State of Competition in the Dutch EV charging sector
Emerging issues in a developing market

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14. State of Competition in the Dutch EV charging sector

Emerging issues in a developing market

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In the Netherlands and some neighbouring European countries, the electric vehicle (EV) charging sector is receiving attention from market regulators. Concerns relating to competitive processes in this developing and rapidly growing sector are being raised. This paper identifies specific markets where regulation can help increase the level of competition for the development of affordable and accessible public charging infrastructure, both within the *built environment* (slow charging) as well as *along highways* (fast charging). Barriers to competition include exclusive concessions at the municipality level and long-term exclusive concessions at locations along highways.

Introduction

The electric vehicle (EV) and EV charging sectors are rapidly developing, both in the Netherlands and around the world. These developments concern both the technology as well as the markets that make the technology accessible to the general public. New roles are emerging among the participants in these developing markets, delivering innovative goods and adding value through specialised services.

In this paper, we examine emerging issues that are relevant for fair and transparent markets in the EV charging sector in the Netherlands.

Role of EVs in the energy transition

The electrification of passenger mobility forms an important part of the energy transition. Cars and light commercial vehicles contribute to about 17% of the EU's total CO2 emissions[1]. Decarbonisation of the emissions associated with passenger mobility is therefore aligned with the Paris climate objectives.

Fig. 1 (see page 20) shows the average CO_2 emissions occurring during operation of all vehicle models registered in the EU27, Iceland and Norway in 2020, disaggregated by the source of power.
As seen on the right side of the figure, Battery Electric Vehicles (BEVs), as well as hybrid electric vehicles emit lower emissions per kilometre driven than fossil-based alternatives like petrol and diesel. BEVs, together with similar vehicles that emit less than 50 grams of CO_2 per kilometre driven, are classified as Zero and Low Emission Vehicles (ZLEVs)[2]. The substitution of fossil-powered vehicles that currently dominate passenger mobility by ZLEVs is an important mechanism for the decarbonisation of the passenger mobility sector.
The scaled shift in the source of power for the passenger mobility fleet from petrol and diesel to electricity has significant consequences, not only for the transport sector but also for the energy sector. The provision of electricity and supporting infrastructure to charge the largely electric passenger vehicle fleet of tomorrow is an important challenge in the energy transition.

EV Adoption in the Netherlands

The Netherlands is widely regarded as a frontrunner in the electrification of vehicles, both in Europe as well as at the global level. In 2021, about 20% of all the vehicles purchased in the Netherlands were electric in comparison with 1.1% in 2016[3]. However, as only about 5% of the total passenger fleet is electrified so far[4], further electrification of the passenger fleet is inevitable.

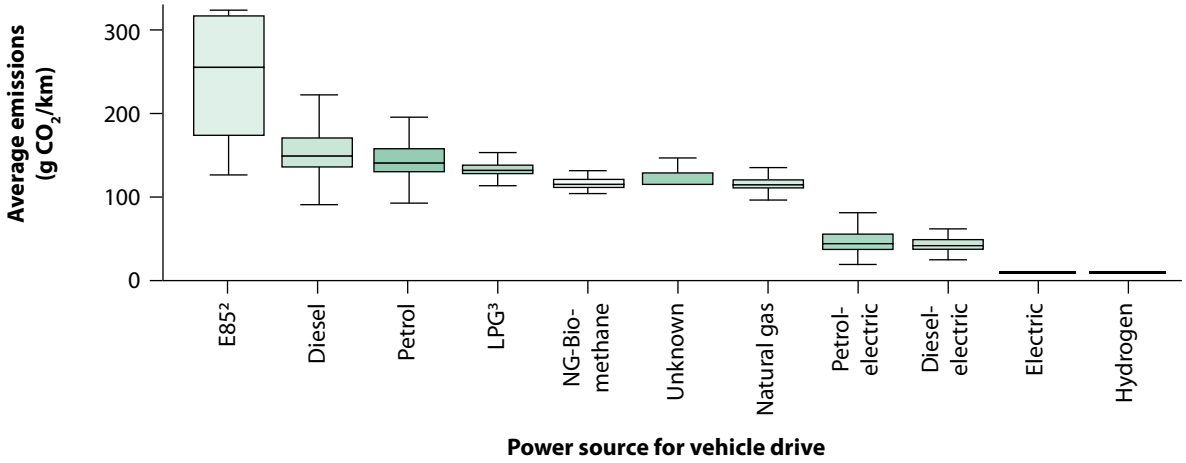
In 2021, about 20% of all the vehicles purchased in the Netherlands were electric in comparison with 1.1% in 2016

1 European Environment Agency, 'Monitoring of CO2 Emissions from Passenger Cars'.

2 The European Parliament and the Council of the European Union, Regulation (EU) 2019/631 of the European Parliament and of the Council of 17 April 2019 setting CO_2 emission performance standards for new passenger cars and for new light commercial vehicles, and repealing Regulations (EC) No 443/2009 and (EU) No 510/2011.

3 Netherlands Enterprise Agency (RVO), 'Statistics Electric Vehicles and Charging in The Netherlands up to and including March 2022'.

4 As of March 2022.



The EV charging infrastructure in the Netherlands is also at an advanced stage of development, having among the highest ratios of public EV charge points per EV in the world. Both the number of charge points and their utilisation are rapidly increasing. Since 2018, the number of public charge points used in the four largest Dutch cities of Amsterdam, Rotterdam, the Hague and Utrecht has more than doubled from about 12 thousand to over 28 thousand. In the same period, the number of charging sessions and the number of unique users have shown similar rapid growth[5].

Strong governmental ambitions for EVs and charging

As part of the Dutch Climate Accord, the Dutch Government aims to reduce overall CO_2 emissions by 55% by 2030 relative to 1990 levels[6]. To achieve this overarching objective, several targets for the passenger mobility sector have been set.

1. The sale of new fossil fuel-powered vehicles is to be banned by 2030 in the Netherlands, 5 years ahead of a similar ban at the EU level.
2. 1.8 million public, semi-public and private charging stations are to be made available by 2030[7].
3. By 2025, Zero Emissions Zones are to be established in at least 30 large municipalities in the country.

These policies phasing out fossil-fuel powered vehicles and providing necessary public infrastructure for EV charging suggest rapid and scaled electrification of the passenger mobility sector in the upcoming decade.

EV users in the Netherlands

Several studies surveying EV users in the Netherlands reveal that the dominant profile of the Dutch EV driving population is middle-aged males with high education levels who are wealthier and more likely to own parking spaces than the average Dutch citizen. A large fraction of this dominant profile uses the EV as their primary vehicle and tends to be divided across the political spectrum[8].

Current EV users greatly appreciate the EV driving experience: almost all of them state that their next car will be electric as well. Moreover, they are sensitive to subsidies and tax advantages, particularly the exemption from vehicle tax for private EV owners. Business leases form a large share of the overall number of EVs[9] as the low costs of operation of EVs make them particularly attractive for businesses with vehicle fleets[10].

How do EVs charge in the Netherlands?

EVs "fill up" the energy needed for their motion in a different manner than vehicles with an internal combustion engine (ICE) powered by petrol or diesel fill up their tanks. While ICE vehicles typically fill up their tanks completely in a few minutes, EVs generally take much longer to charge due to limitations in the speed at which the EV battery can be charged. Typically, EVs can be fully charged in about 4 to 12 hours, depending on the size of the EV battery.

Because of their longer charging durations, EVs generally charge at the locations where they are parked. Typical parking locations are at the home or the workplace of the EV user or at locations that the EV users visits, like shopping centres, rather than at dedicated charging stations.

The exception to this is *fast charging* along highways. On long-distance trips, EVs need to charge quickly, and fast charging generally takes only about half an hour to charge the battery. However, although very important for long trips, fast charging forms a relatively minor fraction of the total energy delivered to EVs, accounting only for around 8% of total kilometres driven by EVs in the country. Slow

5 EVdata.nl.

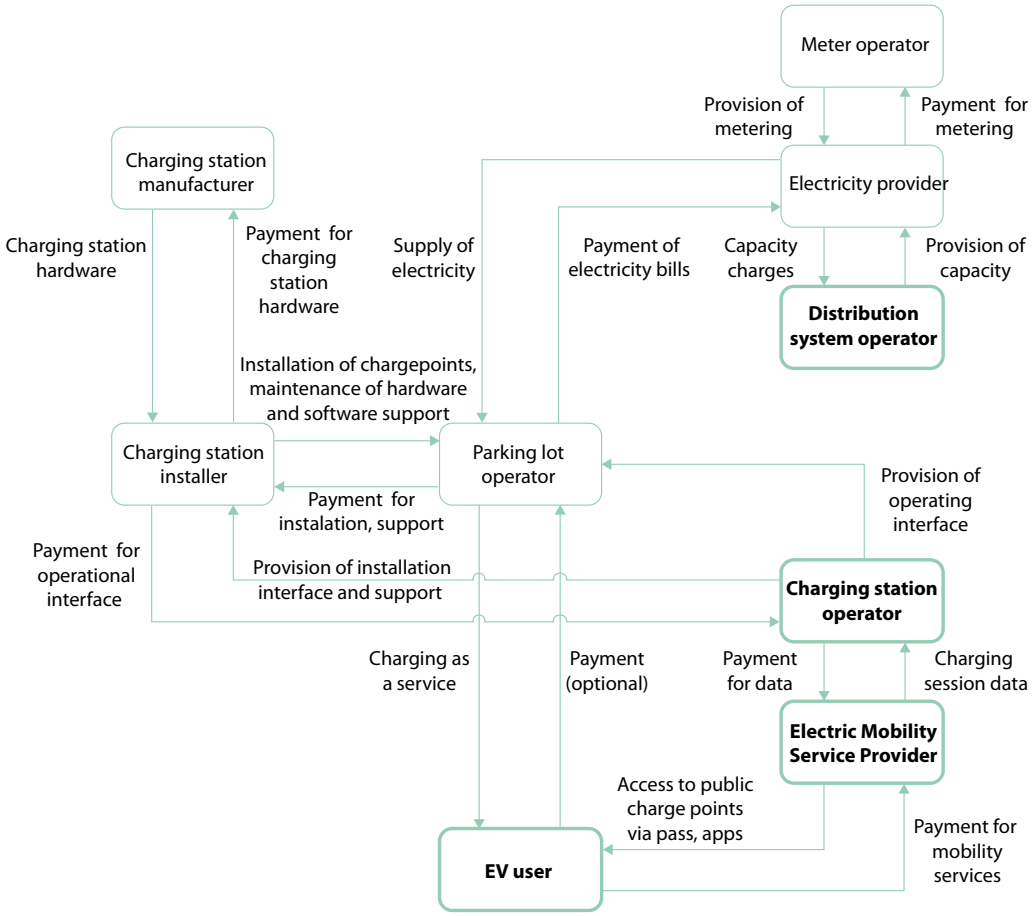
6 Rijksoverheid, 'Climate Agreement'.

7 As of March 2022, there were about 94,336 public and semi-public chargers and about 238,000 private chargers in the Netherlands. Thus, 1.8 million by 2030 implies an increase of over 400%.

8 Duurkoop et al., 'The Netherlands National Electric Vehicle (EV) and Driver Survey: Experiences and Opinions of Users'; Hoekstra and Refa, 'Characteristics of Dutch EV Drivers'.

9 Kampert and Ewalds, 'Haalbaarheidsonderzoek: Aandeel private lease electrische personenauto's bij rechtspersonen in de RDW'; Alberda et al., 'Verdeling elektrische personenauto's naar provincie, 1-1-2020'.

10 Duurkoop et al., 'The Netherlands National Electric Vehicle (EV) and Driver Survey: Experiences and Opinions of Users'.



charging at homes, which delivers about 60% of the total kilometres driven, comprises the largest share of charging[11].

The EV charging sector in the Netherlands: who is involved?

The various actors involved in EV charging in the Dutch ecosystem and their relationships with each other are mapped out in Fig. 2. The actor map describes the ISO 15118 model[12] of the EV charging ecosystem and retains the same terminology as the technical standard[13].

These actors are described below:

1. The *vehicle user* is the person using the plugin EV. The vehicle user takes decisions regarding charging and interacts with a user interface to input data and make payments.
2. The *Electric Mobility Service Provider (EMSP)* is the commercial party with whom the vehicle user has a contractual agreement for charging services at publicly accessible charge points. These services include identification, authentication, roaming, aggregation of transactions and billing. E.g.: Shell Recharge, Eneco e-Mobility, MultiTankCard.
3. The *Charging Station Operator*[14] *(CSO)* is responsible for developing the software installed on the charging stations that are used by different stakeholders. The CSO provides the charging station installer with an interface for the initial commissioning of the charging station. The CSO provides the parking lot operator with an interface to monitor the charging stations, control access and set tariffs. The CSO provides the EMSP with the charging session data and the availability of charging stations. E.g.: Allego and GreenFlux
4. The *parking lot operator* is the manager of real estate where publicly accessible[15] charge points are located. The parking lot operator is tasked with choosing a location for charging stations, ensuring that the charging stations are operational, providing charging services and paying for the electricity used by all charging

11 National Charging Infrastructure Agenda, 'Monitoring Landelijk'.

12 Refer Klapwijk, Driessen-Mutters, and Müde, 'Exploring the Public Key Infrastructure for ISO 15118 in the EV Charging Ecosystem.' for details.

13 ISO Technical Committee, 'ISO 15118-1, Road vehicles - Vehicle to grid communication interface - Part 1: General information and use-case definition'.

14 The term Charge Point Operator (CPO) is commonly used in literature but is now avoided due to trademark concerns.

15 Within the scope of publicly accessible charging points, the European Alternative Fuels directive includes privately owned recharging points accessible to the public that are located on public or private properties, such as public parking lots or parking lots of supermarkets, even when the access is restricted to a general category of users such as clients. However, charge points located on private properties to which access is restricted to a limited specified set of individuals, such as parking lots in office buildings to which only employees have access are not included.

stations. For public charging in cities, the parking lot operators are often the commercial parties to whom this role has been tendered out. For example, for the city of Amsterdam, this role is currently tendered out to TotalEnergies while for the Metropolitan Region of Rotterdam and the Hague, it is currently tendered out to Equans (formerly Engie Mobility and Infra).

5. The *charging station manufacturer* is the original equipment manufacturer of the charging station hardware. E.g.: Alfen, EVBox, Ecotap.
6. The *charging station installer* is the commercial party responsible for installing and commissioning the charging station on the terrain of the parking lot operator. These are typically local companies providing various electrical services.
7. The *electricity provider* is responsible for the wholesale purchase of power for resale to customers through a contract. The electricity provider may trade electricity in markets or restructure tariffs to influence customer electricity profiles. E.g. Eneco, Vandebron, and Vattenfall.
8. The *Distribution System Operator (DSO)* is responsible for the design, maintenance, development, and operation of the distribution system that facilitates the delivery of electricity to customers. E.g.: Stedin, Liander and Enexis
9. The *meter operator* is responsible for installation, monitoring and maintenance of meters for electricity customers and disclosure of the metered values to other stakeholders. E.g.: Joulz and Fudura.

It should be noted that these roles have developed differently in different European countries. For example, in Cyprus, Greece, and Italy, DSOs have owned and developed publicly accessible charging infrastructure[16] while in the Czech Republic, charging infrastructure has been developed in competitive markets that are driven by the energy utilities (electricity providers in the model presented above). Further, existing market players often overlap in function, performing more than one of the roles described above. These roles continue to evolve as the EV charging sector develops.

Competition law and the EV charging sector: European developments

There have been several recent investigations relating to competition concerns within the EV charging sector in Europe. A few examples are listed below.

European Commission's review of the Innogy acquisition[17]:
In 2019, the European Commission expressed concern about the acquisition of certain assets belonging to Innogy[18] by the German energy company, E.ON. As part of the acquisition, E.ON was to acquire an estimated 50 million European customers, increasing its customer base by over 60%. The Commission was concerned that the acquisition would significantly reduce competition among the suppliers of fast charging stations on German motorways, a market where EON and Innogy were part of a small set of competitors. The European Commission subsequently approved the acquisition conditional on E.ON's commitment to discontinue the operation of 34 EV fast charging stations along German motorways.

UK Competition and Markets Authority investigation into The Electric Highway[19]
In July 2021, the UK Competition and Markets Authority (CMA), launched a competition law investigation into The Electric Highway, a CSO. The Electric Highway had established long-term exclusivity contracts (10-15 years) with motorway service operators Moto, RoadChef and Extra. These operators together operated around two-thirds of the service stations in the UK. As a result, The Electric Highway provided about 80% of all charge points along UK motorways. The CMA was concerned that the low competition in the sector as well as the high barrier to entry resulting from the exclusivity contracts, would lead to poorer availability of charging infrastructure for EV users along UK motorways and thus affect consumer uptake of EVs in the UK. As such it presented a threat to the UK's plans for electrifying passenger transport. Based on the investigation, Gridserve, the company that owns The Electric Highway, made legally binding commitments to reduce the duration of exclusivity in its contracts. The commitments were subsequently accepted by the CMA in March 2022.

Investigation by the German Monopolies Commission[20]
In 2021, the German Monopolies Commission[21] published the results of an investigation that identified several features of the EV charging sector in Germany that are of interest from a competition law perspective.

1. CSOs were frequently found to have more than 40% of the market share in the districts where they operated[22]. As a few CSOs controlled a significant proportion of public charge points in a given area, customers had few alternatives and providers were assumed to be in a position to raise charging prices.
2. The Tank & Rast group in Germany managed a large fraction of the country's motorway infrastructure, be-

16 The European Directive 2019/944 now prohibits DSOs from owning, developing, managing or operating charge points, except for their own use.

17 For further details, refer Cardoso and Tsoni, 'Mergers: Investigation into E.ON's Acquisition of Innogy'; Wess and Skomra, 'Eon's €43 Billion Acquisition of Innogy, Asset Swap with RWE'; Caudet and Tsoni, 'Commission Conditionally Clears E.ON's Acquisition of Innogy.'

18 The controlling stake in Innogy was owned by RWE, another German energy company.

19 For further details, refer Competition and Markets Authority, UK, 'Further Action Needed on EV Charging to Meet Net Zero'; Competition and Markets Authority, UK, 'Investigation into the Supply of Electric Vehicle Chargepoints on or near Motorways'; Competition and Markets Authority, UK, 'Final Report'; Competition and Markets Authority, UK, 'CMA Unlocks Electric Vehicle Charging Competition for Motorway Drivers'.

20 For further details, refer Monopolkommission, 'Energie 2021: Wettbewerbschancen bei Strombörsen, E-Ladesäulen und Wasserstoff nutzen'.

21 In the original German, *'Monopolkomission'*.

22 This remains true when calculated based on market share of charging points in the district or market share of charging locations in the district.

nefiting from long-term concessions awarded by the German government. Due to this dominant market position, it was in a position to demand higher lease rates for fast chargers along motorways.

3. The expected growth in the number of fast chargers along motorways meant that locations with fast charging stations were expected to expand through the installation of more fast chargers at the same location. Additional regulation was recommended to ensure that later entrants to this growing market would have equal opportunity to set up chargers at these hubs, in addition to early entrants that already had charge points at these locations.
4. Several municipalities in Germany, notably Hamburg and Berlin, took the early initiative in setting up charging infrastructure in collaboration with DSOs. This led to overlapping roles of CSOs and DSOs. After the passage of the European Directive 2019/944 into German law, DSOs were precluded from developing EV charging infrastructure. However, DSOs who had also played CSO roles had information advantages, leading to fewer competitors in these areas. This led to insufficient participation in the tendering processes which have emerged as the new *modus operandi* for the development of public EV charging infrastructure.
5. The existing contractual arrangements of EMSPs presented a barrier to the entry of new providers of ad hoc charging[23] at public locations. To enable fair competition between ad hoc charging and contractual offers from EMSPs, as well as to enable direct competition via ad hoc pricing, information about the price of charging and occupancy status was recommended to be transparently available for ad hoc charging consumers.

Similar investigations are also being carried out in Austria[24] and France[25]. Several of the concerns raised in other countries regarding fair competition in the ongoing and future development of the EV charging sector are also relevant to the Netherlands.

The profitability of public EV charging in the Netherlands

Public chargers are chargers installed on public land, typically with oversight from some level of government. The business case for public charging in cities differs from that for public charging along highways. These two are therefore treated differently. The respective business cases influence competition in the Dutch market for public charging, a market that shares many similarities with the markets in surrounding countries.

The developing business case for public slow charging

Public slow chargers are located on public land in residential areas, along public streets, in public parking lots. About 22% of charging sessions in the country (and 45% of the sessions in the G4 region[26]) are public slow charging sessions. Public slow charging tends to form a smaller fraction of total charging in rural areas than in urban ones, generally substituted by privately owned home chargers. For example in the more rural north of the country[27], only about 12% of charging occurs in public slow chargers as opposed to 22% at the national level and 45% in the G4[28]. A large fraction of the costs for public slow charging is used to find suitable locations for placing charging stations and for grid connections. The average cost to find the location for a charging station is €350, while the average cost for a grid connection is €750, in comparison with average hardware costs of €2000 per charging station[29]. Operational costs include electricity, ICT, and maintenance. Costs have decreased in recent years but may increase later due to the emergence of new standards and technologies and a reduction in subsidies.

The business case for public slow charging is uncertain and still in the development phase. The profitability related to charging infrastructure depends on several factors: the magnitude of energy charged, the number of users, the price of electricity, the use of renewable electricity, and the lifespan of the charging station (5-7 years)[30]. To promote the development of charging infrastructure and in recognition of the uncertain business case, there has been significant government intervention in the EV charging sector.

Public funding has contributed to improving the business case for public slow charging by subsidising several of the factors affecting the business case. Until 2018, municipalities partially financed charging infrastructure through the use of government grants, for which provisions were made in the Green Deal GD-185[31]. Since 2017, the electricity used for public EV charging has been taxed at a lower rate[32]. In most municipalities, infrastructure is financed with joint procurements (either as a municipal or regional concession), to lower investment risks and to develop charging in rural areas [33]

23 Ad hoc charging is defined as 'charging of an electric vehicle which does not qualify as the performance of continuing obligations between the electric vehicle user and its electricity supplier or charging point operator'. As such, ad hoc charging would enable charging sessions without a long-term contract with an EMSP or other party and would enable free charging or charging with payment on the spot via cash, card or through a web-based system.

24 Bundeswettbewerbsbehörde, 'AFCA Starts a Sector Inquiry into Electric Vehicle Charging Sector in Austria'; Bundeswettbewerbsbehörde, 'Sector Inquiry into EV Charging Infrastructure'.

25 Gauthier, 'For the First Time, the Autorité de La Concurrence Is Studying the Markets for Electric Vehicle Charging Stations'.

26 The G4 consists of the four largest metropolitan cities of the Netherlands, including Amsterdam, Rotterdam, the Hague and Utrecht.

27 Consisting of the provinces of Friesland, Groningen and Drenthe.

28 This value is calculated as the fraction of range delivered by each charging location. For details, refer Duurkoop et al., 'Laden van EV's in Nederland: Ervaringen En Meningen van EV-Rijders' and National Charging Infrastructure Agenda, 'Monitoring Landelijk'.

29 Dirks et al., 'Onderzoek Naar de Businesscase van Laadinfrastructuur'.

30 Dirks et al.

31 Netherlands Enterprise Agency, 'Rijksbijdrage laadinfrastructuur voor elektrische auto's'; Rijksoverheid, 'Green Deal - Openbaar Toegankelijke Elektrische Laadinfrastructuur'.

32 Belastingdienst, 'Tabellen tarieven milieubelastingen'.

33 For example, TotalEnergies was awarded regional concessions in the province of Friesland.

Benefits and challenges of smart charging

Smart charging involves controlling the rate of charging the EV in response to an external signal. The control of EV charging rates can enable a reduction in peak electricity demand, an increase in the use of renewable electricity, and reduce grid congestion. The use of smart charging can help to avoid or delay the grid expansion needed at certain locations for public slow charging which can be very expensive.

> The support for smart charging is increasing because it can help avoid blackouts and expensive grid expansions

Several Dutch pilot projects have illustrated the benefits of smart charging at home[34] as well as for public slow charging[35]. As EV adoption progresses, the use of smart charging is widely seen as necessary for ensuring access to charging in the future and is expected to become the Dutch norm after 2025[36]. The support for smart charging is increasing because it can help avoid the high societal costs associated with the electricity grid: these societal costs may be either in financial terms caused by expensive grid expansion or through the poorer quality of electricity supply, with increasing frequencies of events like blackouts. In a recent study, Dutch decision-makers were found to consistently value smart charging above other charging techniques[37].

With home charging, consumers control the smart charging process. The financial benefits, such as overnight electricity tariffs, are therefore easily recognised. A governmental survey conducted in 2021, reveals that 41% of respondents who charge at home have access to smart charging, while 21% were connected to a smart energy management system[38]. Public smart charging is more complicated, for several reasons: charging speeds vary with smart charging, which affects the social acceptance and therefore, the utilisation of smart chargers. The goal of using renewable energy in charging can conflict with the goal of increasing available grid capacity. Besides, the lack of agreements between CSOs and DSOs makes flexible pricing more complicated, which prevents the charging market from evolving into a capacity market.

Stakeholders have been exploring solutions to further enable public smart charging. ElaadNL, the knowledge and innovation centre for smart charging infrastructure in the Netherlands, reports that network operators need to improve their tariff structure for a more flexible energy market, and that compensation for risk-taking market parties could be considered to improve the business case for public smart charging[39].

The Dutch National Charging Infrastructure Agenda[40] suggests that the availability of transparent, up-to-date information would provide a stimulus for the smart charging market as well as for the consumer to adopt it[41]. It also suggests a fair way of valuing smart charging through agreements and improving third-party access, though specific solutions are yet to be determined. Stedin, a Dutch DSO, is exploring the possibility of flexible contracts with CSOs to enable smart charging during peak hours in neighbourhoods with low grid capacities[42].

High costs of public fast charging along highways

Fast charging infrastructure forms a specialised segment of public charging. Fast chargers are mainly located along highways, where EVs need to charge quickly. Since the land alongside highways is state-owned and regulated, fast chargers are almost entirely public. Similar to slow chargers, the business case for fast charging is also uncertain and still developing.

The business case for fast charging is affected by the higher costs of grid connections and the high costs of the fast charging points. Due to these factors, the electricity tariffs that vehicle users pay for fast charging are higher than those paid for slow charging. Despite the high tariffs which customers seem willing to pay, the fast charging market faces challenges in terms of profitability. As an example, Fastned, a large European market player in highway fast charging that was founded in 2012, expects to be profitable only in 2023[43].

Competition in public charging in the Netherlands

Slow charging in the built environment

In the Netherlands, municipalities are typically the organisations responsible for the facilitation of commercial participation in the development of public slow charging infrastructure within their administrative zones. Municipalities generally work with one of three organisational models[44]:

1. *Exclusive concessions model:* A single party is awarded the rights to install and exploit charging infrastructure in a specific area for a fixed duration of time, to the exclusion of other parties.
2. *Commission model:* The municipality or a third party appointed on its behalf commissions charging infrastructure and allocates, finances, and carries the investment risk.

34 Enexis, 'Slim laden van elektrische auto's ontlast elektriciteitsnet met 40%'.
35 Wolbertus, 'Eerste resultaten Flexpower3'.
36 Heijnen, 'Regionale Uitrol Laadinfrastructuur', June 15, 2022.
37 Van der Koogh et al, 'Stakeholder Prioritizations for Electric Vehicle Charging across Time Periods'.
38 Duurkoop et al., 'Laden van EV's in Nederland: Ervaringen En Meningen van EV-Rijders'.
39 Ten Have, Hendriks, and Idema, 'Verkenning Organisatie Slim Laden - Voorstel Thema's Voor Ontwikkeling'.
40 In the original Dutch, Nationale Agenda Laadinfrastructuur (NAL).
41 National Charging Infrastructure Agenda, 'Basis gelegd voor opschaling slim laden'.
42 Stedin, 'Houd de Energietransitie Betaalbaar - Maak Slim Laden de Norm'.
43 Fastned b.V., 'Charging Day 2022'.
44 Netherlands Knowledge Platform for Charging Infrastructure, 'Handleiding Contracteren Laadinfrastructuur'.

3. *Open market model:* All market parties can apply for a permit to place charging stations. Sometimes these charging stations are requested directly by citizens

The choice of a particular model by individual municipalities is linked to factors such as EV adoption levels, the number of inhabitants with private (home) chargers as well as the expected revenue through public charging in that location.

In the Netherlands, it is common for municipalities to award exclusive contracts for public EV charging infrastructure

It is common for municipalities to award exclusive concessions for public EV charging infrastructure. These exclusive concessions are attractive because the investment risk for the commercial party is lower. Some municipalities combine their market inquiries, benefiting municipalities with less expertise in charging infrastructure. Regional level concessions are also sometimes awarded to enable larger areas to be covered more efficiently by the charging network[45]. This also prevents double investments in the same infrastructure by both the municipality and the regional government.
Within the exclusive concession structure, there are several concerns: the demand is usually too high for a single market player to meet, leading to unmet demand. To acquire strategic locations, market players sometimes offer extremely low pricing, leading to a poor business case[46]. Market players also complain that tenders are too focused on a static low price[47] and do not reflect the real cost of charging at different locations. This real cost is influenced by the DSO, and flexible pricing has potential benefits for the market as well as the consumers.
In comparison to exclusive concessions, the open market model shows several benefits. The increase in competition enables competitive pricing and increases the choices available to consumers who wish to charge their EVs. It also reduces the risk of technology or contractual lock-in, particularly if the hardware is interoperable. Further, if a single party is unable to deliver infrastructure, other parties can be contracted to meet the demand. Some drawbacks of the open market model for municipalities include lower control over the development: lower control over prices, roll-out strategies and roll-out deadlines. Due to allocation and traffic decisions, the awarding of permits may also be slower.
Municipalities also commission charging infrastructure within their administrative zones. This model is typically used when they need to develop infrastructure without an attractive business case for CSOs. This allows them to set electricity prices and protocols (e.g., smart charging), and enables EV users to charge publicly in rural areas where charging infrastructure is not profitable.

Fast charging along highways
In contrast with slow charging in the built environment, fast charging along highways is organised through the awarding of permits by the Ministry of Infrastructure and Water Management. The ministry awards two types of permits that enable an awardee to install fast charging infrastructure[48]:

1. Primary facility permit: A single primary facility permit is awarded per rest area along the highway for facilities like a fuel station, a restaurant or a fast charging station.
2. Additional facility permit: These are given to existing establishments with a primary facility permit for extra facilities at the location, such as fast charging or food and beverage sales.

In the rollout of fast charging infrastructure along highways, both commercial organisations (such as Shell, BP, Tamoil and NRG Value) and restaurants had an advantage since they were already in possession of a primary facility permit for each of their facilities: fuel stations and restaurants. They were able to install fast charging stations using additional facilities permits for fast charging, which were less exclusive and came with longer terms than primary permits for fast charging.
At these fuel stations and restaurants, fast chargers were considered more attractive by consumers in comparison with locations with a primary permit for fast charging. This was because these locations provided other services, such as toilets and shops, which were available for EV users during the half-hour wait for charging.
To make locations with only a primary facility permit for fast charging equally attractive for consumers, a court decision enabled parties with a primary facility permit for fast charging to apply for additional facility permits. As such, they are now allowed to compete for infrastructure expansions and sale of other services like food and beverages at the same location[49].

Due to exclusive contracts for fast chargers on highways, other parties were locked out, resulting in a lack of charging infrastructure

45 Netherlands Knowledge Platform for Charging Infrastructure, 'Wat zijn de voordelen van een gezamenlijke aanbesteding laadinfrastructuur?'
46 ParknCharge, 'Regionale concessies voor laadinfrastructuur moeten van de agenda'.
47 Dutch Organisation for Electric Transport, 'Brandbrief aanbesteding publieke laadinfrastructuur'.
48 For further details on fast charging permits, see Van Asperen, 'Snellaadpunten voor elektrische auto's langs de Nederlandse snelwegen'.
49 For further details, see ECLI:NL:RVS:2018:2996, Raad van State, 201800298/1/A1; ECLI:NL:RVS:2020:2607, Raad van State, 201907833/1/R1; ECLI:NL:RVS:2021:1837, Raad van State, 202002478/1/R1, 202002480/1/R1, 202002481/1/R1, 202002483/1/R1, 202002484/1/R1, 202002485/1/R1, 202002487/1/R1, 202002488/1/R1; Fastned b.V., 'Rechter oordeelt dat Fastned shops en toiletten mag realiseren bij haar stations'.

Due to the structure of this licensing scheme, there have been other challenges to the deployment of fast charging facilities at highway rest areas[50]. Fast charging infrastructure developers were awarded primary facility permits, conditional upon the deployment of the station within 1.5 years. However, these parties sometimes failed to meet their deadlines. Due to the exclusive nature of the awarded license, other parties were locked out from the rest areas where the permit was granted, resulting in a lack of charging infrastructure.
On consultation, primary facility license holders at rest areas complained about the restrictions of additional facility permits: they were bound to their location boundaries. Both primary and additional facility license holders also described the high costs of grid connections being a challenge: the return of investment was not guaranteed within the permit duration.

Parallels between the Netherlands and other European markets
There are several parallels between the public EV charging markets in the Netherlands and those in neighbouring European countries. These parallels exist in both slow as well as fast charging.
Similar to the case in Germany, exclusive concessions for public slow charging are commonly awarded by local authorities. This leads to CSOs having a high market share in the areas where they receive these concessions. Although the concessions are only for the development of public charging infrastructure, the strong local presence of CSOs is also likely to dissuade competitors in the private charging sector.
As in both the German and UK cases, governmental concessions are awarded for facilities along motorways. However, the Netherlands seems to have more market players. In addition to fast charging services as an additional service at fuelling stations, exclusive fast charging services and fast charging at restaurants have both emerged as competitors. The total market share for fast charging along highways is thus broadly divided among these three categories. However, there are still barriers for entry for late entrants to this market. Exclusive contracts at specific locations tend to prevent new players from installing charge points at locations with existing grid connections.
Transparent data on charging at various locations, to enable competitiveness of ad hoc charging, is also being made available[51], similar to developments in other parts of Europe[52].

Conclusions and Recommendations

Several challenges to fair competition are emerging in the EV charging sector in the Netherlands, leading to concerns similar to those in neighbouring European countries. The following key issues were identified.

Public slow charging in the built environment
A key challenge for equal access to EV charging is the geographical disparity in available charging infrastructure. There is also a disparity in the use of this infrastructure and the organisation of public charging markets. In the G4, about 45% of charging occurs via public slow charging, while in the northern provinces, this fraction drops to 12%. For urban areas, open markets in which multiple commercial parties respond to customer demands are found to result in accessible charging at competitive prices for customers. However, for areas where the grid is weaker and EV adoption is low, the challenging business case for charging infrastructure results in poor market interest and participation. Alternative models may be needed at these locations. To encourage market participation, local governments may need to commission charging infrastructure or provide concessions for commercial parties.
Exclusive concessions, which are commonly used throughout the country, have several challenges. Among these are the lack of infrastructure upon non-compliance with deadlines, risks of technology and vendor lock-in at the end of the concession period, price gouging due to lack of competitors and regional monopolies. For locations with few competitors, there are some parallels with the Dutch district heating sector where customers also have limited options in choosing their suppliers[53]. Steps taken to protect these customers can also be taken in the EV charging sector[54]. These steps include providing guidelines about costs, service guarantees, equal access to subsidies and fair consideration of alternatives.
Our recommendations for a fair public charging market are:

1. Reduce long-term area exclusivity to lower the barrier to entry for competitors
2. Ensure access to EV charging in rural areas where either low grid capacity or low utilisation of charge points lead to weaker business cases and correspondingly low market participation.

50 Van Kerkhof and van Zante, 'Laadinfrastructuur Op Verzorgingsplaatsen'.
51 Ministry for Infrastructure and Water Management, 'Meer Zekerheid over Opladen Elektrische Auto'.
52 additional recommendations in Hoen et al., 'Onderzoek & Implementatieplan Prijstransparantie' and benchmarks Netherlands Knowledge Platform for Charging Infrastructure, 'Benchmark Prijstransparantie: Onderzoeksmethode'.
53 In the transition from gas supply to district heating, consumers cannot choose suppliers on an individual level. This makes them sensitive to steep price increases, as with the cost of gas in 2022. In 2023, the Dutch Heat Law is expected to be adjusted to decouple heating prices from gas prices, to protect customers who are connected to district heating systems (who have no easy access to alternatives) from higher premiums. The Dutch Authority for Consumers and Markets (ACM) updated guidelines to protect these consumer, capping maximum price increases to 67%.
54 Autoriteit Consumenten en Markt, 'Waarborgen Voor Consumenten in de Wijkgerichte Aanpak'.

3. Provide guidelines to protect consumer interests in areas with low competition such as price ceilings, access to customer service and minimum expected maintenance.
4. Ensure fair access and pricing for charging outside the EMSP contracts both locally as well as at the European level.

Smart Charging

The Dutch DSOs are not able to expand the grid fast enough for charging at a large scale. This is due to a large number of requests for new grid connections, a widespread shortage of technical personnel[55] and supply chain challenges. Furthermore, the time required for installing grid infrastructure compliant with regulations, including land acquisition, local governmental permissions and technical commissioning, is also lengthy. As an example, the installation of a new high voltage transformer station in Beverwijk to accommodate higher power will take at least another three years to install[56].

According to ElaadNL, the grid of over 3,000 neighbourhoods will be overloaded by 2025[57]. Smart charging presents a more affordable alternative. Rural areas and distributed populations are typically connected to the grid with lower diameter cables to reduce the cost of connecting customers over long distances. These thinner cables conduct less power. Due to the long distances involved, they are also very expensive to replace. Smart charging may be the only economically and logistically feasible choice for developing sufficient charging infrastructure within a reasonable timeframe in these areas.

However, there are several challenges to smart charging. The business case for smart charging is still under development. Some of the locations in which smart charging has the most value are where the business case for EV charging is poor: rural areas with distributed populations have a higher percentage of home charging. Smart charging is also an example of misaligned incentives: the benefits are societal but risks and uncertainty in profitability make it less attractive for CSOs. Smart charging and its further contribution to the future development of charging infrastructure are actively being included in national-level policy[58].

Our recommendations to further develop smart charging are:

1. Facilitate flexibility agreements between DSOs and CSOs, using the avoided costs of grid expansions to determine the value of flexibility.
2. Provide governmental funding to enable smart charging in lower grid capacity areas as a way to address the geographical disparity in charging infrastructure and ensure equal access to charging.
3. Make the scarcity of grid capacity explicit in the price paid for charging by consumers at public slow charging stations by:
   - Transitioning from static prices to variable pricing which reflect the time-variant scarcity in grid capacity.
   - Adding smart charging requirements for neighbourhoods with low grid capacity.

Fast charging on highways

Fast charging along highways is distinct from other public charging in terms of the hardware, the locations and the market structure. An important prerequisite for participation in this market is the possession of a license from the Dutch Ministry for Infrastructure and Water Management. Several legal cases have already led to the opening up of the market, whose participants include fuelling companies and restaurants that offer fast charging in addition to dedicated fast charging service providers.

Our recommendations for fast charging on highways are:

1. Enable the take-over of grid connections by new market players for a fee based on permit terms and depreciation.
2. Enable the take-over of charging infrastructure by new market players for a fee based on permit terms and depreciation.
3. Ensure compliance with interoperable standards for installed infrastructure to make these take-overs possible and to avoid technology lock-in, vendor lock-in and lower switching costs.
4. Reduce the duration of exclusivity contracts.[59]
5. In case of low availability of infrastructure:

- Allow allocation outside the permit holders' location boundaries.
- Enforce roll-out deadlines.[60]

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55 Liander, 'Levertijden En Energienet Onder Druk'.
56 TenneT TSO, 'Nieuw Schakelstation in Beverwijk'.
57 BNR, 'Geen plek voor nieuwe laadpalen door overvol stroomnet'.
58 For further details on smart charging, see National Charging Infrastructure Agenda, 'Basis gelegd voor opschaling slim laden'; Stedin, 'Houd de Energietransitie Betaalbaar - Maak Slim Laden de Norm'; ten Have, Hendriks, and Idema, 'Verkenning Organisatie Slim Laden - Voorstel Thema's Voor Ontwikkeling'.
59 The duration of exclusivity contracts for tank stations is traditionally long or indefinite, whereas primary facility permits for highway charging are typically only 15 years. Additionally, the implementation of take-over costs (see recommendations 1 and 2) makes market players less dependent on long-term contracts to ensure a return on investment.
60 Van Kerkhof and Van Zante, 'Laadinfrastructuur Op Verzorgingsplaatsen'.