Vision document / Position paper
Open Market & Open Protocols

NAL Working Group Open Market & Open Protocols

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Michel Bayings, Emobility Consulting Kor Meelker, KMmanagement	0.1	April 2021	Initial structure, for discussion in NAL Open Market & Open Protocols core team
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1. Introduction & objective

The Netherlands is facing a major challenge in its mobility transition, due to a reduction target in the Climate Agreement of 7.3 megatonnes of CO2 by 2030. Based on this target, the coalition agreement contains an ambition for all new cars sold to be zero emission vehicles by 2030.

The National Charging Infrastructure Agenda (NAL) is part of the Climate Agreement. The purpose of the NAL is to ensure that charging infrastructure does not constitute a barrier to the rollout of electric transport. To this end, the NAL envisions 1.8 million charging stations in the Netherlands by 2030. Preconditions for achieving this goal are shortening lead times and strategic placement of charging infrastructure before demand arises. A number of other elements will also be required at a national level, such as accessible information about the location and availability of charging stations, charging tariffs and future-proof charging infrastructure. This applies to all types of chargers: AC, DC, HPCs (high power chargers), and all types of sites: public, semi-public and private, and for both passenger and commercial transport.

In this vision document/position paper, we indicate how we in the Netherlands view an open market for EV charging infrastructure, which is accessible for EV drivers and other stakeholders in the value chain.

The document seeks to interpret the characteristics of the open market as the Netherlands envisions it, at this moment and over the next five years. It is therefore a guiding document for the design of the market for charging infrastructure and the route to market maturity. It can also serve as inspiration for other countries: “That’s how the Netherlands does it”.

This vision document/position paper addresses the following topics:

- The challenges of sustainable transport, with a focus on charging infrastructure;
- The definition of open markets and open protocols;
- An overview of the protocols and standards in use in the Netherlands;
- The organisation of the open market in the Netherlands:
    - The organisations involved (NKL, ElaadNL, DOET, eViolin, FET, etc.)
    - International collaboration
- Vision/position with regard to market development for the coming years and the development of an open market with the associated protocols and standards.

Alongside this vision document/position paper, a document entitled “A Guide to the Open Market & Open Protocols in Contracting” is available (only in Dutch). It describes in more detail how you can incorporate the components of an open market and open protocols in propositions and tenders.

2. Target audience & scope

The target audience for this document is everyone in the Netherlands or abroad who wants to understand why good charging infrastructure is necessary to achieve the ambitions of electric transport and how the Netherlands is tackling this challenge, now and in the future.

This is how we want to position the Netherlands, while presenting a vision of how we see the future.

We focus in particular on the challenges in the field of charging infrastructure in all its forms:

- Public, semi-public and private
- AC, DC, HPC (High Performance Charging)
- For private and commercial transport
- For passenger cars, delivery vans, buses and trucks

An open market using open protocols/standards is the leading theme of this document.

3. The challenges of sustainable transport

The EV market is dynamic and constantly changing. Developments are emerging at a rapid pace. Charging stations and electric cars are developing quickly. Until fairly recently, there was a limited range of affordable electric cars, with limited battery capacity. The same applied to the development of charging infrastructure. The introduction of 50 kW rapid chargers was a big leap forward for drivers of electric vehicles (EVs). Today, developments have reached the point where consumers and commercial drivers can choose from a wide variety of electric cars, which often have a range of 350 km or more, and 350 kW chargers are available, making it increasingly easy to travel with an EV.

These developments in technologies and the market are time-consuming and expensive and can only be realised if there is intensive cooperation between market operators, public authorities and knowledge institutions. The ecosystem of the EV market has many different aspects that must all be accounted for. These aspects are controlled by different parties, each focusing on a part of the market, who make agreements with each other to connect everything using open protocols (standards, interfaces). In 2009/2010, when the Netherlands began to set up charging infrastructure – driven by the Elaad Foundation and the Formula E Team (FET) – there were many small operators, a limited budget and a limited number of experts, which meant that everyone, even competitors, depended on each other in order to develop the entire EV chain. This happened in an open and transparent manner. Many of these collaborations have led to open protocols such as OCPP and OCPI. Because of the open market, new players can easily enter the market and see whether their innovation can add value.

OCPP and OCPI are good examples of open protocols that were developed by the open market. Many market players collectively contributed their expertise to develop these standards.

It is partly for this reason that the Netherlands has become a global leader in the area of charging infrastructure. Approximately 25% of all charging stations in Europe are located in the Netherlands. [1]

The population of EV drivers is growing and changing. The first people to drive EVs were pioneers, who understood and accepted the limitations. Now we are dealing with “regular” drivers, who expect that driving an EV will be just as easy as driving a petrol car.

4. Definition of open markets and open protocols

To help explain the Dutch success and the Dutch system of an open market and open protocols, we use the following definitions:

Definition of open

Nearly all protocols use the term 'open'. In the context of protocols for EVs, this term may refer to open access to charging infrastructure, but it can also mean that the protocol is an open standard. What makes a standard 'open', in the area of standardisation, is the subject of ongoing debate. In response to this debate about open standards, the Technical Barriers to Trade (TBT) Committee of the World Trade Organisation (WTO) formulated the following six conditions for international standardisation processes [2] [3]:

(1) **Transparency**: With regard to documentation on proposed and final standards;
(2) **Openness**: Open membership at every stage of the standardisation process;
(3) **Impartiality** and **consensus**: No preferential treatment of or advocacy for certain parties;
(4) **Effectiveness** and **relevance**: Facilitating international trade;
(5) **Coherence**: No duplication of or overlapping with work by other standardisation bodies;
(6) **Development dimension**: No 'de facto' exclusion from the process for any party.

In the Netherlands, we go a step further in our definition of 'open' by adding 'licence free and royalty free'. OCPP and OCPI protocols are freely available without restrictions, and no conditions (such as licence fees) are attached to their use. This is in contrast with ISO and IEC standards, where you have to pay for the standards, and where the standards were developed under F/RAND [4] conditions.

Open Market

An open and competitive market, where interoperability, market access, access to each other's networks and the application of widely supported, neutral and open (patent free) protocols are the standard in the tendering, building and operation of charging infrastructure.

Open Protocols

An open protocol is a standard that is publicly available and to which various rights of use are connected. The term is primarily used in relation to hardware and software because that is an area in which closed standards are usually used, where you have to apply for a licence to access the specifications.

The aim of open standards is to increase the interoperability (and interchangeability) between different information systems or data collections and to record information in a future-proof format. A side effect of open standards is more freedom of choice and therefore less chance of 'vendor lock-in' (dependency on certain suppliers).

Open protocols are a result of the phenomenon of 'released specifications'. However, it is not the manufacturer that determines whether a protocol is also a standard. The authorities that can do that are the generally recognised standardisation bodies and the market. In the former case, we talk about 'de jure' standards ('by law') and in the latter case about 'de facto' standards (which have become more or less standard due to widespread use). Most 'de facto' standards are later codified as 'de jure' standards.

Overview

This diagram provides an overview of how the Netherlands looks at the market and how and where various protocols are situated.

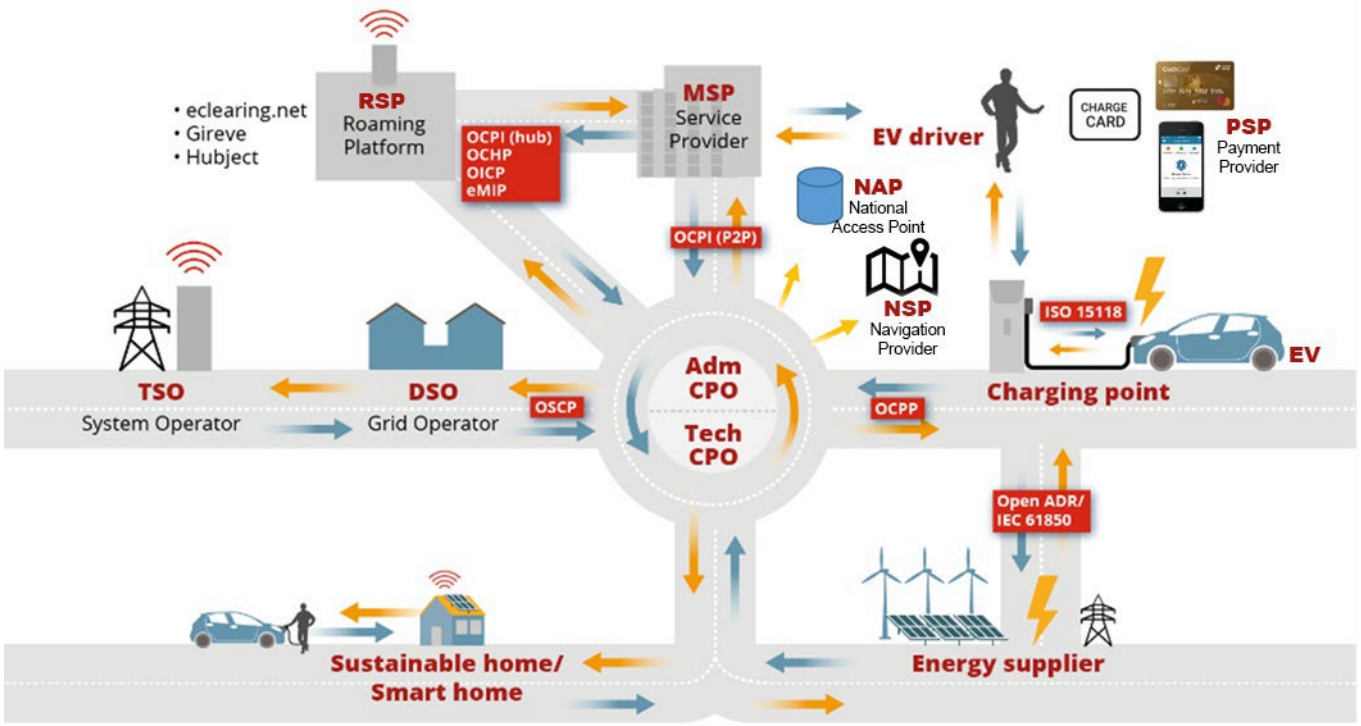

Figure 1: Overview of an open market with open protocols

5. Overview of protocols and standards in use in the Netherlands

OCPP – Between the charging station and the charging station management system

OCPP (Open Charge Point Protocol) was developed to make it possible to connect different types/brands of charging stations to a single charging station management system (CSMS) and vice versa, i.e. to connect a single type/brand of charging station to a range of charging station management systems.

OCPP supports the management of charging stations and the handling of charging transactions, including the identification and authorisation of the EV driver. In addition, the protocol can be used to control charging stations for smart charging.

OCPP is used by the Charging Station Operator (CSO) to communicate with the charging stations it manages through its Charging Station Management System (CSMS). OCPP has developed into the international 'de facto' standard for managing charging stations and is used by many CPOs.

OCPP is managed by the Open Charge Alliance. [5]

There are currently two versions of OCPP in use:

OCPP v. 1.6	At the moment, this is the most commonly used version of the protocol.
OCPP v.2.0.1.	This is the latest version of the protocol. Many 'lessons learned' were taken into account in developing this version. The protocol is working from usage scenarios to illustrate the ways in which charging stations are managed. Furthermore, data security has been significantly improved and a lot of attention has been given to remote management of charging stations via the device model and to the support for V2G and ISO 15118.

A charging station with v. 1.6 can function adequately, but in the future the charging station will need to support v. 2.0.1 due to developments in the market requiring new functionalities that are not present in version 1.6, such as V2G, ISO 15118, extra security and better charging station monitoring and management. If V2G support is desired immediately, it is only possible with v. 2.0.1.

ISO 15118 – Between the car and the charging station

This protocol was developed mainly by the German car industry, and has two important goals:

1) A user-friendly mechanism for authentication, authorisation and payment at the charging station without further user interaction, known as Plug and Charge (PnC).
2) Integration of the EV into the Smart Grid to enable flexible energy transfer (V2G) and thereby deliver added value for the grid without compromising the EV or its driver.

To implement ISO 15118 [6], both the software and the hardware of the charging station have to be adapted compared to the current mode of operation with a card or direct payment. At present, only a limited number of cars support this standard; likewise, only a limited number of charging station suppliers and charging station operators support it.

ISO 15118 works with a new approach to authentication, authorisation and transaction processing. This is done via

Public Key Infrastructure (PKI). PKI is a set of roles, rules and procedures needed to work with digital certificates and encryption. This system has two major risks:

- Consumer lock-in: Consumers can only use charging stations or a contract with an MSP if they are connected to the PKI chosen by the car manufacturer.
- Competitor lock-out: PKI management organisations have the option to exclude parties from their PKI system or only admit them on unfavourable terms.

To set up a fair, reasonable and non-discriminatory PKI, additional effort is needed from regulators (at the national, EU and global level), the EV market (car manufacturers, CSOs and MSPs) and the energy industry (grid operators, energy suppliers and balance responsible parties). In the Netherlands, the government has joined forces with businesses, and organisations such as the ACM are also involved.

It is currently uncertain whether ISO 15118 will be adopted by the market, and how quickly that could happen. However, many Dutch charging station manufacturers and CSOs are already taking this development into account, and some are directly involved.

OCPI – Between the charging station operator and the mobility service provider

The OCPI (Open Charge Point Interface) protocol is used to exchange information between the charging station operator (CSO) and the mobility service provider (MSP), but also with other market operators who require EV information. The OCPI protocol is used to set up a direct connection between two parties (a peer-to-peer connection) or to communicate with a number of roaming service providers such as Gireve [7] and eClearing [8].

The OCPI protocol supports the exchange of information on locations, tariffs, authorisations and charging transactions. It also supports smart charging through the management of charging profiles. In the Netherlands, OCPI is the standard protocol for communication between CPOs and MSPs. Internationally, it is increasingly becoming the ‘de facto’ standard for exchanging information between parties in the EV market.

There are currently two versions of OCPI in use:

OCPI v. 2.1.1	This version of the protocol has been implemented by the majority of operators and provides good support for the exchange of information.
OCPI v. 2.2.	This version features a number of improvements compared with version 2.1.1., including better support for tariffs, transaction data and smart charging. All Dutch operators have pledged to implement v. 2.2. this year.

OCPI is managed by the EVRoaming Foundation [9].

Using OCPI can reduce costs, because only one type of connection has to be made between the CPO and the MSP. Because many operators have already implemented OCPI, it is relatively easy for others to activate it. Furthermore, OCPI offers opportunities to be informed about charging stations and their availability, and about charging transactions. OCPI also makes it possible to provide information to EV drivers in accordance with laws and regulations.

In the Netherlands, all CPOs and MSPs have implemented this OCPI protocol, and the number of international users is also growing quickly.

OSCP – Between the charging station operating environment and the grid operator

OSCP (Open Smart Charging Protocol) is used between the charging station operator (CPO) and the grid operator (DSO, distribution system operator). This protocol provides many opportunities to make optimal use of the availability of flexible power. It enables interactive communication between operators to ensure optimal alignment of power needs and availability. OSCP is increasingly being used, although not all operators have implemented it yet. However, in the context of smart charging it is recommended that it be incorporated. The current version is OSCP 2.0.

For major projects where smart charging has to be applied on a large scale and interaction with other parties such as energy suppliers and grid operators is extremely important, OSCP offers significant benefits and is increasingly included as a requirement. In situations where only the distribution of available energy (load balancing) is required, OSCP is less relevant.

OSCP is managed by the Open Charge Alliance [10], and descriptions with use cases can be downloaded from their website.

OpenADR – Between the charging station operating environment and the DSO

OpenADR [11] is an open, secure, two-way model for information exchange and a global Smart Grid standard. OpenADR standardises the message format used for Auto DR and DER (distributed energy resources) management, so that dynamic price and reliability signals can be exchanged in a uniform and interoperable way between utility companies, ISOs and energy management and control systems. There will be an investigation of whether these protocols can also be applied to controlling charging infrastructure in the context of smart charging.

Agreements regarding protocol updates

Updates to protocols are regularly released. Some of these updates are minor, some are major. All updates require effort to implement, and sometimes operators depend on other operators to implement the update to ensure all systems in the chain continue to work. This means it can take a long time for systems to be updated.

When can systems be expected to update their protocols? In the past, there was a standard requirement that every update had to be implemented within a year of release, but this did not always happen in practice. That is why new agreements have been made, taking into account whether they are large or small releases, and the update period can be up to two years.

Protocol developments

In 2018, the European Commission submitted a request to the European standardisation organisation CEN-CENELEC to develop ‘de jure’ protocols for alternative fuel infrastructure, including the technical specifications for interoperability for supplying electricity to EVs. The protocols being developed in response to that request are:

IEC 63110	This is a protocol for managing EV charging infrastructure and charging transactions, including energy management and V2G support. The protocol is under active development, and initial publication is expected in 2024. It is possible that OCPP will

eventually be merged with this standard. Until then, OCPP will continue to be developed.

IEC 63119	This is a protocol for the exchange of information between EV operators to support roaming services. The protocol is under active development, and initial publication is expected in 2023. OCPI could eventually be merged with this standard. Until then, OCPI will continue to be developed.
IEC 63382	This is a protocol for the management of distributed energy storage based on EVs. It primarily concerns support for V2G and smart charging. Development of this protocol will begin shortly.

It is possible that these 'de jure' protocols will replace the 'de facto' protocols in the market when they are published. Given the slow adoption of updates to the existing 'de facto' protocols, this will take some time, and it remains to be seen whether it will be successful. The determining factors will include what kind of connection there is with the 'de facto' standards, and how difficult and expensive it will be to replace them with the 'de jure' protocols. We do not expect the 'de facto' protocols to be replaced with the 'de jure' protocols before 2025, given that publication of the first 'de jure' protocol is only scheduled for 2024.

In early 2021, the European Commission included both OCPP and OCPI in its recommendations for 'Public authorities on recharging infrastructure' [12], and also referred to California, where OCPI is included as a requirement in the rules for charging infrastructure.

However, the European Commission recently avoided direct references to the 'de facto' protocols that are now used worldwide, because they prefer to refer to official European and international standardisation bodies. This is being actively brought to the attention of the European Commission and other stakeholders by the Netherlands, in collaboration with various international operators and organisations, to obtain an accurate picture of developments in the market.

6. Organisation of the open market in the Netherlands

In September 2021, the Netherlands had around 78,000 public and semi-public AC (ordinary) charging stations and more than 2,500 rapid charging stations [13].

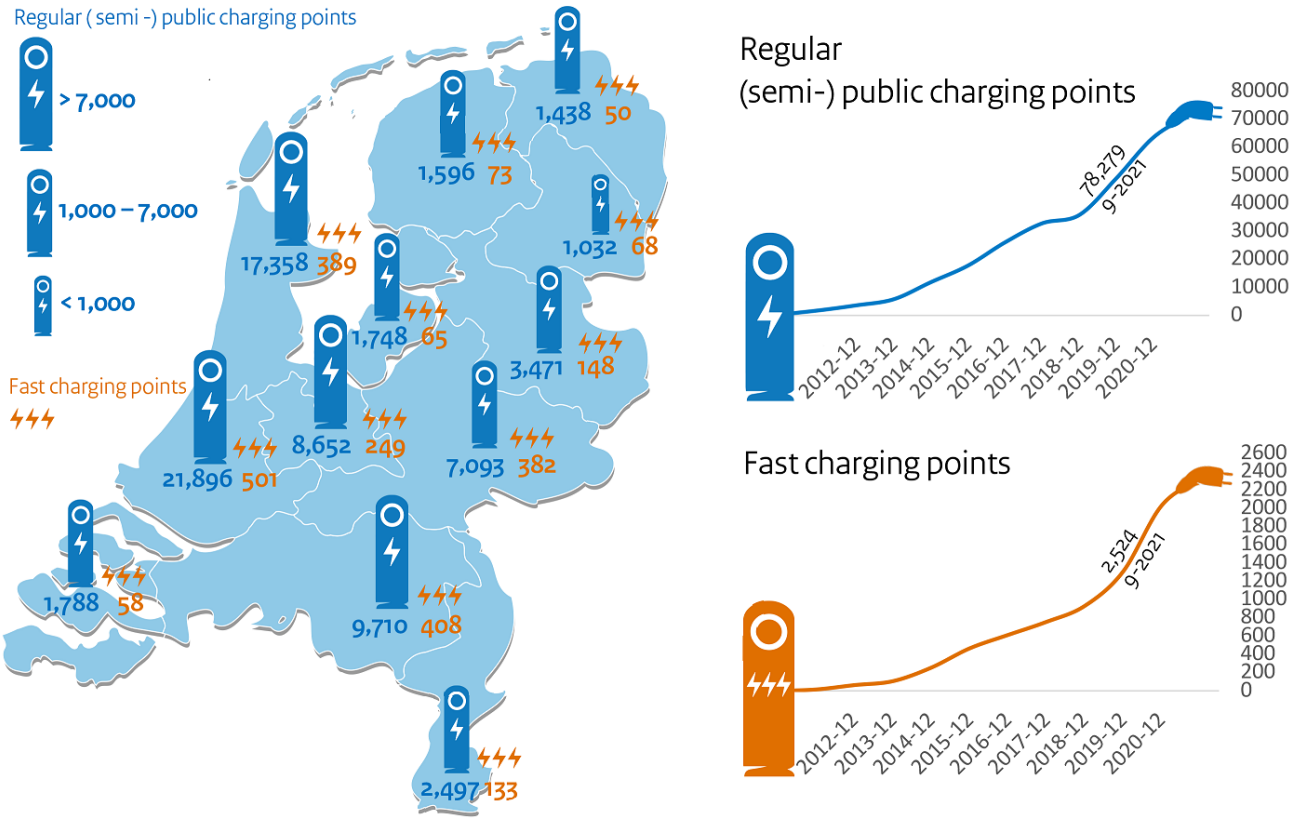

Figure 2: overview charging stations in the Netherlands - Sept. 2021

These charging stations are managed by approximately 25 charging station operators (CSOs) [14] and are accessible for EV drivers who use a charging card from one of the 74 different mobility service providers (MSPs), or via direct access [15]. More than 26% of all charging infrastructure in Europe is located in the Netherlands, making the Netherlands a global leader in charging station density.

The Netherlands owes its leading position and large quantity of charging stations to an open market which is based on four key, interrelated factors:

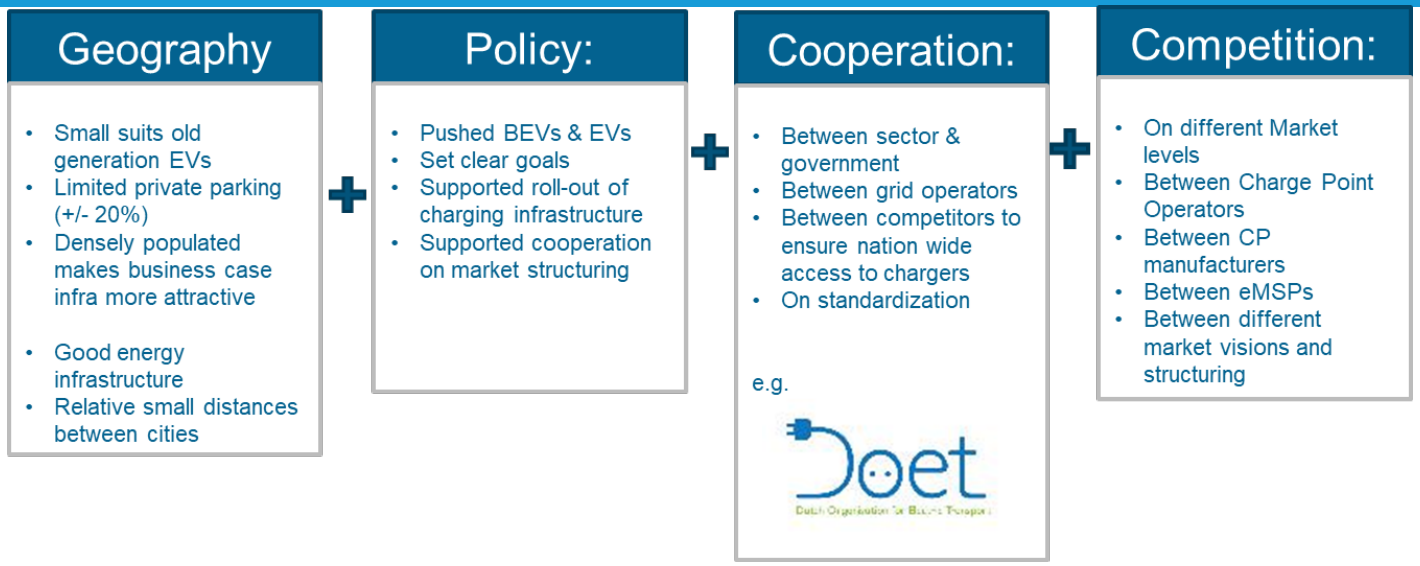

Figure 3: Open market collaboration in the Netherlands (source: DOET)

All of these factors have resulted in an open market, with close collaboration, but also room for competition. Not only is this in the interest of tendering organisations, it is also of particular benefit to EV drivers.

The above factors are being supported by various organisations with roots in the Netherlands, which are active at a national and international level in promoting an open, accessible charging infrastructure market. Many of these organisations have been involved since the initial emergence of electric transport and have therefore developed a substantial amount of knowledge.

These organisations can be divided into:

- Inter-institutional: National and international partnerships in which various organisations are represented
- Sector: Associations and organisations that represent a specific sector or group of businesses in the market
- Technical: Organisations that primarily focus on the development of certain standards and technologies used in the market.

The main examples of each of these types of organisations are shown below.

Figure 4: Open market organisations in the Netherlands

Dutch success in the area of electric transport and charging infrastructure can be attributed to the synergy between the government, supporting organisations and market operators. There has also been good collaboration with the Electric Vehicle Drivers Association (VER). Together, they have achieved more than they ever could separately.

7. Vision

The Netherlands will continue promoting electric transport at the national and international level. Charging infrastructure is a crucial prerequisite [16]. The aim for 2025 is for 50% of all new vehicles sold to be at least partially electric and for 15% to be fully electric. By 2030, ALL newly sold vehicles should be emissions-free. Taking this into account, charging infrastructure is also faced with a significant task. Ultimately, over the next nine years, more than 1.5 million charging stations must be installed [17], which translates to 644 per day! An enormous challenge.

The National Charging Infrastructure Agenda (NAL) is part of the Climate Agreement. The aim of the NAL is to ensure that charging infrastructure does not form a barrier to the rollout of electric transport. Stakeholder representatives, including the operators listed in Chapter 6, participate in the NAL and work together to achieve this goal.

What does this mean for the open market, and what developments will we see in the area of open protocols?

Future of the open market

We have observed a number of developments:

- The market is becoming more international.
- While new operators are still entering the market, consolidation is also taking place, with parties merging or being acquired.
- In recent years, the European Commission has become much more active in terms of regulation and guidance, which has had an effect on new legislation at a national level.
- New international organisations are emerging, which often focus on either policy or standardisation, with operators choosing what to participate in. This development will continue.

For the Netherlands, this may mean that the various supporting organisations will collaborate more and explicitly seek connections with other countries and with other organisations that are active at the international level.

The Netherlands will also continue to be pragmatic, tackling developments together with the market and not unilaterally imposing them from above. This is, and will continue to be, the strength of the Dutch approach.

In this way, the Netherlands will continue to be able to participate in an Open Market at the forefront of electric transport and charging infrastructure worldwide.

Future of open protocols

The Netherlands will continue to work at an international level towards the application of open protocols. This will create a more competitive market with lower costs, which will benefit EV drivers, procurement and the market itself.

The development model for both OCPP and OCPI – ‘agile’ development of new functionalities within short timeframes, based on the needs of the market – has proven to be a big success. This method of protocol development is essential for the future. Customer wishes, market models, technological developments and regulations have not yet reached calm waters, and continuous improvements will also have to be quickly supported by the protocols in the coming years.

It is likely that certain 'de facto' open protocols, such as OCPP, OCPI and OSCP, will be merged into international 'de jure' protocols in the future. This is a positive development, provided the features currently provided by these protocols are preserved and incorporated into the new standards, and care is taken to ensure a relatively simple transfer from the 'de facto' protocols to the 'de jure' protocols. By being involved in these standardisation processes, Dutch organisations will address these points. Until then, the Netherlands will continue to actively participate in the continued development of the current protocols, together with organisations from other countries.

Whether the 'de jure' standards will actually be used and at what pace they will be implemented will partly depend on how the transition from the 'de facto' standards will take place. Since official standardisation bodies do not run compliance and end-to-end testing, there will always be a role for the management organisations that are currently developing the 'de facto' standards.

In the Netherlands, the international 'de facto' standards OCPP and OCPI have already been fully implemented and are in use. This gives Dutch businesses an outstanding starting position to use their expertise in the international market.

Specific developments

There are a number of areas that will become important over the coming years for the market and for protocols:

Safety and security

Both physical safety and cyber security will become much more important now that different networks and markets are connected to each other. The Netherlands is fully committed to ensuring both safety and security. Various working groups are tackling these issues, to ensure a safe and secure system both in terms of regulations and in terms of physical operation.

Smart charging

For years, the Netherlands has been a forerunner in the technical and practical implementation of smart charging and in the collection of learning experiences in pilot projects. With all the ambitions, this is becoming even more important. The Netherlands is also internationally active to ensure that other countries are participating in smart charging.

Transparancy/ease of use

The attention given in the Netherlands to the use of electric vehicles and the installation of charging infrastructure is spreading across Europe. Price transparency and expected charging capacity are an important part of that. The Netherlands will continue to work on this and be a model for other countries.

Logistics

In addition to passenger transport, the electrification of commercial transport, including logistics, is an important point of attention. In the coming years it will be a very important topic for the Netherlands, as a logistics country, as it will have an impact on the open market and open protocols. It is not expected that separate protocols will be required for this; but current protocols can be adapted to meet the requirements of commercial transport. This is already being looked into and will only become increasingly important in the future.

Quality of information

Given the large amount of information that is being exchanged, it is important to ensure that the information is correct and complete. Better and unambiguous definitions will be sought for the information, and efforts will be made to fulfil the obligation to make certain information available to third parties. A good example is the setting up of a national charging station register.

8. Conclusion

The Netherlands started setting up a network of charging infrastructure at an early stage. A number of protocols that are now being used worldwide, such as OCPP, OCPI and OSCP, originated here, and they are now being further developed with international parties. All this is only possible thanks to good collaboration between government, industry and research institutions.

Together, this has created an open market where collaboration goes hand in hand with a good competitive market. This has put the Netherlands on the international map, resulting in not only a strong domestic market, but also good opportunities for businesses and institutions to contribute internationally to the rise of electric transport.

Challenges remain with regard to the future of the standards, safety and security, smart charging, transparency and ease of use, logistics, and the quality of information for EV drivers and for stakeholders in electric transport.

On an international level, the Netherlands will continue to work towards an open, transparent and accessible charging infrastructure network, where there are opportunities for all parties (large and small) under the same conditions. In Europe, this is achieved through the participation of various Dutch companies and institutions in the Sustainable Transport Forum (STF) [18] and in the renewal of the Alternative Fuel Infrastructure Directive (AFID) [19]. In addition, we will continue to actively monitor development of the ‘de jure’ standards as closely as possible, to ensure that the switch from the ‘de facto’ standards is acceptable in terms of cost and effort. This is particularly important if future laws and regulations mandate the use of the ‘de jure’ standards.

Our leading position is not self-evident, as there are all kinds of actions from many countries in the field of electric transport. Together (government, market and institutions), we will have to continue work in different areas in the EV market to maintain and strengthen our position. This will ultimately create opportunities for the Netherlands.

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