European Association for Storage of Energy

Energy Storage and the Alternative Fuels Infrastructure Directive

Brussels, April 2020

Table of Contents

This paper was elaborated by the EASE Mobility Working Group, chaired by Mr Enrique Meroño, Iberdrola. EASE Secretariat would like to thank all the EASE members who contributed to this document.

Introduction

In 2013, the European Commission (EC) Communication "Clean Power for Transport: A European Alternative Fuels Strategy" stressed the need to reduce Europe's dependence on oil imports from third countries.[1] In pursuit of this objective, the Communication identifies electricity, hydrogen, biofuels, natural gas, and liquefied petroleum gas as alternative fuels (AFs) which can act as a substitute for oil in the transport sector. The Commission's Communication advocated for the development of AF infrastructure to support the market uptake of alternative vehicles. As a consequence, the Alternative Fuels Infrastructure Directive was adopted in 2014.[2] It requires, among others, that Member States assess the current and future development of the AF market and set national targets [3] for recharging infrastructure.

The 2050 long-term decarbonisation strategy, published by the European Commission in 2018, assesses different pathways for the EU to achieve greenhouse gas emissions reductions starting from 80% reduction and going up to net-zero greenhouse gas emissions by 2050. To reduce emissions and meet its 2050 targets, we believe that the EU should intensify its efforts in promoting net-zero transport solutions, since the transport sector is the only EU sector in which greenhouse gas emissions have risen since 1990. To this end, The Alternative Fuels Infrastructure (AFI) Directive should exclusively focus on new emerging transport means, mainly BEVs and FCEVs, in order to support the 2050 decarbonisation targets.

E-mobility is one of the key options to decarbonise the transport sector, and it can be complemented by other solutions that rely on existing supply infrastructures, such as synthetic green fuels, which can be produced large-scale at competitive costs.

As the representative of the energy storage industry in Europe, and as explained in EASE's "Energy Storage for a Decarbonised Europe by 2050" [4] paper, EASE is committed to supporting the transition to clean mobility. Stationary and mobile storage can play an important role in facilitating the rapid and efficient decarbonisation of the mobility[5] sector. EASE's position paper on energy storage and mobility introduced a number of general principles that should be implemented at EU level to support the roll-out of Electric Vehicles (EVs). It also explains how energy storage systems can reduce the cost of this roll-out by coupling the energy and transport sectors.

We believe that the role of energy storage in supporting the efficient roll-out of charging infrastructure should not be underestimated. In light of the foreseen evaluation of the AFI Directive, EASE is putting forward recommendations on how the Directive could be revised in order to address the current gaps in the legislation and support the further uptake of EVs, assisting in the decarbonisation of the European economy, and allowing energy storage to reach its full potential in terms of supporting EV deployment and integration into the grid. Electromobility can play a key role in meeting the EU's new CO2 regulations for 2025 and 2030: it is paramount to design an appropriate legislative framework able to foster it.

[1] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2013:0017:FIN:EN:PDF
[2] Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure, Art.3.
[3] The decision to include a target for hydrogen refuelling points is left to the Member State.
[4] http://ease-storage.eu/wp-content/uploads/2019/11/ES-for-a-Decarbonised-Europe-by-2050.pdf
[5] http://ease-storage.eu/energy-storage-transport-sector/

1. Alternative Fuels Infrastructures: What to Tackle at an EU Level?

Binding Targets for National Policy Frameworks and TEN-T Core Network

The Directive 2014/94/EU on the deployment of alternative fuels infrastructure requires that Member States provide a minimum infrastructure for recharging points accessible to the public to ensure that electric vehicles can circulate along the main Trans-European Transport Network (TEN-T) and in urban and suburban agglomerations. However, in its current form, the directive does not set binding minimum targets per Member State; rather, it requires Member States to set up National Policy Frameworks (NPFs) providing for minimum infrastructure coverage by 2020, 2025, and 2030.

In the NPFs, the Member States should outline their national targets and objectives, as well as supporting actions for the development of the market, including the deployment of the necessary infrastructure to be put in place. However, the analysis of the NPFs[6], published by the European Commission in 2019, revealed differing levels of effort, ambition, and available funding between Member States. It also indicated that the deployment of all types of suitable recharging infrastructure may fall short of being comprehensive and evenly distributed at European Union level.

For the TEN-T Core Network, although the suggested distance targets are usually respected, some portions of the road Core Network will remain without appropriate recharging infrastructure by 2025. In general, the NPFs feature very different ambition levels across the Member States in terms of projected future deployment and their corresponding infrastructure. The future estimates are lower than what was estimated in the Impact Assessment for the Directive[7]: even considering a low ambition scenario, very few NPFs define sufficient corresponding targets. This leads to the risk of falling short of the publicly accessible charging points required across the European Union, as underlined by IEA as well[8].

It should be kept in mind that a significant share of today's car owners can charge neither at home nor at work, making it impossible for them to switch to e-mobility as long as public charging infrastructure is not sufficient, and thus hampering e-mobility market take-off. The adoption status and likely impact of support measures seem too low to ensure that the national targets and objectives contained in the NPFs are reached. All this can lead to a market fragmentation at EU level and even within certain Member States.

EASE Recommendations

To prevent the risk of falling short in deploying a comprehensive and aptly distributed recharging infrastructure that could hamper EV market uptake, the revised directive should enforce binding targets per Member State for the deployment of public electric charging infrastructure, including binding targets on the minimum proportion of fast charging points based on the methodology proposed below. This is not restrictive, and should account for the national network planning strategies for charging infrastructure, according to the needs of each Member State.

[6] European Commission, Report on the Assessment of the Member States National Policy Frameworks for the development of the market as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure, 2019.
[7] EC Report on the Assessment of the Member States National Policy Frameworks for the development of the market as regards alternative fuels in the transport sector and the deployment of the relevant infrastructure pursuant to Article 10 (2) of Directive 2014/94/EU. SWD(2019) 29 final pag 26.
[8] IEA Global EV Outlook 2019 pag 74.

2. A New Methodology to Design the EU's EV Charging Infrastructure

Elaborating a Sound Methodology

A metric that can indicate to policymakers how to determine the optimal volume and location of EV charging structures is paramount for the elaboration of valid National Plans and EU strategy. In the currently elaborated scenario of high penetration of EVs, the deployment of accessible and suitable public charging infrastructure is essential to avoid a negative impact on the future market growth prospects of EVs. Clarifying how many charging points are needed to provide enough coverage is therefore vitally important. Residential, workplace, and fleet deployment is directly related to the size of the EV stock and, therefore, uses a simpler methodology to calculate the expected growth in charging points.

Stationary and mobile DC Fast Chargers will be important in the future. The obvious reference, number of petrol stations/petrol pumps, is an unclear reference due to two opposite factors related to EV charging habits that create uncertainty. First, a 'push' factor is that the minimum time to charge in a DCFC station is 10 times higher than fuelling at a petrol station. This would imply a 10 times higher number of DCFC stations vs petrol stations. Secondly, a "pull" factor is the impact of residential and workplace charging on the number of DCFC stations in urban areas, which will certainly be lower until at least 2030. Many EV buyers until 2030 are expected to have a private parking place, either residential or at their workplace. These EVs may not need publicly accessible charging infrastructure due to short distances travelled per day and a limited percentage would be 'homeless' cars.

A correct urban deployment should address the needs of 'homeless' EVs, which due to their limited percentage would imply fewer charging stations as compared to petrol stations. To what extent these push-pull factors are going to entail completely different numbers is currently unknown, but it is certain that the number of petrol stations or petrol pumps is not a reliable starting point to estimate EV charging needs.

Also, the 2014 AFI Directive suggested a ratio of "one charging point per estimated ten electric vehicles (EV)" for urban deployment. In 2014, BEVs had a 100-150km range and limited possibilities to charge in high power DC. We have assumed this recommendation applies to AC charging solutions for "homeless cars" with no private parking available and current conditions; as stated before, on-street DCFC is both the present and future of urban deployment. Thus, this 10:1 ratio is an outdated reference.

EASE Recommendations

- The metric proposed by the current framework should be revised to address the diversity in recharging needs (urban, suburban, rural, normal, stationary and mobile fast charging etc.), driver preferences, and EV requirements. Indicators and technologies to assess the right geographical coverage of infrastructure, taking into account population density and housing structures, the increasing charging speeds, and the evolution of battery technology, should be developed. The targets should be reviewed and made progressive to match the market uptake.

- We recommend analysing the expected charging habits of an estimated EV fleet, and after that, to estimate the number of DCFC urban and interurban charging points. Simplifying, the process would include the following:
  - Estimate charging habits of a vehicle with availability of private parking. For example, in the case of Spain, 80% of the energy would be consumed in private parking and 20% in interurban trips; and in France, respectively 90% and 10%. In some Member States such as Germany, publicly accessible fast charging infrastructure will be crucial to accelerate the uptake of electric mobility and should therefore also be factored into the methodology.
  - Estimate the % of "homeless cars", in this case an assumption of 50% of energy consumed in urban DCFC, 30% in slow charging in commercial areas and 20% in interurban trips.
  - Estimate the % use of the DC Fast charging points in both interurban and urban deployment.

- In light of the uptake of electromobility foreseen to meet the EU's new CO2 regulations for 2025 and 2030, post-2020 policies should reflect the estimated development of the EV market, and take into account future technology developments, the ambitious sales announcements made by car manufacturers, and the diverse recharging needs beyond 2020. Against this background, the European Commission should consider new, more effective policy instruments than indicative targets, as in the current Directive, and new metrics and methodologies to assess the right geographical coverage of charging points to meet the demand of EV drivers.

With the above assumptions in mind, we can calculate the number of EVs charged per day, and on this basis, the number of urban and interurban charging points needed for a certain year (for example, 2030). Providing an order of magnitude, on-street DCFC deployment in Spain 2019-2030 would have a ratio of 250-300 BEVs:1 charging point (CP); breaking down this ratio, Spain would need 250-350:1 interurban and 1500-2700:1 urban CPs. We believe that if we apply this on a European scale, the appropriate ratio would be 200-450 BEVs:1 CP, depending on the population density and the distance between urban centres. A careful analysis of the areas selected to deploy the charging points (density, housing structures, ...) will therefore be extremely important in order to identify and deploy the most suitable type of charging infrastructure (AC or DC charging), and thereby make the right investment decision.

Stages of Deployment - Demand vs Coverage Criteria

As said in the previous section, a thorough analysis of EV drivers' demand is of key importance. However, it is questionable in the first stages to rely exclusively on a demand criteria deployment (i.e. define the number of charging points by looking at the number of EVs circulating) mainly because there are currently not enough EVs, and public infrastructure should guarantee a minimum standard of service to the widest possible public. Coverage criteria (i.e. xCP per 1km2 or per 50k inhabitants) imply an advance of investments to encourage the acquisition of EVs and, in the beginning, a short-term negative impact on the sustainability of the DCFC business model. The decision on the level of coverage deemed necessary or adequate is arbitrary, and depends on the specific objectives of each country. In the example below, the coverage criteria defined guarantee at least the estimated demand in 2027, but in some cities, demand exceeds coverage by 2022. The specific criteria are defined taking into account not only the specific urban distribution of each urban area of the country, but also the topology of the network. The following table suggests how different criteria for charging infrastructure deployment should be tailored to the geography; and highlights how different criteria should be adopted based on the stage of the deployment (i.e. up to ~2022 – stage 1; from ~2022 to 2027 – stage 2).

EASE Recommendations

- In the first stages of charging infrastructure deployment, decision-making must be linked to the determination to foster the market. After quantifying the estimated EV growth and the estimated number of charging points needed (ratio 150-300:1) for the following years, coverage criteria are defined depending on the amount of investments to be advanced. Therefore, there is no single valid method even though 1 CP per 'x' km in interurban areas and 1CP per x km2 in urban areas should be the correct approach in all cases. Nonetheless, at least 5-6 years of advance investments in the coverage approach could be a reasonable proposal. After that period, real data can provide valuable information for the next stage of deployment.

- Criteria for charging infrastructure deployment should change according to the stage of the charging infrastructure deployment. In other words, some criteria may be suitable for the initial phase of the deployment, but not once the infrastructure is more mature; and vice versa.

- Cross analyses between land use and electric distribution networks in urban areas can provide very useful information for municipalities in order to define specific locations of charging stations. This step should be taken after quantifying the number of charging points, including fast charging points, in a specific urban area. In order to support the provision of flexibility services and thereby alleviate stress on the grid, regulators should also actively promote the deployment of public charging infrastructure coupled with energy storage solutions.

Table 1. Deployment criteria adoption according to stage of deployment and geographical area

Urban deployment criteria Estimation based on: Spain			Large Urban Area	Small Urban Area	Other
Coverage Criteria		Densely urbanised areas: 1 CP x min 50 kW* each km2 in continuous urban fabric with more than 4,000 ESP.	A	A	B
		Relevant commercial and industrial area: 1 CP x min 50 kW every 2 km2 in industrial, commercial and recreational area with more than 1,000 ESP.	B	B	B
		Ensuring a maximum distance between CP of 15 km.	B	-	-
Demand Criteria		Meeting the charge needs of "homeless vehicles".	A	B	B
Inter-urban routes deployment criteria			Inter-urban		
High Capacity Routes	Coverage Criteria	One Fast Charging Station every 60 Km of road.	A		
	Demand Criteria	Average daily traffic intensity according to estimated fleet.	B		
Other Roads	Coverage Criteria	Ensuring a maximum distance between CP of 30km.	A		
		One Fast Charging Station every 200 Km of road with 1 CP x min 50kW.	B		
	Demand Criteria	Average daily traffic intensity according to estimated fleet.	B		
A: First stage of the deployment up to ~2022			B: Second stage from 2022 to 2027		
CP: Charging Point. ESP: Electrical Supply Point. LUA: Large Urban Area≥50k inhabitants. SUA: Small Urban Area<50k inhabitants.					
*In the near future, the growing capacity of batteries could lead to considerably higher power. In some cities, AC stations may be needed.					

3. New Policies and Necessary Regulatory Changes

Interoperability

Interoperability can be defined as the security or guarantee that an EV user, who is the customer of an Electromobility Service Provider (EMSP), can use any Charging Point (CP) installed in the EU. Therefore, EMSPs must have agreements with the different EU Charging Point Operators (CPOs) on the methodology and technology to identify, charge, and receive payments for the service provided. Interoperability is essential in order to foster the use of public charging infrastructure, which is a significant factor, as several studies stated, in the EV acquisition decision. Interoperability is also paramount for Vehicle-to-Grid (V2G) solutions: as stated in the 'Clean Energy for All Europeans' package, V2G can support the future energy system while also empowering customers to participate. Unsurprisingly, Original Equipment Manufacturers (OEMs) play a key role in enabling and allowing interoperability.

EASE Recommendations

While the need for interoperability is commonly accepted, there are different ways to approach this issue given the current lack of clear standards. The following recommendations could support a proper framework that would encourage interoperability:

- E-roaming platforms have been a good tool because they give a common operational standard for different CPOs (charging point operators) and EMSPs (electro-mobility service providers). However, the current system involves several parties, transactions and fees, making it economically inefficient, and with the development of peer-to-peer OCPI (Open Charge Point Interface), and even with blockchain tools, the need of an intermediary figure is not clear. Due to the possibility of artificially influencing the future cost of service (software updates, commission costs, etc.) or isolating the CPOs/EMSPs outside the platform, it is uncertain whether e-roaming platforms are the best option for the medium-term. Considering that the technical interoperability of the EV charge is guaranteed (standardized voltage levels and EV charge ports), the regulatory framework should allow CPOs to operate offering exclusively direct payment options (credit card through physical or web-based terminal), without the need to establish roaming contracts with other market players.
- Legislation on EV charging should avoid leading to varying national implementation. The lack of a common understanding on whether recharging constitutes a supply of goods or the provision of a service could lead Member States to apply different interpretations, which in particular has knock-on effects for VAT treatment.
- Charging of electric vehicles should be clearly defined as a service to avoid unnecessary barriers and hinder EMSP players to make cross border business in the EU, slowing down the deployment of affordable and cross-border e-mobility services.
- It is also paramount to guarantee access to charging to all drivers, having or not a contract with EMSPs, following market principles in a competitive environment.
- Information and clarity about energy prices, availability status, and the possibility to reserve the charging point in advance should be implemented in at least the language of the country as well as in English.
- Regarding payment methods, we suggest simplicity for the customers so that not only mobile phone applications (apps) but also credit card payments should be implemented in order to give alternatives in case of lack of coverage.
- Cybersecurity requirements are under continuous revision and in this volatile context it is challenging to specify concrete measures. However, in software applications, the application of cybersecurity requirements can be almost immediate while in charging points, hardware would have to harmonise with the rest of the electric network.
- Regarding V2G/V2H, interoperability, harmonised protocols, and standards covering the different infrastructures and systems should be implemented to enable seamless communication; technical standards for charging processes are mostly defined, but there is currently no formal procedure to ensure the compliance between these standards and the vehicles coming into the EU market from abroad. Furthermore, with regards to charging stations management system communication, as well as electric vehicle communication, standards such as IEC 63110 will be of key importance; as well as the upcoming ISO 15118 standard, whose adoption by a.o. OEMs is paramount.
- In short, guaranteeing interoperability between the different assets involved is essential to extract the full value from their connectivity. Regulatory measures have to ensure that this can become a reality as soon as possible. Appropriate standards are crucial to support consumer engagement and the provision of V2G integration services across Europe.

Tariffs, Pricing Structures, and Levies

As already underlined in the previous section, regulatory changes to enhance V2G interoperability are necessary. But in order to favour the uptake of EVs and maximise their potential, additional efforts are essential to remove the barriers that currently hamper V2G. V2G is not regulated yet at EU level even though it supports greater integration of RES in the system and can provide numerous grid services. Indeed, it can provide valuable flexibility services and non-frequency ancillary services, e.g. voltage control or synthetic inertia. In a nutshell, there is significant, untapped potential that appropriate legislation would enable - as also laid out in the EASE position paper on energy storage and mobility.

EASE Recommendations

- Energy tariffs and pricing structures should be smart and enable V2G integration. EV owners must pay a proper charging price, based on transparently defined, traceable, and possibly time-differentiated tariffs. Dynamic pricing for the energy part of the bill is necessary to provide effective price signals. Similarly, network tariffs should be designed to incentivise EVs to recharge when and where it is most efficient for the system. This may require an adequate mix between fixed, capacity, and volumetric components of the charges and a time and spatial-differentiated approach.

- Double-charging of taxes and levies should be avoided: owners pay once when charging their storage asset (e.g. battery buffered and/or mobile chargers, BEVs or FCEVs) and should not pay again when they feed electricity back into the grid or for other purposes.

- Aggregated EVs, battery buffered and/or mobile chargers should be able to participate in all electricity markets, including balancing and capacity markets. To remove potential entry barriers, they should be subject to proportionate administrative processes. Appropriate regulatory frameworks should support the use of smart solutions which can defer costly investments.

- Standard and codes on metering should be harmonised and simplified, in order to reduce hardware costs and allow EU wide tariff structures.

- Open markets should also be developed for non-frequency ancillary services. These services can provide further revenue and value for aggregated EV sources and EV owners.

- An output-based regulation for network operators is needed to create new markets for non-wire grid expansion solutions, e.g. investment deferral thanks to flexibility procurement from network operators.

- Access to energy consumption data should be ensured. The availability of charging patterns to the EV energy supplier or EV aggregator is crucial for consumers to be offered the right tariffs. This should include protection of consumer privacy and security and the consumers' access to their own data, notably in case of switching of service provider.
  - V2G operators should be able to access data related to the battery, e.g. its characteristics (e.g. the power in KWh as well as capacity in kW) and state of charge. Without this, V2G deployment may not be possible.

- Building codes need to be revised to be more e-mobility friendly and ensure the "right to charge" for building owners and tenants to help overcome nonfinancial barriers.

Conclusion

To reduce emissions and meet the EU 2050 targets, energy storage, alternative fuels, and related infrastructures should and must play a key role. It is extremely important to set binding targets for EV charging infrastructure per Member State; to improve the methodology currently used to assess charging needs; to adopt new analysis and deployment approaches; to introduce valid interoperability criteria; and to develop tariffs, pricing structures, and levies that encourage smart charging and vehicle-to-grid integration.

To do so, the Alternative Fuels Infrastructure Directive should be revised to guarantee the highest uptake of Electric Vehicles and Fuel Cells Electric Vehicles. EASE believes that having millions of energy storage units interconnected to the grid will bring enormous benefits to the transport and energy sector, leading to a greener, safer and more stable, system, and to a more interconnected European Union.

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About EASE:

The European Association for Storage of Energy (EASE) is the leading member - supported association representing organisations active across the entire energy storage value chain. EASE supports the deployment of energy storage to further the cost-effective transition to a resilient, carbon-neutral, and secure energy system. Together, EASE members have significant expertise across all major storage technologies and applications. This allows us to generate new ideas and policy recommendations that are essential to build a regulatory framework that is supportive of storage.

For more information please visit www.ease-storage.eu

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Disclaimer:

This content was elaborated by EASE and reflects a consolidated view of its members from an energy storage point of view. Individual EASE members may adopt different positions on certain topics from their corporate standpoint.

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