

# Public perceptions of electric vehicles and vehicle-to-grid (V2G): Insights from a Nordic focus group study

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**Abstract:** Public awareness and acceptance of electric vehicles (EVs) are essential components to catalyse a faster uptake of more sustainable passenger transport as well as vehicle-to-grid (V2G) mobility. As such, public perceptions are central to decarbonize transportation and help capture the co-benefits of reduced local pollution, noise emissions, and oil dependency. However, we observe that the general public is often treated statically and seen as either problematic or peripheral to questions within the transport and energy studies communities. This paper asks two questions. First, given increasing adoption in the Nordic region, how do ordinary members of the public perceive EVs? And second, how do they perceive V2G? With these questions, the paper offers an international and in-depth assessment of public perceptions of EVs and V2G systems across five Nordic countries using original data drawn from eight focus groups. We find eight themes of relevance for future research and policy. These include often discussed insights like an EV's environmental sustainability, range, charging or price, but also insights around themes like social status, sound, and acceleration. Additionally, we asked the participants whether V2G strengthens (or weakens) the desirability of EVs. The paper ends with a reflection on the knowledge discrepancies between national focus groups and individuals with and without EV presence and the different informational requirements that are needed to address them.

**Keywords:** Electric Vehicles (EVs); Vehicle to Grid (V2G); Public Perceptions; Focus Groups; Nordics

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# **Public perceptions of electric vehicles and vehicle-to-grid (V2G): Insights from a Nordic focus group study**

## **1 INTRODUCTION**

Studies within the burgeoning literature on electric mobility tend to find an array of sobering barriers to future adoption and use. For example, many studies have noted that consumer barriers to a faster Electric Vehicle (EV)<sup>1</sup> uptake include the higher price and lower range compared to internal combustion engine vehicles (ICEVs), a (perceived) lack of charging infrastructure, a lack of EV models and sizes, unpredictable government support policies (or their absence), and, for various reasons, low consumer awareness and acceptance (Biresselioglu et al., 2018; Coffman et al., 2017; Hardman et al., 2018; Kester et al., 2018a; Li et al., 2017; Liao et al., 2017; Rezvani et al., 2015).

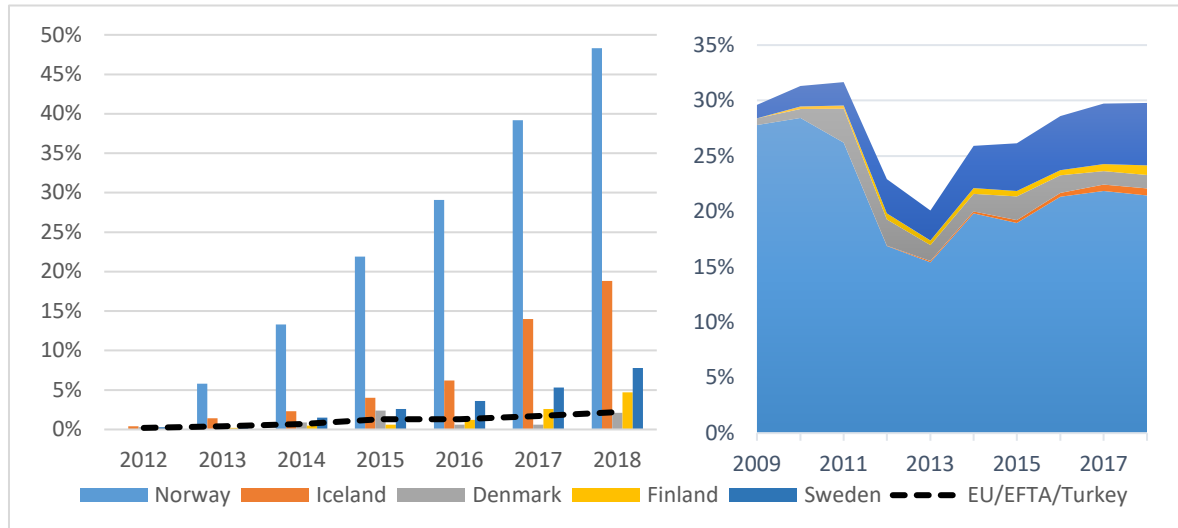
The EV market is changing however; more and more original equipment manufacturers (OEMs) are shifting production lines, more and more EVs appear on the streets, and overall market shares are growing – slowly – across the globe (IEA, 2018; IEA and Nordic Energy Research, 2018). The Nordic region especially offers an exemplary case study to analyse how EV adoption influences the perceptions, reasoning and acceptance of EVs, now that the markets are moving from niches to early adopters in Denmark, Finland and Sweden to strong double-digit market shares in Iceland and Norway, see Figure 1. Given that these countries share similar political systems and values, and broadly agree on the importance of emission reductions in transport, the different adoption rates primarily stem from differences in public support schemes for electric mobility, although local car market and employment considerations also play an important role (IEA and Nordic Energy Research, 2018; Kester et al., 2018a).

Among these countries, Norway and Iceland stand apart, with, among others, high percentages of renewable electricity, high car taxation levels and large VAT and purchase tax exemptions which lead to comparably priced EVs and conventional cars. These countries are followed by Sweden, which recently set up a bonus-malus subsidy but also is home to a domestic biofuel and car industry which historically have led to low car taxes and strong biofuel support. Finland with its slightly lower purchasing power levels is another country with a strong biofuel industry but is also home to a growing number of internationally operating EV charging companies, and offers CO<sub>2</sub> based registration and ownership reductions favouring EVs. The lowest sales share can be found in Denmark, which sees high purchase car taxes and a fluctuating commitment to a purchase tax exemption (Figenbaum, 2018; IEA and Nordic Energy Research, 2018; Ryghaug and Skjølsvold, 2019).

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<sup>1</sup> With EVs we refer to all pluggable electric vehicles (e.g. PEVs), both full battery electric vehicles (BEVs) and pluggable hybrid electric vehicles (PHEVs).

**Figure 1: EV sale shares of Nordic countries and European continent (left), and Nordic contribution to total European EV fleet (right)**



Data: EAFO (2018)

With the developing EV market comes a growing body of academic research. While highly insightful on consumer preferences, EV driver practices, public support schemes, supply chains and technological developments, recent reflections point out that the literature tends to be based on similar assumptions. It is noteworthy for example that EV consumer preference studies are primarily survey and choice-experiment based (Helveston et al., 2015; Hidrue et al., 2011; Jensen et al., 2013; Wolbertus et al., 2018). Studies that are qualitatively oriented, in turn often focus on the experience of EV drivers (Anfinssen et al., 2019; Franke et al., 2012; Graham-Rowe et al., 2012; Ryghaug and Toftaker, 2014; Skippon and Garwood, 2011), the ways that potential early adopters (e.g. car buyers) can be influenced through incentives (Axsen et al., 2013; Bjerkan et al., 2016; Burgess et al., 2013; Egbue and Long, 2012), or on EV adoption barriers by experts and stakeholders (Bergman et al., 2017; Matthews et al., 2017; Noel et al., 2018; Ryghaug and Toftaker, 2016; Zarazua de Rubens et al., 2018). In other words, there is little qualitative research on the perceptions and reasoning of those who do not directly own or are in the market for an EV.

In their reflections, Coffman et al. (2017) and Hafner et al. (2017) similarly conclude that there is lack of in-depth qualitative analysis that bridges and explains the stated preferences in broad representative surveys and choice experiments to actual consumer reasoning and behaviour. Likewise, Axsen and Kurani (2011, p. 150) and Bergman et al. (2017) remark that EV consumer research is vulnerable to a broader critique in transport studies, which relies too much on a 'technical rational model' and simplifies how consumers behave (Marsden and Reardon, 2017). Besides the need for

more qualitative studies on a wider range of consumer groups, Rezvani et al. (2015) note that the current literature could also benefit from more research on consumer perceptions towards EV incentives and government transport policies.

Additionally, a small stream of research is engaging with the two-way interaction between academy and consumer markets. Kühl et al. (2019) recently argued that there is a discrepancy between what the academic literature sees as the core barriers (price and car characteristics) and what consumers and EV drivers in their daily life (twitter) discuss as EV challenges (charging and other aspects). This relates to insights from Epprecht et al. (2014) and Berkeley et al. (2018) that early consumer perceptions about EVs and their barriers can become entrenched in EV discourses. These scholars specifically highlight the enduring narratives among consumers about the size, range and aesthetics of early EV models. However, we would argue that the argument can be extended to general EV research that repeatedly reconfirms the same barriers and thereby supports a counter adoption discourse that offers little to help understand and disclose the underlying drivers. Fry et al. (2018, p. 7) in this respect surmise that EV adoption is a moving target, and argue that acceptance and adoption research should be 'addressed on an on-going basis in the same way as [EV] knowledge and awareness[, as] it is possible that perceptions and attitudes will also evolve in time.' There is thus a need for repeated observations of the EV market and its consumers (Burgess et al., 2013) in a general public context.

This study offers a comparative focus group-based assessment of the perceptions and awareness of both EVs and V2G systems in the Nordic region among members of the general public. In other words, people who are not directly involved in the testing or buying of an EV and who do not necessarily have an updated and informed perception about these technologies. The study utilizes a semi-structured focus group approach to answer two questions. First, how do ordinary members of the public in the Nordic region perceive EVs, given the rapid but varied uptake there? And second, how do they perceive Vehicle-to-Grid (V2G) configurations? We ask this second question as V2G is a relatively young but promising technology that enables bi-directional electricity flows and thereby enables EV batteries to be used as a storage device for electricity grids. It is expected that the monetary compensation to EV owners for V2G services will support EV adoption, but that questions around battery ownership, warranty, degradation and privacy could refrain people from participating (Kempton and Tomić, 2005; Sovacool et al., 2018).

The contribution of this paper is four-fold. First, it offers an updated and perhaps more nuanced analysis of public perceptions about EVs and EV markets. Second, to the best of our knowledge, it offers the first such analysis of V2G. Third, it offers these analyses of eight focus groups with 61 participants across the five Nordic countries, thereby making it one of the few international oriented focus group studies, especially in relation to electric mobility. Lastly, this paper not only discusses the

explicitly stated challenges and benefits of EVs, but also assesses knowledge gaps, myths and ignorance that participants have about EVs.

The paper proceeds by first summarizing its research method, before moving to discuss eight qualitative insights and concluding.

## **2 RESEARCH METHOD**

This paper utilizes semi-structured focus groups (Kitzinger, 1994, 1995; Krueger and Casey, 2014; Wiklund et al., 2014) as these are particularly useful to better understand public perceptions and social awareness around a topic or theme.

Within transport studies, focus groups are used to explore the reasoning and choices behind new or existing themes (Carvalho et al., 2016; Delbosc and Currie, 2016; Ferrer and Ruiz, 2018; Pudāne et al., 2018) or to test survey questions and triangulate findings with other methods (Pronello and Rappazzo, 2014; Shay et al., 2016). In relation to electric mobility, focus groups are used to test assumptions behind survey analyses and choice modelling (Cordera et al., 2018; Higgins et al., 2012; Melliger et al., 2018; Robinson et al., 2013) or conducted in combination with interviews or travel data (Bunch et al., 1993; Kurani et al., 1994; Ryghaug and Toftaker, 2014; Zaunbrecher et al., 2015).

To our knowledge only a few studies on EVs have taken them as an independent or deep method (Caperello et al., 2014; Flamm and Agrawal, 2012; Hoffmann et al., 2014; Wikström et al., 2016). Furthermore, most of these studies on EVs or green vehicles draw on small sample sizes, a single region, or focus on EV drivers. For example, Zaunbrecher et al. (2015) draw insights from three focus groups with 24 participants in Germany in 2012, and found that misconceptions about EVs persist and that responses were gendered. Flamm and Agrawal (2012) found that participants rarely thought about the environmental impact of their vehicle choice when they discussed the purchase of sustainable vehicles in 4 focus groups with 36 randomly sampled Californian participants. Macias and Gregory (2015) in turn found that the level of understanding among 62 participants in Vermont about the environmental and health benefits is not a good predictor for actual sustainable transport mode choices, which they linked to lower costs, exercise, ideological resistance against motorized transport and incentive programs.

This study draws on original data from 8 semi-structured focus groups with 61 participants across Iceland, Sweden, Denmark, Finland and Norway to discuss public perceptions about the benefits, challenges and measures behind EVs and V2G. The focus groups were conducted over the course of a year alongside the fieldwork (expert interviews) of a large EV and V2G study, for which we visited 17 different cities across the five Nordic countries from October 2016 to September 2017. In most of the cities that we visited we tried to set up a focus group. The participants in Table 1 were recruited either through local university connections and a combination of personal contacts and broad advertisement

or through local psychology labs and their email lists. The only requirement for participation was that the participants were over 18 and living permanently in the region of the focus group. Candidates were offered around 20 euros and a light meal with refreshments. In general, the groups lasted between 1.5 and 2 hours, and, in line with Krueger and Casey (2014), consisted between 5 to 10 and ideally 6 to 8 participants. At the start, the candidates received a brief introduction about the focus group, followed by another brief explanation of V2G halfway in (see Annex 1 for an overview of the questions).

In addition to the mixed gender focus groups, we conducted one additional all-male and one additional all-female groups in Aarhus (Denmark) to make potential gender differences more explicit, although we do not report on that here. Overall, the groups were tilted towards participants living in urban/semi urban regions and towards more highly educated young professionals and (advanced) students with professional backgrounds ranging from a musician, a chef and a train conductor to sustainability and business major students and engineers working on wind energy. Gender was relatively equal, but age ranged from 19 to 61, with the majority in their late twenties and early thirties. Most of them had a driver's license but only half of them owned or frequently used a car (many borrowed one from family and friends or used shared car services). In some of the focus groups in Denmark, Sweden and Norway participants had experience with an EV and shared this with the group.

**Table 1: Overview of Focus Groups**

Classifications	Participants (n=61)	% of Participants
ICE: Iceland [Mixed Gender] (Oct 2016)	5	8,2%
SWE: Sweden [Mixed Gender] (Nov 2016)	6	9,8%
DK1: Denmark [Mixed Gender] (Feb 2017)	10	16,4%
FIN1: Finland 1 [Mixed Gender] (Mar 2017)	9	14,8%
FIN2: Finland 2 [Mixed Gender] (Mar 2017)	7	11,5%
DK2: Denmark [Male] (Jun 2017)	7	11,5%
DK3: Denmark [Female] (Jun 2017)	8	13,1%
NO: Norway [Mixed Gender] (Sept 2017)	9	14,8%
Female	32	52,5%
Driver's license	50	81,9%
Currently own or regular use of a car	29	47,5%
Experienced an EV (as driver or passenger)	8	13,1%

The meetings were recorded, transcribed and coded in NVIVO on a statement by statement level while differentiating between challenges, benefits and solutions. Given contradictory statements, participants changing their mind or learning from colleagues, we later bundled these challenges, benefits and solutions under general themes. Analytically, our coding scheme was exhaustive and inductive, but with some themes inspired by the literature or our deliberate focus on V2G and situational car use (Pudāne et al., 2018). As a result, the themes partly confirm well known categories,

but also issues that we deemed important or that surprised us, like the amount of time the groups spent discussing sound. Subsequent word counts of the coded participant statements confirmed the relevance of these insights and provided us with an indication of their relative popularity across the countries as it adjusts for number of groups (see Table 2, section 3). Naturally, word counts are only indicative of the time spent discussing these issues. They offer no indication of the quality, level of agreement and nature of the discussion. If anything, they highlight disagreement and uncertainty.

Focus groups have multiple benefits compared to other methods. As it is not a quick round of strategically placed questions and answers (a group interview) but an actual group discussion, the participants have a lot of freedom to (re)direct the discussion. This enables them to bring up and work through arguments, priorities and perceptions based on the combined knowledge of the group, beyond what any individual participant or the organizers would have considered (Kitzinger, 1995, 1994). Participants can add, reject or question each other's input, and together come to new insights and priorities. This is desirable for our study, firstly, because of our interest in the interaction between those who have or have not experienced a drive in an EV and, secondly, because V2G is relatively unknown and the group process gives participants the opportunity to come to a position collectively (Pudāne et al., 2018). However, as Wiklund et al. (2014) note, this freedom has a cost as focus groups are not representative samples. Participation often involves some level of self-selection bias (participants are drawn to the topic or not) and is mediated by a mixture of convenience and purposeful sampling on the organizers side.

### **3 RESULTS**

A multitude of perceived benefits and challenges of EVs and V2G were mentioned in the focus groups. During the discussions eight shared themes emerged. In line with earlier findings (and perhaps because of them), these themes include well known discussions about the environmental impact of EVs and their price, range and charging aspects. However, the groups also touched on other aspects including the performance of the car, the sound dimension, the status of an EV and general consumer awareness aspects. As per Annex 1 and our initiative, they further discussed government incentive programs and V2G technology.

Each of these themes will be discussed below. In general, and partly driven by differences in EV markets, incentive programs and local circumstances, there are slight differences in concerns and discussions across the countries, as summarized in Table 2. Noteworthy are the relative low word counts in Finland for the environmental aspects of EVs and in Sweden for the discussions about price and fiscal measures. Table 2 also shows that range and charging are a shared basic concern across the respective nationalities of our sample, and that in Iceland and Norway, the countries with the largest incentive programs, relatively more attention was paid to topics related to status, awareness and

information. Furthermore, the final column shows that participants tend to spend less time on the first three themes which most participants framed as the core benefits of EVs – meaning there was less to talk about (indicating more agreement) then when discussing the other topics.

Given the limitations of word counts, these percentages are not used to rank the themes in order, instead we follow the general line of the focus group discussions as described under the explorative questions in Annex 1. Section 3 thus starts with a discussion of what participants initially describe as the three most discussed benefits (including their uncertainty, questions and alternative perspectives), then discuss what they considered the core challenges and then turn to V2G and a discussion about EVs more broadly as a mode of transport.

**Table 2: Relative share of coded topics per focus group theme and country**

	Iceland	Sweden	Denmark	Finland	Norway	Total
1 Environmental sustainability	13,9%	10,6%	9,3%	3,1%	8,4%	9,2%
2 Sound, noise and silence	12,7%	7,1%	6,7%	4,4%	6,6%	7,3%
3 Power, acceleration and technology	8,2%	20,5%	5,2%	6,6%	5,7%	8,1%
4 Price and fiscal austerity	14,6%	3,2%	17,3%	17,4%	15,6%	14,6%
5 Range and charging infrastructure	16,2%	13,0%	16,5%	19,0%	17,6%	16,5%
6 Status, awareness and information	22,6%	13,6%	13,6%	17,2%	21,9%	17,0%
7 Innovation and vehicle-to-grid applications	9,4%	12,4%	14,7%	21,7%	6,2%	12,9%
8 EVs and multi-modal transport	2,4%	19,5%	16,7%	10,5%	18,0%	14,4%

### 3.1 Environmental sustainability

The lack of emissions was a clear and well acknowledged relative benefit of EVs across the groups, yet confusion and questions about their precise impact made it simultaneously one of the most questioned themes. In Sweden for example, when asked about the benefits of EVs, participants immediately mentioned the lower emissions of an EV, while also pointing to the differences between direct local tailpipe emissions and indirect well-to-wheel emissions. Such a well-informed distinction did not come up in all groups. In fact, six groups saw some sort of a discussion about the precise climate benefits of EVs focusing on either the electricity generation, the battery production or actual well-to-wheel lifecycle emissions.

First, half the groups discussed electricity generation (Ortar and Ryghaug, 2019). In Norway and Iceland because participants were aware that their electricity was green, and in Sweden because they hoped no coal plants were used. Yet it was most discussed in Denmark, where participants from DK1 and DK3 both had discussions like this:



*DK1\_M1<sup>2</sup>: I'm not really sure whether it is really a green car, because most of the electricity that it is using is not green. So, it's polluting somewhere but not where it is driving.*

*DK1\_M2: Yes, you are correct, but maybe it is also ... You are at least not polluting while driving...*

*DK1\_M1: Yes, yes.*

*DK1\_M2: So, I mean of course, if you want to have a really, really clean car, then the energy produced has to be green, and then the car can be really green because you are using green energy. So of course, if you are not using the green energy the car might be not so green. But at least while driving you are green.*

*DK1\_M3: But for example, if we are talking about Denmark, even if the energy is not 100% green, it is much easier to control just the factories which produce energy compared to, you know, controlling 6 billion people, what they do and how they drive, to impose taxes on stuff.*

*DK1\_F1: And if like 40% of the energy right now is green, then at least 30 or 40% of the energy of the car will also be green, while right now it is all petrol. So, at least it would be a bit better. And we hopefully keep working on getting ourselves to 100% green energy in Denmark*

The notion of an easier to govern control of emissions at the source of electricity generation also returned in Norway, while a participant in DK3 repeated the argument of DK1\_F1 about having at least *'the possibility of getting the electricity from carbon dioxide neutral emission sources.'*

Second, participants touched on the batteries, but mainly through questions about their recycling, production and shipping. Such questions were followed in some cases by calls for more regulation and attention. As one participant remarked quite passionately and elaborately:

*DK3\_F: I would like there to be some kind of certified battery. I mean it's not going to be nice because it's mining and it's going to be dirty and it's going to be hard to dispose of – but at least a way of knowing that it's not totally horrible; the conditions of, for example, the workers in the mine, where they come from, and that there's some way of taking care of the battery afterwards.*

While she was talking about certification, participants in Iceland and DK3 were discussing different – less polluting – battery technologies and the need for recycling programs, just as participants in Sweden and Norway were discussing recycling and second-life projects (without giving real examples) and the use of solar energy at manufacturing sites.

Importantly, although these discussions about energy and battery production were conducted on a level beyond our expectation, not all participants took part. For example, the Danish quote above already highlights three levels of understanding about EVs and their environmental effects: those who doubt (DK1\_M1), those who believe and reason (DK1\_M2) and those who know or repeat knowledge

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<sup>2</sup> Participants are fully anonymized. Each abbreviation reflects country and the number of the group (per table 1), gender, and for longer quotes whether it's the same participant talking: DK1\_M1 is the first Danish group and the first speaker is male.

(DK1\_M3 and DK1\_F1). DK1\_M1 was not alone however. In Finland, the second group did not discuss the environmental benefits of EVs explicitly, but did remark on the well-to-wheel emissions with a male participant stating that there are *'still conflicting theories or studies whether [an EV] is more efficient during its lifetime compared with normal cars.'* He was not alone, as a female participant in DK3 similarly confessed that *'people are saying that it's even worse than [] the gasoline and CO2 and fossil fuel consumption. I don't know.'* Like the Danish example, in these groups too, the social dynamics of focus groups subsequently resolved some of this uncertainty as people shared information, as for example in the Norwegian group:

*NO\_F1: Because of the batteries in the cars I think you pollute twice as much, when you create a car. So, in that sense you have to drive a fossil fuel car a little bit before it is worse for the environment than an electrical car.*

*NO\_F2: If you look at the entire lifetime of a car?*

*NO\_F1: Yes. Then the electrical car wins.*

Third, while the Norwegian group thus had participants aware of recent EV lifecycle analyses, they too questioned certain environmental consequences, especially in relation to the turnover rate of the fleets. Norwegian participants questioned a practice that they observed in their country where EV owners buy a new model while the old EV is still fully functional *'as if they were iPhones.'* Likewise, participants in SWE, FIN2 and DK3 briefly questioned the lifecycle impact of replacing a valid ICE vehicle with a new EV. Basically, participants in these groups were confused about turnover rates as they approached EVs from an individual and social justice (Sovacool et al., 2019) perspective, not a fleet perspective. They acknowledged that it makes sense to replace a 25-year-old diesel, or that, when someone wants to buy a new car it should be an EV, but they struggled with the question whether it makes sense to replace modern cars. They thus ignored the systemic benefits of a fleet turnover; e.g. that when an EV replaces a modern petrol car, the latter replaces an older petrol car, and so on.

This leads to three broader remarks. First, it should be noted that the discussions about the lifecycle impact of EVs were usually divorced from the broader context of EV benefits and their comparative advantage over ICE vehicles. When participants questioned specific environmental aspects (as well as car characteristics below), like the electricity generation, battery production and other broader lifecycle analysis, they treated them rather independent of earlier contentions that EVs were environmentally better. Second, we observe a knowledge differential between participants, on a gliding scale between those who are interested in EVs but approach them hesitantly because they only know what they have heard based on generalized statements from peers or media, those who are interested but approach them positively, up to those who discussed the challenges and benefits with some experience and background knowledge, but still felt a desire for more certainty and data. Ultimately, however, all groups had questions about the relative environmental position of EVs. To us

this points to a need for a dual line of communication: one with simple and trustworthy messages and another with more nuanced analyses.

### 3.2 Sound, noise and silence

Surprising to us was the relative attention spent – in every group – on the sound dimension of EVs in relation to both the safety and aesthetic aspects of EVs. While least discussed overall, as a benefit, sound and noise returned more than once right after the CO2 emissions. As participants in Sweden remarked:

*SWE\_M: With emissions, I also thought about noise emissions. That it's supposed to be silent. Actually, I try to, when I walk around in the street nowadays, when you hear cars, most of the times [...] you don't hear the engines. It's the noise of the wheels/tires. So, it's not really less on the outside. On the inside it has less noise emission, but not really on the outside.*

*SWE\_F: But I think I read somewhere, I might be wrong, that one of the issues they have with these electric cars was that they didn't make any sound. They also have to create some kind of [sound] when you are driving. But I mean, definitely, bus 55 that goes from Chalmers to Lindholmen, that is an electrical bus and... To ride it, it's very nice, it's very calm...*

In FIN1, likewise, the lack of sound was described as *'the biggest benefit of an electric vehicle [FIN1\_F]'*, only to get an immediate response that *'it's also a danger [FIN1\_M]'*. Similar shifts were visible in the other groups, with one participant asking about the experiences of others or one participant calling it a core benefit and others thereafter highlighting the potential danger for pedestrians.

Subsequently the debate turned to 'adding sounds', like in Iceland, where a female participant promptly linked it to individualization (farting sounds, Star Wars theme songs) and the car-culture in certain areas of Iceland to have music 'blasting' out of the windows. The group subsequently acknowledged that this might become a bit too much, and was hesitant about giving people the ability to set *'a continuous ringtone for their car [ICE\_M]'*. This was followed by comparisons to modern ICEVs (referring both to alarms when trucks pull back and aesthetic motor sounds) and by more reflective remarks about the responsibility of pedestrians. As one Icelandic participant remarked in response to the danger of silent vehicles: *'Yeah that's true, but I mean you can have something in your ears, people do that. They walk around with their iPhones [ICE\_F]'*, or in Sweden where a participant made the comparison with bikes and that people check for bikes before crossing a bike lane. Those with EV experience in turn added their active response to driving a silent car and highlighted their awareness that *'the people wouldn't hear me coming up behind them, so I had to be extra careful, like not to ride over them [NO\_M]'*.

Besides discussions about the potential benefit and dangers of quieter EVs, discussions on sounds also led to reflections on the importance of sound for the aesthetics of a car. While most of the male participants did not display strong preferences about this and the remarks were mostly anecdotal or about ‘a certain percentage of men’, one participant in Denmark remarked:

*DK1\_M: My opinion is like this: if the car for you is a matter of transportation from point A to point B, then it is all right you can have like an electric car. But if you are like a real fun [e.g. car enthusiast] ... Like have you ever driven an electric car? It's like, you know, eating food without taste. When you don't feel the strain of the engine, you know, the sound .... it feels like [...] like a toy, you know.*

The participants in Norway thought quite a bit differently and responded more in line with the Icelandic discussion above:

*NO\_F1: But I remember once a friend of mine said – and this is because I come from the countryside – and he said: ‘the sad part about the electrical car is that it doesn't make any noise, and the noise is like, that's the sexiest part of the car. You start the engine [revving sound]; what are you going to do if you don't have the sound?’ And I was like, ‘that's the whole point!’ It is so nice that they don't make any noise.*

*NO\_M1: That is the customer group that is going to be very hard for electric cars to appeal to. Those type of people that want a car for the styling, for the sound, for the identity creation ... That's going to be a difficult nut to crack.*

The experience with car sounds, whether aesthetic or safety related, was something many of the participants related to in one way or another and hence was one of the most discussed elements. Most likely because it is an aspect that they could easily identify with, but also because it makes them part of a discursive process that ‘decouple[s] the symbolic links between speed, societal dominance and loud sound, on the one hand, and the building of new links between engine power and silence, on the other (Krebs, 2016, p. 2)’. In other words, it is how those without actual driving experience connect bodily with an EV, what they see and hear outside the vehicle, and how they internalize this. This implies that not just EV drivers develop new use-scripts (Gjøen and Hård, 2002; Labeye et al., 2016; Ryghaug and Toftaker, 2014), but that other traffic users too adjust their scripts about how to behave in traffic and what to like aesthetically.

### 3.3 Power, acceleration, and technology

A third benefit of EVs, closely related to the sound dimension, was the actual performance of EVs. Whether experienced or read about, participants highlighted that they are ‘*powerful. Loads of power. They go fast. And many drivers want powerful cars* [FIN2\_M].’ The interesting thing here is the difference between those with and without experience driving (or being driven) in an EV. As one participant noted: ‘*I've driven twice and I really liked the feeling of the car, the responsiveness was*

*amazing* [SWE\_M].’ Another participant remarked regretfully that his electric taxi the one time he was a passenger was driving rather carefully which made that *‘it felt like a normal car* [FIN2\_M]’. In some cases, those with experience shared this with the others, like in Denmark:

*DK2\_M1: Tesla is faster than most cars.*

*DK2\_M2: I haven’t tested an electric car, but, if any of you has technical experiences about this, information, knowledge, what’s the difference between having a sports car that is fossil-fuelled of course, and comparing to the other one? The torque? How does it manifest, do you have a different feeling?*

*DK2\_M1: I haven’t tried it, I only talk to people who have, and it’s as fast as any supercar, I mean, I don’t know how fast it is-*

*DK2\_M2: It is?*

*DK2\_M3 [with experience]: Five seconds. [...] The best car is only three seconds.*

Curiously these positive performance aspects did not return as strongly in the Norwegian group. After acknowledging its environmental contribution, the benefit of an EV was primarily discussed there in economic terms as the cheapest car to drive resulting from the all prevailing Norwegian incentives.

Besides sound and performance, the all-female group discussed the benefits of an EV as a nice drive, not only due to the absence of motor sounds and vibrations, but also because they do not smell:

*DK3\_F1: And it’s nice to drive I think*

*DK3\_F2: You can actually hear each other.*

*DK3\_F1: Yea, it’s different*

*Moderator: Any other benefits?*

*DK3\_F1: It doesn’t smell like gasoline [laughter].*

*DK3\_F3: Yeah, it’s true. It’s a very good thing you mention, because I really think sometimes when I was pregnant this thing made me sick. I didn’t used to sit in the car.*

Another bodily experience, directly linked to the lack of tailpipe emissions, but not one that we’ve seen discussed elsewhere. Yet, it powerfully depicts the value of an EV.

In contrast to an EV’s environmental and sound aspects, there were few negative discussion points in relation to performance and technology. In line with earlier survey work (Egbue and Long, 2012; She et al., 2017), only the reliability of EVs was discussed as an issue by a small number of participants across multiple groups. This linked up to stories about winter weather and mountain/rural travel in Sweden, Finland and Norway, the long-term reliability of the cars (Finland), the impact of the cold on the batteries (Norway), and the need for special assistance to fix the cars instead of having the option to ask a handy friend or neighbour to fix your ICE vehicle [FIN1\_F]. Simultaneously, those Norwegian participants with a more than passing EV experience rejected reliability as an issue. Overall,

we can surmise that among our sample EVs were viewed with interest by those without EV experience and positively by those who had.

### 3.4 Price and fiscal austerity

In terms of price, the participants seemed aware of the relatively higher initial purchase costs and the lower operational costs. As the second Finnish group answered collectively in response to the question about what needs to change for them to drive an EV: *'Price!!!'* Comparable to the benefits, participants also expressed uncertainty immediately after making such statements. For instance, a participant in FIN1 wondered, based on hearsay, whether the marginal costs of an EV really compensate its higher capital costs:

*FIN1\_F: I don't think getting an electric vehicle would be overall a more economical choice than a normal car. Even though you have to oil all the time [e.g. have maintenance]. But I still heard it's not better economic wise than a petrol car.*

At this point however, there were clear differences between the different incentive schemes across the countries, as indicated by a Norwegian reflection:

*NO\_M: My impression is that it is still economically better for you to have an electrical car. My dad, he had this huge Excel map worked out before he bought a Tesla, and he basically figured that he came out on top regardless of whether the taxes came back or not. Because you do not really buy fuel, and you can charge at home and you get free charging for Teslas as well.*

Of course, this is a comparison between the two most extreme countries of the Nordics: Finland which at the time had no additional incentives for EVs and only a few available models and Norway where EVs are the obvious option given the range of national and local incentives.

Troubling in this respect is that in Iceland, a country with its own VAT and purchase price exemptions at the time of the focus group, the participants were unaware of any government incentives for EVs. Similarly, the Danish groups, even though they were not completely unaware, were unclear about why the Danish government started to reduce the tax exemptions for EVs. DK1\_M2, in fact, asked point blank *'does anyone know the reason behind that? Because I think it was rather good that it was in there'*, but none of the group knew. They subsequently reflected about the costs of such incentives, in terms of decreasing petrol taxes ('a lose-lose' in terms of the government budget) and in terms of the higher taxation on ICEVs (unfair to those who can only just afford a car). Interestingly, the group went further and reframed current costs of incentive programs as an investment into future savings on health expenditures caused by pollution. In the end, none of the participants knew precisely why the Danish government changed its incentive program, which points to poor communication of government decision-making.

Another argument, brought up briefly in four of the groups, details the reduction in petrol consumption. This was seen as beneficial by the groups, because consumers no longer have to pay for fossil fuels. Besides the direct benefit, it was also seen to reduce support for the petrol companies [DK1] and thus lower the influence of these companies [ICE]. For the Nordic countries it would reduce fossil fuel imports [ICE] and make the countries less dependent on the Middle East [FIN1, DK2]. One participant even mused that it could diffuse a lot of the conflict in the Middle East and potentially lead to ‘world peace.’

In short, the price of EVs was known and interpreted as a core private financial limit (Hafner et al., 2017). Yet, our participants were also aware on a group level of the operational economic benefits of EVs, as well as some of the underlying discussions on the cost and incentive side. And although they showed a desire to pay as little as possible, among others by calling for equal car prices, to us this seemed born out of 1) hard financial limitations, 2) no need for a car (see section 3.8), and 3) a strategic desire for cheaper products. At other moments during the focus groups it seemed that at least a small number of participants, if they could, was willing to pay extra for an EV’s performance, reduced environmental impact and cheaper operating costs. Still, even though most of the participants claimed interest in sustainability and electric mobility, and with the exception of the Norwegian group, participants voiced ignorance and/or a lack of understanding about incentive programs in line with Rezvani et al. (2015). Similar confusion reigned about total cost of ownership and maintenance, partly in line with non-existing second-hand markets.

### 3.5 Range and charging infrastructure

Like price, the range and recharging infrastructure were discussed as challenges in every group, and often together. Again, analysis initially confirms that participants claim a need for a longer range. However, when moving beyond the initial introductory or summarizing statements, the groups in each case offer more in-depth discussions and nuanced comments. For instance, the range question seemed more pressing in Finland than Norway, yet in all countries it returned in one of three ways. Either as a break in existing routines:

*NO\_F1: Range for me is one of the things. Because honestly, I do drive Oslo - Bergen a lot, and yes it’s possible now, but you do have to stop and charge, and it is just not the scenario that I think seems like that much fun; that you have to stop in the mountains, that you have to charge for an hour, you know, you have to plan around that. So, for me to be able to do a full eight hours drive in a stretch that would really increase my willingness to buy an electrical car.*

As a fear of stranding in the middle of nowhere (and not knowing how to act):

*NO\_F2: I think for me it has to do with everything. It just has to be so common that I have no fears of any complications or whatever. That I’m not afraid of getting*

*stuck in a tunnel for two days. ... Okay, in the North the gas stations might be a bit further away, but at least here in the East and the West [of Norway ...] running out of gas is almost impossible. And running out of electricity is actual possible. And what do you do then? Because when you stop with a gas driven car, then you might get someone to buy some gas and give you a can of gas and you can fill it up and it's okay and you can drive to a gas station, but what do you do with an electrical car?*

Or in terms of an actual inability to buy or drive a vehicle:

*SWE\_F: I think, for example, in the bigger cities you will be able to use electric cars, because you will have the infrastructure for it. But then ... let's say I live up in the Northern parts of Sweden, like almost close to Kirana, which is a very, very small town. I don't think, even if I wanted to have an electric car, I might not be able to have one. Because there will be a lot of issues with like charging it and so on. Or if I wanted to go somewhere and visit someone, I could maybe go there but I could not go back.*

And the response to this, according to some, is that 'every gas station should have electric [charging] also [DK2\_M]', even though the first two of these claims are not in fact infrastructure dependent but based on an unwillingness to adjust travel routines or a lack of experience and information on how to handle an EV.

Furthermore, as with the price of an EV, participants seem to struggle between what is desirable (charging stations everywhere) and what EV drivers would really need. In each of the countries, for example, there were participants questioning the initial statements in the groups about more range. Again, in Norway,

*Moderator: What would the range need to be?*

*NO\_M1: It would need to be eight hours for me.*

*NO\_F1: Like I've been driving with the Tesla to Christiansen from Bergen, that's pretty much to Oslo, and it was no problem. We had to stop one-time to charge but during that time, like the charging stations are always with a cafe or something, so we just bought some food and ate ...*

*[...]*

*NO\_F2: I also have been driving to Oslo and Trondheim with the Tesla. I don't think it is a problem when you stop.*

*NO\_F1: You just have to plan it.*

*NO\_F2: If you plan it then it's okay. And it is way cheaper to use the electric car, especially as power is free for Tesla.*

In Denmark too, the question of planning came up in relation to the required range and needed stops, with some participants highlighting that people rest anyway:

*DK2\_M1: That is what it is, not four hours, it's less, it's only 300 kilometres.*

*DK2\_M2: But if you drive for four or five hours, usually wouldn't you have a break anyways?*



*DK2\_M1: Five hours is good. I would say if you go five hundred kilometres and then you take a break, that is fine. But right now, with electric cars you hardly reach 300, or even less if you're driving fast.*

In fact, some of the participants actually saw these rest stops as beneficial to traffic safety, as it enforces (truck) drivers to pause and rest [DK3, NO].

Another aspect in relation to this was charging time. For example, in Sweden a male participant argued against long range vehicles arguing that '*I think that we don't need range. ... I think we have the perception [that we do, more] than that we actually do.*' He continued arguing that charging time was more important:

*SWE\_M: If we reduce the time [to the time that] you now refuel your fossil fuel car, then you don't have a problem. If you need to have like three stops than it's okay. Because ... the bigger the battery the more environmental impacts you have. And right now, we are not sure that we can recycle these big batteries. And the bigger the batteries the more expensive the car gets.*

Charging time was not just discussed in terms of an inconvenience, but also in terms of potential economic costs for clients and companies paying for travel time [DK3], adding additional working hours to the bill. Furthermore, the desire for less charging time was also discussed by some participants as a matter of 'habits' that need to be (re)formed:

*SWE\_M: Before smart phones, we had these old phones, which we would charge on Monday and then next Monday. But [with smart phones] we learned. So, it's matter of changing behaviour. Every night I charge my phone, so every night I can charge my car as well.*

Others discussed it from the business case of a charging infrastructure company and reflected on the difficulty to install additional chargers without more cars. Individual participants voiced both the argument that the government should support the purchase of cars and have the chargers follow [NO\_F] and the argument that the government should support charging infrastructure so that consumers are willing to purchase an EV [FIN1\_M]. Lastly, in Iceland the group brought up apartment charging, especially the skewed looks an EV owner receives if charging from a communal outlet, another topic that poses challenges for many urban residents.

While these reflective answers might indicate that range and recharging are well understood issues, this was only the case for some of the participants. Another section of participants questioned both. For example, initially the Icelandic group could not identify any chargers in Reykjavik, and only during the discussion collectively discovered that there were more than they initially thought. Similarly, participants in FIN2 were unaware of the different types of charging stations, just as participants across the groups wondered about the actual time to charge a vehicle, and participants from four groups had questions about the costs of charging an EV.

In sum, the participants offered relatively insightful comments on the EV charging infrastructure and its use. Nevertheless, even in our sample of rather pro-EV enthusiasts the more pragmatic, systemic, and business-oriented reflections of the participants ultimately did not negate the individual desire for more range and more charging stations. Furthermore, there was some disagreement between participants about real driving needs and about the value of rest stops. Participants without experience also expressed a need for local (peer-to-peer) examples of EV use in cold weather and a solution for stranding (towing; vehicle-to-vehicle recharging).

### 3.6 Social status, awareness and information

The most discussed theme included topics like a shifting status of EVs, a lack of consumer awareness among the general public, a lack of EV advertisement, and a lack of general public attention to EVs. To start, the participants more or less agreed that EVs were *'kind of cool now'* and *'sort of like they have become the sick thing to have'* [NO\_M]. With this, they counter earlier findings by Graham-Rowe et al. (2012, p. 140) about early EV models being described as *"work in progress" products.* Instead it confirms work from Ferguson et al. (2018) who find considerable openness to EVs among Canadians, Anfinssen et al. (2019) who find shifting aesthetic and gender patterns, or Hansen et al. (2017, p. 554) who write for Denmark that *'EVs have become visible on the roads and in the mass media. They now appear as a realistic alternative for many consumers instead of a utopian or exotic choice.'*

That said, there were small differences across the groups. In the Norwegian group, EVs were portrayed as the economical choice given Norwegian incentive schemes, and the logical choice for most consumers except those driving very long rural distances. In turn, a participant in Sweden remarked that even though EV drivers still receive more questions than ICEV drivers, they no longer need to defend their choice [SWE\_F]. In Denmark, EVs were approached with a bit more scepticism, summarized by one participant when she voiced how *'other people might think that you are really cool [...] but I think that it is a status symbol. One that drains from the environment and stuff. I don't think that people do it only because it is good for the environment, I think they want to feel better than other people [DK1\_F].'* And in Finland participants remarked how this shift in EV enthusiasm only applied to the younger generations, as the older generations were still distrustful of EVs:

*FIN2\_M1: We don't have to go back far, when, if you were speaking of electric cars [...], people thought: 'what kind of weirdo you are' or 'hippie'. With the old people it's still like that [...] we still have this older generation that thinks like we used to do – and drives an old Volvo.*

*FIN2\_F1: It is pretty impossible to have an electric car in the country side and that's because of old people.*

Participants here pointed to the way the uncertainty about EVs and the images of older EVs remains present in stories about electric vehicles as small kids' cars [FIN2\_F], toys [DK1\_M], and having '*an electric vehicle, that is like driving a toaster or something*' [DK1\_M].

Simultaneously, others described the newer models as nice looking [FIN2\_F], nicely designed [NO\_M], even too big [DK2\_M]. Yet, one of the core problems for our participants, in every Nordic country, was the low number of models to choose from to '*hit all the market segments*' [NO\_M]. As a participant in Iceland remarked:

*ICE\_F1: There could be more variety of cars. You know some people want to drive big fancy cars. These sorts of trucks and ... I have not seen many trucks that are electric, you know....*

These (pickup) trucks can be very important regionally, as the group earlier discussed:

*ICE\_F2: In Iceland's cities or towns I see many, like, big four-wheel-drive cars that actually do not need [to be that size] to drive in town.*

*ICE\_F3: Oh yeah because they are like 'the men'.*

*ICE\_Group: Yep [sigh]!*

*ICE\_F4: Yes, that is not something we are very proud of... as Icelanders. We just live here, I was born here but you know...*

*ICE\_M: It was really interesting that the first time the guy from Top Gear, Jeremy Clarkson went to Iceland, he thought it really interesting that for Icelanders it wasn't the most expensive car that people liked, it was simpler, it was the biggest car that was the status symbol.*

*ICE\_F4: Yeah, it is pretty primal.*

Besides highlighting a gender aspect to EVs, this vignette also shows the ingrained traditions and status aspects of cars that coincide with the perceived needs of people, like driving to the cabin in the forest or up the mountain.

A desire for more models coincides with a lack of brand recognition in the countries with lower EV market shares. As one Danish participant made his plea for additional car models by calling '*for more choices*' because '*right now there's only Tesla*', it became clear that – with a couple of exceptions – participants in our Finish, Danish and Icelandic groups had trouble identifying EVs other than Tesla. In Iceland, for example, the group only talked about Tesla, even though our team observed many more Nissan Leafs than Teslas in the streets of Reykjavik. Likewise, in Denmark:

*DK1\_F1: But there are electric cars that are not Tesla, aren't there?*

*DK1\_M1: Not fully, I think.*

*DK1\_F2: Yeah, there are.*

*DK1\_F3: Yeah, but now there are hybrids mostly.*

*[later in the discussion:]*

*Moderator: Besides Tesla, are there other electric cars?*

*DK1\_F3: There are like hybrid cars.*

*DK1\_M1: I know that Toyota Prius is always electrical, there is a Nissan car that is also electrical.*

*DK1\_F4: The Nissan Leaf? I think it is, but I think it is a hybrid.*

FIN2 and DK3 also struggled to come up with brands other than Tesla, while often confusing hybrids, PHEVs and full BEVs. DK2 was most thorough when identifying brands and car models, although still missing top-selling EV brands like Volkswagen or Renault. To be clear, the issue is not that participants cannot recite lists of brands and car models, rather it is, as the Icelandic case shows, that these principally interested people do not recognize other EV brands on the street, and instead focus on the most status-oriented EVs.

When asked what governments could do to support EVs, advertisement and awareness campaigns were mentioned in all groups, in addition to tax reductions and charger support schemes. For the participants, EVs still have *'an image problem [DK1\_F]'* and lacked advertisement [ICE\_F] or *'some old school marketing, like newspapers etc. [FIN2\_M]'* and public debates in the press and political arena [ICE]. One participant in Iceland argued that, for EVs to become more acceptable for friends and family, what is needed *'is simply more advertising, more discussion, more ... to not take an electric vehicle as being something completely different [ICE\_M].'* This sentiment was repeated in Sweden:

*SWE\_M: It just has to get a bit more common, I think. Many people are like sceptical about, okay what would happen - I could buy it, but what if I don't get service for it? What if the battery breaks down in the middle of nowhere? You have to raise the awareness that they are safe, they are stable and trustworthy and you can use them. And more companies, like the companies who are selling these cars, they could advertise it with like 'yeah, road side service in 10/15 minutes.' So at least you have 'yeah, someone will come and look at my battery in 10 minutes.' That might increase the sales and make it more common and you don't have to worry about it much. Once it's common, people will buy it.*

Besides a normalization of electric vehicles and some *'old school marketing'* by the companies, participants across the groups interacted with each other as they answered each other's questions. This practical exercise of word of mouth in the groups themselves was not reflected on, but participants did bring up anecdotes of such experiences. Some of them positive:

*DK3\_F: I took a GoMore [a private ride sharing service] trip once and the driver was so proud of [his Tesla]. It was so sweet, he was so happy to take me. And of course, since he had free charging with the Tesla, he was also allowing me to go with him because 'I am not spending any money.' [Laughter]. And he was just so happy: 'ah look how it goes now, and speeding so fast' and inviting me for eating: 'now we have to charge, we can go and have fast food.' And he was enjoying himself. He was so proud.*

Yet, others were negative. This includes earlier discussed anecdotes about the difference between Finnish generations, the Norwegian discussion about the effects of cold weather on range, or the slightly negative framing of EV owners in Denmark.

Overall, however, the majority of our participants is enthusiastic about electric vehicles. Furthermore, there is a shared agreement among the participants that the status of EVs has shifted from these small and weird cars to acceptable and, for some, even exiting cars, and that EVs will continue to normalize across society. However, we can also infer that there remains a need for more consumer awareness, not only because the participants themselves feel this is missing, but also because the above shows that certain groups had trouble recognizing the EVs and charging infrastructure in their own backyards, and that they were relatively unaware of any incentive programs. As per their own suggestions, this requires advertisement, public debate, better information, and more situated practical examples of EV use in their environment.

### 3.7 Innovation and vehicle-to-grid applications

In addition to questions about transport, energy and electric mobility, the participants were also asked about V2G, the technology that enables a bidirectional flow of electricity from the grid to the car and back, if so desired by the grid operators and market players (Kempton and Tomić, 2005). As this is a new technology, the moderator offered a brief technical description before asking the question about V2G. During the subsequent discussion of its benefits and challenges, the participants generally were carefully optimistic about the technology, but highlighted their ignorance, that it seemed mainly an electricity grid affair, and that it would only work with proper compensation for the battery degradation and with a planning system that would not disturb their routines. They did not care about controlling the technology, but a few wanted to be kept informed of any activity taking place with their battery. Interestingly, there was little difference in the answers across the countries.

The benefits of this technology generally were seen as *‘really clever [ICE\_F],’ ‘actually pretty good if people can do that, maybe can smooth out the production of electricity [FIN1\_M],’* and potentially helpful to sell EVs [ICE\_F, FIN1\_F]. They also saw its potential in times of local grid disruptions, especially on the countryside [FIN1\_M]. However, while not negatively inclined, the technology brought up three main questions. First, the questionable benefit for consumers, as one Finnish participant reflected *‘I think I agree with what they [the group] say. A lot of it doesn’t provide too much benefit for the consumer [FIN1\_F].’* The participants here remark on the fact that it’s primarily a business-to-business and electricity grid-oriented technology, not a consumer technology. As such, some wondered whether they even should be involved, or whether it shouldn’t be automated and

completely integrated in the electricity/charging system – and consequently a given when buying and using an EV. As a participant in Denmark reflected:

*DK2\_M: But no one knows if that's what it comes down to. Maybe it becomes automated over time anyways, right? I mean, in the beginning you might have to give your consent to only discharge and recharge your battery, but I think over time we have to assume that this process might change...*

Where DK2\_M imagined the process to become fully integrated and automated over time, a participant in Iceland thought that it would need to be standardized across all cars and chargers for V2G to work in the first place and become ‘something that just is the way we use electric vehicles [ICE\_M].’ A participant in Denmark pushed it further by arguing that basically the consumer should not, need not, and to some extent does not want to be involved, so long as the technology does not interrupt their travel demands:

*DK2\_M: But if for some reason it would be decided that it's a good idea to use the cars for the grid and makes sense from a system perspective, for me, personally, I would have no issue with it, unless of course the batteries are dead in the morning when I need to drive the car. But that's probably not the case. So, for me as a consumer - not the electric company and balancing the grid - I don't really care too much. It's not business, but if it was to be done, it's probably from the government and imposed on people. But in that case, it must be a smart thing. If they go to all the trouble to do that.*

Not all participants in the groups agreed, partly because they feared a disruption of their freedom to use the cars and partly because they wanted to be kept up to date of how others were using their batteries [FIN2\_M, NO\_M].

This connects to a second aspect around V2G. Namely the discussion about fair compensation for the use and degradation of the battery and the subsequent distribution of profits. One participant remarked after some discussion about battery degradation and the free use of the batteries:

*DK1\_M1: I think that's how a Ponzi scheme evolves.*

*DK1\_M2: I think it actually depends on how they actually use this, because if they use it just to get a higher profit for themselves, it is not good. But if they use it to put a lower price out than the other companies. Then you sort of have a good spiral going.*

Basically, the system should be constructed in such a way that ‘the consumer has the perception that there is a fair exchange going on; that they are fairly compensated for the loss of the battery [NO\_M].’

If not, the Danish remarks above show how quickly V2G can be reframed.

The third question from the groups relates to how this would work in real life, in terms of planning, discharge levels, warranties [FIN2] and so forth.

*NO\_F1: To what percentage would they take out the electricity? Because that would be the question then, because that could make the car a problem. Because*

*if you have that automated you might not have the battery life that you need to get where you're going. When you go, if it is not planned.*

*NO\_M1: So, predictability becomes a problem with that.*

*NO\_F2: You don't know how much 'gas' you have left.*

*NO\_M1: So, I guess it should be a voluntary sign up then ... Especially if it's supposed to be automated, that you sign up for the service, like you pay me and I give you something and I get something from you. But maybe it shouldn't be mandatory then for all the cars.*

*NO\_F2: Yes, or you could say that between the hours of then and then, you can do as you please. But between these hours I need a fully charged battery.*

All groups in one way or another discussed the need for the consumer to set boundaries on the discharge level and time. For instance, participants in both Iceland and Sweden discussed a cap on minimum state of charge, to always be able to drive to the hospital, etc. Essentially, the groups seemed to grasp what the parties involved have realized and are constructing as we speak: an automated system with consumer input on when the car needs to be charged and to what level it can be discharged, as well as the ability to highlight any non-routine journeys. As such, assuming that third-party aggregators are able to meet these organization and fair payment demands, our sample indicates that there will be little consumer resistance to V2G.

When asked what could help support V2G, the participants together offered only a few suggestions due to a perceived unfamiliarity with the technology. A central suggestion was that this should be a voluntary arrangement, to be 'encouraged' but 'not enforced' [DK2]. Given their unfamiliarity with V2G, the discussion ultimately came back to information, information about how it works, what effects it has in line with an increasing percentage of renewable energy sources, and especially what the cost-benefits are of having (for the grid) and accepting (for the consumers) such a technology. While these remarks are preliminary at most, it seems an automated system with either proper compensation or complete integration into the grid, and one that does not unduly hinder travel routines while being clear about battery degradation is not looked at negatively by the participants

### 3.8 EVs and multi-modal transport

One last result often missing in targeted approaches, like surveys or qualitative work among existing or potential EV owners, is a reflection on how people perceive EVs, not compared to ICEVs but as a (private) mode of transport. We offered space for such comments, and 6 out of 8 of the groups touched on the argument that EVs remain cars (one group in Finland and Denmark did not). For example, some participants wondered how the environmental impact and promotion of EVs relates to that of public transport [FIN1\_M], thereby linking up to questions about the general environmental effects of EVs as discussed in section 3.1.

Others had a stronger opinion. These, admittedly, few participants found EVs to be somewhat of a stopgap solution: *'I want to add that if you really want to be a friend of the environment you shouldn't buy a car, you should bike and you should stop eating meat, start buying organic stuff, and you should think of so many other things than only your car. You're not saving the planet by buying an electric car [DK3\_F].'* Another participant questioned not only the environmental impact of EVs, but also their space use:

*SWE\_M: I really like electric cars and they are fun, but in a city the system is absolutely inefficient. It doesn't matter if it's a combustion engine or an electric engine [...] you still have this trend of these huge SUVs cars for one person with two bags of groceries. That's such an amount of metal you transport for nothing.*

To be clear, the participants made these remarks on the back of discussions about the challenges to public transport – focusing on perceived high costs, additional travel time, and the low frequency and intermittent nature of public services – as well as the use and experiences with shared car services (SWE, DK). They also discussed the actual need for different groups of people in these countries to own a car; countries that are characterized by their long distances, low population density and harsh winter weather. From these and other remarks it becomes clear that these EV remarks were primarily urban oriented, especially as elsewhere in the focus groups participants highlighted and discussed the important societal role of cars (and limited public transport options) in rural areas. But the message was far from unanimous. One older Danish participant, a single father, explained how in all his life he never needed nor wanted a car. When pressed by other group members whether this was a cost issue, he stated *'no, I have the money, I could buy a Tesla tomorrow if I want to [DK3\_M]'* and repeated that it was a principle for him. Simultaneously, these and other remarks show the complex relationship people have with cars, based on perceived needs, income, status, geography, values and the availability of alternatives. And while the groups were adamant about the need for cars in rural areas, the remarks above show that cars – including EVs – should be seconded whenever there are alternatives available. As one participant summed it up: *'Yeah I have mixed feelings too. Because an electrical car is still a car, and I have the feeling that we have to change our habit in transportation instead of the media of transportation [SWE\_F].'*

#### **4 CONCLUSION**

Based on eight focus groups with 61 participants across the five Nordic countries, this paper analysed how members of the public, not necessarily directly involved in an EV purchase or a test drive, perceive the technical attributes, use and policies around EVs and V2G. While most of the barriers to an uptake of EVs are well known in the literature, our brief review highlighted a need for more nuance among customer segments and a need to trace the changes in consumer perceptions about EVs, V2G and respective incentive programs in developing EV markets (Coffman et al., 2017). In brief, and



accounting for the sampling and generalization weaknesses of focus groups, our study reconfirms many of the well-known challenges and benefits of EVs. However, it also affirms that there is a difference between first response about the environmental benefits or the challenges of range and price, and the subsequent discussions – as summarized in Table 3.

**Table 3: Summarizing Nordic Focus Group Responses and Subsequent Discussions**

	First Response	Subsequent Discussion	Reflection
Environmental sustainability	Benefit	<ul style="list-style-type: none"> <li>- Local emissions vs lifecycle</li> <li>- Battery recycling</li> <li>- Electricity generation</li> <li>- Fleet turnover</li> </ul>	Different knowledge levels exist between those who 1) repeat the lack of emissions as the main EV benefit, but also repeat counter claims (little to no knowledge); those who 2) acknowledge local benefits but question lifecycle effects; and 3) those who know of and reproduce lifecycle analyses.
Noise-emissions	Benefit	<ul style="list-style-type: none"> <li>- Safety</li> <li>- Customization / aesthetics</li> </ul>	Noise-emissions is something people can experience even if they have never been inside an EV. This shifts the use-scripts of both EV drivers and other traffic participants.
Performance	Benefit	<ul style="list-style-type: none"> <li>- Acceleration</li> <li>- ‘Just a normal car’</li> <li>- No smell</li> <li>- Reliability</li> <li>- Self-service / handiness</li> <li>- Winter weather</li> </ul>	The performance (together with aesthetics and environmental sustainability) of EVs is altering car aesthetic and gender patterns (Anfinssen et al., 2019). Interestingly, participants did not discuss entertainment systems and other added options.
Price	Challenge	<ul style="list-style-type: none"> <li>- Hard financial limit</li> <li>- Desire for lower price</li> <li>- Confusion about operational costs and resale value</li> <li>- Lack of awareness (except for Norway) and understanding of regional available incentive schemes</li> </ul>	Participants frequently desire lower prices and all argue for price incentives to bring ICEV and EV prices closer together. However, as they also see EVs to have benefits over ICEVs – more comfortable, better performance, less emissions – it should not be necessarily from a system perspective to equalize them. The participants were relatively unaware of government incentive programs (except in Norway). Incentive schemes act as sign of approval, shifting policies a sign of uncertainty. Policy makers should be aware of the discrepancy between individual social justice perspectives and systemic transport transition perspectives when it comes to EV support policies.
Range and recharging	Challenge	<ul style="list-style-type: none"> <li>- Actual range</li> <li>- Driving and rest routines</li> </ul>	Initially, range is a core and almost automatic challenge for participants, but then during the discussions a translation

		<ul style="list-style-type: none"> <li>- Hard geographical inspired use and access limits</li> <li>- Stranding</li> <li>- Recharging time</li> </ul>	occurs to local and private use – spurred on by participants sharing information about new EV models. Participants were looking for real-life local use cases under adverse conditions. E.g., EV sales should focus more on road-side assistance, vehicle-to-vehicle charging technology, and such to limit stranding fears.
Status, awareness and information	‘Sick thing to have’	<ul style="list-style-type: none"> <li>- Differences among groups</li> <li>- Lack of advertisement</li> <li>- Lack of public discussion</li> <li>- Shifting level of government support (DK)</li> </ul>	Status of EVs has shifted positively, with exceptions, among our non-EV drivers. Participants in countries with relatively low EV presence missed seeing and hearing about EVs around them – both literally (on the street) and figuratively (in public discourse). Peer-to-peer narratives have a high trust factor; but can repeat both positive and negative framing.
V2G	Smart	<ul style="list-style-type: none"> <li>- Battery wear</li> <li>- Compensation</li> <li>- Organization</li> <li>- Information</li> </ul>	As long as it’s automated, does not interrupt their travel and adopters get fair compensation, V2G is not seen negatively. This contrasts with the expected consumer resistance (Sovacool et al., 2018) as well as ambivalence or ignorance among expert opinions (Kester et al., 2018b). However, V2G is also easily framed otherwise.
EVs as cars	From medium to mode shift	<ul style="list-style-type: none"> <li>- Public transport &gt; EVs</li> <li>- Active transport in cities</li> </ul>	Participants are aware that EVs remain cars, and depending needs, location, and so on, acknowledge that such private transport modes are not optimal from an environmental and spatial/urban perspective.

Source: Authors

This difference between first response (or stated preference) and the more nuanced discussions that follow when participants are given the opportunity to express uncertainty, ask questions and correct each other, highlights how these initial responses act as containers for various perspectives. The analysis of the focus groups offers four other reflections: the differences between the groups, the information requirements of different groups of participants, the dynamic nature and learning of and within EV discussions, and the multiple positions of the participants.

First, there are clear differences between the participants across the Nordic countries, contrasting earlier findings that EV consumer barriers are shared across geographical regions (Liao et al., 2017) and enduring (Epprecht et al., 2014; Berkeley et al., 2018). Table 2 used topical word frequencies as a proxy to show the popularity of relative themes and the subsequent discussions showed further differences with, on average, the Finnish groups being least informed, the Norwegian and Swedish groups being most knowledgeable, and the Danish and Icelandic groups showing enthusiasm and a

wider diversity across participants. In no particular order, we observe these differences to be influenced by the presence of national support schemes (which relates to the presence of market parties, the availability of models and advertisement, and the on-street presence of EVs), the presence of participants with EV driving experience or high levels of EV interest in our groups, and local travel conditions. That said, those are not a guarantee for positive perceptions, as given by the uncertainty and range demands of some of the Norwegian participants.

Second, we observed throughout the focus groups that participants had a multitude of questions. Questions about almost all aspects of an EV: its environmental impact, costs, recharging time, acceleration, battery life, range, and so on. As one Danish participant reflected at the end of her group *"I think I remember how much we do not know about electric cars [DK1\_F]."* It is this uncertainty that lies behind the difficulties that our participants encounter to judge available reports and anecdotes on EVs, like the environmental remarks in section 3.1, and subsequently leads to a demand for information. Within the literature this too is a frequent suggestion, with some studies arguing for more detailed environmental information (Biresselioglu et al., 2018) and others for a simplification of information (Cordera et al., 2018; Wikström et al., 2016). Our focus groups however point to a two-tier simultaneous information stream. The first stream includes simplified information that is aimed to increase trust in EVs, to help normalize them for those unfamiliar with EVs. Across the groups this returned in peer-to-peer contact and a translation of similar preferably local use-cases to one's private situation, but also in the acknowledgment of government support schemes (a sign of approval) or advertisement (a sign of normalization). The second stream of information is targeted at participants who already perceive EVs favourably but still encounter environmental, economic and technical questions. Our focus groups showed that these participants demanded more nuanced data, comparisons and conclusions from other sources than the media, EV companies or interest organizations.

Closely related, third, are the learning effects that took place during the groups. We know from Dumortier et al. (2015) that better information can increase the willingness to adopt them or that people without information start to reason by analogy (Wibeck et al., 2017). Unfortunately, we find that learning goes both ways in a peer-to-peer environment – both within the focus groups, and, through participants anecdotes, outside of the groups. DK1 offers a nice example. During the discussion on EV models, the group failed to correct faulty statements about hybrids and other EVs (section 3.6), meaning that the group continued believing that most EVs were hybrids. This shows how certain myths and faulty information remains active and lingers, a finding similar to Sovacool and Blyth (2015). Simultaneously, one Danish participant reflected at the end how surprised he was to learn from some of the other participants about the newer EV models with over three hundred kilometres of

range, concluding that range was thus less of an issue. This participant updated his perceptions of EVs during the focus group.

Fourth, the focus on a lack of information and learning in turn draws attention to the multiple reactions and preferences of the participants and their seemingly paradoxical positions. For example, from the discussions we learn that the participants generally regard EVs positively and as a group were surprisingly nuanced in their discussions about EVs. Yet, simultaneously they also see consumer awareness as a core concern and they expressed a strong desire for more information, as well as for cheaper vehicles, more recharging stations and more range. Elsewhere, Ryghaug and Toftaker (2016) find a similar paradoxical position among experts when they describe potential EV adopters as both rational (as they are guided by economic and technical limits) and irrational (because of range anxiety), and how stakeholders use rational measures instead of engaging with the irrationality of certain positions. We also see participants reflect on themselves and their fellows as both rational (because guided by economic and technical rationalities) and irrational (as they are guided by fears about stranding and range anxiety). In our case however, participants are not necessarily paradoxically engaged, because there is a difference between what they say as a private consumer and that what they say as a citizen.<sup>3</sup> Or as Hagman (2003) observed: some arguments are made from personal and direct experience (range, sound, price, acceleration), while others are made from and towards public discourse (environmental impact, incentive programs, V2G, modes of transport).

Besides these four reflections, there are more practical lessons to be gained from these focus groups. Foremost, future research should consider setting up more longitudinal research designs with the same participants, and a sample not limited to before and after EV test-drive projects (Jensen et al., 2013), to observe the diffusion of EVs, EV awareness and these shifting perceptions over time, let alone across different regions. Additionally, in terms of incentive policies one could consider supporting information projects in addition to price incentives for chargers and EVs given the importance participants attach to local translations of use cases. In terms of specific messages, the group discussions point to a need for information and practical examples or advertisement. For example, about what to do when stranded or about the expected operational costs in different use cases and models.

In closing, a caveat. The differences between the countries might indicate that EVs beget EVs in a virtuous cycle of normalization, growing markets, and increasing peer-to-peer interaction. However, while enthused by our participant's enthusiasm, that cycle, if it exists, is still fragile and support mechanisms remain needed to ensure positive dimensions continue to outweigh negative ones.

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<sup>3</sup> We would like to thank an anonymous reviewer for bringing these dual roles to our attention.

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## 6 ANNEX

### Focus group questions:

- Engagement questions
  - So could you tell us a little bit about yourself, your name and whether you own or drive a car?
  - What is the role of cars in (country x)?
  - What kind of car would you like?
  - What do you think are the future energy and transportation challenges for (country x)?
    - [probe if not discussed:]
    - Energy?
    - Transportation?
- Exploration questions:
  - What do you think about Electric Vehicles?
    - Benefits?
    - Downsides?
  - Why would you or your friends/family buy or not buy an EV here in (country x)?
  - What would need to change for you to buy an EV?
    - What should or could the government do?

- What do you think that EV's mean for the future of (country x)?
- What do you think about letting companies use your EV for storage?
  - Benefits?
  - Downsides?
  - Would you choose V2G if it's in your car?
  - Is there something the government can do to support this?
- Exit question:
  - Is there anything else you would like to say about why you would or would not buy an electric car?
  - What do you feel was most important about what we discussed today?