MASTER

Electric vehicles in the fleets of organisations

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Award date:
2016

Link to publication
Electric vehicles in the fleets of organisations

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identity number 0635567

in partial fulfilment of the requirements for the degree of
Master of Science
in Innovation Sciences

EINDHOVEN UNIVERSITY OF TECHNOLOGY

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Series Master Theses Innovation Sciences

Subject headings: electric vehicles, mobility, fleets, organisations
ABSTRACT

The Netherlands is seen as a frontrunner in electric mobility, at the time of writing being close to crossing the 100,000 mark of number of electric vehicles (EVs). More than 90 percent of these are owned by organisations. In this study, 10 fleet managers from 10 large organisations are interviewed, organisations whose fleets collectively hold 1% of the EVs in the Netherlands. EVs have been very risky vehicles in these fleets, and have been carefully deployed, only at 'the right place'. The sustainability of electric mobility is not deemed as evident as is often portrayed, and is something that is challenged by these fleet managers. This study questions the scalability of electric mobility in the near future, for the reliance on home chargers, the conflict between professional and private use, but most of all, for the role policy stimulus has in this: contributing to the positioning of EV as an employment benefit product.
ACKNOWLEDGEMENTS

There are a number of people I’d like to thank for helping me on this project. My first supervisor, Hans Jeekel, for the time and effort put into me, and for both his guidance and his ability to make me think I did it myself. My second supervisor, Geert Verbong, for his critical feedback. I’d like to thank Baerte de Brey from Stedin and Frank ten Wolde from Rijkswaterstaat for helping me get this project started, when they didn’t necessarily have to do so. I wish to acknowledge the interviewees by name for their willingness to help, but, as agreed, I’m not going to. And lastly, thank you friends and family. You know who you are, thank you for being there for me.
EXECUTIVE SUMMARY

The Netherlands is seen as a frontrunner in regard to electric mobility, at the time of writing being close to crossing the 100,000 mark of number of EVs. More than 90 percent of these are owned by organisations. This, together with the identified potential of fleets by different parts of scientific research, led to the following research question:

What are the most important socio-technical barriers hindering the adoption of electric vehicles in fleets of organisations?

Research approach
10 fleet managers from 10 large organisations were interviewed; organisations whose fleets collectively hold 1% of the EVs in the Netherlands. Multiple themes were discussed: the current situation in regard to electric mobility in these organisations, how the employees use and charge EVs, and the decision-making in relation to their employees, other departments, and external parties.

Findings
While these organisations have struggled with the initial experiences with plug-in hybrid, over time they have been much better able to 'position it at the right employee'. While plug-in hybrid has been mostly prompted by the demand from the employees pursuing tax incentives, full electric has been handled differently. A number of these organisations have seen a moderate success of the Tesla Model S as an employment benefit product. Still, there remain barriers related to charging, conflict between professional and private use, and this employment benefit status of the lease car.

Conclusions
The ability to scale electric mobility in the near future seems limited. Technological development only addresses a number of barriers. Overall electric mobility is often seen as a threat to flexibility, with collaborations with third parties not substantive enough to overcome this.

Policy recommendations are to (1) continue simplifying the tax exemption scheme on company cars to allow for more flexibility in fleets (2) provide stability in terms of national mobility policy for organisations like these to move towards sustainable mobility, and (3) a focus on making more tangible links between electric mobility and the CO2-reduction goals of organisations, instead of on trying to persuade the employees of the Netherlands individually to adopt EVs.
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1 INTRODUCTION

Electric vehicles (EVs) are hot right now. There is a widely recognised potential they can help solve urgent mobility and energy problems. The Netherlands is seen as a frontrunner in Europe in regard to electric mobility, at the time of writing being close to crossing the 100,000 mark of number of EVs. Both in terms of absolute numbers of EVs and relative to the total number of cars, the Netherlands is second only to Norway (RVO, 2015a) (and on the latter, second worldwide as well, see Fig. 1-1). However, the two countries’ fleets of EVs are built up very differently. More than 80 percent of Norway’s EVs are in the hands of private individuals, while more than 90 percent of the Dutch EVs are owned by organisations (RVO, 2015b). Why that is, is a question that cannot be given a clear and concise answer to, but it is evident that Norway has been the exception in successfully stimulating the private adoption of electric mobility (Kumar, 2013). The success the Netherlands has had in regard to EVs in corporate markets means attention has at least partly shifted towards trying to pick up the consumer market (possibly by learning from Norway on this). (Nederland Elektrisch, 2016b)

1.1 Problem statement

At the same time, this success is not unanimously seen as ‘success’ at all. First of all, because it has required significant government investments (e.g. an estimated 6.4 billion in loss of government revenue over the period 2008 – 2013 due to tax deductions (Kok, van der Linden, Smokers, Verbeek, van Zyl, 2015). Moreover, because this has resulted in an electric fleet that consists for 85% of plug-in hybrid vehicles and 15% full-electric vehicles (RVO, 2016). It is questioned how much these plug-in hybrids are actually driven electrically (Autoweek, 2016), and in a broader sense, how much they contribute towards a transition towards electric mobility (Dijk & Yarime, 2010; Sierzchula, Bakker, Maat & van Wee, 2012).

As mentioned, there is a “widely recognised potential EVs can help solve urgent mobility and energy problems.” In the scientific community, electric mobility is approached from a number of different angles. The relative swift rise of electric mobility in the recent years has brought to the forefront the problem of charging: Eising, van Onna and Alkemade (2014) caution that in the Netherlands, with current diffusion rates and current charging behaviour, the functioning of the electricity grid could be compromised in the recent future. Finding ways to ‘systemise’ charging on a large scale not only holds promise to minimise these negative impacts, but to actually take advantage of the aggregated storage capacity of the batteries of the EVs, a concept called vehicle-to-grid (V2G) (Kempton & Tomic, 2005a; Guille & Gross, 2009; Sovacool & Hirsh, 2009).

![Fig. 1-1 Electric vehicle market share (percentage of new car registrations) in the leading countries. Based on OECD/IEA (2016).](image-url)
In terms of electric mobility as an answer to overcoming persistent mobility issues, there are a number of identified possibilities, but concerns as well. Banister (2008) argues ‘sustainable mobility’, and even how this concept is interpreted, has so far been too narrow. Bigger social components are aspects that are often missing in the discourse on mobility. There is a possibility for electric mobility here according to Dijk, Orsato and Kemp (2013), who point in the direction of the intertwinement of the emergence of electric mobility and car sharing, the latter being one of those ‘social solutions’ which previously have never really taken off.

What becomes apparent all throughout scientific research relating to electric mobility, is the recommendation that fleets may very well be part of the solution. On the subject of the adoption of electric vehicles, fleets owned by firms and governments are seen as promising because “fleet managers […] have a better comprehension of lifetime vehicle costs than do private households (Lane & Potter, 2007; Sovacool & Hirsch, 2009)” (Sierzchula, 2014, p. 127). In regard to V2G and exploring the matter of charging EVs in general, the more centralised and predictable spatial relations and usage scenarios are advantageous (Hill, Agarwal & Ayello, 2012). Additionally, “compared to individual vehicles, fleets are more easily accommodated within existing electric market rules” (Tomic & Kempton, 2007, p. 459).
1.2 Significance of this study

This recommendation that points in the direction of fleets does not materialise much further however. Concrete research on electric vehicle fleets is hardly at hand. The aforementioned study by Sierzchula (2014) dives deeper into the motives of commercial entities accommodating EVs in their fleet, and concludes that this is at the moment often done from a standpoint of experimentation, ‘gaining experience’, often despite there not being a compelling business case. On the one hand this lack of research is strange. Leaving EV for what it is for a moment, the corporate car fleet accounts for 11 percent of the total car fleet in the Netherlands and almost 50 percent of the influx of new cars (VNA, 2015). But more importantly, because the mobility of organisations probably plays a significant role for mobility in a larger context, as corporate and private mobility are not separate worlds. On the other hand, it is probably not unreasonable to assume that the scientific community and that of leasing and commercial fleets don’t exactly match up, and that this may result in a subpar understanding of how the adoption of electric vehicles in commercial fleets shapes and influences sustainable mobility at large.

This study tries to improve that understanding, not only by continuing the research of Sierzchula (2014) on the motives of organisations to adopt EVs, but also by examining how in a broader sense these organisations see electric mobility fulfilling their mobility needs. This links to many topics in the scientific exploration of electric mobility: (1) Whether fleets managers indeed make a different assessment on the adoption of vehicles than private individuals (Lane & Potter, 2007; Sovacool & Hirsch, 2009) and whether that is to the advantage of electric mobility or not. (2) The interaction with other modalities that are being resorted to by organisations (Dijk et al., 2013) (3) How organisations and their individual employees deal with the charging of EVs has implications for resolving charging issues, and the place electric vehicles have in the electricity grid in general. Next to this scientific relevance, this study relates to the current state of affairs on electric mobility in the Netherlands. As mentioned, more than 90% of the Dutch electric vehicles are owned by companies (RVO, 2015b). Apart from fleet managers’ motives and assessments of the viability of electric mobility, examining how successful they’ve actually been in utilising it and overcoming the obstacles they have faced is crucial in anticipating what electric mobility may stand for in the coming years.
1.3 Research question

The main research question:

**What are the most important socio-technical barriers hindering the adoption of electric vehicles in fleets of organisations?**

Three sub-questions are considered:

1. How does the stimulation of electric mobility from inside the organisation work?
2. Which interventions can the organisation do independently, and which require the government or other parties?
3. In what way does EV infrastructure influence the adoption of EVs in fleets of organisations?

1.4 Outline of this report

1. Introduction
2. Literature review — Exploration of the scientific studies related to electric mobility.
3. Theory — The innovation theories underlying this study.
4. Methodology
5. Where EV takes form — The position the lease car has in the mobility of the organisation, and for which users exactly EV has been able to gain a foothold.
6. Charging — How organisations see the charging of EVs, and how they have collaborated with third parties on charging facilities.
7. Threat to flexibility — EV for the organisation attempting to keep its workforce able and flexible works very differently from EV for the individual adopter.
8. Smart mobility — National mobility policy as an impediment, and the opportunities for market parties.
9. Conclusion
2 LITERATURE REVIEW

This study was preceded by a literature review exploring the scientific expertise relating to electric vehicles and sustainable mobility. This chapter contains the relevant extracts that are referred back to in this study.

2.1 EV from a mobility perspective
2.1.1 Mobility trends
2.1.2 Alternative fuel vehicle development
2.1.3 EV adoption by individual consumers
2.1.4 EV adoption by organisations

2.2 EV from an energy perspective
2.2.1 Renewables
2.2.2 Infrastructure

2.3 Summary

2.1 EV from a mobility perspective

If electric vehicles are to replace internal combustion engine vehicles, it is important to understand how people deal with mobility, and the expectations they have of the vehicles they drive and own. § 2.1.1 Mobility trends and § 2.1.2 Alternative fuel vehicle development look at the historical developments which played a role in getting electric vehicles where they are now, and will play a role in where they are going. The last two sections deal with the adoption of EVs: § 2.1.3 (p.19) does so for the individual consumer: what current adoption rates can tell us about future ones, the often counter-intuitive psychology of people’s decisions to choose for an EV or not, and how policy addresses this. § 2.1.4 (p. 21) considers how these dynamics change when organisations make these decisions instead of individuals.

2.1.1 Mobility trends

For almost a century, the car has been the centrepiece in our mobility. There have been many car-related innovations, but the essence of it has remained the same. In fact, throughout the century we’ve seen an increase in car dependence. Developments related to mobility are underway that may as of this moment have limited visible influence, but may well undermine the position of the car.

Environmental impact

One of the main drivers for the development of alternative fuel vehicles has been the polluting effect of conventional vehicles. This was especially spurred on in the 60s and 70s by the public debate on air pollution and the dilemmas surrounding energy security and oil
In the last two decades, climate change instead of local pollution became the more important topic, although the latter still remains relevant (Budde, Alkemade & Weber, 2012; Dijk et al., 2013). Alternative fuel vehicles are still seen as a viable solution in dealing with inner city pollution (Chapman, 2007). Interesting is whether they actually are. Sioshansi and Denholm (2009) reviewed, specifically for EVs, several studies on this topic and came to the conclusion that the potential is there, although they argue the case is “highly sensitive to the generation mix” (p. 1203). They saw EVs becoming overall more polluting than conventional vehicles when the energy came from older coal plants.

This uncertainty of the potential of EVs to solve environmental problems is further augmented by another factor that has been discussed earlier in this literature review: Assessing the generation mix Sioshansi and Denholm (2009) speak of is incredibly complex, as trying to pinpoint the exact composition of energy sources may be too difficult and might give a misunderstood representation. The energy system consists of a plethora of different components, not just the ones that are dealing with delivering the raw amounts of energy. Additionally, the position of EVs in this system is still undetermined, which will no doubt have its influence on this assessment. Bearing this in mind, it is clear that over time a proper verdict on this is crucial: Egbue and Long (2012) interviewed almost 500 people, mostly young adults, on their views on EVs, and it became apparent that this uncertainty can be seen as a major barrier in the consumer acceptance of EVs.

The fact that some members of this group question the sustainability and environmental performance of EVs compared to [internal combustion engine] vehicles may mean that some individuals with high environmental awareness or values may not consider the purchase of an EV as beneficial to the environment. (Egbue & Long, 2012, p. 724)

Just as important as EVs polluting less than conventional vehicles is that people see it as such.

**Concept of mobility**

Which technologies have been most important in the last decade as ‘competitors’ for the car? Public transport, airplanes and bicycles are oft-mentioned, but what about the internet? Lots of consumer goods are bought nowadays via the internet, which would a decade ago have been purchased in a store, after a trip with the car (Jeekel, 2015). Substitution by ICT, but also land-use developments and bigger social components are aspects that are often missing in the discourse on mobility according to Banister (2008). He argues that the paradigm of sustainable mobility has been too narrow.

Whether the development of EVs is a good one in this regard can be debated. EVs provide many opportunities, but what the opportunity costs are is something of great importance. EVs may be a step in the right direction, but if it hinders other, much bigger steps, it shouldn’t be seen in such a positive light. Researchers are worried that technological solutions such as EVs could stand in the way of societal solutions in solving the underlying cause of the problems: car dependence and our mobility habits (Geels, Kemp, Dudley & Lyons, 2011). Closely linked is the argument that “[b]ecoming too dependent on one transport mode that will face an unknown future presents societal risks and vulnerabilities” (Jeekel, 2014, p. 99). Turton and Moura (2008) show the same kind of scepticism for vehicle-to-grid:
Although there are no foreseeable alternatives able to provide the same range of services as the automobile, the possibility of technological breakthroughs cannot be ruled out. This raises a connected issue, which is whether V2G [vehicle-to-grid] technologies may themselves further entrench the private motor vehicle as the dominant transport mode, and whether this would necessarily be a good development. (Turton & Moura, 2008, p. 1105)

Ultimately, it is still very much unclear what the influence of EVs may be. EVs may indeed cause a change in perception from seeing mobility as a pressing matter into a problem that has been solved while it hasn’t been. On the other hand, Dijk, Orsato and Kemp (2013) see an intertwinement in the emergence of electric mobility and car sharing, with the latter being one of those ‘social solutions’ which previously have never really taken off.

### 2.1.2 Alternative fuel vehicle development

In 1899, a fierce battle went on in the United States between three different types of automobiles (Cowan & Hultén, 1996). The most popular of the three was the steam car, with 1,681 of those being sold. A close second was the electric car, with 1,575 units sold. Third was the gasoline car, of which 936 were sold that year. In 1924, only 25 years later, both steam cars and electric cars saw sales numbers of a couple hundred, while a staggering 3,185,490 gasoline cars were produced.

**Electric and hydrogen**

Cowan and Hultén (1996) argue gasoline cars were able to gain an advantage over the competitive technologies because “[a]lthough all three technologies exhibited early technical problems, gasoline car manufacturers rapidly found solutions, whereas the producers of steam and electric vehicles were unable or unwilling to reduce the faults of their cars” (p. 67). Over time, there have been multiple attempts at reintroducing the electric car (Dijk et al., 2013; Cowan & Hultén, 1996). Why those attempts failed is contested, but clear is those same technical problems remained a major barrier. Fundamental was the lack of improvement of battery density.

In the 1890s battery capacities were in the vicinity of 10 Wh/kg. By 1901 this had been improved to 18 Wh/kg and by 1911 was close to 25 Wh/kg. This trajectory of technological improvement was stopped at that point, however, and it has taken close to 80 years to double the capacity. (Cowan and Hultén, 1996, p. 62)

Another technology that has been posed as a serious alternative to gasoline and diesel is that of hydrogen fuel cells. This technology came from a different origin...
than that of electric vehicles. Adopted from the aerospace industry, fuel cells were initially solely seen as a form of power generation and only later did this change into a focus on mobility (Verbong, Geels & Raven, 2008). Exactly this change of focus, and the ambiguity that came from it, is seen by Verbong et al. (2008) as one of the reasons that the expectations so far have never been met.

**Picking a winner**

While electric and to a lesser extent hydrogen fuel cell are the technologies ‘in style’ today, the investments being made by car manufacturers show that there is still a significant amount of uncertainty. Sierczhula, Bakker, Maat and van Wee (2012) looked at the technological diversity of alternative powertrains over the last decades and found this to be increasing, with plug-in hybrid, H2ICE (hydrogen internal combustion engine), flexfuel, LPG (liquefied petroleum gas), CNG (condensed natural gas) and turbocharging being in the mix next to the aforementioned two. The paths taken by car manufacturers depend not only on expectations of these technologies themselves. Budde et al. (2012) demonstrate this for BMW and Daimler (Mercedes): two car manufacturers both from Southern Germany, producing premium vehicles, subject to the same national and regional policy and choosing between the same alternative powertrain technologies. They did so differently because of different expectations on how these fit in with the future mobility systems and the role the firm will play in that.

**Strength and weaknesses**

Fuel cell hydrogen and electric were introduced to the market in different ways. Different in term of the strategies, but also in terms of the actors involved. Van Bree, Verbong and Kramer (2010) characterise fuel cell hydrogen as a technological niche: demonstration projects set up in highly protected settings by mostly incumbent actors, with the goal of scaling up those demonstration projects and developing a more mature infrastructure. They define electric as a dedicated market niche: individual models, introduced by actors external to the regime, for markets “in which the drawbacks of EVs are less pronounced (such as the city car niche and electric bicycle niche) or in which their benefits are magnified (such as the sports car niche)” (p. 535).

Sierczhula et al. (2012) position the different powertrain technologies based on the two continuums of incremental or radical (if they require new expertise or knowledge (Tushman & Anderson, 1986)) and artefactual or systemic (how much the socio-economic environment is required to change (Hekkert, Hendriks, Faaij & Neelis, 2005)) (Fig. 2-1). They argue car manufacturers have often chosen to reinforce the existing dominant internal combustion engine design (Sierczhula et al., 2012). In that light, one can be critical of perceiving the moderate success of plug-in hybrid in recent years as a big step in the direction of electric mobility, as the challenge in foregoing the usage of the petrol infrastructure is a different one from the adoption of electric drivetrains.
2.1.3 EV adoption by individual consumers

Innovation can go very fast. The prime example of that in recent years has been the mobile phone. In a few short years, smart phones have replaced ‘dumb phones’ all over the world and have had far reaching influences outside of mobile telephony. But this seems to be the exception rather than the rule, as examples such as these can be offset by a plethora of (often much more dull) examples of when such efforts weren’t as fruitful. The fact that electric vehicles have matured from just a technological development into having an actual place in today’s mobility, albeit a small one, raises the question: Are electric vehicles going to cause a disruption in mobility in the near future?

The diffusion of electric vehicles

A concept not far away when discussing the adoption of EVs is the diffusion of innovations theory by Rogers (2010). Rogers divides adopters in five categories based on ‘innovativeness’, and with empirical findings denotes the share of each of those: 2.5% innovators, 13.5% early adopters, 34% early majority, 34% late majority and 16% laggards. As electric vehicles have matured and have gained a small foothold in car mobility, the argument is there that the time is near that the larger share of people (in the form of the early majority) can be reached and electric vehicles will really ‘take off’ (Gärling & Thøgersen, 2001).

Grübler (1990) builds upon Rogers work specifically for infrastructure dependent technologies by differentiating between the diffusion of the infrastructure and that of the technology itself. His empirical research shows that for infrastructure dependent technologies, the diffusion of infrastructure often precedes the technology, with both S-curve shaped in a similar fashion to infrastructure independent technologies. At the same time, that does not mean we should blindly expect things to take off. Dijk and Yarime note that “the seminal work of Rogers offers a typology of adopters based on when they adopt but does not offer a dynamic model of innovation diffusion in terms of endogenous and exogenous mechanisms” (Dijk & Yarime, 2010, p. 1372), something which goes just as much for Grüber’s (1990) work. The problem with that is that it does not help in assessing when the model holds and when it does not. It could be for example that the early adopters and the early majority for the aforementioned smartphones were very similar in terms of desires and expectations, but that this might not be the case for EVs, the latter being a concern expressed by Graham-Rowe et al. (2012).

Behavioural complexity

Price and uncertainty are two factors that have been identified as important barriers for the adoption of EVs (Sierzchula et al., 2014; Egbue & Long, 2012; Sovacool & Hirsh, 2009). But the experience so far shows the situation is more complex than that. The aforementioned research by Egbue and Long (2012), in which they surveyed approximately 500 people on their perspectives on EVs, shows how more experience with EVs (something that is often seen as a good thing (Sierzchula et al., 2014; Sovacool & Hirsh, 2009)), leads to both positive and negative consequences. People with more experience with EVs see them as safer, but at the same time they are more critical of their environmental impact.

Another aspect which is often misunderstood is that of range and the more specific notion of range anxiety. As battery technology has been a limiting factor in the development of EVs, the distance that can be travelled with EVs has been limited, especially compared to traditional vehicles (Cowan and Hultén, 1996). Range
anxiety specifically means the fear people have of being stranded, of not reaching their destination (Egbue & Long, 2012). Some researchers conceptualise the problems surrounding range (sometimes implicitly) as some sort of threshold in the daily travel requirement of people, meaning that once EVs are able to meet that requirement, range anxiety becomes less of a problem (van Bree et al., 2010; van der Kam & van Sark, 2015). Other researchers argue that people’s perceptions of their daily travel requirements vastly differ from the actual figure (they think they drive much more than they do) and possibly the ability to be able to drive more if wanted or needed is an important demand people place on their vehicle, even if they may never actually do so (Egbue & Long, 2012; Trigg et al., 2013). At the same time Franke, Neumann, Bühler, Cocron and Krems (2012) argue more experience with EVs seems to change people’s perceptions of daily travel requirements and mitigates these kind of problems.

The concept of range anxiety shows how the adoption of EVs does not only depend on an assessment of the car itself. The lacking infrastructure is another element that has been deemed a significant barrier (Steinhilber, Wells & Thankappan, 2013; Ahman, 2006). Central in this is the ‘chicken-and-egg conundrum’: with the infrastructure and EVs being interdependent but both lacking, development of the whole is hindered (Browne, O’Mahony & Caulfield, 2012; Budde, Alkemade, Hekkert, 2015; van Bree et al., 2010). Even when governments have been shown willing to invest in infrastructure, uncertainty regarding ownership, business models and compliance with the legal framework act as barriers (Steinhilber et al., 2013).

**Fitting policy measures**

When it comes to car purchasing, environmental issues have a very low priority for private and fleet consumers. This is at odds, both with the high level of concern declared by members of the public, and with the increasing importance of environmental issues within the business sector. (Lane & Potter, 2007, p. 1090)

That is why policy measures are needed to ‘internalise the externalities’. As said on the topic of behavioural complexity: price and uncertainty are two factors that have been identified as important barriers for the adoption of EVs. In many countries, policy measures have focused mostly on the former (Sierzchula, Bakker, Maat & van Wee, 2014; Steinhilber et al., 2013; Egbue & Long, 2012). Researchers question in how much subsidies on the purchase of EVs really have had an effect (Lane & Potter, 2007; Sierzchula et al., 2014) and argue the increased adoption of EVs has not been caused by subsidies but by increased oil prices (Diamond, 2009) (which by the way makes the drop in oil prices in current times interesting for further research). More importantly, they argue policy measures are in dire need to tackle the uncertainty surrounding EVs (Egbue & Long, 2012).
2.1.4 EV adoption by organisations

While lots of research focuses on understanding what makes individuals willing to choose for EVs, the fact of the matter is that a significant portion of vehicles are not purchased by individuals but by organisations. As ultimately the person in the organisation who decides to purchase EVs is an individual, and the person who drives one is an individual, that research certainly plays a role, but in a different context. There are three main reasons things are different for organisations:

- First of all, the purchase and the actual usage of the vehicle are done by different persons creates a different dynamic.
- Secondly, the purpose the vehicle serves: it has to fit the needs of the organisation, but more often than not, the car is also used in the private sphere.
- Lastly, research has shown that organisations altogether have different criteria and different priorities in deciding which direction to go with their mobility.

Especially in that last point it is that researchers see potential for fleets to play a more significant role in the adoption of EVs.

A different set of rules

One of the barriers for EV adoption by individual consumers that has not been discussed as thoroughly in the previous chapter is that of costs: specifically, the consideration of fuel costs by individual consumers in the purchasing decision of a vehicle. In recent years, researchers have been able to show not only that often an understanding of this topic is lacking, but that it is often misunderstood. “[T]he consumers we spoke to do not think about fuel economy in the same way as experts, nor in the way experts assume consumers do” (Turrentine & Kurani, 2007, p. 1221).

Consumers have a lacking understanding of the fuel costs of the vehicle they own, and when considering buying a vehicle they look at the purchase costs and hardly take in consideration the fuel costs (Diamond, 2009; Lane & Potter, 2007; Turrentine & Kurani, 2007; Egbue & Long, 2012). What makes this relevant for EV adoption by organisations is that they are much more able to rationally assess the fuel costs, and in general the lifetime costs of a vehicle (Sovacool & Hirsh, 2009; Lane & Potter, 2007). “Consequently, organisations are more likely to adopt vehicles that have high purchase costs but offer the potential of lower total ownership costs through reduced operating expenses” (Sierzchula, 2014, p. 127), playing to the competitive strengths of EVs.

Next to a more accurate assessment of costs of vehicles, the prioritisation of factors like these is different for organisations. Much more so than consumers, organisations value low costs of their vehicles, in the form of low lifetime costs, but also in terms of low financial uncertainty (Shell, 2004; House of Commons Transport Committee, 2004). Moreover, Sierzchula (2014) has shown that “[t]he propensity of fleet managers to test new technologies and their willingness to act on those inclinations supports theoretical expectations from the literature and empirical evidence that organisations will be early EV adopters (Nesbitt & Sperling, 1998; Kumar, 2013)” (Sierzchula, 2014, p. 130). At the same time, from both arguments a critical notion must be formed. While organisations may be willing to ‘test’ alternative vehicle technologies relatively early, and there is potential for EVs to play well with the priority of organisations for lower lifetime costs, in terms of that other priority, low financial uncertainty, EVs may at the moment not be that good a fit.
Tackling uncertainty
Uncertainty surrounding EVs, not only financial uncertainty but also the underlying uncertainty regarding usage, future proofing, reliability, and hidden costs, are things that can be diminished with experience. But this once again seems a ‘chicken-and-egg problem’, just like with infrastructure. Wikström, Hansson and Alvfors (2014) argue that in this regard, technology procurement by public organisations may play a leading role. They analysed the demonstration phase of the Swedish National Procurement of EVs initiated by the City of Stockholm and Vattenfall, in which in a period of 18 months, initially 50 and ultimately 174 EVs were used by 30 public organisations. Their results support the notion that uncertainty regarding usage of EVs is diminished by experience: both the use of the EVs within the organisations and the driving distance between charging increased significantly over the 18-month period.

Assessing which role technology procurement can play in the diffusion of EVs requires not only an understanding of the results for the users of such projects, but also of the decision-making that preceded such projects and the results in a broader context than just the users of the EVs. Sierzchula’s (2014) research suggests that private organisations can be leading as well. He investigated 14 Dutch and American organisations, both public and private, and found the public/private distinction was not an important differentiator for predicting whether organisations expanded upon the EV part of their fleet or not. What was most important was the size of the organisation. Small firms (he defines ‘small’ as less than 50 people) were much less likely to purchase additional EVs because of the required initial investment. ■
2.2 EV from an energy perspective

A car and a bread toaster both rely on a vast, complex energy-system behind them, just not the same one. While for both their power may originate from the same crude oil, somewhere down the supply chain there is a split into different systems. From this point of view, an electric vehicle is arguably more similar to an appliance than to a traditional vehicle. And, as EVs become more common, their energy requirements amplified by their (uncertain) dynamic charging profile make them more and more significant components in the electricity system. § 2.2.1 Renewables discusses what the learnings from the successes and failures of renewable energy technologies mean for EVs. § 2.2.2 Infrastructure (p. 25) considers the charging of EVs and how that interacts with other aspects of mobility.

2.2.1 Renewables

The role EVs should play in the electricity system is not clear. There are significant risks in how we deal with charging them, but at the same time, the batteries they bring with them are seen as an opportunity. Renewable energy technologies (RETs), which have been around much longer than EVs, have faced similar challenges. Still, the shared desires and hopes for them to generate a significant share of our energy demand have more often than not led to disappointment. The same factors that have played a role in that (e.g. expectations, policy, learning mechanisms) will have to be considered for the diffusion of EVs to happen, let alone a combined effort between the two.

Hype cycles and changing policies

The valley of death: “the phase in the technology life cycle just before market introduction. In this phase high uncertainties about market success are coupled with high investment costs for building production capacity” (Negro, Alkemade & Hekkert, 2012, p. 3841), a crucial aspect in the success of any technology, RETs included. But commitment and a willingness to invest is not enough to bridge such a gap, the diffusion of wind energy in Europe shows that much. Both the Netherlands and Denmark saw the future in wind energy in the early 70s, and both countries committed wholeheartedly. The respective industry never took off for the former, while in 2000 15% of the electricity demand was met by wind energy for the latter (Kamp, Smits & Andriesse, 2004). Kamp, Smits and Andriesse (2004) argue the focus in the Netherlands was too much on acquiring new knowledge, while Denmark’s learning by interacting resulted in a much more coherent development process between turbine producers, turbine owners, and researchers.

Verborg et al. (2008) argue especially in the Netherlands the expectations of renewables have been too volatile. This relates to the concept of hype cycles, introduced by research firm Gartner (Linden & Fenn, 2003) (Fig. 2-2). While Gartner’s hype cycle concept discusses the patterns of expectations from the perspective of individual technologies, Verborg et al. (2008) take a more macro-perspective and consider
how the failures of one RET are being used as legitimation for the next RET, which subsequently fall prey to the same obstacles as learnings are substandard. This has created an unstable innovation culture with ever-changing policy measures. However, policy measures alone cannot be seen as the sole determinant of success. Dewald and Truffer (2012) looked at Germany’s successful adoption of solar energy and showed that while national policy (and in this case geophysical conditions) played a role in explaining why certain regions of Germany did better than others, local market formation played a very significant role. This means experiments on the local scale, interaction between new and old actors and involving users.

**Learnings for EV**

While there are certainly differences in the nature of vehicle technologies like EVs, and RETs such as solar and wind, there are enough similarities that warrant taking into account the learnings from the latter for the development of the former. Just like renewables, alternative fuel vehicles see failed expectations of the one fuelling the hopes for the other (Fig. 2-3).

![Graph](image)

**Fig. 2-3 The hype cycle patterns for the different alternative fuel vehicle technologies (Geels, 2012).**

When looking at the approach taken by Denmark and Germany in regard to renewables, and especially contrasted to the approach taken by the Netherlands, we see the importance of broadly developed innovation instead of a focus on the advancement of specific technologies by specific actors. In the same way that Denmark didn’t leave the development of wind energy up to wind turbine manufacturers, sustainable mobility should not be left to car manufacturers. Especially when taking into account the impact alternative fuel vehicles have on the electricity system, they should be seen just as much as components in the electricity system as mobility vehicles, and it is critical the opportunity is taken to experiment and involve a broad platform of stakeholders: car manufacturers, grid operators, energy companies, scientists, politicians, and above all: users. Policy can play a vital role in this. Sierzchula (2014) interviewed fleet managers to understand their motives for incorporating EVs in their fleets. He noted that in many cases, the uncertainty surrounding EVs has been more of a barrier than the often thought of associated high costs. While policy certainly can deal with the latter, for example in the form of subsidies to lower the investment costs of EVs, there is an argument to be made that policy should be focused on the former and help create that space for experiments and knowledge transfer.
2.2.2 Infrastructure

EVs are significant enough components in the electricity system that managing when and how they are charged is crucial. It has already been shown by multiple studies that there is a danger of EVs becoming a problem for the electricity grid: they could cause power losses and significant increases in peak loads, which could require significant, expensive alterations to the electricity system (Verzijlbergh, Grond, Lukszo, Slootweg & Ilic, 2012; Eising, van Onna & Alkemade, 2014; Clement-Nyns, Haesen & Driesen, 2010). Eising et al. (2014) and Verzijlbergh et al. (2012) have analysed the situation for the Netherlands, which has one of the best performing grids worldwide (CEER, 2011), and have shown grid capacity problems can arise in one or two years at the neighbourhood level (Eising et al., 2014), and in two decades at the higher level (Verzijlbergh et al., 2012). How ever EVs should be charged, doing so instantly when they are plugged in and plugging them in whenever needed seems not to be the solution.

Isolated research

When looking at the scientific literature on how to solve this charging problem, it becomes apparent that research on EV adoption and people’s mobility needs are not taken into account. Lots of studies dealing with solutions to solve this charging problem, such as studies relating to vehicle-to-grid (V2G), seem to assume people’s driving needs are static: when people don’t drive, their vehicles are available for charging and most importantly, people are willing to consolidate and plan around the charging scheme (Tomic & Kempton, 2007). It is probably more conceivable for an energy company to enter a business relationship with organisations using a large number of vehicles than with individual EV-drivers. Moreover, the social aspects are often missing. Those aspects are sometimes mentioned, but as an afterthought. For example, Tutton and Moura (2008) question whether electric companies will see vehicle-to-grid charging solutions as an opportunity or as a threat, but do not go further into this. When Kempton and Tomic (2005b) discuss the viability of using EVs as a stabilising unit for the electricity system, they note that “[r]egulation is needed 24 h per day, and unlike peak power is often needed as much overnight as during higher load hours” (p. 289). And yet when assessing the viability of vehicle-to-grid schemes, most studies do so in a best-case scenario situated in a vacuum, while exactly considerations like the above are to be included to do so effectively. Niesten and Alkemade (2016) reviewed smart grid literature and projects and conclude that for vehicle-to-grid there is “limited attention to the business case” (p. 636).

Aggregating electric vehicles

While electric mobility might be approached from two different angles, researchers ‘from the energy perspective’ see potential for the fleets of organisations just like researchers ‘from the mobility perspective’, albeit for different reasons (§ 2.1 EV from a mobility perspective, p. 15). In steering the charging behaviour of groups of EV-drivers, Tomic and Kempton (2007) argue that “compared to individual vehicles, fleets are more easily accommodated within existing electric market rules” (p. 459). It is probably more conceivable for an energy company to enter a business relationship with organisations using a large number of vehicles than with individual EV-drivers.
barrier regarding the requirement for “individual drivers [to] surrender control of their vehicle” (Hill, Agarwal & Ayello, 2012, p. 222) is possibly easier overcome with drivers who are already familiar with sharing interest in the vehicle they use with an organisation.

A topology of fleets

What scientific literature on electric vehicles seems to be lacking at the moment is some sort of topology of existing ways to aggregate vehicles and possible new ones, and what that would mean for its possible uses. Just on vehicles of an organisation, we can differentiate for example between if the vehicles are owned or leased, used as pool cars or allocated to individual employees, used to commute, are deployed as taxis, etc. Dutch national transmission system operator Tennet has started a collaboration with mobility service provider The New Motion (Tennet, 2016): EV-owners who use the same mobility service provider could be another way to aggregate EVs. Creating a topology and differentiating between different forms of fleets would help in gaining an understanding how in the big picture they can be utilised in progressing EV infrastructure and, more practical, how this can be translated in viable business cases.
2.3 Summary

Scientific literature on electric mobility has been covered from two perspectives: first relating to ‘mobility’ and second relating to ‘energy’. EVs are seen as a sustainable solution for dealing with environmental issues, although its focus has changed over time: in the public debate, climate change instead of local air pollution has become more important, nevertheless the latter still remains relevant. Taken together with energy security aspects, ‘the jury is still out’ on the environmental potential of electric mobility. A proper verdict on this is also relevant for the adoption of EVs, as it has been shown this uncertainty can form a major barrier in consumer acceptance. EVs have initially been posed as a dedicated market niche: they have been introduced in markets where the drawbacks of EV are less pronounced (e.g. ‘the city car’) or in which their benefits are magnified (e.g. ‘the sports car’). In the maturation of electric mobility, a lot of potential is seen in the intertwinement with car sharing, a ‘social solution’ which previously has never really taken off. Even though EVs have been able to gain ‘a small foothold’ in car mobility, it is unclear if this will result in a more significant adoption. The often referred to theory of diffusion of innovations by Rogers explains when people adopt certain innovations but is not meant to predict the available potential. Its use for electric mobility is further restricted by the infrastructure-dependence of EVs.

The interaction of range anxiety and mobility needs goes further than in solely people’s daily travel requirements being met. Not only does the perception people have of their driving requirements vastly differ from their actual driving requirements, the ability to ‘drive when needed or wanted’ is an important demand people place on their vehicle, even if they may never actually do so. Here, organisations are seen as possibly more appropriate in initially adopting EV than individual consumers. Organisations are much better able to rationally assess usage patterns and resulting fuel costs, and seem more willing to exploit lower total ownerships costs for the drawback of a higher initial investment. But while organisations have been eager to adopt an initial number of EVs for testing purposes, it remains to be seen in how much this can be translated to them actually being frontrunners in a more substantive adoption of electric mobility.

From an energy perspective, electric mobility shows a lot of similarities to how we have been dealing with renewable energy. The shared desires and hopes for renewables has more often than not led to disappointment: in fact, the failures of one renewable energy technology have often been used as legitimation for the next. Already the same can be seen in the field of sustainable mobility. Electric mobility has, together with hydrogen fuel cell and biofuel, over the years gone through similar hype cycles. Also the scientific literature approaching electric mobility from ‘an energy perspective’ sees potential for the fleets of organisations to play an important role. They could be more suitable candidates for steering the charging behaviour of large groups, and their capabilities might be more easily ‘unlocked’ by energy companies through collaborating with these organisations than in trying to get a hold of individual, separate EV-drivers.
3 THEORY

The preceding literature review tries to give a concise picture of the state of the art on scientific research on electric vehicles. This is necessary to expose ‘anchors’ to which the results of this study can be linked. However, as of yet, two things in this report have remained untended: First of all, the underlying theories with which you can analyse the development of technological innovations such as electric mobility. The theoretical lens that will shape this research needs to be elaborated upon, both to provide a stable foundation for this research, as well as to take in deliberation how that theoretical lens shapes the research. Secondly, one cannot not look through a theoretical lens, meaning that the foregoing literature review is already framed a certain way. This chapter will discuss the theoretical lens taken, and work its way towards a conceptual framework that will guide the research.

3.1 Theoretical lens

Diffusion of innovation

The literature review discussed already one specific theory on the development of technologies: the diffusion of innovations (Rogers, 2010) (see § 2.1.3 EV adoption by individual consumers, p. 19). A significant part of the currently prevailing expectation that EVs are hot and truly upcoming now, has to do with the belief in this model. As electric vehicles have matured and have gained a small foothold in car mobility (at least in the Netherlands), it is argued that now society is ready for a more significant, larger adoption. The literature review shows the complexity regarding infrastructure-dependent technologies such as EV, but more importantly, that the diffusion of innovations is a theory that describes an often seen adoption trajectory of the technologies that surround us, which does not mean it has the predictive value. Using it to predict the success of yet to prove technologies involves a considerable amount of survivor bias.

A socio-technical perspective

This is a study from the field of science and technology studies, in which it is argued technological innovations, such as electric mobility, are often assessed too narrow. Technologies are in many ways a product of the human mind, meaning that the study of technology should be done broader, and more inclusive: not just taking into account technical and economic aspects, but also social, political and cultural ones (Bijker, 1987). Just how these different aspects relate, and much weight should be attributed to the “social soul in the machine” (Fischer, 1987, p. 1153), is a question of continuously contested nature (Winner, 1993). This research probably has little to add to that discussion, but the reason it is discussed, is because it is important to position the findings of this research against this background, especially since this research focuses on the user-side of electric mobility.
A concept from this field that is central for this study is that of the socio-technical system (Fig. 3-1), in which Geels (2004) depicts the production, diffusion and use of technology (in a non-linear fashion). What is interesting, is that in his paper Geels relates his approach against the backdrop of a rising interest in a sectoral systems of innovation approach. With the socio-technical system, he intends to ‘rectify’ the overemphasis of the production-side of the technology (and like so a lack of attention for the user-side). “Although firms and industries are important actors, other groups are also relevant, e.g. users, societal groups, public authorities, research institutes” (Geels, 2004). Fig. 3-2 shows a socio-technical configuration of personal transportation made by the same author, again showing that electric mobility needs to be more than just an alternative drive-train technology plus charging poles.

Strategic Niche Management and transition studies

An analytic research tool and policy tool specifically focusing on sustainable innovations is that of Strategic Niche Management. “[SNM] is the creation, development and controlled phase-out of protected spaces for the development and use of promising technologies by means of experimentation, with the aim of (1) learning about the desirability of the new technology and (2) enhancing the further development and the rate of application of the new technology” (Kemp, Schot & Hoogma, 1998). It is argued that these new promising technologies cannot possibly compete from the outset with existing technologies (and more importantly, existing socio-technical systems). In SNM, three processes are seen as central for niches to mature (Schot & Geels, 2008):

- Articulation of visions and expectations.
- Building of social networks.
- First and second order learning processes (i.e. the accumulation of facts and data versus enabling changes in cognitive frames and assumptions).

Niches need to mature. How this can be facilitated is something on which the theory of SNM itself has gone through a development. The initial work by Kemp et al. (1998), as can be seen in the above quotation, speaks of controlled phase-out, meaning the aim is for niches to create a regime shift (meaning to change among others those socio-technical systems). Later work has attributed more weight to the importance of aligning niches to these socio-technical systems so a regime shift can come about (Hoogma, Kemp, Schot & Truffer, 2002; Schot & Geels, 2007; Smith & Raven, 2012). This has gone hand-in-hand with the development of an overarching theory, called the Multi-Level
Perspective. The MLP, just like SNM and the concept of socio-technical systems, is a concept from the field of sustainability transitions. It differentiates between three different levels that interact with each other: landscape, regime, and niches. I call it overarching in the sense that it (re)combines a lot of previous theories: including SNM for the niche-level, trajectories and technological regimes (Dosi, 1982; Nelson & Winter, 1977) and the in this section discussed socio-technical system for the regime-level (Markard, Raven & Truffer, 2012) (regime being the underlying intangible elements of a socio-technical system, e.g. beliefs, heuristics, and routines (Geels, 2011)). However, one has to draw the line somewhere, and this is where the line is drawn. Transition studies try to understand global sustainability challenges, analysing systems that are inherently complex and inert, in which change thus take decades, rather than years. This study does not try to do so, but tries to, at least in regard to transition studies, show the importance of a wider notion of the user-side.

The fleet as a niche?
The most cited studies that use an SNM-approach (or are at least inspired by it) show it is mostly used to analyse sustainable energy innovations. Additionally, “SNM originally emerged from the observation that, in particular in the transport sector, many innovations with (potentially) improved environmental characteristics fail to become commercially successful” (Verborg, Mourik & Raven, 2006). These two facts seem to imply that looking at fleets of organisations using SNM is an excellent match. However, it should also be noted that there are significant differences between what this study is looking at and what SNM-studies commonly look at. Taking an SNM-approach and concentrating at the user-side of technology often means looking at civil-society and the local community. When again examining the most cited studies that use an SNM-approach, but now solely the ones that focus specifically on electric mobility, this quickly becomes apparent. The experiments analysed are (1) car sharing schemes, (2) experiments set up by local governments, and/or (3) experiments focusing on very specific niches of users (Newman, Wells, Nieuwenhuis, Donovan & Davies, 2014; Hoogma et al., 2002; Schot, Hoogma & Elzen, 1994; Browne et al., 2012; Steinhilber et al., 2013). The experiments done by large private organisations seem to match none of these three characteristics. Partly this is because different kinds of experiments are being compared here. As “SNM aims at broad and deep learning (second order learning), at the development of a broad aligned network, at widely shared specific expectations and, finally, at complementary technologies and infrastructures” (Hoogma et al., 2002), SNM-experiments do so as well. Large private organisations experiment with electric mobility to gauge the cost-effectiveness of the technology, and how it can be implemented and managed within a fleet. In essence the difference is that for the former the primary objective is second-order learning, while for the latter it is first-order learning.

This begs the question: why then still use Strategic Niche Management as an approach? Because those experiments, while maybe focusing on first-order learning, are not void of second-order learning, and that is exactly what this study is trying to examine. The aim is not only to assess how much EVs currently ‘fit’ within fleets, but also what can be learned from the organisations trying, and what they collectively learn from it (and it might well be that a lot of second-order learning is going on beneath the surface). “There are already sufficient management tools that focus on the individual project level. The SNM tool would have much
added value in providing guidelines for the management of multiple projects and their interaction” (Mourik & Raven, 2006) (Fig. 3-3).

The organisation as a user

As discussed, most studies on the user-side of EV define the user as an individual experiencing an electric vehicle, while this study tries to incorporate a wider notion of the user of EV. In a sense the organisation can be seen both as a group of users of electric mobility and as a single individual user of electric mobility: respectively the employees choosing and experiencing electric vehicles, and the organisation itself fulfilling their mobility need (Fig. 3-4). This may lead to friction, as what the organisation demands from electric mobility may very well be distinctly different from that which the employee demands. This dichotomy of the user is something that, together with the theory of SNM, serves as input for the conceptual framework discussed in the next section.
3.2 Conceptual framework

The preceding literature review and theoretical lens give an abundance of material to work with, but here things are approached from a more practical angle. An important theme throughout this previous work is the multitude of mobility needs that co-exist, but that can often also be conflicting. This is taken as a starting point for the conceptual framework (Fig. 3-5). It is expressed in one way by the disparity between the mobility needs of the organisation in relation to those of the employee, in another by 4 categories of mobility needs: maintaining flexibility, minimising costs, increasing sustainability, and keeping up appearances.

What are the most important socio-technical barriers hindering the adoption of electric vehicles in fleets of organisations?

The research question of this study has for a large part to do with mapping how these mobility needs relate to each other within fleets of organisations: initially how this works for mobility in the broad sense, but then how electric mobility influences that dynamic. This means the below depicted conceptual framework is leading for the setup of the methodology (discussed next), but also in how the results are formulated.

Interaction between mobility needs

This study analyses electric mobility incorporating both what is depicted in the horizontal orientation of the conceptual framework (maintaining flexibility, minimising costs, increasing sustainability, and keeping up appearances) and in the vertical orientation (organisation versus employee). Bear in mind that this is on itself nothing new. Individual sections of this framework have already been extensively examined by previous studies, as has been discussed in the literature...
review. The earlier cited work of Lane and Potter (2007), for example, arguing organisations are better able to assess lifetime costs of vehicles than do individual consumers, deals exactly with those differences in mobility needs between organisation and employee in the category of *minimising costs*. Egbue and Long’s (2012) research on how the perceptions of people on the sustainability of EVs relate to the effectiveness of tax incentives deals with the interaction between the category *increasing sustainability* and *minimising costs*, albeit only from the perspective of the individual user.

How all these mobility needs interact isn’t conflicting per se: e.g. the organisation wanting to achieve its CO₂-targets doesn’t have to be at odds with the employee wanting to pay less for his or her car. But these mobility needs certainly *can* be conflicting: e.g. the organisation trying to maintain the flexibility of the fleet and the workforce, and the employee picking a lease car shaped by their vacation plans. To sensibly assess the potential of electric mobility in the fleets of organisations, you have to consider the broad spectrum of mobility needs for both organisation and employee.
4 METHODOLOGY

I interviewed 10 different persons from 10 different organisations, with these persons sharing that they are in some way responsible for the organisation’s fleet of personal vehicles. This chapter covers three things: (1) what I did exactly, (2) why it is done in this way, and (3) how this leads to the findings this study presents.

4.1 Cases

What are the most important socio-technical barriers hindering the adoption of electric vehicles in fleets of organisations?

The research question of this study is in a way a misnomer: it seems to imply the answer is some sort of list of the most important socio-technical barriers. That is not what this study produces, not in the least because there would be little value in such a list. What this study tries to produce is a better understanding on how the socio-technical barriers to electric mobility interact for arguably the so far largest user group, and in what direction we should search for solutions. By ‘largest user group’ I build upon the earlier mentioned study of RVO (2015b) that concludes that “more than 90% of the Dutch electric vehicles fall under the responsibility of companies.”

Largest user group

10 ‘fleet managers’ from 10 large private organisations where interviewed. This selection is my effort in attaining the best representation of this largest user group. Best in this case does not mean average or typical: ‘companies owning electric vehicles’ is a heterogeneous mix that includes sole proprietorships, foundations and government agencies, (notwithstanding the fact that owning and using are two different things). The focus is on large private organisations for their potential to play an important role according to prior scientific research covered in the literature review, and for practical arguments. This is discussed in § 4.2 Implications (p. 38).

Selection criteria

Apart from the rationales as to why this study focuses on the mobility of large private organisations, selection criteria were used to come specifically to these 10. Criteria both in regard to the organisation, as well as the particular person to be interviewed. This was done for three reasons: (1) To make sure these 10 interviewees represent as well as possible this largest user group. (2) To increase the quality of the interviews. (3) For practical reasons: the interviewees were approached
through cold calling. Calling an organisation and ex-
expecting to be lead to the right person might not work.
Furthermore, being able to tell someone specifically
why you are asking them to participate in this study
seemed to me as to increase my chances of success. Be-
low these criteria for the organisation and the specific
person are discussed.

The organisation has to …

… have had tangible prior experience with EV.
Self-evident, as this study is for a large part about the
experiences of users with EV. It would be interesting
to examine why some organisations have in its entirety
not taken up electric mobility, but this is not part of
this study. Note that this does not mean the organisa-
tion has to have been successful with EV. A number of
the selected organisations have decided to (partly)
forego EV after piloting and testing it.

… have a very large fleet. This partly relates to the
previous criteria: the larger the fleet, the more active
the organisation can be with exploring alternative
forms of mobility, among others EV and possibly the
more potential for exploiting EV (Sierzchula, 2014;
VNF, 2016). Additionally, from the perspective of this
study, there are signals that organisations with larger
fleets have more in-house capabilities and expertise in
relation to managing the fleet (read: outsource less re-
sponsibilities to leasing companies and importers),
which helps in gaining an understanding of the users-
side of technology. (Fleet Profile, 2014; Mckinsey,
2016; Follow the money, 2014).

… use their fleet of vehicles to cover large parts
of the Netherlands. Electric vehicles have initially
been posed as solutions for specific niches (think of the
rise of the EV as a ‘city car’ (van Bree, Verbong & Kra-
mer, 2010)). The mobility needs of employees whose
vehicles are part of the fleet of a large organisation are
not equal, meaning parts of the fleet are presumably
better suited to EV than others. However, the selected
organisations should have large parts of the fleet that
are used to drive a substantial number of kilometres in
varying settings, to assess the viability of EV in ful-
filling a more substantive role in the mobility of the
Netherlands.

… utilise their fleet separately from their core
business. This criterion is meant to exclude grid oper-
ators and energy companies. EVs pose a threat and
provide an opportunity in relation to the electricity
grid and energy products. This means these type of or-
ganisations may have interests in adopting EVs in
ways that other organisations do not share. This study
focuses on organisations that use their fleet for mobil-
ity purposes.

For the specific ‘fleet manager’, …

… his or her involvement in the mobility of the
organisation has to be known beforehand. So far fleet
manager has been put in quotation marks because in
practice there is no such thing as a fleet manager: the
responsibility for mobility and likewise the fleet is
something that is shared by various departments
within the organisation, and how this is shared differs
per organisation. Additionally, how mobility is ap-
proached depends on who you ask: hyperbolically
speaking, an HR-manager sees the fleet as an opport-
unity to attract talent, a representative of the depart-
ment of corporate social responsibility (CSR) sees the
fleet as an emission source to be contained. Having an
initial understanding how the interviewee ties into the
mobility of the organisation allowed for more depth in the interview.

... there should be ‘evidence’ of previously having discussed mobility on both a strategic and operational level. Mobility is a widely shared responsibility in any of these large organisations, as the fleet alone is responsible for often between a third to half of the CO₂-output. From every interview, I wanted to learn how electric mobility fits in with the mobility needs of the organisation in the broad sense, but also for example what the experience is of employees participating in a recent pilot with EV. By selecting persons from whom I could find earlier evidence that they discussed mobility over this range, I tried to negate the chance of asking the wrong questions to the wrong person.

**Interview proceedings**

The interviews were semi-structured, meaning a guideline was used to discuss several themes and specific items, but with flexibility to promote discussion and interaction (Appendix 1 – Interview guide, p. 82). They were held face-to-face and were recorded and subsequently transcribed. All interviewees participated under the condition that the interviews would be worked out anonymously, and that this study only draws conclusions ‘over the 10’, and not on an individual basis (Appendix 2 – Research description for interviewees, p. 83). 9 out of 10 agreed that it could be disclosed their organisation took part in this research.
4.2 Implications

With this study I try to gain an understanding how organisations adopt EVs to fulfil their mobility needs, and with this report I try to make it understandable for others. But interviewing 10 different fleet managers from 10 different organisations might not be the best way to go about gaining such an understanding (Fig. 4-1). As discussed in the § 3.2 Conceptual framework (p. 33), the disparity between the mobility needs of the organisation in relation to those of the employee is taken as central. Then why not interview 5 fleet managers and 5 employees from those organisations, to be much better able to show this disparity? That same conceptual model depicts the varied mobility needs that the organisation itself has. Why not, from 5 organisations, relate the perspectives of the HR-manager to that of the CSR-manager? A large part of the answer has of course to do with practical constraints, but that is not what this chapter focuses on. I argue this flawed methodology can still lead to valuable, valid answers to the research question, but that it is imperative to examine how this methodology affects what can be found (which is important nonetheless).

Research design

This study is an exploratory multiple-case study. The work of Yin (2002) is used to discuss more thoroughly the methodological quality of this study. In a study of this kind, Yin argues three measures are of importance: construct validity, external validity, and reliability. The unit of analysis of this study can be formulated as the decision-making and experiences of the organisation in regard to their fleet. This means the 10 selected organisations serve as the 10 cases. At the same time, none of the 10 cases are discussed individually in this report (primarily because if that was the plan, none of the participants would have participated in this study). On the one hand this is okay, the value of this study is in the cross-case analysis, on the other hand this does create issues. The heart of the problem is that each case is represented by one interview. Yin defines construct validity as “identifying correct operational measures for the concepts being studied” (Yin, 2002, p. 34). He argues using multiple sources of evidence (in the form of data triangulation) is an effective measure to increase construct validity. Thus the construct validity on a per-case is a concern. To put it in more simple terms: if an interviewee tells me a lie, how am I able to discern it as a lie?

... which represents electric mobility in the Netherlands
national policy support
EV infrastructure
vehicle technology

... that represent electric mobility in fleets of organisations
employees
leasing companies
importers

... who represent these organisations
large
private
drive many kms
fleet covers large parts of NL

interviewed “fleet managers”

interviewees

Accenture
Heijmans
Capgemini
KPMG
Centric
PWC
DSM
Sogeti
Engie
Services
[anon.]

Fig. 4-1 A study on the user-side of electric mobility.

Partly this is dealt with by the fact that each case is in practice represented by more than just the interview: annual reports disclosing information about the mobility of the organisation, numerous informal interviews with other market parties, analysing earlier in-
terviews (sometimes by colleagues), studies by analytics companies, etc. But the most important way this is dealt with in the research design is in the way the cases relate to each other. The strict criteria for the case selection, discussed previously, serve as an attempt to increase the utility of each preceding case for the next, which also relates to the external validity of the study. Yet this flaw is not cancelled out completely. Two of the ten interviewees, right after the interview, revealed information that was very relevant for the case, but which they acknowledged they were not willing to disclose during the formal, recorded interview. In both instances this had to do with the organisation’s collaboration with other parties. This example very clearly shows that there are certain things this study is unable to examine thoroughly, in this case in regard to mapping the exact role third parties play in setting up EV in these organisations. But what this study can do is show for which employees EV is a suitable form of mobility, what potential exists to increase that share, and how these organisations perceive EV as a solution to their mobility needs, three areas that have been relatively unexplored. In § 4.3 Outline of the findings, the implications are linked to the results that are presented thereafter.
4.3 Outline of the findings

This section discusses how the collected data in combination with the aforementioned research design leads to the findings presented in Ch. 5 to 8. As can be seen in the interview guide that served as a structure for the interviews (Appendix 1 – Interview guide, p. 82), I discussed multiple themes with the fleet managers: the current situation in regard to electric mobility in these organisations, how the employees use and charge EVs, how over time they came in contact with and experienced electric mobility, and the decision-making in relation to their employees, to other departments, and to external parties. Central in forming this structure has been the findings from the literature review. In analysing the data however, I used the conceptual framework as a reference point (Fig. 4-2) (§ 3.2 Conceptual framework, p. 33). As discussed there, this study aims not per se to identify additional barriers to electric mobility (there seem to be more than enough), but to examine how they interact: both for in the horizontal orientation (flexibility, costs, sustainability, appearances), as well as in the vertical orientation (employee, organisation).

To every argument made by the fleet managers, a keyword was attributed. This was a very unrestricted, unstructured procedure leading to a scramble of around 80 of such keywords (Appendix 3 – Analysis process, p. 84). Using the conceptual framework to identify when similar conflicts between mobility needs were discussed, an iterative process lead to a consolidated 20 keywords that both represent what the interviewees expressed and the mobility needs distinguished in the conceptual framework (Appendix 4 – Analysis in relation to the conceptual framework, p. 86). Subsequently, all arguments made by the interviewees were categorised as one of these 20, helping in structuring and comprehending what they expressed.

The findings are organised in four chapters: Ch. 5 Where EV takes form (p. 41) describes the position that the lease car, not just EV, has in the mobility of organisations. It continues on how plug-in hybrid and full electric have been handled differently over time. Ch. 6 Charging (p. 49) considers how organisations have dealt with the responsibility for charging, how they have collaborated with market parties on this, and in what way charging options are utilised by employees. In Ch. 7 Threat to flexibility (p. 55) the future potential of EV is the central topic: how these fleet managers assess this, and how these organisations experience electric mobility in the search for more sustainable forms of mobility. Lastly, Ch. 8 Smart mobility (p. 61) discusses how the direction the mobility of the organisation is going towards interacts with firstly, national mobility policy and secondly, the products and services offered by the market.
This chapter discusses the position that the lease car has in the mobility of the organisation, and for which users exactly EV has been able to gain a foothold. § 5.1 *A car as a right* shows how the lease car fulfils many needs, only of which a few have to do with actual transportation. The great majority of EVs in the Netherlands are plug-in hybrid, not full electric, and § 5.2 *The stimulation of plug-in hybrid* deals with the interaction between national fiscal stimulus and the organisation’s mobility policy. Slowly, full electric is becoming a more viable alternative, and organisations have been better able to manage that (§5.3 *Demand for EV from 2 groups*).

## 5.1 A car as a right

“We leave it up to the employees, to avoid that those who live a bit further from work cannot enjoy the tax benefit while the ones closer to work can.”

interviewee 1

“We we leave it up to the employees to put that in perspective: 2% are about pension. Both cost us about the same.”

interviewee 7

“It has to have a tow bar because it needs to be able to pull a caravan. You have to be able to use it to go on vacation. The demands for a lease car are much more dictated by private needs than by professional needs.”

interviewee 6

The fleet of lease cars can have a substantial part in the total CO₂-emissions of an organisation. Depending on the core business, this share can mount up to 50% or more. Thus when the moment arrives that an employee has to pick a new lease car, numerous measures are in place. There is the restriction based on the measurable sustainability of the individual car. Standardised tests of fuel efficiency and CO₂-emissions allow organisations, in collaboration with lease companies, to guide the employees towards the right vehicles. Not every employee gets to choose from the complete selection of cars: depending on the type of function, depending on the ‘height’ of your function, certain cars are available and others are not. Apart from the availability, the individual has to decide what he’s willing to spend on a car, as picking a car requires investments not only from the employer but also the employee himself (for the sake of convenience, government policy effects are brought into the equation later). There are countless other measures the organisation has to its disposal in managing the fleet: granting mobility budgets instead of directly providing lease cars, offering other types of modalities, putting restrictions on how the lease car is used, etc.

Although less tangible and direct, the employees collectively have power in shaping the mobility of the organisation as well. The employer might be cost-driven and have carbon emission reduction goals, they are treading a fine line not to harm other interests: The lease car is a form of mobility, but above all, an employment benefit. Of course the organisation is acutely...
aware of the role mobility plays in both job satisfaction and attracting new talents to the organisation. But the tug of war over the lease car is not only between the employer and the employee. ‘The employer’ is represented by different departments within the organisation, that are in different ways responsible for mobility (Fig. 5-1). This all leads to a rather peculiar end result: A car that is perfect 80% of the time but inadequate the other 20% is not good enough, it has to do a reasonable job 99% of the time. ■

“We should tighten the CO2-limits and further restrict our user-chooser policy if we wish to achieve our company-wide CO2-goals.”

“We need to invest in our mobility. People care disproportionally about mobility, meaning it allows us to become employer-of-choice and attract talent.”

“EV poses a threat. Our mobility above all needs to be predictable so we are able to reduce costs.”

“Let’s say you drive with a heavy right foot, and you don’t reach 1:15… we’re not going to punish you. We’re not going to send you the bill for a higher fuel consumption. [Organisation] doesn’t really like to punish, we favour reward.”

“Interviewee 10”

“Interviewee 7”

"When you do well, [organisation] pays you, simply because we don’t want to profit from your fuel savings. But if you do poorly then you have to pay. And those are considerable penalties: we’re talking about €500 to €1000 here. I see this at home with my own children as well. Everyone tells me I need to be nice, and I’ve tried that once. Punishment works much better.”

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**Fig. 5-1** Exaggerated view of how mobility is approached differently by different parts of the organisation.
5.2 The stimulation of plug-in hybrid

“So because of our own policy plus that of the government, we’ve attained our CO2-goals rather easily to be honest. But that’s going to change.”

interviewee 5

“So because of our own policy plus that of the government, we’ve attained our CO2-goals rather easily to be honest. But that’s going to change.”

interviewee 5

“In 2012 we were rather late with allowing electric vehicles. Many of my competitors decided to do so much earlier, and based their calculations on the figures given by lease companies. When the efficiency of those cars proved to be much lower, they had a big problem: often the leasing policy didn’t allow for the extra costs to be passed onto the employee, as that’s not what you normally do with cars. We haven’t made that same mistake.”

interviewee 10

“Ultimately we want to get rid of those plug-in hybrids. You need to apply so much effort to steer towards the right behaviour.”

interviewee 3

Surely an important dimension in this balance between the mobility needs of employer and employee is policy measures by the government. Vehicle registration tax [BPM], road tax [MRB], and a tax on private use of a company car [‘bijtelling’] are taxes on which EVs receive (or have received) a preferential treatment compared to ‘normal cars’ (ACEA, 2016; IEA, 2016). And this is just national policy, with regional policy often also chiming in (Nissan, 2016). The tax landscape for vehicles has been one for dispute and controversy, long before the whole EV-thing came up. But despite its contested character, it has been quite effective. Especially the fragmentation of the tax on private use of a company car based on its measurable sustainability has been crucial in shaping the fleets of organisations: throughout the decades, people have chosen smaller and more sustainable lease models, motivated by tax exemptions (Kok, van der Linden, Smokers, Verbeek, 2014). It is important to discuss how up to this moment, before EV, fuel costs were incorporated in the leasing policies of organisations. On the one hand the aggregated fuel costs of the fleet can really add up. It is vital for organisations to manage this effectively, and pressure their employees to choose and drive sustainably, and make them responsible for the costs they’re making. On the other hand, the main priority is for people to actually do their job. Tasking employees with too many administrative tasks to monitor their fuel consumption and pressuring them not to make trips they actually should be making, probably has a positive impact on the mobility performance indicators of the organisation but creates consequences elsewhere. This, together with the employment benefit elements discussed earlier, means fleet management is a balancing act of a very iterative nature: it is all about predicting fuel costs, re-adjusting afterwards, and creating ‘one size fits all’ solutions.

In comes electric mobility. It becomes apparent from these interviews that plug-in hybrid has mostly arisen from the demand of the employee. Looking at the number of EVs in the Netherlands, it is interesting to see that full electric came before plug-in hybrid: at the end of 2011, there were 1,124 full electric vehicles and only 17 plug-in hybrids in the Netherlands (Fig. 5-2).

Full electric has over the years gone through a steady increase towards around 11,000. It has however, for a long time been seen as ‘not yet mature enough’, and plug-in hybrid was deemed a viable alternative (Ministerie van Economische Zaken, 2011). Fig. 5-2 shows how plug-in hybrid really started taking off from 2013.
onwards. But from the perspective of the organisation, from the perspective of “predicting fuel costs, re-adjusting afterwards, and creating ‘one size fits all’ solutions”, plug-in hybrid has been very much a threat. Experience showed that that the standardised testing figures of the fuel efficiency of petrol and diesel cars have been off by 30 to 40 percent (Kok et al., 2014), and that is something organisations take into account. But what became clear for plug-in hybrid is that not only do these numbers rise twofold or more, it depends very much on how you use the car.

Many organisations have learned the hard way the risks that come with plug-in hybrid, and speaking with ten of them a few years into it shows the ‘once bitten, twice shy’ mentality that has arisen. Ultimately, there are three ways in which plug-in hybrid is dealt with (Fig. 5-3). Option (1) is to skip it. Either through testing it themselves, or by learning from others (see the second quote of this section), an organisation sees plug-in hybrid as too high a risk, and decides not to adopt them (read: not to allow their employees to pick them). Option (2) is to set up strict conditions for the employees to be able to pick plug-in hybrid, so that it ends up at ‘the right place’. Employees who do not meet these requirements are not able to choose a plug-in hybrid. Option (3) is to create additional policy measures so that, while the employee is able to choose plug-in hybrid, he himself is to a high degree responsible for his fuel costs: he bears the risks that come with plug-in hybrid (and the possible benefit as well). Whether an organisation goes for option 2 or 3 depends not only on their assessment of the effectiveness of plug-in hybrids in fulfilling their mobility needs. Plug-in hybrid is stimulated and placed on the agenda of these organisations, and their decision-making revolves just as much around how it could fit in with their current mobility policy. To put it in other words: the mobility policy can’t be overturned for a couple of plug-in hybrids. Option 3 is only available to organisations where fuel costs are already more directly a responsibility of the employee (remember, fleet management is about creating ‘one size fits all’ solutions). In relation to the question “how fuel efficient are plug-in hybrids?”, one can’t answer this without taking into consideration where organisations are able to deploy them, and how able they are to compel their employees to ‘use them right’. This results in, on the individual level, a plug-in sometimes being branded a success and sometimes an utter disappointment (see the two quotes on the next page).
Both option (2) and (3) have some issues. Option (2) results in the exclusion of large parts of the organisation: “You have to be able to charge at home, otherwise you can’t pick a plug-in hybrid”, “You have to ‘prove’ beforehand you’ll be able to drive electric with a plug-in hybrid”. Measures like this generate constant friction between employer and employee. Option (3) seems at first sight a natural way to make sure plug-in hybrid ends up at the employees whose mobility needs it fits: it is now their own responsibility. But there are two major problems here. The first is that this responsibility entails the employee having to assess in how much he’ll be able to drive electrically over his full lease-term (often 3 to 5 years). If he can do it, he’ll be better off financially because of the significant tax incentive. If, after a year his job requirements change and he isn’t able to do it from then on, he pays dearly. Subsequently, people often deem plug-in hybrid too risky. Early on when organisations had allowed plug-in hybrid without implementing the right policy measures, the employee could come to the conclusion that, “with my tax incentive and my employer paying for a large part of my fuel, I can just drive petrol and still be better off.” When the employer has been able to shift the responsibility for fuel costs to the employee, that couldn’t be done. However, this is the second and biggest problem, ‘plug-in hybrid’ as a technology has not been static. It has become clear from these interviews that the type of car models that have been available and adopted in these organisations has shifted over time. This shift in car models (brought forth by the room fiscal policy has allowed for it), together with organisations altering their mobility policies, resulted in the carousel depicted in Fig. 5-4. The conclusion “I’m going to pick a plug-in hybrid and drive petrol” became viable again.

“We’ve got lots of people driving around in Mitsubishi Outlanders who are getting 1:120, 1:130, so it is possible.”

interviewee 7

“We base the fuel efficiency on actual consumption, and we see that for example a Mitsubishi Outlander drives 1:10. The regulatory standards telling us it’s 1:40 are meaningless.”

interviewee 4

The tax incentive creates a demand for PHEVs from employees. Leasing policy optimised for fossil fuel cars together with too optimistic efficiency estimations result in the employer bearing the costs.

Organisations adapt their leasing policy to make the employee much more responsible for fuel costs. The employee spends his tax incentive on higher fuel costs.

The employees get their tax incentive on higher fuel costs. The government is stimulating a €60,000 car that drives 20 kilometres electric.

Fig. 5-4 General trend of ‘shifting the blame’ by the interaction of national fiscal policy, car development, and the organisation’s leasing policy.
5.3 Demand for EV from 2 groups

“If you order the Tesla instead of the BMW, you will save €9,000 on taxes each year. The car serves as a good representation for this organisation, and you can use that €9,000 to rent a normal car in your vacation that is able to tow your boat.”

Interviewee 3

“Plug-in hybrid is hardly at the staff; it is mostly chosen by the sales. That has everything to do with the fact that V60s, C-Classes, Outlanders... staff employees haven’t got the money to drive a €80,000 car and pay fiscal tax on that. They on average choose more affordable cars, which usually aren’t plug-in hybrids.”

Interviewee 2

“Two groups of people get a car here: for practical reasons, if you have to drive a lot of kilometres, or as an employment benefit, based on the ‘level’ of your job. From both groups the demand for electric was about the same, but luckily we’ve managed to deploy it in the right one.”

Interviewee 3

The previous section discussed how the danger of plug-in hybrids mostly being driven on petrol has existed from the start up till now, albeit in different forms. However, it also mentions how some organisations have been able to ‘find the right place’ for plug-in hybrid, and this goes for full electric as well. This section goes deeper into what ‘the right place’ means: who pick EV and why, and where these organisations have been able to deploy it so that they and their employees are satisfied with the result. As mentioned, plug-in hybrid was mostly a demand from the employees wanting to take advantage of the tax incentive. Full electric however, has initially been much more actively sought out by these organisations: the majority of these organisations have actively experimented with full electric, often already early on (2011, 2012). This is discussed more thoroughly in § 7.1 The necessity of experimentation (p. 55). Most often these early experiments have been the cue to drop EV, or at least wait until it is more mature. In the last few years as full electric has matured, it also has seen a demand from employees. Looking at the specific numbers of EVs that reside in these fleets now, we can see that taken together the interviewed organisations hold a bit more than 1 percent of all the electric vehicles in the Netherlands. A quarter of that is full electric. What is interesting to see that when looking at the specific car models that make up that quarter, 80 percent are Tesla Model S. The other twenty percent are for the large part Nissan Leafs and a few BMW i3s in car sharing positions. So this study might be about electric mobility, and in a larger context how electric mobility fits within the mobility needs of organisations, but it is very much about one specific car model. Collectively, these fleet managers show very clearly that there are many things standing in the way of a more significant adoption of EV in their fleets, things that are remarkably absent from the public discourse on electric mobility. But those representing the organisations where the Tesla Model S has ‘landed’, express the idea that “despite the issues, and despite that of course the Tesla Model S is only suitable for a very specific group of people, the fact that ‘it’s working’ means that EV will come along eventually.” This is explored in § 7.2 Expanding upon EV (p. 57).

Considering for a moment the financial proposition that an individual electric car provides, it is distinctly
different from a petrol or diesel car: a much higher ratio of investment costs in relation to fuel costs. Of course, currently electric mobility is not yet mature enough to compete independently and it is overall more expensive, but even if it would become competitive in the future, the whole concept of an EV is to have a different ratio: the battery in an EV makes the investment costs relatively higher, the input of electricity instead of petrol or diesel makes the fuel costs cheaper. From this perspective, the financial returns of an EV compared to that of a traditional vehicle become higher the more it is driven. At the same time however, the limitations that exist in terms of range and charging capabilities make an EV only a suitable alternative when your mobility needs are (a) predictable and (b) limited. This points in the direction of EV being suitable for private ownership (as this target group on average drives less than employees leasing cars (Nederland Elektrisch, 2016b), or in these organisations at least the commuters, who drive relatively few kilometres and in predictable ways. How this contradiction is ‘solved’, and why full electric can still be successful in a number of these organisations, has everything to do with what was discussed in § 5.1 A car as a right (p. 41): “The lease car is a form of mobility, but above all, an employment benefit.” A number of the interviewed fleet managers were surprised to see their employees’ willingness to adapt to plug-in hybrid and full electric after choosing them, but all expressed that from the beginning right up until now, the tax incentive has been by far the most important reason for choosing EV in the first place. The lack of conviction in the inherent sustainability of EV that is apparent both on the side of the employee and the employer is discussed more thoroughly in § 7.3 Predictable overall, variable individually (p. 59), as this has implications in how organisations see EV as a future solution.

Both plug-in and full-electric have seen demand at the higher levels in the organisations. Depending on the role mobility has in the organisation, the threshold as to what is ‘high enough’ varies. For the demand for EV that exists above this threshold, these organisations try to differentiate between those whose mobility pattern is predictable enough and, most of all, marginal enough, and those for who EV would create issues (Fig. 5-5). It is here that plug-in hybrid and full electric mostly differ: with full electric they have been much more able to do so.

![Fig. 5-5 EV has been successful as an employment benefit product.](image-url)
6 CHARGING

When the employee picks an EV, is it the responsibility of the organisation to provide him with means to charge it? § 6.1 The Battle of the Car Park illustrates how organisations facilitate charging at the office, and how that has not always come easy. It is evident the ability to charge at home is still very much an important requirement to be able to drive EV (§ 6.2 Public & at home). § 6.3 Responsibility for charging discusses how in a larger scope these organisations see the charging of EVs, and how they have collaborated with third parties on charging facilities.

6.1 The Battle of the Car Park

“At nine o’clock, someone from facilities or security walks past all charging points and notes the licence plates. They do so again at precisely five to one. Who hasn’t moved their car at one o’clock gets an angry mail. After that, an even angrier mail. The following step is blocking your charging card.”

Interviewee 7

“In the beginning, we had not organised things so strictly. Things quickly got out of control. Between your facilities and your HR, you have to make good policy on your infrastructure.”

Interviewee 7

“Yes, I know of some organisations that cram their car parks with charging points. I know of an EY, an ING, organisations like that. But for what kind of cars? Panameras, Teslas... not Nissan LEAFs or Renault Zoes.”

Interviewee 5

An inherent aspect that ties in with the adoption of electric vehicles is organising the ability to charge them. As charging an EV is not yet so commonplace as filling up a diesel or petrol car, these organisations had to decide how much to facilitate this, and how much they could rely on public facilities. All have arranged charging points at their office locations, but to vastly different degrees: some have only a handful, others have dozens. This has to do with, next to of course their varying degree of success with EV, both how the organisation sees their responsibility for charging, and their actual ability to expand upon the number of charging points at the office. There is high uncertainty how, when EV would grow, charging would look like on a large scale: are in the future people going to be charging mainly at home, in the car park at the office, or in the public space? This uncertainty is seen for some as a reason not to load their car park with charging points, which is undoubtedly a large and long-term investment. At the same time, some fleet managers see the availability of charging points at the office as decisive for the adoption of EV within their organisation. But just as crucial as their willingness, is their ability to expand upon the number of charging points at the office. Parking space on itself is clearly a more pressing issue for some than others. Some organisations lease their own building and parking place; some share a high-rise with limited parking capabilities. On the subject of leasing real estate, there is the need to collaborate with the property owner (and sometimes an additional parking operator), and expressed as well was the additional risk of investing in charging points at a
rental that you could be leaving in a few years’ time. The current accommodation situation can prevent an organisation to take on such a role for EV.

But this chapter is not called *The Battle of the Car Park* for nothing. Every organisation that has even to some degree relied on their car park to facilitate the charging of the EVs of employees has experienced the challenges that arise with that: When an employee arrives at the office in the morning and plugs in his EV, how do you get him to unplug his EV and move his car when its full? When no measures are taken, the result is that they do so at the end of the day, when they leave the office. This means every charging point is able to charge only one EV per day (meaning per socket, some charging points have 2 sockets). In theory, depending on the types of cars and mobility needs, this number could be much higher. Hiring additional people to move those cars (valet charging), forcing employees to at all times interrupt their meetings to move their car once it’s full, these are drastic ways in which such a higher number could be attained. In practice however, many organisations have severely underestimated the effort required to make this work. They often settle on 2 EVs being charged per day per point, with the employee having to unplug and move his EV around lunchtime. The organisations get this done by putting the employees that have chosen an EV in app groups and on call lists, to try to foster some kind of community that can handle charging among themselves. But more importantly, quite a bit of force is needed: EV drivers are obligated to move their EV during lunchtime, otherwise harsh sanctions are imposed.
6.2 Public & at home

“I think that of the 200 that drive electric, only a handful, about 5, haven’t got a home charger.”

interviewee 6

“How am I going to offer EV to the people who can’t charge at home, without stuffing the car park full with charging points? That’s something I just don’t know.”

interviewee 5

§ 5.2 The stimulation of plug-in hybrid (p. 43) discusses how organisations either avoid plug-in hybrid or attempt to position it the right way. Table 6-1 shows a number of examples of specific measures taken in regard to the charging of plug-in hybrid. What becomes clear from speaking with these organisations is the high degree of EV-drivers, not just plug-in drivers, who rely on a charging point at home. Every one of the organisations where EV, either plug-in or full-electric, can be chosen as a lease car opt to include by default a home charger in the lease contract. As mentioned earlier, for some organisations this is compulsory to be able to pick an electric vehicle, for some the employee can forego a home charger in his lease contract.

Table 6-1 A number of examples of measures taken with plug-in hybrid.

<table>
<thead>
<tr>
<th>Charging requirements</th>
<th>Usage requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>You need a home charger.</td>
<td>You have to be able to drive 75% of the time electric with your plug-in hybrid.</td>
</tr>
<tr>
<td>You need a home charger and a charging points at the office available.</td>
<td>You have to be able to daily drive the battery capacity of your plug-in hybrid.</td>
</tr>
<tr>
<td>You don’t need a home charger, but there must be a public charging point within 500m from your home.</td>
<td>You get up to 20,000km paid for, based on the EC-standards + a small margin. The rest you pay yourself.</td>
</tr>
</tbody>
</table>

But even for the organisations where a home charger is not mandatory, and where they have filled their car parks with charging points, the majority of EV-drivers also rely on a home charging point (the organisation of the first quote of this section being one of them). At the same time a number of fleet managers expressed both their own and their employees’ interest in charging being done as much as possible at the office, as corporate energy prices are much lower than consumer energy prices. So the preferred place to charge seems to be the office, but for the adoption of an EV a charging point at home is crucial (Fig. 6-1). As 70 percent of Dutch citizens do not have a private driveway (Nederland Elektrisch, 2016a), it seems most EV-drivers from these organisations are part of that other 30 percent. The exception to this of course being the group of people that is able to pick a plug-in hybrid, drive petrol and enjoy the tax benefit.

Fig. 6-1 A home charger is a requisite to be able to drive electric.
Still, while this study shows how little is relied on public infrastructure on a day-to-day basis, the importance of its role in the actual adoption of EV is something that has not been determined. The organisations with offices spread throughout the Netherlands see electric mobility form disproportionately at places where public infrastructure coverage is highest. While this could be simply because this is where their main offices are located and thus where the ‘target group’ discussed in § 5.3 Demand for EV from 2 groups (p. 46) is largest, it could also be that, although on a day-to-day basis a dense public charging infrastructure is not being depended on much, the availability of it is vital for the adoption of EV (Ahman, 2006).

“In my neighbourhood we’ve got a few public charging points. I know all those Outlander drivers that use them have their little WhatsApp-group: ‘Hey, sod off, now it’s my turn to charge.’ But if I fail once to get my LEAF in between, I’m in big trouble, while they just go petrol.”

interviewee 5

“And sometimes it’s just plain theft. And the government has no policy on this: make them display on their charging points what they cost, just like taxis have to put their prices on the windshield. The employees often don’t see this, but as the employer, we do. I feel this is a big hiatus in the professionalisation of EV.”

interviewee 7
6.3 Responsibility for charging

“They take a 33% margin. I paid for the charging points, I paid for the back office... When Shell would do something like this there would be hell to pay, but when EV-Box does it we all seem to be fine with it. It’s an insult to the corporate market.”

interviewee 6

“But what you run up against: a party like The New Motion again collaborates with all kinds of subcontractors. So you’re again working with an installer... You go through many layers, which sometimes can make things more difficult.”

interviewee 8

“The proposition is for all these parties very product-based. ‘I want to sell you a charging point.’ ‘I want to sell you that back office-functionality.’ And these components have to be profitable individually.”

interviewee 6

The adoption of electric vehicles requires the staff services that are responsible for the mobility of the organisation to take on a very different role. Through the leasing company, they come in contact with unfamiliar organisations with which they need to arrange the charging facilities at the office. Every employee that decides for an EV requires a four-way collaboration between employer, leasing company, mobility service provider (MSP) and employee to establish the home charging situation of that employee (Fig. 6-2). When an organisation decides, “we’re going to provide charging solutions for our employees at the office”, the follow-up question is going to be, “out of which department’s budget?” One of these organisations got momentum going by initially the HR-department paying for the first few charging points until facilities’ budgets could be increased, as well as allocating charging points meant for the office’s car park to the lease contracts of individual employees.

The 3 quotes above, plus the last quote from the previous section, deal with the common expressed notion that the world of electric mobility is simply not yet mature and professional enough for these organisations to do business with in more substantive ways. On the one hand this is natural: a new technology such as EV requires new ways of working, between parties that are unfamiliar with each other. It is inevitable this comes with a bit of conflict. It could be argued it is only a matter of time before procedures and processes like these are streamlined. On the other hand, it is exactly what could stand in the way for electric mobility. First of all because from the perspective of these fleet owners, it is an awful lot of work considering 95% of their fleets is arranged in much more straightforward ways. More importantly however, because the many challenges ahead for electric mobility require not just ‘doing business with’, but much more fruitful collaborative partnerships than seem to exist today.

![Fig. 6-2 The adoption of EV requires the employer to be involved in arranging the home charging situation of the employee.](image-url)
7  THREAT TO FLEXIBILITY

EV for the organisation attempting to keep its workforce able and flexible works very differently from EV for the individual adopter. To handle a changing mobility landscape and volatile policy support, organisations need to above all remain informed and explore their options (§ 7.1 The necessity of experimentation). In § 7.2 Expanding upon EV, the role EV has in the mobility of these organisations is elaborated upon by discussing the measures they have taken to integrate EV in their fleet, and what technological progress on the front of EV means for this. In the wider scope of the mobility of organisations, EV is only one of the contenders. It is critical not only EV 'plays well with the rest', but has a clear relation to the striving of organisations to attain their CO₂-goals (§ 7.3 Predictable overall, variable individually).

7.1 The necessity of experimentation

“We knew we had to look at electric, because that is the only thing that can lead to a win-win situation for us and the employees if we want to accomplish our CO₂-goals. We have to find out if we can get it operable in a professional fleet.”

interviewee 5

“And when such a VW Golf comes around, and it actually has that range, then of course I’m willing to say: let’s deploy 10 of those. We’re just gonna try them.”

interviewee 4

It has to be emphasised how much this study is actually about the Tesla Model S, and how little, unfortunately, about more affordable available electric mobility. It was mentioned that these organisations have, combined, a bit more than 1 percent of Dutch electric vehicles in their fleets (plug-in hybrid + full electric). When we detract from that all the plug-in hybrids, all the Teslas, then what is left is slightly less than 50 EVs. When we detract from that EVs with a range extender, we are left with about 30 EVs. This implies that full electric, bar the Tesla, has not left the experimentation phase. For these organisations ‘experimenting with EV’ has meant leasing 5 to 10 EVs and cooperating with suppliers to learn as much as possible about their applicability (often despite the business case). However, many of these fleet managers expressed how they have (partly) been able to return those EVs, as they were not seen as able to fulfil an adequate role within the organisation. These findings are in line with previous work discussed in the literature review that stated ‘the testing of new technologies’ as the main reason for this adoption (Sierzchula, 2014). However, as § 5.2 The stimulation of plug-in hybrid (p. 43) noted, this ‘testing’ should be seen broader than just in relation to the evaluation of ‘new technologies’. It is not just about coming to an accurate assessment of electric vehicles, but much more so about how it could conceivably fit within existing mobility policy.

It is here that national policy on mobility is seen as a big risk factor. As noted earlier, government support has been vital over the decades for organisations like these to make their employees pick more sustainable vehicles. But especially for electric mobility, national
policy has above all been very volatile. A number of organisations stated the luck they have had in regard to their experimentation decisions coinciding with changing national policies, allowing them to gain momentum and get electric mobility going. Others in hindsight saw themselves stepping into plug-in hybrid too late, as it would later become clear policy support would move away from plug-in hybrid, and they lament their lost efforts. Ch. 5 Where EV takes form (p. 41) tried to illustrate how the mobility policy of organisations is inherently inert, and to a high degree about ‘one size fits all’ solutions. Although this study has been unable to examine exactly how these pilots and experiments emerge, it has become evident much of the responsibility and initiative lies at the suppliers (leasing companies, importers, mobility providers), and these experiments are done in a collaboration between supplier and the organisation. Especially when taking into consideration these two notions, the inertia of mobility and the collaborations required for exploration, it becomes clear the volatility of national mobility policy on itself is a hindrance to change.

“And then you see that while the experiment was originally cost-driven, the real value is somewhere else: the ambassadors we gain within the organisation, the impact on our sustainability, but most important, the image of the organisation. But for the internal budget holders, experiments like these are primarily cost-driven.”

interviewee 3

“I’m not going to do a pilot with 5 Teslas for the board of directors. It has to be for the average employee. That puts restrictions on your pilot.”

interviewee 5
7.2 Expanding upon EV

“It has to fit for at least 30 to 40 percent of your population. So from a business case perspective, an electric vehicle is a very risky car to have in your fleet.”

Interviewee 9

“When they quit before their contract is up, should I tell them: ‘I amortise your charging pole over 3 years. If you leave after one and a half year, it'll cost you €750, then the pole is yours and I take over your lease contract’? And what do I do with that car? Am I going to pay for a new pole for the remaining years?”

Interviewee 5

“The moment they want to go to France, they themselves are okay with the risk of stranding with their Teslas. But since wife and kids are coming along, I get the question: ‘Haven’t you got a spare petrol car somewhere? Can I use it for 2 weeks?’ Since everyone asks this at about the same time, we only do this for directors.”

Interviewee 10

“Despite the issues, and despite that of course the Tesla Model S is only suitable for a very specific group of people, the fact that ‘it’s working’ means that EV will come along eventually.” While the previous section accentuates the diminutiveness of full electric, it was mentioned already in § 5.3 Demand for EV from 2 groups (p. 46) that the Tesla Model S has had an impact at some of these organisations, and the above depicted argument was often articulated by those fleet managers. While plug-in hybrid came mostly from the demand of the employees, and full electric has been more about the organisation deliberately seeking out learning, overall the relative high numbers of Tesla Model S have come in both ways: employees trying to convince the organisation they should be able to pick one, and the organisation telling some of its employees: “It would be good if you’d pick a Tesla” (this differs of course per organisation). However, this belief that the moderate success of the Tesla Model S proves electric mobility will come along, is inconsistent with exactly how these fleet managers describe what stands in the way of an expansion of electric mobility within their organisation. The issue is twofold: (1) there are specific artificial measures in place that work for electric mobility at this moment, but that impede scaling, and (2) a thriving technological development in terms of car technology and charging technology can only address a few of those barriers to scalability (Fig. 7.1).

<table>
<thead>
<tr>
<th>Barriers eased by next generation EVs</th>
<th>Structural barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td>lowers the need to charge regularly</td>
<td>dependence on home charging points remains</td>
</tr>
<tr>
<td>increases people’s ability to fulfill a day’s trips on one charge</td>
<td>vacation limitations (range; charging; towing capability)</td>
</tr>
<tr>
<td>increases the usability of public infrastructure</td>
<td>limited ability to redeploy</td>
</tr>
</tbody>
</table>

Fig. 7.1 Technical advancements of EV only solve part of the problem.

In § 6.3 Responsibility for charging (p. 53) it was discussed how ‘creativity’ is required to get the charging infrastructure of the organisation going (charging points at the homes of employees, and in the car parks). The focus there was on the required change of the organisational structure and in relation to internal budget holders. But a lot of this creativity has to do with the fact that members of the board of directors
and higher managers are, as EV adopters, in a different situation compared to the average employee in regard to handling the restrictions of EV. For example, one fleet manager expressed how in the initial phase a member of the board of directors was willing to put an additional charging point on the lease contract of his Tesla. Relative to a Tesla Model S, a charging point is still an expensive ‘accessory’, but relative to more affordable EVs much more so. Of course, the idea is that the price of charging points will go down over time, but already now it can be seen that the main costs of charging points are not to be found in the actual charging point, but in the ground works and installation, and in the required collaboration with property owners and operators. ‘The build-up of momentum’ in relation to charging points that many of the organisations with Teslas and higher-end plug-in hybrids have been able to bring about, might not be doable for an organisation where only a handful of directors are able to drive Tesla, and where electric mobility should come directly from the average employee and more affordable cars.

The lease car as an employment benefit also means electric vehicles have to work just as well in the private domain as they should in fulfilling professional needs. Even for the Tesla drivers, private use, and more specifically vacation, remains a challenge. Tesla’s proprietary fast-charging network without a doubt plays an important role in overcoming this, but there are other ways that this is dealt with. The first quote from § 5.3 Demand for EV from 2 groups (p. 46) shows how a fleet manager was able to convince an employee to choose a Tesla instead of a BMW by arguing the tax incentive advantage could be used to rent a diesel car during vacation time. Other fleet managers as well have expressed this ‘vacation argument’ is used to either help employees deal with their EVs or convince specific employees to pick EV. Leasing companies have started offering ‘vacation cars’ often as an integrated option for an EV-lease (Athlon, 2016; Leaseplan, 2016). As a temporary solution to get EV going this might be fine, but when even an €80,000 electric vehicle is being swapped during vacation time for ‘spare’ petrol or diesel cars that the organisation has residing in its fleet, it is questionable how scalable electric mobility is in the near future.
### 7.3 Predictable overall, variable individually

“Here’s what holds us back at the moment: People work on a project for 6 months. That project determines your deployment. After 6 months you get a new project, one that could be 10 kilometres from home or a 100. Over 3,000 lease cars it’s all quite predictable, but on the individual level the variance is huge. In this sense the traditional lease car with a long term 1-on-1 relation between car and employee is an outdated concept.”

*interviewee 6*

“Earlier we’ve considered whether we should make the pool either hybrid or electric. But I have cars in there that are used 10,000 km a year, and ones that drive 50,000... That is not going to work.”

*interviewee 5*

“There are two things you can do: search for the ideal mix, given the professional mobility needs, and secondly, drive less. And maybe you should combine them.”

*interviewee 6*

It was frequently expressed by these fleet managers how the changing fiscal landscape has negative consequences for both the financial costs of their mobility and their CO₂-reduction goals. Electric mobility is but one of the directions they are looking in. A quick glance at the broader themes discussed in the field of ‘fleet management’: telematics (IT in measuring mobility at the level of the individual), multi-modality, car sharing, integrating public transport, and collective private lease (Fleetmanagement, 2016). On the surface, electric mobility alone looks like it could easily do the job: multiple interviewees indicated how the average number of kilometres driven on a day-to-day basis with the cars of their fleet is around 100 kilometres. But what they experience is that mobility needs are much more complex and intricate: the average is not what matters here. To reiterate: “A car that is perfect 80% of the time but inadequate the other 20% is not good enough, it has to do a reasonable job 99% of the time.” Mobility needs vary per individual: some employees need to drive much more than others, in time: the next project requires a commonly infrequent driver to make a number of long trips, but also in other aspects than just the number of kilometres: good luck for example charging your electric vehicle on a construction site.

For electric mobility to catch on, it is critical the complex relation we have with mobility becomes a more appreciated part of the public discourse. Unfortunately, the public discourse has already moved on: We seem to believe we have “persuaded the corporate market” (Nederland Elektrisch, 2016b, p. 5) and are now well on our way to do the same for the consumer market: “Drivers of second-hand cars have a profile ideal for electric driving. They drive on average less than 13,000 kilometres per year. This comes down to on average 36km per day, or 50km per workday. By offering this target group the prospect of a charging credit, we are quite certain they will cover those kilometres electrically” (Nederland Elektrisch, 2016b, p. 10). This line of reasoning is not only not in line with what this study suggests, but it also goes against the scientific consensus that has been discussed in the literature review (Turrentine & Kurani, 2007, Egbue & Long, 2012; Trigg et al., 2013) (§ 2.1.4 EV adoption by organisations, p. 21). Somehow we seem unwilling to admit the high standards we have set with petrol and diesel cars.
In § 5.3 Demand for EV from 2 groups (p. 46) it was mentioned there is a lack of conviction in the sustainability of EV, both on the side of the employee and the employer. All but one fleet manager were sceptical of how sustainable electric mobility is. The three most brought up themes were ‘energy generation with coal-fired plants’, ‘the disposal of exhausted batteries’, and the experiences with plug-in hybrid which were discussed in § 5.2 The stimulation of plug-in hybrid (p. 43). The most promise for EV is seen in improving the local air quality. This seems to coincide with research discussed in the literature review that more experience with EV leads to a number of positive shifts, but often also a more critical perception of the environmental impact of EVs (Egbue & Long, 2012). For employees, in regard to this lack of conviction in the sustainability of EV, there might be nothing inherently wrong with instead ‘convincing’ them with tax incentives. However, for the employer-side this is more complex. How exactly electric mobility ties into attaining the CO₂-goals of the organisation is something that is seen as highly uncertain. And as the beginning of this section discussed, electric mobility is but one of the directions they are looking in: not only in lowering CO₂-footprints, but also in managing CO₂-responsibilities. It was expressed how (other) organisations in certain situations are able to evade CO₂-responsibilities via mobility budgets, and in general how the measurement of emissions related to the mobility of organisations is handled problematically. This seems to suggest that policy measures focused on exposing the links between electric mobility and emissions might be more effective than directly stimulating people to choose EVs.

Arguments relating to the critical notion of the sustainability of EV, and to how electric vehicles are not able to provide what traditional vehicles provide (and will not be able to) are not meant to advocate we should seek another alternative, or drop electric mobility altogether. It signifies that for electric mobility to become successful, it cannot be a like-for-like replacement of petrol and diesel: it can become part of the solution, but only if we find ways to position it as such. ■
8 SMART MOBILITY

Organisations are diversifying their means of mobility. § 8.1 Apples to oranges focuses on the paradox of national mobility stimulus being both the main reason EVs and more environmentally friendly diesel and petrol car models are picked, and the impediment to more compelling forms of sustainable mobility. But smart mobility is not just about changes in policy. There are significant opportunities for market parties that are prepared to embrace this diversification instead of disregarding it (§ 8.2 Full service provider).

8.1 Apples to oranges

“We’re not going to say ‘you chose an EV, so you have to have a charging point.’ Because then you’d also have to turn it around: ‘If you can’t have a charging point, you can’t order an EV.’ And then you get: ‘Why can he have an EV and I can’t?’ You’d have to try very hard to explain yourself, and you end up with animosity either way.”

interviewee 10

“While their solutions sound good in theory, I have to give it a considerable practical twist to explain it to the works council and the average employee. Is the works council going to agree with me comparing apples to oranges? You inevitably end up with something very obvious and simple. So indeed, I come to one way of calculating. No exceptions.”

interviewee 5

Ch. 5 Where EV takes form (p. 41) depicted how the management of the mobility of an organisation is very much “a balancing act of a very iterative nature: it is all about predicting fuel costs, re-adjusting afterwards, and creating ‘one size fits all’ solutions.” But the mobility of organisations is not just about petrol and diesel cars anymore. The landscape of mobility is widening, moving towards an array of mobility products that together should form solutions, of which EV can only be a part. Central in that is the effect that IT has on mobility: not only in allowing for such integrated solutions, but also in the fact that the costs of managing individual mobility decisions are falling through the floor. This suggests that slowly but surely, the principle of ‘one size fits all solutions’ is crumbling. But as that same section discusses, the reason mobility management of organisations is as it is, has only partly to do with the costs of individual solutions: the second aspect is that lease cars are not only a mobility solution, but also an employment benefit. This is the aspect that currently is impeding sustainable mobility, this is the aspect that is not being dealt with by technological advancements and policy.

What a lot of these fleet managers allude to is how, in theory, there is a lot of potential within the fleets themselves for more sustainable mobility. A large group of employees with varying and fluctuating mobility needs can be met by a palette of varying and fluctuating mobility solutions (Fig. 8-1). But solutions in this direction are where this employment benefit status of the car hits hardest.
The literature review discussed how the combination of electric mobility and car sharing might hold promise (Dijk et al., 2013). These organisations are essentially looking in two directions. The first is introducing electric mobility in their ‘pool’. *Pool cars* are company cars within the fleet not allocated to a single employee but to a group of employees (or sometimes all employees). Because also within the pool, mobility needs vary incredibly on the individual level, electric vehicles are often positioned here as either allocated to a very specific group of employees with limited mobility needs, or, positioned as a combination of pool car and pilot: for example, an electric car available to everyone in the organisation to ‘try out’ and get to experience EV. This seems thus to be more about the learning it can provide and possibly the relation with suppliers than about the actual car sharing functionality the car can fulfil. It is important to note that these are almost always EVs with a range extender, another form of plug-in hybrid (Fig. 8-2), because full electric is not able to fulfil a role here. (If plug-in hybrid was supposed to be a stepping stone for full electric, wouldn’t the range extender have been a much better technology to stimulate?)

"In the Netherlands we’ve taken things so far in terms of employment benefits: telephone reimbursement, vacation days, lease car, company fitness… the whole shebang. But that does mean that as an employer you have much more potential to control your mobility." 

Interviewee 7

"When you facilitate informal car sharing within your mobility policy, he can use his colleague’s EV instead of his own diesel to get to the customer nearby. If he then hands over his own car to a colleague heading to Groningen, you can locally create your ideal mix. I can do that because I have 3,000 cars. With a smaller fleet you can’t do that."

Interviewee 6
The second direction for a combination of car sharing and electric mobility these organisations look at is expressed by the last quote: car sharing on a day-to-day basis. This is much closer to the idea depicted in Fig. 8-1. However, the key word in this quote is the word informal. Organisations are looking in this direction, but are very limited in what they can do. Just for a specific trip on a given day, you might swap your car with that of a colleague. At the end of the day, you get it back and it is still ‘your car’. When that colleague is, let’s say, caught speeding and gets a fine, this has to be arranged between the two colleagues. Taking car sharing further than that is obstructed however, as it would mean it has to be formalised. Formalising car sharing within these fleets would mean for the organisation an enormous additional administrative workload and for the employees, deductions and increases on their income statements, depending on their car sharing behaviour: this is caused exactly by the complex national tax benefit scheme that tries to stimulate more sustainable mobility. Offering incentives to the employees of the Netherlands on their decision-making in regard to company cars might persuade people to pick EV, or in general more sustainable car models, but also contributes significantly to a tighter 1-on-1 relation between person and car (Fig. 8-3). It sways the power balance of ‘who gets to decide over mobility’ that was discussed in § 5.1 A car as a right (p. 41) towards the employee, and limits more compelling forms of sustainable mobility.

Fig. 8-3 Incentives for individuals to choose more sustainable lease cars hinders the fleet from become more flexible and sustainable overall.
8.2 Full service provider

“And then EV came along. We had to sit together and consider: ‘Do we want to do something with that? What do we think of EV?’ You inevitably are confronted with the whole charging thing: ‘What do we want to facilitate at home? And at the office?’ EV appears to be a much more complex product.”

Interviewee 7

“The lease companies also found it difficult. They have little experience with the residual value of EVs, which in term affects the lease calculations. I’ll probably have to negotiate with the importer about some kind of return policy. Ultimately when enough people start, the system might work.”

Interviewee 5

“Fastned works quite well but is crazy expensive. Am I going to allow it? Should I obligate people to pay up when they quit prematurely? On normal cars we have 5-year lease contracts. I’m not going to do that with electric cars.”

Interviewee 5

In the previous section it was posed that “the landscape of mobility is widening, moving towards an array of mobility products that together should form solutions, of which EV can only be a part.” Throughout Ch. 5 Where EV takes form up until this chapter, there have been numerous examples of how that has come hand-in-hand with an increasing responsibility and complexity in terms of managing the fleet. In making sure EV lands at the right place within the organisation, specific employees are approached with the attempt to convince them to pick an EV. Other employees going through the highly automated process of ‘picking a lease car’ are singled out after choosing for an EV, and are persuaded not to do so. In terms of charging, the organisation collaborates with new parties, reshapes budgets, and helps the individual employee in accommodating his home charger. And this is just for EV. Diesel and petrol are far from ‘over’, and have to be managed smarter. There are probably more types of mobility cards available right now than that there are EVs in the Netherlands.

The solution for ‘smarter’ lies in the potential of the fleet. But not just the fleets of the organisations themselves. This study looks at the mobility of organisations and the role electric mobility plays, and can play in that. The interviewed organisations were selected because their fleets are some of the biggest in the Netherlands, as just the sheer size of the fleet provides possibilities that are otherwise not there. Still, even for organisations like these, a more significant adoption of electric mobility cannot be kick-started from within these fleets, and require a much larger scale. In many ways ‘the potential of the fleet’ is not about the fleets of these organisations, it is about the fleets of leasing companies, importers, mobility providers.

“You discover it’s quite hard to manage such a car sharing initiative. You need an external party for that.”

Interviewee 3

“We have a mobility budget, and the demand for a small EV often comes together with the demand for an e-bike. How am I going to do that? I have to integrate it somehow. It has to be a watertight system.”

Interviewee 5

“Dear mobility providers, give me kilometres. Not cars, kilometres.”

Interviewee 6
Yet the limitations that were identified in § 6.3 Responsibility for charging (p. 53) in relation to an immature market go beyond just the domain of charging. The mobility landscape might be widening, but it is also fragmentising. Organisations like these have demand for e-bikes, and a provider might present the perfect e-bike, packaged in an appealing financial proposition. However, if the organisation cannot integrate it in the overall picture of the mobility for their employees, if they have to put in more effort to do so than the value it provides, it is not going to happen.
9 CONCLUSION

When you’re reading this, you’ve probably skipped most of the report and started with the conclusion. While you might not agree with me, I hope to be able to convince you, once you’ve read a bit more of this report, that there is merit in these three main points:

- **For EV-believers**: The Netherlands is at the time of writing close to crossing the 100,000 mark of number of EVs. The 10 interviewed organisations have 1% of those. Although there is some opportunity for growth, these cars have been deployed in very specific parts of the organisation, under very specific conditions. There are structural barriers to EV that an expansion of public charging points and a car that is €10,000 cheaper and has +100km range alone will not solve.

- **For policy makers**: In the short-term it is indispensable, but in the long term the stimulation of sustainable mobility in these fleets on the *individual* level, such as the private use tax benefits [bijtelling], is not a stimulation but an impediment. While so successful in bringing about significant incremental improvements in the past, EV is bound to fail if it is supposed to be a like for like replacement of diesel and petrol. There is tremendous potential in these fleets that can’t be seized right now. The solution in the long run is to pressure organisations like these to make their mobility more sustainable, but at the same time give them the *opportunity* to do so, against the backdrop of a workforce that sees the car as an employment benefit.

- **For market parties**: This study was specifically about cars, about electric vehicles, but numerous times during the interviews the subject of e-bikes popped up. All these organisations are dealing with EV, are looking towards diversifying their forms of mobility. With the mobility landscape becoming more complex than ever, they seek solutions. Not electric cars, not e-bikes, not mobility cards, *solutions*. And yet they find none.

§ 9.1 Main findings elaborates on these 'allegations' by answering the three sub-questions and the main research question of this study. Subsequently, three specific policy recommendations are given (§ 9.2 Policy recommendations, p. 71). The § 9.3 Reflection on this study (p. 72) relates to the scientific literature review and the theoretical approach used. Lastly, two § 9.4 Suggestions for further research (p. 73) are discussed based on the findings of this study.

9.1 Main findings

The research question of this study:

What are the most important socio-technical barriers hindering the adoption of electric vehicles in fleets of organisations?

The three sub-questions:

1. How does the stimulation of electric mobility from inside the organisation work?
2. Which interventions can the organisation do independently, and which require the government or other parties?
3. In what way does EV infrastructure influence the adoption of EVs in fleets of organisations?

Sub-question 1: How does the stimulation of electric mobility from inside the organisation work?

The employees wanted electric, not the employer. While these organisations have explored as early as 2011 how electric mobility might tie into the CO₂-reduction goals they have, the wave of adoption of plug-in hybrid has been by employees going ahead of them, with their demand almost entirely being incited by tax incentives. After an initial lack of understanding of plug-in hybrid by these organisations, the hidden costs were exposed in short time. Hidden costs that became the responsibility for the employer, not the employee. With the lease car’s position as not only a mobility solution but also an employment benefit product, a part of these organisations have decided to forego plug-in hybrid. After this initial encounter, allowing plug-in hybrid as a leasing option has come together with the organisation exerting considerable effort in (1) preventing the wrong employees from picking EV, and (2) moving the responsibility for fuel costs to the employees as much as possible. Over time, this effort became less pressing, as the plug-in hybrid car models available and adopted in these organisations shifted. More petrol-reliant plug-in hybrids posed less of a threat to the flexibility and predictability of the fleet, and the employees could still attain their tax incentive.

Full electric has been handled differently. As mentioned, these organisations have actively experimented with electric as early as 2011, and while this has not resulted in any noteworthy adoption and application of full electric, they continue to follow and explore the potential electric mobility might have for their fleets in the future. There is one exception to this: the Tesla Model S. These organisations have, combined, more than 1% of all Dutch electric vehicles in their fleets. A quarter of that is full electric, and 80 percent of that quarter consists of Teslas. While the adoption is prompted by tax incentives for the employees just like for the plug-in hybrids, for the Tesla many of these organisations have a more active role in collaborating with specific employees. The Tesla is seen as beneficial for the reputation of the organisation, and can in some instances be combined with the earlier mentioned activity of ‘following and exploring full electric’. The Tesla as well is perceived a threat to the flexibility of the employees and the fleet for its dependence on home charging, private use limitations and redeployment challenges. This is dealt with by positioning it, as mentioned, at ‘specific employees’: employees whose leasing budgets are high enough, mobility needs are limited enough, and for whom a restriction on flexibility is altogether less of an issue.

Sub-question 2: Which interventions can the organisation do independently, and which require the government or other parties?

National mobility stimulus results in quite a paradox for these organisations. On one hand it has been paramount in lowering the CO₂-footprints of their fleets over the years by its role in making the employees pick more sustainable car models and, as discussed above, has been the main reason for their employees to even consider EV. On the other hand, national mobility policy has been very much an impediment for more sustainable mobility. Some of these fleet managers expressed how, in hindsight, they have had much luck in aligning their pilots and explorations of electric mobility with the volatile national mobility policy. The chapter of plug-in hybrid in their fleets is lamented, for while the Netherlands may consider itself ‘a frontrun-
In electric mobility, it is not clear how these vehicles, including full electric, contribute to more sustainable mobility and a CO₂-reduction in these fleets. These fleet managers see different forms of car sharing as obvious solutions that are available within these fleets: mobility needs can be fulfilled by individualised, diversified solutions that are becoming available (of which EV can be a part), but this requires organisations to challenge the status of the lease car as an employment benefit. This is exactly what the national stimulation of electric vehicles, and in general the complex scheme of the tax on private use of company cars [bijtelling] strengthens.

In arranging their mobility, these organisations work together with third parties on multiple fronts. While this study has been unable to examine where exactly the initiative lies in this exploration and the formation of pilots on electric, it is apparent organisations are in tight collaboration with leasing companies on this. At the same time, it is expressed how in the actual integration of mobility solutions, third parties are less able to contribute. With car sharing initiatives, e-bikes, mobility cards and electric, the organisation has more options to fill in their mobility, but also more responsibilities. They have a very active role in facilitating the charging of the EVs of employees (discussed more thoroughly in answering the next sub-question), and collaborate with leasing companies and importers not only on exploring these new mobility solutions, but also managing their current ones (e.g. leasing companies’ training programs and monitoring dashboards to control fuel efficiency numbers of petrol and diesel drivers). But while the lack of ability of third parties to contribute to the integration of mobility solutions may have been manageable for these organisations in prior times when mobility was synonymous with diesel and petrol, the move towards a more diversified mobility landscape also results in making it harder for them to embrace more compelling forms of sustainable mobility.

Sub-question 3: In what way does EV infrastructure influence the adoption of EVs in fleets of organisations?

As discussed in the answer on the first sub-question, after the initial struggles with plug-in hybrid, many of these organisations have been putting a lot of effort, and have been very able in positioning electric mobility at the right place (or limiting it altogether). A vital aspect in that has been the charging of EVs. Facilitating this with charging points in the car parks for the employees is seen as important by these fleet managers for EV to succeed at their organisation, but not all organisations are willing and able to fulfil this role. Willing in the sense that car park charging is seen by some as important now, but ultimately temporary. Able because it depends to a high degree on the accommodation situation of the organisation: the parking facilities of the leased real estate, collaborative options with the property owner, and expectations for the longer-term accommodation of the organisation in general. Facilitating charging not only has to do with the car parks of the office, but also with the ability for employees to charge at home or in the public space. A number of these organisations only allow EVs when the employee is able to install a home charger (as one of those ‘considerable efforts of organisations in getting EVs to the right employees’ discussed in relation to sub-question 1). However, the other organisations at the very least establish a home charger as a default option in the leasing contract, and at all these organisations the vast majority of EV-adopters make use of a home charger. As 70 percent of Dutch citizens do not have a private driveway, this seems to imply the EV-adopters in these organisations reside in the other 30 percent. The role
of public infrastructure is unclear in this. The first preferred option to charge is at the office, as that is cheaper because of corporate energy prices, but at the same time a home charger is seen as more important for even considering an EV, showing the role of infrastructure in adoption and actual usage differs. Public infrastructure seems not to be depended on much and is regarded more as an ‘extra’, but might hold a more significant role in adoption.

As remarked in answering sub-question 2, the active role of these organisations in facilitating charging for their employees also manifests itself in their collaboration with third parties. Arranging the installation of a home charger for an individual employee who chooses for an EV requires them not only to organise this with the employee, but also with the leasing company and the mobility service provider. With the latter they also continuously work together on improving and optimising the charging facilities at the car parks of the office. But most of these fleet managers consider their role in facilitating charging too active: EV is just one of their responsibilities, and they see these as activities they would like to outsource. Especially on this subject the lack of ability of third parties to contribute to the integration of mobility solutions is seen as restrictive.

Main research question: What are the most important socio-technical barriers hindering the adoption of electric vehicles in fleets of organisations?

While EVs has been able to fulfil a role for specific employees in these fleets, from the perspective of the organisation a more significant adoption of electric mobility above all poses risks to the flexibility of the fleet and likewise the workforce, and provides too little of a solution for their problems. The dependence on home chargers, conflict with private use of the car and charging experiences at the office are the more tangible barriers. Underlying however, is the fact that national mobility policy is in many ways not helping, and collaborations with market parties are too slight to for example overcome uncertainty on residual value and integrating EV with other forms of mobility. Ultimately, part of these barriers to electric mobility are not per se barriers to electric mobility. They are ways in which electric mobility is an inherently different form of mobility, and our reluctance to adapt our notion of mobility makes them barriers.
9.2 Policy recommendations

Continue the path taken on fiscal policy
Sustainable mobility is not to be found solely in alternative modalities such as electric mobility, and neither just in smart configurations of multiple alternative modalities, as this report might sometimes seem to suggest. Ultimately it needs to align with current mobility practices to bring about more substantive results. Continuing the path taken in simplifying the tax exemption scheme on company cars can already ‘unlock’ the limited but significant potential that resides in these organisations for more flexible and sustainable fleets.

Prioritise stability
Leasing contracts on company cars are 3 to 5 years. The employment benefit aspects of mobility make it hard for organisations to allow for exceptions and to individualise mobility solutions across employees. Electric mobility needs to be tested rigorously in this environment, and is introduced gradually and cautiously: the mobility of organisations is inherently inert. National mobility policy that fluctuates every few years becomes another impediment towards sustainable mobility.

Show EV is a solution
What this report hopes to demonstrate above all is that, despite the fleets of these organisations representing 1 percent of electric vehicles in the Netherlands, and despite national policy stimulus clearly being the number one reason behind this, these organisations have done their utmost best in restraining EV. How electric mobility should be viewed in regard to sustainability is not clear from the perspectives of these organisations. Policy measures with the intent of stimulating electric mobility have mostly tried to do so in relation to persuading the employees of the Netherlands to adopt EVs. What is needed are policy measures making more tangible the relation between electric mobility and the CO₂-reduction goals of organisations.
9.3 Reflection on this study

Stance in relation to existing scientific literature

This study was preceded by a literature review, of which the most important extracts have been discussed in Ch. 2 Literature review (p. 15). Scientific research on electric mobility, but also mobility in general, often drifts towards either the level of the individual (e.g. what factors into the decision-making of someone adopting an electric vehicle?), or the national/global level (e.g. what can electric mobility mean for reducing air pollution?). With this study I hope to show there is still an abundance to be discovered in the ‘levels in between’, especially in relation the status aspects of mobility.

Implications for Strategic Niche Management

The theoretical approach of Strategic Niche Management was used for this study. To recap: three processes in technological development are deemed central: (1) the articulation of visions and expectations, (2) the building of social networks, and (3) First and second order learning processes. It was discussed in Ch. 4 Methodology (p. 35) how the setup of this study allowed for only a limited understanding of especially the process of the building of social networks. While, with this in mind, I hardly have insightful theoretical remarks to make, I do have one practical argument to point out in regard to how SNM relates to rival theories in transition studies. It is often debated whether specific technological developments should be the starting point for analysing and trying to comprehend innovation (e.g. electric mobility), or more independent, broader perspectives (e.g. sustainable mobility). This study demonstrates the value of the former, as electric mobility and its current relevancy have in a way been ‘exploited’ to examine the mobility of organisations in a broader sense, a topic that is often kept out of sight and, as argued previously, underrepresented in scientific research.
9.4 Suggestions for further research

This study has looked at how organisations manage their fleet of lease cars and how electric mobility can be positioned in that. This could not have been considered in isolation: How organisations give effect to their CO2-targets and how they collaborate with third parties are examples of themes that have been discussed in this report. These two are also the avenues I would like to go into for suggestions for further research.

The mobility of the organisation

While the mobility landscape might be shifting towards a lesser dependence on the car, and in general a more diversified selection of modalities, the car has and will still have a very decisive role. While for this study its role was confined to that of a lease car, its role in the mobility of the organisation is a much more pervasive one. As was mentioned in the introduction, in §1.2 Significance of this study (p. 13), the corporate car fleet accounts for 11 percent of the total car fleet in the Netherlands, and almost 50 percent of the influx of new cars (VNA, 2015). However, it also stated that this cannot be translated directly into notions of ‘corporate mobility’ and ‘consumer mobility’, as these are not separate worlds. The private consumer buying a second-hand car and driving it 9 out of 10 times for demands related to his job, in how much is that the responsibility of his employer? The fleet of lease cars might be a very direct and tangible product of this mobility of the organisation, but it is this link with the consumer domain that is much more interesting. Multiple fleet managers expressed how CO2-responsibilities related to mobility are still very much uncharted territories. When the organisation moves towards ‘mobility budgets’ instead of lease cars, are they giving their employees means to fulfil their responsibilities, or are they offloading their own?

Leasing & Co

§4.2 Implications (p. 38) of the methodology-section of this report remarked that two interviewees revealed information right after the interview that was very relevant, but which they were not willing to disclose during the formal, recorded interview. In both instances this had to do with the organisation’s collaboration with other parties. Exploring alternative forms of mobility, and alternative forms of arranging mobility, is an endeavour organisations like these do in close collaboration with market parties such as leasing companies and importers. On which side the initiative resides and how exactly for example electric vehicle pilots come about is something this study hasn’t adequately examined. This study has been one on the user-side of technology (§3.1 Theoretical lens, p. 29), but even for a more thorough comprehension here, it is necessary to consider how that user-side interacts with the production-side.
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APPENDICES

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1 Interview guide

Warm up | general description of the experience with EVs so far, and the concrete results

Experiences | current situation
- Can you, more extensively, describe your current experience with EV?
  - Experience so far with "fuel-costs" of PHEVs?
  - What has the experience been for employees so far?
  - How do employees charge their (P)HEVs?
  - Does the organisation have a policy in regard to the stimulation of driving electric with PHEVs? (e.g. reimburse 1 liter per 30km)

Decision making | future
- When are you planning to expand the number of EVs in your fleet?
- What needs to happen to expand the number of EVs in your fleet?
  (- IF: price; range; development EVs >> THEN: What if that is solved? What is then impeding?)
- Suppose those changes occur: what needs to happen internally to effectuate an increase of EVs?

Focus on specific points of improvement internally OR policy OR cooperation but NOT reflecting on EV developments in general.

In how much do time and experience solve the problems with (P)EV for the employees?

Ratio PHEVs : FEVs

Decision making | internal
- Can you tell how the decision making goes in this organisation in relation to the adoption of electric mobility in the fleet?
  - What has been your role?
  - How was the cooperation between you and the facility manager? In how much were there incompatible interests?
  - What was the role of "higher management" in stimulating EVs?

HAVE to keep asking until frictions or discrepancies in terms of interests are brought in the discussion.

How does the fleet manager see the responsibility of charging EVs?

"EVs are often marketed in line with solar and wind energy, but you and I both know that in practice, the majority of energy for EVs shall come from coal and gas..."

Decision making | external
- What uncertainties do you see surrounding EV?
  - What uncertainties are especially important to you? How do you deal with those?
  - Which parties do you ask for advice to deal with those uncertainties?
  - How did you know where to look?

Infrastructure | future
- How can charging for your employees be improved in the near future?
  - How should, in the long run, employees of your organisation charge their EV? At the office, at home, in the public space?

Leasing companies
Policy
Service providers

Experiences | current situation
- Can you, more extensively, describe your current experience with EV?
  - Experience so far with "fuel-costs" of PHEVs?
  - What has the experience been for employees so far?
  - How do employees charge their (P)HEVs?
  - Does the organisation have a policy in regard to the stimulation of driving electric with PHEVs? (e.g. reimburse 1 liter per 30km)

Expectations | future
- Do you believe EVs are better for the environment than conventional cars?
2 Research description for interviewees

Harmen van Oijen

Description of the research

At the moment there are about 90,000 electric vehicles (EVs) on the road in the Netherlands. 10,000 of those are full electric. While this number is expanding (among others by improving the charging infrastructure and by the development of innovative battery technology), in many cases EVs are not yet respectable successors of diesel and petrol cars.

In the upscaling of this development, scientists see an important role for fleets of organisations: they are able to both more effectively manage the risks of EV than individuals, and exploit the cost reducing innovations surrounding electric mobility. At the same time these fleets and these organisations can fulfil an ‘example role’ in society concerning the mobility of the future. To do so it is essential the complexity that is involved with decision-making and shaping mobility of large organisations is included in research and development.

Interview

Your participation in this research serves to represent fleet management in the development of electric mobility in the Netherlands. Furthermore, it will help you develop insight in how your colleagues deal with EV.

- The interview takes a maximum of 1 hour.
- The results will be handled anonymously.
- The focus of the interview will be on the decision-making in the adoption of electric vehicles, and the experience that has been acquired so far.
## 3 Analysis process

The actual transcripts of the interviews cannot be made public, for the sake of anonymity. Still, this appendix can be a valuable addition to the methodology-section in showing how the data was analysed. As mentioned, arguments made by the interviewees were assigned keywords, and using the conceptual framework as a reference point, this was simplified to a network of 20 keywords, after which the interviews were categorised over these 20 keywords. Below shows a part of the analysis early on in the process, close to the transcripts, and the last iteration: this network of 20 keywords.
VAN OIJEN (2016) ELECTRIC VEHICLES IN THE FLEETS OF ORGANISATIONS

- Collaboration with market
- Internal budget holder
- Pilots
- Charging infrastructure
- Charging behavior
- Internal niche
- Expectations of EV
- Sustainability
- Repurchase
- Mobility pattern
- Fuel budget
- Range (anxiety)
- Terms of employment
- Tax liability
- Reputation
- CO2 targets
- Adjusting leasing policy
- Flexibility
- Level of the organisation
- Level of the individual
- Experimenting and learning EV

- Status
- From ownership to usage
- Business versus private use
- CO2 targets
- Internal budget holder
- Pilots
- Charging infrastructure
- Charging behavior
- Internal niche
- Expectations of EV
- Sustainability
- Repurchase
- Mobility pattern
- Fuel budget
- Range (anxiety)
- Terms of employment
- Tax liability
- Reputation
- CO2 targets
- Adjusting leasing policy
- Flexibility
- Level of the organisation
- Level of the individual
- Experimenting and learning EV
4 Analysis in relation to the conceptual framework

Structuring and analysing the data was an iterative process. The composition of this network of 20 keywords was done with the conceptual framework as a reference point and by continuously consulting the transcripts of the interviews to determine where keywords overlapped and where they were missing.