electric-car-plans-across-europe-2019-2025

[2] IEA, Global EV outlook 2019 (Paris), available here: https://www.iea.org/publications/reports/globalevoutlook2019/

[3] The Sustainable Transport Forum was established on 23 April 2015 by Commission Decision C(2015) 2583 final to provide the Commission with advice on all subjects related to the Alternative Fuels Infrastructure Directive. The Sustainable Transport Forum consists of representatives of the European Commission, representatives for the 28 Member States and 32 expert associations involved in Transport policy, which have been selected following a call for applications. Pursuant to Article 5(3) of the Decision establishing the Sustainable Transport Forum, the Commission can, on an ad hoc basis, call upon other experts to conduct its work.

Deliberations in the plenary of the Sustainable Transport Forum in 2018 structured this process into two main work streams:

1. Minimum requirements for alternative fuels infrastructure:
   o Deployment of alternative fuels infrastructure: progress, targets, methodologies and policy orientation;
   o Minimum quality requirements for alternative fuels infrastructure;
   o State of play of market: competition and market failures.
2. Consumer services and seamless payments:
   o Accessibility and availability of static and dynamic data regarding alternative fuels infrastructure;
   o Payment methods: ad-hoc and contract based (related to e-roaming);
   o Identification/authentication of users;
   o Cybersecurity;
   o Transparency of prices and billing;
   o Smart charging and vehicle-to-grid (V2G), including issues related to access to vehicle data.

The Commission services translated these topics into two informal questionnaires, which were sent out between 25 March and 15 May 2019 to all members of the Sustainable Transport Forum and additionally among 79 ad hoc experts. On 19 July the Commission sent out a first draft version of the Report for comments. 4 additional ad hoc experts contributed to the review of the draft report. The full list of consulted ad-hoc experts can be found in Annex 1. These have all been duly summarised in this report, which was subsequently adopted unanimously by the STF Plenary on 26 November 2019.

1.3 Methodology of the Report

This report provides a comprehensive overview and summary of the responses received. It seeks to give an informed overview of the broad spectrum of opinions on future needs and requirements for a policy framework on alternative fuels and infrastructure at EU level. It points out areas of emerging consensus among respondents as well as areas of continued divergence of opinions. The Report does not aim at critically evaluating proposed solutions, at delineating majority positions or at proposing specific solutions. Instead, it identifies problems that cut across many contributions, and highlights the spectrum of possible policy responses.

Since not all participants have replied to all questions, the total number of respondents may vary per question. Where percentages of respondents are provided (e.g. "85% of respondents agreed that..."), these percentages refer to the number of respondents that replied to that particular question with a specific position (referred to as 'respondents' – to avoid any misunderstanding, this excludes "No opinion / I don't know" responses), not to the amount of participants that provided answers to the Questionnaire overall (referred to as 'participants').

In other words, this report in general does not present blanks and "No opinion / I don't know"-responses in the statistics and graphs, as such responses / lack of response indicate either a lack of the required

knowledge to answer that question, or an indifference to the answer. Graphs do always show the total amount of responses received to a particular (sub-)question. Moreover, to avoid misrepresenting the view of a minority as a majority, the report clearly identifies when a question has a low response rate and it is therefore difficult to draw firm conclusions from the responses. Where possible, the report will also provide likely reasons for the low response rate (e.g. technicality of the question, question relates to one type of fuel only etc.).

1.4 Overview of stakeholders and respondents

In total, the first Questionnaire on minimum requirements for alternative fuels infrastructure received 83 responses, while the second Questionnaire on consumer services and seamless payments received 77 contributions. Since respondents were not obliged to reply to both Questionnaires, there are also a number of respondents that only replied to one or the other Questionnaire: 69 respondents replied to both Questionnaires, while 14 only replied to the first Questionnaire and 8 only replied to the second Questionnaire, adding up to a total of 91 unique responses. Since the Questionnaires were sent out to 60 STF members[4] and 84 ad hoc experts, the overall response rate is 63%.

In addition to the members of the Sustainable Transport Forum, the Commission also invited a set of other stakeholders on an ad hoc expert basis to respond to the questionnaire in order to obtain a balanced representation of stakeholders in terms of geographical coverage, types of stakeholders, fuel representation and transport mode. Particularly the second Questionnaire relates to more technical issues experienced mainly in the electromobility sector. For this reason, this exercise targeted particularly ad hoc experts from this sector. Since those electromobility experts were also invited to answer the first questionnaire, which contains more strategic questions in relation to alternative fuel infrastructure needs, natural gas and hydrogen stakeholders feel that the electromobility views are overrepresented in that part of the Report. They argue this to be particularly the case since many electromobility stakeholders were invited to participate individually (thereby adding to their numbers) while natural gas and hydrogen stakeholders mostly participated through their established European associations (thereby each time counted as one reply only). An overview of the represented fuels is provided for each of the questionnaires in Figure 1 and Figure 2 below.[5]

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[4] 28 Member States, Iceland and Norway + the 30 STF expert members that had confirmed their interest to participate to this exercise in the course of 2018. Hyer was excluded as it was no longer registered in the Transparency Registry, while Deutsche Lufthansa did not confirm its interest to participate to this exercise.
[5] Based on respondents' own replies to the questionnaires.

Figure 1: Questionnaire 1: represented fuels

Legend:
- Conventional fuels (petroleum derivatives, excl. LPG)
- Liquefied petroleum gas (LPG)
- Natural gas (CNG or LNG), incl. biomethane
- Synthetic and paraffinic fuels
- Biofuels
- Hydrogen
- Electricity (BEV and plug-in hybrids)
- None of the above
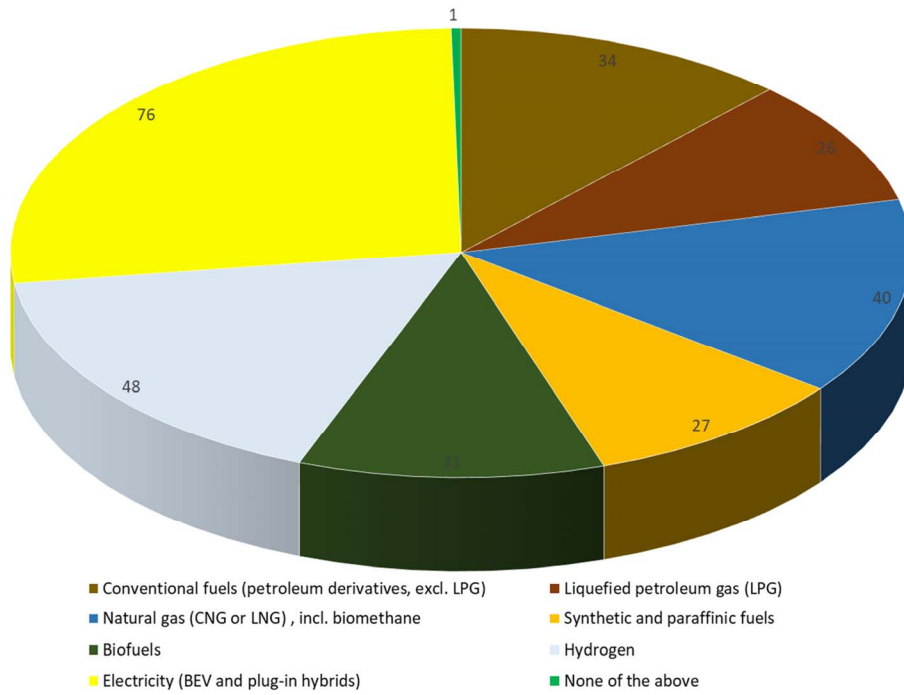
Figure 2: Questionnaire 2: represented fuels

Legend:
- Conventional fuels (petroleum derivatives, excl. LPG)
- Liquefied petroleum gas (LPG)
- Natural gas (CNG or LNG), incl. biomethane
- Synthetic and paraffinic fuels
- Biofuels
- Hydrogen
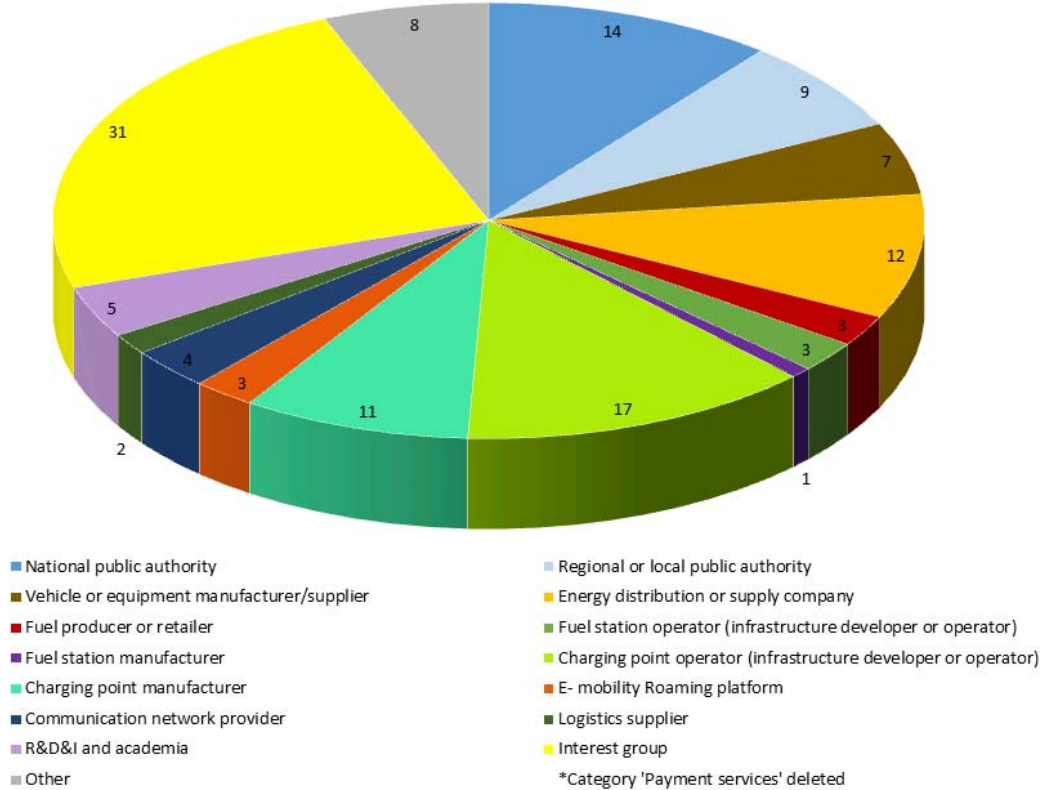- Electricity (BEV and plug-in hybrids)
- None of the above
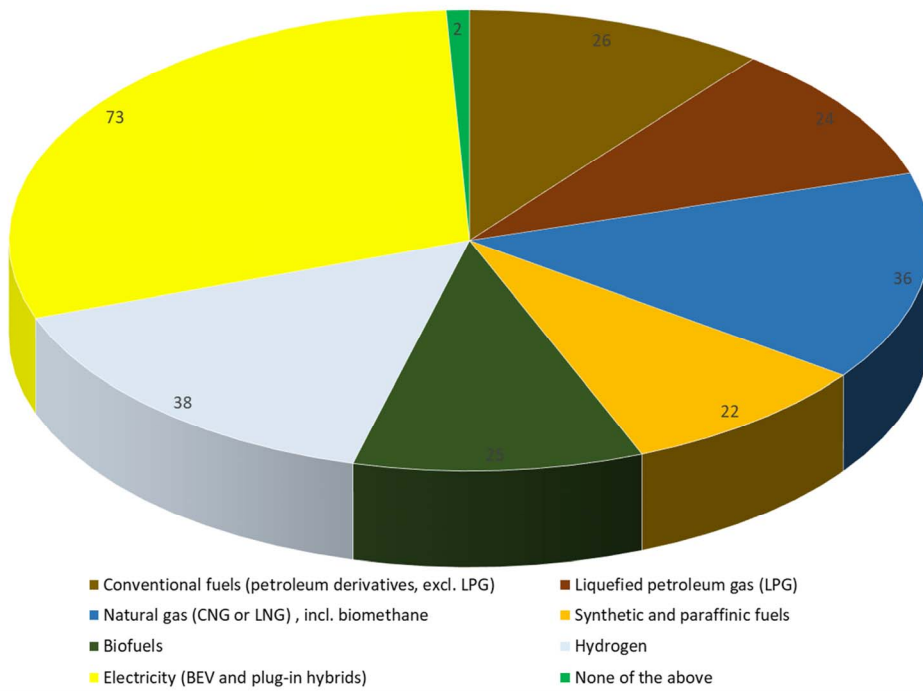
Amongst the respondents, there is a notable strong representation of Central Western European Member States. This reflects the more advanced state of the alternative fuels market in these Member States, particularly in the Netherlands. Respondents to the first Questionnaire are from 19 Member

States and three non-EU countries, while respondents to the second Questionnaire are from 22 Member States and three non-EU countries. A full overview of the represented countries for each Questionnaire can be found in Annex 1.

Figure 3 and Figure 4 provide an overview of the type of respondents per questionnaire.[6] Detailed graphs on fuel and transport mode representation can be found in Annex 1. Overall, the statistics indicate a balanced mix of respondents, with a strong representation of individual electromobility actors whereas the hydrogen and gas fuel sectors were represented mainly through their established European associations. Again, this can be explained by the fact that the second Questionnaire specifically addressed technical questions of relevance to electric mobility mainly. This also explains why electricity is the most represented alternative fuels among all respondents. Last but not least, there is a noticeable dominance of road transport actors amongst the respondents.

As a result of the strong representation of electromobility actors, fairly large numbers of participants to Questionnaire 1 (chapter 2 below) did not provide answers or noted their lack of knowledge to questions related to natural gas and hydrogen refuelling infrastructure.

Figure 3: Questionnaire 1: represented stakeholders

- National public authority
- Vehicle or equipment manufacturer/supplier
- Fuel producer or retailer
- Fuel station manufacturer
- Charging point manufacturer
- Communication network provider
- R&D&I and academia
- Other

- Regional or local public authority
- Energy distribution or supply company
- Fuel station operator (infrastructure developer or operator)
- Charging point operator (infrastructure developer or operator)
- E- mobility Roaming platform
- Logistics supplier
- Interest group
- *Category 'Payment services' deleted

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[6] Based on respondents' own replies, but corrected for obvious errors. The category "payment services" was deleted due to clearly inconsistent interpretation by stakeholders.

Figure 4: Questionnaire 2: represented stakeholders

Legend:
- National public authority
- Regional or local public authority
- Public transport operator
- Vehicle or equipment manufacturer/supplier
- Energy distribution or supply company
- Fuel producer or retailer
- Fuel station operator (infrastructure developer or operator)
- Charging point operator (infrastructure developer or operator)
- Charging point manufacturer
- E- mobility Roaming platform
- Communication network provider
- Private fleet operator
- R&D&I and academia
- Interest group
- Other

*Category 'Payment services' deleted

2 Requirements for deployment of infrastructure

2.1 *Deployment of alternative fuels infrastructure: progress, targets, methodologies and policy orientation*

2.1.1 Overall development of the network

Problem Description

The Alternative Fuels Infrastructure Directive sets minimum requirements for the deployment of alternative fuels infrastructure, including recharging points for electric vehicles and refuelling points for natural gas (CNG/LNG) and hydrogen fuelled vehicles. That Directive stipulates that Member States have to ensure that a sufficient number of publicly accessible recharging points and LNG and CNG refuelling points are put in place and to this end establish National Policy Frameworks (NPFs). Member States can add the number of hydrogen refuelling stations in their NPFs but this is not mandatory. The Directive does not, however, specify further what amount of infrastructure deployment should be understood as adequate, though its recitals suggest reference values for necessary average distance between CNG and LNG refuelling points on the TEN-T network and an approach on how to calculate the appropriate number of recharging points. A key motivation of the Directive is – as explained further in the recitals – to avoid fragmentation of the internal market due to uncoordinated market introduction of alternative fuels. Member States have to set long-term targets, objectives and supporting actions as part of their NPFs and coordinate where needed, particularly in view of cross-border connectivity.

The current market situation is characterised by ambiguity. On the one hand, there are many concerns that the current ambition in Member States in terms of future planning of infrastructure is not sufficient, on average. The Commission in its 2017 assessment of National Policy Frameworks of Member States concluded that the NPFs apply a broad variety of approaches to setting targets, objectives and support actions. It also concluded that NPFs lack, on average, the level of ambition needed to ensure that infrastructure deployment copes with expected vehicle uptake by markets, mainly in view of the period post-2020 where an accelerated uptake particularly of battery-electric passenger cars is expected. Meanwhile cities and regions are developing their own policies to rolling out relevant alternative fuels infrastructure. On the other hand, investment into alternative fuels infrastructure is still fraught by lack of profitability of the infrastructure due to lack of vehicle fleet demand. While the fleet for electric vehicles is ramping up to 1.5 million vehicles, representing a tenfold increase since 2014, when the Alternative Fuels Infrastructure Directive was adopted, growth in natural gas and particularly fuel-cell electric vehicles fleet has been sluggish. Altogether, this leaves the policy discussion with a considerable amount of uncertainty about the needs and requirements for the further development of the overall network and the corresponding policy framework.

Analysis of stakeholder views

Sufficiency of alternative fuels infrastructure

Respondents to the Questionnaire were invited to share their opinion and information on the question whether there are currently sufficient publicly accessible recharging and refuelling points in urban

agglomerations and other densely populated areas. The categories of infrastructure reflect those for which (national) targets are provided in the Alternative Fuels Infrastructure Directive (different types of infrastructure for electricity, hydrogen and compressed or liquefied natural gas). Figure 5 provides an overview of the responses to this question.

In general terms, a majority of respondents agreed that the current situation is insufficient or somewhat insufficient for all alternative fuels, though differences can be detected for the different fuels in different settings. It is not entirely surprising that the biggest shortcomings in infrastructure coverage are perceived in relation to those fuels and modes for which the Member States must set national targets under the Alternative Infrastructure Directive only on a 2025 or 2030 horizon.

Figure 5: Respondents' perception of current infrastructure coverage[7]
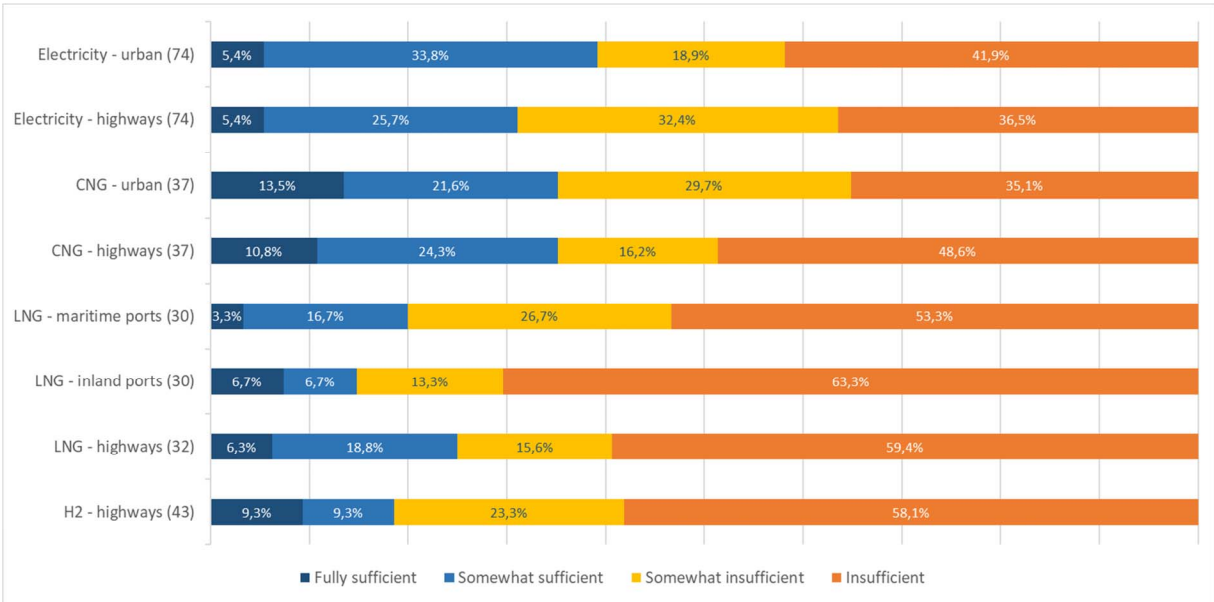
Perceptions slightly change when being asked about future (2030) prospects for the different alternative fuels (see Figure 6). A slight majority of respondents (54%) expects recharging infrastructure for battery-electric vehicles to be fully or somewhat sufficiently developed by that year in urban and other densely populated areas, and 59% come to that conclusion for the provision of highways with electric recharging infrastructure. Around 17-18% of participants, however, also do not have an opinion. For the two other fuels (CNG/LNG and hydrogen), the picture remains rather unchanged – in terms of all responses there is a considerable lack of knowledge or uncertainty visible as the "No opinion / I don't know" responses and participants not providing an answer make up between 50% to 70% of all responses.[8] Of those providing specific answers, a certain split between those seeing future developments as likely to be sufficient or somewhat sufficient or not sufficient or somewhat sufficient can be detected.

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[7] Total number of responses (out of a total of 83; excluding blanks and 'No opinion / I don't know') for each question between brackets.
[8] This may be explained by the participation of a large number of electromobility stakeholders to this exercise: see paragraph 1.4.

Figure 6: Respondents' perception of future infrastructure coverage (2030)[9]
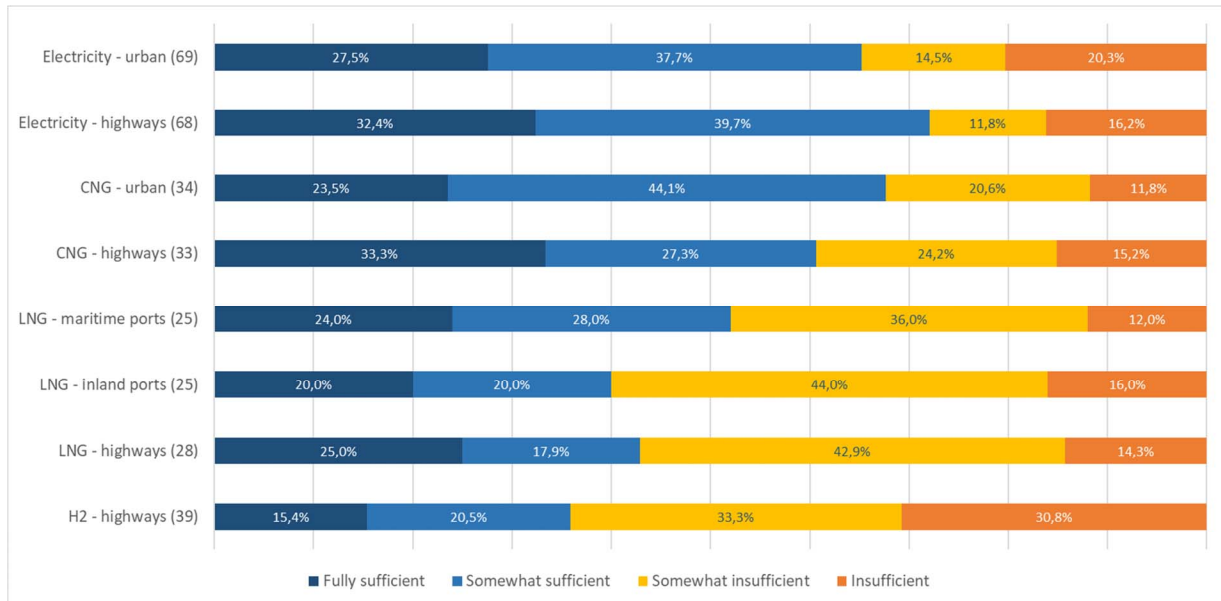
National Policy Frameworks or mandatory deployment targets

Subsequently, respondents to the Questionnaire were asked about their opinions and information on National Policy Frameworks (NPFs) of Member States. The Questionnaire asked whether the NPFs have been and will continue to be successful in delivering a sufficient number of publicly accessible infrastructure, corresponding to the expected uptake of alternatively fuelled vehicles.

82% of respondents (60 out of 73) noted that this mechanism will not or only in certain cases be successful, whereas 18% (13 out of 73) stated the opposite. Of the respondents with sceptical views, a majority of 70% (42 out of 60) noted possible success of NPFs in specific cases, but not overall, whereas 30% (18 out of 60) negated any potential future success. In sum, the majority of respondents can be qualified as having reservations about the approach to using national policy frameworks, which is a key implementation mechanism of the current Alternative Fuels Infrastructure Directive. Few respondents noted that support for the adoption of binding deployment targets should not be misunderstood as a request to do away with the national policy frameworks altogether, as these would still have value as a reporting tool if made more easily comparable through compulsory use of a template.

Respondents that expressed a sceptical view were invited to provide their views on possible other measures to be deployed at EU level to ensure full coverage with alternative fuels infrastructure. This open question generated 51 responses, which covered a broad range of actions. 21 of the overall responses, however, referenced explicitly the need for mandatory target setting at EU, national or regional level, to push the market, create a level playing field and ensure the necessary infrastructure

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[9] Total number of responses (out of a total of 83; excluding blanks and 'No opinion / I don't know') for each question between brackets.

everywhere in the EU. Three respondents explicitly argued against such a measure, noting differences in market and technology developments, whereas the other responses did not touch upon this topic. Some of the positive responses noted the need to differentiate targets for long-distance networks and urban areas. A common view was also that a new set of metrics is needed to underpin such a discussion, taking into account fleet volumes, traffic volumes, spatial requirements and available technology options. A few responses noted the need to explicitly provide fiscal incentives (taxation) and public finance support and ensuring mandatory requirements for hydrogen. More singular responses underlined topics such as opening up networks, conditions for equal market access, real-time infrastructure information, transparent rules for concession policy or ensuring common standards for communication protocols and services. Those groups of measures clearly attracted more discussion in the later part of the questionnaire.

The Questionnaire then turned to collect opinions and information on the relevance of setting concrete and mandatory requirements at EU level for the deployment of alternative fuels infrastructure by Member States. Again, the responses show a similar response pattern compared to the qualification of current and future market developments. Many respondents expressed the view that mandatory targets for their respective alternative fuels infrastructure would be needed. This may indicate that parties active on the alternative fuels market expect a strong declaration of support for the entire alternative fuels sector from the European Union and Member States.

With regard to the relevance of mandatory adoption of deployment targets for electric recharging infrastructure a vast majority (73% or 61 out 83) agreed to the relevance for urban agglomerations and other densely populated areas, as well as for highways (76% or 63 out of 83). In both cases a small fraction of the total contributions (11% or 9 out of 83) noted that this was not relevant.

In relation to CNG refuelling stations in urban areas, more than half of the participants did not provide an answer or replied "No opinion / I don't know" (around 55%, or 46 out of 83). Of those 37 participants providing specific responses, those considering it relevant were twice those considering it not relevant: 25 respondents noted the relevance (or around 68% of all specific responses), whereas 12 negated it (or around 32% of all specific responses). Similar results were obtained for the provision of CNG stations at highways, LNG refuelling in maritime ports and inland ports and highways.

Respondents that considered mandatory adoption of deployment targets for alternative fuels as not relevant were asked through an open question to provide further information. In total, this answer received 28 responses. 11 out of these argued that there should not be mandatory action on roll-out of CNG and LNG infrastructure as these were fossil fuels and not in line with the long-term decarbonisation prospects for transport[10]. These respondents moreover felt that focus should be on the roll-out of infrastructure for electrification, whereas hydrogen was considered to become only relevant in the longer term. Four contributions specifically underlined the need to avoid simple target setting, but use metrics based on fleet volumes and infrastructure demand. Eight contributions objected to mandatory

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[10] To this argument, representatives of natural gas fuels however rebut that CNG and LNG infrastructure can in the future also accommodate bioCNG and bioLNG and, in some cases, hydrogen blended with natural gas.

targets given the state of play of markets, but to address conditions for open market development. Few respondents also noted that, even if not supported by a target, any efficient planning should take into account the status of the electricity system. To this end, DSO's argue for early involvement in infrastructure planning, while other respondents argue that DSOs should publish clear maps of their grid (indicating *inter alia* possible congestion areas, state of digitalisation and flexibility of the grid) to allow market actors to plan their infrastructure investments accordingly).

Also for hydrogen, a large share of participants did not provide an answer or replied "No opinion / I don't know" (40 out of 83, or around 48%).[11] Of those providing a specific answer, a majority supported the adoption of binding requirements. 31 respondents noted this relevance (or around 72% of all specific responses), whereas 12 respondents negated the relevance (around 28% of all specific responses).

Geographical scope of EU policy for the deployment of an alternative fuels infrastructure network

Currently, the Alternative Fuels Infrastructure Directive focuses in its requirements for electric recharging points on urban agglomerations and other densely populated areas. However, for LNG infrastructure it focuses in its requirements on the TEN-T Core Network, while for CNG infrastructure it targets both urban agglomerations and the TEN-T Core Network. Member States who want to deploy hydrogen infrastructure are free to decide the spatial scope of action. The survey asked participants about their opinions and information on the suitable geographical scope of a European policy for the deployment of an alternative fuels infrastructure network.

There was a clear response to this question when it comes to recharging infrastructure. For electricity, a majority of 72% (60 out of 83) considered it necessary to have the whole transport network as geographical scope. Only 12 % (10) of participants considered the complete TEN-T network as relevant. Nobody was of the opinion that the – current – focus on the core TEN-T was sufficient. 16% (13) of participants did not provide an answer or replied "No opinion / I don't know".

As with the other fuel network specific responses, participants more often neglected to respond or indicated 'No opinion / I don't know' with respect to gas- (CNG/LNG) and hydrogen-related questions compared to electricity.[12] Of those providing specific responses, 66% (21 out of 32) noted a preference for the whole transport network for CNG refuelling stations, whereas only 27% (9 out of 33) saw this as the most relevant option for LNG refuelling. For LNG the combination of Core and Comprehensive network got the most support (39% or 13 out of 33), followed by the Core network only (33%, 11 out of 33). With respect to the scope of the Directive in relation to hydrogen infrastructure, 37.5% of respondents (15 out of 40) supported the complete network, while 40% (16 out of 40) supported both the Core and Comprehensive Network and 22.5% (9 out of 40) the Core TEN-T network only.

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[11] This may be explained by the participation of a large number of electromobility stakeholders to this exercise: see paragraph 1.4.
[12] This may be explained by the participation of a large number of electromobility stakeholders to this exercise: see paragraph 1.4.

2.1.2 Methodologies and targets for deployment of alternative fuels infrastructure

Problem Description

There has been an ongoing debate about targets, requirements and corresponding methodologies for the deployment of alternative fuels infrastructure. The original Commission proposal for AFID back in 2013 contained mandatory minimum requirements for recharging and refuelling points based on population density and car stock. As an example of the latter, it required that there should be one publicly accessible recharging point for every ten electric vehicles. The co-legislator, however, rejected this approach. The recitals of the Directive kept some of them as recommendations; the others continue to influence the further discussion about roll-out of alternative fuels infrastructure. The Joint Research Centre moreover suggested certain values as part of its assessment of National Policy Framework adopted by Member States. The Questionnaire inquired whether these metrics were still considered relevant by stakeholders.

Analysis of stakeholder views

Respondents to the Questionnaire were invited to share their opinions and information on the current set of recommendations, either included in the recitals or widely referenced in the public discussion following the original proposal of the Commission. Concerning the recommendation in the Alternative Fuels Infrastructure Directive to have one publicly accessible recharging point for every ten electric vehicles, specific responses were rather split. 57% of respondents (or 40 out of 70) noted support for the recommendation, whereas 43% (or 30 out of 70) did not. 16% of all participants (13 out of 83) did not provide an answer or replied "No opinion / I don't know". Therefore, even though a slight majority of respondents were in favour of the current recommendation, further review of this recommendation is warranted, for instance to take account of other considerations, such as their even distribution.

Regarding the Joint Research Centre's assessment criterion of having one recharging point at least every 60 km on the Core TEN-T Network, the picture of responses has been more conclusive. 77% of all respondents (or 53 out of 69) agreed to this recommendation, whereas only 23% (16 out of 69) noted their disagreement. 17% of participants did not express an answer or replied "No opinion / I don't know".

Responses were also split with regards to the Joint Research Centre's assessment criterion to have one CNG recharging point per 600 vehicles. Only about a third of participants responded to this question; out of the 27 specific responses to this question, 59% (or 16 out of 27) supported this recommendation, whereas 41% (or 11 out of 27) did not. Even though it returned a similarly low amount of responses, replies to the question whether the AFID recommendation to deploy one CNG refuelling station every 150 km along the TEN-T core network is appropriate, were more conclusive. Here 83% of respondents (or 24 out of 29) supported this recommendation, whereas 17% (or 5 out of 29) did not.

For the LNG AFID recital recommendation on having a LNG refuelling opportunity at least every 400 km on the TEN-T core network, there was a similar broad support among respondents: 81% (or 22 out of 27) noted their agreement.

All 22 specific responses supported the installation of fixed and mobile LNG installations in maritime ports of the TEN-T core network to ensure proper circulation of LNG maritime vessels. Of 23 specific responses, 20 supported the installation of fixed and mobile LNG installations in inland ports of the TEN-T core network to ensure proper circulation of LNG inland waterway vessels.

Concerning hydrogen refuelling infrastructure, the relevance of having a refuelling station every 300 km –as used by the JRC to assess the Member States' National Policy Frameworks– along the TEN-T Core Network found broad support among respondents: 79% (or 30 out of 38 respondents) noted their agreement. However, some representatives of the hydrogen industry indicate the need for a shorter intermediary distance requirement (e.g. 150 km).

A fairly large numbers of participants (> 50%) either did not provide an answer or replied "No opinion / I don't know" to questions related to natural gas and hydrogen refuelling infrastructure minimum requirements.[13]

In terms of open follow-up question, 42 respondents sent written comments on the adequacy of the current set of recommendations. Independent of their view on mandatory deployment targets, the respondents to this open question generally indicated a need to review one or more of the currently proposed deployment metrics, particularly those related to average minimum distances between recharging or refuelling points. But also, the ratio of one recharging point per ten electric vehicles was questioned in view of the expected ramp-up of electric vehicles. There was also a conceptual critic that a fixed vehicle-to-infrastructure ratio could not adequately represent the differences in market conditions, but should be replaced by more elaborated metrics, including those differentiating traffic volumes and actual demand for alternative fuels vehicles. Respondents also indicated a need to reflect changing recharging patterns and needs, including improvements in battery technologies, the actual utilisation rates of slow (home, office) and fast (on the road) recharging points and other emerging charging technologies (such as 'dynamic' conductive charging, either from above through overhead lines or from below via conductors in the road, for which the vehicle does not have to stop at a recharging point[14]). A few respondents also objected to any such metric. An additional recurrent comment was to focus not only on publicly accessible infrastructure, but also on large private parking garages and other forms of private parking infrastructure.

2.1.3 Deployment of alternative fuels infrastructure in urban areas

Problem Description

Urban areas are in different ways specific for the deployment of alternative fuels. Around 70% of the EU's population live in urban areas by now. The vast majority of daily trips take place in urban settings, many of them short-distance based. On the contrary, long-distance trips make up a relatively small

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[13] This may be explained by the participation of a large number of electromobility stakeholders to this exercise: see paragraph 1.4.
[14] Some respondents noted that the notion of 'recharging point' in the Alternative Fuels Infrastructure Directive is not appropriate to cover such dynamic recharging solutions.

amount of the overall average car use. At the same time, implementation conditions for alternative fuels infrastructure in cities differ widely. Moreover, besides electrifying their own public fleets and supporting increased use of public transport and captive fleets in order to reduce emissions, local public authorities are experimenting with different approaches to facilitating the uptake of alternatively fuelled vehicles and related infrastructures, including by giving consumers basic rights to have access to recharging or refuelling infrastructure.

In this context, it is important to reflect if there are specific needs with regard to the implementation in urban areas - including links to urban planning and permitting procedures - that could require further requirements at European level for specific measures to enable deployment of alternative fuels infrastructure in urban settings. It is also important to distinguish needs for the different alternative fuels. Currently, the Alternative Fuels Infrastructure Directive does not include requirements that are more specific than the requirement that vehicles should be able to circulate in urban and sub-urban areas without problems.

Analysis of stakeholder views

A majority of 71% of respondents (55 out of 77, or 66% of all 83 participants) supported the view that additional specific measures at EU level are needed to enable deployment of alternative fuels infrastructure in urban and suburban areas. 16% of respondents (12 out of 77 or 14% of all 83 participants) negated this need. 28 written follow-up responses were received for this question. In their majority respondents pointed to the strong role of municipal authorities for influencing the roll-out of infrastructure, particularly through clear and integrated planning and permitting procedures, long-term roll-out strategies defining minimum accessibility to public recharging infrastructure, defining smart infrastructure requirements and providing adequate user tools, such as a good digital mapping. It is in urban agglomerations that accords with key public or private employers for corporate fleet conversion and infrastructure provision can be made. Urban agglomerations also contain many large parking lots where cars are parked for longer periods, such as park&rides, large shopping centres, convenience stores and supermarkets, which all provide excellent opportunities for a quick roll-out of off-street recharging infrastructure. A few respondents also highlighted the role of local public authorities for setting up targeted support programmes. One respondent expressed the view that stationary wireless charging at public parking places should also be considered as an option.

In view of providing a network of publicly accessible recharging points at municipal level, different organisational approaches are possible and in use.[15] Respondents did not clearly outline a specific preference for one particular approach. As Figure 7 shows, the largest number of respondents supported a mixed public-private approach, followed by an approach to tendering out one or several interoperable networks.

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[15] In relation to the response option 'municipality via public company', reference is made to Article 33 of the recast Electricity Directive 2019/944 which provides that, except in the cases and under the conditions described in that Article, distribution system operators shall in principle not own, develop, manage or operate recharging points.

Figure 7: Best approach to achieve a comprehensive publicly accessible recharging network at municipal level[16]
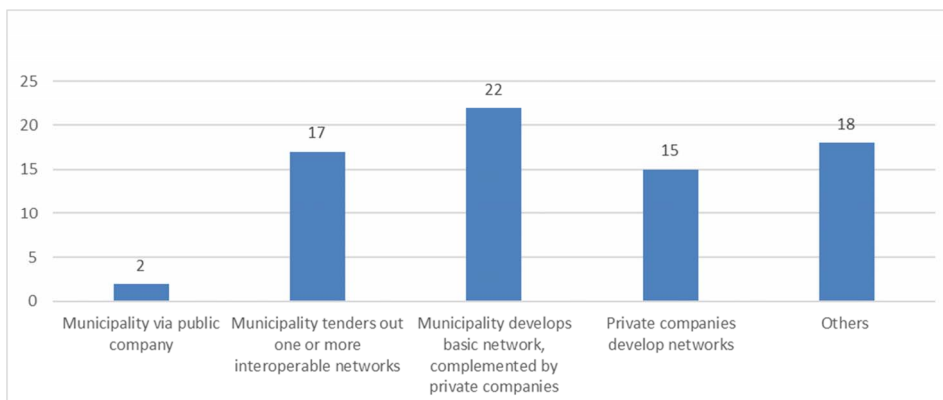
The Questionnaire asked whether all EV-users should have a principled right to request a publicly accessible recharging point near their residence. Here, the overall responses were rather positive, with 61% (37 out of 61) of all respondents supporting this measure. 39% (or 24 out of 61) rejected this measure. Follow-up information outlined a broad diversity of opinions as regards a possible implementation of such a requirement, with quite a few responses pointing to a right to charge, compared to the right for a recharging point. Access to e.g. fast DC charging could also solve issues.

2.1.4 Principal policy orientations for further development of the network

Problem Description

Currently, the markets for the alternative fuels with distinct infrastructure requirements are characterised by different degrees of market maturity, also taking into account the situation, needs and prospects for use of alternative fuels in different modes of transport. For example, all major European vehicle manufacturers are now investing heavily into the electrification of their light-duty vehicle fleet. Also, regarding main lines, 60% of the European rail network is already electrified, operating 80% of traffic.[17] In those cases, where electrification is difficult, there are also promising developments on zero-emission alternatives -such as hydrogen or hybrid (electric/LNG) trains- to replace diesel trains. However, in other markets for heavy-duty vehicles, waterborne or aviation it is less clear how the market uptake of alternative fuel technologies will develop over the next decade and which alternative fuels will prevail.

A discussion about the principal needs of alternative fuels infrastructure is hence fraught by considerable uncertainty about future market needs and the related possibility to invest either too much or too little into the further development of the network.

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[16] Total number of responses (out of a total of 83) provided above the bars.
[17] European Commission (2017) Electrification of the transport system; Report and studies.

Analysis of stakeholder views

Against this background, participants of the survey were invited to share their opinions and information on where they saw a need to accelerate the roll-out of relevant infrastructure, and on which time scale (rather by 2025 or 2030). Figure 8 provides an overview of the responses.

Figure 8: Perceived need for accelerated roll-out of alternative fuels infrastructure at different time horizons
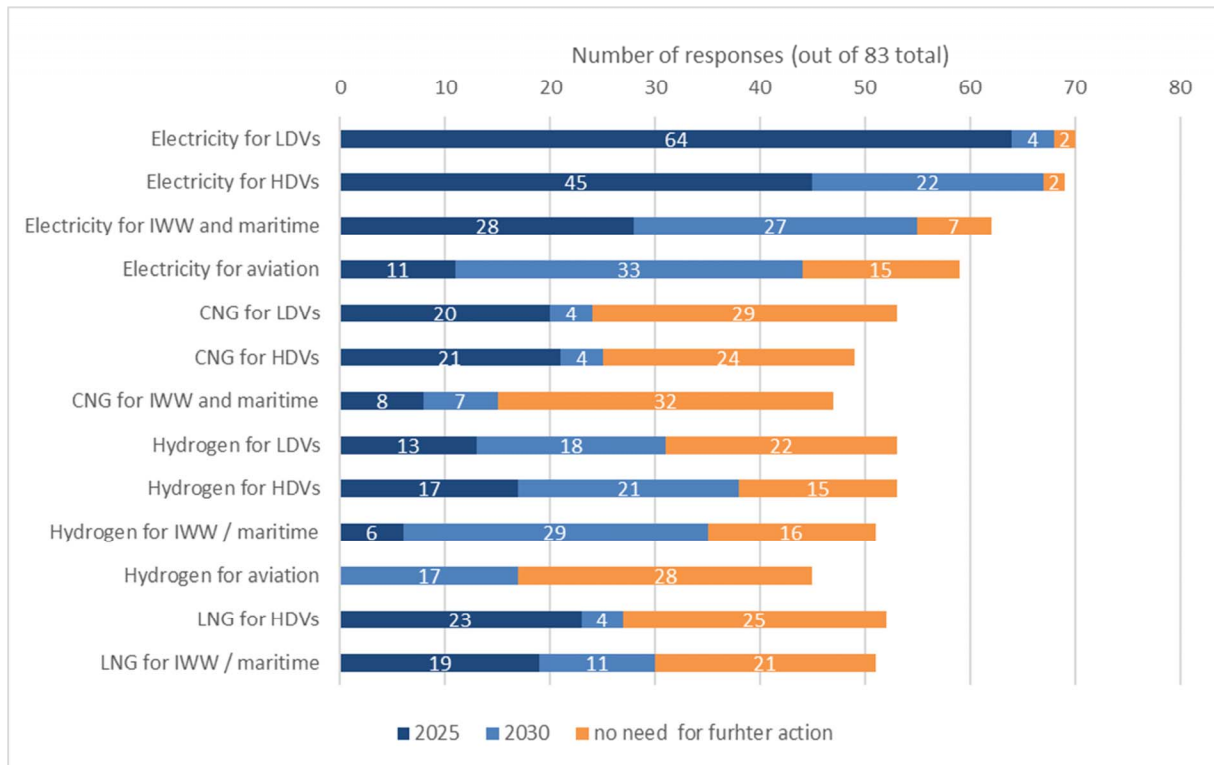
The vast majority drew a clear picture on needs to accelerate the roll-out for recharging infrastructure for light-duty electric vehicles by 2025. A majority also conceded this need for recharging infrastructure for heavy-duty road vehicles, whereas the view was split on the time span for electricity for inland waterways and maritime transport, with more or less the same number of respondents noting both 2025 and 2030 as important points of orientation. However, only a few respondents noted that there was no need for action. For aviation, infrastructure needs related to electricity were majorly related to 2030.

This question returned comparatively fewer responses for natural gas and hydrogen, and in these responses a larger number of respondents noted that there was no need for further action. However, there was also a consistent view that the needs for accelerating the roll-out of hydrogen refuelling infrastructure would rather arise by 2030. In addition, it was suggested to broaden the scope of the Directive in order to include the rail sector, where hydrogen is already used as a zero-emission alternative to diesel. Moreover, on natural gas, there is a consistent pattern that respondents either see a need to accelerate infrastructure roll-out by 2025 or not at all, a view that was consistently shared by the majority for all transport modes.

Participants were then asked which specific aspects related to alternative fuels infrastructure in their view require additional policy action at EU level. The responses are summarised in Figure 9 below. The topics are covered in more detail in other sections of this report.

Figure 9: Which specific aspects related to alternative fuels infrastructure require additional policy action at EU level?[18]
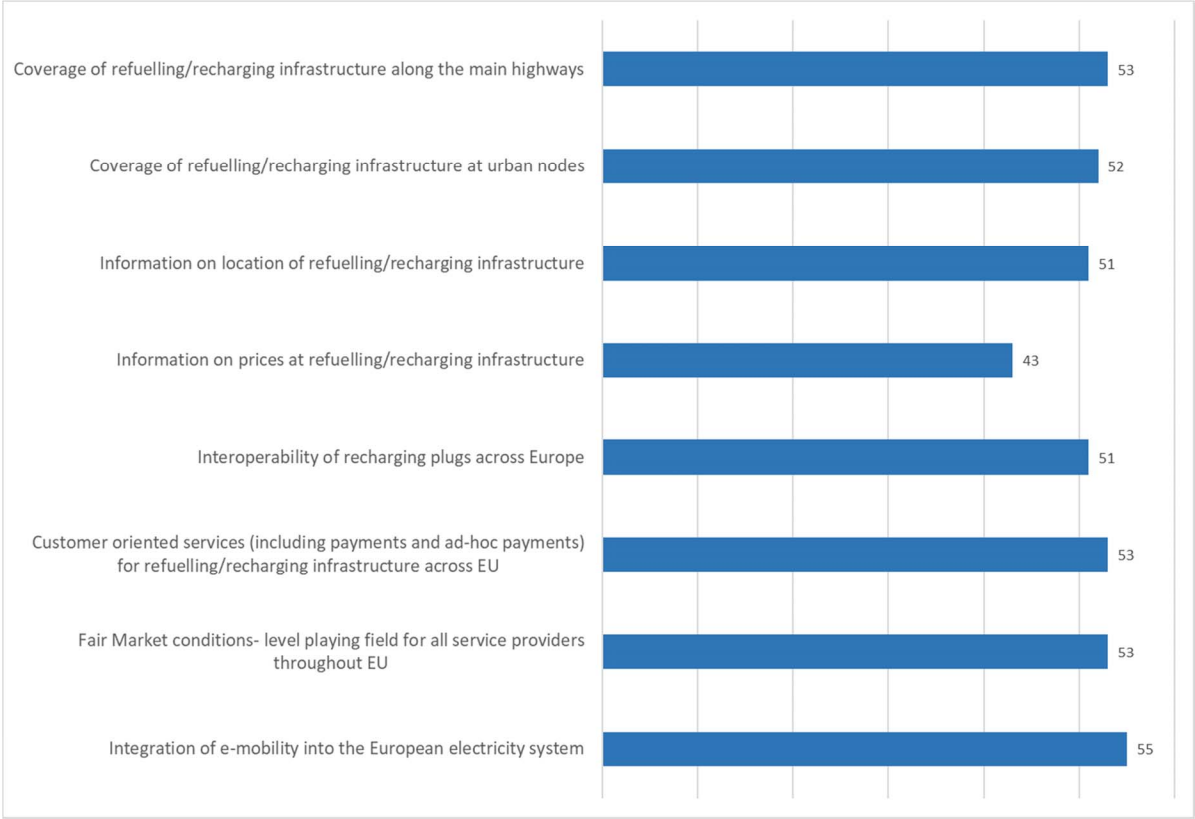
Last but not least, the Questionnaire inquired whether AFID covers all relevant fuels and transport modes. The majority of respondents believes it does: see Figure 10.

Figure 10: Does AFID cover all relevant fuels and transport modes?[19]

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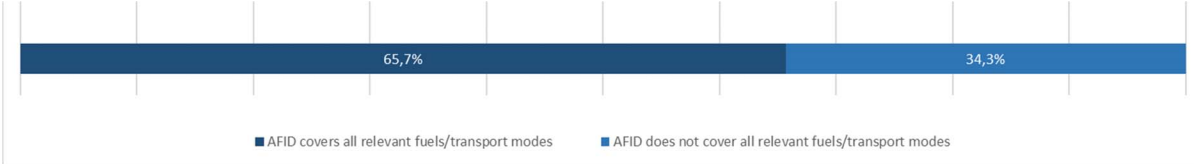
[18] Multiple replies were possible. The numbers next to the bars indicate the number of unique respondents (out of a total of 83) that believes these aspects require further policy action at EU level.

[19] 70 participants (out of a total of 83) replied to this question.

2.2 State of play of market: competition and market failures

This section aims at identifying possible market barriers for private investments in recharging/refuelling infrastructure. For the recharging infrastructure, it also addresses possible market barriers when it comes to the operation of recharging points, namely for e-mobility service providers (EMSP).

2.2.1 Investments in recharging and refuelling infrastructure

Problem Description

Investments in alternative fuels infrastructure in many Member States is still largely driven by public authorities and public funding. However, in the long run it is expected that the investments will be driven by private operators. In this chapter, stakeholder views on current funding needs for different alternative fuels infrastructure are presented as well as their views on barriers that currently prevent or limit private investments.

Analysis of stakeholder views

When it comes to investments in alternative fuels infrastructure (Figure 11), most stakeholders state that public support is required and that market barriers exist for alternative fuels infrastructure investments. However, the results vary significantly among the different recharging and refuelling infrastructures.

Figure 11: Perceived funding needs[20]
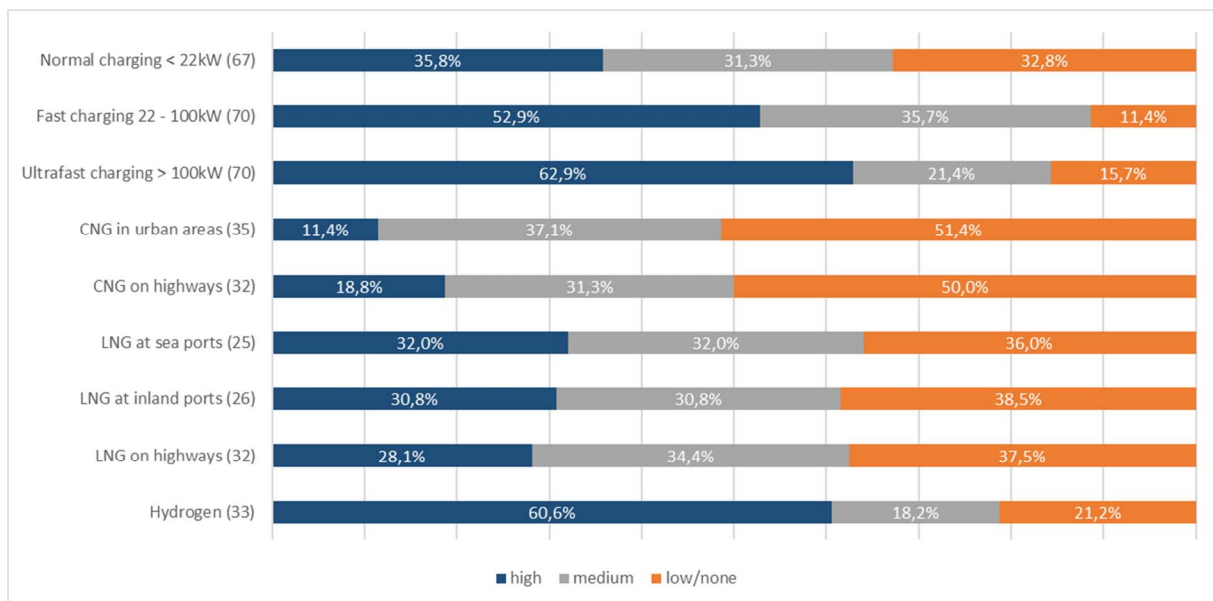
80% of participants responded to questions regarding recharging infrastructure. Among those respondents, two thirds believe that public funds are required for normal charging infrastructure while

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[20] Total number of responses (out of a total of 83; excluding blanks and 'No opinion / I don't know') for each type of infrastructure between brackets.

significantly more - around 90% - see funding needs for the significantly more expensive fast recharging points (above 22kW). A similar picture can be observed when it comes to market barriers that 55% of respondents feel exist for normal recharging while around 80% see market barriers for fast charging. Existing concession practises are viewed as being critical by around 50% of respondents.

For hydrogen 40% of all participants responded to the corresponding questions. Of those, around 80% indicated market barriers and funding needs for hydrogen infrastructure.

For roadside gas infrastructure only 32% of participants responded to this question, of which around 50% indicated a need for public support for CNG refuelling in urban areas and on highways while around 60% see this need for LNG stations on highways.

Representatives of the natural gas industry pointed out that infrastructure for CNG/LNG refuelling is still highly concentrated in a few Member States, and this requires continuing the discussion about natural gas infrastructure requirements to ensure minimum coverage across the EU, including possible financial support needs.

The main market barriers mentioned by respondents can be roughly categorised as follows:

- Market uptake of vehicles: current small number of alternatively fuelled vehicles do not allow for a profitable investment in charging/refuelling infrastructure at this stage of market development.
- Licencing: current licencing and public procurement processes for recharging stations often favours 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 the following issues were reported by respondents:
  o Concession timing is not aligned with long term investments for recharging/refuelling infrastructure, meaning that the concession time is sometimes shorter than the lifetime of the infrastructure;
  o Tenderers are not always aware of required upgrades to the electricity grid that can lead to considerable additional costs and time-consuming procedures that directly affect the business case of the tenderer;
  o Transparent and competitive procedures are not always used for concessions, especially on highways. For example, in some Member States the petrol stations concession holders were also granted concession (sub-concessions) for recharging infrastructure without a prior open tendering procedure. Furthermore, concessions and sub-concessions do not always have the same timeframe.
- National and local regulations for the instalment of alternative fuels infrastructure: many stakeholders criticise what they consider to be an overregulation on national and regional level. Regulations that can differ greatly even within Member States and include restrictions to build infrastructure in certain areas (building permits), lengthy permitting procedures involving many different administrative procedures and actors which make procedures unnecessarily costly.

- Differing national tax systems, for example related to VAT or electricity taxes, risk to render the business case for all alternative fuels and investments in related infrastructure negative.
- DSO tariffs and network capacity: network charges/connection fees can be very high, especially if they are capacity-based and hence risk to render the business case negative. In addition, lengthy procedures occur if the grid needs to be expanded to cover for additional power demand.
- Within apartment buildings, interested parties face great problems if they want to install recharging points, either with their landlord or the building community.
- Without public incentives, there is also hardly a business case to offer centralised charging for common use in shared commercial buildings.

For LNG in maritime and inland ports only 25 participants responded of which slightly more than 60% indicated funding needs for refuelling infrastructure. While not part of the question, two respondents also explicitly raised the need for support for shore-side electricity connections. The market barriers for investments in ports are similar to those for road transport:

- A lack of harmonised procedures and standards across Europe for permitting LNG stations in ports lead to very lengthy and costly approval processes;
- Overall costs for installing infrastructure is still very high and from a pure profitability viewpoint does not justify any investment, especially considering the low number of "clean" vessels/ships on the market,
- For an overall LNG strategy in waterborne transport it will also be crucial to address the overall supply scheme including bunkering facilities;
- For onshore electricity supply, high electricity taxes for shore-side electricity make its use economically unattractive, especially considering that on board fuels are tax-free.

Respondents made a number of proposals with respect to possible policy measures to overcome barriers to investment in charging and refuelling infrastructure:

- Accelerate the uptake of alternatively fuelled vehicles and vessels, e.g. by purchase subsidies, tax incentives, and expose the transport sector to CO2-pricing, which will increase the demand for charging services and hence the profitability of recharging infrastructure.
- Provide increased funding for currently not profitable investments, possibly linked to mandatory targets for alternative fuels infrastructure to boost public investment in infrastructure.
- Authorities should introduce competitive tendering processes for the construction and operation of recharging infrastructure. This includes concession policies that enable competitive bidding without favouring incumbents such as local utilities, especially in urban areas and petrol station operators on highways.
- In order to limit the need for grid extension and hence connection costs / approval times, national regulation should - in line with the recast of the Electricity Directive (2019/944) – fully enable DSOs to become active network managers. In that respect they should be enabled to procure flexibility and enable smart charging and vehicle-to-grid while maintaining their role as

neutral market facilitator. At the same time, grid expansion processes should be accelerated on the national level.

- Planning and construction of infrastructure should be facilitated, e.g. by streamlining planning and approval processes at least within Member States. This also applies to streamlining and facilitating connection of recharging infrastructure to the grid;
- Regional authorisation processes could be shortened if more European harmonisation with respect to recharging points was established, such as "European type approval" for recharging points.
- The setting up of joint ventures and collaborations between industry and regional authorities should be encouraged as a way to share the initial risk of low profitability of the infrastructure.
- A swift transposition of the Energy Performance in Buildings Directive (EPBD) is required to overcome barriers for charging in apartment buildings. Additionally, a "right to charge" (a right to install a recharging point in an apartment building without mandatory agreement of all/majority of the owners of the other apartments in that building) could be established and financial incentives could be considered.

2.2.2 Market barriers with respect to the operation of recharging points

On these particular questions only around 60% of participants provided answers. The percentages given in this section always refer the number of participants who expressed an opinion on the questions.

Problem Description

The market for recharging infrastructure and related services shows certain features of network industries. This is particularly true for highway and urban on-street infrastructure, which has features of a natural monopoly: high sunk costs (mainly in case of fast and ultra-fast chargers) and, most notably, a non-duplicable network. In such cases, it is essential to avoid abuse by the operators of such infrastructure of their dominant position, e.g. in the form of excessive prices for consumers or bad service. This can be avoided in a number of ways.

First and foremost, the development and operation of highway and urban on-street infrastructure is almost always subject to a concession granted by public authorities. As already addressed in the previous chapter, one way to avoid uncompetitive behaviour is therefore: (i) to award concessions in a competitive way, while also limiting them in time and possibly dividing interesting locations to different bidders, and (ii) to agree on clear conditions in the concession agreement, e.g. on maximum prices or minimum uptime requirements. These aspects will also be the subject of the 'Guidelines on minimum quality requirements for infrastructure and best practices for public tendering', which the STF should deliver in the course of 2020.

Secondly, in the case of a non-duplicable network, there is a risk that the operators that are able to secure the best locations for their infrastructure obtain an important advantage over their competitors. If consumers are dependent on one specific Charge Point Operator (CPO) for all the on-road charging in their city, there is a risk that this CPO can dictate the terms of their relationship as consumers have no alternative. In fact, many CPOs *de facto* require consumers to conclude a contract with them in order to

be able to recharge at their station, by making ad hoc charging (albeit mandatory under art. 4(9) AFID) as user-unfriendly as possible – for instance via cumbersome authentication requirements and limited payment options. A possible strengthening of the ad hoc requirement is addressed in chapter 3.2 below. In addition, the Alternative Fuels Infrastructure Directive contains another important safeguard for consumers, against abusive pricing: art. 4(10) AFID requires prices for recharging to be reasonable, easily and clearly comparable, transparent and non-discriminatory.

It is argued, however, that these requirements fall short of offering competitors fair and transparent access to the infrastructure, in order to ensure competition in service provision. Such 'open network access' is, however, common in other network industries, such as energy and telecommunications. When it comes to recharging, different commercial actors can be involved in a charging service on a publicly accessible recharging point. Next to the CPO (who is very often also the owner of the infrastructure), this can also include an EMSP that offers specific services to its customer (EV-user), such as payment handling, etc. Such EMSPs often face problems when they want to offer their services at recharging points operated by third parties. In most Member States it is the CPO that decides if and which EMSPs are allowed to offer services at their recharging points and under which conditions. 85% of respondents indicated that this is indeed a market barrier for EMSPs, who are either not allowed to offer their services at all or face very high fees to do so. However, opinions are divided if these barriers are actually barriers to competition or if this is just a normal market feature where owners of a property can decide if and with which other market players they wish to cooperate.

A second potential market barrier for EMSPs could be established on the vehicle side. In case of a future automatic authentication of a vehicle, vehicle manufacturers could establish by vehicle design unfavourable conditions for third party EMSPs to offer their services for a particular vehicle. This problem may specifically arise in the future in case the vehicles use standard ISO 15118 with a certificate that belongs to the vehicle manufacturer/EMSP. Around 50% of respondents signalled that such practices are indeed in place by vehicle manufacturers (see also chapter 3.2.2).

Analysis of stakeholder views

As already outlined above, the possibilities for EMSPs to offer their services on recharging points can be limited in most Member States by the CPO. Some Member States have however introduced regulation that obliges CPOs to grant non-discriminatory access to all EMSPs to their recharging points, either as a general rule or as part of the Member States' tendering / concession policy. Approximately 40% of respondents support policies that separate market roles at least to some extent while the other 60% see little benefit in it or dismiss it altogether.

Proponents of non-discriminatory access suggest that this will boost competition in the electromobility market and will hence contribute to a better consumer experience and possibly lower prices. If the markets are not opened, they argue, there is a risk that monopolistic or oligopolistic structures will develop in the EMSP market that would then be dominated by the vehicle manufacturers or large CPOs also acting as EMSPs.

However, opponents of measures to oblige CPOs to grant access to all EMSPs on a non–discriminatory basis argue that this would be an unjustifiable intervention into the CPO's commercial freedom. They furthermore stress that investments in recharging infrastructure are currently not profitable and that offering mobility services on their recharging infrastructure is an essential part of their business case. If the revenue stream from mobility services could be taken by third parties who do not bear any investment risk, investments in recharging infrastructure would become riskier and even less profitable. Investors would then either reduce their investments or ask for higher public funding which would risk delaying the establishment of a recharging infrastructure across Europe. Other arguments against any regulatory action in this area refer to the early stage in market development and the risk to overregulate at an early stage as well as to the interest of CPOs to attract as many EV-users as possible making arrangements with a variety of EMSPs a profitable option in the future.

Respondents also flag a lack of interoperability and the need for harmonised communication protocols between the different market actors, including roaming platforms. Interoperability is hence considered as a precondition for open markets to develop (see also chapter 2.3 and 3.4.2 for further details).

With regard to roaming platforms three quarters of respondents consider that all or most platforms grant non-discriminatory access to their platforms while 22% say that some do and only 4% (or 2 respondents) claim that none does. Those who see problems refer to non-standardised communication protocols and to high roaming fees that risk to be a market obstacle, especially for smaller EMSPs as in many cases the roaming fees decrease in dependence of the number of usages. In some Member States (e.g. in Poland and Czech Republic) roaming platforms are not yet available effectively limiting market access for EMSPs.

2.3   Minimum technical requirements for alternative fuels infrastructure

The Alternative Fuels Infrastructure Directive aims to make it as easy to recharge or refuel an alternative fuels vehicle or vessel anywhere in the EU as is currently the case for its conventionally fuelled predecessors.

Many divergent aspects are important for enabling this, and will in turn be addressed in this section:
- (i) standardizing and ensuring interoperability of infrastructure, which allows consumers to recharge/refuel on a 'foreign' network as he does on his domestic network;
- (ii) limiting the technical downtime of infrastructure;
- (iii) distant monitoring of infrastructure to identify problems asap;
- (iv) correct measuring of offtake to avoid unnecessarily high or non-transparent costs; and
- (v) accessibility to infrastructure for all persons, including those with reduced mobility.

2.3.1   Standards and interoperability requirements

Problem Description

As the market for alternative fuels develops, it will be important to ensure a sufficient level of interoperability between different vehicles, recharging points and back offices. This involves several key elements:

- From the point of view of the driver of a vehicle, it is important to be able to access and use all relevant infrastructure: similar to petrol and diesel nozzles, electric vehicles' plugs and hydrogen and natural gas dispenser nozzles must be interoperable with all vehicles on the road. This also relates to captive fleets (e.g. bus fleets), where it should be possible to introduce new vehicles from different manufacturers without the need to modify the existing recharging/refilling infrastructure. Most of these elements are covered one way or another by existing standards or by standards currently under development; some of these are mandatory by law.
- In the case of electromobility, a further element relates to the availability of seamless authentication and payment options, including through roaming arrangements. It is also important for a CPO to be able to integrate new recharging points from a different supplier, in order to avoid lock-in. Different possible solutions could be developed to address these issues, which might require some form of standardisation of one or more or a set of different communication protocols. These include e.g. communications from vehicle to recharging point, from vehicle to DSO, from recharging point to CPO, from recharging point to recharging point, from CPO to roaming platform, etc.

Analysis of stakeholder views

Sufficiency of standards and interoperability requirements

The rate of responses to the question about sufficiency of standards and interoperability requirements was relatively high for the main established standards for electric vehicles recharging (Normal power AC – Type 2, EN 62196-2; High power AC – Type 2, EN 62196-2; High power DC – Combo 2, EN 62196-3), with up to 35% of participants selecting "No opinion / I don't know" or providing no answer. Responses

were quite similar for all three standards: the standards are sufficient and complete according to 65%-70% of the respondents, partially sufficient and complete for 23-27% and not sufficient for 6-8% of respondents. Respondents *inter alia*[21] identified specific areas where further work would be required, including among others the development of a standard for DC normal power connectors, standards for heavy-duty vehicles, standards for smart charging, communication protocols between different elements/actors in the recharging infrastructure, LNG pressure at the nozzle and safety aspects in the hydrogen standards. Some respondents indicated that local authorities' requirements going beyond the standards represent a barrier to the quick deployment of the infrastructure, and suggested that no further requirement should be introduced for recharging/refilling infrastructure meeting the relevant standards. The answers therefore seem to suggest that a relatively high number of participants is satisfied with the current standards.

Figure 12: Perceived sufficiency of current infrastructure standards – electricity (1)[22]
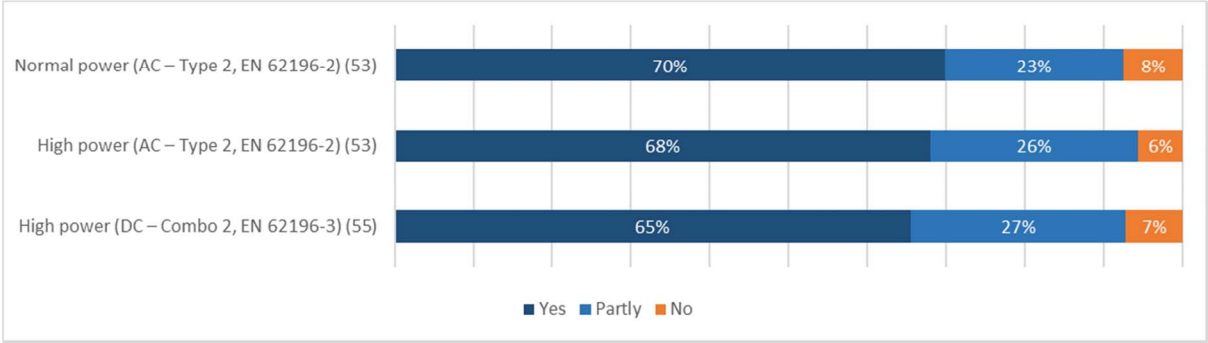
A different picture emerges for the electric charging standards currently under development (wireless charging, battery swapping, electric buses), and for standards for electric charging of other categories of vehicles (L category, shore side electricity for sea going ships and for inland waterways vessels). Here, a large majority of participants (from 63% in the case of electric buses to 89% for electric seagoing vessels) did not answer or replied "No opinion / I don't know".[23] Furthermore, the share of respondents expressing satisfaction with some of these standards is relatively lower compared to the ones mentioned above (EN 62196-2 and 3). This is particularly evident in the case of the standard for battery swapping, which 53% of respondents consider not sufficient and complete.

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[21] The overview of responses presented here only lists suggestions made by more than one respondent, and specific comments for H2 and natural gas (in view of the relatively lower number of replies concerning these fuels).
[22] Total number of responses (out of a total of 83; excluding blanks and 'No opinion / I don't know') for each question between brackets.
[23] This may be explained by the participation to this exercies of a low number of stakeholders active in those modes.

Figure 13: Perceived sufficiency of current infrastructure standards – electricity (2) [24]
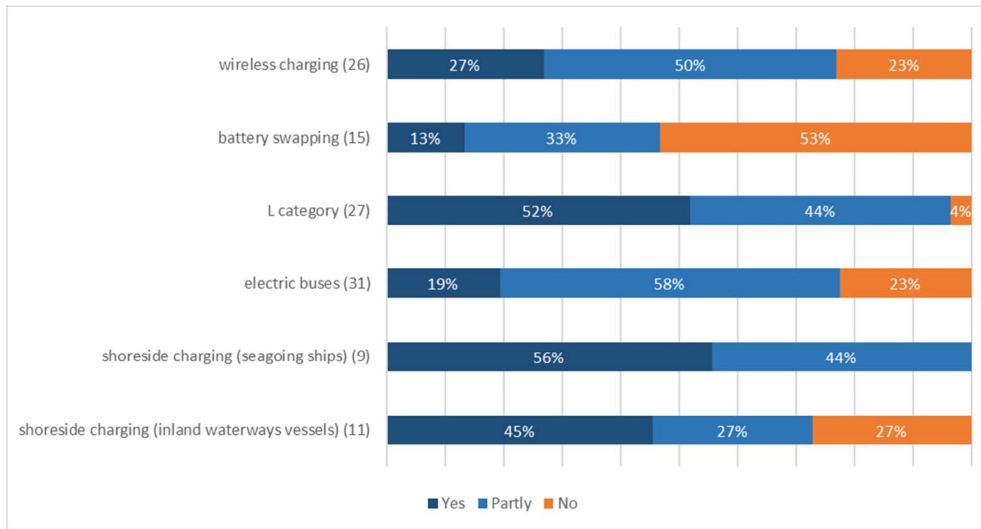
Responses to the questions about standards for CNG and LNG are also characterised by a relatively low rate of specific responses[25]; however, between 67% and 82% of respondents indicated that these standards are sufficient and complete. A small share of respondents suggested that they are not sufficient for CNG refuelling points interoperability (7% of respondents) and for LNG refuelling points for sea-going ships (10% of respondents).

Figure 14: Perceived sufficiency of current infrastructure standards – CNG and LNG[26]
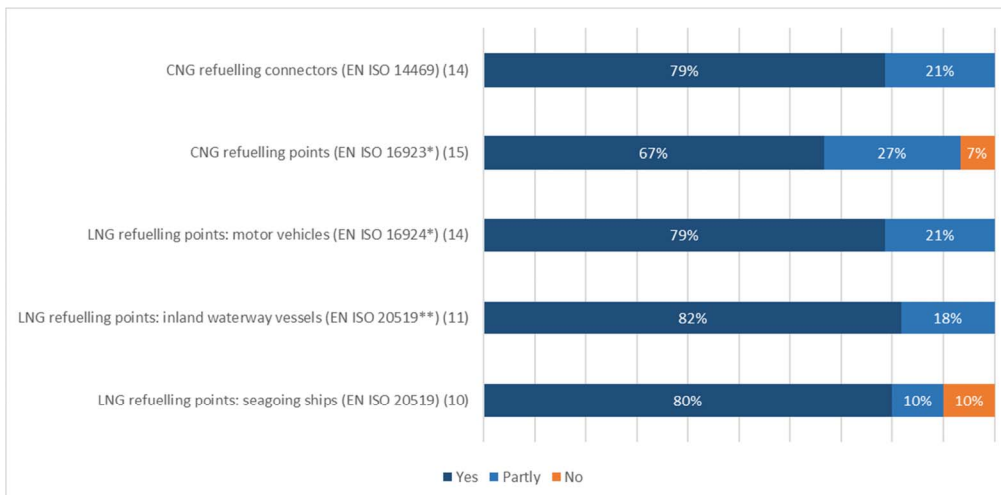
*only interoperable aspects of standard
**only parts 5.3 to 5.7 of the standard

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[24] Total number of responses (out of a total of 83; excluding blanks and 'No opinion / I don't know') for each question between brackets.
[25] This may be explained by the participation of a large number of electromobility stakeholders to this exercise: see paragraph 1.4.
[26] Total number of responses (out of a total of 83; excluding blanks and 'No opinion / I don't know') for each question between brackets.

Questions about the standards for hydrogen fuelling are characterised by a similar response pattern to those about natural gas: these questions also turned out a relatively low number of specific responses.[27] Among those that did provide an opinion, however, the majority of respondents considered the current standards sufficient and complete, and a small faction considered them insufficient / incomplete: see Figure 15.

Figure 15: Perceived sufficiency of current infrastructure related standards – hydrogen (H2)[28]
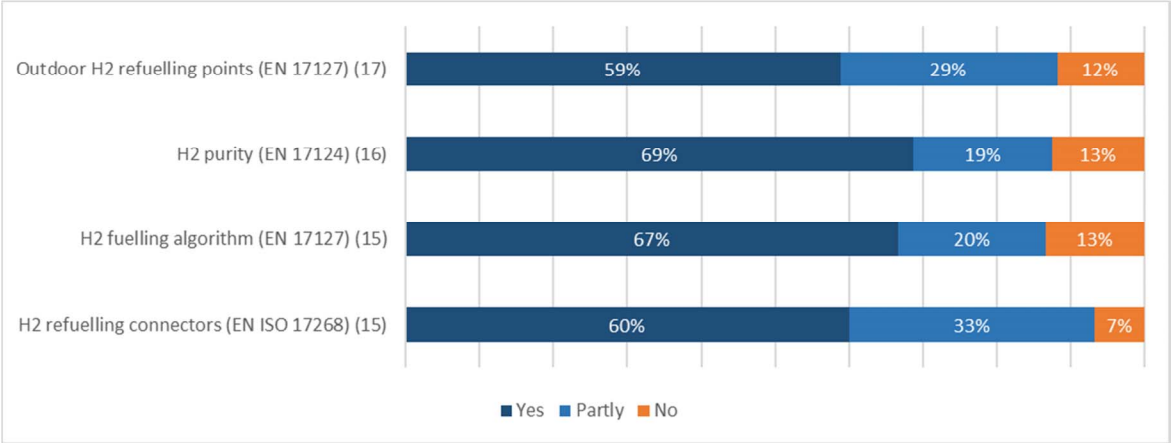
In relation to the possible practical need to equip recharging points with multiple connector socket outlets and connectors, the majority (71%) of respondents indicated that in their view the current situation is not problematic; and 29% suggested that the situation is problematic. In total, 25% of participants did not reply or selected "No opinion / I don't know". The respondents indicating that the situation is problematic mostly identified additional costs of equipping multiple connectors as the main concern; others argue that this cost is limited (5-10% of the overall cost of a recharging point - hardware and installation works – according to one participant). This suggests that respondents do not generally see the current coexistence of other socket outlets and connectors (e.g. CHAdeMO) with the ones mandated by the Directive as a problem.

Possible need to harmonise different types of communication/protocols at EU level

More than half of the participants indicated that they had no opinion or did not answer this question for specific protocols. This means that at this stage no firm conclusions can be drawn in this respect and further analysis of market needs is required.

However, it can already be noted that a group of six protocols is identified by an absolute majority of respondents (who also make up more than 30% of all participants) as presenting a high or very high need for harmonisation: EV to CP, CPO to EMSP, CPO to DSO, EMSP to roaming platform, CPO to

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[27] This may again be explained by the participation of a large number of electromobility stakeholders to this exercise: see paragraph 1.4.
[28] Total number of responses (out of a total of 83; excluding blanks and 'No opinion / I don't know') for each question between brackets.

roaming platform and CP to CPO (see Figure 16). Specific contributions highlighted in particular the need to ensure data interoperability between electric vehicles and recharging points for authentication and payment, with one contribution comparing it in importance to the connector interoperability established in the current Directive.

Figure 16: Perceived need for harmonising communication protocols at EU level[29]
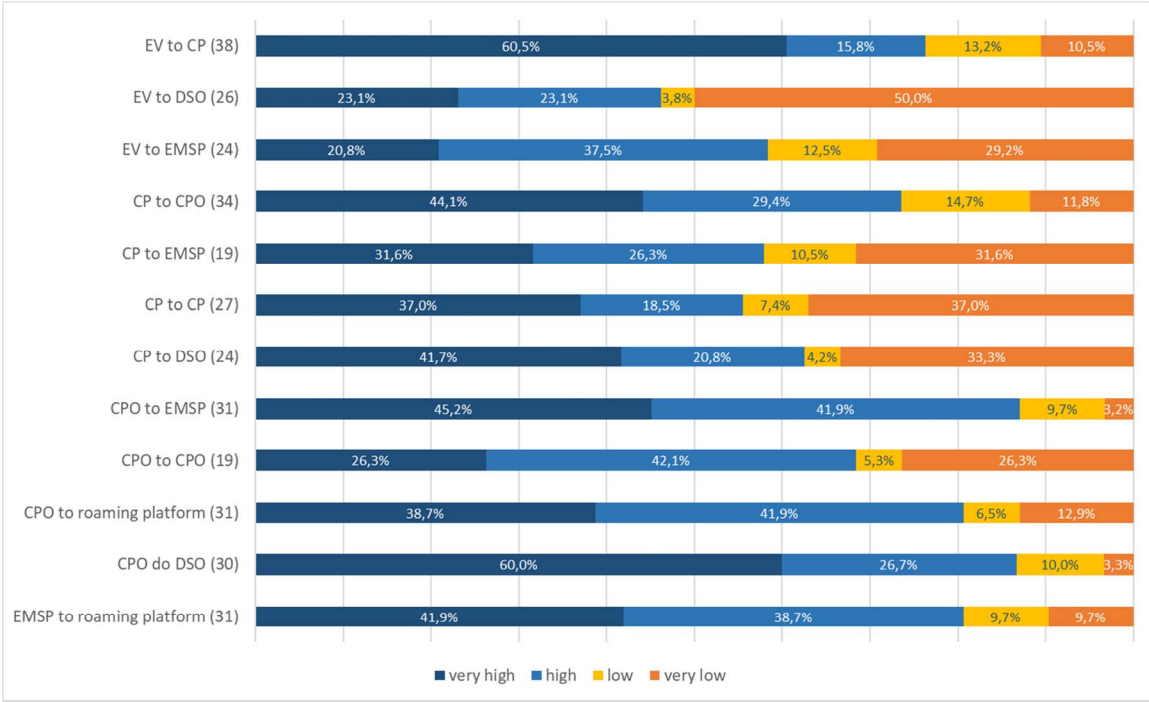
For the other six protocols, respondents identifying a high or very high need to harmonise are less than 20% of the total number of participants, although they still outnumber respondents indicating a low or very low need, with one exception: EV to DSO is the only protocol for which respondents who consider that there is a low (3.8%) or very low (50%) need to harmonise outnumber those who identify a high (23%) or very high (23%) need.

A number of respondents indicating a low or very low need for harmonisation in this area raised concerns about singling out communication protocols as this domain evolves and progresses quite rapidly and in their view such harmonisation may inhibit healthy market competition.

Participants were also asked to indicate whether in their view there were already suitable standards for the different types of communication/protocols. Relatively few respondents identified specific

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[29] Total number of responses (out of a total of 77; excluding blanks and 'No opinion / I don't know') for each question between brackets.

standards, and only partial conclusions can be drawn from this question; however, the analysis of the answers can lead to some preliminary considerations:[30]

- The most answers were received for the EV to CP protocol – where 25 respondents mentioned ISO 15118 and 13 mentioned IEC 61851. No respondent suggested that a standard would not be necessary/relevant for EV to CP. ISO 15118 was also mentioned by 10 respondents in relation to EV to EMSP, while 5 respondents considered that no standard would be needed/relevant for this type of communication. On the other hand, 10 respondents – representing the majority for this question – expressed the view that no standard would be needed/relevant for EV to DSO. These answers appear to suggest a certain convergence of views in relation to the communication protocols involving the vehicle.
- A relatively high number of answers was also received for CP to CPO, where 21 respondents mentioned OCPP and 7 respondents referred to the upcoming IEC 63110 standard, which shall include parts of OCPP; one respondent expressed the view that a standard is not needed. On the other hand, few respondents identified specific standards in relation to the other communications linked to the individual recharging point (CP to EMSP, CP to CP, CP to DSO).
- OCPI was identified as a relevant standard in most of the answers provided for CPO to EMSP communications (17)[31], CPO to roaming platform communications (15)[32], EMSP to roaming platform communications (14) and CPO to CPO communications (6)[33].
- The upcoming IEC 63119 standard was also mentioned in relation to several communications (CPO to roaming platform: 5; CPO to CPO: 4; EMSP to roaming platform: 4; CPO to EMSP: 3), while OCHP was referred to for CPO to roaming platform (4) and EMSP to roaming platform (3). The number of respondents indicating that they do not think a standard would be relevant/necessary was 4 for CPO to CPO and 2 for CPO to EMSP, CPO to roaming platform and EMSP to roaming platform.
- Finally, in relation to CPO to DSO, 9 participants referred to OSCP and 7 to OpenADR; one respondent considered that a standard would not be relevant/needed for this protocol.

2.3.2   Technical availability

Problem Description

Because of the current limited coverage of recharging and refuelling infrastructure for alternative fuels, its technical unavailability (downtime) can represent a more serious problem for users compared to that of conventional fuels infrastructures: in case of unexpected unavailability of a petrol or diesel filling station, it is generally easy for a driver to find another one within a short distance; this is not currently the case for alternative fuels infrastructure.

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[30] The overview of results presented here does not include standards mentioned by fewer than three respondents. When a respondent has mentioned two or more standards, the answer has been counted separately for each standard.

[31] Supported by 5 out of 8 CPOs responding to this question, with good geographical spread (NL, FR and DE).

[32] Supported by 4 out of 8 CPOs responding to this question (NL, FR).

[33] Supported by 3 out of 6 CPOs responding to this question (NL, FR).

Analysis of stakeholder views

A little less than one fifth of participants expressed no opinion on the issue of whether the technical unavailability (downtime) of publicly accessible recharging or refuelling infrastructures currently represents a problem for consumers. A large majority of those who expressed their opinion indicated that technical availability is very problematic (32%) or somewhat problematic (40%); 21% considered it a little problematic and only 7% indicated that it is not problematic at all. When providing further details, respondents highlighted the negative impacts that real or perceived risk of technical unavailability can have on customer's confidence and willingness to switch to alternative fuel vehicles, in particular electric vehicles; downtime is often perceived as reinforcing existing range anxiety. Several respondents noted that downtime – especially if not properly communicated in real time – can be particularly problematic in the current early stages of development of the market. At the second STF working group meeting, a few stakeholders therefore highlighted the need for mandatory up time requirements for any publically accessible infrastructure. As the availability of recharging/refuelling infrastructure increases, there is an expectation that possible temporary unavailability will become a less serious problem, as customers will be able to find an alternative more easily. This consideration seems to be partly confirmed by some responses from MS with a relatively developed EV market (e.g. NL), suggesting that they do not see downtime as a serious problem for consumers.

2.3.3 Connectivity

Problem Description

Digital connection of alternative fuels infrastructure can help provide real-time information about its availability, price, etc. In the case of electric charging, the question of how to allow seamless payments across different recharging point networks (e.g. through roaming arrangements) also needs to be considered. Currently, there is no obligation for alternative fuels infrastructure to be digitally connected.

Analysis of stakeholder views

Digital connectivity

In total, more than 97% of respondents – representing almost three quarters of all participants - would support some form of obligation for all publicly accessible alternative fuels infrastructure to be digitally connected: 53% of respondents consider that it should apply to all recharging points (both existing and new), 24% would prefer a gradual introduction (first for newly built and significantly renovated, and later for all recharging points) and 19% would only apply such an obligation to newly built and significantly renovated recharging points. Only 3% of respondents consider that such an obligation should not be introduced at all. 25% of participants had no opinion or did not respond to this question. In their explanations, most respondents highlight the need to ensure timely information to customers about availability, and the possibility to quickly identify and address problems/unavailability. Several respondents point out the relatively high burden and limited benefits of imposing connections for existing infrastructure as a reason to prefer a gradual approach. One respondent suggests that a widespread, freely available slow charging network (e.g. linked to street lamp posts) would not require this type of connection and would be dependent on keeping the costs of individual recharging points as

low as possible. Finally, one respondent suggests that similar requirements should be introduced for LNG stations.

Connection to roaming platform

In relation to a possible mandatory requirement on recharging points to be connected to one or more roaming platforms, the responses indicate that a shared view that it must be possible for a user to recharge their vehicle when driving in another Member State emerges. However, respondents express substantially divergent views as to how this should be achieved (e-Roaming platform, P2P arrangements, ad hoc payments, etc.). While some respondents consider e-Roaming platforms a good solution, others express the view that these will introduce an additional layer and extra costs, and that existing protocols allow a more efficient P2P approach. The explanations provided in the follow-up question show that participants often gave different interpretations of the question depending on their specific profile and expertise – e.g. answering yes, but then indicating in the follow-up that they support some form of mandatory roaming / ad hoc solution, but not necessarily through a roaming platform.

2.3.4 Measurement of electricity offtake at publicly accessible recharging points

Problem Description

In all Member States, the electricity meters used for measuring electricity consumption of a final electricity customer need to be certified by a competent national body in line with the Measuring Instrument Directive (2014/32/EU). This certification procedure guarantees safe operation of the electrical equipment as well as accurate measurement of the electricity offtake and subsequent billing. However, when it comes to measuring equipment installed in individual recharging points to measure the offtake of an individual EV-user for a charging session, only some Member States impose strict accuracy requirements. In particular the German Weights and Measures Law (*Eichrecht*)[34], and its strict interpretation in technical rules set by the PTB (*Physikalisch-Technische Bundesanstalt*), has set a high standard for the industry.

It is argued that such an accurate measurement is essential to correctly charge and invoice EV-users for their actual off-take, on a kWh basis.

Currently AFID does not address off-take measurement requirements. Respondents expressed different opinions about whether for offtake measurement devices the same or similar accuracy and certification requirements need to be established as for electricity meters.

Analysis of stakeholder views

45% of respondents consider that it would be very important to set minimum requirements for the correct metering of electricity offtake at recharging stations, 33% consider it relatively or somewhat

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[34] It should be noted that, in addition to regulating metering accuracy, the *Eichrecht* also sets rules on data handling, trust mechanisms, verifiability of bills and receipts, and even physical protection of equipment against manipulation, dust, the elements, etc.

important, and only one respondent considers that it is not important at all. 21% of participants replied "No opinion / I don't know" or did not answer the question. The main reasons mentioned for supporting minimum requirements for the correct metering of electricity relate to transparency and consumer information. It could also be relevant in order to allow EV-users to provide smart charging or vehicle-to-grid services. One respondent stressed the importance of accurate metering to enable the national transposition of REDII and allow electricity to bid into fuels markets to enable more innovative ways to comply with clean fuels regulations.

At the same time, several respondents stressed that recharging is a service rather than a sale of electricity; some of them argue that other approaches (e.g. time-based, flat rate) can also be used, or that not all the requirements applicable to the main electricity meters would need to apply to measuring equipment at individual recharging points, and that the costs of requiring certified meters for individual sockets would exceed the benefits. In this context, some respondents suggested that a minimum level of accuracy (e.g. maximum deviation of +/- 1%) would be sufficient.

Representatives of the hydrogen community indicated that the issue of correct fuel offtake metering is not limited to recharging points, but is also relevant for hydrogen refuelling stations.

2.3.5   Accessibility for persons with reduced mobility

Problem Description

On 9 April 2019, following the positive vote by the European Parliament on 13 March 2019, the Council of the European Union adopted the European Accessibility Act. The Accessibility Act sets accessibility requirements for people with reduced mobility, amongst others for payment terminals and certain transport services and infrastructure.

This section considers whether alternative fuels infrastructure presents specific accessibility limitations for persons with reduced mobility, and whether specific mandatory requirements should be introduced to ensure accessibility and ease of use by all users.

Analysis of stakeholder views

More than half of participants (54%) did not answer or did not know how often persons with a disability have difficulties accessing and using alternative fuels infrastructure. Of those who provided an answer, almost one third considered that this is the case often (24%) or very often (5%). 42% considered that this is sometimes the case, and almost one third considered that this never (3%) or almost never (26%) happens.

Among respondents identifying difficulties, lack of sufficient space around the parking place, height of the buttons/screen and especially the weight of the charging cables are highlighted as the main factors reducing accessibility and ease of use.

In relation to the opportunity of setting mandatory requirements for accessibility and ease of use by persons with a disability, more than 40% of participants have no opinion or do not know, 20% of respondents do not consider any obligation needed, neither for new nor for existing infrastructure, and

80% of respondents consider that this should be done at least for newly built and renovated infrastructure. [35]

In addition to setting requirements for new infrastructure, 16% of respondents would introduce the same requirements at the same time also for existing infrastructure, 35% would gradually introduce them at a later stage and 29% would not introduce any obligation for existing infrastructure, but only for newly built and renovated infrastructure.

Several respondents expressed the view that comparable requirements should be set for alternative fuels and conventional infrastructure; some voiced concerns that setting stricter rules for alternative fuels infrastructure would effectively penalise it in comparison to conventional fuels.

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[35] The question gave the option to indicate whether there was a justification to introduce requirements "for all (existing or new) publicly accessible AFI" (8 respondents), "only for newly-built publicly accessible AFI and AFI that is being significantly renovated or upgraded, and set a later date by which all other publicly accessible AFI must be compatible" (17 respondents), "only to newly-built/renovated/upgraded publicly accessible AFI – and allow all other AFI to exist as they currently are" (14 respondents), or not at all (10 respondents). The three first possible answers all foresee requirements for newly-built AFI, while they differ in relation to how existing AFI should be treated; therefore, all respondents who selected one of these three answers have indicated that they consider that requirements should be introduced for newly built AFI. 80% represents the sum of respondents choosing one of these three options. The share of each of these three options is presented in the following paragraph.

3 Consumer services and seamless payments

3.1 Finding alternative fuels infrastructure

Consumers need comprehensive and up-to-date information on the location, type and availability of recharging points. In this section, the Questionnaire asked for your views on different means of making it easier for consumers to find and choose the infrastructure at which they want to recharge/refuel their vehicle.

3.1.1 Communication of static and dynamic data on alternative fuels infrastructure

Problem Description

The Alternative Fuels Infrastructure Directive provides in Article 7(7) that, "Member States shall ensure that, when available, the data indicating the geographic location of the [publicly accessible alternative fuels] refuelling and recharging points […] are accessible on an open and non-discriminatory basis to all users. For recharging points, such data, when available, may include information on real-time accessibility as well as historical and real-time charging information."

This provision is complemented by the provisions of the Intelligent Transport Systems (ITS) Delegated Regulation (EU) 2015/962 on Real-Time Traffic Information Services and ITS Delegated Regulation (EU) 2017 on Multimodal Travel Information Services, both adopted under the ITS Directive (Directive 2010/40/EU). These Delegated Regulations contain some minimum requirements regarding the sharing of certain static and dynamic road and traffic data, including some static and dynamic data regarding alternative fuels infrastructure.[36]

The Commission is supporting the implementation by Member States of the ITS Directive and its Delegated Regulations in the field of alternative fuels infrastructure through a CEF Programme Support Action (PSA) entitled "Data collection related to recharging/refuelling points for alternative fuels and the unique identification codes related to e-Mobility actors". This PSA firstly supports Member States in collecting and making available –through national or common access points – static and dynamic data regarding alternative fuels recharging / refuelling infrastructure. Secondly, it helps Member States in setting up an effective, EU-wide coordination mechanism to assign unique identification codes to recharging points, CPOs and EMSPs.

The Commission is moreover examining whether the aforementioned legislative framework should be clarified or complemented, in particular to make it easier for consumers to find alternative fuels infrastructure, and to use it more efficiently.

Range anxiety (the fear of not being able to drive long distances, e.g. for holiday travels, with an electric vehicle) and charge anxiety (the fear of not finding a recharging point) are consistently named in the top

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[36] For the purposes of this chapter static and dynamic data have the meaning given to them in the ITS Directive, namely 'static data' means data that do not change at all or do not change often, such as location data, whereas 'dynamic data' are data that change often or on a regular basis, such as availability data.

three reasons for consumers to not buy an alternatively fuelled vehicle, behind the price of such a car compared to an ICE vehicle.[37] In particular in the early stages of market development, when infrastructure is still relatively scarce, it is crucial to create confidence with prospective alternative fuel consumers that sufficient infrastructure is available and that they will be able to find it easily when needed. Moreover, in the case of EV recharging –which still takes considerably more time than refuelling– it will be equally crucial for consumers to know that the recharging points which they would like to use are actually available before they drive to them, in particular once markets start to develop and the amount of EVs in circulation increases.

Analysis of stakeholder views

When asked who is best placed to provide static and dynamic data relating to alternative fuels infrastructure, a slight majority of respondents argues this is the operator of the alternative fuels infrastructure. Another 5.5% argue it is the owner of the infrastructure, whereas the strong majority of those having responded 'others' argues it should be a combination of those two. 18% of respondents argued it is the Member States that should provide the data, but looking at some of the comments these respondents made, what at least some of them mean is to make the data available/accessible to others. A number of respondents also argue that the data should be provided in a standardised format. Another respondent argues that it is essential to perform quality checks on the data that is provided, arguing this should be done by a party independent from the market actors, to avoid any conflict of interest.

In a second set of questions, we asked to what degree access to certain data regarding alternative fuels infrastructure is enabled on an open and non-discriminatory basis in the different Member States. Due to the low response rate in combination with very dispersed replies, it is not possible to extrapolate useful messages from the questions relating to the geographic location of CNG, LNG and hydrogen stations. Although the questions on recharging infrastructure received more responses, replies were equally distributed over the different options. But where almost 40% of respondents believe that information regarding the geographic location of recharging points is fully available, a mere 15% believes the same of the real time accessibility of such recharging points. This reduces to almost 0% in relation to historical and real-time charging information, where more than 90% of respondents believe that such information is available only to some degree or simply not at all (17%), even though the provision of such data is explicitly suggested in the Alternative Fuels Infrastructure Directive (Article 7(7)).

There is a much wider consensus in the replies to the next question: what should be the geographical scope of the obligation to provide static and dynamic data in relation to publicly accessible alternative fuels infrastructure? More than 85% of respondents argues it should be EU-wide.

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[37] See for instance: Joint Research Centre (JRC) 2017 Report 'Quantifying the factors influencing people's car type choices in Europe', p. 14; available here:
http://publications.jrc.ec.europa.eu/repository/bitstream/JRC109452/kjna28975enn.pdf

Similarly, a large consensus exists between the respondents as to the free provision of certain static data (see Figure 17 below).

Figure 17: Which of the following static data should be accessible to users?[38]
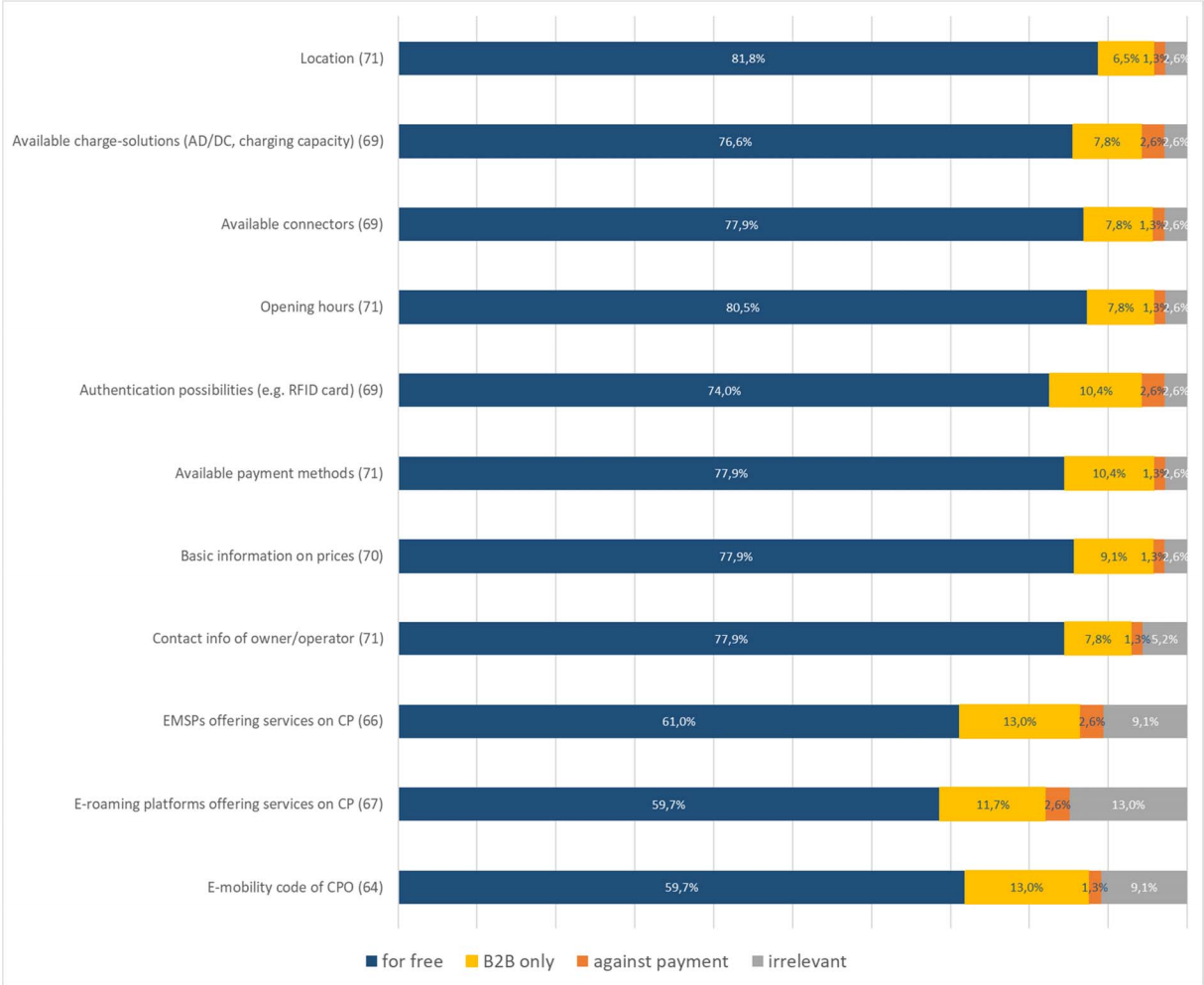
In relation to the last three categories of static data, the majorities in favour of providing those data for free are smaller, at around 60%, since more respondents believe that the provision of such data is either a nice-to-have (to be purchased from a via a commercial application) or even irrelevant for users. This is particularly argued for the information whether the recharging point is covered by an e-roaming provider: some respondents explain that it must be clear for EV-users which EMSP offers services on the recharging point, but it is irrelevant which roaming platform (if any) links the recharging point in question to that EMSP.

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[38] Total number of responses (out of a total of 77; excluding blanks and 'No opinion / I don't know') per type of static data between brackets.

But also with respect to the provision of dynamic data to end users, a wide consensus exists that such data should be provided for free (see Figure 18 below).

Figure 18: Which of the following dynamic data should be accessible to users?[39]
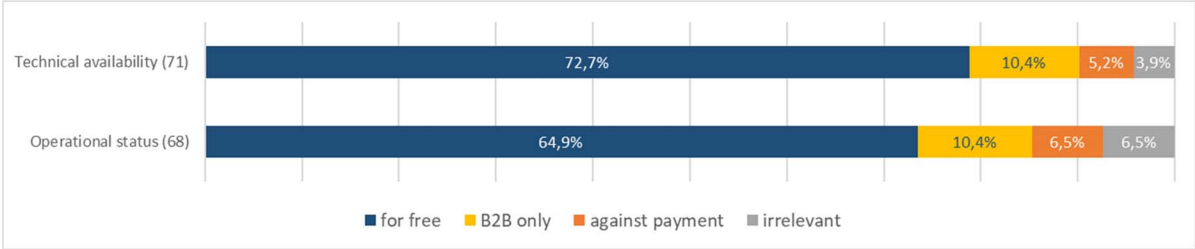
Interestingly, there is not much divergence between the percentage of all respondents supporting free provision of dynamic data and the percentage of CPOs supporting the same. 11 out of 15 individual respondents (so excluding associations that include CPOs among their members) that identified themselves as CPOs support the free provision of data on technical availability, 10 out of 15 those on occupancy. In both cases, only 2 out of the 15 CPO respondents believe such data should be provided against payment, the others believe such data is irrelevant for users.

The proponents of the open and free provision of static and dynamic data generally agree that this serves three key objectives:

1) Providing a full overview of the charging possibilities helps building confidence with users that recharging infrastructure is widely available (it helps overcoming charge and range anxiety)
2) Reaching a positive user experience is key for adoption. Knowing where the refuelling infrastructure is located but finding it unavailable or non-interoperable upon arrival is frustrating.
3) Making key data on recharging point location, availability, providers and prices accessible to the consumer is key to empower EV users to choose the most convenient offer, promoting sound competition between CPOs.

In case the provision of data would entail a cost for CPOs, respondents argue that this should be included in the charging price.

The adversaries of open and free data provision (in particular dynamic data) argue that the provision of such data gives too much insight to competitors (in particular historic dynamic information). They also argue that technical availability and occupation status is not something requested of gas stations today nor of other retail outlets.

Where respondents could propose 'other' static or dynamic data that should be made available to users, the following were suggested (some for free, others against payment):

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[39] Total number of responses (out of a total of 77; excluding blanks and 'No opinion / I don't know') per type of static data between brackets.

- Customer service hours
- Accessibility: public, company or private (requires a uniform definition of accessibility)
- Reserved for specific target groups (for instance: car sharing or taxi's)
- Parking space reserved for charging
- Pictures of the station
- Unique ID of recharging point
- Reservation possibilities / waiting list
- Actual maximum power available at the CP (dynamic data)
- Advanced price information (e.g. tariff for roaming)
- Source of energy (RES, nuclear, grey)
- Whether or not it allows freedom of choice for energy supplier
- Smart charging / V2G capability
- Historical data
- Static or dynamic power profiles applied
- Load balancing, free advice on where to recharge without causing congestion on the grid
- Quality feedback, rating
- Other customer services, such as valet charging
- For CNG/LNG/hydrogen refuelling stations: available connectors (e.g. if station is equipped with NGV2 connector for heavy duty)
- For CNG/LNG/hydrogen refuelling stations: range of gas pressure
- For CNG/LNG/hydrogen refuelling stations: renewable gas quantities
- For HDV: ability to host heavy and long vehicle combination
- Also for HDV: if the refuelling/recharging station has other services available adapted to HDVs such as conventional fuels, AUS 32, resting facilities etc.

3.1.2 Categorisation of recharging stations

Problem Description

The correct categorisation of recharging stations is particularly important to keep track, in a useful way, of the development of the network (i.e. for statistical and reporting purposes). But it is also important for consumers to know what type of recharging points are available in the vicinity in order to determine which is the most suitable recharging option in the given circumstances.

Analysis of stakeholder views

In response to our question whether it is relevant, in the Alternative Fuels Infrastructure Directive, to further distinguish fast recharging infrastructure from the currently provided normal (P < 22kW) and high power (P > =22kW) recharging infrastructure, a majority of more than 85% of respondents finds this at least somewhat relevant.

We then inquired whether the following representation would be relevant:

Category	Sub-category	Definition	Power
Category 1		Normal power recharging points	P < 22kW
Category 2	A	High power recharging points (AC)	22kW < = P < = 43 kW
	B	High power recharging points (DC)	P < = 100 kW
	C	High power recharging points (DC)	P > 100kW

A first important comment received is that such aggregated categories are relevant for statistical purposes only, while consumers and service providers will need more granular data, and in particular the actual maximum power available at a given recharging point. Regarding that statistical use, another important remark relates to the counting of recharging points by Member States, where in particular issues are experienced in relation to multi-plug columns (e.g. a combination of CCS, CHAdeMO and AC Type 2 connectors) that, while being counted as three recharging points, can at best serve two but often only one EV at a time.

A number of respondents correctly spotted that the table contained an error, as it omitted Category 2C: High power recharging points (DC): P > 100kW. It has been included in red in the table above.

Fifteen respondents[40] argue that the threshold between high power charging and ultra-high-power charging should be at 150kW instead of 100 kW, which is *inter alia* argued to be better aligned with the Fuel Labelling obligations. For a better sub-division of higher power DC recharging points, CharIN proposes the following categorisation[41]:

[50 kW - 149 kW, Fast Charging, FC 50]
[150 kW - 249 kW, High Power Charging, HPC 150]
[250 kW - 349 kW, High Power Charging, HPC 250]

A further sub-division above 100/150 kW is also considered necessary for e-busses and HDV recharging points, where the proposals for an 'ultra-high power category' range between P > 300kW and 1MW (with another possible subdivision also proposed, e.g. 300kW < P > 500kW).

A number of respondents propose to delete Category 2A (AC power > 22 kW), as it will soon no longer be relevant since recent EV models all rely on DC for fast charging. In that respect, thirteen respondents argue that the lower threshold for DC high power recharging should be at 50kW; one explains that this is because the low voltage grid connection threshold is typically at 50kW in the EU. One respondent however explicitly points out that DC recharging will soon also be available at lower capacity: 22-50kW.

One respondent argues that, given the fast technological progress, the Commission should review the categories at least every 3 years.

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[40] Out of a total of 52 providing a specific response to this open question.
[41] This is endorsed 'as is' by one other respondent, while two others suggest variations on it.

Respondents also commented on the relevance of distinguishing between AC and DC recharging (five explicitly stating it is very relevant in view of much faster recharging speed with DC recharging; while one respondent argues only power matters) and a possible future indication of the number of phases on the recharging point (one or three phases).

The Joint Research Centre proposes the following alternative representation:

Category	Sub-category	Definition	Power
Category 1	A	AC recharging point	P < 6 KW
	B	AC recharging point	6kW < = P < = 22 KW*
Category 2	A	DC fast recharging point	P < 50 kW
	B	DC fast recharging point	50kW < = P < 150 kW
	C	DC ultra-fast recharging point	150kW < = P < 350 kW
	D	DC ultra-fast recharging point	P > = 350kW

* This may include cases of outlets of AC of up to 43kW (three phase), usable only by one type of car

This representation was subsequently criticised at the second STF working group meeting as it lacks a category for normal DC charging. As a proposed improvement of the latest JRC proposal and addressing some of the above comments, a sector association proposed the following alternative categorisation:

Category	Sub-category	Definition	Power
Category 1	A	Normal power recharging points, single-phase (AC)	P < 7.4kW
	B	Rapid power recharging points, triple-phase (AC)	7.4 kW < = P < = 22 kW
Category 2	A	High power recharging points 1 (DC)	22 kW < P < 50 kW
	B	High power recharging points 2 (DC)	50 kW < = P < 150 kW
	C	Ultra-high power recharging points 1 (DC)	150 kW < = P < 350 kW
	D	Ultra-high power recharging points 2 (DC)	P > = 350 kW

3.1.3 Roadside indicators for alternative fuels infrastructure

Problem Description

Last but not least, we asked for your views whether it would make sense for the European Commission to harmonise roadside indicators for alternative fuels infrastructure, despite it being expected that users of alternatively fuelled vehicles will increasingly rely on mobile applications or in-built navigation systems to find alternative fuels infrastructure.

Analysis of stakeholder views

71 out of 77 participants responded to this question. An overwhelming majority of respondents (93%) believes that the EU should indeed take action in this area.

3.2 Payment methods: ad hoc and contract based

In 2014, when the Alternative Fuels Infrastructure Directive was adopted, not all publicly accessible recharging points were equipped with a payment terminal. It was argued that the installation of such a payment terminal would be relatively costly compared to the equipment costs of slow recharging points in particular. In view of the alleged negative business case of such recharging points, and the willingness to roll out equipment quickly, it was left for the market to determine which payment options would be made available to users, as long as they could recharge ad hoc.

The ability to recharge ad hoc has hence been prescribed by Art. 4(9) of the Alternative Fuels Infrastructure Directive. It requires that all electric vehicle users can recharge at any publicly accessible recharging point "without entering into a contract with the electricity supplier or operator concerned". Although in some EU jurisdictions any acceptance (in this case by the EV-user) of an offer for a service (the recharging service) constitutes a "contract", Art. 4(9) clearly intends ad hoc charging to be similar to the habitual refuelling of an ICE vehicle. Although not explicitly prescribed by the Alternative Fuels Infrastructure Directive, such understanding of ad hoc charging would require (i) a one-off contract, that is concluded when the EV user starts charging his EV and ends with payment for that recharging session, without there being any longer-lasting mutual obligations, (ii) no need for any written agreement, (iii) no need for the EV user to identify himself and (iv) easy payment, on the spot. Hence, payment for ad hoc charging would require e.g. cash or bank wiring or similar transactions that end "the customer to service provider relationship" at payment (on the spot), which is currently the standard for refuelling conventional vehicles.

In addition, the Directive also refers to the possibility of CPOs to offer contract-based charging. In fact, Article 4(8), second sentence, explicitly recognises the right of recharging point operators "to provide electric vehicle charging services to customers on a contractual basis, including in the name and on behalf of other service providers". Such contracts allow CPOs to offer preferential charging services to their customers and allow for more customer-friendly billing methods, e.g. monthly billing. Such contracts can also help circumvent allegedly high bank transaction costs for allegedly low turnovers per charging session.

Problem Description

The Sustainable Transport Forum discussions of 2018 however revealed that there are problems with both payment approaches.

In relation to the ad hoc charging requirement, the Commission has been alerted that it has been implemented in very diverse ways throughout the EU, sometimes even within Member States, if at all. Similarly, the practice of contract-based charging has in certain cases obliged EV-users to enter into contracts with a multitude of CPOs or EMSPs in order to be able to recharge at different recharging stations.

Even though the latter issue may gradually be overcome through roaming platform and peer-to-peer network access agreements, in the current stage of market development this is still perceived as an issue for consumers. According to the European Consumer Organisation (BEUC):

*Many [C]harg[e] [P]oint [O]perators do not provide this possibility (*ad hoc charging, Ed.*) to EV drivers. Very often, to be able to use a publicly accessible [re]charging station, an EV driver must sign up for a contract with its operator. The consumer will be asked to confirm his/her identity via a Smartphone app or a contactless card (the so-called "RFID card"). As a result, consumers travelling long distance will probably need an array of apps and/or cards to be able to use the charging network everywhere. Only by transforming today's patchwork-like situation into a unified refuelling system can people's primary concerns – range anxiety and doubts regarding availability of [re]charging infrastructure – be addressed. People driving cars running on petrol can use every petrol station. This logic should be the same for electric drivers*

In a test of 53 recharging points in different German Länder, published in May 2018, the German automotive club ADAC found that ad hoc charging was simply not possible in 23% of the cases.[42] Respondents to the Questionnaires pointed to similar problems across major cities in the EU.

The accumulation of RFID cards in EV-users' wallets may be sub-optimal from a consumer (not consumer-friendly) and competition (possibly closed networks) perspective, it does not in and of itself raise problems in relation to the interoperability of payment solutions.

3.2.1   Ad hoc charging

This section of the Report will look into the problems identified above in relation to ad hoc charging, the urgency of addressing those, and –as the case may be – propose possible solutions in that respect.

Analysis of stakeholder views

Ad hoc still relevant?

A first question that we raised in the Questionnaires to stakeholders was whether in their view the legal ad hoc charging requirement is still sensible. No less than 97% of respondents agreed that it is, with a small group however nuancing this to some extent, and arguing that ad hoc charging is only relevant in certain cases (see Figure 19). One of the two respondents that argued against maintaining the ad hoc charging requirement in fact argued against maintaining it in its current –vague- form, advocating a clarification of the concept.

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[42] Available here (in German only): https://presse.adac.de/meldungen/adac-ev/tests/e-laden-noch-zu-wenig-kundenservice.html

Figure 19: Is the ad hoc requirement still relevant?[43]

| 73,9% | 23,2% | 2,9% |

■Yes ■In certain cases ■No
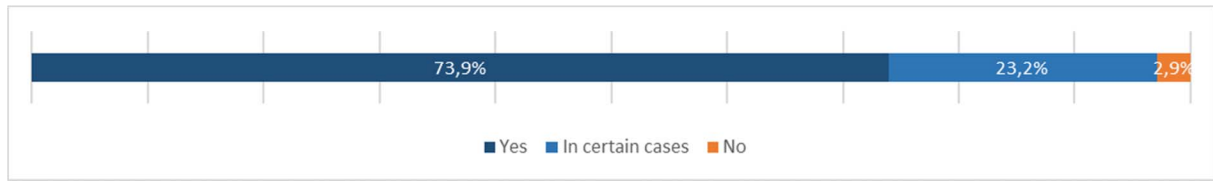
Amongst the respondents that plainly agree ad hoc charging is still relevant, only one out of four believes that requirement is currently sufficiently defined in the Directive. Two respondents explicitly praise the current 'broad' definition, which is argued to leave room for implementation, taking account of the specific circumstances of each recharging point (e.g. no app-based solutions in areas with low telecommunications coverage). The broad consensus is however that the disparity of solutions is not consumer-friendly. Two respondents argue that the digital solutions offered as ad hoc charging (e.g. smartphone-based payments) risk leaving behind users that are less familiar with digital technologies; one of them argues that depending on the Member State, between 25% to 40% of Europeans do not have smart phones.

Amongst those who argue that the ad hoc charging requirement only makes sense in certain cases, there is no consensus as to what those cases should be. One respondent argues that it should be mandatory only as a technical back-up option in those areas which have issues with internet or telecoms connections. Two others argue that it should be limited to stations that will likely be used by visitors, such as highway DC stations; two more similarly see the main use case for fast recharging stations, along the TEN-T core and comprehensive network.

One respondent argues that it should in any case not be mandatory for those recharging points where charging in itself is free (costs e.g. born by other services, V2G or advertisements). One more argues that it should not be mandatory for residential, workplace or typical low-power recharging stations, while another argues that operators of so-called semi-public recharging points (publicly accessible recharging points on parking lots of supermarkets, shopping malls etc.) should be allowed to develop their own payment options.[44]

Five respondents argue that contract-based charging should be the main use case, and ad hoc charging a 'nice to have'. They argue that new technologies, such as 'plug-and-play', will make contract-based charging easier and the more competitive option.

Even here, multiple respondents argue for a better clarification of the actual meaning of ad hoc charging.

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[43] 69 respondents (out of a total of 77) replied to this question.
[44] In this context, some respondents argued for a better definition of publicly accessible infrastructure, and a possible separate category of semi-public infrastructure.

Standardised ad hoc payment means?

As much as there is a majority in favour of more harmonisation of ad hoc charging options, opinions differ on whether to prescribe one or the other option. Certain respondents argue that the Commission should reinforce the ad hoc charging requirement by specifying a number of payment options, but leaving it to the CPO to choose between those options depending on the location and circumstances of each recharging point/station individually. Others argue that the Commission should be careful to mandate one or the other option, as customer preferences (e.g. in relation to the use of credit cards) differ between the Member States. Still others warn that (payment) technologies are evolving rapidly, meaning that it would be unwise to carve one or the other in stone.

Figure 20 provides an overview of the respondents' preferences to make certain payment options mandatory. A large majority is against prescribing cash payment on recharging points. Opinions are different as to payment by bank or credit card and via smartphone, where in each case a majority is in favour of mandating them, albeit sometimes only in certain occasions.

Figure 20: Should following payment options be imposed by law?[45]
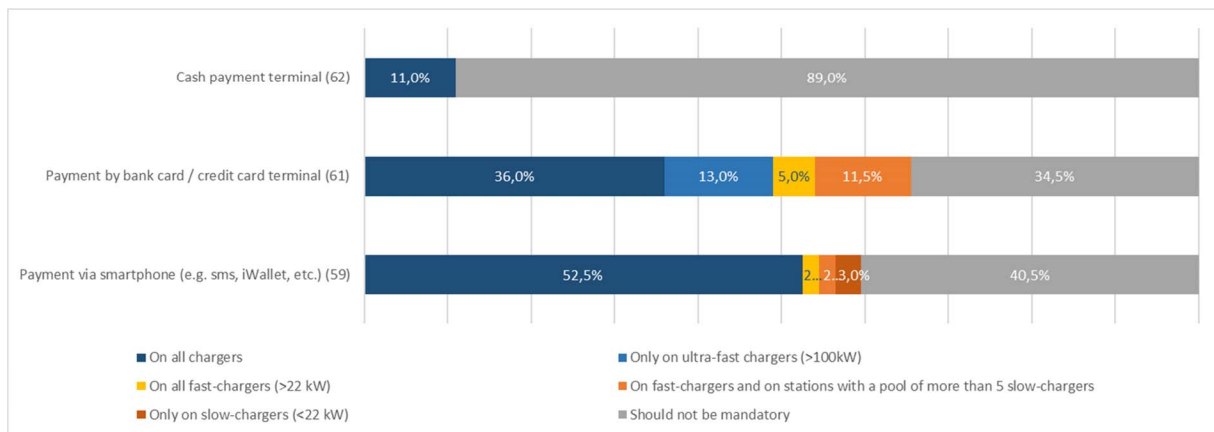
Amongst the 'other' proposals for mandatory payment options brought up by stakeholders, the following were noteworthy:

(i)   prepaid cards, like in telecoms, that are valid on all recharging points
(ii)   NFC payment, which is a contactless payment option that can be used for debit or credit cards, but also smartphone apps, but does not require a physical bank terminal to be in place; and
(iii)   Payment via web portals

3.2.2   Contract based charging: authentication of users

Unlike the ad hoc payments for charging, contract-based charging requires:

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[45] Total number of responses (out of a total of 77; excluding blanks and 'No opinion / I don't know') per payment option between brackets.

- A contractual relationship between the EV-user and EMSP that is usually concluded before the user arrives at the recharging station for an individual recharge and does not end 'on the spot', i.e. after the recharging transaction is terminated. This makes it possible to send a single bill to the customer for the settlement of all payable recharging sessions in any given month at the end of that month; and
- Identification and authorization of the user by the CPO and EMSP for each individual recharging transaction 'on the spot' to link the specific user to the right contract.

This section only concerns the different authentication systems; questions relating to prices and roaming are addressed in section 3.5 on transparency of prices.

As stated, contract-based recharging requires the unique authentication of users at the recharging station. Different solutions exist, but a main distinction can be made between two main authentication systems:

- 'manual' authentication systems, based on radio frequency identification technology, where the user has to take some action to authenticate himself at the recharging point (e.g. swiping of a customer card at an RFID reader, entry of a password at a recharging point, etc.); and
- 'automatic' authentication systems, where for instance the mere plugging of the recharging connector into the vehicle performs the authentication function. Such automatic authentication is for instance planned under the ISO 15118 standard, and has led to the development of the "Plug&Charge" technology.

Problem Description

'Manual' authentication systems

As already mentioned in chapter 3.2 on payment methods, current contract-based charging is predominantly dependent on the use of RFID cards for authentication purposes. The individual and uncoordinated development of RFID cards by different CPOs and EMSPs has led to a proliferation of such cards. It is not uncommon that an EV-user needs multiple RFID cards to be able to recharge since different cities often have different charging network operators who all have their own RFID card.

'Automatic' authentication systems

Although still in its development phase, there seems to be a growing interest of different market parties for the potential of, what we for the purposes of the Questionnaire have termed, automatic authentication technologies. What this term refers to are technologies that allow EV users to recharge their vehicle by simply plugging the recharging connector into the vehicle without any further administrative or other requirements on the EV user. The vehicle simply communicates automatically with the recharging point and the underlying communication protocols do the rest: authenticating the vehicle, possibly its state of charge and requested recharge, log the amount of electricity effectively recharged and possibly the time for recharging (in case of time-based fees) and transfer all these data to the CPO and eventually EMSP back-end for billing purposes.

Different solutions to enable such 'automatic' authentication and recharge are being developed, but the most prominent development in this area is the ISO/IEC 15118-20 standard (part of the broader ISO 15118 standard), a protocol for communications between the electric vehicle and recharging point, that will amongst others enable reciprocal unique recognition of recharging point and vehicle. For it to work, both recharging points and electric vehicles need to be attributed a unique identifier. The solution that the market seems to propose is the setting up of one or more Public Key Infrastructures (PKIs), which are systems for managing digital certificates that are used for securing digital communication.[46] Within the PKI, a trusted authority called Certification Authority (CA) –or Root Certification Authority (Root CA) in case of larger PKIs– issues certificates, which contain information on the owner of a specific key, the validity period of that key, who issued it and the digital signature of the CA to authenticate the key. The keys are subsequently used to encrypt and decode messages between market parties, providing the required security for their communication.

Both the standard and the ongoing developments in relation to the set-up of PKIs have however been subject to criticism from market parties.

With respect to the ISO 15118 standard, market parties allege it is a process driven by the vehicle manufacturers –who are allegedly the only market parties represented around the ISO table where the standard is developed– which means that the architecture of the standard is designed in their favour. By way of example, the driver must identify through the vehicle, the charging session is initiated through the vehicle and there is no scope for external access to in-vehicle data, such as the battery state of charge. In other words, the vehicle is the centre piece in this set-up, giving its manufacturer-service supplier a central role in this market. Some respondents have expressed a fear that those vehicle manufacturers that are also active as EMSPs will sell their vehicles with their EMSP branch as default EMSP (lock-in), and that –due to automatic authentication systems such as Plug&Charge- the consumer will automatically recharge with its default EMSP instead of having a choice.

Market parties have criticised the first initiatives for developing PKIs under ISO 15118-20 on similar grounds. Allegedly, these first initiatives were set up by market parties with a potential conflict of interest, and are therefore not trusted by other market parties. The risk is that these in turn develop their own PKI, which will lead to a proliferation of PKIs alongside one another, and a resulting need for mutual recognition agreements or certificate pools to allow useful exchange between the different PKIs. It is feared that adding such layers of complication will eventually make the ISO 15118-20 standard unworkable in practice.

This next sub-section of the Report will provide an overview of the replies received from stakeholders in relation to the issues described above.

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[46] ELAAD, Exploring the Public Key Infrastructure for ISO 15118 in the EV charging ecosystem, p. 3, available here: https://www.elaad.nl/uploads/files/Exploring_the_PKI_for_ISO_15118_in_the_EV_charging_ecoystem_V1.0s2.pdf

Analysis of stakeholder views

Manual vs automatic authentication systems

Only one respondent (out of 60) believes that the advent of automatic authentication systems will entirely do away with manual authentication systems.[47] It is a clear signal that manual authentication systems should not be neglected. Many respondents note that automatic authentication systems are still at a conceptual stage today, whereas the manual authentication systems are widely used and supported. A number of respondents believe that gradually automatic authentication systems will make manual authentication systems obsolete, adding that manual authentication remains useful on those recharging points that do not yet support ISO 15118-20 in a transitory period, which according to proponents of automatic authentication systems is expected to last until approximately 2030. A number of respondents explicitly warn against making a regulatory choice for one or the other system, arguing that both systems should continue to co-exist, mainly to allow consumer choice, but also as technical back-up solutions for one another. They argue that making a choice may hinder innovation and the advent of new authentication systems, e.g. based on biometrics.

When commenting upon the pros and cons of both systems, many respondents agree that automatic authentication offered for instance by the proposed Plug&Charge functionality is more user-friendly; even more "seamless" than refuelling an ICE. Few respondents add that –if properly implemented- Plug&Charge will allow more information to become available for smart charging, thereby enabling lower prices for EV users, sustainable charging and making most efficient use of the capacity of the electricity grid.

Proponents of ISO 15118-20 and its proposed Plug&Charge functionality also argue that it is more digitally secure, something that is not denied by opponents, who however argue that these issues can be overcome (as in the US with the NEMA EVSE1 – 2018 standard). In this respect, a few respondents also point to the possibilities offered by manual authentication via smart phone application (QR code recognition or NFC). This is argued to be a user-friendly and safe alternative authenticating process, which can be implemented at much lower cost. It is moreover argued that such an RFID/NFC tag can be attached or embedded into the recharging cable to have an effect similar to Plug&Charge, without requiring costly retrofits of recharging points.

Without judging the qualities of either system, one respondent asserts that automatic authentication systems will simply be necessary for autonomous vehicles.

The majority of respondents (around 71.5%) are however sceptical towards the automatic authentication system offered in particular by Plug&Charge for a variety of reasons. Many find the – relatively small- comfort gain disproportionate to the cost of retrofitting recharging points and vehicles. Another recurrent argument against automatic authentication systems is the fear that EV-users will be locked-in by their vehicle manufacturers, a concern also voiced in the context of chapter 2.2.2.

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[47] 47 responded that manual authentication systems will continue to exist alongside automatic authentication systems, while 12 responded they will continue to exist side-by-side 'in certain cases'.

Therefore, many respondents argue that consumers should in any case have the choice between manual and automatic charging, effectively being able to 'override' the automatic prompt. Another proposal to address this issue is to couple the adoption of the ISO15118-20 standard to mandatory adoption of other open protocols, such as OCPP and OCPI.

Manual authentication systems are seen as more independent from the vehicle manufacturer. Moreover, manual authentication systems are argued to be better from an EV-user's data privacy perspective, as some argue that the vehicle will have all the information on the consumer in the automatic authentication system. Following through on this, into the discussion regarding access to in-vehicle-data, a number of respondents argue that the EV user should be in control of his data (consumer-centric model as opposed to vehicle-centric model) and fear that this will not be possible under ISO 15118-20.

On a similar note, a number of respondents argue that a vehicle-linked authentication may pose problems in relation to payments, where the assumption is that the recharging costs will be invoiced to the vehicle owner. It is argued that this may be problematic in use cases where owner and user are different, e.g. car sharing or for company cars, where companies may want to distinguish between professional and private use. This constitutes another point to the advantage of user-linked authentication, where a user could in principle use different vehicles with one user account only.

Although many stakeholders believe that interoperability can be achieved with both authentication systems, if properly implemented, some respondents fear more issues with automatic authentication systems, in particular with regards to implementation at scale. It is argued that ISO 15118-20 is not yet a fully developed standard, and that there are still quite a few other standards (IEC 63110 / 63119, as well as the GB/T-CHAdeMO (61851-23, -24) harmonisation efforts, all of which are however also still under development) and technological evolutions (for instance 5G smartphone technology) which merit the Commission's attention. A suggested alternative to picking one standard, is to develop a set of requirements, e.g. regarding security, that any given communication protocol should comply with. Few respondents also highlight that automatic authentication with ISO 15118-20 will not be possible on slow (AC) recharging points, for which reason a general obligation would not make sense.

On 'manual' authentication systems: harmonize RFID?

A good majority of around 65% of respondents argues that the approach of using radio frequency identifiers (RFIDs) for user authentication purposes related to recharging solutions should be harmonised at EU level (see Figure 21). Almost 4 out of 5 of those respondents think this should be done by means of a customer RFID card/badge. An argument often voiced in favour of card/badge identification is that the identification should be with the customer, not the car, such that the customer can use his RFID identifier with any car.

Figure 21: Should a European approach to using radio frequency identifiers (RFIDs) for user authentication purposes related to recharging solutions be required, and in what form, with a view to ensuring interoperability?[48]
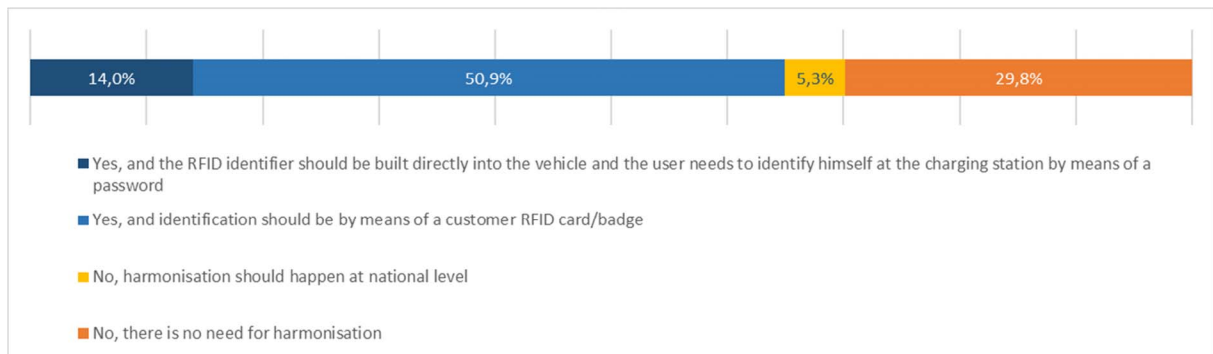
A number of respondents point out that the reply options were insufficient, as identification through smartphone RFID/NFC is safer and cheaper, as a harmonised RFID card would require setting up a platform at EU-level which is expected to lead to more costs for the system.

Following standards are proposed for RFID harmonisation:

- ISO / IEC 14443A, as is used in the Netherlands, which is the only Member State to have harmonised RFID cards (13.56 mhz of mifare series)
- CEN/TS/16794
- NEMA EVSE 1-2018 or similar in terms of (cyber)security and also facilitates internet work/driver roaming
- IEC 63119

Less than a third of respondents in favour of RFID harmonisation at EU level also replied to the question "how should the underlying governance framework be set up in your view, and who should set it up". The majority of those recommends the setting up of an EU ID issuing organisation, who would also be responsible for further harmonisation and standardisation.

The respondents that argue against harmonisation at EU level mainly do this because they believe the market can or should solve this issue. In this respect, it is observed that, if ad hoc payment and charging is available everywhere, there is no need to further harmonize contract-based charging: every user will be able to recharge using either an available non-harmonized contract method or via the fall-back mandatory ad hoc payment method. It will then be up to the market and the charging operators to deliver a workable and consumer-friendly contract authentication method, or users will simply use ad hoc payments.

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[48] 57 respondents (out of a total of 77) replied to this question.

On 'automatic' authentication systems: adoption of upcoming ISO 15118-20[49] as EU standard?

A large number of respondents is in favour of harmonising automatic user authentication related to electromobility recharging at EU level: about 86% of respondents support this (see Figure 22 below). Among those, almost 63% agree that the upcoming ISO 15118-20 should be the protocol of choice.

Figure 22: Should automatic authentication systems be harmonised at EU level?[50]
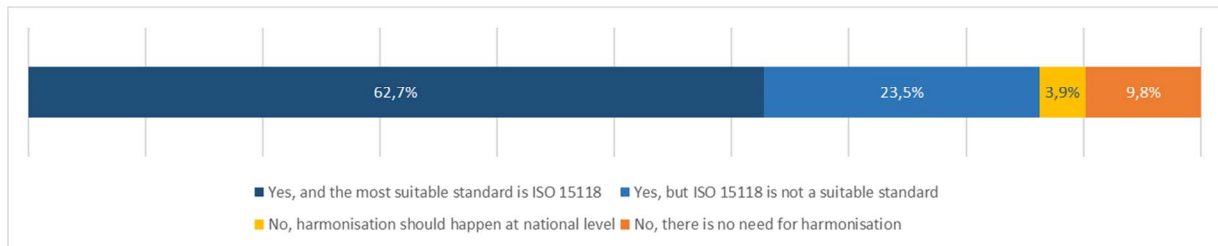
The responses of individual CPO respondents (so excluding associations who indicated they have CPOs among their members) run along similar lines, although there is a greater discrepancy of views regarding the suitability of ISO 15118-20 as the basis for harmonisation. 5 out of 15 individual CPO respondents support harmonisation by means of ISO 15118-20, while another 5 support the same but indicate that ISO 15118-20 is not suitable for that purpose. Only one CPO respondent feels harmonisation should happen at national level, while 2 CPO respondents indicate there is no need for harmonisation at all.

It should however be noted that there are a number of criticisms with regard to the upcoming ISO 15118-20 in its current form, which many respondents feel should be addressed before this standard is published and generalised (see above in the section 'Manual vs automatic authentication systems').

On 'automatic' authentication systems: which system for unique authentication and mutual recognition of EV actors?

Preliminarily, it should be mentioned that the –possibly very detailed and technical- questions in this section of the questionnaire received a relatively low response rate: only 36 out of a total of 77 respondents to this questionnaire.

When asked what is the most suitable format to authenticate electromobility actors and encrypt messages between them, 89% of respondents argued it is a PKI. Only two respondents believe that blockchain has a role to play here. Another respondent argues that there is a third way: the simplest, most secure and most open source solution would allegedly be a Europe-wide obligation for VIN communication within the CCS standard. Last but not least, one respondent argues that the market is simply in a too early stage of development to single out two technologies only.

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[49] It should be noted that the relevant question in the original Questionnaire II distributed to the stakeholders in April 2019 incorrectly referred to "ISO 15118" (some versions of which are already published) and not to "ISO 15118-20" (currently in the making), which the question intended to refer to.
[50] 51 respondents (out of a total of 77) replied to this question.

Figure 23: Who should set up PKIs and who should set them up and act as "root certification authority"?[51]

- A unique PKI should be set up for the entire European Union by an independent third party with no conflict of interest
- Different PKIs should be set up by one or more third parties without any conflict of interest in the e-mobility market
- Public authorities should set up the governing framework and market parties can manage the PKI(s)
- It should be fully left to market parties

Amongst the proponents of a PKI, there, however, does not appear to be a consensus as to who should set it/them up and act as "root certification authority" for issuance of the root "keys" (see Figure 23). A majority of respondents (almost 70%) does agree that government intervention of some form is required. Among those, a small majority favours the setting up of a unique PKI for the entire European Union by an independent third party with no conflict of interest; the remainder feels that the public authorities should limit themselves to setting up the governing framework, while allowing market parties to manage the PKI(s). These proponents of a unique PKI argue that the development of multiple PKIs alongside one another risks leading to non-interoperable systems and may greatly increase the complexity of the system. Some stress the importance of an independent PKI management, arguing that if the role of RootCA is left to a specific market player (and competitor to others), this will result in the market not trusting this PKI to be neutral and fair, not participating in this PKI and therefore not adopting the secure digital communication.

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[51] 51 respondents (out of a total of 77) replied to this question.

3.3 Cybersecurity

Problem Description

Member States have to transpose the NIS Directive (Directive 2016/1148 on security of network and information systems) into their national laws by 9 May 2018 and identify operators of essential services by 9 November 2018. In general, the NIS Directive provides legal measures to boost the overall level of cybersecurity in the EU by ensuring:

- Member States' preparedness by requiring them to be appropriately equipped, e.g. via a Computer Security Incident Response Team (CSIRT) and a competent national NIS authority,
- cooperation among all the Member States, by setting up a cooperation group, in order to support and facilitate strategic cooperation and the exchange of information among Member States. They will also need to set a CSIRT Network in order to promote swift and effective operational cooperation on specific cybersecurity incidents and sharing information about risks,
- a culture of security across sectors which is vital for our economy and society and which relies heavily on ICTs, as in the sectors of energy, transport, water, banking, financial market infrastructures, healthcare and digital infrastructure. Businesses in these sectors that are identified by the Member States as operators of essential services will have to take appropriate security measures and to notify serious incidents to the relevant national authority. Also, key digital service providers (search engines, cloud computing services and online marketplaces) will have to comply with the security and notification requirements under the new Directive.

While Member States have defined electricity network operators as operators of essential services, none have identified CPOs or any other actors operating in the mobility system as operators of essential services. Hence, at present, the NIS directive does not yet apply to EV charging and there is no clear EU regulation for the cyber-security of EV recharging.

This could be critical as for example electric vehicles and recharging points are connected to the grid and hence interact directly with the electricity system. Recharging stations are usually connected devices, which means that they can be controlled remotely by the CPO. The CPO can, for example, execute remote maintenance of software, or reset the recharging station if it ran into a fault. In addition, there might be a need to manage the available capacity for EVs in peak hours when this capacity demand imposes a grid challenge and hence managed charging is needed from the grid perspective. Furthermore, EVs become increasingly connected. It is hence safe to say that the electromobility sector will develop into a data-driven sector that will be based on IT technology and digital communication.

The downside of this connectivity is that also malicious users could potentially interfere with the system. This would foremost hit the mobility sector itself as EV drivers (cars, buses, heavy duty) may be inhibited from charging and hence cannot circulate. However, the bigger impact could be a disruption of the electricity system caused by hacked recharging points or by hacked electric vehicles. By controlling thousands of recharging points or vehicles and hence being able to request charging at times when the grid is already at its capacity limits can seriously disrupt the energy grid and can potentially lead to black-outs. It is hence important that especially recharging points are secure and meet cyber security requirements.

Such cybersecurity requirements could for example address the physical recharging point or recharging station, the communication protocol(s) used and the (cloud) servers:

- Concerning the physical device itself, it should be future-proof, for example: enough computational power and memory resources to be able to handle future algorithms and protocols, and firmware updates would need to be required.
- Cryptographic algorithms and protocols: most currently used cryptographic algorithms and protocols are considered secure. However, it could be that a vulnerability is found which requires to switch to a different algorithm. An obligation, to follow the latest security advice, could be part of the cybersecurity requirements.
- Communication security: Communication to and from the device(s) should be secured, e.g. by TLS encryption and digital signatures.

Analysis of stakeholder views

Opinions by the respondents were divided as to the need of specific requirements on EU level for alternative fuels infrastructure with respect to cybersecurity. Only 41 stakeholders (or slightly more than 50% of stakeholders) responded to the question with a slight majority (56%) being in favour of additional requirements at EU level. However, most respondents were not explicit on how and where those issues should be addressed. While some made explicit reference to AFID, others would rather like to see the inclusion of issues linked to recharging points in the context of the work on cybersecurity in the energy sector.

Some respondents being against specific requirements highlighted that existing legislation was already sufficient and that adding too many costly requirements could make electromobility overly expensive.

3.4 Transparency of prices and billing

Problem Description

Article 4(10) of the Alternative Fuels Infrastructure Directive requires that "prices charged by the operators of recharging points accessible to the public are reasonable, easily and clearly comparable, transparent and non-discriminatory".

Despite this provision, it has resurged from a number of consumer surveys that consumers often do not know the exact price prior to their recharge or are confronted with unexpected costs on their bill, e.g. session fees or roaming costs.

In this section, we will analyse and consolidate the replies of stakeholders to our inquiries about transparency of prices at the station and on the bill, including issues in relation to price components and roaming charges.

3.4.1 Price transparency

Analysis of Stakeholder views

Transparency of prices: ad hoc vs contract-based charging

First and foremost, almost four out of five respondents believe that consumers currently never or rarely have full information about all the different components of the total price for recharging at publicly accessible recharging points. Interestingly, this feeling is shared by about 70% of CPOs, EMSPs and roaming platforms responding to this question; the ones that do think that consumers have full information admit this is only true 'in most cases'. Of all respondents to this question, only one (a public authority) believes that consumers always have full information of the different components that will constitute the final price.

Almost three out of four respondents feel that there is a distinction to be made between ad hoc price transparency and contract-based price transparency. In particular, CPOs indignantly point to the fact that the issue is not so much that prices are not displayed at the station, but that prices on the bills may differ from those advertised prices due to different contractually agreed prices and the addition of – non-transparent– roaming costs. In other words, in reality the EMSP often determines the final price for the charging service, not the CPO, notably in the case of contract-based charging. This leads to the confusing situation where the consumer is not invoiced according to the price that he sees on the station and assumes to be his agreed transaction price, but according to a price that he agreed to when he concluded his EMSP contract. Some EMSPs by contrast complain that they cannot display their prices on stations they do not own or operate. It is also argued that the application by CPOs of a variety of tariff structures (time-based, kWh-based, flat rates, start-up costs, etc.) combined with variable costs such as EMSP transaction costs and additional roaming fees makes it hard to offer a one-size-fits-all solution for charging. They also argue that the specific CPO tariff is not always known in advance by EMSPs which makes it hard for EMSPs to properly inform consumers ahead of a recharging session; it is argued that widespread adoption of a uniform protocol for communications between CP/CPO and EMSP back-end systems would help overcome this issue.

Overall, respondents differ strongly in their opinions on which form of pricing is more transparent: ad hoc pricing or contract-based pricing. The proponents of ad hoc based pricing argue it has the potential (even though currently often not yet the case) of best informing consumers of the price right before they make their decision to initiate a recharging session; they claim consumers are often not aware of their contractual terms and hidden surcharges, such as for roaming. Proponents of contract-based charging argue that, once consumers are fully aware of their contract price, they will no longer have to check it each time before they recharge – as opposed to the ad hoc price which should be checked ahead of each recharging session. This is however, they admit, only the case when they remain within the remit of the network of their EMSP; when recharging at a recharging point owned/operated by a third-party, those same respondents fear for the addition of roaming costs (*Note from the Commission: roaming only applies in contract-based solutions*).

Ad hoc price transparency

A large majority of respondents (five out of six) believe that a further harmonisation of ad hoc price information would be beneficial for consumers. Of those respondents, no less than 90% is in favour of harmonising the price components.

When asked where prices should be displayed or communicated to consumers, respondents answered as follows (multiple responses were possible – percentages indicate the number of respondents out of total respondents to this question (68) that agreed to a specific solution):

Figure 24: Where and how should prices for ad hoc charging be communicated to consumers?
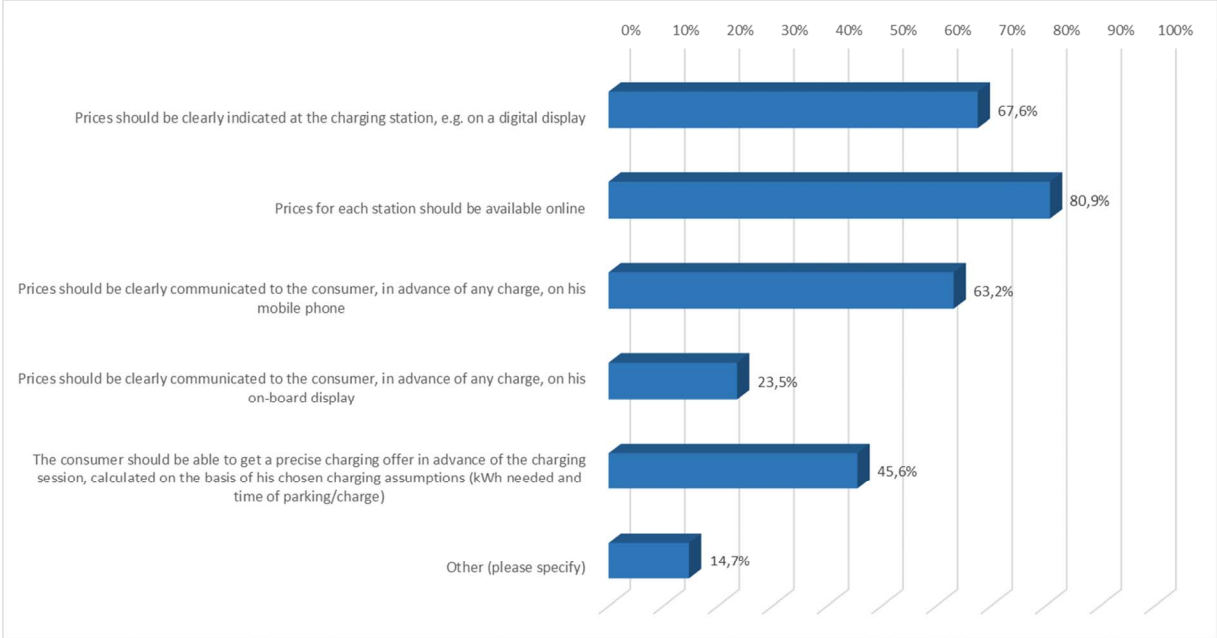
About two thirds of CPOs responding to this question (eighteen responding CPOs, including two associations that include CPOs among their members) believe that prices should be clearly indicated at the recharging station, via a display (which allows dynamic pricing) or at least a sticker (in case of fixed

prices). Only four CPOs explicitly argue against a digital display, mainly because this would increase the station cost, and thus charging costs, but also because this might confuse EMSP customers who may be charged an entirely different price for charging at that station (see above).

3.4.2 Roaming

With already hundreds of different CPOs managing their own networks around the EU, market actors are developing different solutions to link different CPOs together, and in turn link them to EMSPs. This will then allow consumers of one network operator to get access to a network managed by another operator.

The most basic model to achieve this is peer-to-peer connections that require individual bilateral agreements between the CPOs. However, since many CPOs are small and geographically dispersed, market parties have come up with new platform solutions to link all charging networks together through so-called e-roaming platforms. Although these have now been developed by the market 'bottom-up', it is important to note that different e-roaming solutions could be imagined. Besides the current set-up, where a number of private e-roaming platforms connect a multitude of CPOs and EMSPs, one could think of alternative set-ups which are more regulated or publicly driven. An example of the latter can be found in the telecommunications sector, where one roaming platform in each Member State connects all operators on that market and in turn connects those to all operators in another Member State through that other Member State's national roaming platform.

With respect to current private e-roaming platforms, some market actors have indicated that, as the electromobility market grows, such platforms may reach a level where they can "make or break" new entrants, by deciding whether and under what conditions they can be 'linked' through their platform (e.g. by setting the access fees to new entrants).

Against this background, the Questionnaire asked participants which policy measures at EU level, if any, could help to ensure full geographic coverage of roaming services while ensuring access to the market for new entrants and reasonable and transparent prices/charges for EV-users.

Analysis of Stakeholder views

Respondents' views on roaming platforms are highly divergent and can be roughly summarised along the following lines[52]:

- Roaming should be mandatory / CPOs must connect to at least one roaming platform / it should be mandatory for all CPOs to open their network to any EMSP (15 respondents)
- Promote internet-model P2P connections / impose single communication protocol (e.g. OCPI) (12 respondents)

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[52] The overview of results presented here does not include suggestions mentioned by fewer than three participants. Some respondents have expressed concerns that fit in more than one category, in which case they have been counted towards each category.

- Prices for roaming should be made public / roaming prices should be reasonable and the same for all market actors (10 respondents)
- Obligation for roaming platforms to connect any market actor at reasonable terms / regulate roaming platform independence from other market roles / set up national roaming platforms: CPO/EMSP (9 respondents)
- Ensure competition amongst roaming platforms by promoting multiple roaming platforms (3 respondents)
- No need for intervention on contract-based charging on condition that ad hoc works properly / market will solve it (10 respondents)

3.4.3 Other information, billing and consumer protection

Analysis of Stakeholder views

Regarding other information that should be displayed at the recharging station, more than half of respondents to the questionnaire believes that the origin of the energy, and in particular whether or not it is renewable, should be mandatorily displayed at the recharging station. The main argument is that decarbonisation is an explicit objective of the Alternative Fuels Infrastructure Directive, for which reason the Directive should ensure that the energy being recharged into EVs is indeed supporting that objective. About a fourth of respondents believes this should not be mandatory; a large part of those would however be in favour of a mandatory communication by the CPO of the origin of the energy supplied, albeit not necessarily at the recharging station. Only a small number of respondents feel that consumers should be mandatorily informed about the supplier of the energy at the recharging point. Few respondents point to experiments in the Netherlands to allow consumers to choose their supplier at the recharging point, and ultimately use their own home-produced (solar) energy, though it is also acknowledged that these projects are in a research phase and require changes to the existing electricity market design. It would hence be too early to include anything in this respect in European legislation.

It was argued by one participant to the second STF working group meeting that the European Commission should consider adopting minimum customer-friendly requirements for recharging stations (presumably recharging stations on highways), just like these exist for conventional petrol stations. This could include requirements for cover against the rain, the availability of recharging cables, etc. Another participant however argued that, if mandatory, such requirements would add cost to the infrastructure and would risk delaying the roll-out.

Respondents are divided as to the need for more detailed rules for billing for recharging services at EU level, with a small majority in favour of more detailed EU regulation. The proponents propose to require a minimum amount of data on invoices, reflective of harmonised ad hoc price components if these are adopted.[53]

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[53] For instance: the date, time, and place of the charging event; the number of kWh provided; the cost per kWh; any time-based or parking fees and the total cost.

Three respondents use this question to ask the Commission to clarify whether recharging constitutes a supply of goods or the provision of a service, since apparently Member States apply different interpretations for the resale of electricity for electromobility, which in particular has knock-on effects for VAT treatment, and other energy taxation.[54]

There is not much appetite amongst respondents to include more detailed rules for consumer protection in sector-specific European legislation for alternative fuels (two thirds against).

By contrast, a large majority (more than 93%) of respondents believes that consumers should have the legal right to freely choose the EMSP or several EMSPs of their choice and switch between EMSPs as they like.

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[54] The Commission services have already stated that they consider the provision of electricity for recharging at publicly accessible recharging infrastructure to constitute a service. Moreover, it follows from Art. 4 (8), first sentence of the Alternative Fuels Infrastructure Directive that CPOs are to be considered final customers in the meaning of the Electricity Directive (2019/944). As such, a CPO is considered to be the final customer within the Electricity Directive who sells a recharging service to the EV-user. The CPO does not sell electricity and therefore cannot be considered as a supplier in the meaning of the Electricity Directive.

3.5 Smart charging and vehicle-to-grid (V2G), including issues related to access to vehicle data

Problem Description

This section analyses if and to which extent barriers for smart charging and vehicle to grid services exist. These services are widely seen as necessary to efficiently integrate EVs into the electricity system. However, currently, smart charging offers are already available on the market in some Member States while vehicle-to-grid has been so far mostly tested in pilot applications with first commercial offers slowly emerging in some markets. The recent recast of the Electricity Directive (2019/944) aimed at removing barriers on the side of electricity markets, such as: fully enabling non-discriminatory access of aggregated loads to all wholesale and ancillary markets, enabling DSOs to actively manage their grids and purchase flexibility, granting final customers the right to request a smart meter and a dynamic price contract[55], granting independent aggregators access to the markets, etc. This section focuses on remaining barriers for smart charging and vehicle-to-grid at the recharging infrastructure and vehicle side.

Analysis of stakeholder views

Around three quarters of stakeholders replied to the questions related to smart charging. Of those stakeholders that responded to the questions, 96% feel that the current legislative framework is not or only partly sufficient to enable vehicle-to-grid services. In principle, four main areas have been identified as possible bottlenecks:

- Energy markets: aggregators must be able to access the EV-user as well as the electricity markets while DSOs need to be enabled to buy flexibility and electricity from storage operators for managing their networks. Less frequently, also the importance of smart charging infrastructure, intelligent metering, dynamic electricity retail prices and dynamic grid tariffs were mentioned. All these aspects are in principle enabled by the revised Electricity Directive. However, it will be crucial that Member States transpose the corresponding provisions correctly to fully enable smart charging/vehicle-to-grid. Doubts were raised by some stakeholders that Member States may not implement dynamic network tariffs which will minimise the price signal and hence make smart charging less attractive.
- One economic bottleneck for vehicle-to-grid and in fact all electricity storage services is the risk of double taxation (and double charging of levies[56], etc.) which risks to render the business case negative. This happens if electricity is taxed when the electricity is stored and then again when the stored electricity is sold and finally consumed.
- Standards and communication protocols to enable vehicle-to-grid and to a lesser extent smart charging are not yet fully developed and risk not to be the same across Europe.

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[55] In the case of public recharging infrastructure these rights are granted to the CPO as the final customer in the meaning of the Electricity Directive.

[56] For example double network charges. However, Art 15 of the revised Electricity Directive (2019/944) already requires the elimination of any double charges in the context of vehicle-to-grid operations.

- All operators of vehicle-to-grid services need access to battery data in order to offer their services. However, currently only vehicle manufacturers control access to this data. Furthermore, it is not always clear as to who authorises smart charging and vehicle-to-grid (is it always the EV-user, or can the CPO, vehicle manufacturer, DSO or other actors also authorise such operations without approval of the EV-user) and who can ultimately benefit from offering these services.

A few other aspects were mentioned such as grid-friendly location planning, safety concerns and battery warranty that would need to be addressed in order to ensure that vehicle-to-grid services can be offered.

What concerns intelligent metering systems that will, for example, allow for pricing of charging services according to actual electricity prices at the spot market and the state of the electricity grid, respondents were rather divided concerning the need for such systems (see Figure 25). For publicly accessible recharging points 78% of the respondents think that such systems are essential or important for slow recharging points (<22kw) while 58% respectively 48% feel it is essential or important for fast and ultra-fast recharging points. While figures are similar for semi-public recharging points (in supermarkets, etc.), most respondents (around 75%) consider that smart metering systems are either essential or important for private slow and fast recharging points. Hence, a majority of respondents seem to believe that smart metering systems are specifically relevant for private and publicly accessible slow charging while being less relevant for publicly accessible fast and ultra-fast charging.

Figure 25: Perceived need for intelligent metering[57]

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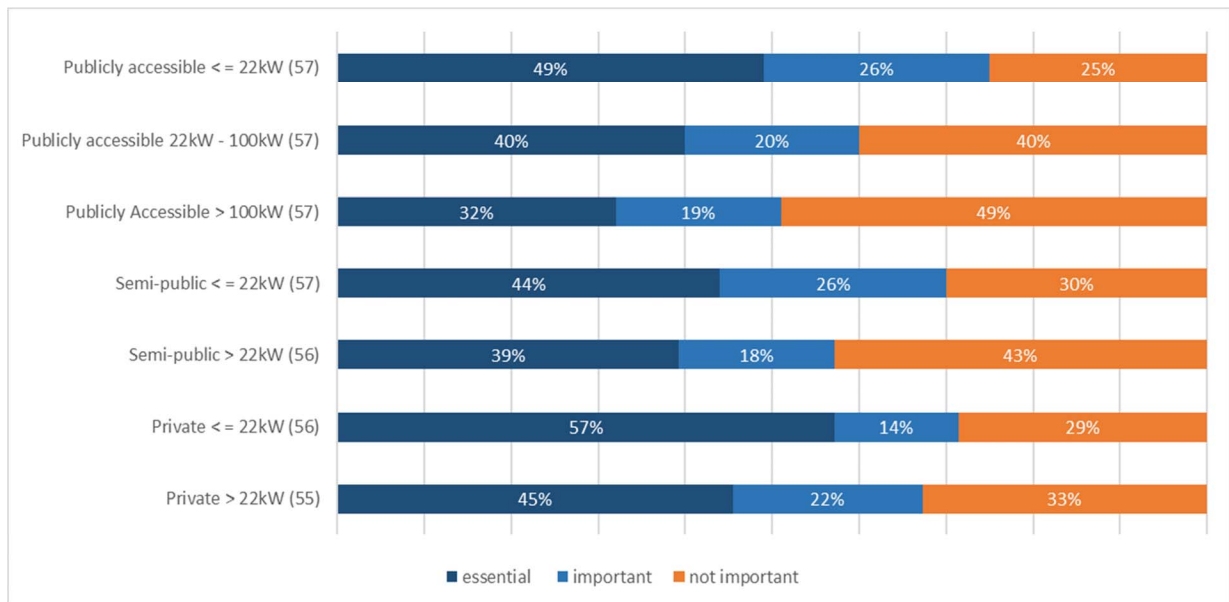
[57] Total number of responses (out of a total of 77; excluding blanks and 'No opinion / I don't know') between brackets.

While the problems with respect to smart charging and vehicle-to-grid were clearly identified and described, possible solutions were not addressed in the same detail.

Aspects related to electricity markets and the role of DSOs, have already been addressed in the recently adopted electricity market design. The same is true for smart metering systems, where all final customers (including CPOs) have been granted the right to request a smart metering system. However, to fully enable smart charging/vehicle to grid also the charging infrastructure must be smart, e.g. be able to measure the charging, control it and communicate. No solutions were suggested that would go beyond the provisions of the market design, apart from one stakeholder proposing to introduce a definition of smart charging infrastructure into AFID and another proposing to require that all publicly accessible infrastructure is "smart charging ready". However, it is of crucial importance that the provisions are correctly transposed in national law and subsequently enforced.

Avoiding double taxation is clearly important to ensure that vehicle-to-grid (and in fact all storage) use cases can be economically beneficial. However, while the Energy Taxation Directive sets some general principles, Member States are responsible for their own tax regimes and hence European legislative measures that avoid double taxation will -for subsidiarity reasons- be difficult to implement.

No solutions were presented on how EV-users are being guaranteed that smart charging/feeding electricity back to the grid will not negatively affect battery performance or battery lifetime. This suggests that aspects related to battery warranty should be best left to the market.

This leaves effectively two aspects with regards to smart charging/vehicle-to-grid for which concrete solutions on an EU level were proposed:

- 90% of respondents stated that access to battery data is required in order to enable all interested parties to offer services to the EV-users and for DSOs to actively manage their grid efficiently. However, aspects related to vehicle battery data may best be addressed within the larger framework of access to vehicle data (e.g. for maintenance, etc.). One respondent specifically highlights in this context that the issue of data security should also be appropriately addressed.
- Harmonisation of standards and protocols to enable vehicle-to-grid use cases are clearly required. However, such standards/protocols that are – for example - being developed under IEC 63110 and ISO 15118 are not yet sufficiently mature to be made mandatory

Individual respondents also made the following recommendations:

- Setting up a common registration process for EV's as service providers to minimise the administrative burden to offer grid services
- Issuing technical recommendations for vehicles to allow efficient recharging, e.g. a 3-phase recharging solution

4 Main findings of the stakeholder consultation

This section summarises the main findings from the stakeholder consultation through the Sustainable Transport Forum. These findings represent the views of the 91 unique respondents to the questionnaires. This report does not assume to represent the full spectrum of possible stakeholder views. Further analysis and exchange among stakeholders can help further fine-tune the findings of this exercise. This is particularly true for the market for electric recharging, which has developed as a very different market from the conventional refuelling market, creating specific regulatory challenges, which also explains the larger focus of this report on this market.

The findings of the stakeholder consultation, which are summarised below, reveal a general consensus about some topics or policy areas among respondents as well as clear discontent about others. They provide a general view of the status, challenges and needs for future policy developments for alternative fuels and infrastructure at EU level.

I. Requirements for deployment of alternative fuels infrastructure

Deployment of alternative fuels infrastructure

- A majority of respondents agreed that the current situation is insufficient or somewhat insufficient for all alternative fuels. Views of future market needs differ. In spite of a broad expectation that deployment of recharging infrastructure will accelerate, responses majorly underline the need for clear legislative minimum requirements to support this ramp up.

- In relation to the future deployment of infrastructure, quite a few respondents feel there is a need to review the metrics that are currently in wide use in the policy discussion. A majority of respondents supports binding targets as part of a future policy framework, but note that they would need to be based on a more elaborate methodology. Some respondents question the need for future deployment legislation to mandate LNG or CNG infrastructure since it is fossil-fuel based.

State of play of market: competition and market failures

- There is broad consensus that alternative fuel infrastructure should develop as a competitive and market driven business. However, investment in alternative fuel infrastructure is widely seen as still unprofitable. Although respondents perceive different funding needs for different types of alternative fuels infrastructure, the overall picture reveals a sentiment that private investments alone may not ensure a sufficient coverage of refuelling/recharging infrastructure. Therefore, a vast majority of respondents call for additional public support in setting up such infrastructure. Particularly market actors identify heavy and lengthy permitting procedures as a barrier and call for simplification and streamlining. Some respondents point to concession policies in Member States that are not always considered to allow for fully competitive bidding and favour larger or local investors.

- When it comes to competition for offering recharging and related services on a recharging point, there is a clear consensus among respondents: the operator or owner of the recharging point currently controls the access to his infrastructure and, therefore, the services offered, including by third-party E-Mobility Service Providers. However, there is a divergence of views among respondents whether this is a normal feature of a market were the investor decides with whom he cooperates on his infrastructure or an abusive business practise that unduly limits competition on infrastructure that is built in the public domain and that is publicly accessible.

Minimum technical requirements for alternative fuels infrastructure

- The Alternative Fuels Infrastructure Directive already defines a number of technical standards mostly related to the physical connection between the recharging/refuelling point and the vehicle/vessel. Only a small share of respondents identify problems with these standards, while the majority find them fully or at least partly adequate. In order to create an open market, a number of further standards on communication interfaces / protocols (notably ISO 15118-20) are currently under negotiation within the relevant international standardisation body, especially for electromobility. Some respondents suggest that further standardisation might be necessary, but there is currently no clear consensus between stakeholders on this issue.

- Most respondents also highlight the potential negative impacts of technical unavailability of recharging and refuelling points, especially in the earlier stages of development of the alternative fuels market, when the coverage is limited. Some call for mandatory uptime requirements in the future to address this. Finding an alternative recharging/refuelling point might require driving a relative long distance. Several respondents express the view that digital connection might help by providing accurate and timely information about technical availability.

- Many respondents also consider the question of ensuring accurate metering at recharging points relevant, in order to allow fully transparent pricing and consumer information.

- Finally, no consensus emerged in relation to accessibility of alternative fuels infrastructure for persons with a disability, and in particular the extent to which requirements should differ from accessibility requirements for conventional fuels infrastructure.

II. Consumer services and seamless payments

Finding alternative fuels infrastructure

- Respondents to the stakeholder consultation consider it essential that EV-users have easy access to information on the location and availability of all recharging points. A strong majority amongst them believe that such information should be available at no cost. Many respondents believe that such data should logically be provided by the operator or by the owner of the infrastructure, or by both. Member States should in turn be responsible for enabling open access to such data. Most respondents feel that in practice information regarding the geographic location of rechargers is available in full or to some extent. However, the opposite is

true for real-time information relating to the rechargers (technical availability / occupation status).

- Respondents clearly agree that a further sub-categorisation of high power (DC) recharging points is beneficial – both in order to develop more granular deployment methodologies (in particular for HDV) and for statistical purposes.

- Last but not least, an overwhelming majority of respondents believes that roadside indicators / road signs for alternative fuels infrastructure should be harmonised across the EU.

Payment methods: ad hoc and contract based

- A near unanimity of respondents consider that ad hoc charging still is a relevant ease-of-use way of recharging for EV-users. Two-thirds of respondents, however, feel that ad hoc charging needs to be better circumscribed, in particular the payment method offered to ad hoc users. Despite this, there is less agreement on the precise payment method to be offered to ad hoc users.

- Answers to questions on contract-based charging are fraught by greater disagreement, in particular in relation to the need for regulatory intervention at this early stage of market development. Despite this, some clear majority views emerge. In order to address authentication issues experienced in relation to contract-based charging, almost two-thirds of respondents argue for some form of harmonisation of the authentication by means of radio frequency identifiers (RFID) at EU level; a majority of those argue for harmonisation of the card/badge technology for electromobility. Similarly, a large number of respondents is in favour of harmonising automatic user authentication for electromobility at EU level. Two-thirds of respondents support the use of the upcoming ISO 15118-20 protocol for this purpose. Yet many respondents plead for greater involvement of market actors other than vehicle manufacturers in the development of this protocol. Respondents also feel that additional work is needed to develop an open Public Key Infrastructure that is argued necessary to enable ISO 15118-20, in order to create a level-playing field between electromobility actors.

Cybersecurity

- As any digitally connected sector, electromobility is exposed to cyber threats; specifically the recharging infrastructure. Attacks could potentially affect the charging and hence the operation of electric vehicles but also – and more critically – have impacts on the operation of the electricity grid.

- There is no consensus among respondents if those threats need a separate EU intervention dedicated to electromobility. However, if it was so decided, a vast majority of respondents indicated that it should be done through the cyber security work within the energy sector where potentially also security of recharging stations (interface between the electromobility and the electricity system) could be addressed.

Transparency of prices and billing

- Respondents by and large acknowledge that EV-users currently have limited information on the final price of a recharging session. The interchangeable advertising of ad hoc and contract-based prices can lead to user confusion.

- A large majority of respondents is in favour of a further harmonisation of ad hoc price information, while, in turn, the large majority of those is in favour of harmonising ad hoc price components to that end. A majority of respondents is moreover favourable to more harmonised rules on the ways of communicating the ad hoc price to consumers (different channels enjoy majority support: online, at the station and on user's phones).

- Respondents' views on roaming platforms are highly divergent. They indicate a lack of consensus on the need for any regulatory intervention in this area at this stage of market development. This seems also caused by a lack of clarity regarding the future role and importance of such platforms.

- Respondents feel that current consumer rules already enable a good protection of users of alternative fuels infrastructure. Nevertheless, a large majority of respondents believes that consumers should have the legal right to freely choose the E-Mobility Service Provider or several E-Mobility Service Providers of their choice and switch between E-Mobility Service Providers as they like.

Smart charging and vehicle-to-grid (V2G)

- There is wide consensus that smart charging and vehicle-to-grid will be essential to ensure an efficient integration of electric vehicles into the electricity system. Many respondents indicate that the recent recast of the Electricity Directive (2019/944) already provides a framework for the development of competitive electricity services that – if transposed swiftly and correctly in Member States – would be sufficient to allow smart charging and vehicle-to-grid services to develop in the market if smart charging infrastructure was deployed. On the technical side, further work is required on the harmonisation of standards and protocols to enable vehicle-to-grid use cases.

- However, a potential bottleneck for the development of smart charging and vehicle-to-grid services lies in the availability of battery data that – according to a vast majority of respondents – should be made available to all interested commercial parties subject to consent by the EV-owner in accordance with the General Data Protection Regulation (EU) 2016/679.

Annex 1: Overview of invited stakeholders and respondents

1. Overview of invited stakeholders and their responsiveness[58]

	Cat.1 Member States / EFTA observers		
	Country	**Questionnaire I**	**Questionnaire II**
1	Austria		
2	Belgium		
3	Bulgaria	X	X
4	Cyprus	X	X
5	Czech Republic	X	X
6	Germany	X	X
7	Denmark		
8	Estonia		
9	Greece	X	X
10	Spain	X	X
11	Finland	X	X
12	France	X	X
13	Croatia	X	X
14	Hungary		
15	Ireland	X	X
16	Italy		
17	Lithuania		
18	Luxembourg		X
19	Latvia	X	X
20	Malta	X	X
21	Netherlands	X	X
22	Poland	X	X
23	Portugal		
24	Romania		
25	Sweden		
26	Slovenia		
27	Slovakia		
28	United Kingdom		
29	Iceland		
30	Norway		
	TOTAL RESPONSES	14	15
	RESPONSE RATE CAT. 1	47%	50%

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[58] Note that if a stakeholder has not responded to either of the Questionnaires, this does not necessarily indicate lack of interest, but may indicate that he has never received the questionnaires in the first place (e.g. due to use of incorrect contact details for the invitation).

	Cat. 2 STF expert members		
	Organisation	Questionnaire I	Questionnaire II
31	ACEA - European Automobile Manufacturers Association	X	
32	Liquid Gas Europe		
33	Alstom	X	
34	AVERE	X	X
35	European Automotive Research Partners Association (EARPA)		
36	European Consumer Organisation (BEUC)	X	X
37	CEN-CENELEC	X	X
38	CLEPA		X
39	Deutsche Post DHL Group	X	
40	European Biodiesel Board (EBB)		
41	EMT Madrid		
42	European Producers Union of Renewable Ethanol (ePURE)	X	
43	European Sea Ports Organisation (ESPO)	X	
44	Eurelectric	X	X
45	European Biogas Association		
46	FuelsEurope		
47	Gas Infrastructure Europe (GIE)	X	X
48	International Road Transport Union (IRU)	X	
49	Hydrogen Europe	X	
50	Natural Gas Vehicle Association (NGVA)	X	X
51	Orgalim	X	X
52	Polis	X	X
53	SNCF		
54	Transport & Environment (T&E)	X	X
55	Tesla	X	X
56	Union Petrolière Indépendente (UPEI)	X	
57	Verband der Elektrotechnik - Elektronik Informationstechnik (VDI-VDE-IT)		
58	Alliance for Synthetic Fuels in Europe (ASFE)	X	
59	Nissan-Renault	X	X
60	European Biofuels Technology Platform		
	TOTAL RESPONSES	20	12
	RESPONSE RATE CAT. 2	67%	40%

Ad hoc experts Cat. 3		
Organisation	Questionnaire I	Questionnaire II
61	Region Ile de France (FR)		
62	Provincie Noord-Brabant (NL)	X	X
63	Barcelona city / Catalunya (ES)		
64	Copenhagen city (DK)	X	X
65	MZA - Warszaw public transport operator (PO)		
66	Stuttgart Region	X	X
67	City of Amsterdam	X	X
68	Brussels Capital Region (BE)	X	X
69	Flanders Region (BE)	X	X
70	Walloon Region (BE)	X	X
71	Volkswagen		
72	Volvo		X
73	IVECO		
74	Emoss		
75	Solaris Bus & Coach SA	X	
76	Daimler		
77	E.DSO	X	X
78	ENTSO-E	X	
79	SmartEN		
80	GEODE	X	X
81	CEDEC		X
82	ESMIG		
83	ElaadNL / Stedin	X	X
84	CEER		
85	Hydrogen and Fuels Cells Joint Undertaking		
86	Shell / NewMotion	X	X
87	Polish E-mobility Promotion Foundation (FPPE)	X	
88	Netherlands Knowledge Platform for Charging Infrastructure (NKL) / evRoaming4EU	X	X
89	WindEurope		
90	SolarPower Europe		
91	European Association for Storage of Energy (EASE)	X	X
92	European Federation of Inland Ports (EFIP)	X	
93	European Barge Union (EBU)		
94	EIBIP	X	
95	EFACEC	X	X
96	ABB	X	X
97	ChargePoint	X	X
98	Allego	X	X
99	Fastned	X	X
100	ENEL	X	X
101	Slovanian Charging Network (Ultra E project)		
102	Renovatio Asset Management (RO Charging Network - CEF)	X	X
103	Clever (DK)		
104	Elmo- charging network Estonia		
105	Mobi-E (PT)		
106	PlugSurfing		

107	Eco-movement (NL)	X	X
108	Zappass (BE)		X
109	Ionity	X	X
110	PitPoint	X	X
111	EVBox	X	X
112	Parking Energy	X	X
113	Electricité de France (EDF) / Sodetrel	X	X
114	EnBW Energie Baden-Württemberg AG	X	X
115	Chargy		
116	Vattenfall- InCharge, (RFID system)		
117	Jedlix, / reneweable		
118	Nuvve Corporation	X	X
119	TomTom		
120	Here Technologies		X
121	Hubject	X	X
122	Gireve	X	X
123	Smartlab Innovationsgesellschaft mbH	X	X
124	Association Française pour l'Itinérance de la Recharge Électrique des Véhicules (AFIREV)	X	X
125	CHAdeMO	X	X
126	European Environmental Citizens' Organisation for Standardisation (ECOS)	X	X
127	CharIN e.V.	X	X
128	ANEC (consumer organisation for standardisation)		
129	VITO NV	EnergyVille	X	X
130	Living Lab Smart Charging	X	X
131	Norwegian EV Association	X	X
132	Siemens	X	X
133	International Association of Public Transport (UITP)	X	X
134	ECF		
135	Payment service provider Worldline		
136	Regulatory Assistance Project (RAP)	X	X
137	E-motus (IT EV association)		
138	MOL (HU energy incumbent)		X
139	Eurocities	X	X
140	Westnetz/Innogy		
141	EON		
142	German Association of the Automotive Industry (VDA)	X	X
143	Toyota Motor Europe		X
144	JRC	X	X
	TOTAL RESPONSES	49	50
	RESPONSE RATE CAT. 3	58%	60%
	TOTAL CAT. 1-3	83	77
	RESPONSE RATE CAT. 1-3	58%	53%

2. Country of origin[59]

Questionnaire 1: origin of respondents

Legend:
European Union, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Malta, Netherlands, Poland, Portugal, Romania, Spain, USA, Switzerland, Norway

Values shown: 29, 4, 1, 1, 8, 6, 2, 1, 1, 1, 1, 1, 1, 1, 15, 3, 1, 1, 1, 1, 1, 1

Questionnaire 2: origin of respondents

Legend:
European Union, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Spain, Sweden

Values shown: 22, 6, 1, 7, 5, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 15, 1, 1, 1, 1

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[59] Based on respondents' own replies.

3. Transport modes[60]

Questionnaire 1: represented transport modes

- Road transport: passenger vehicles (cars, vans etc.) — 63
- Road transport: buses, coaches etc. — 56
- Road transport: trucks, lorries, etc. — 53
- Rail transport (trains and tramways) — 28
- Inland waterway transport — 28
- Maritime transport — 23
- Aviation — 18
- None of the above — 11

Questionnaire 2: represented transport modes

- Road transport: passenger vehicles (cars, vans etc.) — 62
- Road transport: buses, coaches etc. — 53
- Road transport: trucks, lorries, etc. — 44
- Rail transport (trains and tramways) — 24
- Inland waterway transport — 22
- Maritime transport — 19
- Aviation — 15
- None of the above — 11

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[60] Based on respondents' own replies.

Questionnaire I - Requirements for deployment of infrastructure

RESPONDENT INFORMATION

1. **Please state the full name of the organisation on whose behalf you are responding to this questionnaire.**

2. **Please provide your full contact details (name, surname, title, telephone, email).**

3. **Please state the Member State where your organisation is located. For groups of companies that have subsidiaries or activities in a number of Member States, please state the Member State where the main offices of the respondent organisation are located. For associations representing their members at EU level, please select "European Union". For organisations having their main offices in a non-EU country, please select "Other" and specify.**

   ( ) European Union

   ( ) Austria

   ( ) Belgium

   ( ) Bulgaria

   ( ) Croatia

   ( ) Cyprus

   ( ) Czech Republic

   ( ) Denmark

   ( ) Estonia

   ( ) Finland

   ( ) France

   ( ) Germany

   ( ) Greece

   ( ) Hungary

   ( ) Ireland

   ( ) Italy

   ( ) Latvia

   ( ) Lithuania

   ( ) Luxembourg

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[61] Due to technical constraints of the EU survey online questionnaire tool (e.g. in relation to the use of tables), certain questions may have been reformatted or split for the purposes of integrating these word versions of the questionnaires into the online EU survey tool. This may for instance have led to a renumbering of the questions.

( ) Malta

( ) Netherlands

( ) Poland

( ) Portugal

( ) Romania

( ) Slovakia

( ) Slovenia

( ) Spain

( ) Sweden

( ) United Kingdom

( ) Other: please specify

4. Which of the following best describes your organisation (multiple answers possible):
National public authority (transport ministries, agencies)
Regional or local public authority
Public transport operator*
Vehicle or equipment manufacturer/supplier
Energy distribution or supply company
Fuel producer or retailer*
Fuel station operator (infrastructure developer or operator)*
Fuel station manufacturer*
Charging point operator (infrastructure developer or operator)
Charging point manufacturer*
E- mobility Roaming platform (e-roaming) – enabling platform for accessing different service providers networks
Payment services provider
Communication network provider
Logistics supplier
Private fleet operator
R&D&I and academia
Interest group*
Other*

4.1. If *, please specify:

5. In which of the following transport modes is your organisation active (multiple answers possible)?
Road transport: passenger vehicles (cars, vans etc.)
Road transport: buses, coaches etc.
Road transport: trucks, lorries, etc.
Rail transport (trains and tramways)
Inland waterway transport
Maritime transport
Aviation
None of the above

6. Which of the following fuels are relevant for your organisation (multiple answers possible)?

Conventional fuels (petroleum derivatives, excl. LPG)

Liquefied petroleum gas (LPG)

Natural gas, incl. biomethane, in gaseous form (compressed natural gas (CNG)) or in liquefied form (liquefied natural gas (LNG))

Synthetic and paraffinic fuels

Biofuels as defined in point (33) of Article 2 of Directive (EU) 2018/2001

Hydrogen

Electricity (BEV and plug-in hybrids)

None of the above

I. Requirements for deployment of alternative fuels infrastructure

I.1 Deployment of alternative fuels infrastructure: progress, targets, methodologies and policy orientation

I.1.A Overall development of the network

In this sub-section, we ask for your views on the current status and progress made under the Alternative Fuels Infrastructure Directive with respect to achieving a basic network of alternative fuels infrastructure throughout the EU.

1. **Taking into consideration the amount of alternatively fuelled vehicles/vessels in circulation in the EU, do you believe that, in your Member State, there are currently sufficient publicly accessible recharging/refuelling points?**

   NB: by "publicly accessible" it is understood that everyone has non-discriminatory access to such infrastructure, irrespective of whether it is located on public or on private premises

	Fully sufficient	Somewhat sufficient	Somewhat insufficient	Not sufficient	No opinion/ I don't know
Electric rechargers					
in urban/suburban agglomerations and other densely populated areas					
along the main highways					
CNG refuelling stations					
in urban/suburban agglomerations and other densely populated areas					
along the main highways					
LNG refuelling stations					
at maritime ports					
at inland ports					
along the main highways					
Hydrogen refuelling stations					
along the main highways					

2. **In view of the expected uptake of alternatively fuelled vehicles/vessels, do you think that by 2030 publicly accessible infrastructure will be sufficiently developed**

	Fully sufficient	Somewhat sufficient	Somewhat insufficient	Not sufficient	No opinion/ I don't know
Electric rechargers					
in urban/suburban agglomerations and other densely populated areas					
along the main highways					
CNG refuelling stations					
in urban/suburban agglomerations and other densely populated areas					
along the main highways					
LNG refuelling stations					
at maritime ports					
at inland ports					

along the main highways					
Hydrogen refuelling stations					
along the main highways					

3. **The Alternative Fuels Infrastructure Directive currently asks Member States to develop 'national targets and objectives' for the deployment of alternative fuels infrastructure, based on an assessment by the Member States of national, regional or Union-wide demand. Do you think this mechanism has been and will continue to be successful in delivering a sufficient number of publicly accessible infrastructure in line with the expected uptake of alternative fuel vehicles?**

☐ Yes
☐ No
☐ In certain cases
☐ No opinion/I don't know

If not or only in certain cases, which concrete policy measures at European level (such as targets set at EU level for each Member State or for the EU as a whole, as suggested by the European Parliament) could in your view be successful to ensure sufficient coverage of refuelling/re-charging infrastructure across the EU?

4. **The Alternative Fuels Infrastructure Directive currently requires Member States to set national targets and objectives' for electric recharging points, CNG and LNG refuelling stations, which are reported under the National Policy Frameworks. The setting of targets for hydrogen is optional.**

Please indicate whether, in your view, the <u>mandatory adoption</u> by Member States of deployment targets for the following types of infrastructure is relevant:

Type of infrastructure		Relevant	Not relevant	No opinion / I don't know
Electric rechargers				
	in urban/suburban agglomerations and other densely populated areas			
	along the main highways			
CNG refuelling stations				
	in urban/suburban agglomerations and other densely populated areas			
	along the main highways			
LNG refuelling stations				
	at maritime ports			
	at inland ports			
	along the main highways			
Hydrogen refuelling stations				
	along the main highways			

In case you indicated 'not relevant' for one or more types of infrastructure, please explain.

5. What should be the geographical scope of a European policy for the deployment of a network for the following alternative fuels infrastructure?

Type of infrastructure	Complete transport network	Core and comprehensive TEN-T network	Core TEN-T network	No opinion / I don't know
Electric rechargers				
CNG refuelling stations				
LNG refuelling stations				
Hydrogen refuelling stations				

I.1.B Methodologies and targets for deployment of alternative fuels infrastructure

When developing their 'national targets and objectives' for the deployment of alternative fuels infrastructure under the Alternative Fuels Infrastructure Directive, Member States are encouraged to take into account certain recommendations for the deployment of alternative fuels infrastructure, which are included in the recitals of the Directive.

In this sub-section, we ask you whether these recommendations are still relevant or whether other deployment methodologies should be recommended/prescribed.

6. The following recommendations for the deployment of alternative fuels infrastructure are either included in the recitals of Alternative Fuels Infrastructure Directive or were used by the Joint Research Centre as part of its assessment of National Policy Framework adopted by Member States: do you believe these are (still) relevant?

Fuel	Deployment recommendation	Yes	No	No opinion / I don't know
Electricity	One recharging point per estimated ten electric vehicles			
	At least every 60 km on TEN-T Core Network			
CNG	One CNG refuelling point per estimated 600 CNG vehicles			
	At least every 150 km on TEN-T Core Network			
	along the main highways			
LNG	For vehicles: at least every 400 km on TEN-T Core Network			
	For maritime vessels: coverage of maritime ports with mobile or fixed installations to enable the circulation on TEN-T Core Network			
	For inland waterway vessels: Coverage of inland ports with mobile or fixed installations to enable the circulation on the TEN-T Core Network			
Hydrogen refuelling stations	At least every 300 km on TEN-T Core Network			

7. **In case you replied to the previous question that any of the currently recommended deployment methodologies are no longer relevant, please explain why you believe this to be true and, if possible, propose an alternative deployment methodology, including for example requirements based on vehicle fleets, or spatial density. Please provide any supporting arguments for such an alternative methodology. NB: documents can be uploaded at the end of the questionnaire.**

I.1.C Deployment of alternative fuels infrastructure in urban areas

According to Eurostat almost three quarters of the European population lived in an urban area in 2015. It is therefore particularly important to develop an appropriate network of alternative fuels infrastructure in or near those urban areas. This is recognised by the Alternative Fuels Infrastructure Directive where it requires that an appropriate number of publicly accessible recharging points and refuelling infrastructure for CNG are put in place to ensure that electric vehicles and vehicles fuelled by CNG can circulate "at least in urban/suburban agglomerations and other densely populated areas". Besides this general requirement, the Alternative Fuels Infrastructure does not contain any specific rules for alternative fuels infrastructure deployment in urban/suburban areas.

In view of the expected strong electrification of passenger vehicles and of the importance of the proximity of infrastructure for EV-drivers ("charge anxiety"), the main deployment challenge in urban/suburban areas relates to electric chargers.

Questions in this sub-section are specifically related to the challenge of developing an appropriate number of alternative fuels infrastructure in urban/suburban areas.

1. **Are specific measures at EU level needed, in addition to those currently contained in the legislative framework, to enable deployment of alternative fuels infrastructure in urban/suburban areas?**

   ☐ Yes
   ☐ No
   ☐ No opinion/I don't know

   If yes, what kind of specific measures would be needed?

2. **What is in your view the best approach to achieve a comprehensive publicly accessible recharging network at municipal level?**

   ☐ Municipality develops unique network via public company
   ☐ Municipality tenders out development and operation of one or more interoperable networks
   ☐ Municipality develops basic network but this is complemented by infrastructure developed by private companies
   ☐ Private companies are best placed to develop the network(s)
   ☐ Other

   Please explain your answer

3. **Should all EV-users have the right to request a publicly accessible recharging point near their residence?**

☐ Yes
☐ No
☐ No opinion/I don't know

Please explain your answer. If yes, please specify the preferred perimeter within which each EV-user should have access to a publicly accessible recharging point. Please also indicate whether and, if so, which exemptions should apply (e.g. for pedestrian zones)

I.1.D Principal policy orientations for further development of the network

In this section we take a more forward looking view and ask you where you see the most urgent needs for policy action in relation to alternative fuels infrastructure.

1. **Where, if any, do you see a need for accelerated roll-out of alternative fuels infrastructure and on which time horizon?**

	2025	2030	No need for (further) action
Electricity for light duty cars and vans			
Electricity for heavy duty vehicles			
Electricity for inland waterways/maritime			
Electricity for aviation			
CNG for cars and vans			
CNG for heavy duty vehicles			
CNG for inland waterways/maritime			
Hydrogen for cars and vans			
Hydrogen for heavy duty vehicles			
Hydrogen for inland waterways/maritime			
Hydrogen for aviation			
LNG for heavy duty vehicles			
LNG for inland waterways/maritime			
Other*			

*please specify

2. **Which specific aspects require additional policy actions on EU level with regard to alternative fuels infrastructure? (multiple replies possible)**

☐ Coverage of refuelling/recharging infrastructure along the main highways
☐ Coverage of refuelling/recharging infrastructure at urban nodes
☐ Information on location of refuelling/recharging infrastructure

- Information on prices at refuelling/recharging infrastructure
- Interoperability of recharging plugs across Europe
- Customer oriented services (including payments and ad-hoc payments) for refuelling/recharging infrastructure across EU
- Fair Market conditions- level playing field for all service providers throughout EU
- Integration of e-mobility into the European electricity system
- Other, please specify

3. Do you believe the Directive covers all relevant alternative fuels for all relevant transport modes or do you believe that additional fuels or transport modes should be addressed within the directive?

- AFID covers all relevant fuels/transport modes
- AFID does not cover all relevant fuels/transport modes
- No opinion/I don't know

If you replied that AFID does not cover all fuels/transport modes, please briefly explain your answer and clearly identify the missing fuels/transport modes.

I.2 State of play of market: competition and market failures

The EU market of alternative fuels and related infrastructure is still in an early stage (around 4% of the EU's total passenger car vehicle stock runs on alternative fuels, the large majority of which is on LPG) although it has been growing quickly in recent years. This trend is expected to accelerate further post 2020, amongst others in view of binding fleet CO2 emission targets.

In view of accelerating market development, it is important to ensure that the market conditions allow the market to develop in an open and competitive manner.

In this section we ask you for your views on funding needs, the state of play of the markets for the development and for the operation of alternative fuels infrastructure, as well as your expectations for future market developments, including possibly emerging competition issues.

I.2.A Alternative fuels infrastructure: funding needs

1. **How would you currently describe the need for public support in relation to the following alternative fuels infrastructure in the Member State where your organisation is located?**

Type of infrastructure	High	Medium	Low	None	No opinion / I don't know
Electric rechargers, slow charging < 22kW					
Electric rechargers, fast charging 22kW – 100 kW					
Electric rechargers, ultrafast charging > 100 kW					
CNG refuelling stations, in urban/suburban agglomerations and other densely populated areas					
CNG refuelling stations, along the main highways					
LNG refuelling stations at maritime ports					
LNG refuelling stations at inland ports					
LNG refuelling stations along the main highways					
Hydrogen refuelling stations along the main highways					

I.2.B State of play: market for the development of infrastructure

As the markets for alternative fuels infrastructure mature, open market access, in particular for new entrants, becomes essential.

1. Do investors face market barriers when investing in the following alternative fuel infrastructure markets?

	Yes, many	Yes, some	Yes a few	No, none at all	No opinion/ I don't know
Electric rechargers, slow charging < 22kW					
Electric rechargers, fast charging 22kW - 100 kW					
Electric rechargers, ultrafast charging > 100 kW					
CNG refuelling stations					
LNG refuelling stations					
Hydrogen refuelling stations					

If you replied yes to the previous question, please describe the market barriers to investments and, where possible, indicate the Member States where you face such market barriers.

2. Attractive locations for alternative fuels infrastructure are necessarily limited and often depend on public concessions or authorisations. In your opinion, to what degree is the concession practice in the Member State where your organisation is located appropriate to allow for a competitive market?

	To a full degree	To a large degree	To some degree	Not at all	No opinion/ I don't know
Electric rechargers, slow charging < 22kW					
Electric rechargers, fast charging 22kW - 100 kW					
Electric rechargers, ultrafast charging > 100 kW					
CNG refuelling stations					
LNG refuelling stations					
Hydrogen refuelling stations					

Please explain your reply. If you are aware of problems with concession practice in other Member States, please specify this here.

3. Which additional policy measures would in your view be needed at EU level, if any, to help ensure an open market for the development of alternative fuels infrastructure?

I.2.C State of play: market for the operation of alternative fuels infrastructure

1. **Did you experience or are you aware of any barriers for e-mobility service providers (EMSPs) to offer their services on charging points operated by third parties?**

   ☐ Yes, certain CPOs/EMSPs do not allow other EMSPs to offer services with respect to their charging stations
   ☐ Yes, there are commercial barriers (e.g. prohibitive or very high access tariffs)
   ☐ Yes, there are technical barriers (e.g. no interoperability of protocols / systems)
   ☐ Yes, a combination of the above
   ☐ No, not at all
   ☐ No opinion/I don't know

If yes, please briefly explain your answer, identify those barriers in more detail and provide your solutions for addressing them.

2. **Are there currently barriers for e-mobility service providers (EMSPs) to offer their services on certain vehicles?**

   ☐ Yes, for certain vehicles the choice of EMSP is limited by design (lack of interoperability)
   ☐ Yes, for certain vehicles the choice of EMSP is limited due to the commercial conditions linked to the purchase of the vehicle
   ☐ Yes, a combination of the above
   ☐ No, not at all
   ☐ No opinion/I don't know

If yes, please briefly explain your answer, identify those barriers in more detail and provide your solutions for addressing them.

3. **As part of efforts to increase competition in the market, some Member States have introduced regulation that aims at legally separating owners and operators of recharging station from e-mobility service providers. How useful are such requirements to improve competition and accelerate investments in charging infrastructure?**

   ☐ Useful
   ☐ Somewhat useful
   ☐ Of little use
   ☐ Not useful at all
   ☐ No opinion/I don't know

Please briefly explain your answer.

4. **From a competition point of view, to what extent do electromobility roaming platform operators grant non-discriminatory and equal access to their platforms for any and all charging point operators?**

   ☐ All roaming platforms provide full access to any CPOs and all are charged equally (e.g. based on the amount of CPs or based on the amount of transactions) for access to the platform
   ☐ Most roaming platforms grant non-discriminatory and equal access to all CPOs, but some improvement is possible
   ☐ Some of the roaming platforms grant non-discriminatory and equal access to all CPOs, but the majority does not and/or a number of issues persist
   ☐ None of the roaming platforms grants non-discriminatory and equal access to all CPOs

☐ No opinion/I don't know

Please briefly explain your answer and, in case you see problems, propose solutions for addressing them.

5. Can you think of any other market evolutions that could potentially raise competition issues in the future?

I.3 Minimum technical requirements for alternative fuels infrastructure

The Alternative Fuels Infrastructure Directive aims to make it as easy to recharge or refuel an alternative fuels vehicle or vessel anywhere in the EU as is currently the case for its conventionally fuelled predecessor.

Many divergent aspects are important for enabling this, and will in turn be addressed in this section:

   (i) standardizing and ensuring interoperability of infrastructure, which allows consumers to recharge/refuel on a 'foreign' network as he does on his domestic network;
   (ii) limiting the technical downtime of infrastructure;
   (iii) distant monitoring of infrastructure to identify problems asap;
   (iv) correct measuring of offtake to avoid unnecessarily high or non-transparent costs; and
   (v) accessibility to infrastructure for all persons, including those with reduced mobility.

I.3.A Standards and interoperability requirements

1. **Are the standards and interoperability requirements as set out in the Alternative Fuels Infrastructure Directive and subsequent/proposed secondary legislation sufficient and complete?**

For electric rechargers	Yes	No	Partly	No opinion / I don't know
Normal power (AC – Type 2, EN 62196-2)				
High power (AC – Type 2, EN 62196-2)				
High power (DC – Combo 2, EN 62196-3)				
Wireless charging (under development – Mandate M/533)				
Battery Swapping (under development – Mandate M/533)				
L-category motor vehicles (up to 3.7 kVA – Type 3A, EN 62196-2 for Mode 3 charging or IEC 60884-1 for Mode 1 and 2 charging; above 3.7 kVA – Type 2, EN 62196-2)				
Electric Busses (under development – Mandate M/533)				
Shore side electricity for seagoing ships (IEC/ISO/IEEE 80005-1)				
Shore side electricity for inland waterway vessels (EN 15869-2 or EN 16840 depending on energy requirements)				

For hydrogen refuelling stations	Yes	No	Partly	No opinion / I don't know
Outdoor hydrogen refuelling points (EN 17127)				
Hydrogen Purity (EN 17124)				

Hydrogen fuelling algorithm (EN 17127)				
Hydrogen refuelling connectors (EN ISO 17268)				

For CNG refuelling stations	Yes	No	Partly	No opinion / I don't know
CNG refuelling connectors (EN ISO 14469)				
CNG refuelling points (the interoperable aspects of standard EN ISO 16923)				

For LNG refuelling points	Yes	No	Partly	No opinion / I don't know
For LNG motor vehicles (the interoperable aspects of standard EN ISO 16924)				
For inland waterway vessels (EN ISO 20519, parts 5.3 to 5.7)				
For seagoing ships (EN ISO 20519)				

1.1. **In case you believe that the standards/interoperability requirements as set out in the Alternative Fuels Infrastructure Directive and subsequent/proposed secondary legislation are not sufficient, please indicate in which areas new standards/interoperability requirements would be required and briefly describe the context?**

2. **The Alternative Fuels Infrastructure Directive currently requires that all recharging points are, for interoperability purposes, equipped at least with socket outlets or vehicle connectors of Type 2 (for AC recharging points) and connectors of the combined charging system (CCS- 'Combo 2 (for DC recharging points). At the same time, the Directive does not prohibit the presence of others (e.g. CHAdeMO). Is the current situation, which in practice often leads to the equipping of recharging points with multiple connector socket outlets and connectors, problematic?**

☐ Yes
☐ No
☐ No opinion/I don't know

2.1. **If yes, please briefly explain your answer indicating the concrete problems and your ideas for solutions.**

3. **A number of communication protocols are emerging in the e-mobility market to enable information exchange between different market actors and infrastructures and vehicles.**

3.1. **In the following table, please indicate what is, in your view, the most suitable protocol for information exchange between the given actors/infrastructure and whether or not use of that protocol is royalty-free.**

Type of communication	Preferred protocol	Royalty-free
EV to CP		
EV to DSO		
EV to EMSP		
CP to CPO		
CP to EMSP		
CP to CP		
CP to DSO		
CPO to EMSP		
CPO to CPO		
CPO to roaming platform		
CPO to DSO		
EMSP to roaming platform		

3.2. Still in relation to these communication protocols, in the following table, please indicate what is the need of harmonising this type of communication/protocol at EU level.

Type of communication	Very high need	High need	Low need	Very low need	No opinion / I don't know
[type of answers possible]					
EV to CP					
EV to DSO					
EV to EMSP					
CP to CPO					
CP to EMSP					
CP to CP					
CP to DSO					
CPO to EMSP					
CPO to CPO					
CPO to roaming platform					
CPO to DSO					
EMSP to roaming platform					

3.3. In case you consider that we have overlooked a stream of communications between e-mobility market actors and/or infrastructure, please list those here. For each such communication stream, please indicate your preferred communication protocol, whether or not it is royalty-free and what is the need for standardisation.

I.3.B Technical availability

This sub-section inquires about downtime issues (technical unavailability) of recharging and refuelling infrastructure and potential solutions for addressing them, such as binding uptime requirements.

1. **To what degree is the technical unavailability (downtime) of publicly accessible recharging or refuelling infrastructure currently a problem for consumers?**

   - ☐ It is very problematic
   - ☐ It is somewhat problematic
   - ☐ It is a little problematic
   - ☐ It is not problematic at all
   - ☐ No opinion/I don't know

Please explain your answer. In case you answered that it is perceived as problematic, please provide solutions for addressing the issue (e.g. EU wide uptime requirements).

I.3.C Connectivity

This sub-section inquires about the need to impose different forms of connectivity requirements in relation to alternative fuels infrastructure, to improve monitoring and interoperability of networks.

1. **In its Action Plan on the deployment of alternative fuels infrastructure (COM(2017) 652 final) the Commission noted the benefits of digitally connected infrastructure (i.e. the infrastructure is connected with a central monitoring system and/or back-office through wireless or cable internet connection).**

   In your view, should it be mandatory for all publicly accessible alternative fuels infrastructure to be digitally connected ?

   - ☐ Yes, for all (existing or new) publicly accessible charge points
   - ☐ Yes, but only for newly-built publicly accessible charge points and charge points that are being significantly renovated or upgraded, and set a later date by which all other publicly accessible charge points must be compatible
   - ☐ Yes, but apply the requirement only to newly-built/renovated/upgraded publicly accessible charge points – and allow all other charge points to exist as they currently are
   - ☐ No
   - ☐ No opinion/I don't know

Please explain your answer.

2. **Some Member States have linked national public funding for recharging stations with an obligation to connect those to an e-Roaming platform. In your view, should it be mandatory for publicly accessible recharging stations to be connected to at least one e-Roaming platform?**

   - ☐ Yes, for all (existing or new) publicly accessible charge points
   - ☐ Yes, but only for newly-built publicly accessible charge points and charge points that are being significantly renovated or upgraded, and set a later date by which all other publicly accessible charge points must be compatible
   - ☐ Yes, but apply the requirement only to newly-built/renovated/upgraded publicly accessible charge points – and allow all other charge points to exist as they currently are
   - ☐ No
   - ☐ No opinion/I don't know

Please explain your answer.

I.3.D Offtake measurement at publicly accessible charging points

This sub-section inquires about issues with (sub-)meters at recharging stations. Specific questions on intelligent metering systems related to grid integration are addressed in the Questionnaire on customer services.

1. **How important is it to set minimum requirements for the correct metering of electricity offtake at recharging stations?**

   ☐ Very important
   ☐ Relatively important
   ☐ Somewhat important
   ☐ Not important at all
   ☐ No opinion/I don't know

Please explain your answer and, as the case may be, propose minimum requirements.

I.3.E Accessibility for persons with reduced mobility

1. **The European co-legislators are expected to reach an agreement soon on the European Accessibility Act, which sets accessibility requirements amongst others for transport services and infrastructure. These requirements will also apply to alternative fuels infrastructure.**

   1.1. **In your view, how often do persons with a disability have difficulty getting access to and using alternative fuels infrastructure?**

      ☐ Very often
      ☐ Often
      ☐ Sometimes
      ☐ Almost never
      ☐ Never
      ☐ No opinion/I don't know

   1.2. **Would the occurrence of such issues justify the introduction of minimum requirements in relation to the design of publicly accessible alternative fuels infrastructure stations, in order to ensure that they are accessible and easy to use by persons with a disability?**

      ☐ Yes, for all (existing or new) publicly accessible AFI
      ☐ Yes, but only for newly-built publicly accessible AFI and AFI that is being significantly renovated or upgraded, and set a later date by which all other publicly accessible AFI must be compatible
      ☐ Yes, but apply the requirement only to newly-built/renovated/upgraded publicly accessible AFI – and allow all other AFI to exist as they currently are
      ☐ No
      ☐ No opinion/I don't know

   If yes, please clarify which aspects related to accessibility need to be improved.

Questionnaire II - Consumer services and seamless payments

RESPONDENT INFORMATION

1. **Please state the full name of the organisation on whose behalf you are responding to this questionnaire.**

2. **Please provide your full contact details (name, surname, title, telephone, email).**

3. **Please state the Member State where your organisation is located. For groups of companies that have subsidiaries or activities in a number of Member States, please state the Member State where the main offices of the respondent organisation are located. For associations representing their members at EU level, please select "European Union". For organisations having their main offices in a non-EU country, please select "Other" and specify.**

    ( ) European Union

    ( ) Austria

    ( ) Belgium

    ( ) Bulgaria

    ( ) Croatia

    ( ) Cyprus

    ( ) Czech Republic

    ( ) Denmark

    ( ) Estonia

    ( ) Finland

    ( ) France

    ( ) Germany

    ( ) Greece

    ( ) Hungary

    ( ) Ireland

    ( ) Italy

    ( ) Latvia

    ( ) Lithuania

    ( ) Luxembourg

    ( ) Malta

    ( ) Netherlands

    ( ) Poland

    ( ) Portugal

    ( ) Romania

    ( ) Slovakia

    ( ) Slovenia

( ) Spain

( ) Sweden

( ) United Kingdom

( ) Other: please specify

4. Which of the following best describes your organisation (multiple answers possible):
National public authority (transport ministries, agencies)
Regional or local public authority
Public transport operator*
Vehicle or equipment manufacturer/supplier
Energy distribution or supply company
Fuel producer or retailer*
Fuel station operator (infrastructure developer or operator)*
Fuel station manufacturer*
Charging point operator (infrastructure developer or operator)
Charging point manufacturer*
E- mobility Roaming platform (e-roaming) – enabling platform for accessing different service providers networks
Payment services provider
Communication network provider
Logistics supplier
Private fleet operator
R&D&I and academia
Interest group*
Other*
4.1. If *, please specify:

5. In which of the following transport modes is your organisation active (multiple answers possible)?
Road transport: passenger vehicles (cars, vans etc.)
Road transport: buses, coaches etc.
Road transport: trucks, lorries, etc.
Rail transport (trains and tramways)
Inland waterway transport
Maritime transport
Aviation
None of the above

6. Which of the following fuels are relevant for your organisation (multiple answers possible)?
Conventional fuels (petroleum derivatives, excl. LPG)
Liquefied petroleum gas (LPG)
Natural gas, incl. biomethane, in gaseous form (compressed natural gas (CNG)) or in liquefied form (liquefied natural gas (LNG))
Synthetic and paraffinic fuels
Biofuels as defined in point (33) of Article 2 of Directive (EU) 2018/2001
Hydrogen
Electricity (BEV and plug-in hybrids)
None of the above

II Consumer services and seamless payments

II.1 Finding alternative fuels infrastructure

Consumers need comprehensive and up-to-date information on the location, type and availability of recharging points, as well as clear instructions on how to use them.

This section looks at different aspects of providing and gathering data and information in relation to alternative fuels infrastructure.

II.1.A Communication of static and dynamic data on alternative fuels infrastructure

The Alternative Fuels Infrastructure Directive provides in Article 7(7) that, "Member States shall ensure that, when available, the data indicating the geographic location of the [publicly accessible alternative fuels] refuelling and recharging points […] are accessible on an open and non-discriminatory basis to all users. For recharging points, such data, when available, may include information on real-time accessibility as well as historical and real-time charging information."

This provision is complemented by the provisions of the Intelligent Transport Systems (ITS) Delegated Regulation (EU) 2015/962 on Real-Time Traffic Information Services and ITS Delegated Regulation (EU) 2017 on Multimodal Travel Information Services, both adopted under the ITS Directive (Directive 2010/40/EU). These Delegated Regulations contain some minimum requirements regarding the sharing of certain static and dynamic road and traffic data, including some static and dynamic data regarding alternative fuels infrastructure.

For the purposes of the below questions, static data means data that do not change at all or do not change often, such as location data, whereas dynamic data are data that change often or on a regular basis, such as availability data.

The Commission is examining whether the current legislative framework should be clarified or complemented.

1. **Who is, in your view, best placed to provide static and dynamic data relating to alternative fuels infrastructure?**

   NB: although a mobility actor could play multiple roles, please select the role that best corresponds to the provision of data.

   - ☐ Member States
   - ☐ Road operators
   - ☐ Owners/developers of alternative fuels infrastructure
   - ☐ Operators of alternative fuels infrastructure/charge point operators
   - ☐ Fuel distributors for refuelling points and electricity network operators for recharging points
   - ☐ Consumers (bottom-up)
   - ☐ Digital map providers
   - ☐ OEM- car manufacturers
   - ☐ Others
   - ☐ No opinion / I don't know

In case of 'others', please specify.

2. **To what degree is access to the following data regarding alternative fuels infrastructure enabled on an open and non-discriminatory basis in the Member State where your organisation is located?**

Type of data	To a full degree	To a large degree	To some degree	Not at all	No opinion / I don't know
geographic location of CNG refuelling stations					
geographic location of LNG refuelling stations					
geographic location of hydrogen refuelling stations					
geographic location of recharging infrastructure					
real-time accessibility of recharging infrastructure					
historical and real-time charging information of recharging infrastructure					

3. **In your view, what should be the geographical scope of the obligation to provide static and dynamic data in relation to publicly accessible alternative fuels infrastructure?**

   ☐ EU-wide (no restrictions)
   ☐ Along the TEN-T core and comprehensive network
   ☐ Only along the TEN-T core network corridors

4. **Which of the following static and dynamic data should in your view be accessible to all users on an open and non-discriminatory basis?**

Type of data	Yes, but against payment	Yes, for free	Yes, on non-discriminatory basis to commercial "users" who can then develop commercial applications against payment to "end users"	No, this obligation would be irrelevant	No opinion/ I don't know
Location					

(GNSS coordinates and precise address – street name, zip code, city,…)				
For rechargers only: available charge-solutions (AC/DC, charging capacity)				
For rechargers only: available connectors (plugs, sockets, induction plate...)				
Opening hours				
User identification possibilities (e.g. RFID card)				
Available payment methods (e.g. cash, credit card etc.)				
Basic information on prices (e.g. price for ad-hoc charging)				
Contact info of owner/operator				
For rechargers only: information on which e-mobility service providers offer services there				
For rechargers only: information if the charge point is covered by an e-roaming provider (+ list				

which ones)					
For rechargers only: e-mobility code of the charging point operator					
Technical availability: operational/ non-operational (under maintenance)					
Occupation status (free, occupied)					
Other 1 (please specify)					
Other 2 (please specify)					
Other 3 (please specify)					

4.1. Please explain your answer.

4.2. In case you consider that certain of the above data should only be made accessible at a price, how could abusive pricing be avoided?

II.1.B Categorisation of recharging stations

The correct categorisation of recharging stations is particularly important to keep track, in a useful way, of the development of the network (i.e. for statistical and reporting purposes). But it is also important for consumers to know what type of rechargers are available in the vicinity in order to determine which is the most suitable recharging option in the given circumstances.

5. The Alternative Fuels Infrastructure Directive adopted in 2014 distinguishes between normal (P < 22kW) and high power (P > =22kW) recharging infrastructure.

In view of technological advances since the adoption of the Directive, how relevant is it to further distinguish fast-charging infrastructure?

- ☐ Very relevant
- ☐ Somewhat relevant
- ☐ Of little relevance
- ☐ Not relevant at all
- ☐ No opinion/ I don't know

5.1. If you consider a further distinction relevant, would you agree with the following aggregated representation as included in the Guidance note to Member States on their reporting under the Alternative Fuels Directive:

Category	Sub-category	Definition	Power
Category 1		**Normal power recharging points**	**P < 22kW**

| Category 2 | A | High power recharging points (AC) | 22kW < = P < = 43 kW |
| | B | High power recharging points (DC) | P < 100 kW |

5.2. If not, please propose an alternative.

II.1.C Roadside indicators for alternative fuel infrastructure

Although it is expected that users of alternatively fuelled vehicles will increasingly rely on mobile applications or in-built navigation systems to find alternative fuel infrastructure, consumers may still rely on roadside indicators to find alternative fuels infrastructure.

1. **Are specific requirements at EU level needed to harmonise roadside indicators/signalling on highways, roads etc. to indicate the presence of and/or remaining distance towards alternative fuels infrastructure stations?**

   ☐ Yes
   ☐ No
   ☐ No opinion / I don't know

II.2 Ad-hoc and contract based charging

In the electromobility market, two types of customer models are emerging: Ad hoc and contract based charging.

One of those models is prescribed in Article 4(9) of the Alternative Fuels Infrastructure Directive, which holds that "[a]ll recharging points accessible to the public […] also provide for the possibility for electric vehicle users to recharge on an ad hoc basis without entering into a contract with the electricity supplier or operator concerned."

In addition to ad hoc solutions, some charge point operators and e-mobility service providers have started offering contract based solutions to circumvent allegedly high banking transaction costs for allegedly low turnovers per charging session. Many have also argued against the equipment of recharging stations with credit card terminals, for allegedly prohibitively high costs.

This section inquires about the options and solutions regarding both customer models and their consequences.

II.2.A Ad-hoc charging

Ad-hoc charging can be understood as a client to service provider relationship that does not require any time-based contractual arrangement between them, allowing the client to choose or alter his/her service provider at any time. Hence, **payment for ad-hoc charging** would require e.g. cash or bank wiring or similar transactions that end "the customer to service provider relationship" at payment (on the spot), which is currently the standard for refuelling conventional vehicles. For further clarification: this section does not relate to pre-payment schemes, which are considered as a form of contract based recharging for the purpose of this questionnaire.

The implementation of the ad hoc charging requirement in the Alternative Fuels Infrastructure Directive has led to a patchwork of solutions across the EU, including different forms of payments via smartphones (requiring users to download apps, use QR codes, etc.) or via payment terminals. This diversity of approaches creates an additional burden for users and may hamper electric vehicle uptake.

1. **Do you believe that, in the current state of the electromobility market, it continues to make sense to require that all recharging points offer ad-hoc charging solutions?**

   - ☐ Yes
   - ☐ No
   - ☐ In certain cases
   - ☐ Don't know

   1.1. If not or only in certain cases, please explain your answer

   1.2. If yes, do you believe that the right for consumers to be able to charge "ad-hoc" is currently sufficiently well defined in the legislation and is guaranteed in practice?

   - ☐ Yes
   - ☐ No
   - ☐ In certain cases
   - ☐ Don't know

   Please explain your answer.

2. **The ad-hoc charging requirement in the Alternative Fuels Infrastructure Directive currently only relates to electromobility. Do you think that a similar requirement would be necessary for other forms of alternative fuels refuelling?**

      ☐ Yes
      ☐ No
      ☐ In certain cases
      ☐ Don't know

  2.1. If yes, please explain

3. **Should any of the following payment schemes for ad-hoc charging become mandatory? (you can also add other payment options in the last two rows)**

Payment Option	On all chargers	Only on ultra-fast chargers (>100k W)	On all fast-chargers (>22 kW)	On fast-chargers and on stations with a pool of more than 5 slow-chargers	Only on slow-chargers (<22 kW)	Should not be mandatory	No opinion / I don't know
Cash payment (coins / cash payment terminal)							
Payment by bank card / credit card (bank card / credit card payment terminal)							
Payment via smartphone enabled by a third party payment service provider (e.g. payment via messages, iWallet, etc.)-							
Other*							

*In case of other, please specify and indicate whether and in what circumstances such other payment options should become mandatory.

II.2.B Contract based charging: authentication of users

Unlike the ad-hoc payments for charging, **contract-based charging requires**:

i.   **A contractual relationship between the user and e-mobility service provider** that does not end 'on the spot', i.e. after the charging transaction is terminated. This enables for the settlement of all payable recharging sessions in any given month in one bill sent to the customer at the end of that month; and

ii.   **Identification and authorization of the user** by the charge point operator and e-mobility service provider 'on the spot' to link the specific user to the right contract.

This section only inquires about the different authentication systems; questions relating to prices and roaming are addressed in section II.5 on transparency of prices.

As stated, contract based recharging requires the unique authentication of users at the charging points. Different solutions exist, but a main distinction can be made between two main authentication systems:

i.   'manual' authentication systems, based on radio frequency identification technology, where the user has to take some action to authenticate himself at the charge point (e.g. swiping of a customer card at an RFID reader, entry of a password at a recharger, etc.); and

ii.   'automatic' authentication systems, where for instance the mere plugging of the recharger into the vehicle performs the authentication function. Such automatic authentication is for instance planned under the ISO 15118 standard, and has led to the development of for instance the "Plug and Charge" technology.

In this sub-section we ask your views on these two types of authentication systems and possible standardisation needs in this respect.

II.2.B.i Manual vs automatic authentication systems

1.   **What, if any, are the advantages of manual authentication systems as compared to automatic authentication systems and *vice versa*? Please in your reply take account of following aspects: user-friendliness, interoperability, market openness and competition, (cyber)security, …**

2.   **In your view, will manual authentication systems continue to exist alongside automatic authentication systems?**

    ☐ Yes
    ☐ No
    ☐ In certain cases
    ☐ Don't know

Please explain your answer

II.2.B.ii On 'manual' authentication systems

1.   **Should a European approach to using radio frequency identifiers (RFIDs) for user authentication purposes related to e-mobility charging solutions be required, and in what form, with a view to ensuring interoperability?**

    ☐ Yes, and the RFID identifier should be built directly into the vehicle and the user needs to identify himself at the charging station by means of a password

- ☐ Yes, and identification should be by means of a customer RFID card/badge
- ☐ No, harmonisation should happen at national level
- ☐ No, there is no need for harmonisation
- ☐ No opinion / I don't know

Please explain your answer and, if available, please suggest a suitable standard.

1.1. In case you consider that more harmonisation is needed, how should the underlying governance framework be set up in your view, and who should set it up?

II.2.B.iii On 'automatic' authentication systems

1. **Should a European approach to automatic user authentication related to e-mobility charging be required, and in what form?**

   - ☐ Yes, and the most suitable standard is ISO 15118
   - ☐ Yes, but ISO 15118 is not a suitable standard
   - ☐ No, harmonisation should happen at national level
   - ☐ No, there is no need for harmonisation
   - ☐ No opinion / I don't know

If you answered "Yes, but ISO 15118 is not a suitable standard" please suggest a more suitable standard if you know any

2. **For the functioning of automatic authentication systems a system needs to be set up that allows the unique authentication and mutual recognition of electric vehicles and charge points. Effective data encryption is equally a key requirement of such a system. Recently, some market actors have started setting up one or more Public Key Infrastructures (PKI) for these purposes. Other market actors have argued for the creation of one single Public Key Infrastructure for the e-mobility market by an independent third party, which is not itself active on the e-mobility market.**

   2.1. What is the most suitable format to authenticate emobility actors and encrypt messages between them?

   - ☐ The most suitable format is a PKI
   - ☐ The most suitable format is blockchain technology
   - ☐ The most suitable format is another technology (please specify)
   - ☐ No opinion/I don't know

Please explain your answer.

   2.2. If you consider that the most suitable format to authenticate emobility actors and encrypt messages between them is a PKI, who should set them up and act as "root certification authority" for issuance of the root "keys"?

   - ☐ It should be fully left to market parties
   - ☐ Public authorities should set up the governing framework and market parties can manage the PKI(s)
   - ☐ Different PKIs should be set up by one or more third parties without any conflict of interest in the e-mobility market
   - ☐ A unique PKI should be set up for the entire European Union by an independent third party with no conflict of interest
   - ☐ No opinion/I don't know

Please explain your answer and elaborate on any specific risks/problems you identify

II.3   Cybersecurity

With an increasing number of electric vehicles charging at the same time and the emergence of technologies that enable the management of charging from a distance, cybersecurity is becoming an issue.

Cybersecurity risks are addressed in different legal instruments at EU level, most notable in Directive 2016/1148 on security of network and information systems (NIS Directive) and in the proposed Regulation on ENISA, the "EU Cybersecurity Agency", and on Information and Communication Technology cybersecurity certification (the ''Cybersecurity Act'').

1. Do we need to complement this policy framework with specific requirements for alternative fuels infrastructure at EU level?

    ☐   Yes
    ☐   No
    ☐   No opinion/I don't know

If yes, please explain which additional rules and requirements would be needed.

II.4 Transparency of prices and billing

Article 4(10) of the Alternative Fuels Infrastructure Directive requires that "prices charged by the operators of recharging points accessible to the public are reasonable, easily and clearly comparable, transparent and non-discriminatory".

Despite this provision, it has resurged from a number of consumer surveys that consumers often do not know the exact price prior to their charge or are confronted with unexpected costs on their bill, e.g. session fees or roaming costs.

In this section, we inquire about transparency of prices at the station and on the bill, including issues in relation to price components and roaming charges.

II.4.A Price transparency

1. **Do you think that users have full information about all the different components of the total price for recharging at publicly accessible recharging points? E.g.: are users aware of roaming and other charges?**

    - ☐ Yes always
    - ☐ Yes in most cases
    - ☐ No, this is rarely the case
    - ☐ No never
    - ☐ No opinion / I don't know

Please explain your answer, if possible illustrated by examples

2. **Do you think that there is a difference for consumers in terms of price transparency between 'ad hoc' charging and contract based charging?**

    - ☐ Yes
    - ☐ No
    - ☐ No opinion / I don't know

Please explain your answer

3. **Certain market players have argued that price components for ad hoc charging should be harmonised throughout the EU to improve price transparency and avoid surprises for consumers (price components refers to the different components of the final price, such as a kWh based fee, a time based fee, etc.). In this way, each EMSP/CPO would clearly have to indicate the cost components of the 'ad hoc' price, while contracts could in turn be obliged to base their contract prices on these ad hoc price formulae (either providing discounts to these prices, or add fees for additional services, such as roaming and reservation fees).**

    3.1. **Do you think that a further harmonisation of ad hoc price information would be beneficial for consumers?**

    - ☐ Yes
    - ☐ No
    - ☐ No opinion / I don't know

In case you replied no, please explain your answer.

3.2. If yes, would it in your view be beneficial for consumers to harmonise price components that need to be displayed at the station?

- ☐ Yes
- ☐ No
- ☐ No opinion / I don't know

In case you replied no, please explain your answer.

3.3. If yes, which of the following price components should be displayed?

Price component	[Y/N]	Why (not)?
kWh based fee		
Time based fee (please specify appropriate time)		
Session fee		
Other (please specify)		

4. Where and how should prices for ad-hoc charging be communicated to consumers (multiple answers possible)?

- ☐ Prices should be clearly indicated at the charging station, e.g. on a digital display
- ☐ Prices for each station should be available online
- ☐ Prices should be clearly communicated to the consumer, in advance of any charge, on his mobile phone
- ☐ Prices should be clearly communicated to the consumer, in advance of any charge, on his on-board display
- ☐ The consumer should be able to get a precise charging offer in advance of the charging session, calculated on the basis of his chosen charging assumptions (kWh needed and time of parking/charge)
- ☐ Other: please specify

5. Should it be mandatory to provide any of the following additional information to consumers in relation to the alternative fuel product offered at alternative fuelling stations (multiple replies possible)?

- ☐ Origin of the energy (e.g. renewable)
- ☐ Supplier
- ☐ Other: please specify
- ☐ Don't know

Please explain your answer

6. Do you think that more detailed rules for billing for recharging services are needed at EU level?

      ☐   Yes
      ☐   No
      ☐   No opinion / I don't know

If yes, which price components should be specified on the bills?

II.4.B Roaming

With already hundreds of different charging point operators managing their own networks around the EU, market actors are developing different solutions to link different CPOs together, and in turn link them to EMSPs. This will then allow consumers of one network operator to get access to a network managed by another operator.

The most basic model to achieve this is peer-to-peer connections. However, since many CPOs are small and geographically dispersed, market parties have come up with new platform solutions to link all these small charging networks together through so-called e-roaming platforms. Although these have now been developed by the market 'bottom-up', it is important to note that different e-roaming solutions could be imagined. The current set-up, where a number of private e-roaming platforms connect a multitude of CPOs and EMSPs, or alternative set-ups, which are more regulated or publicly driven. An example of the latter can be found in the telecommunications sector, where one roaming platform in each Member State connects all operators on that market and in turn connects those to all operators in another Member State through that other Member State's national roaming platform.

With respect to current private e-roaming platforms, some market actors have indicated that, as the e-mobility market grows, such platforms may reach a level where they can "make or break" new entrants, by deciding whether and under what conditions they can be 'linked' through their platform (e.g. by setting the access fees to new entrants).

1. Which policy measures at EU level could help to ensure full geographic coverage of roaming services while ensuring access to the market for new entrants and reasonable and transparent prices/charges for EV-users?

II.4.C Consumer protection

1. Consumer rights are generally protected by different European Directives and Regulations (e.g. EU Directive on Consumer Rights, the Unfair Commercial Practices Directive and the EU Payment Services Directive). It is however not uncommon to prescribe more detailed rules if the specificities or technicalities of a certain sector so require. Do you think that more detailed rules for consumer protection should be included in sector-specific European legislation for alternative fuels?

      ☐   Yes
      ☐   No
      ☐   No opinion / I don't know

If yes, please explain your answer.

2. Do you believe that consumers should have the legal right to freely choose the EMSP of their choice and switch between EMSPs as they like?

☐　Yes
☐　No
☐　No opinion / I don't know

Please explain your answer.

II.5 Smart charging, vehicle-to-grid (V2G), vehicle to home (V2H) including issues related to access to data

A massive uptake of electric vehicles will significantly increase overall electricity demand that – if not managed properly – may cause problems to the grid and require substantial grid enforcements. A number of concepts exist to efficiently deal with the integration of electric vehicles into the electricity system:

Smart charging: management of the final users electricity demand for the purpose of EV charging, in order to avoid network congestions and to reduce charging costs;

Vehicle-to-grid (V2G): refers to the bi-directional charging capabilities of electric vehicle batteries and, in particular, the situation where a battery is not only charged, but also unloaded for grid purposes (e.g. balancing of the grid).

Vehicle-to-home (V2H): in this case EV batteries are unloaded not to support the electricity grid, but to support domestic household electricity needs, for example when electricity prices rise during peak hours.

Most solutions for electricity demand management in the e-mobility sector as described above require data exchange between different actors in the **transport and the electricity system**. This section inquires whether the legislative framework as well as required technologies are in place to enable such data exchange.

1. **Do you believe that with the current legislative framework in place, smart charging and V2G/V2H services can develop and thereby an efficient integration of electro-mobility into the electricity system can be ensured?**

   - ☐ Yes
   - ☐ No
   - ☐ Partly
   - ☐ No opinion / I don't know

If you answered "No" or "partly", please briefly explain your answer, if possible illustrated by examples

2. **In case you believe the current framework is not sufficient to efficiently integrate electro-mobility into the electricity system, what should be done on European level to improve the situation and trigger investments in solutions that ensure the development of smart charging and vehicle to grid services?**

3. **To what degree is intelligent metering necessary to efficiently integrate electric vehicles into the electricity system and enable smart charging and V2G/V2H services?**

	Essential	Important	Somewhat important	Not important	No opinion/ I don't know
Publicly Accessible, slow, < 22kW					
Publicly Accessible, fast, 22kW					

- 100 kW				
Publicly Accessible, ultrafast, > 100 kW				
Semi public (carparks, supermarkets, etc.), slow, < 22kW				
Semi public, fast, > 22 kW				
Private chargers, slow, < 22kW				
Private chargers, fast, > 22 kW				

4. **Is additional regulation at EU level required to fully enable smart charging and V2G/V2H services?**

☐   Yes
☐   No
☐   Partly
☐   No opinion / I don't know

Please explain your answer.

5. **Is access to in-vehicle-data, such as the battery state of charge, needed in order to fully enable V2G/V2H services?**

☐   Yes
☐   No
☐   No opinion / I don't know

If yes, please explain who needs access to which data.

6. **Do you think that under current conditions and subject to consumer consent, all interested parties can in principle offer V2G and V2H services to the EV owner?**

☐   Yes
☐   No
☐   No opinion / I don't know

If not, please explain.