Be in Charge – Making policy for E-charging infrastructure

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Abstract

There are over 100.000 electric cars in the Netherlands and this number will increase exponentially over the next years. The growth in demand for charging stations will exceed the number of cars. Because of this increase governments need to stay on top of the number of parking spaces with and without charging infrastructure. The desire to construct new buildings in built-up areas causes pressure on the available space in city centres, which is why increase in the number of parking spaces with charging stations at the expense of the actually available parking capacity in city centres should be prevented. In order to achieve this we developed key numbers for electric charging stations which will lead to a future-proof guideline for placing the right number of charging stations in the right spots and in that way making cities more liveable and vital. Thus we will stay in charge.

1. More than 100.000 electric cars

There are over 100.000 electric cars in the Netherlands and this number will increase exponentially over the next years. The growth in demand for charging stations will exceed the number of cars. Because of this increase governments need to stay on top of the number of parking spaces with and without charging infrastructure. The desire to construct new buildings in built-up areas causes pressure on the available space in city centres, which is why increase in the number of parking spaces with charging stations at the expense of the actually available parking capacity in city centres should be prevented. In order to achieve this it is pivotal to have the right key numbers for tools. In addition to this, placing electric charging stations in the right places offers opportunities for city centres to become future-proof, clean and liveable.

1.1 Sufficient and readily available charging infrastructure is essential

The installation of the current number of public charging stations is not parallel with the increase in the number of electric cars. The vast majority of electric drivers have no choice but to charge their vehicles in public space; the rest of them are comfortably in possession of a charging station on their own premises. This is why facilitating sufficient and readily accessible charging infrastructure is essential if the growth in electric transport is to be accommodated. In the Netherlands municipalities are responsible for public space and, therefore, providing ample charging stations for electric vehicles.

1.2 Municipalities use key numbers to respond to rapid increase in electric transport

Future-proof municipalities are in possession of good charging infrastructure that shows a clear vision on mobility. Each location is different and specific needs differ, too, so custom-made solutions are required. However, these custom-made solutions need guidelines as a starting point. Key numbers provide municipalities with guidelines on the number of charging stations that should be placed. They offer useful tools to create frames and to develop policy. In this way municipalities

and market parties stimulate the positioning of charging stations, while maintaining a balance between parking spaces for electric and parking spaces for non-electric vehicles.

The number of electric vehicles compared to the number of non-electric vehicles is relevant in determining the key numbers for the number of charging stations for electric vehicles. In other words, the more electric vehicles are parked, the more parking spaces need to be provided with electric charging stations. It is important not to create too few, but certainly not too many parking spaces with charging facilities, especially in areas where parking space is in high demand. A parking spot with charging facilities will be at the expense of parking capacity of non-electric vehicles if the former is never or hardly ever made use of. This is not a desirable situation for neither residents, nor the municipality, nor the operator of the charging station and therefore equilibrium is of the utmost importance.

1.3 How mobility policy influences our cities and vice versa

Clogs, tulips, and the connection between spatial planning and mobility have shaped the Netherlands. Since the 1960s mobility policy has influenced our urban development and vice versa. The approach, though, has changed over time: the Netherlands had a facilitating parking policy until the late 1970s. When car traffic increased in the 1970s it started to threaten accessibility and liveability. This was when the government introduced a controlling parking policy, resulting in the first parking norms, which curbed previous parking opportunities. A consequence of this measure was that functions with a high demand for parking space stopped settling in city centres and moved to the outskirts of towns. Over the past 20 years we have changed to a more 'facilitating' approach. Mobility is here to stay and had best be managed by focusing on facilitating it; that is, matching supply and demand and, in the process, making drivers aware of the costs of the mode of transport they opted for. Strengthening and improving (the quality of) public transport, investing in bicycle facilities like high-tech bicycle parking stations and fast cycle roads, and a good strategy for charging infrastructure in combination with key numbers are important tools to achieve this. In this way we work towards conscious and publicly acceptable mobility behaviour. This strategy enables excellent cities, which are economically vital, attractive, sustainable, and socially equitable.

1.4 Charging versus parking

Like in regular parking, it is an illusion to assume that a person drives somewhere with the sole purpose to charge their vehicle. An exception to this scenario are fast charging stations on the side of a motorway, which can be compared to refuelling a vehicle. In most cases charging a vehicle is parking the vehicle. It tends to be prohibited in the Netherlands to park in a space that is designated for charging when it cannot be proved that the vehicle parked there is actually doing so. Since this policy could potentially create tension between electric and non-electric vehicles it is essential to find the right equilibrium between parking spaces with and without charging stations.

When an electric vehicle is intended to be stationary for some time it can be charged. Whether or not the parking time is actually used as charging time depends on the following factors:

- the presence of a charging station
- the availability of a charging station
- the duration of parking (whether or not connecting the vehicle is worthwhile)
- the necessity of charging (empty battery or a long trip ahead)

2. Government, market parties and knowledge institutes work together.

In order to achieve the right key numbers it is important that the methodology and results are supported by a broad group of experts and potential users. Under supervision of *Stichting Nationaal Kennisplatform Laadinfrastructuur* (NKL, Foundation National Knowledge Platform Charging Infrastructure) market parties, government, and knowledge institutes have worked together on the development of key numbers for public charging infrastructure[1]. They help municipalities set up charging infrastructure proactively and efficiently. The key numbers for public charging infrastructure have been developed based on market knowledge and scientific analyses.

Charging data from 2015 and 2016 were used for the development of key numbers. These data include information on the increase and usage of all public charging stations in several large cities in the Netherlands. The data used in this study come from charging stations in the cities of The Hague (which proactively places charging stations and does not do so on request only) and Amsterdam (the European capital of electric transport). These data were compared with non-urban data from the province of Gelderland for verification of the analysis.

Analysis of the data provided insight into the usage of the charging stations (moments of charging, charging time, connection time) during that period for different types of neighbourhoods and cities. In this way light is shed on whether, and to what extent, the demand for electric charging stations differs and increases for each type of neighbourhood. The fact that the number of charging stations has risen over time has been taken into consideration and the results of the analysis have been corrected to accommodate it.

There is a connection with:

- Presence of functions: living, working, retail;
- catchment area of the function: the larger the catchment area, the longer the driving distances and the greater the need to charge the vehicle;
- Audience function: possession of an electric car is connected with the audience. This element will change over the next few years as the transition to electric driving is made

The analysed data are connected to the total number of available parking spaces in the specific research area. In this way insight is given into the share of parking spaces for charging electric vehicles compared to the total number of parking spaces.

[1] The following parties and people have contributed to the key numbers: Nationaal Kennisplatform Laadinfrastructuur – Roland Ferwerda; Municipalty of the Hague – Floris van Elzakker; CROW – Hillie Talens; Amsterdam University of Applied Sciences – Nanda Piersma; ENGIE – Jeffrey Kluitenberg; Over Morgen – Skadi Renooy and Gijs van der Poel; Goudappel Coffeng – Aukje van de Reijt and Niels Voogt

3. Key numbers

Infrastructure for electric transport and charging stations have not yet found their way into municipal policy. Municipalities tend to respond reactively: a charging station is only placed when a resident has requested one. In this way demand by visitors is not covered. This ad hoc approach used to be sufficient, but has become inadequate because of the rise in electric transport. This uncoordinated situation is stressful for both municipalities, electric drivers and market parties. Key numbers have been developed to offer municipalities guidelines for placing charging stations.

3.1 From data to information

Analysis of the charging behaviour in the researched areas has identified four different types of users, based on charging time and time of connection to the station:

- Residents: Charging time > 8 hours; connection time in the evening
- Workers: Charging time between 5 and 8 hours; connection time in the morning
- Visitors long: Charging time between 2 and 5 hours; connection time spread throughout the day
- Visitors short: Charging time < 2 hours; connection time spread throughout the day

Figure 3.1 shows different types of users based on the time of connection during the day. The left graph shows visitors, the middle the workers, and the right features residents.

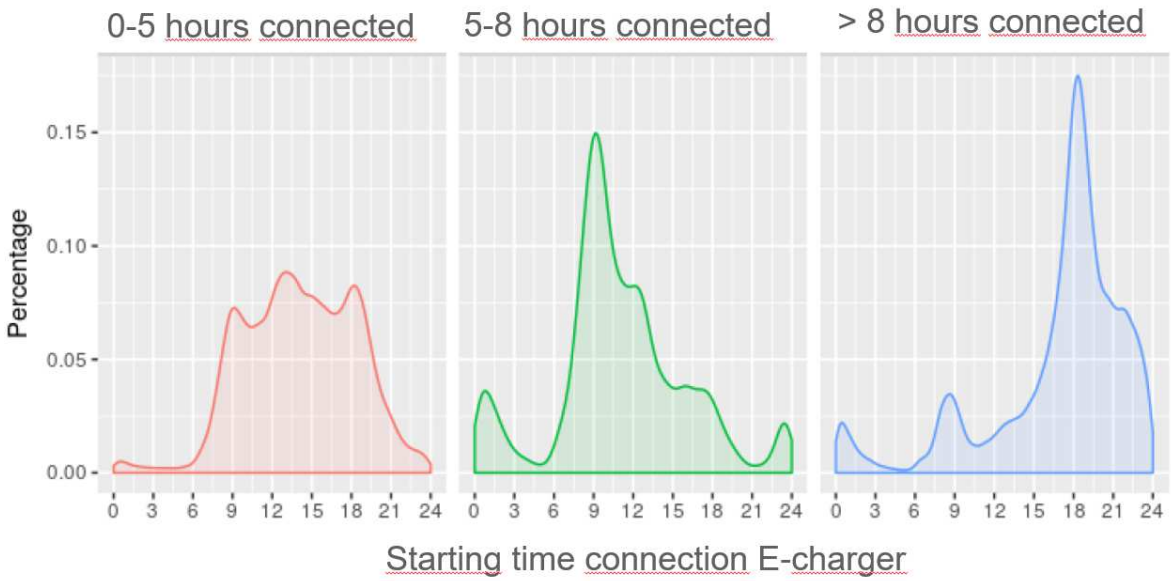

Figure 3.1. Time of connection for each type of user start

We also looked at the occupancy of charging stations in different types of areas during the day. The number of electric drivers (and, therefore, use of charging stations) may differ from neighbourhood to neighbourhood. Figure 3.2 shows the occupancy of the charging station for each hour of the day during the time of research. Different types of users have been represented using charging times.

The analysis has us conclude that in the areas that were researched it turned out that residents were predominantly accountable for the occupancy of the charging stations. Occupancy was highest at night. Other types of users used the stations during the day, but demand was highest at night. This makes the group of residents the key group when determining the number of charging stations in residential areas.

The analysis was conducted for different types of neighbourhoods (which is essential in determining the charging demand) in the Netherlands and reduced the number of relevant factors to two: 1. residents' average income and 2. the year of construction of the neighbourhood/houses, divided into pre-war (built before 1940, World War II) and post-war (built after 1945).

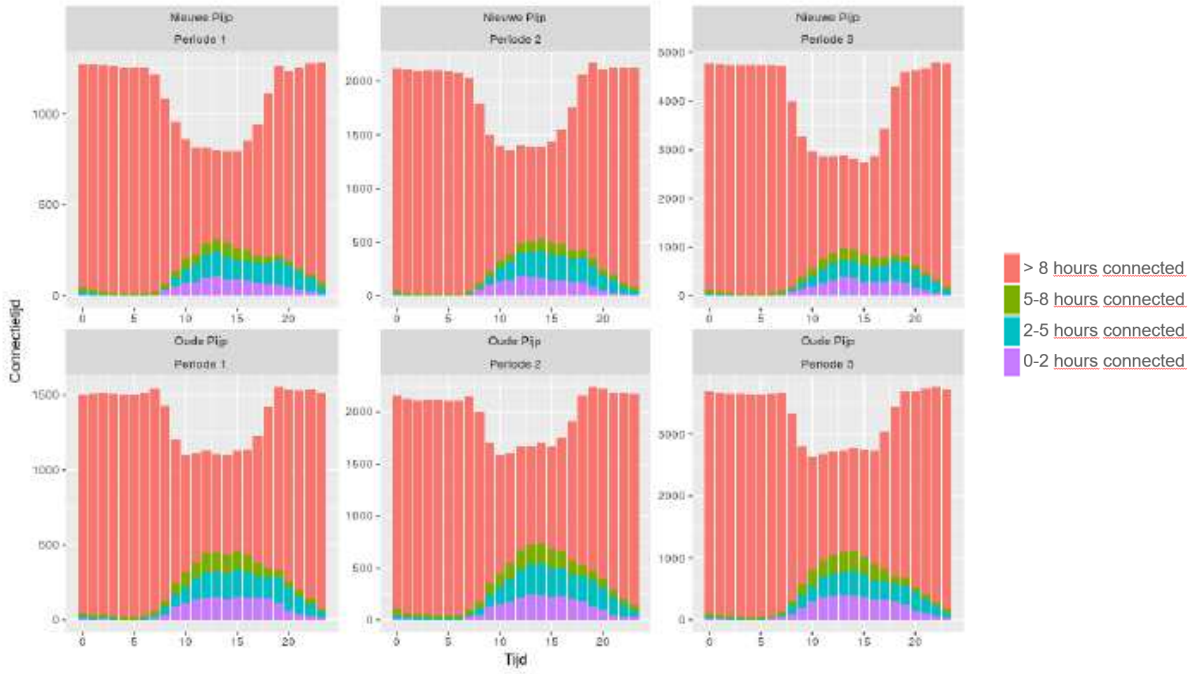

Figure 3.2: Occupancy of charging stations during the day for different types of areas and periods

Average income says something about possession of electric vehicles. Presently, there is a relatively high percentage of electric lease cars compared to the overall percentage of electric cars. Two factors contribute to this. First, electric cars are more expensive to purchase than conventional vehicles. Second, because of national regulations driving an electric lease car is beneficial for tax purposes. The share of lease cars is higher in high-income neighbourhoods than in other neighbourhoods.

The year a neighbourhood was constructed is crucial for its parking situation. Houses with on-site parking places are uncommon in neighbourhoods that were built before World War II, because of limited vehicle ownership at the time of construction. As a result, there is higher demand for public charging stations in these neighbourhoods than in post-war neighbourhoods. The latter feature a large number of houses with on-site parking space (and the option to place a private charging station) and, therefore, there is relatively little demand for public charging stations here.

Charging behaviour was researched in areas where mainly workers park (for instance, areas with a lot of offices) and areas that attract a lot of visitors because of corresponding functions. A distinction was made between functions that mainly attract visitors for a duration up to 2 hours (visitors short) and functions that mainly attract visitors for a duration of more than 2 hours (visitors long). Since the former category (visitors short) mostly concerns visitors from the surrounding area, there is little need to charge. Besides, the period of visiting is too short to charge effectively. The effort it takes to connect a car to the charging station does not outweigh the amount of energy the vehicle can be charged with over so short a time. This does not go for functions that attract visitors for more than 2 hours. The distance people drive to get to these functions is larger, increasing the need to charge. Besides, during the period of visiting there is enough time to charge the battery (for a large part).

3.2 Growth forecast

It goes without saying that electric cars are going to make up for a larger part of cars overall. The speed at which the number of electric cars will grow and how many more charging stations are needed depends on a number of developments. These developments concern the policy of the national government regarding stimulating electric transport and technical developments on the free market. Government policy can stimulate the use of electric cars by settling on a low added taxes for 100% electric cars or by making the use of conventional fuel less appealing.

Technological developments influence the supply in electric cars. They are relatively expensive at the moment and potential e-drivers are deterred by the car's travel range. Technological developments could make the care cheaper to produce and increase the number high-range cars to be manufactured. As a consequence, driving electrically will appeal to more people and the number of electric cars will grow.

These developments (technological developments in electric cars and in charging infrastructure (plug or electrostatic induction)) caused the people who occupy themselves with key numbers to assume a conservative growth forecast in the study 'future exploration electric transport', which was issued by the Ministry of Economic Affairs. This view was adopted to ensure no investments in charging stations will be made that turn out to be redundant or outdated in some years' time.

3.3 To key numbers

The information provided by the analysis per type of user per neighbourhood is related to the number of houses and public parking spaces in said neighbourhood. Based on this comparison, as well as the actual use of charging stations, insight is given into the share of parking spaces with electric charging stations out of the total number of parking spaces. This information enabled the creation of key numbers. These numbers offer guidelines concerning the share of charging stations to be placed compared to the total number of parking spaces for each type of neighbourhood (identified by income and year of construction). The key numbers have been indicated as a bandwidth with a minimum and a maximum percentage.

The number of electric vehicles, and, therefore, the number of charging stations needed, will be subject to several factors over the next years. The key numbers offer the opportunity to move along with political, civic, technological, and other developments and will be updated regularly.

Type of neighbourhood/user	Share parking spaces with charging infrastructure in relation to the total number of parking spaces		Remark
	2017	2020	
Neighbourhoods expensive	0,6% - 1,2%	0,8% - 1,7%	
Neighbourhoods medium	0,20% - 0,35%	0,3% - 0,5%	
Neighbourhoods cheap	0.05% - 0.15%	0,07% - 0,20%	
Work locations	2,0% (at least)	3,0% (at least)	Related to the % electric cars that is used to travel to and from work
Visitors long (>2 hours)	1,5% - 2,0%	2,5% - 3,0%	Related to the % of electric cars compared to the total numbers of cars
Visitors short (<2 hours)	Not applicable	Not applicable	

Table 3.1 Key numbers (with bandwidth) for percentage parking spaces with electric charging stations of the total number of parking spaces

Example: pre-war neighbourhood in the outskirts of the city centre with medium-expensive houses

In a pre-war residential area with medium-expensive houses in the outskirts of the city centre of Alphen aan den Rijn, a city with approximately 70,000 inhabitants in the Randstad area, there is frequent demand of public charging facilities. The number of private, on-site parking spaces is limited and the demand in this neighbourhood, where there are 873 public parking spaces, is high. There are shops in this area that provide every-day necessities. Parking spaces at these shops are used by customers by day and by residents at night. The municipality employs an average key number (0.3%) to make sure the pressure on parking spaces for non-electric vehicles becomes too high. Using the key numbers it was decided to provide 3 parking places (0.3% of 873 places) in this neighbourhood with charging infrastructure. No extra charging facilities were introduced for the shopping functions.

Note: the numbers in this example are fictive.

4. Making policy

It is important to note that municipalities ought to look for equilibrium between civic interest, operators' interests, and the parkers' interests when making and applying key numbers and implementing the actual infrastructure for charging stations.

4.1 Looking at it from the right perspective

Realising complete infrastructure for electric charging stations tends to be regarded in a financial way. It makes sense for operators, when placing charging infrastructure, to want to keep the costs as low as possible and receive turnover as high as possible. However, it is a risky way to approach creating a solid and future-proof network: a financial balance (placing infrastructure in a single place in a large area in the outskirts of a city centre/residential area) is created, but without taking the public need for a cleaner environment into consideration.

The latter is a topic that is constantly placed higher on the political and public agenda. Many city centres are faced with smog, particulates, and high CO_2 emissions. One way to realise a reduction in particulates, more clean air, and liveable cities is banning cars from car from city centres (by implementing low-emission zones like in German, English, and Dutch cities) and having them in the outskirts of town. Another way is to provide more space for public transport, pedestrians, and cyclists. Stimulating cleaner vehicles, like electric cars, helps achieve this. By giving good and considerable thought to where these cars should go it is possible to kill two birds with one stone.

4.2 Opportunity: Reward the clean driver

People in the Netherlands face a plunge in the sale of electric cars, because of the wrong incentive that is given to driving hybrid cars, which is eligible to tax benefits. Sales of electric cars are expected to rise when a large number of inexpensive electric vehicles becomes available and when their travel range increases. Until then the government could choose to reward electric drivers, even when it is not possible to offer financial incentives. By offering more convenience (an electric charging station (and parking space) in the most desirable (nearest) place) the use of electric vehicles can be stimulated. This allows people who display socially desirable behaviour (i.e. contributing to a cleaner city) to be rewarded without causing financial grief to anyone.

4.3 You're in charge!

Using key numbers to determine the number of charging stations needed in the near future contributes to driving electrically. Merely applying the numbers is not sufficient to reward actual socially desirable behaviour. If the government wants to diminish polluters' roles they will have to pay more attention to non-polluters. They can do this either by rewarding them and providing them with ample charging facilities, or by giving them priority access to the most desirable parking spots.

It remains unknown whether electric transport will go up quickly or develop gradually over time. In spite of this, municipalities can prepare by implementing infrastructure for electric driving when redeveloping streets or car parks. This is cheaper than redeveloping streets later on and it will not have to be done suddenly and hastily when the need arises.

The government can be more in charge than they might think, so they will better make use of it.

5. References

- Parkeerproblemen in woongebieden: oplossingen voor de toekomst, Planbureau voor de Leefomgeving, 2008.
- Kencijfers parkeren en verkeersgeneratie, CROW publicatie 317, oktober 2012.
- Cleaner car contracts benchmark 2017, overview of vehicle fleets and efficiency benchmark, Backers, K. & U. Tietge, april 2017.
- Ecofys: Eindrapport Toekomstverkenning elektrisch vervoer (december 2016)