SUSTAINABLE TRANSPORT FORUM

Summary Handbook

Of the STF Recommendations for public authorities for procuring, awarding concessions, licences and/or granting support for electric recharging infrastructure for passenger cars and vans

Version 1 – adopted by STF on 2 December 2020

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1. Why do we need a handbook on procuring and awarding concessions or licences to deploy electric recharging infrastructure?

The European Green Deal aims to make Europe climate neutral by 2050, boosting the economy through green technology, creating a sustainable industry and transport, and cutting pollution. Different actions have been proposed such as more stringent air pollutant emissions standards for combustion-engine vehicles, the revision of legislation related to CO2 emission performance standards for cars and vans, and the review of the Alternative Fuels Infrastructure Directive in 2021. The same Green Deal expects that a possible fleet of up to 13 million electric vehicles in 2025 will require the number of publicly accessible recharging points to grow from approximately 200,000 in 2020 to at least 1 million in 2025.

Some of the Union's regulatory interventions, most notably the CO2 emission standards for cars and vans, are already starting to have their effects: vehicle manufacturers are increasingly investing in low- and zero-emission alternatives and in particular in battery-electric passenger cars and vans. Dozens of new models have been announced for release in the next couple of years, including in middle price segments, increasing the attractiveness and consumer appeal of low- and zero emission vehicles. The demand for these vehicles is also quickly growing with the help of purchase incentives. In view of this, a rapid and wide market deployment and uptake of these low- and zero-emission vehicles is expected in the next couple of years.

The Sustainable Transport Forum (STF) 2019 stakeholder consultation confirmed that few to no recharging points are commercially viable in the EU with the current fleet of BEVs and PHEVs. Therefore, it can be expected that varying degrees of public funding for recharging points will be required for some time to come. This will in turn result in public authorities at all levels of government being at some point confronted with choices to be made regarding the deployment of a widespread recharging infrastructure in their territories. They will have to address issues around planning and technical choices while balancing options against long-term climate objectives (e.g. reducing car use overall, ensuring smart charging, etc.).

This poses a number of challenges[1], but also creates opportunities - for instance to stimulate and accelerate the deployment of cost-efficient, grid-beneficial, truly interoperable and user-friendly solutions while avoiding to (co-)fund infrastructure that does not meet certain minimum requirements.

Through their concession or licence award procedures, public procurement procedures or grant award procedures, public authorities of all levels of government can help shape market developments in this area. They can learn from the experience of frontrunners, by avoiding the mistakes they may have made and borrowing the practices that have proven to be successful.

To this end, the STF has drawn up this set of recommendations for public authorities procuring, awarding concessions, licenses and/or granting support for electric recharging infrastructure for passenger cars and vans (M1 and N1 category of vehicles according to UNECE standards).

To prepare the STF Recommendations an eQuestionnaire was distributed to gather input and learn from the experiences of Europe's cities, regions and Member States in relation to concession, license or government support procedures and public procurement of alternative fuels infrastructure. Additional expert input was received from a number of Charge Point Operators and electromobility experts who had indicated a willingness to participate to this process. Together with a revision of relevant literature and examples, the first draft report was core reviewed by a handful of cities as well as e-mobility experts. As part of this core review, additional best practices and experiences were included into the report.

1 The 2019 STF stakeholder consultation revealed that many public authorities are still struggling with concession tenders: 50% of respondents expressed concerns around existing concession practises (concession timing, transparency and competitiveness were amongst the most pressing issues identified).

The STF Recommendations report and Handbook are meant to provide practical guidelines for public authorities that plan to organise tendering procedures for the deployment or operation of recharging infrastructure for electric vehicles. They include several examples of real-world situations and recommendations for these public authorities. These are not exhaustive, meaning that most likely numerous other very good examples exist. The examples and recommendations provided are merely a reflection of information that was gathered by or provided to the European Commission, TNO and POLIS. Moreover, not all recommendations can be applied to all circumstances nor can all examples. Therefore, they should not be interpreted as the only way or even the best way to realise recharging infrastructure.

This handbook highlights the main findings, recommendations and examples included in the detailed STF report. It follows the same three main steps to be considered by public authorities when planning the deployment of recharging infrastructure in their territories:

a. Defining the deployment approach

b. Organising the tender procedure

c. The specific tender requirements

While the first chapter is relevant for all public authorities, the latter two are targeted in particular at those authorities who intend to publicly procure or award concessions, licences and/or government support for electric recharging infrastructure.

The aim of this handbook is to introduce the STF recommendations in a concise way. The goal is to reach public authorities but also other relevant stakeholders. European cities and regions can consider and apply the recommendations and examples presented in this handbook, while other actors can benefit from recognising how local authorities are currently organising the deployment of recharging infrastructure and implementing innovative solutions to reduce transport related air and CO2 emissions.

Acknowledgements

The Recommendations and Handbook have been drawn up for the STF by the European Commission with the assistance of the European Alternative Fuels Observatory (EAFO) partners TNO and POLIS. The Sustainable Transport Forum acknowledges that the Recommendations and Handbook could not have been developed without the input received from the following 37 public authorities responding to the eQuestionnaire distributed by the European Commission and POLIS: City of Arnhem (Netherlands), City of Dortmund (Germany), City of Paris (France), Metropolitan Region of Amsterdam (Netherlands), Ente Regional de la Energías de Castilla y León (Spain), Area Metropolitana de Barcelona (Spain), Government of Ireland (Ireland), Toulouse Metropole (France), City of Ghent (Belgium), City of Oslo (Norway), Bilbao City Council (Spain), Vestland City Council (Norway), City of Stockholm (Sweden), Région Auvergne-Rhône-Alpes (France), Ministry of Economy, Energy and Business Environment (Romania), City of Berlin (Germany), City of Stuttgart (Germany), Ministry of Transport of the Republic of Latvia (Latvia), Thüringer Ministerium für Energie, Umwelt und Naturschutz (Germany), City of Munich (Germany), Brussels Environment Administration (Belgium), Federal Ministry of Transport and Digital Infrastructure (Germany), City of Amsterdam (Netherlands), Madrid City Council (Spain), City of Antwerp (Belgium), Enova SF (Norway), Botosani City Hall (Romania), Flanders Region (Belgium), Transport Malta (Malta), Ministry of Economy of the Slovak Republic (Slovakia), Sustainable Energy Authority of Ireland (Ireland), Ministry for Climate Protection, the Environment, Mobility and Urban Development, Bremen (Germany), City of Lisbon (Portugal), Gothenburg City Parking (Sweden), Municipality of Reggio Emilia (Italy), City of Rotterdam (Netherlands) and City of Leuven (Belgium).

Special thanks go out to the core reviewers of the Report: MRA-E, ElaadNL, the European Investment Bank, Eurocities, Nationaal Kennisplatform Laadinfrastructuur Nederland (NKL), the Regulatory Assistance Project (RAP) and Fier Automotive (EAFO), as well of the core reviewing cities of Berlin, Ghent, Stockholm and Stuttgart.

2. Defining the deployment approach

Long-term mobility strategies & cooperation

1. Public authorities should develop a long-term mobility vision and strategy with clear goals on future developments. Plans and strategies for the uptake of electromobility and the deployment of its recharging infrastructure should be part of this long-term mobility vision and should ideally include measurable targets to monitor progress and create a stable investment climate.
2. To ensure consistency, public authorities should align their recharging infrastructure deployment strategies between different levels of government and between neighbouring nations, regions, and cities.

Note on EU policy

The Alternative Fuels Infrastructure Directive (AFID) requires that “National policy frameworks shall take into account, as appropriate, the interests of regional and local authorities”. Since cities claim that this has often not been the case, they ask for the establishment of multilevel governance frameworks, to address potential local and regional infrastructure gaps and align policy measures between authorities.

Public authorities play an important role in the successful deployment of electric recharging infrastructure. This infrastructure will be connected to the (public) electricity network, will likely take up (public) space and will, certainly in the early stages, require public support. In all cases **it will be primordial for public authorities to develop a long-term electrification strategy**.

The insights gained from long-term mobility planning are essential to identify the needs for recharging infrastructure and, ultimately, define the best locations for that infrastructure. A good analysis of the real needs is required to prevent that short time investments in infrastructure turn out to be suboptimal, or in the worst case redundant (stranded assets) in the longer term, since recharging infrastructure has an expected lifetime of at least 7 years[2].

The long-term strategies for recharging infrastructure require **a clear vision on how the local mobility and electricity demand situation should develop**. Main factors to consider include:

- urban planning changes, especially regarding amount and type of parking lots (public - private);
- changes in vehicle fleets, e.g. in terms of number of vehicles overall as well as vehicle categories (light duty and heavy duty) and drivetrain types;
- changes in traffic densities and traffic flows;
- all of the above possibly spurred by local UVARs/LEZs;
- reductions in private vehicle ownership and increased use of shared (electrified?) vehicles;
- expected modal shift, e.g. towards active mobility solutions such as walking and cycling, but also towards public transport;
- technological developments of electric vehicles (e.g. in terms of battery size, recharging capabilities, etc.) in turn affecting expected recharging needs;
- degree of electrification and resulting recharging needs of specialised and captive fleets such as taxis, (urban) logistics, etc.; and
- local energy demand developments and hosting capacity of the local electricity grid.

Public authorities responding to the eQuestionnaire generally include **measurable targets for electromobility and/or the deployment of recharging infrastructure** in their long-term electrification strategies. This is useful for two main reasons: it helps in keeping track of progress and allows timely intervention (e.g. amendments to the relevant policy framework) if needed, while also creating a stable investment climate for private investments.

Cross-border cooperation: Franco-German alignment on deployment

There are annual bilateral meetings between the Federal Ministry of Transport and Digital Infrastructure (Bundesministerium für Verkehr und digitale Infrastruktur) and the French Ministry for Ecological and Solidary Transition (Ministère de la transition écologique et solidaire) devoted to the deployment of recharging infrastructure, focussing in particular on deployment in the border regions and on connecting the largest cities.

2 This is the expected time period for an operator to refinance his investment in the city of Berlin. MRA-E prescribes a minimum lifetime of ten years in its tender specifications, and has not experienced any significant problems with the first recharging stations deployed on large scale since 2010; they expect the lifetime to be increased to fifteen years with minor software and hardware upgrades. Stuttgart explains that the lifetime ranges from 8 years for some components of the recharging pole itself to 30 years for the underground power supply and cables.

The Netherlands: regional cooperation

A specific example of regional cooperation in the Netherlands is the Metropolitan Region Amsterdam-Electric (MRA-Electric). MRA-E was founded in 2012 to support municipalities in the three provinces of North-Holland, Flevoland and Utrecht with the development and implementation of EV-policies. Supported by a team of electromobility experts, the municipalities share experience and knowledge, develop demonstration projects, develop standard documents/templates for use by all, and jointly procure/manage recharging infrastructure. The cooperation ensures that an interoperable recharging network is not only deployed in the main cities, but also in the surrounding municipalities (hinterland). Beginning 2020, MRA-E announced the selection of the concessionaire of the biggest EU tender for recharging infrastructure thus far: 20,000 new recharging points!

Check out https://www.mra-e.nl/

The Netherlands: cooperation between public and private stakeholders

In the Netherlands, the Dutch Ministry of Infrastructure and Water has drawn up a National Agenda charging Infrastructure to ensure that a well-functioning infrastructure for electric transport can be rolled out. The National Agenda was drawn up in collaboration with public and private stakeholders, who jointly made agreements and defined the goals and actions on the deployment of charging infrastructure. The Eurocities Paper Better Alternatives For City Authorities, reported that members from the Netherlands highlighted the benefits of such a consultation, which was said to 'lead to improved coordination in the deployment of infrastructure, while ensuring broad multi-stakeholder buy in.

Since public authorities at different levels of government will likely develop their own long-term strategies for recharging infrastructure, **coherence between those documents is key** to ensure that measures implemented by different governance levels - but also between different policy domains (energy, mobility, housing, etc.) - reinforce and leverage impact. The same is true for public authorities governing adjacent territories.

Examples of cooperation for the deployment of electric recharging infrastructure include different levels of administration and governance as well as cooperation between public and private actors.

In addition, public authorities throughout the EU can benefit from **technical and/or financial support for their EV recharging projects from the European Investment Bank**.

Technical and financial support provided by the EIB

The European Investment Bank (EIB) provides technical and financial support via different mechanisms such as the European Investment Advisory Hub (the Hub), which acts as a single access point to various types of technical and financial advisory services. The Hub has actively supported local authorities for their clean bus transition investments, including related recharging infrastructure, participates in urban mobility advisory and on the preparation of projects under the Cleaner Transport Facility or URBIS for integrated urban development investment programmes which can include urban mobility investments. Specifically, in electric mobility recharging infrastructure, the Hub also provides support to promoters seeking to apply under the CEF Blending Facility.

The Hub's advisory services are available free of charge to public authorities and can be contacted via the online platform https://eiah.eib.org, where details on the different advisory EIB divisions can also be found like: the European PPP Expertise Centre (EPEC), the Financial Instruments Advisory (FIA), the InnovFin Advisory (IFA) or the Joint Assistance to Support Projects in European Regions (JASPERS), which all have solid experience in providing advisory services to support the development of EV recharging infrastructure projects.

The building blocks of a suitable recharging network

To the extent that public authorities are involved in the planning of a recharging network in their territories, they should aim for recharging networks to cost-effectively provide sufficient availability and capacity for EV-users to recharge at their convenience. This requires taking account of two main aspects:

1. Providing flexibility for electric vehicle users by:
   a. defining the required amount of recharging points;
   b. identifying appropriate locations;
   c. ensuring geographical dispersion; and
   d. identifying appropriate power levels.
2. Reducing overall deployment costs and nuisance by:
   a. making best use of existing infrastructures to limit installation costs;
   b. limiting the use of (public) space;
   c. preventing nuisance during installation and maintenance works; and
   d. maximising the occupancy rate of recharging infrastructure (effective EV parking policy).

NOTE on appropriate locations for recharging points

In a (peri-)urban context, several parameters are useful to forecast demand for recharging points, such as (expected) EV ownership, number of daily commuters coming to a given area, amount of transit (long-distance) traffic, amount of semi-public and private recharging infrastructure and number of licences for specialised fleets (such as taxis).

When identifying appropriate locations for ultra-fast chargers (150kW or more), long distance travel considerations should be borne in mind, including the occurrence of seasonal holiday recharging peaks. This issue needs to be addressed holistically, across borders, to enable uninterrupted EU-wide EV travelling.

1. Providing flexibility for electric vehicle users

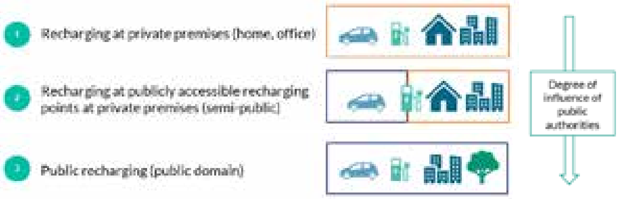
To stimulate the uptake of electric vehicles, (potential) EV-users must feel confident that sufficient recharging points are available at the right locations with high enough power to meet their mobility demands[3]. The recharging infrastructure network should thus be configured to meet the actual and forecasted future patterns of mobility users.

The amount of publicly accessible recharging points that will be required in any given area will be mainly driven by demand, which can be forecast based on the following factors:

- the (expected) number of electric vehicles circulating in that area taking account of expected developments in city planning;
- the amount of/potential for semi-public infrastructure in that area;
- the amount of/potential for private infrastructure in that area;
- local electricity grid hosting capacity;
- the power of recharging points;
- developments in battery technology; and
- the advent of new technologies, such as the uptake of connected and autonomous driving.

Public authorities often seek to limit the amount of recharging infrastructure in the public domain. For this reason, many public authorities apply a **'hierarchy of recharging'**, requiring that recharging takes place as much as possible on private domain (see Figure 1).

Figure 1: Hierarchy of recharging



Source: Floris Jousma (Fier Automotive), "Planning the roll-out of (public) recharging infra", (with adaptations)

To identify appropriate locations for recharging infrastructure there are three main ways, with a plethora of options to combine aspects of the three:

- Modelling/forecasting of the recharging demand development;
- Utilising data extracted from existing recharging points; and
- Responding to requests for a new recharging point from an electric vehicle owner.

Real 'demand' is always a good indication of where 'supply' should be. An easy means of mapping 'real' demand is for public authorities to monitor the use of existing recharging points, e.g. by means of dynamic data on the availability of the recharging point. They could then identify locations with a high turnover and (ask to) increase the amount of infrastructure at or near those locations.

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When identifying appropriate **locations for ultra-fast chargers (150kW or more)**, long-distance travel considerations should be borne in mind - including the occurrence of seasonal holiday recharging peaks. This issue needs to be addressed holistically, across borders, to enable uninterrupted EU-wide EV travelling.

3 NB: Providing flexibility to users also means that consumers have access to as many recharging points as possible: opening up the recharging network through increased transparency on the locations and prices of recharging points, interoperability between different recharging service providers (CPOs and EMSPs), etc. will be considered in more detail in chapter 4.

Ensuring geographical dispersion. As almost all passenger cars will gradually become net-zero emitting, mobility users in areas with lower population density will equally require good access to recharging infrastructure. This is also mandated by the objective of a socially just transition: no regions should be left behind in the transition to a decarbonised mobility.

Power levels. Electric energy can be provided to electric vehicles at various power levels. The power, and therefore the speed with which the EV-battery can be recharged at any given recharging point determines how that recharging point will be used. Three main utility models for recharging can typically be distinguished:

- long-time or overnight recharging at normal or rapid power recharging points (P ≤ 22 kW);
- high power recharging (22 kW < P < 43 kW) in places where people charge for a top-up (e.g. supermarkets, convenience stores, charging plazas, park-and-rides); and
- high power or ultra-high-power recharging (43 kW ≤ P) for recharging 'on the go' during longer itineraries. Although many EV models are still constrained in the power level at which they can recharge (by the on-board converter, battery or the power inlet), the benefits of high power or ultra-high power recharging points cannot currently be reaped by all passenger cars and vans on the market. Future EVs are however expected to be able to cope with higher power-levels, meaning that high and ultra-high-power recharging may likely be more fit-for-future.

The power level of the publicly accessible recharging points in any given area will have a direct relation to the amount of publicly accessible recharging points needed. A study undertaken by the Netherlands showed that for the establishment of each high power recharging point, 44.3 fewer normal power recharging points will be required in 2030.

Identifying new locations for recharging infrastructure: Madrid, London, Dortmund, and Stuttgart

In **Madrid**, city authorities use data from the concessionaire to steer network deployment. In particular the concessionaire must "provide information concerning the parameters for the use of the recharging network, inter alia: state and maintenance of the network, recharging times, average consumption for each recharging session and user typology. Data must be transmitted in such a way that the collected information can be analysed to offer the city of Madrid a clear understanding of the development of electric mobility in its territory."

The city of London mainly takes the following elements into consideration when identifying new locations for the deployment of recharging infrastructure: locations of existing recharging infrastructure, current electric vehicle ownership, new licensing requirements for taxis and private hire vehicles and expected future uptake of EVs.

The **city of Dortmund** bases its deployment strategy on a forecast of EVs, grid analyses, socio-economic data, city planning data and involves citizens in its decisions regarding locations and types of recharging points.

The **city of Stuttgart** bases its deployment strategy on the number of inhabitants and working places in each of the 152 city districts. The required amount of new recharging points in each city district is therefore determined at macro-level. It is subsequently left to market parties to decide where exactly in each city district they want to roll out the required amount of recharging infrastructure.

2. Reducing overall deployment costs and nuisance

Developing and maintaining a network with sufficient and well-dispersed recharging points at suitable power levels requires significant investments which may be partly covered by public authorities. Moreover, the infrastructure takes up valuable public space and could potentially lead to nuisance, both during installation and operation. For the infrastructure to be socially accepted and sustainable in the longer term, these effects should be minimised.

Firstly, when identifying appropriate locations for infrastructure deployment, public authorities should optimally **exploit existing grid capacity and make efficient use of existing infrastructures (e.g. buildings and roads)** to reduce cost of grid connection and use.

Germany: grid transparency through StandortTool

The German federal government created an online tool for the planning of recharging infrastructure called the “StandortTool”. This StandortTool provides a map of Germany, divided up into small rectangular zones with different colours. The colours indicate, for each rectangular zone whether there is a low or high need for additional recharging infrastructure, ranging from dark green (lowest need) to pink. To make this assessment as accurate as possible, the StandortTool combines data on the existing vehicle fleet, the existing recharging infrastructure stock as well as the mobility patterns of German drivers. For each zone, the StandortTool also provides information on the possibilities to connect to the medium voltage grid (see graph below). In doing so, potential investors can get a first idea of the possible costs for connecting a recharging station to the grid at any given location. The StandortTool also makes projections for the future expected needs (time horizon 2022 and 2030), so that the deployment of recharging infrastructure can keep pace with the expected demand.

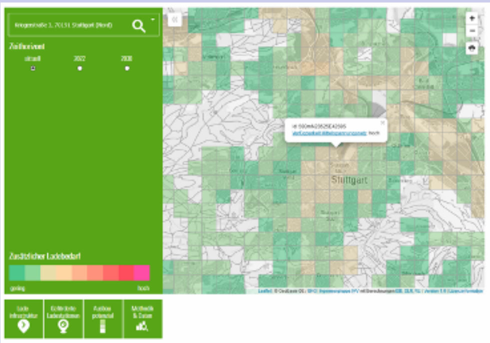
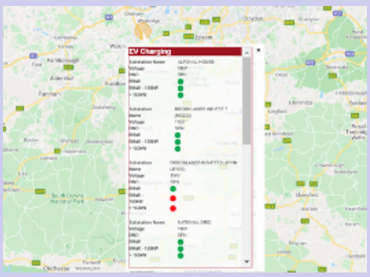


Figure 7: StandortTool

Source: https://www.standorttool.de/

Mapping grid capacity: UK Open Power Networks

The UK Open Power Networks project issues maps detailing the grid’s hosting capacity for recharging points with different power levels (50kW, 100kW, 150kW). Mapping recharging demand on these locations will reveal cost-optimal locations that need the least public support.



Source: UK Power Networks, available here: https://dgmap.ukpowernetworks.co.uk/site/?q=ev_ext

Secondly, authorities should seek **to exploit the presence of existing electrified on-street structures** to accelerate roll-out at limited cost. Integrating recharging solutions in existing electrified structures, such as lamp posts or on-road telecom distribution boxes, could be an efficient, low-cost and fast means to roll-out (slow-charging) recharging options in cities. Moreover, by avoiding the need to install new infrastructure on the streets, public authorities can limit the use of public space.

Figure 2: Integration of recharging solution in a lamp post (left) and telecom distribution box (right)

Source: Ubitricity (left) and Deutsche Telekom (right)

Lastly, to reduce the need for additional recharging infrastructure, public authorities should **maximise the occupancy rate of recharging infrastructure** as much as possible. EV parking policies can be an effective means to that end. Parking places that are equipped with a recharging point (EVPL) should be reserved for EVs when recharging infrastructure is still scarce. Progressive parking rates can be effective to limit the use of EVPL by (plug-in hybrid) electric vehicles that are not recharging.

e-Parking policy in the City of Amsterdam

The city of Amsterdam allowed free parking for electric vehicles at EVPLs for a short while to encourage the uptake of EVs. This was gradually replaced by regular parking rates. However, EV owners living in the city of Amsterdam can apply for a special e-parking licence. With very limited new parking licences being granted, applications for e-parking licences get priority, and are usually issued within weeks. For regular combustion engine vehicles these waiting times can run up to several years in certain parts of the city.

Moreover, the Dutch national government has recently adopted a new legal framework of parking policy, allowing cities and regions to differentiate parking rates between zero-emission vehicles and regular combustion engine vehicles. The city of Amsterdam will consider applying such differentiated parking policy.

3. Organising the tender procedure

Establishing roles & cooperation, contract models, policy instruments, and supporting market competition

1. Public authorities need to consider the most appropriate level of government to deploy/ support the roll-out of recharging infrastructure
   a. Coordination with other levels of government and surrounding municipalities and regions is needed to prevent the creation of island networks.
   b. Cooperation with other public authorities to procure recharging infrastructure can be an advantage by benefiting from the experience gained and possibly also reducing costs in case of joint procurement.
2. When developing recharging infrastructure public authorities need to set clear objectives and assess risks. By mapping these, they can determine who should own and operate the infrastructure and identify the best contract model/policy instrument to serve public interests.
3. Public authorities need to consider public procurement and State aid rules, irrespective of the form of contract chosen. In particular, bearing in mind that the recharging market should develop as a competitive market, public authorities should always consider the possibility that several parties may be interested in developing and operating the recharging infrastructure.
4. When selecting a contract model and policy instrument, authorities should perform a proper analysis of costs and risks for each affected stakeholder, including end users.
5. Public authorities should look into which policy instrument and contractual models support the development of a competitive market of recharging infrastructure and services. Combinations of instruments and contracts can also be used for this purpose.
6. A competitive market guarantees a qualitative (innovative) and affordable infrastructure in the longer run.

COMPETITION FOR THE MARKET

Public authorities should enable open market access for multiple parties. There are various measures to support this, such as: limiting contract duration, breaking up existing long/ perpetual concessions, splitting up lots and increasing competition in public tenders.

In order to gain more insight into what market parties can offer, a market consultation can be an interesting instrument. By means of a market consultation, public authorities can get more insight into what innovations and prices the market can offer.

Public authorities should investigate which financial and project (process management, permits etc.) risks they can reduce or take over, so that private parties can offer more competitive prices. One example is to auction locations which are already equipped with a grid connection, another is to auction locations that are sure to get support from the competent authorities for permitting purposes.

In order to deploy a basic infrastructure network at the lowest possible cost, public authorities should consider organising competitive auctions for (potential) recharging locations, similar to the auctions for renewables. In this way, they can reveal the real economic value of certain lots, avoiding overcompensation

At the same time, public authorities can 'batch' or group different lots, with more and less expected turnover, in their competitive auctions. In this way, they can ensure that investments are not only focused on the most profitable locations, while also reducing the need for subsidies for the least profitable locations through cross-subsidies.

Public authorities should ensure that not only the costs incurred by the government play a decisive role in the choice of the instrument, but also the price ultimately paid by the end consumer. This could for instance be done by making bidders compete on the maximum prices to be charged to consumers, and including this as an award criterion in tenders.

Cooperation: Flanders' annual concession tender

The Flemish Region (BE) organises an annual concession tender for and on behalf of interested municipalities. The distribution system operator is responsible for organising the tender. The aim of the regional concession is to ensure that the infrastructure meets the same requirements (harmonisation) and to prevent the creation of small closed networks (interoperability). Participation is voluntary: larger cities like Leuven, Ghent and Antwerp have chosen to organise their own tenders.

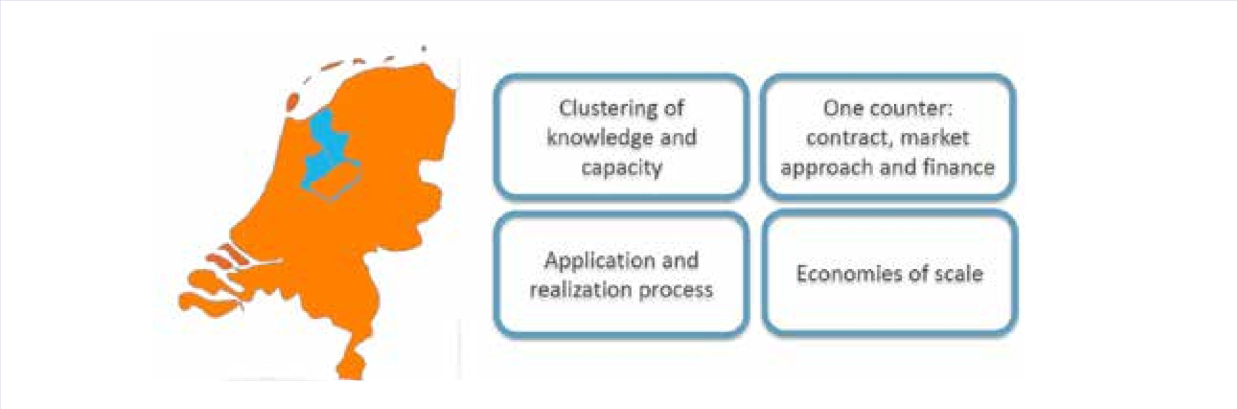
Cooperation and joint procurement between public authorities leads to **specialisation, harmonisation and economies of scale**. This results in better infrastructure at lower cost.

Cooperation and joint procurement in the Netherlands: increasing buying power through economies of scale

In the Netherlands, the government has set up a national knowledge platform for recharging infrastructure (Nationaal Kennisplatform Laadinfastructuur, in short 'NKL'), where all information regarding recharging infrastructure is gathered, stored and exchanged between public authorities of different levels. The knowledge platform includes a section dedicated to public procurement, concession awards or government support, including tender specifications.

Under the auspices of NKL, municipal governments and market parties have jointly developed a Standard Set of recommended requirements for recharging stations or recharging plazas (hubs). The Standard Set contains a number of requirements regarding recharging infrastructure for public authorities to include in their tender specifications.

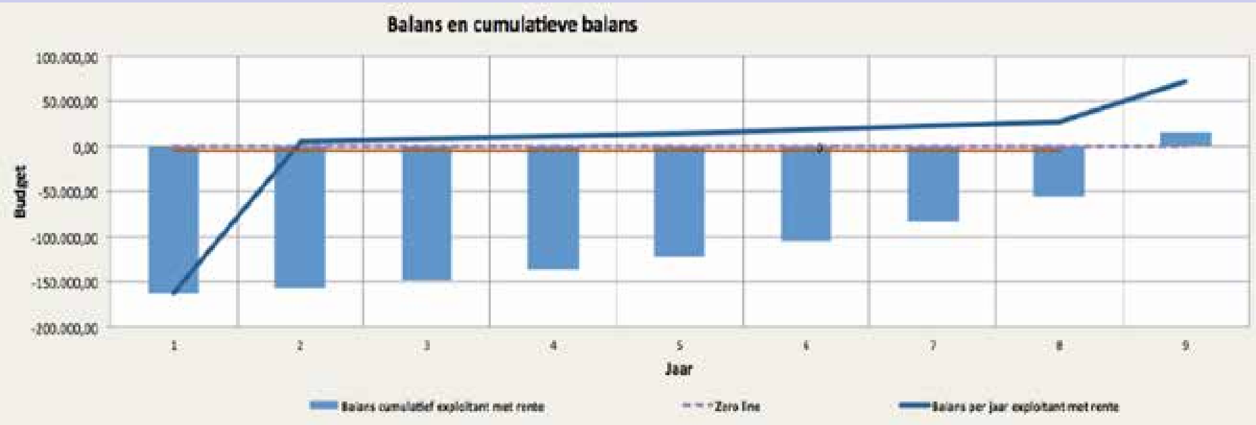
Figure 3: Four advantages to regional procurement (Netherlands)



Source: Tim van Beek (EVConsult), Joint regional procurement in the Netherlands, CIVITAS Electromobility workshop, 2016, Rotterdam

Moreover, a couple of provinces and large cities have set up a network to coordinate project and policy approaches. The best known examples are MRA-E (Metropoolregio Amsterdam-Elektrisch or Metropolitan Region Amsterdam-Electric) and MRDH (Metropoolregio Rotterdam Den Haag or Metropolitan Region Rotterdam The Hague). They have inter alia jointly selected a tender procedure and drawn up a programme of requirements to achieve specific public policy objectives, such as sustainability, maintenance and availability and accessibility of recharging points. This cooperation has been very successful in achieving the objectives listed in **Figure 3** above and has, in particular, significantly brought down procurement costs (**Figure 4**) due to the economies of scale.

Figure 4: 7 years plan of bringing down costs through regional procurement (Netherlands)



Source: Tim van Beek (EVConsult), Joint regional procurement in the Netherlands, CIVITAS Electromobility workshop, 2016, Rotterdam

A first key question competent authorities will have to answer when setting out their deployment strategies, is: **who will develop and own publicly accessible recharging infrastructure?** This could be a public authority, a private company, user-owned, or a combination of the aforementioned. Different aspects could influence the answer to this question - most notably the expected costs of deploying and operating such a network and its expected profitability, the degree of control public authorities want to maintain over infrastructure deployment in their territories and the (lack of) interest of the private sector. As these aspects change over time, depending on the state of development of the recharging market, public authorities should regularly re-assess this question

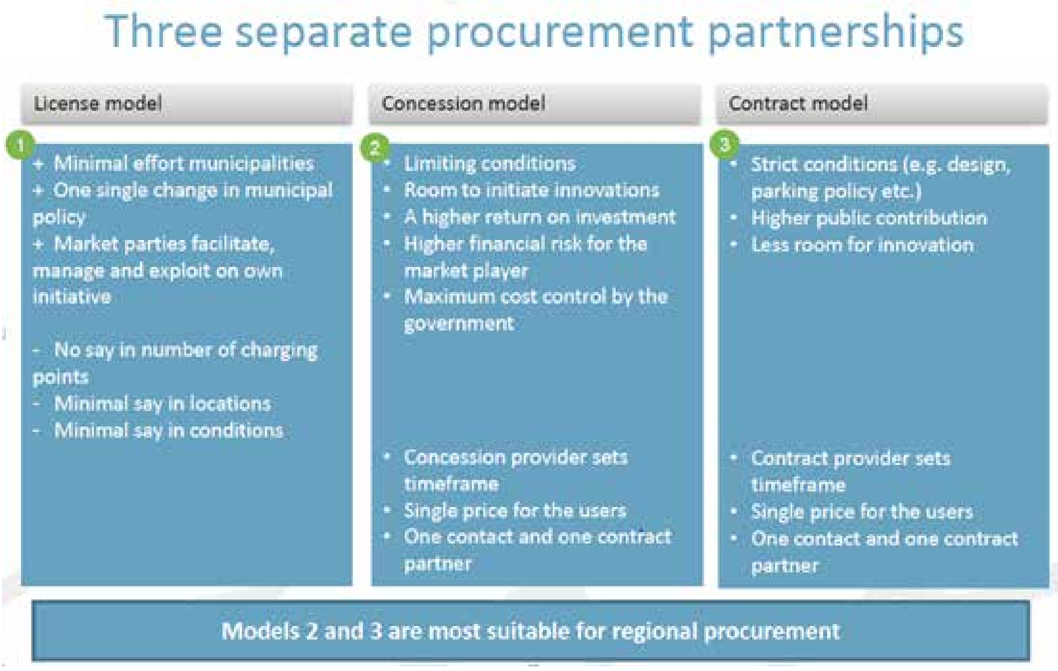
Different approaches to the question: who will develop and operate the infrastructure?

The responses to the eQuestionnaire indicate that public authorities choose different ownership structures:

- The city of Gothenburg has chosen to develop the infrastructure itself (via a public company). According to Gothenburg the deployment of a public network contributes to the visibility of electric transport and the market for infrastructure in Gothenburg is not yet sufficiently developed for private parties to make a sound business case. Developing recharging infrastructure, for them, is a temporary solution until the market is attractive for private market participants.
- Many public authorities tender the development and operation of one or more networks.
- Several municipalities develop the basic infrastructure and allow this to be complemented with infrastructure developed by private companies. While the level of cooperation varies, this strategy allows them to ensure that the likely less profitable areas (less used infrastructure) are still served while at the same time making optimal use of the technical and more business-minded expertise of the private sector.
- The municipality of Rotterdam chose to tender out the development and operation of the recharging network on its territory but maintained its ownership.
- The City of Paris currently still considers the development of infrastructure to be (financially) risky. For this reason they prefer to work with concessions, allowing them to retain control and benefit from the royalties paid by the concessionaire while outsourcing the most important operational risks to the concessionaire.
- The City of Oslo develops its own basis public network. In addition, it works with a joint-venture structure with private actors to develop high power recharging infrastructure chargers in the public domain.
- Other public authorities leave the development and operation of recharging infrastructure as much as possible to the private sector. This is primarily to avoid (financial) risks. For the Ministry of Economy of Slovakia, there is no role for municipalities in the deployment of infrastructure, as it considers this too challenging for them, both financially and in terms of human resources. Private parties offer sufficient expertise.
- Other municipalities or regions, such as the Vestland county in Norway, have already invested significantly in the initial phase of recharging infrastructure deployment and therefore choose to leave further development to the market.

To support the deployment of recharging infrastructure in their territories, (local) governments can make use of various contract-models and policy instruments. Public authorities may have multiple contracts managing multiple contractors, all managing different parts of the network or involved in different stages of network deployment. In general, three main models have been identified and are used by public authorities to distinguish the risks and costs associated with the different options: see Figure 5 below.

Figure 5: Main characterizations of the different models, according to CIVITAS Electromobility initiative



Source: Tim van Beek (EVConsult), Joint regional procurement in the Netherlands, CIVITAS Electromobility workshop, 2016, Rotterdam

The European Investment Bank distinguishes **five main contractual models** that can be used to roll-out recharging infrastructure:

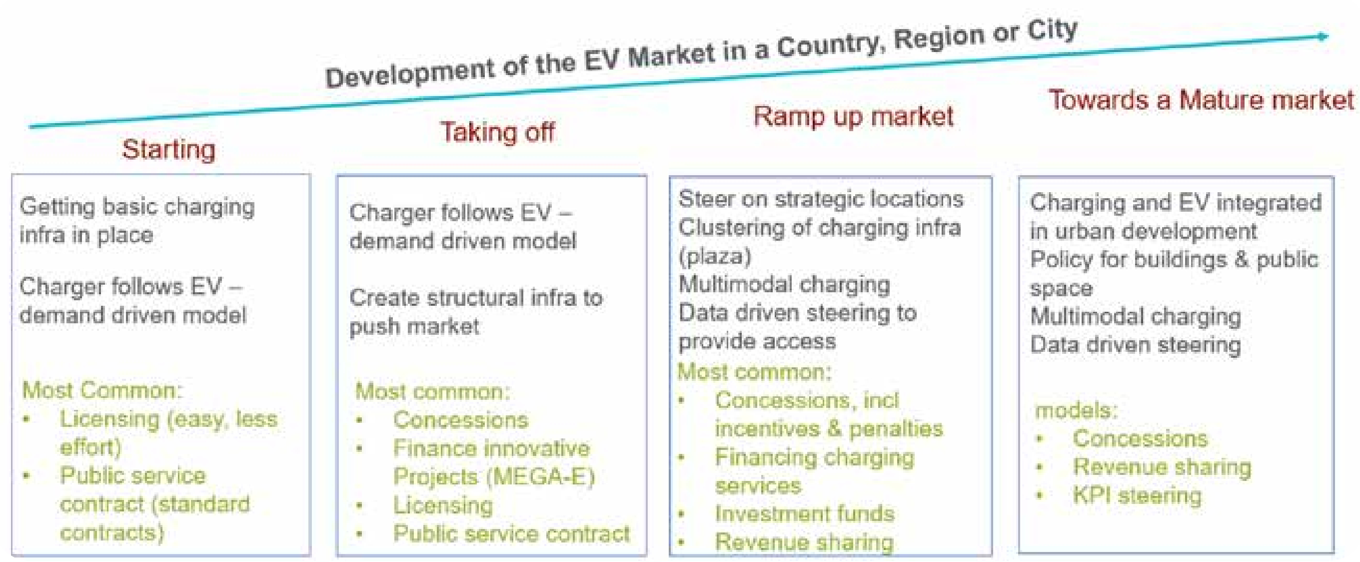
1. **The public contracting model:** the public authority keeps control over the infrastructure and retains most of the project risks, from construction to exploitation
2. **The joint-venture model:** the public and the private sector share the overall control of the infrastructure. The project risks are also shared. The model remains flexible on financing of the expenditure.
3. **The concession model:** a private party is given the concession to run and utilise (and build) a certain work or service. The (financial) risks lie with the concessionaire. The public authority can make more demands on where and what kind of infrastructure will be rolled-out according to a contract. There are many aspects of the concession model that can be tailored

to suit the public authority's objectives and constraints[4].

4. **The availability-based model:** the public sector allocates the project risks between the public and the private sector, but the public sector collects the revenues from the consumer and therefore retains the demand (revenue) risk of the project. The private sector finances the expenditure and is paid back by the public authority over the duration of the contract only if the infrastructure is available for the intended use.
5. **The licence model:** A party that complies with the policy rules drawn up by the public authority can be given permission to erect, manage and operate recharging points in the public space. The licence can include constraints over what the private sector can do. The private sector keeps the control over the infrastructure and retains most of the project risks, from construction to operation, and finances the expenditures and collects the revenues from the consumer. Through licences it is possible to limit numbers, but erection at less favourable locations cannot be enforced. Where there is a limited number of licences or even just one licence, transparency obligations can apply when granting the licence.

Experience by Allego indicates that national, regional, and local governments use different policy instruments depending on the market maturity in the area concerned.

Figure 6: Allego's experience: different policy instruments depending on market development

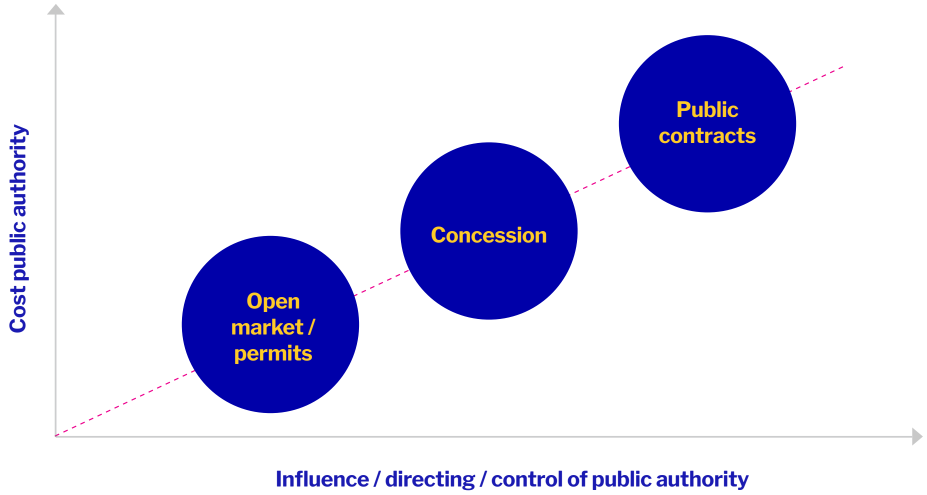


Source: Allego, presentation Harold Langenberg, Managing Director Benelux

Public authorities often choose a combination of instruments. The choice for an instrument depends on the goal that the public authority wants to achieve. There are also several variables that play an essential role in choosing the most suitable instrument/model. Figure 7 shows the most important variables and costs for Leuven (and other public authorities):

4 The concession model and the availability-based model, will be further explored in a paper currently developed by EPEC (European PPP Expertise Centre)

Figure 7: Factors influencing choice of most appropriate policy instrument



Source: City of Leuven. Integrated vision for the role out of charging infrastructure. Clean vehicles working group POLIS - 26 September 2019 – Bilbao.

The licence, concession or public contract is often combined with a **subsidy**, as in many places the deployment of recharging infrastructure is not yet a sufficiently profitable business. When granting subsidies, public authorities can impose requirements on the infrastructure and services to be provided.

Several countries have national subsidy schemes. Some countries choose to pay the subsidy directly to the project developer and/or operator (such as Germany). Other countries (such as the Netherlands) distribute the subsidy among the provinces and municipalities responsible for the deployment of infrastructure, who in turn organise tenders to select project developers and or operators. In both examples the subsidy is used to set minimum requirements to ensure quality. Germany also uses the grant to avoid uncontrolled deployment across the territory.

According to recital (30) of the Alternative Fuels Infrastructure Directive (2014/94/EU), **"[t]he establishment and operation of recharging points for electric vehicles should be developed as a competitive market with open access to all parties interested in rolling-out or operating recharging infrastructures".**

Public authorities procuring, awarding concessions or granting government support for the establishment and operation of recharging points have an eminent role to play in ensuring just such a competitive market - first and foremost by designing the contract award procedure appropriately.

Competitive tenders make it possible for parties to get a fair chance to compete for what is called a scarce right or exclusive right, whether it is a public contract, concession or even a limited licence. The tender procedure ensures that everyone has been able to take note of the possibility to compete and that a choice has been made for a party in a transparent and fair manner. A potential weakness of the procurement model, in particular if exclusive rights are granted, is that it can restrict free market access of non-selected operators and can therefore unintentionally impede innovation and eventually lead to higher costs for end-consumers. This disadvantage can however be limited by tendering several smaller lots instead of one large concession.

Different approaches to support market competition

Malta, Slovakia, and Germany divide concessions into smaller lots to support the entry into the market of new, smaller, market parties, thereby allowing different operators to co-exist.

The municipality of Reggio Emilia limits applications for the development of recharging stations by private companies. Every request by a private company must not exceed 60 recharging points. After 3 months another request can be submitted.

Stuttgart has used the smallest possible lots (one location, two recharging points) in order to make the market as accessible as possible, in particular to smaller players (there are currently 4 investors, one of them a smaller market party).

Leuven allows all interested CPO's to develop and operate infrastructure on its territory on the sole condition that they comply with a list of basic requirements.

The city of Stockholm uses a 'first come, first served' (licence-) model, that allows different parties to co-exist. Stockholm has mapped possible locations for on-street recharging point on a publicly accessible online map, inviting interested project developers and operators to apply for locations on a first come-first served basis. In order to ensure competition, the city applies a limitation in the number of applications that can be made by the same party (maximum 30 applications/locations). Some streets have been or will be pre-cabled by the DSO and are identified as "orange" locations on the map. An applicant may only apply for a maximum of 4 orange locations.

Existing concessions, which are often infinite or run over very long periods of time, may also limit access to new market parties. It is sometimes necessary to reconsider existing concession agreements that stand in the way of the emergence of a new market. There are often possibilities to modify or open- up existing agreements - in particular those with an infinite duration. Moreover, the extension of existing concessions without organising an open, competitive award procedure may raise State aid concerns or other competition concerns regarding the granting of exclusive rights.

Another way to increase the number of participants in a competitive tender procedure is by **lowering financial risks for the bidders**. Public authorities should investigate which financial and project (process management, permits etc.) risks they can reduce or take over, so that private parties can offer more competitive prices. One example is to **auction recharging point locations**, like auctions for renewable energy generation sites. The auction locations could be those already equipped with a grid connection, or locations that are sure to get support from the competent authorities for permitting purposes (so called certain to get locations). This enables bidders to better estimate the value of the specific locations tendered, in particular if the authorities have already performed a pre-assessment regarding the possibilities to obtain (construction/ environmental) permits for those locations[5].

A properly designed competitive allocation process minimises the costs for the deployment of recharging infrastructure, as long as the design of the bidding process ensures competitive pressure and prevents the exercise of market power.

In particular, for public support schemes, it is essential to capture fast-evolving market

5 Building a market for EV charging infrastructure: A clear path for policymakers and planners, J. Hildermeier, RAP, June 2020. Online version can be found here: https://www.raponline.org/knowledge-center/building-market-for-ev-charging-infrastructure/.

economics. Experience with funding schemes in Norway confirms that, where EV-usage goes up, subsidies for recharging infrastructure go down – sometimes drastically in short periods of time. Today, many recharging stations in Norway, mostly around cities and highways, are built without subsidies. It shows that these areas are increasingly interesting for commercial parties. A rigid funding scheme, that provides fixed remuneration for recharging points over a longer time period, cannot capture fast-evolving changes in the EV-fleet and corresponding changes in funding needs. In case the fixed subsidy offered for the construction of recharging stations is lower than the real subsidy needs, the subsidy scheme will not provide adequate incentives for investments and will thus be ineffective. If the fixed subsidy offered is too high (or more likely, becomes too high over time), the subsidy scheme will not deliver value for money and result in overcompensation for the beneficiaries, possibly distorting the recharging market.

Public authorities will want to ensure that investments into infrastructure are not only directed to the most profitable locations (with most expected usage, due to high traffic flows only – locations which can be expected to be equipped by private parties in any case at a given moment in the future). They will also want to equip potentially less profitable locations (with less expected usage), to have a widespread infrastructure network. Public authorities can ensure this by **'batching' or grouping different lots**, with more and less expected turnover, in their competitive auctions. In this way, they can ensure that investments are not only focused on the most profitable locations, while also reducing the need for subsidies for the least profitable locations through cross-subsidies. Where they decide to do so, public authorities should ensure that the batches are not so large as to preclude the participation of smaller players in the bidding process.

Batching locations in Switzerland

The Swiss Federal Roads Office (FEDRO) organised a tender for 100 high power recharging stations along Swiss highways. To avoid 'cherry picking' FEDRO made several batches of locations that are on average comparable in commercial attractiveness.

The tender allocated 100 locations in 5 packages of 20 sites. These 20 locations are a mix of very high traffic roads near densely populated areas and more rural roads. However, the party that wins the batch, must build high power recharging stations on all 20 locations.

Public authorities should ensure that not only the costs incurred by the government play a decisive role in the choice of the instrument, but also the price ultimately paid by the end consumer. This could for instance be done by **making bidders compete on the maximum prices** to be charged to consumers and including this as an award criterion in tenders.

Price as an award criterion

Some authorities set a maximum price themselves, as part of their tender specifications, while others encourage market players to come up with lower prices, by selecting the bidder that can offer the best price to the end user. Germany grants government support to the bidder who can offer the lowest cost in terms of €/kW capacity. In this case it is not a price cap for what the users pay, but a cost cap for what investors pay.

4. Specific tender requirements

The check list of a high-quality recharging infrastructure

1. Recharging points are well-designed and positioned
2. Infrastructure is interoperable, both in terms of hardware (connector fits vehicle) and software (infrastructure can communicate and interact)
3. Infrastructure is future-proof
4. It is easy to find and use, and users know in advance what they will pay for recharging
5. Infrastructure functions properly, with a high uptime, while errors and bugs are quickly resolved
6. It is (cyber-)secure

Enforcing high quality

Besides setting requirements regarding the quality of infrastructure, public authorities should make sure these can be enforced.

To this end, public authorities should require guarantees from bidders or include enforcement mechanisms in their tender specifications. A common example are penalties for failure to meet uptime requirements.

Various policy instruments can be used to realise a high quality public recharging infrastructure network. In all cases, **public authorities can and should impose quality requirements and enforce them**.

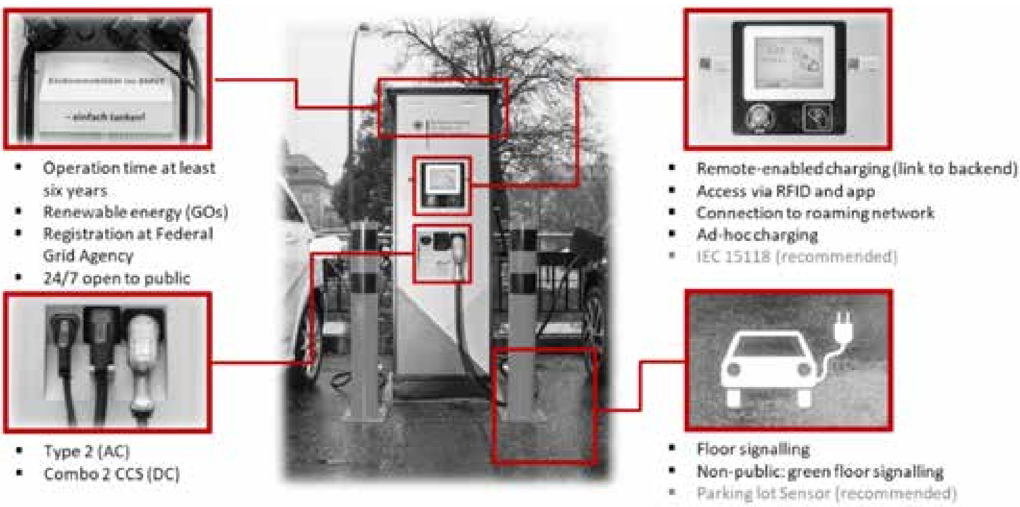


Figure 9: Germany: visual overview of requirements for funding (2018)

Source: NOW gmbh

1. Well-designed and well-positioned recharging points

Access requirements:

- At least recharging points in the public domain should be publicly **accessible 24 hours a day, 7 days a week**, meaning they can be used by everyone to smart recharge their electric vehicle at any time.
- **No access restrictions** should apply to publicly accessible recharging points, with non-discriminatory access for all EV-users (as required by AFID 2014/94/EU).
- Public authorities should ensure that, in principle, the location of all recharging points as well as the recharging poles themselves are **designed in such a way that they can be used by as much of the public as possible**, in particular taking into consideration the specific needs of older persons, persons with reduced mobility and persons with disabilities. In particular, they must, in principle, be accessible for persons with disabilities. This means for instance sufficient space around the parking lot, the recharging pole is not installed on a kerbed surface, the buttons / screen of the recharging point are at an appropriate height and the weight of the recharging cables is such that the general public can handle them with ease. In cases where it can be justified that certain recharging locations or recharging poles cannot be configured to make them fully accessible, the tender requirements should seek to maximise accessibility. They could for instance require that, as an absolute minimum, at least one, fully accessible recharging point is deployed within a predetermined radius (e.g. at least one fully accessible recharging point/ location in any 1km radius).

Dedicated parking: Public authorities should ensure that every recharging point is served by at least one adjacent parking lot that may only be used by EV-users. Obligations to this end could be imposed on concessionaires.

Design of the recharging pole: the recharging infrastructure should take account of the surroundings (size, positioning, safety, outer-appearance, potential generation of light pollution, ect.), the recharging point's lifecycle (circular design, sustainability, durability, modularity - components can be easily taken out and replaced - and easy repairability), safety of the design (no sharp ends, no pieces sticking out, location of cables) and user-friendliness (clearly visible when in use/out of order, easy accessibility to people with reduced mobility).

Leuven: requirements for positioning recharging infrastructure

The city of Leuven includes the following requirements in tendering charging infrastructure:

- the passage for other traffic (bicycle, pedestrian, wheelchair, ect.) remains guaranteed (cf. to comply with the guidelines as included in the Vademecum Public Accessible Domain);
- there are no obstacles with respect to other street furniture or (public) greenery;
- the recharging infrastructure fits in with the streetscape. The recharging point has RAL colour anthracite grey (RAL 7016). Desired means of advertising or communication may only be used with the permission of the city of Leuven.

Amsterdam: requirements on durability, modularity and open interfaces

- Durability: include quality requirements e.g. relating to use of non-corrosive materials and the protection of electrical parts (waterproof).
- Modularity: require a modular set-up of the recharging point, so all components and systems (e.g. RFID reader and controller) can be easily replaced.
- Mandate the use of open (hard- and software) interface standards between components and systems, so components and systems are interoperable and can be easily upgraded or transferred to a new operator.

Recharging cable: every DC recharging point is equipped with a fixed recharging cable, that is at least compliant with the standards set in Annex II of Directive 2014/94/EU. They should consider requiring companies that deploy AC recharging stations to equip these with a fixed cable, since this is more convenient to EV-drivers. In these cases, the cables should have sufficient length to recharge most vehicles and an appropriate cable management system should allow easy and safe handling of the cable and connectors (e.g. by automatically roll-up and storing of the cable in the recharging pole or by using a helical cable).

Requirements relating to metering: EV-users should be confident that the invoice for recharging correctly reflects the actual amount of electricity recharged. Recharging points should be equipped with a certified meter for highly accurate kWh metering and where needed a data storage device as well as the possibility to check the historical measurement data, for billing purposes.

Requirements relating to the grid connection:

- Public authorities should, if possible, set suitable requirements regarding the capacity of the grid connection, in order to ensure that recharging points can recharge EVs at full power.
- Where recharging poles are equipped with two or more connectors for simultaneous recharging, the recharging point must be able to distribute the electricity in an efficient and intelligent way over the number of vehicles connected. The same applies for recharging stations offering two or more recharging points.
- Grid connections should be fit for the future and upgradable, to anticipate extensions of the recharging station.

2. Interoperable infrastructure

Interoperability essentially refers to the ability of all electric vehicles to recharge at any recharging point. This has a number of desired outcomes:

1. it reduces the consumption of (public) space by reducing the need for (parallel) infrastructure overall;
2. it helps to create a healthy, competitive and open market, avoiding technical operator lock-in; and
3. it gives EV-drivers access to an increased amount of recharging points through a single subscription.

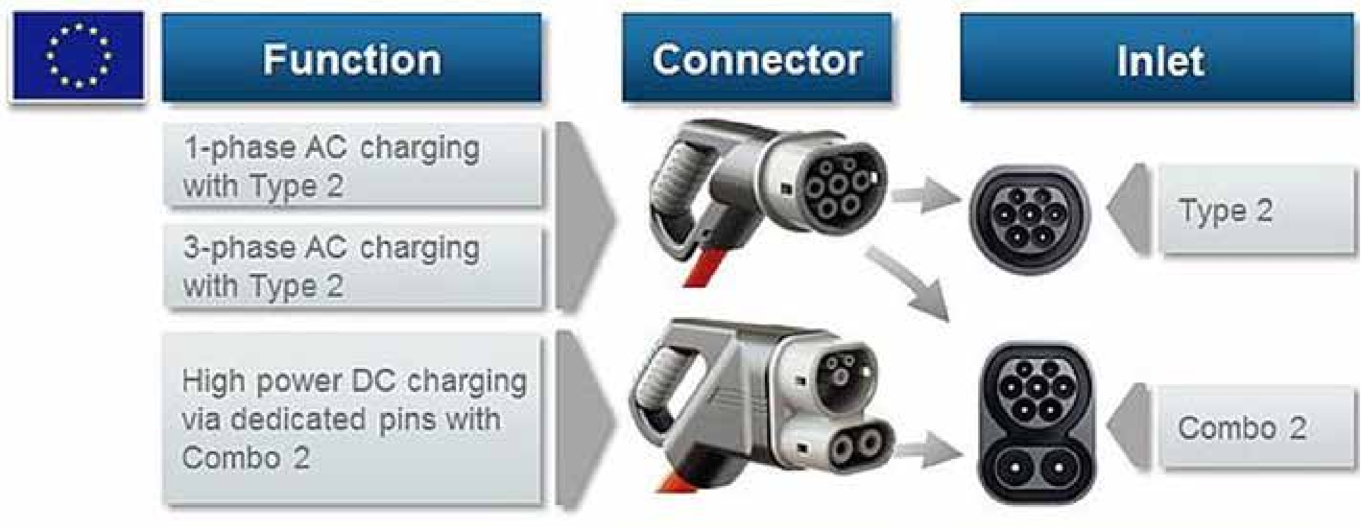
Hardware interoperability:

All recharging points should comply at least with the technical specifications set out in point 1.1 or point 1.2 of Annex II of the Alternative Fuels Infrastructure Directive or, more precisely, the national transposition of those standards (while leaving it to the market to decide whether or not to add other connectors). The minimum tender specifications should require that:

- Alternating current (AC) recharging points shall be equipped at least with socket outlets or vehicle connectors of Type 2 as described in standard EN 62196-2.

- Direct current (DC) recharging points shall be equipped at least with connectors of the combined charging system 'Combo 2' as described in standard EN 62196-3.

Figure 10: Mandatory recharging connectors in EU



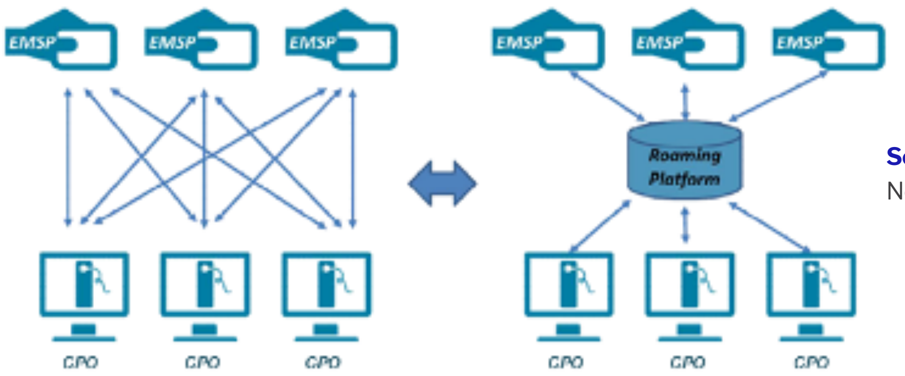
Source: CharIN, https://www.charinev.org/ccs-at-a-glance/ccs-implementation-guideline/

Software interoperability:

Software interoperability is only relevant to allow seamless contract-based authentication, payment and related services. Where user-friendly ad-hoc charging options are available, software interoperability is not strictly required to offer a seamless recharging experience to the EV-driver. Public authorities should therefore, first and foremost, ensure that user-friendly ad-hoc recharging and payment options are available at all recharging points.

In order to offer contract-based recharging, a recharging point must be accessible from a distance. In the absence of such a connection, (direct or indirect, through the CPO) an EMSP cannot obtain the data of a recharging session (identification of customer, kWh charged, time spent) it needs for billing purposes. When an EMSP also acts as CPO and owns/operates his own infrastructure, this is relatively easy to establish between his own recharging points and back-office. It however becomes more complicated in cases in which his customers recharge at a recharging point owned/operated by another CPO. This is where software interoperability comes into play: it allows the two (or more) software systems to communicate and exchange the necessary data (referred to as roaming, either peer-to-peer or via a roaming platform: see Figure 11). The easiest way of enabling such communications is to ensure that two software systems speak (different versions of) the same language; in other words, ensuring that they use the same protocols for communications.

Figure 11: Peer-to-peer roaming (left) versus roaming via a platform (right)



Source: Province of North-Brabant

For interoperability purposes:

- Public authorities should require that all publicly accessible recharging infrastructure is **digitally connected**. This implies the installation of the necessary software, standards, protocols and overall IT systems required to ensure the infrastructure is able to send and receive static and dynamic data in real time, as well as to connect the different market actors that are dependent on these data for enabling the recharging process. It is essential to ensure an adequate network connection: in this respect, best practice is to set minimum connection uptime requirements, irrespective of the chosen technology.
- As most EV-drivers today already have RFID cards, public authorities should consider to at least require the integration in the recharging point of an NFC / RFID card reader. Several public authorities require that such an NFC / RFID card reader communicates at a radio frequency of 13,56 MHz and applies NFC Tag 1-functionality according to ISO/IEC 14443A. Since standards for **automatic authentication** are either proprietary solutions or not yet fully developed, public authorities should not, at this stage, mandate automatic authentication on recharging points. They should however keep an eye on market developments regarding the ISO 15118-20 "Plug and Charge"-authentication possibilities.
- Future tenders will need to ensure that **communication standards and protocols** for the four main communication domains of the EV recharging ecosystem are interoperable. To achieve this, public authorities will have to closely follow developments regarding the adoption of new standards. Tender specifications should include a requirement that the concessionaire implements the 'latest version' of a standard, or that future updates of a standard are implemented at no additional cost within a maximum period (e.g. one year) from their adoption. For each respective communication domain, the following considerations should be made:

EV – Recharging point

While the IEC 61851 standard is currently being mandated in certain tenders, others are gradually moving towards the ISO 15118 standard. It is recommended that public authorities ensure that recharging infrastructure is future-proof and thus require that it contains the necessary hardware and software elements to support an upgrade to ISO 15118, at no extra cost to the contracting authority, when the different parts of the standard are both completed and suitable to the specific recharging use-case.

Recharging point - Back-end/network management system

OCPP is the current dominant protocol for this communication domain. Standardisation work is ongoing at IEC level to transpose and harmonise the OCPP and its functionalities into a de iure international standard, IEC 63110, which should be backwards-compatible with OCPP. This convergence process may still take a couple of years. At least until a final, OCPP backwards compatible version of IEC 63110 becomes available, the use of OCPP for recharging point to back-end communications should be encouraged in upcoming public tenders.

Roaming

For communications between CPO to EMSP and CPO/EMSP to roaming platforms, public authorities are strongly encouraged to require the use of open, non-proprietary protocols that are free to use. Imposing a requirement on CPOs to implement at least one, specific protocol for roaming communications - ideally one that is not linked to any specific commercial roaming platform - would have the benefit of ensuring that all recharging stations use at least one, common communication protocol to facilitate roaming agreements, while not precluding the use of additional communication protocols. In the future, it is expected that IEC 63119 will harmonise the roaming communication domain, including the interaction between CPOs and EMSPs.

California: At least one common roaming protocol to facilitate roaming agreements

On 29 May 2020 the US State of California filed legislation to facilitate roaming agreements. A new title 13 § 2360.3 in the Californian Code of Regulations requires that "[n]o later than July 1, 2021, [all CPOs operating one or more networked recharging points installed in California] shall meet, at a minimum, and maintain the "California Open Charge Point Interface Interim Test Procedures for Networked Electric Vehicle Supply Equipment for Level 2 and Direct Current Fast Charge Classes", adopted April 15, 2020, and incorporated by reference herein, for each applicable [recharging point]. This does not preclude the additional use of other communication protocols."

Distributed energy resources

The communication between CPOs, EMSPs, grid operators, grid users and facility managers is expected to be harmonised under IEC 61850. It is important to note that IEC 61850 works as a data model where different open protocols can be used. This approach differs from common standard conception and responds to the communication needs of power systems. Currently the IEC working group responsible for this standard has finalised and made available data models for EVs and supply equipment, where other functionalities are under development (distributed energy resources object model, including grid connection function modelling, microgrids, thermal energy). Future tenders should require the use of IEC 61850, and consequently, allow the use of open data models according to the needs of CPOs and DSOs.

In conclusion, it is important to remark that the predominant protocols proposed in this Handbook correspond to a possible future harmonised scenario over the next 2 to 5 years, as shown in Table 1 below. These scenarios take into account current standardisation works carried out by international standardisation organisations. Until their work is complete and an advanced ecosystem is built up, public authorities should cover the various communication domains with those standards and protocols that best facilitate an open and resilient environment enabling a smooth digital interaction between

Table 1: Overview of main EV communication domains and possible future harmonisation

Possible Future Harmonized Scenario		
Communication domain	**Standards**	
EV – Recharging point	ISO 15118	Vehicle-to-grid communication interface
Recharging point - Back-end/ network management system	IEC 63110	Management of EVs recharging and discharging infrastructures
Roaming	IEC 63119	Governing of information exchange of EV roaming services
Distributed energy resources	IEC 61850	Exchange of information with distributed energy resources

vehicle, services and customers. **The use of open, non-proprietary protocols, that are free to use, fosters the development of the recharging services market as an open and competitive market, with non-discriminatory access to new entrants.**

E-roaming requirements:

Public authorities should require that the CPO-concessionaire allows non-discriminatory third party (EMSPs) access to its recharging points, so third party-EMSPs can offer services on these recharging points (start/stop a session, financial transaction, smart recharging) to their customers. Moreover, this requirement should be complemented by an obligation on the CPO-concessionaire to establish a minimum amount of roaming connections, without, however, mandating the way roaming is implemented (Peer-to-Peer or via a clearing house).

3. Future-proof infrastructure

As electric vehicles and the required recharging infrastructure are relatively new technologies, a lot of (technological) developments will likely take place in the decades to come. Since recharging points are made to last a decade or longer, publicly accessible recharging points should be future-proof. This requires not only that they are state-of-art today, but also that they can be easily configured to future standards, should these arise.

The most important technological developments to keep an eye on are:

i. **higher power levels and more energy-dense batteries:** ever faster recharging times and ever higher energy-dense batteries could have significant impacts on the recharging needs and behaviour of EV-users, potentially increasingly replicating the refuelling patterns of conventional ICE-vehicles;

ii. **'smart' recharging** (commonly referred to as smart charging) and V2G: smart (re)charging' (or controlled recharging) is a term used for techniques that manage the energy supply to recharge electric appliances and vehicles in such a way that the peaks in network load are reduced and possibly the best use is made of available sustainably generated electricity. In a simple form, this means that the recharging session of certain coupled vehicles is temporarily postponed, interrupted or the power level altered, for instance driven by electricity market price signals. In a more complex form, the vehicle battery can be used as a buffer in the energy system, which can be recharged when there is excess (renewable) electricity and discharged when more electricity is needed than is generated in other parts of the electricity network (referred to as Vehicle-to-Grid or V2G). Public authorities should require that all publicly accessible recharging points are at least 'smart charging ready'. This requires the inclusion of a smart controller in the recharging point and back office with power steering algorithms (which must still be harmonised).

iii. **inductive or wireless recharging:** while currently most EVs must be physically connected to recharging infrastructure to recharge, some electric vehicles can already be recharged wireless or inductively. In this case, the recharging system is installed under or just above ground and the electrical energy is supplied to the vehicle via induction. In an urban context, this could have major advantages in limiting visual pollution and occupancy of public space. Moreover, inductive recharging could be perceived as more user-friendly, as the EV-user would have to engage in fewer operations to recharge (no need to connect and disconnect the vehicle).

4. User-friendly infrastructure

Finding infrastructure by means of data: Public authorities should include in their tender specifications an obligation on CPOs to transmit at least the following static and dynamic data to them, in real time (only in case of changes for static data):

- location (address, GNSS coordinates)
- opening hours
- maximum power offered (AD/DC, kW, voltage range, maximum current)
- available connectors (plugs, sockets, induction plate, battery swapping)
- available authentication and payment methods
- identification of the owner/operator
- technical availability (in service/out of order)
- occupation status (occupied/available)
- price for recharging (ad hoc price)

Making data public in Germany and Berlin

In Germany, CPOs are generally obliged to transmit certain static data to the regulator (Federal Grid Agency, Bundesnetzagentur) electronically or in writing at least four weeks before deploying any recharging infrastructure. The regulator then makes the data available on its webpage in the form of xlsx and csv-files and offers a publicly available recharging map.

The city of Berlin has set up a CPO independent information platform, operated by the city, with static and dynamic information on recharging infrastructure in Berlin.

At which interval should dynamic data be transmitted?

Amsterdam wants visibility (in XML, SOAP, HTTPS and TCP/IP format) on availability of all recharging points individually, with max 30mins delay (from real time).

Norway requires real-time connection and reporting to the public recharging point database NOBIL Madrid asks CPOs to provide information on the situation of the recharging infrastructure in real time, to adequately meet demand and to allow optimum use of the grid.

Moreover, public authorities should require strict compliance with the requirements of Directive (EU) No 40/2010 on Intelligent Transport Systems and subsequent delegated and implementing acts, in particular Commission delegated Regulation (EU) No 962/2015 and delegated Commission Regulation (EU) No 1926/2017. This includes the requirement that certain static and dynamic data regarding recharging points are made accessible in Datex II (CEN/TS 16157) format (or relevant upgrades of that standard) online, at least through the relevant National Access Point.

Finding infrastructure by means of road signs and graphical displays: Public authorities should equip roads with clearly visible and easily recognisable signposting towards recharging points. Similarly, they should clearly mark lots that are reserved for recharging electric vehicles. Obligations could be imposed on concessionaires.

User-friendly ad hoc payment: Public authorities should require in their tender specifications that any EV-user is able to recharge on an ad hoc basis at any publicly accessible recharging point, namely:

- with a one-off agreement, that is concluded when the user starts charging the vehicle and ends with payment for that recharging session, without there being any longer-lasting mutual obligations;
- without any need to enter into any written agreement with the Charge Point Operator or owner;
- without any need to download a dedicated smartphone application (e.g. from the Charge Point Operator);
- without any need to identify or register himself; and
- offering an easy payment option on the spot, that shall as a minimum allow for payment by debit or credit card (e.g. contactless payment via NFC reader) or other direct bank payment through widely supported digital means.

European Commission clarification of ad hoc requirements

The requirement that an EV-user does not need to identify or register himself in any way is intended to preclude the situation where an EV-user needs to fill in an online form or download a specific application provided by the Charge Point Operator or an affiliated organisation, where he needs to identify himself directly to the Charge Point Operator or its affiliate. Payment via bank/credit card or third-party payment services application (e.g. iWallet or an application provided by their bank), where identification is only indirect and the user does not need to register beforehand, is therefore permitted. In all cases, Charge Point Operators should ensure that ad hoc payment options offered are generally available and used by the public in the country in which the recharging point is installed. Limiting ad hoc to one proprietary payment service application, which is dependent on the ownership of a specific smartphone (such as iWallet) would not be in compliance with the requirements of AFID.

Ensuring fair and reasonable prices:
Public authorities should require in their tender specifications that **bidders specify a maximum B2B (contract-based) and ad hoc price in their bids** – these maximum prices serve as a cap on the prices charged to users throughout the duration of the contract/concession (with the exception of contractually agreed price indexation or price review provisions).

Antwerp: price as an award criterion

First award criterion: pricing for (potential) EV-users (40 points)

The Autonomous Antwerp city Parking Agency (AAPA) assumes an operational model in which the concessionaire can deliver the full scope of services without any financial contribution of AAPA or other public authorities. In this context, the candidate should indicate in his proposal a maximum price payable by (potential) EV-drivers at its recharging points. In his bid, the candidate must specify a maximum price (per kWh) for each of the following two payment methods:

- The maximum price per kWh [payable for contract-based recharging] (e.g. via a charging card, app, etc.) (15 points);
- The maximum price per kWh for ad-hoc payments by SMS (price including cost for sending SMS) (cf. 15 points);
- Rotation rate per 15 minutes (day) (10 points).

Public authorities should moreover require in their tender specifications that there is **no discrimination between the prices charged by CPOs to B2B customers (EMSPs) and the prices charged to B2C customers** (i.e. the ad hoc price charged to EV-drivers). For example, public authorities could require that the difference between the price charged by a CPO to a third-party EMSP for a recharge at his stations or the price charged directly to an EV-driver recharging at his stations ad hoc, shall never exceed [X]%.

Amsterdam: same maximum price for EMSPs and end consumers

The concessionaire shall charge a maximum price of EUR X per kWh (excl. VAT) to EMSPs and end consumers alike.

Price transparency: Public authorities should require that (all elements of) the ad hoc price are displayed at any publicly accessible recharging point in a visible, transparent and unambiguous manner.

Moreover, in order to ensure **fair, transparent and easy-to-compare pricing**, they should mandate that the ad hoc price and contract-based price offered by the successful concessionaire are based mainly on electricity consumed (i.e. a kWh based price), possibly complemented by a time-based fee (to dissuade unnecessary long occupation of the dedicated parking space). In case of dynamic prices, the intraday price changes should be accurately reflected in the costs charged to the EV-users, and ultimately in the invoice.

Reggio Emilia: price transparency and price structure requirements

In the case where the recharging service is provided by a company in return for a fee, the service provider should adopt a consumption-based price model, based on the kWh of energy consumed and time passed during the recharging session, so as to discourage prolonged recharging sessions beyond the maximum allowed recharging time , and allow as many EV-drivers as possible to recharge.

The applicable prices must be communicated to all users in a clear and transparent manner prior to recharging. Failure, even partial, to comply with the provisions of this point [...] will entail the forfeiture of the concession and the obligation to restore the premises at the expense of the concessionaire, in addition to the right of the municipality to claim damages.

Electricity supply requirements: In order to support the green image of electromobility, public authorities should consider requiring that only renewable electricity is offered for electric vehicle recharging.

Ownership of data: Public authorities should clearly specify in the tender specifications the data that the infrastructure operator should gather for and provide to them. Depending on the contractual set-up, but certainly in cases where the public authorities own or co-fund the infrastructure, they should require ownership of the data generated by the infrastructure, allowing them to collect and consolidate these data on an independent data platform and use them as they deem fit - including by making them freely available to all interested parties for re-use.

Cybersecurity: Since recharging infrastructure is an essential and critical infrastructure, tender specifications should set requirements for electric recharging infrastructure in terms of cyber-security. In particular, public authorities should try to minimise security disparities, by including in their tenders requirements for incident reporting and promoting an information-sharing culture among the different players in the EV-ecosystem to reduce the risk of threat propagation. Finally, as concessions may run for a long period of time, public authorities should require in their tender specifications that they can, if necessary, in the future, require the upgrading of infrastructure to the desired level of cyber-security.

Performance requirements: In order to offer the best possible service to EV-drivers on the one hand, and to get the best value for money on the other hand, public authorities should set **minimum uptime requirements** for infrastructure. Monitoring is best performed in real time, or at least on the basis of real time data. Financial penalties could be considered as a deterrent to ensure that maintenance is taken sufficiently seriously by the contractor, also towards the end of the concession period.

Public authorities should also include **minimum support requirements** in their tender specifications - such as obligations on the operator to repair infrastructure within a given timeframe, either from a distance (e.g. a software issue) or, if needed, on site. 24/7 phone assistance should be provided as a minimum. Support in at least one, common European language other than the native tongue of the country/region in which the infrastructure is located, is advised. The phone number of the call centre should be clearly displayed on each recharging point.

Amsterdam: full cycle of quality of equipment testing/maintenance

General quality requirements: recharging point including its base is designed for low maintenance erection in outdoor space during 10 years.

Testing of equipment: factory acceptance test (by independent third party) and site acceptance test

Uptime requirements: Amsterdam asks 99% uptime on a monthly basis; with max 3 failures per month

Support service requirements: 24h support service and failures must be corrected within 24h, with two exceptions:

- It must be possible to stop a recharging session and uncouple the plug from a distance (so immediately when the user calls)
- failures where a user cannot connect or disconnect his vehicle or where there is a risk to safety, must be solved within 2h of notification

Preventive maintenance requirements: minimum every 6 months

Guarantees and enforcement mechanisms: More generally, in order to avoid that the tender requirements remain hollow phrases, public authorities should require **appropriate guarantees** from their concessionaires and/or include **appropriate enforcement mechanisms (e.g. penalty mechanisms)** in their tender specifications. These must at the same time be sufficiently high to have a deterring effect during execution of the contract, while not being so high as to deter bidders from participating in a tender altogether.

To **determine the appropriate duration of a concession, public contract or licence** for deploying and/or operating recharging infrastructure, public authorities should strike a balance between a number of considerations. As a general principle, the duration of the contract will depend on the chosen ownership model and related division of costs and risks between the contracting authority and contractor.

For contracts where the contractor invests in the infrastructure, the duration should not exceed the time in which he can reasonably be expected to recoup his investment together with a reasonable return on it, as mandated – at least for concessions – by Directive 2014/23/EU. Moreover, in those cases the amortisation period will be directly proportional to the contract period, which may in turn impact the final prices for consumers.

The legitimate interests of investors to recoup their investment and considerations regarding the amortisation period and its impact on the final prices paid by consumers should be balanced against the public interest of limiting the duration of contracts, and in particular those that grant exclusive rights, as they restrict free market access and competition.

End of concession, licence, public contract: Public authorities should include rules on who owns and is responsible for the infrastructure after the contract term.

Examples of requirements at end of contract

To ensure that the infrastructure is maintained during the end of the concession period, the municipality of Reggio Emilia demands the operator to pay a deposit. The deposit shall be paid back at the end of the contract period, provided that the operator has complied with the maintenance obligations.

In order to ensure that the infrastructure can be re-used after the end of the contract the city of Amsterdam requires that "[t]he recharging point (hardware) and all systems (software) [are] free from IPR and based on open standards, so they can be transferred freely at end of concession".

Arnhem sets the following requirements:

- After the concession period the publicly accessible recharging points are to be transferred to the city or another party without additional costs;
- The contractor is obliged to cooperate in the transfer at the end of the concession agreement;
- Suppliers of the recharging infrastructure are to provide maintenance for a minimum of 3 years after termination of the concession agreement;
- Recharging objects and related systems (such as software) are free of any property rights and should operate [using open standards]; and
- All complementary documentation is provided by the contractor at termination of the concession agreement.

Annex: Glossary

2019 STF stakeholder consultation	The stakeholder consultation on key policy needs and options for action in Alternative Fuels Infrastructure deployment and consumer services conducted by the Sustainable Transport Forum ("STF") in 2019. The findings of this consultation were recorded in the Sustainable Transport Forum Report 'Analysis of stakeholder views on key policy needs and options for action in Alternative Fuels Infrastructure deployment and consumer services', available here: https://ec.europa.eu/transport/sites/transport/files/2019-stf-consultation-analysis.pdf
AFID - Alternative Fuels Infrastructure Directive	OJ L 307, 28.10.2014, p. 1–20, Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure.
Alternative fuels	Meaning fuels or power sources which serve, at least partly, as a substitute for fossil oil sources in the energy supply to transport and which have the potential to contribute to its decarbonisation and enhance the environmental performance of the transport sector. They include, inter alia — electricity, — hydrogen, — biofuels as defined in point (i) of Article 2 of Directive 2009/28/EC, — synthetic and paraffinic fuels, — natural gas, including biomethane, in gaseous form (compressed natural gas (CNG)) and liquefied form (liquefied natural gas (LNG)), and — liquefied petroleum gas (LPG).
BEV - Battery Electric Vehicle	Also known as an all-electric vehicle, a BEV has all its power from its battery packs and thus has no internal combustion engine, fuel cell, or fuel tank.
Connector	A connector is the physical interface between the recharging point and the electric vehicle through which the electric energy is exchanged.
CPO - Charge Point Operator	Entity responsible for the management, operation and maintenance of one or more recharging points. The role of a CPO can include both the administrative operation (e.g. access, roaming, billing to EMSP etc.) and technical maintenance of recharging points.
DSO - Distribution System Operator	The organisation that designs, operates and maintains the public distribution grid through which electricity is supplied to recharging points. The recharging points are connected to the DSO grid through a delivery point.
Dynamic data	Data that changes frequently over time, such as data on the availability of a recharging station.
eMobility/Electromobility	eMobility refers to road transportation based on plug-in electric powertrains. To enable eMobility, EV recharging infrastructure must be deployed to enable EVs to recharge ubiquitously.
EMSP - Electromobility Service Provider	An entity offering eMobility services to end customers (services offered may include recharging, search & find, routing and other services).
eQuestionnaire	Survey distributed to public authorities in Europe (European Member States, EEA countries and the UK, but also European cities and regions) for the purposes of these Recommendations, to gather input and learn from the experiences of Europe's cities, regions and Member States in relation to concessions, procurement and subsidy schemes for alternative fuels infrastructure.

EV - Electric vehicle	Meaning a motor vehicle equipped with a powertrain containing at least one non-peripheral electric machine as energy converter with an electric rechargeable energy storage system, which can be recharged externally.
EV-driver	Human driving an electric vehicle.
EV-enabled parking lots (EVPLs)	Parking lots especially equipped for EV recharging.
EV-user	Human using an electric vehicle.
High power recharging point	Means a recharging point that allows for the transfer of electricity to an electric vehicle with a power of more than 22 kW.
ICE	Internal Combustion Engine: an engine which generates motive power by the burning of petrol, oil, or other fuel with air inside the engine, the hot gases produced being used to drive a piston or do other work as they expand.
Interoperability	The ability of two or more networks, systems, devices, applications, or components to interwork, to exchange and use information in order to perform required functions.
kWh - Kilowatt hour	Measure Unit of energy equal to 1,000 watt-hours, or 3.6 megajoules. The kilowatt-hour is commonly used as a billing unit for energy delivered to consumers by electric utilities.
NFC - Near Field Communication	A set of standards specifying uni- and bi-directional messaging between devices using radio communication over small distances. It is used for access, authorisation and billing purposes, typically using a NFC-enabled smart card or smart phone.
Normal power recharging point	Means a recharging point that allows for the transfer of electricity to an electric vehicle with a power less than or equal to 22 kW, excluding devices with a power less than or equal to 3,7 kW, which are installed in private households or the primary purpose of which is not recharging electric vehicles, and which are not accessible to the public.
PHEV - Plug-in hybrid electric vehicle	A PHEV shares the characteristics of both a conventional hybrid electric vehicle - having an electric motor and an internal combustion engine (ICE), and of an all-electric vehicle, having a plug to connect to the electrical grid.
RFID - Radio Frequency Identification	Automatic identification technology which uses radio-frequency electromagnetic fields to identify objects carrying tags (usually RFID cards) when they come close to a reader.
Recharging location	A location (public or private) where one or more recharging points are erected.
Recharging network	Recharging points are frequently operated and managed as a collection of distributed devices in a branded network. These networks have relationships with the site owners on which recharging points are deployed, and work on behalf of the site owners to manage delivery of EV recharging and other services. In some instances, EV recharging networks may own the EV recharging equipment and may have rights to the property on which the equipment resides. EV recharging networks may also have relationships with the EV-drivers and may provide consolidated account management and billing of services rendered. Services to EV-drivers may be rendered not only “in-network”, but also on “off-network”. In short, EV recharging networks help bridge the gap between entities wishing to offer EV recharging (i.e., supply-side) and EV-drivers wishing to use EV recharging (i.e. demand-side).
Recharging point accessible to the public, public recharging point or publicly accessible recharging point	Meaning a recharging point which provides Union-wide non-discriminatory access to users. Non-discriminatory access may include different terms of authentication, use and payment.

Recharging point	Meaning an interface that is capable of recharging one electric vehicle at a time or exchanging a battery of one electric vehicle at a time.
Recharging pole	A physical object with one or more recharging points, sharing a common user identification interface.
Recharging service provider	Depending on the context, can refer to a CPO or EMSP, or to both.
Recharging session	A recharging session is a unit of recharging service consumption. It starts when the EV is connected to the EVSE (and if required, authorised). It ends when the EV is disconnected, or by some other well-defined event (different providers may select different terminating conditions, depending upon whether they bill consumers for parking without charging). During the recharging session, the EV consumes different services, including energy and parking/occupancy. The EV-user may be billed by session, or by the consumption of energy/occupancy that took place during the session, or some other mechanism.
Recharging Station	A location which groups more than one recharging point for EV recharging.
RES, Renewable energy sources, Energy from renewable sources or renewable energy	Means energy from renewable non-fossil sources, namely wind, solar (solar thermal and solar photovoltaic) and geothermal energy, ambient energy, tide, wave and other ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas, and biogas.
Roaming Platform or Roaming Clearing House	A central organization connecting multiple electromobility market players. They are responsible for contractual clearing and enabling electromobility services between the connected actors and end consumers.
Roaming, e-roaming or EV roaming	Roaming of EV related services will occur when a service is contracted between consumer A and provider B, but is delivered to consumer A by provider C, based on a contract between provider B and provider C.
Semi-public recharging points or infrastructure	Publicly accessible recharging points erected on private domain, subject to specific, though non-discriminatory, access restrictions, e.g. in terms of opening hours or use, such as the requirement to make use of the associated facilities. Examples include recharging points in car parks of large warehouses or convenience stores, underground car parks, at hotel and catering establishments, etc.
Smart (re-)charging	Smart (re)charging (or controlled recharging) is a term used for techniques that manage the energy supply to recharge electric appliances and vehicles in such a way that the peaks in network load are reduced and possibly the best use is made of available sustainably generated electricity. This can be done in different ways and with different degrees of complexity. In a simple form, this means that the recharging session of certain coupled vehicles is temporarily postponed, interrupted or the power level altered, for instance driven by electricity market price signals.
Static data	Data that does not vary with time, such as the geographic location of a recharging station.
SUMPs	A Sustainable Urban Mobility Plan (SUMP) is a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. It builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles.

STF - Sustainable Transport Forum	Following the adoption of Directive 2014/94/EU on the deployment of alternative fuels infrastructure the European Commission decided to create the Sustainable Transport Forum (STF). The STF should help the Commission to advance the application of the Clean Power for Transport strategy and facilitate the implementation of Directive 2014/94/EU. It shall assist the Commission in implementing the Union's activities and programmes aimed at fostering the deployment of alternative fuels infrastructure to contribute to the European Union energy and climate goals.
UVARs	Urban vehicle access regulations (UVARs) is a form of traffic management that regulates access in specific urban locations according to vehicle type, age, emissions category – or other factors such as time of day, or day of the week. UVARs can include Low Emission Zones (LEZs) and/ or Congestion Charging and involve a wide range of considerations in implementation.

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