NORTH SEA REGION ELECTRIC MOBILITY NETWORK
e-mobility NSR

Analysis of consumers' EV potential

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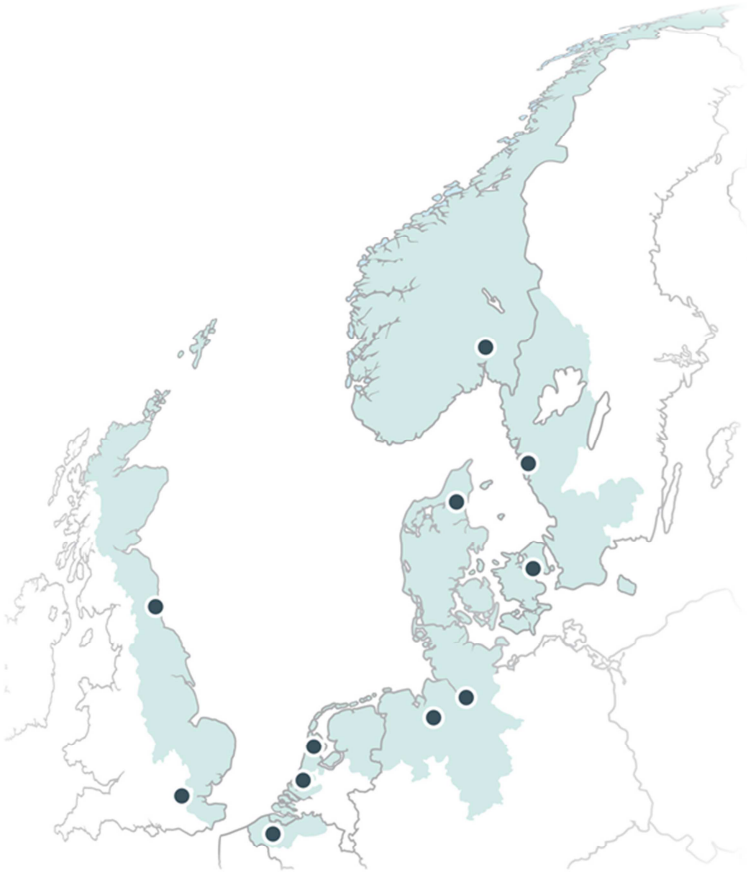

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The Interreg IVB North Sea Region Programme
Investing in the future by working together for a sustainable and competitive region

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Contents

E-Mobility NSR

At present, several cities and regions in Europe and the North Sea Region are developing strategies and action plans to bring forth electro mobility. To achieve this objective, a range of different incentives are currently being developed throughout Europe to seize the potential of electro mobility, especially in terms of local and regional traffic. However, to date many of these activities are neither well synchronized nor aligned with one another, so that realization is actually confined to only a few cities or regions. As a result, many opportunities for further development and growth of this future key mobility sector remain unexploited.

The EU-funded project North Sea Electric Mobility Network (E-Mobility NSR) will help to create favourable conditions to promote the common development of e-mobility in the North Sea Region. The project aims to increase accessibility by fostering the diffusion of e-mobility and stimulating the use of public and private electric car transport as well as freight across the North Sea Region (NSR). Transnational support structures in the shape of a network and virtual routes are envisaged as part of the project, striving towards improving accessibility and the wider use of e-mobility in the North Sea Region countries.

The North Sea Region Electric Mobility Network project is being undertaken in the framework of the Interreg IVB North Sea Region Programme. The project runs from October 2011 to September 2014.

Within the E-Mobility NSR project, various Work Packages deal with different aspects of the implementation of e-mobility. Specific project objectives are:

- to provide state of the art information which may help policy development in e-mobility in the NSR;
- to provide insight on gaps and needs in respect of infra-structure, logistics, and preliminary standards for multi charging techniques;
- to develop a NSR smart grid concept with charging points, hence increasing accessibility in the region;
- to provide a long-term basis upon which regional and local governments as well as other relevant stakeholders in the NSR may engage on e-mobility, among others by creating physical or virtual e-mobility information centres in each participating region or city;
- to integrate the urban freight logistics dimension into the e-mobility network promoting better accessibility and cleaner cities by stimulating the use of electric vehicles as a more efficient solution.

Analysis of consumers' EV potential

Work Package 3.8

1 Introduction

Facing a period of renewed interest, EVs have been receiving much attention in the past few years because of their potential role in the reduction of CO2 emissions and providing independence from fossil fuels. However, while EVs can be attractive for consumers, they also face certain problems regarding the limited driving range, the availability of charging stations, the higher purchase costs, and some relatively minor issues (although sometimes essential for an individual consumer) such as their towing limitation.

To estimate the potential demand of EVs, many studies on the willingness to purchase have been carried out (e.g. Ewing and Sarigollu, 2000, Dagsvik et al., 2002, Dimitropoulos et al., 2011, Hidrue et al., 2011, Hoen and Koetse, 2014, Koetse and Hoen, 2014). Due to insufficient revealed (preference) data, these studies are usually based on stated preference surveys in which potential consumers are asked how they would value characteristics of EVs. The disadvantage of such studies is that they deal with hypothetical situations. Few studies, however, have addressed the question whether it is possible for households to replace one or even more cars with an electric one, while maintaining the greater part of their current driving behaviour.

In this report, we hypothesize that the potential of switching to an EV would be highly dependent on the built environment where people live (and work) in. It can be assumed that inner cities provide the best environment (Bakker and Trip, 2013), as shops and services are nearby, however there is less space for private parking and consequently a reduced possibility for home charging. Rural areas and villages may be less attractive because due to their location, generally longer distances have to be covered to perform the same activities. On the other hand, they include more detached houses and consequently more options for home charging (Newman et al., 2014). City neighbourhoods and outskirts have urban characteristics in between the other types, so their position related to EVs are a bit more unclear. So far, there are few studies on the association of adopting an EV with the spatial setting (see also Maat et al., 2014).

This study was based on a multi-national survey among respondents in urban areas in the seven NSR-countries. Households were asked to report on their residential and work locations, their driving behaviour, and many other characteristics. Based on these characteristics, it was calculated whether they have the potential to drive electric, resulting in six conditions to drive electric. It is noteworthy that we selected a random sample from each urban region rather than specific households who consider an electric vehicle. Consequently the data represent general driving behaviour. Moreover, as we focused on a limited range of urban regions, the data is not representative for the whole countries, but provides insight into urban regions in the north-western part of Europe. The unit of analysis is the household: we assume that not individuals, but households decide on the purchase of one or more cars. Only car-owning households were selected, as it is unlikely that an EV will be an option for non-fossil fuel drivers. Our focus is placed on the travel behaviour of the household heads. We take into account whether the household consists of a single person or a couple, and whether

none, one or both partners commute for work. Hybrid electric vehicles (HEVs) are not taken into account as they do not face the same limitations for range and electric charging as battery electric vehicles (BEVs). However, to get a higher return on investment, owners of a plug-in hybrid car prefer to charge electricity instead of driving fossil fuels, so the conclusions are also relevant for HEVs.
We do not take into account the higher costs, as cost sensitivity depends on too many factors: not just income, but also the availability of a company car, the specific tax and subsidy rules in a country, etc. Furthermore, the natural environment which increases electricity consumption, including factors such as relief and climate is outside the scope of our research (for this we refer to Maat et al., 2014).

We assume that people aim to maintain their current car ownership and current driving behaviour. Obviously, the rise in comfort, reduced environmental pressure and new technologies may increase car purchases, while higher purchase costs are likely to reduce them.

2 Methodology

The survey was designed as a web-based questionnaire. Several measures were taken to avoid misinterpretations and maximise the comparability of the responses. The questionnaire was translated to the NSR languages with the help of e-mobility partners in each country. Furthermore, extra attention was paid to the translation of certain terms which might have different meanings or subcategories in each country (e.g. "lease auto", "row house", types of parking places, etc.). Finally simple visual/graphic aids were used to distinguish between categories when needed (e.g. car types, residential location type or to explain differences between BEVs, PHEVs and ICEs). The English version of the questionnaire is included in Appendix 1.

Approximately four hundred respondents per country were selected from medium-sized urban areas, ranging from 200,000 to 600,000 inhabitants. The background for the choice for medium-sized cities is that much policy and financial attention goes to the big metropolitan regions, while the majority of the population lives in the medium-sized cities (Dijkstra et al., 2013). Moreover, respondents were selected from a variety of residential environments including core cities, urban neighbourhoods, outskirts and suburbs, and nearby towns and villages. The chosen urban regions include Kingston upon Hull and Newcastle upon Tyne from the UK, Aarhus and Copenhagen from Denmark, Ghent from Belgium, Groningen and Leiden from the Netherlands, Bremen and Kiel and Lubeck from Germany, Oslo and several other urban regions from Norway, Gothenburg and Malmo from Sweden. For the abovementioned cities, postcodes within a 15 km radius of the historical city centre/town-hall were chosen. Figure 1 shows the NSR-region and the urban regions involved in this study. Table 1 shows the chosen urban regions, their approximate population and number of respondents per NSR countries. Each country includes about 400 respondents and (apart from Belgium) more urban regions, providing some variety.

The target group consisted of households with at least one car in their possession from the selected urban regions. Filter questions were applied which made sure that the person filling the questionnaire was a household head (i.e. the person who owns/rents the house or his/her partner) and had a valid car driving license. We used the service of "SSI-web", a survey sampling company and address provider which distributed the online questionnaires' links to respondents from the chosen postcodes. During the fieldwork, for urban regions where the target number of complete responses

were not reached, extra postcodes were chosen within a larger radius (30km) of the cities. The exception is the case of Norway where due to the initial lack of number of complete responses, links were sent to a representative sample from the whole country.

After filtering ineligible responses, either because of the very short amount of time spent on completing the questionnaire or indications of random response behaviour, we ended up with 2,707 complete responses.

Figure 1. Urban regions within the NSR countries.

Table 1. Approximate population and number of respondents per urban region per NSR-country

NSR country		City	Approx. population	no. of respondents
1	United Kingdom	Kingston upon Hull	250,000	140
		Newcastle upon Tyne	280,000	244
			Total	**384**
2	Denmark	Aarhus	260,000	142
		Copenhagen	570,000	289
			Total	**431**
3	Belgium	Ghent	250,000	**374**
4	the Netherlands	Groningen	215,000	188
		Leiden	260,000	195
			Total	**383**
5	Germany	Lubeck	210,000	144
		Kiel	240,000	136
		Bremen	550,000	140
			Total	**420**
6	Norway	Whole country	Total	**355**
7	Sweden	Malmoe	300,000	172
		Gothenburg	540,000	188
			Total	**360**
	Total			**2,707**

The following tables give an impression of the dataset. Table 2 shows that about one third of the households consists of singles or single-parent families, which reasonably represents the population. Income has been asked for households as a whole, after the reduction of taxes, and shows a normal distribution, although incomes are slightly higher in the Nordic countries. In this survey only households with at least one car were selected. We asked for the total number of cars in the household, however as children over the age of 18 can have their own car, we distinguished between the total number of cars in the household and those available to the household heads. Only 6% of the households have more than two cars available, the majority owns only one.

Table 2. Distribution of respondents' household types in the sample

Household type	Frequency	Percent
1 Single	723	27
2 Single with children	250	9
3 Couple without children	814	30
4 Couple with children	920	34
Total	2,707	100

Table 3. Distribution of respondents' net (after the reduction of taxes) monthly household income

Households' net monthly income	Frequency	Percent
1 Less than € 1500	331	12
2 € 1501 - € 3000	978	36
3 € 3001 - € 4500	643	24
4 € 4501 - € 6000	302	11
5 € 6001 - € 7500	125	5
6 € 7501 or more	124	5
7 Other	199	7
Total	2,702	100

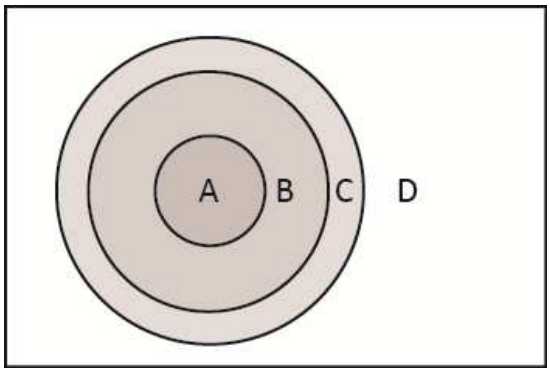
Table 4. Distribution of the number of cars available to household heads

Number of cars available to household heads	Frequency	Percent
1 car	1601	59
2 cars	948	35
3 cars or more	158	6
Total	2,707	100

We asked for a number of built environment characteristics, with the residential type as the most important (see Figure 2). City centres (inner city) and urban neighbourhoods form the core city, while outskirts and suburbs are located at the edges of the cities or at a certain distance of the core city; the fourth category refers to the more rural and periphery of villages and more isolated houses.

Another characteristic, closely related to the built environment, is the dwelling type, which we assume to be highly associated with the possibility of home charging because of its link to the availability of private parking. The dwelling types apartments, row houses (also referred to as town houses), semi-detached and fully detached houses. In particular the Netherlands and the UK have a much higher share of row houses in comparison to other countries.

Figure 2. Residential location types



A: City centre

B: Urban neighbourhood

C: Urban outskirt/suburb

D: Village/rural

Table 5. Distribution of respondents' residential location type

Residential location type	Frequency	Percent
City centres	439	16
Urban neighbourhood	800	30
Urban outskirts, suburbs	874	32
Village/rural	594	22
Total	2,707	100

Table 6. Distribution of respondents' dwelling type

Residential dwelling type	Frequency	Percent
Apartment	962	36
Row house	669	25
Semi-detached	359	13
Detached	717	26
Total	2,707	100

3 Operationalisation of conditions

The potential to drive at least one electric car in a household, is operationalized in 6 conditions. Each condition is tested, taking into account whether it is a single or a dual household, whether they commute for work, whether they use a car for their commutes and whether there are one or two cars available to the household head(s). In other words, each condition takes into account the number of available vehicles in the household and provides an indication of potential modes per household. If the potential modes include at least one EV (i.e. EV; or EV plus alternative mode; or two EVs; or EV plus fuel-based), the household qualifies for having an EV potential. For instance imagine that one of the household heads has a more than 50 kilometre (one way) commute to work. If this household owns only one car it will not be possible to switch that car to an EV without changing the current travel behaviour. However in case two cars are available for the household heads, they will be able to go for the option to own an EV plus a fuel-based car, meaning that they have an EV potential.

Condition 1: Commuting less than 50 kilometres to work

The first condition to drive electric is the distance one can drive on one charge of the battery. Currently, this distance ranges from 80 to about 150 kilometres. The most important and common trip is the commute to work. A person working 75 kilometres from home, can reach the work location (back and forth) with a fully charged battery, assuming that such a driver would buy a car with a 150-kilometre range battery. However, this also assumes that the driver has no anxiety to face an empty battery before the work location is reached, which is possible if the battery is not fully charged, a detour is made, the temperature is low, or when the battery becomes older. To be more realistic we set a threshold of 50 kilometres for a one way commute, as the first condition to drive an electric vehicle.

Condition 2: Home charging

The most attractive feature of an EV is that it is powered by electricity, which is clean and cheap. However, the combination of quite a long charging time and quite a short driving range, requires that the car is fully charged on a daily basis. As a consequence, EV owners need access to a parking lot with charging facilities close to their home. The preferred option is to be able to charge at one's own parcel. For now, we assume that households meet the condition for home charging if they have a parking place available in their own parcel. We take into account the need for two private parking spaces if two cars are involved.

Condition 3: Tow bar requirement

Many households require a tow bar to tow a trailer or a caravan, or to carry a bicycle rack. However, electric vehicles do not have enough power to carry a trailer, so it is not allowed to mount a tow bar. Households which indicated they did not find a tow bar important were considered potentially EV possible and those indicating otherwise were not.

Condition 4: Driving less than 100 kilometres a day

Although most households usually drive rather small distances, sometimes longer distances have to be driven. Furthermore it is possible that a number of shorter trips add up to longer driven distances for a given day. This condition measures the households' frequency of days where total driven kilometres exceed the threshold of 100 kilometres while taking into account the number of available cars in the household. Similar to condition 1, the 100 km threshold was chosen as a safe estimation for an EV's daily range, assuming that there is no possibility for e-charging during that day. Households which indicated they would never drive more than a 100 km during one day were considered to have EV potential. As previously mentioned we opt for the strict assumption that households do not wish to make any concession to their current travel behaviour. However, there are differences in the frequency of such days, ranging from one or several times per week to one or several time per year. These frequencies can be taken into account for a closer investigation or calculating more lenient measures.

Condition 5: Car as the main commuting mode

This condition adds to condition 1 by incorporating the main mode of work commute (e.g. walking, cycling, public transport, etc. versus car) as indicated by the respondent. The rationale is that the potential for an EV rises if car is not the main mode of commute to work. It should be noted that respondents with irregular commute patterns are assumed to use car as their main transport mode.

Condition 6: Work charging for more than 50 kilometre commute

This condition includes the availability of parking at work location for respondents (and their partners) whose one-way commute to work is more than 50 kilometres, while taking into account the number of available cars in the household. For these people if an employer provided parking is available, there is a potential for an EV, assuming that the company is willing to provide its employees with e-charging facilities. This measure also provides an indication of the need for e-charging facilities at work location.

Table 7. Number of respondents per condition met

	condition met (1)	condition not met (0)	mean	stddev
Condition < 50 km commute	340	2418	0.88	0.33
Condition home charging	1,028	1,730	0.63	0.48
Condition tow bar	482	2276	0.83	0.38
Condition journeys > 100 km	2,174	584	0.21	0.41
Condition car main commuting mode	221	2537	0.92	0.27
Condition work charging	245	2513	0.91	0.28
Sum of met conditions			4.37	1.21

4 Analysis of conditions versus built environment characteristics

In this section, each condition is associated with the residential neighbourhood type and the dwelling type, using cross tables and some logit models. The models test the influence of location type and dwelling type, complemented with household income and household structure (single or couple) and in some models the country. The effects are compared to reference categories: location effects are compared to city centres, dwelling types to apartments, couples to singles and countries to the Netherlands. This implies, for example, that a coefficient of 2.5 for Germany means that the effects of that characteristic is 2.5 as big as for the Netherlands, the reference category.

Condition 1: Commuting less than 50 kilometres to work

The first condition with commutes below 50 kilometre one way shows that most households do not commute that far: 88% of the households have the option to replace at least one fuel-based car for an EV: 60% can replace one, and 28% can even replace two cars. The less urban, the higher the possibility to replace at least one fuel-based car for an EV, which is partly due to higher dual car ownership in less urban areas. Still, it is remarkable that 26% of the respondents in city centres need at least one fuel car, while less urban neighbourhoods need respectively for 22%, 20% and 19% a fuel-based car. Apparently, the more urban households are, the farther they commute, and the more often they are dependent on a fuel-based car.

There is also an association with the dwelling type, suggesting that the more detached a house is, the higher the potential for an EV. The explanation is that more detached houses go more often together with dual car ownership and less urban residential areas.

The logistic model confirms the impact of the location type on this condition for changing towards an EV. Dwelling type, however, is only significant for detached houses with p<10%, suggesting that this characteristic has less impact.

Table 8. Condition work commute less than 50 kilometres by residential location type

	Share in percentages				Frequency
	Inner city	Urban neighbourhood	Urban outskirts	Village/rural	
Possible per household					
EV	43.05	41.75	38.67	39.73	1,097
Fuel	7.97	6.25	5.26	3.20	150
EV + alternative mode	10.48	10.38	11.44	7.58	274
Fuel + alternative mode	5.01	4.88	3.66	2.36	107
Two EVs	20.96	26.25	29.86	33.50	762
EV + Fuel	10.02	8.13	9.15	10.10	249
Two Fuel	2.51	2.38	1.95	3.54	68
Potential for an EV					
No	15.49	13.50	10.87	9.09	325
Yes	84.51	86.50	89.13	90.91	2,382

Table 9. Condition work commute less than 50 kilometres by dwelling type

	Share in percentages				Frequency
	Apartment	Row house	Semi-detached	Detached	
Possible per household					
EV	53.95	42.45	21.34	40.52	1,097
Fuel	8.00	4.93	3.49	5.54	150
EV + alternative mode	10.60	11.96	6.56	10.12	274
Fuel + alternative mode	4.05	4.04	2.79	3.95	107
Two EVs	15.80	26.16	47.00	28.15	762
EV + Fuel	6.03	8.07	14.37	9.20	249
Two Fuel	1.56	2.39	4.46	2.51	68
Potential for an EV					
No	13.62	11.36	10.74	12.01	325
Yes	86.38	88.64	89.26	87.99	2,382

Table 10. Logistic regression model for condition to work commute less than 50 kilometres

Household characteristics	Odds ratio	Sig.
Residential location (ref.cat. city centre)		
Urban neighbourhood	1.14	
Urban outskirts	1.44	**
Village/rural	1.72	***
Dwelling type (ref.cat. apartment)		
Row house	1.25	
Semi-detached	1.18	
Detached	1.40	*
Couple (ref.cat. single household)	0.62	***
Household income	0.92	**
Constant	8.70	***

McKelvey and Zavoina's R2: 0.037

Significance: * p<.1 ** p<.05 *** p<.01

Condition 2: Home charging

On the basis of an available parking lot at the own parcel, it appears that 63% of the households can charge at least one car: 40% can charge one car, with 7% who cannot charge the second one, but 24% can charge both cars. This tendency is more or less equal over all countries, except the Netherlands, where 60% does not meet this condition (not depicted in table).

There is a clear effect of the residential location type (Table 9): the less urban, the higher the potential for home charging for at least one, ranging from 49% in city centres to 74% in the rural area. In particular the potential for charging two cars is higher with less urban areas. The explanation is obvious, as less urban areas have more space per dwelling, more often a detached house, and more often two cars.

Likewise, we see in Table 10 that more urban houses, such as apartments (45%) and town houses (50%), have much less space to charge an EV than the semi-detached (81%) and detached (91%) houses.

The logistic model confirms the effects of location and in particular dwelling type. The income effect is presumably correlated with dwelling type. There is also a clear independent effect of the country, suggesting that, controlled for the other variables, all countries have a much higher probability to charge their EVs than the Netherlands, with Sweden having the highest probability.

Table 11. Condition available home charging possibility, by residential location type

	Share in percentages				Frequency
	City centre	Urban neighbourhood	Urban outskirts	Village/rural	
Home charging possible					
No	50.57	45.00	30.09	25.76	998
One car (single car hh)	27.33	30.25	36.84	32.66	878
One of the two cars	9.34	7.50	7.21	4.21	189
Two cars	12.76	17.25	25.86	37.37	642
Potential for an EV					
No	50.57	45.00	30.09	25.76	998
Yes	49.43	55.00	69.91	74.24	1,709

Table 12. Condition available home charging possibility, by dwelling type

	Share in percentages				Frequency
	Apartment	Row house	Semi-detached	Detached	
Home charging possible					
No	54.89	49.93	9.34	36.87	998
One car (single car hh)	32.33	28.70	29.15	32.43	878
One of the two cars	5.09	9.12	7.11	6.98	189
Two cars	7.69	12.26	54.39	23.72	642
Potential for an EV					
No	54.89	49.93	9.34	36.87	998
Yes	45.11	50.07	90.66	63.13	1,709

Table 13. Logistic regression model for condition available home charging

Household characteristics	Odds ratio	Sig.
Residential location (ref.cat. city centre)		
Urban neighbourhood	1.06	
Urban outskirts	1.76	***
Village/rural	1.67	***
Dwelling type (ref.cat. apartment)		
Row house	1.48	***
Semi-detached	5.49	***
Detached	10.44	***
Couple (ref.cat. single)	1.14	
Household Income	1.12	***
Country (ref.cat. Netherlands)		
Britain	2.05	***
Denmark	1.83	***
Belgium	3.73	***
Germany	2.61	***
Norway	3.49	***
Sweden	5.78	***
Constant	0.16	***

McKelvey and Zavoina's R2: 0.322
Significance: * p<.1 ** p<.05 *** p<.01

Condition 3: Tow bar requirement

The preference for a tow bar decreases with the urbanity, ranging from 34% to 44%. One explanation is that families with children live more often in suburbs, so they need to tow a caravan. Another explanation is the association with dwelling type, which varies much more: while urban houses have a preference around 30%, the preference for detached houses is almost twice as high.
Remarkably, in the end, when controlled for higher car ownership, it appears that there is hardly variation for the potential for at least one EV, as all location types and all dwelling types score a little over 80%.
The logistic model is not estimated to predict the condition but the preference. It shows that there is no significant effect of the location type, but the effect of the dwelling type is clear: the more detached, the higher the preference for a tow bar. Also couples express a higher need for this feature. Effects of the countries vary.

Table 14. Condition tow bar limitation by residential location type

	Share in percentages				Frequency
	City centre	Urban neighbourhood	Urban outskirts	Village/rural	
Potential for an EV					
No	17.08	18.63	16.25	17.85	472
Yes	82.92	81.38	83.75	82.15	2,235

Table 15. Condition tow bar limitation by dwelling type

	Share in percentages				Frequency
	Apartment	Row house	Semi-detached	Detached	
Potential for an EV					
No	18.71	18.39	15.20	17.44	472
Yes	81.29	81.61	84.80	82.56	2,235

Table 16. Logistic regression model for *preference* for a tow bar

Household characteristics	Odds ratio	Sig.
Residential location (ref.cat. city centre)		
Urban neighbourhood	0.95	
Urban outskirts	0.83	
Village/rural	1.08	
Dwelling type (ref.cat. apartment)		
Row house	1.66	***
Semi-detached	1.86	***
Detached	3.10	***
Couple (ref.cat. single)	1.61	***
Household Income	0.96	
Country (ref.cat. Netherlands)		
Britain	0.22	***
Denmark	2.56	***
Belgium	0.85	
Germany	0.75	*
Norway	1.54	***
Sweden	1.78	***
Constant	0.31	***

McKelvey and Zavoina's R2: 0.204

Significance: * p<.1 ** p<.05 *** p<.01

Condition 4: Driving less than 100 kilometres a day

This condition with journeys below 100 kilometre a day decreases the potential for an EV dramatically. More than 80% of the households drive more times per year more than 100 kilometre. The effects vary between the location types and do not show a clear picture. The same is true for dwelling type and country. A logistic model was estimated but did not show clear effects either, hence, this condition clearly not related to the built environment.

Table 17. Condition households' frequency of >100km trips, by residential location type

	Share in percentages				Frequency
	City centre	Urban neighbourhood	Urban outskirts	Village/rural	
Possible per household					
EV	3.42	3.38	5.15	3.03	105
Fuel	38.95	34.88	28.26	27.78	862
EV + alternative mode	0.68	1.63	1.95	2.36	47
Fuel + alternative mode	22.78	22.63	22.54	18.35	587
Two EVs	2.05	1.63	2.06	3.03	58
EV + Fuel	14.35	12.00	13.84	11.45	348
Two Fuel	17.77	23.88	26.20	34.01	700
Potential for an EV					
No	79.50	81.38	77.00	80.13	2,149
Yes	20.50	18.63	23.00	19.87	558

Table 18. Condition households' frequency of >100km trips, by dwelling type

	Share in percentages				Frequency
	Apartment	Row house	Semi-detached	Detached	
Possible per household					
EV	5.82	4.33	0.98	3.88	105
Fuel	47.40	30.49	14.50	31.84	862
EV + alternative mode	1.46	2.24	1.26	1.74	47
Fuel + alternative mode	21.52	25.41	15.34	21.68	587
Two EVs	0.94	2.54	3.35	2.14	58
EV + Fuel	10.29	14.35	15.48	12.86	348
Two Fuel	12.58	20.63	49.09	25.86	700
Potential for an EV					
No	81.50	76.53	78.94	79.39	2,149
Yes	18.50	23.47	21.06	20.61	558

Condition 5: Car as the main commuting mode

This condition incorporates the main mode of the work commute to the 50km commute condition, so it relaxes the condition somewhat, as we assume that people do not use their electric car when they do not use it now. The potential appears to be high, which is due to the use of the train for higher distances.

Table 15. Condition work commute more than 50 kilometres plus when car is indicated as the main (work) commute mode, by residential location type

	Share in percentages				Frequency
	City centre	Urban neighbourhood	Urban outskirts	Village/rural	
Possible per household					
EV	57.40	55.88	50.46	46.46	1,416
Fuel	5.92	4.50	4.00	2.53	112
EV + alternative mode	1.37	1.25	2.52	2.19	51
Fuel + alternative mode	1.82	1.63	2.06	1.68	49
Two EVs	25.74	29.00	32.61	36.36	846
EV + Fuel	6.15	5.88	6.98	7.91	182
Two Fuel	1.59	1.88	1.37	2.86	51
Potential for an EV					
No	9.34	8.00	7.44	7.07	212
Yes	90.66	92.00	92.56	92.93	2,495

Table 16. Condition work commute more than 50 kilometres plus when car is indicated as the main (work) commute mode, by dwelling type

	Share in percentages				Frequency
	Apartment	Row house	Semi-detached	Detached	
Possible per household					
EV	67.98	55.01	28.87	52.31	1,416
Fuel	5.72	4.04	2.51	4.14	112
EV + alternative mode	1.66	2.24	1.39	1.88	51
Fuel + alternative mode	1.25	2.09	1.39	1.81	49
Two EVs	17.88	29.60	51.32	31.25	846
EV + Fuel	4.26	5.38	11.16	6.72	182
Two Fuel	1.25	1.64	3.35	1.88	51
Potential for an EV					
No	8.21	7.77	7.25	7.83	212
Yes	91.79	92.23	92.75	92.17	2,495

Condition 6: Work charging for more than 50 kilometre commute

This condition also relaxes the 50km condition, as it assumes that the commuter has the option to re-charge at the work location. The potential appears to be high, although hardly affected by the residential characteristics.

Table 17. Condition work commute less than 50 kilometres plus the availability of work parking, by residential location type

	Share in percentages				Frequency
	City centre	Urban neighbourhood	Urban outskirts	Village/rural	
Possible per household					
EV	47.15	43.88	39.82	41.08	1,150
Fuel	4.56	4.13	4.12	2.02	101
EV + alternative mode	12.07	11.50	11.67	8.08	295
Fuel + alternative mode	2.73	3.75	3.43	1.68	82
Two EVs	25.28	29.50	32.72	38.55	862
EV + Fuel	6.61	5.63	6.64	6.06	168
Two Fuel	1.59	1.63	1.60	2.53	49
Potential for an EV					
No	8.88	9.50	9.15	6.23	232
Yes	91.12	90.50	90.85	93.77	2,475

Table 18. Condition work commute less than 50 kilometres plus the availability of work parking, by dwelling type

	Share in percentages				Frequency
	Apartment	Row house	Semi-detached	Detached	
Possible per household					
EV	56.86	43.20	23.15	42.48	1,150
Fuel	5.30	4.19	1.95	3.73	101
EV + alternative mode	11.43	12.56	7.53	10.90	295
Fuel + alternative mode	3.01	3.44	1.53	3.03	82
Two EVs	17.67	29.60	53.84	31.84	862
EV + Fuel	4.78	5.08	8.79	6.21	168
Two Fuel	0.94	1.94	3.21	1.81	49
Potential for an EV					
No	9.25	9.57	6.69	8.57	232
Yes	90.75	90.43	93.31	91.43	2,475

5 Conclusions

Several cities and regions in Europe and the North Sea Region are developing strategies to bring forth electric mobility. Few studies have addressed the question whether it is possible for households to replace one or even more cars with an electric one, while maintaining the greater part of their current driving behaviour. In this report, we investigated the potential of switching from the perspective of the built environment.

It was found that the location affects whether commuters drive more than 50 kilometres to work: commuters living in the outskirts and suburbs of the cities, or in villages and the countryside, drive longer distances. However, as they also own more cars on average, they have a higher potential to replace at least one fuel-based car for an EV. Two other, more relaxed conditions were tested, taking into account that commuters also take other modes and may have the option to charge at the work location, suggesting that good public transport and other charging options encourage EV potential.

Location is also relevant when it comes to the possibility for home charging: the farther from the city centre, so the less urban, the higher the potential for an electric car. Even more important is the dwelling type: the more detached (e.g. a row house is more detached than an apartment, a semi-detached more than a row house, etc.), the higher the potential to charge an EV. It was remarkable, that in addition, the countries strongly vary.

The potential was also tested on the condition to drive not too often more than 100 kilometres (thus in one charge). It appears that this reduces the potential for an EV dramatically, suggesting that fast charging becomes really important. Built environment and dwelling do not have so much influence on this.

The preference for a tow bar was tested as well, as this is not possible with an EV. Remarkably, this is closely related to the dwelling type: the more detached a dwelling is, the higher the preference for a tow bar.

Table 19. Combined conditions, by residential location type

	Share in percentages				Frequency
	City centre	Urban neighbourhood	Urban outskirts	Village/rural	
Potential for an EV					
No	86.79	90.00	85.47	86.36	2,361
Yes	13.21	10.00	14.53	13.64	346

Table 20. Combined conditions, by dwelling type

	Share in percentages				Frequency
	Apartment	Row house	Semi-detached	Detached	
Potential for an EV					
No	91.58	87.44	82.43	87.22	2,361
Yes	8.42	12.56	17.57	12.78	346

Finally, the conditions were combined: work commute less than 50 kilometres, the availability of work parking for more than 50 kilometre commute, the indication of a car as the main commute mode, plus taking into account the possibility of home charging and tow bar requirement. This combined potential appears to be limited, and shows hardly variation in potential between the urban location types, although urban neighbourhoods score a little lower. A stronger relationship can be observed with the dwelling type: apartments have the lowest potential, followed by row houses and detached houses; owners of semi-detached appear to have the best potential.

All in all, the built environment, both the urban location type and the dwelling type significantly influence the conditions to own an electric car. So, it is recommended to take into account location factors in policies to encourage electric mobility.

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Appendix 1

Questionnaire

Beginpagina

Introduction

Welcome to the survey on car ownership and use. This survey will be administered in the seven North Sea Region countries and carried out by the Delft University of Technology in the Netherlands in collaboration with institutes in these countries.

We would like to stress that your responses will be strictly confidential and will be processed anonymized and compiled with many other responses in summary form. We are just interested in general patterns, not in your individual data. The data will not be shared with others and will only be used by the Delft University. The analysis report will be made publically accessible on the project website atwww.e-mobility-nsr.eu.

We would be very grateful if you could take the time to complete our questionnaire. This will take about 20 minutes of your time.

Thank you for participating in this survey!

Hoofdsectie

Questionnaire: Car ownership and use patterns in North Sea Region countries

This questionnaire starts with some questions on personal and household characteristics. We would first like to know if you belong to the target group of this survey.

1. Do you have at least one car in your household (including lease or company cars)?

- ○ Yes
- ○ No → Ga verder met vraag *afgerond beschouwen*

2. Do you have a valid car driving licence?

- ○ Yes
- ○ No → Ga verder met vraag *afgerond beschouwen*

3. What is your household type?

- ○ Single → Ga verder met vraag *Household characteristics single*
- ○ Single with one or more children living at home
- ○ Couple without children living at home
- ○ Couple with one or more children living at home
- ○ Other household type → Ga verder met vraag *afgerond beschouwen*

4. Are you a household head*?

- ○ Yes → Ga verder met vraag *indien couple naar HC double*
- ○ No

Als Q3 gelijk is aan 3
OF Q3 gelijk is aan 4 → *Household characteristics double*

Household characteristics

Would you please answer the following questions for your household?

5. Age: _____

6. Gender:

- ○ Male
- ○ Female

7. What describes you best?
Please select one:

- ○ Employed (paid)
- ○ Unemployed/job seeker
- ○ Voluntary worker
- ○ Retired
- ○ Student
- ○ Home keeper
- ○ Other, please specify: _____

Als Q3 gelijk is aan 1 → *Do you have a physical disability or another long-standing health problem which affects your travel arrangements?*
Anders als Q3 gelijk is aan 2 → *How many children (regardless of their age) are there in your household who live at home?*

Household characteristics

Would you please answer the following questions for your household? That is for you as well as for your partner.

8. Age:

	You	Your partner
Age:		

9. Gender:

	You	Your partner
Male	○	○
Female	○	○

10. What describes you and your partner best? Please select one:

	You	Your partner
Employed (paid)	○	○
Unemployed/job seeker	○	○
Voluntary worker	○	○
Retired	○	○
Student	○	○
Home keeper	○	○
Other	○	○

11. Does your partner have a valid car driving licence?

○ Yes
○ No

Als Q3 gelijk is aan 3 *Do you, or your partner, have a physical disability or another long-standing health problem which affects your travel arrangements? Please select all that apply:*

12. How many children (regardless of their age) are there in your household who live at home?

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15 or more

13. How many of them have a driving licence?

0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15 or more

14. Do your children drive your [or your partner's] car?

○ Yes
○ No

15. Do you [or your partner] chauffer your children to destinations by car?

○ Yes

- No

Als Q3 gelijk is aan 2 *Do you have a physical disability or another long-standing health problem which affects your travel arrangements?*

16. Do you, or your partner, have a physical disability or another long-standing health problem which affects your travel arrangements?
Please select all that apply:

- No
- One of us could not drive a car
- At least one of us is limited in walking

Please estimate your household's net* monthly income? (We keep this strictly confidential!)*

17. Do you have a physical disability or another long-standing health problem which affects your travel arrangements?

- No
- I am limited in walking

18. Please estimate your household's* net* monthly income? (We keep this strictly confidential!)

- Less than 1200 GBP
- 1201 GBP - 2400 GBP
- 2401 GBP - 3600 GBP
- 3601 GBP - 4800 GBP
- 4801 GBP - 6000 GBP
- 6001 GBP or more
- Other

Cars in the household

19. How many cars (including lease or company cars) do you have in your household in total?

1
2
3
4
5
6
7
8
9
10 or more

20. How many cars are there in your household available to you [and your partner]?

1
2
3
4
5
6
7
8
9
10 or more

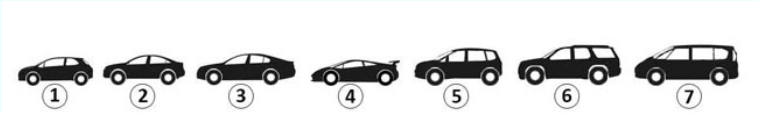
21. How many cars in your household are primarily used by others than you [and your partner] (for example by children)?

0
1
2
3
4
5
6
7
8
9
10 or more

Als Cars2 groter is dan 1 *More than one car*

Please answer the following questions for the car in your household that is used by you [and/or your partner].

22. Type:



- 1. Small car
  1
- 2. Medium car
  2
- 3. Large car
  3
- 4. Sports car
  4
- 5. Estate car, MPV (Multi-Purpose Vehicle)
  5
- 6. SUV (Sport Utility Vehicle)
  6
- 7. Small van
  7
- 8. Other, please specify:

23. Fuel used:

- Petrol
- Diesel
- LPG
- Ethanol
- Full-electric
- Hybrid electric (not plug-in)
- Plug-in hybrid electric
- Other, please specify:

24. Ownership:

- Owned by [one of] the household head[s]
- Leased by [one of] the household head[s]
- Leased by the employer
  *
- Owned by the employer
  **

25. How many kilometres a year is this car driven (by you and/or your partner)? Please make an estimation:

- Less than 2.000 km
- 2.001 - 5.000 km
- 5.001 - 10.000 km
- 10.001 - 15.000 km
- 15.001 - 20.000 km
- 20.001 - 25.000 km
- 25.001 - 30.000 km
- 30.001 - 35.000 km
- 35.001 - 40.000 km
- 40.001 - 45.000 km
- 45.001 - 50.000 km
- More than 50.000 km, please specify:

Als Q3 gelijk is aan 1
OF Q3 gelijk is aan 2 *Approximate manufacturing year?*

26. Please select one:

- I am the main user of this car and it is usually not available for my partner's use.
- Me and my partner both use this car.
- My partner is the main user of this car and it is usually not available for my use

27. Approximate manufacturing year?

Before 1985
1986 - 1990
1991 - 1995
1996 - 2000
2001 - 2005
2006 - 2010
After 2011
I don't know

28. Did you purchase/lease this car new or used?

- New
- Used
- Not applicable

29. What is the most important activity you use this car for?

- Commute to work or school
- Chauffer children or other non-drivers
- Daily activities such as grocery shopping
- Shopping (not grocery shopping, e.g. clothes, furnitures, gifts)
- Business trips *
- Leisure (sports, social visits, day trips)
- Going on holidays
- Other, please specify:

30. I chose this type of car because it is:
Please select maximum three

- convenient for weekend trips and holidays
- convenient for hauling large loads
- economical due to subsidies (on tax, parking, etc.)
- stylish
- environmentally friendly
- cheap to purchase/lease
- inexpensive insurance
- re-sellable
- comfortable
- safe
- reliable
- powerful
- exciting to drive
- not applicable

31. Available parking place at home:
Please select all that apply:

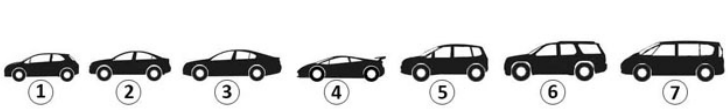
- Own parcel, private garage, carport
- Paid public garage
- Free public garage
- Paid on-street parking
- Free on-street parking
- Other, please specify:

Als Cars2 gelijk is aan 1 *Is it important for you to have a car with a tow bar?*

Please answer the following questions for the cars in your household which are used by you [and/or your partner] [If you have more than two cars for the use of household heads, please choose the two cars which you [and/or your partner] use the most]. We ask you to answer the questions first for car 1 and then for car 2.

The following questions apply to car 1.

32. Type car 1:



- 1. Small car 1
- 2. Medium car 2
- 3. Large car 3

- 4. Sports car
- 4
- 5. Estate car, MPV (Multi-Purpose Vehicle)
- 5
- 6. SUV (Sport Utility Vehicle)
- 6
- 7. Small van
- 7
- 8. Other, please specify:

---

33. Fuel used car 1:

- Petrol
- Diesel
- LPG
- Ethanol
- Full-electric
- Hybrid electric (not plug-in)
- Plug-in hybrid electric
- Other, please specify:

---

34. Ownership car 1:

- Owned by [one of] the household head[s]
- Leased by [one of] the household head[s]
- Leased by the employer
- *
- Owned by the employer
- **

---

35. How many kilometres a year is this car 1 driven (by you and/or your partner)? Please make an estimation:

- Less than 2.000 km
- 2.001 - 5.000 km
- 5.001 - 10.000 km
- 10.001 - 15.000 km
- 15.001 - 20.000 km
- 20.001 - 25.000 km
- 25.001 - 30.000 km
- 30.001 - 35.000 km
- 35.001 - 40.000 km
- 40.001 - 45.000 km
- 45.001 - 50.000 km
- More than 50.000 km, please specify:

Als Q3 gelijk is aan 1
OF Q3 gelijk is aan 2 *Approximate manufacturing year car 1?*

---

36. Please select one for car 1:

- I am the main user of this car and it is usually not available for my partner's use.
- Me and my partner both use this car.
- My partner is the main user of this car and it is usually not available for my use

---

37. Approximate manufacturing year car 1?

- Before 1985
- 1986 - 1990
- 1991 - 1995
- 1996 - 2000
- 2001 - 2005
- 2006 - 2010
- After 2011
- I don't know

---

38. Did you purchase/lease car 1 new or used?

- New
- Used
- Not applicable

---

39. What is the most important activity you use car 1 for?

- Commute to work or school
- Chauffer children or other non-drivers
- Daily activities such as grocery shopping
- Shopping (not grocery shopping, e.g. clothes, furnitures, gifts)
- Business trips
- Leisure (sports, social visits, day trips)
- Going on holidays
- Other, please specify:

---

40. I chose this type of car (car 1) because it is:
Please select maximum three

- convenient for weekend trips and holidays
- convenient for hauling large loads
- economical due to subsidies (on tax, parking, etc.)
- stylish
- environmentally friendly
- cheap to purchase/lease
- inexpensive insurance
- re-sellable
- comfortable
- safe
- reliable
- powerful
- exciting to drive
- not applicable

---

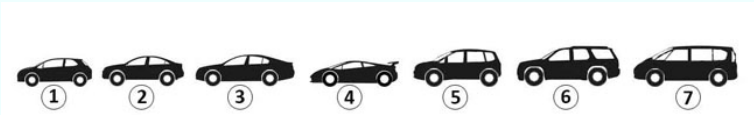
41. Available parking place at home for car 1:
Please select all that apply:

- Own parcel, private garage, carport
- Paid public garage
- Free public garage
- Paid on-street parking
- Free on-street parking
- Other, please specify:

Please answer the following questions for the second car in your household. [If you have more than two cars for the use of household heads, please choose the two cars which you [and / or your partner] use the most].

---

42. Type car 2:



- 1. Small car
1
- 2. Medium car
2
- 3. Large car
3
- 4. Sports car
4
- 5. Estate car, MPV (Multi-Purpose Vehicle)
5
- 6. SUV (Sport Utility Vehicle)
6
- 7. Small van
7
- 8. Other, please specify:

---

43. Fuel used car 2:

- Gasoline
- Diesel
- LPG
- Ethanol
- Full-electric
- Hybrid electric (not plug-in)
- Plug-in hybrid electric
- Other, please specify:

---

44. Ownership car 2:

- Owned by [one of] the household head[s]
- Leased by [one of] the household head[s]
- Leased by the employer *
- Owned by the employer **

---

45. How many kilometres a year is this car 2 driven (by you and/or your partner)? Please make an estimation:

- Less than 2.000 km
- 2.001 - 5.000 km
- 5.001 - 10.000 km
- 10.001 - 15.000 km
- 15.001 - 20.000 km
- 20.001 - 25.000 km
- 25.001 - 30.000 km
- 30.001 - 35.000 km
- 35.001 - 40.000 km
- 40.001 - 45.000 km
- 45.001 - 50.000 km
- More than 50.000 km, please specify: _____

Als Q3 gelijk is aan 1
OF Q3 gelijk is aan 2 → *Approximate manufacturing year car 2?*

---

46. Please select one for car 2:

- I am the main user of this car and it is usually not available for my partner's use.
- Me and my partner both use this car.
- My partner is the main user of this car and it is usually not available for my use

---

47. Approximate manufacturing year car 2?

- Before 1985
- 1986 - 1990
- 1991 - 1995
- 1996 - 2000
- 2001 - 2005
- 2006 - 2010
- After 2011
- I don't know

---

48. Did you purchase/lease car 2 new or used?

- New
- Used
- Not applicable

---

49. What is the most important activity you use car 2 for?

- Commute to work or school
- Chauffer children or other non-drivers
- Daily activities such as grocery shopping
- Shopping (not grocery shopping, e.g. clothes, furnitures, gifts)
- Business trips *
- Leisure (sports, social visits, day trips)
- Going on holidays
- Other, please specify: _____

---

50. I chose this type of car (car 2) because it is:
Please select maximum three

- convenient for weekend trips and holidays
- convenient for hauling large loads
- economical due to subsidies (on tax, parking, etc.)
- stylish
- environmentally friendly
- cheap to purchase/lease
- inexpensive insurance
- re-sellable

- ☐ comfortable
- ☐ safe
- ☐ reliable
- ☐ powerful
- ☐ exciting to drive
- ☐ not applicable

---

51. Available parking place at home for car 2:
Please select all that apply:

- ☐ Own parcel, private garage, carport
- ☐ Paid public garage
- ☐ Free public garage
- ☐ Paid on-street parking
- ☐ Free on-street parking
- ☐ Other, please specify:

---

52. Is it important for you to have a car with a tow bar?

- ○ Yes
- ○ No

---

53. Do you use a tow bar?
Please select all that apply:

- ☐ No
- ☐ Yes, once or twice a year
- ☐ Yes, more than two times a year
- ☐ Yes, to carry bicycles
- ☐ Yes, to tow a caravan
- ☐ Yes, to tow a trailer
- ☐ Other, please specify:

Do you EVER make use of the following transport options for the following purposes?

You may mark multiple transport options for each purpose. For example you might mainly use the car to commute to work. However you might also use a bicycle to go to work on a sunny day or the bus if your partner has to use the car. In this case the result would look like:

	Commute to work/study
Not applicable	☐
Walking	☐
Bicycle	☑
Moped/scooter	☐
Motorcycle	☐
Train	☐
Bus, tram, metro	☑
Airplane	☐
Car (as driver)	☑
Carpooling* with your partner [If any]	☐
Carpooling with other people inside or outside the household	☐
Car sharing (rent a car, e.g. Commonwheels)	☐

---

54. Do you EVER make use of the following transport options for the following purpose: Commute to work/study? Please select all that apply:

	Commute to work/study
Not applicable	☐
Walking	☐
Bicycle	☐
Moped/scooter	☐
Motorcycle	☐
Train	☐
Bus, tram, metro	☐
Airplane	☐
Car (as driver)	☐
Carpooling * with your partner [If any]	☐
Carpooling with other people inside or outside the household	☐
Car sharing (rent a car, e.g. Commonwheels)	☐

---

55. Do you EVER make use of the following transport options for the following purpose: Business trips*? Please select all that apply:

	Business trips *
Not applicable	☐
Walking	☐
Bicycle	☐
Moped/scooter	☐
Motorcycle	☐
Train	☐
Bus, tram, metro	☐
Airplane	☐
Car (as driver)	☐
Carpooling * with your partner [If any]	☐
Carpooling with other people inside or outside the household	☐
Car sharing (rent a car, e.g. greenwheels)	☐

56. Do you EVER make use of the following transport options for the following purpose: Shopping (grocery and non-grocery shopping, e.g. clothes, furnitures, gifts)? Please select all that apply:

	Grocery shopping	Shopping (not grocery shopping, e.g. clothes, furnitures, gifts)
Not applicable	☐	☐
Walking	☐	☐
Bicycle	☐	☐
Moped/scooter	☐	☐
Motorcycle	☐	☐
Train	☐	☐
Bus, tram, metro	☐	☐
Airplane	☐	☐
Car (as driver)	☐	☐
Carpooling * with your partner [If any]	☐	☐
Carpooling with other people inside or outside the household	☐	☐
Car sharing (rent a car, e.g. greenwheels)	☐	☐

57. Do you EVER make use of the following transport options for the following purpose: Leisure (Sports, social visits, day trips)? Please select all that apply:

	Leisure (Sports, social visits, day trips)
Not applicable	☐
Walking	☐
Bicycle	☐
Moped/scooter	☐
Motorcycle	☐
Train	☐
Bus, tram, metro	☐
Airplane	☐
Car (as driver)	☐
Carpooling * with your partner [If any]	☐
Carpooling with other people inside or outside the household	☐
Car sharing (rent a car, e.g. greenwheels)	☐

58. Do you EVER make use of the following transport options for the following purpose: Going on holidays? Please select all that apply:

	Going on holidays
Not applicable	☐
Walking	☐
Bicycle	☐
Moped/scooter	☐
Motorcycle	☐
Train	☐
Bus, tram, metro	☐

Airplane	☐
Car (as driver)	☐
Carpooling * with your partner [If any]	☐
Carpooling with other people inside or outside the household	☐
Car sharing (rent a car, e.g. greenwheels)	☐

59. How may flights (roundtrip) do you make on an annual basis?

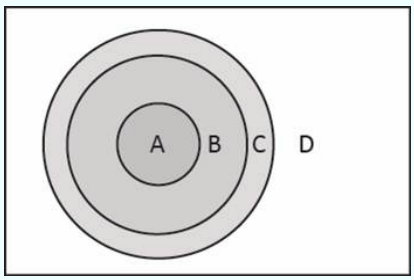
	Number:
Private:	
Business trip * :	

Dwelling characteristics

This section asks some questions about the residential environment in which you live.

60. What is the name of the city/village where you live in/nearby? Name:

61. Looking at the diagram below, to which category do you think your dwelling location belongs?



- ○ A: Inner city
- ○ B: City neighbourhood
- ○ C: City edge/outskirts
- ○ D: Village/rural area
- ○ Other, please specify:

62. What is your dwelling's postcode? Postcode:

63. What is your dwelling type?

- ○ Apartment
- ○ Terraced house or town house
- ○ Semi-detached
- ○ Detached, villa
- ○ Other, please specify:

64. To your opinion, how accessible is your dwelling by public transport?

- ○ Not accessible
- ○ Hardly accessible
- ○ Fairly accessible
- ○ Easily accessible

65. To your opinion, how bicycle/pedestrian- friendly is your neighbourhood?

- ○ Completely unfriendly
- ○ Hardly friendly
- ○ Fairly friendly
- ○ Completely friendly

Als HC1_4b gelijk is aan 1 *Travel behaviour COUPLE*

Travel behaviour

In this section questions are asked about how you use your car[s] to travel in general and for different purposes.

Please answer the following questions for ALL CAR TRIPS you make:

66. How many days a month do you drive? Days per month:

67. How often is the total distance that you drive in one day more than 100km?

- Once a week
- Several times per week
- One or several times per month
- One or several times per year
- Never *Ga verder met vraag to work and study trips go to jump go to to study if respondent does not work*

68. What are the main reasons for your car trips more than 100 kilometres?
Please select all that apply:

- Commute to work/study
- Business trips *
- Shopping (not grocery shopping, e.g. clothes, furnitures, gifts)
- Leisure (sports, day trips, etc.)
- Social visits to family/friends
- Holidays
- Other, please specify:

Travel behaviour

In this section questions are asked about how you and your partner use your car[s] to travel in general and for different purposes.

Please answer the following questions for ALL CAR TRIPS you and your partner make:

69. How many days a month do you drive? And your partner?

	You, as a driver	Your partner, as a driver
Days per month:		

70. How often is the total distance that you drive in one day more than 100km? And your partner?

	You, as a driver	Your partner, as a driver
Once a week	○	○
Several times per week	○	○
One or several times per month	○	○
One or several times per year	○	○
Never	○	○

71. What are the main reasons for you and/or your partner's car trips more than 100 kilometres?
Please select all that apply:

	1	2
Commute to work/study	☐	☐
Business trips *	☐	☐
Shopping (not grocery shopping, e.g. clothes, furnitures, gifts)	☐	☐
Leisure (sports, day trips, etc.)	☐	☐

Social visits to family/friends	☐	☐
Holidays	☐	☐
Other, please specify:		

Als HC1_3 niet gelijk is aan 1
EN HC1_3 niet gelijk is aan 3
EN HC1_3b(1) niet gelijk is aan 1
EN HC1_3b(1) niet gelijk is aan 3

Work trips

This section asks some questions about your commute to your work location.

72. Do you have one or more fixed work locations?

- ○ Yes, one fixed work location outside home → Ga verder met vraag 73.
- ○ Yes, more than one fixed work location outside home, I spend at least one day a week at each of them
- ○ Yes, a fixed work location outside home but I also visit several locations for business trips (to call on clients, attend meetings etc.)
- ○ No, work location changes per period (e.g. temporary jobs, construction worker) → Ga verder met vraag *Jump if respondent does not study*
- ○ No, I visit several locations per day/week (e.g. representative, consultant, plumbers etc.) → Ga verder met vraag *Jump if respondent does not study*
- ○ No, I am always on the move (e.g. driver) → Ga verder met vraag *Jump if respondent does not study*
- ○ No, I work mostly from the home address → Ga verder met vraag *Jump if respondent does not study*

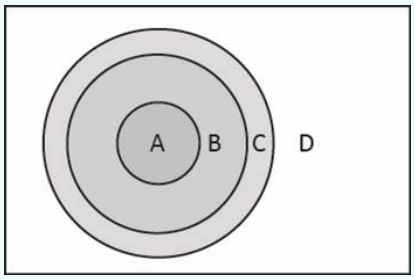
Please answer the following questions for your MAIN* work location.

73. What is the name of the city/village where your work location outside home is situated?
I work in / nearby:

74. How would you describe your work location outside home?

- ○ Business/office park *
- ○ Industrial estate **
- ○ Other

75. Looking at the diagram below, to which category do you think your work location belongs?



- ○ A: Inner city
- ○ B: City neighbourhood
- ○ C: City edge/outskirts
- ○ D: Village/rural area
- ○ Other, please specify:

76. How often do you commute to work on average?

- ○ 5 or more days a week
- ○ 4 days a week
- ○ 3 days a week
- ○ 2 days a week
- ○ 1 day a week
- ○ At least once a fortnight
- ○ At least once a month

77. What is the primary* means of transport for your commute to work location?

- Car
- Train
- Bus, tram, metro
- Motorcycle
- Moped/scooter
- Bicycle
- Electric bicycle
- Walking
- Other, please specify:

78. Please estimate the distance from your home to your work location (single trip).

- 0 - 10 km
- 11 - 30 km
- 31 - 50 km
- 51 - 100 km
- 101 - 150 km
- 151 - 200 km
- 201 - 250 km
- More than 250 km, please specify :

79. Please estimate the average time spent commuting to your work location (single trip). Minutes:

80. Available parking place at your work location:
Please select all that apply:

- Employer provided parking
- Paid public garage
- Free public garage
- Paid on-street parking
- Free on-street parking
- Other, please specify:

Als HC1_3b(1) niet gelijk is aan 5
EN HC1_3 niet gelijk is aan 5 → *Refuelling habit*

Study trips

This section asks some questions about your commute to your study location.

81. Do you have a study location outside home?

- Yes
- No → Ga verder met vraag *Refuelling habit*

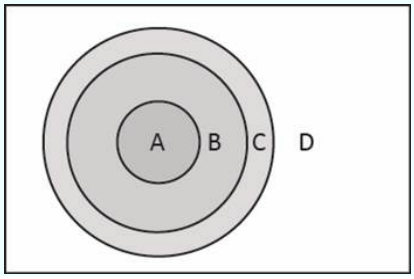
Please answer the following questions for your MAIN* study location.

82. What is the name of the city/village where your study location outside home is situated?
I study in / nearby:

83. How would you describe your study location outside home?

- Business/office park *
- Industrial estate **
- Other

84. Looking at the diagram below, to which category do you think your study location belongs?



- ○ A: Inner city
- ○ B: City neighbourhood
- ○ C: City edge/outskirts
- ○ D: Village/rural area
- ○ Other, please specify: _____

---

85. How often do you commute to study on average?

- ○ 5 or more days a week
- ○ 4 days a week
- ○ 3 days a week
- ○ 2 days a week
- ○ 1 day a week
- ○ At least once a fortnight
- ○ At least once a month

---

86. What is the main* means of transport for your commute to your study location?

- ○ Car
- ○ Train
- ○ Bus, tram, metro
- ○ Motorcycle
- ○ Moped/scooter
- ○ Bicycle
- ○ Electric bicycle
- ○ Walking
- ○ Other, please specify: _____

---

87. Please estimate the distance from your home to your study location (single trip).

- ○ 0 - 10 km
- ○ 11 - 30 km
- ○ 31 - 50 km
- ○ 51 - 100 km
- ○ 101 - 150 km
- ○ 151 - 200 km
- ○ 201 - 250 km
- ○ More than 250 km, please specify : _____

---

88. Please estimate the average time spent commuting to your study location (single trip). Minutes: _____

---

89. Available parking place at your study location:
Please select all that apply:

- ☐ Paid public garage
- ☐ Free public garage
- ☐ Paid on-street parking
- ☐ Free on-street parking
- ☐ Other, please specify: _____

Refuelling habit

Please answer the following question about your car refuelling habit:

---

90. When do you usually fill the tank?

- When the tank is half full
- When the tank is quarter full
- When the tank is quite empty (but the warning indicator is off)
- When the tank is almost empty (and the warning indicator is on)
- Not applicable

Als HC1_3b(2) niet gelijk is aan 1
EN HC1_3b(2) niet gelijk is aan 3

Work trips

This section asks some questions about your partner's commute to the work location.

---

91. Does your partner have one or more fixed work locations?

- Yes, one fixed work location outside home Ga verder met vraag 92.
- Yes, more than one fixed work location outside home, spends at least one day a week at each of them
- Yes, a fixed work location outside home but also visits several locations for business trips (to call on clients, attend meetings etc.)
- No, work location changes per period (e.g. temporary jobs, construction worker) Ga verder met vraag *jump if partner does not study*
- No, visits several locations per day/week (e.g. representative, consultant, plumbers etc.) Ga verder met vraag *jump if partner does not study*
- No, is always on the move (e.g. driver) Ga verder met vraag *jump if partner does not study*
- No, works mostly from the home address Ga verder met vraag *jump if partner does not study*

Please answer the following questions for <u>your partner's</u> MAIN* work location.

---

92. What is the name of the city/village where your partner's work location outside home is situated?

- My partner works [studies] in/nearby: _____
- I don't know

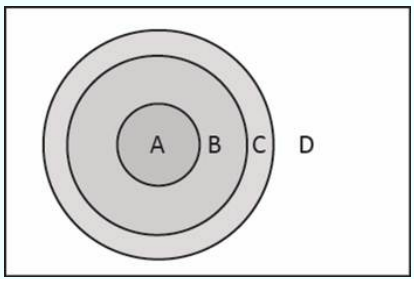
---

93. How would you describe your partner's work location outside home?

- Business/office park *
- Industrial estate **
- Other
- I don't know

---

94. Looking at the diagram below, to which category do you think your partner's work location belongs?



- A: Inner city
- B: City neighbourhood
- C: City edge/outskirts
- D: Village/rural area
- Other, please specify: _____
- I don't know

---

95. How often does your partner commute to work on average?

- 5 or more days a week
- 4 days a week
- 3 days a week
- 2 days a week
- 1 day a week
- At least once a fortnight
- At least once a month
- I don't know

---

96. What is your partner's main* means of transport for the commute to work location?

- Car
- Train
- Bus, tram, metro
- Motorcycle
- Moped/scooter
- Bicycle
- Electric bicycle
- Walking
- Other, please specify:
- I don’t know

---

97. Please estimate the distance from your home to your partner's work location (single trip):

- 0 - 10 km
- 11 - 30 km
- 31 - 50 km
- 51 - 100 km
- 101 - 150 km
- 151 - 200 km
- 201 - 250 km
- More than 250 km, please specify :
- I don't know

---

98. Please estimate the average time spent commuting to your partner's work (single trip).

- Minutes:
- I don't know

---

99. Available parking place at your partner's work location:
Please select all that apply:

- Employer provided parking
- Paid public garage
- Free public garage
- Paid on-street parking
- Free on-street parking
- Other, please specify:
- I don’t know

Als HC1_3b(2) niet gelijk is aan 5

Study trips

This section asks some questions about your partner's commute to the study location.

---

100. Does your partner have a study location outside home?

- Yes
- No Ga verder met vraag *jump if single*

Please answer the following questions for your partner’s MAIN* study location.

---

101. What is the name of the city/village where your partner's study location outside home is situated?

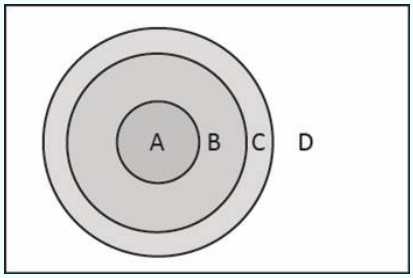
- My partner studies in/nearby:
- I don’t know

---

102. How would you describe your partner's study location outside home?

- Business/office park *
- Industrial estate **
- Other
- I don't know

103. Looking at the diagram below, to which category do you think your partner's study location belongs?



- ○ A: Inner city
- ○ B: City neighbourhood
- ○ C: City edge/outskirts
- ○ D: Village/rural area
- ○ Other, please specify: _____
- ○ I don't know

104. How often does your partner commute to study on average?

- ○ 5 or more days a week
- ○ 4 days a week
- ○ 3 days a week
- ○ 2 days a week
- ○ 1 day a week
- ○ At least once a fortnight
- ○ At least once a month
- ○ I don't know

105. What is the main* means of transport for your partner's commute to the study location?

- ○ Car
- ○ Train
- ○ Bus, tram, metro
- ○ Motorcycle
- ○ Moped/scooter
- ○ Bicycle
- ○ Electric bicycle
- ○ Walking
- ○ Other, please specify: _____
- ○ I don’t know

106. Please estimate the distance from your home to your partner's study location (single trip):

- ○ 0 - 10 km
- ○ 11 - 30 km
- ○ 31 - 50 km
- ○ 51 - 100 km
- ○ 101 - 150 km
- ○ 151 - 200 km
- ○ 201 - 250 km
- ○ More than 250 km, please specify: _____
- ○ I don't know

107. Please estimate the average time spent commuting to your partner's study location (single trip).

- ○ Minutes: _____
- ○ I don't know

108. Available parking place at your partner's study location:
Please select all that apply:

- ☐ Paid public garage
- ☐ Free public garage
- ☐ Paid on-street parking
- ☐ Free on-street parking
- ☐ Other, please specify: _____
- ☐ I don't know

Als Q3 gelijk is aan 1
OF Q3 gelijk is aan 2 *Next car*
Anders als HC1_4b gelijk is aan 2 *Next car*

Refuelling habit your partner

Please answer the following question about your partner's car refuelling habit:

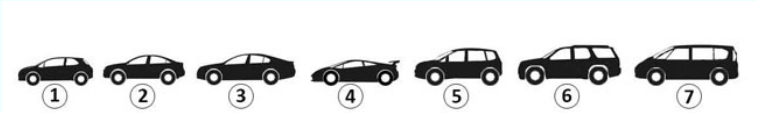
109. When does your partner usually fill the tank?

- When the tank is half full
- When the tank is quarter full
- When the tank is quite empty (but the warning indicator is off)
- When the tank is almost empty (and the warning indicator is on)
- Not applicable
- I don't know

Next car

Imagine you are going to purchase or lease your next car, what would the characteristics of your next car be?

110. Type:



- 1. Small car
  1
- 2. Medium car
  2
- 3. Large car
  3
- 4. Sports car
  4
- 5. Estate car, MPV (Multi-Purpose Vehicle)
  5
- 6. SUV (Sport Utility Vehicle)
  6
- 7. Small van
  7
- 8. Other, please specify:

111. Fuel:

- Petrol
- Diesel
- LPG
- Ethanol
- Full-electric
- Hybrid electric (not plug-in)
- Plug-in hybrid electric
- Other, please specify:

112. What is the most important activity you would use this car for?

- Commute to work or school
- Chauffer children or other non-drivers
- Daily activities such as grocery shopping
- Shopping (not grocery shopping, e.g. clothes, furnitures, gifts)
- Business trips
  *
- Leisure (Sports, social visits, day trips)
- Going on holidays
- Other, please specify:

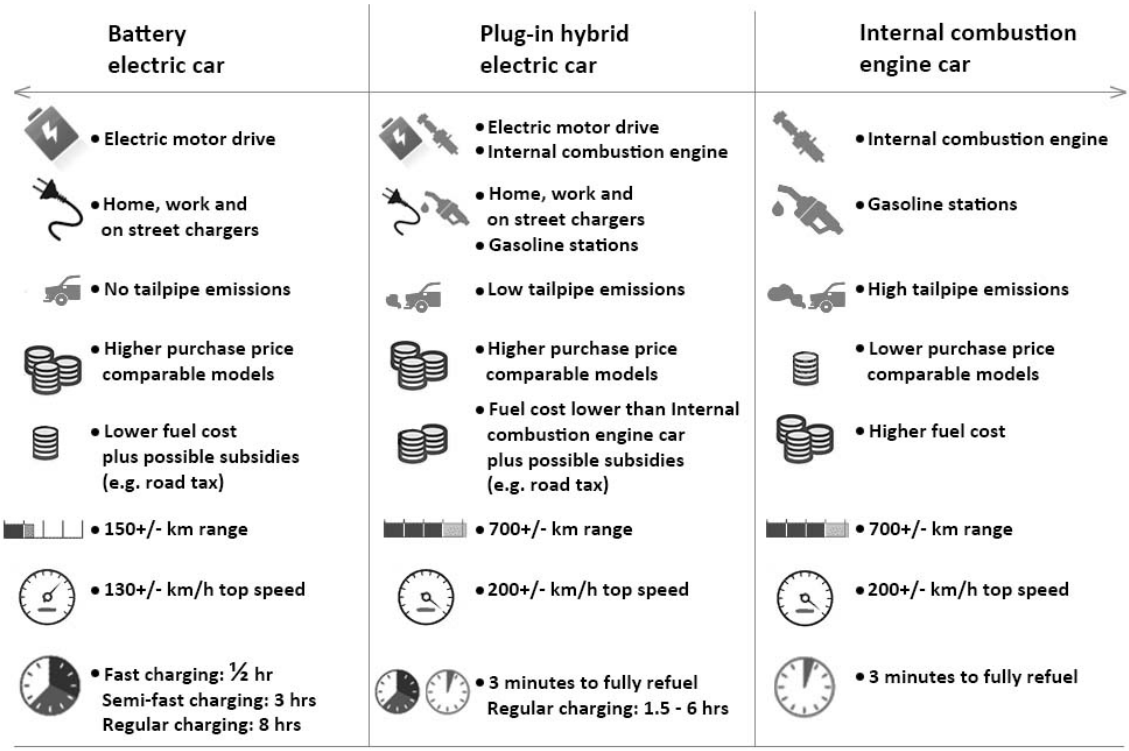
113. I would buy this type of car because it is:
Please select maximum three:

- convenient for weekend trips and holidays
- convenient for hauling large loads
- economical due to subsidies (on tax, parking, etc.)
- stylish

- ☐ environmentally friendly
- ☐ cheap to purchase/lease
- ☐ inexpensive insurance
- ☐ re-sellable
- ☐ comfortable
- ☐ safe
- ☐ reliable
- ☐ powerful
- ☐ exciting to drive

Electric cars

This section provides you with a comparison on three different car types (1.Battery electric car 2.Plug-in hybrid electric car and 3.Internal combustion engine car) and asks you some questions about them.



114. How likely are you to consider buying/leasing the following options as your next car?

	Extremely unlikely			Neutral			Extremely likely
	1	2	3	4	5	6	7
Battery electric car	○	○	○	○	○	○	○
Plug-in hybrid car	○	○	○	○	○	○	○
Internal combustion engine car	○	○	○	○	○	○	○

115. Please indicate how much you agree with the following statements.

	Strongly disagree			Neither agree or disagree			Strongly agree
	1	2	3	4	5	6	7
My car reflects my socio-economic status.	○	○	○	○	○	○	○
I am concerned about our planet earth and environmental issues.	○	○	○	○	○	○	○
I prefer energy-efficient appliances.	○	○	○	○	○	○	○
I think more about saving money than saving the environment when reducing energy use.	○	○	○	○	○	○	○
It is important to be independent from fossil fuels delivered by politically unstable countries.	○	○	○	○	○	○	○
I keep an eye on the new technologies. I dare to take a risk and am the first to buy and try out innovative products.	○	○	○	○	○	○	○
I know about alternative car technologies (fuel cell, electric or hybrid electric cars).	○	○	○	○	○	○	○

I only think of a car as a means to get me from A to B.	○	○	○	○	○	○	○
I try to drive efficiently to save fuel.	○	○	○	○	○	○	○
I prefer to use a transport means that keeps me healthy.	○	○	○	○	○	○	○

116. Please indicate how much you agree with the following statements.

	Strongly disagree			Neither agree or disagree			Strongly agree
	1	2	3	4	5	6	7
Electric cars are for people with limited mobility needs (housewives, retired couples, etc.).	○	○	○	○	○	○	○
Electric cars are economically profitable in the long run.	○	○	○	○	○	○	○
Electric cars are 'work in progress'.	○	○	○	○	○	○	○
Electric car charging would be too inconvenient for my lifestyle.	○	○	○	○	○	○	○
Electric cars would not fulfil my travel needs, because of the battery range.	○	○	○	○	○	○	○
I am sceptical about how green/environmental friendly electric cars actually are.	○	○	○	○	○	○	○
I am optimistic about the future advances in electric cars (batteries and infrastructure).	○	○	○	○	○	○	○

117. Thank you for taking the time to complete this questionnaire. If there is anything else you would like to tell us, please use the box below.

Afsluitende pagina

Your answers have been sent to us. You can now close the window.

Acknowledgements

We kindly thank the following colleagues for their assistance with the review and the translation of the questionnaire.

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About E-Mobility NSR

The Interreg North Sea Region project North Sea Electric Mobility Network (E-Mobility NSR) will help to create favourable conditions to promote the common development of e-mobility in the North Sea Region. Transnational support structures in the shape of a network and virtual routes are envisaged as part of the project, striving towards improving accessibility and the wider use of e-mobility in the North Sea Region countries.

www.e-mobility-nsr.eu

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