

Policy mechanisms to accelerate electric vehicle adoption: a qualitative review from the Nordic region

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Policy Mechanisms to Accelerate Electric Vehicle Adoption: A Qualitative Review from the Nordic Region

Abstract: Electric vehicles are an important instrument to decarbonize transportation, offering a range of co-benefits such as reductions in local pollution, noise emissions, and oil dependency. Unfortunately, price, range, infrastructure and technological uncertainty are only some of the barriers to a faster adoption of these vehicles. To overcome these barriers, there is a broad call for public support and a growing body of primarily survey and choice experiment studies to show which policy mechanisms are effective, with mixed outcomes. In response, this paper offers a qualitative comparative analysis that draws on 227 semi-structured interviews with 257 transportation and electricity experts from 201 institutions across 17 cities within the Nordic region to discuss the reasoning and arguments behind EV incentives and policy mechanisms. A frequency analysis of the most coded responses favoured cost reduction mechanisms, in particular taxation exemptions; infrastructure support for public and apartment charging; the importance of consumer awareness, especially information campaigns; certain other specific policy measures like procurement programs and environmental zones; and more general policy principles. More in-depth, our analysis shows the debates around these mechanisms and how the pros and cons of these mechanisms differ per country, per transport segment, per phase of transition or market share, even per city. In short, this paper calls for strong stable national targets and price incentives combined with local flexibility to implement secondary benefits and more attention to awareness campaigns to advance the implementation of electric vehicles.

Word count: 13.360

Keywords: Electric Vehicles (EVs); Incentives; Policy support; Nordics;

1 INTRODUCTION

Given recent advances in technical performance and improvements in cost, much scholarly attention has shifted beyond the purely technical and economic dimensions of electric vehicles (EVs) to issues of policies, policy mechanisms, and policy mixes [1]. Stokes and Breetz [2] as well as Heidrich et al. [3] for example demonstrate that political factors such as city, state and national policies for EVs can play a determining role in EV diffusion and acceptance. Through modelling, Mirhedayatian and Yan demonstrate the critical importance of policies when discussing EVs for urban freight transport [4]. Similarly, Ji and Huang note the necessity of strong, consistent, and stable policies for Chinese promotion of EVs [5]. In turn, Wolbertus et al., Zhang et al., Berkeley et al., and Hardman et al. all reveal, to varying degrees, how the strength of EV policies interacts with consumer preferences and purchasing patterns [6–9]. The design, implementation, scope, and interactions of EV policy have therefore become central in discussions about widespread EV transitions.

The Nordic region offers a particularly compelling case of testing both the content of policies as well as expert opinions on policy effectiveness for multiple reasons. The close cooperation and integration between the five Nordic countries, Iceland, Finland, Denmark, Sweden and Norway, on a range of topics including climate

change, electricity production and transportation is well established internationally. They share relatively strong climate policies, high public tax levels, and some of the highest renewable energy generation levels in the world. They also agree about the impact of transport (road, sea and air) on climate change. In fact, due to their low CO₂ emitting electricity generation from hydro, nuclear, bioenergy, wind and geothermal sources, for many of these countries transport is one of the primary remaining sectors emitting GHG emissions [10].

Yet, when it comes to the actual transition away from fossil fuel powered internal combustion engines (ICE), the countries have a different track record (see Figure 1 in [11]) and favour different assemblages of technologies (electrification, biofuels, hydrogen, public transport, etc.) and different policy mechanisms to shift the transport sector towards those new technologies. This paper draws on 227 expert interviews with 257 respondents across the five Nordic countries, 17 cities, 201 institutions and a range of sectors to get a better and more complete grasp of these policy mechanisms and the choices behind them in relation to the introduction of Electric Vehicles (EVs)¹ in the Nordic countries (finalized mid 2017).

In both the Nordics and the literature, electric vehicles are seen as an important tool to decarbonize transportation [12,13], while offering other co-benefits, including local health emissions [14], stabilizing the electricity grids and reduced oil dependency and noise pollution [15,16]. At the same time they face a range of impediments from the characteristics of EVs like price and range [17] to political interests and existing business cases [18], as well as a lack of consumer knowledge and practical driving experience [19]. This leads to calls for public support [20].

A growing number of articles has recently been published studying the policy mechanisms that have been set up in response. Some of these focus on specific measures [21] or countrywide programs [22–24] and a select few compare policies across countries [25]. Others generalize across the literature [19,26–29]. Together the literature by now has found a range of factors influencing EV adoption [see for a comprehensive overview 27]. However, as concluded by Coffman *et al* [26], most of these literature reviews are based on surveys and choice experiment data, not in-depth qualitative research across multiple countries. Furthermore, Liao *et al* [28] conclude that public choice experiments are showing mixed result about the effectiveness of the mechanisms. In addition, as Coffman *et al* [26] argue, this mix in findings is further obscured by an unclear causality between the mechanisms and outcomes; the most obvious being the chicken and egg discussion around public recharging equipment.

Simultaneously, the incentives available *do* work, as indicated by the sale shares in Norway and Iceland, two countries with heavy purchase tax exemptions, especially when compared to the other Nordic countries that do not have such exemptions, as indicated by Table 1. This is confirmed in the literature, which concludes for Norway that the most effective mechanisms are aimed at the purchase costs [21] and toll roads or access to High Occupancy Vehicle (HOV) lanes [22]. However, not all countries or local authorities have such options, either fiscally or sociotechnically, and the differences in EV adoption rate are not surprising when incorporating the local political, economic, geographic and sociotechnical context for which policies need to be translated.² There is hence an increasing call for niche market policies [27] and more in-depth regional studies to study the ‘transferability of incentives [30]’ and to ‘build an understanding of best practices [26]’.

This paper contributes to these latter studies by offering a qualitative in-depth analysis of the above mentioned interviews where 257 respondents were asked the question: *What policy mechanisms can further accelerate the transition of electric mobility and vehicle to grid technology?* Due to the volume of data collected,

the authors decided to split this question in two papers: This one detailing the EV policy mechanisms and another [11] discussing the suggestions for vehicle to grid (e.g. using EV batteries as a quick responding storage option to balance out electricity networks). Below this paper presents and discusses what these experts advise in terms of costs, recharging infrastructure, consumer knowledge and awareness, and more general policy directions. First, however, this paper offers a description of the method. It closes with a brief discussion and conclusion.

Table 1: Basic demographic, energy and transport indicators for the Nordic region

| | Iceland | Sweden | Denmark | Finland | Norway |
|---|--|---|--|--|--|
| Population (Mln.) [31] | 0.35 | 9.9 | 5.73 | 5.49 | 5.2 |
| Sq. km (thousand) [31] | 103.0 | 447.4 | 42.9 | 338.4 | 385.2 |
| Population density (thousand p/sq km) [31] | 3.3 | 24.3 | 135.6 | 18.1 | 14.3 |
| GNI per capita (Atlas – US\$) [31] | 56,990 | 54,630 | 56,730 | 44,730 | 82,330 |
| CO2 emissions (metric tons per capita) [31] | 6.08 | 4.62 | 6.78 | 8.51 | 11.74 |
| Non-CO2 electricity production (% of total) [32] | 99% (hydro 73%, geothermal 27%) | 98% (nuclear 35%, hydro 46%, wind 10% and bio & waste 7%) | Over 60% (wind 49%, bio & waste 12%) | 78% (nuclear 34%, hydro 24%, bio & waste 16%, wind 3%) | 98% (hydro 96%, wind 2%) |
| Relation to EU | EEA member | EU member | EU member | Eurozone member | EEA member |
| Transport focused climate targets^a | 2020: 10% RES share in transport. 2050: 50-70% reduction in GHG (comp. to 1990 levels) | 2030: 63% reduction in GHG (to 1990 levels). 2040: 75% reduction in GHG (to 1990 levels). 2045: complete carbon neutrality (= 85% reduction in GHG to 1990 levels). Transport: 70% reduction by 2030 compared to 2010. | 2020: 20% reduction in GHG (comp. to 1990 levels) in non-ETS sector (incl. transport), and 40% in the ETS sector. 2030: 50% renewable energy 2050: complete carbon neutrality. | 2030: Reduce transport GHG emissions by +- 50% (compared to 2005). First replacing current fuels (with biofuels), then alternative technologies and services, targeting 250.000 PEVs / 50.000 gas-fueled vehicles. 2050: 80-95% reduction in GHG (compared to 1990). | 2025: No new traffic growth in cities and all new passenger vehicles Zero-Emission 2030: over 50% of heavy/commercial transport zero-emission and 50% reduction of GHG emissions (Oslo = 95%) 2050: 100% reduction |
| Average age of passenger car fleet^b | 10.6 years | 9.6 years | 8.5 years | 12.7 years | 10.6 years |
| Passenger car taxation^c | Excise duty and weight differentiated registration tax. Annual ownership tax based on weight | Primarily CO2 and weight differentiated yearly ownership tax (no registration tax) | Primarily one-time value-added registration tax Annual ownership tax based on fuel consumption | Annual vehicle tax based on CO2 emissions and weight | Registration tax based on weight, engine and emissions. Fixed annual ownership tax. |
| EV incentives^a | Purchase, VAT, annual ownership tax exemptions Support for charging infrastructure | Subsidy on new BEV (4000e) and PHEV (2000e) Company car reduction | 20% purchase tax until 5000 cars or 2019 (revising the phase out of tax | EVs pay minimal technical purchase tax and ownership tax, no other special arrangements. | Purchase tax and VAT exemptions; 50% company car tax Since 2015 local authorities decide on |

| | | | | | |
|---|------|---|---|-----------------------------------|---|
| | | Five year exemption of annual ownership tax Bonus-malus system (mid-2018) | exemptions (up at 40%) Differentiated parking. Tax rebates for chargers | As of Jan 2017 5 mln for chargers | pricing level of PEV parking, toll roads, ferries and HOV lanes (max 50% of highest price). Infrastructure support on national and local level. |
| EV sales share^a (June 2017) | 8.1% | 3.6% | 0.12% | 1.95% | 34.7% |

Sources: adapted from [11].

^a Based on interviews and respective climate ministries; [10]; [33]; [34]; [35];

^b Respective national statistical offices;

^c Based on interviews and respective national taxation offices;

2. RESEARCH METHODS

To address the missing qualitative cross-country analysis in the literature, this paper assesses the suggestions for and perceptions on public policy support for EVs in the Nordic region. Specifically, this section briefly describes the underlying method and provides an overview of the interviews [repeating similar methodological overviews in 11 and 36].

For the study we conducted 227 semi-structured interviews in the five Nordic countries while visiting 17 cities from late September 2016 until May 2017 (Table 2). The interviews crossed several sectors, including local, regional and national government ministries, agencies, and departments; regulatory authorities and bodies; universities and research institutes; electricity industry players; automobile manufacturers and dealerships; private sector companies working on charging equipment, transport software, alternative transport technologies or electricity and fuel traders; and industry groups and civil society organizations. Importantly, although these institutions were relevant for sampling purposes, individuals spoke in a personal capacity and were guaranteed anonymity. The data sample was gathered by selective and personal e-mail and phone invites, and a snowball question at the end of each interview.

Table 2: Overview of Semi-Structured Interviews

| Classifications | Interviews (n=227) | Respondents (n=257) | % of Respondents |
|---|--------------------|---------------------|------------------|
| Country = Iceland (Sept-Oct 2016) | 29 | 36 | 14.0% |
| Country = Sweden (Nov-Dec 2016) | 42 | 44 | 17.1% |
| Country = Denmark (Jan-Mar 2017) | 45 | 53 | 20.6% |
| Country = Finland (Mar 2017) | 50 | 57 | 22.2% |
| Country = Norway (Apr-May 2017) | 61 | 67 | 26.1% |
| Gender = Male | 160 | 207 | 80.5% |
| Gender = Female | 40 | 50 | 19.5% |
| Gender = Groups | 27 | | |
| Focus = Transport or Logistics | 73 | 81 | 31.5% |
| Focus = Energy or Electricity System | 63 | 75 | 29.2% |
| Focus = Funding or Investment | 10 | 12 | 4.7% |
| Focus = Environment or Climate Change | 12 | 16 | 6.2% |
| Focus = Fuel Consumption and Technology | 22 | 23 | 8.9% |
| Focus = Other | 13 | 14 | 5.4% |
| Focus = EVs and Charging Technology | 34 | 36 | 14.0% |
| Sector = Commercial | 68 | 72 | 28.0% |

| | | | |
|-------------------------------|----|----|-------|
| Sector = Public | 37 | 46 | 17.9% |
| Sector = Semi-Public | 40 | 51 | 19.8% |
| Sector = Research | 37 | 39 | 15.2% |
| Sector = Non-Profit and Media | 12 | 13 | 5.1% |
| Sector = Lobby | 23 | 26 | 10.1% |
| Sector = Consultancy | 10 | 10 | 3.9% |

Source: [11]. Focus represents the primary focus area of the person in question, sector represents the sector where the person was working in (semi-public referring to commercial companies owned by public authorities, like DSOs).

The interviews lasted between 25-90 minutes and were conducted in person (primarily) or by phone if not possible. Generally, the interviews were conducted by either one or two interviewers speaking with one to four experts. Only one of the interviews was not recorded but notes were taken. These recordings were then transcribed and subsequently coded in NVIVO following an inductive, grounded approach; meaning that the interviews were coded based on arguments, adding new codes with new arguments, and only then gathered into higher level themes and categories.

The results that are presented here detail the reply to the question on EV and V2G policy mechanisms but also any mechanisms mentioned elsewhere during the interview. That already points to some of the benefits and downsides of semi-structured interviews. Even though the questions are pre-arranged, the final interview is influenced by the self-selection bias of interviewees as well as the preferences of the interviewer in terms of follow up questions. Another level of selection bias can be found in the level of expertise and background of the interviewees, as in some instances experts felt that certain answers were common knowledge so they skipped them and instead talked more in depth about other less frequently discussed challenges. With such biases influencing the outcomes, the results are non-comparable in a strict sense of the word. However, they are indicative of trends in the general public discourse in the countries we visited, as well as within the different sectors across our cases. In addition, they allow for the emergence of novel ideas [37] and a qualitative testing of arguments, both during the interview and the subsequent data analysis research.

Lastly, there is a timing issue. With a topic so relevant, often the fieldwork in one country could be seen as 'outdated' by the time the team finished the next country. For example, Iceland extended its incentives a month after the team left, just as Denmark rolled back on its earlier phase-out of EV incentives. Still, this timeliness is also a strength of semi-structured interviews for it offers relatively timely data collection (compared to written reports) and allows for a discussion of large topics with complex elements while highlighting underlying perceptions and values [38].

3. RESULTS: REDUCING COSTS, PROVIDING CHARGING INFRASTRUCTURE, AND INFORMING CONSUMERS

This section presents the interview results. Importantly, after coding the different responses, adding new codes whenever a new argument/position was brought forward, the resulting responses were combined in more general themes. These themes include costs; infrastructure; information & awareness; governance principles; government actions; technology and R&D; and a focus on the EV market. Those related to the price differential of an ICE vehicle and EV were gathered under a cost focus. Similarly, those about charging were bundled under an infrastructure focus and those focusing on consumers under an information and awareness focus. Those touching on the role of and regulations by the government were categorized under a government focus, while

those detailing more general EV policy principles were bundled under a general governance focus. In turn, the codes detailing R&D or technology were gathered under a technology focus and the remaining codes detailing advice on for instance leasing or second-hand car markets were gathered under an EV Market focus.

Table 3 provides a frequency analysis of the themes and some of the most recurring arguments, with a weighed percentage of the number of interviewees from a particular country mentioning that particular theme. Each of these will be briefly exemplified below, starting with costs, infrastructure, information and awareness, and closing off with a discussion of the general governance suggestions. The technology and the EV market theme are not discussed as neither of these was mentioned in more than 10% of the interviews, while the government focus theme with its attention to procurement and environmental zones and such, is touched upon in the other discussions but not explicitly discussed for reasons of space.

Table 3: Percentage of Interviews Mentioning Particular Mechanism to promote Electric Vehicles

| | Iceland (n=29) | Sweden (n=42) | Denmark (n=45) | Finland (n=50) | Norway (n=61) | Total (n=227) |
|--|-------------------|------------------|-------------------|-------------------|------------------|------------------|
| Total EV Policy Suggestions | 83% | 93% | 91% | 90% | 85% | 89% |
| Cost Focus | 45% | 71% | 71% | 62% | 44% | 59% |
| Secondary Benefits | 3% | 17% | 24% | 12% | 20% | 16% |
| Subsidize EVs price | 31% | 62% | 51% | 48% | 25% | 43% |
| Tax related | 24% | 38% | 38% | 28% | 20% | 29% |
| Increase taxes on fossil fuels | 24% | 10% | 11% | 12% | 16% | 14% |
| Infrastructure Focus | 41% | 33% | 16% | 48% | 43% | 37% |
| Home/Work/Apt. Charging | 0% | 12% | 7% | 10% | 10% | 8% |
| Public Charging Infrastructure | 38% | 24% | 9% | 48% | 34% | 31% |
| Information & Awareness Focus | 24% | 55% | 24% | 22% | 20% | 28% |
| Information | 14% | 33% | 13% | 12% | 11% | 16% |
| Government Focus | 7% | 29% | 16% | 16% | 20% | 18% |
| Government Procurement | 3% | 12% | 7% | 14% | 7% | 9% |
| Limit, ban, increase requirements | 3% | 19% | 9% | 4% | 13% | 10% |
| Environmental Zones | 0% | 17% | 9% | 4% | 10% | 8% |
| Governance Focus (Principles) | 52% | 50% | 27% | 28% | 72% | 47% |
| Continue Existing Policies | 38% | 5% | 0% | 4% | 57% | 22% |
| Plan phase-out of existing policies | 3% | 2% | 0% | 0% | 28% | 8% |
| Clear Signals, long term planning | 7% | 24% | 18% | 14% | 11% | 15% |
| Technology Focus | 0% | 5% | 9% | 10% | 2% | 5% |
| EV Market Focus* | 0% | 5% | 4% | 6% | 2% | 4% |

Source: Authors. * Even though the question focused on the role of government.

3.1 REDUCING THE COST DIFFERENCE BETWEEN EVS AND ICE VEHICLES

In the interviews, the cost differential between EVs and ICE vehicles was a repeatedly mentioned barrier, up to the point that people saw it as self-evident and only mentioned it after a follow-up question. As Table 3 shows, a cost focus returns in 59% of the interviews and is most present in the countries with minimal direct EV incentives that help reduce the price differential between EVs and traditional fossil fuel vehicles (Sweden, Denmark and Finland). Interestingly, the secondary benefits like free parking, HOV/bus lane access, free charging, and toll road exemptions are not discussed that often (37 interviews) and even less in Iceland and Finland. In turn, tax related measures (66 interviews) return mostly the countries with a particular high (Denmark) or low (Sweden) car purchase tax level, as described in Table 1. A last remarkable take-away from the frequency analysis

is that Iceland is a bit stronger geared towards higher fossil fuel taxes. This follows as transport fuels account for some of the last Icelandic energy imports and thus count as one of their main foreign capital expenditures.

The fact that price is an issue returned not only quantitatively but also qualitatively. As a Norwegian (R198) summarized his country's successful EV policy:

It has been three success factors, it's cheap to buy an EV, it's cheap to use an EV, and it's practical and convenient.

This pragmatic viewpoint is also found in other countries. In Denmark for example, R131 argues that the expenses and range limitation do not outweigh the convenience of an EV and support is thus necessary, while R130 argues even stronger that besides the price there is no other 'barrier that people would like one'. With the price of an EV driving the debates, discussions quickly turned to ways to diminish the price difference between EVs and fossil fuel cars. Either by making EVs cheaper through subsidies or tax exemptions, by increasing the value of EVs through secondary, non-financial incentives, or by increasing the costs of ICE vehicles.

3.1.1 Making EVs cheaper

Suggestions how to make EVs cheaper shifted from the upfront purchase price to the running costs, as well as the creation of additional value or the increase in costs of unwanted alternatives. For R162 it does not really matter as long as the prices become competitive:

It can go either way. Either you can begin taxing the normal petrol driven cars more or you have to subsidise the EVs. But the price difference between the two must become smaller.

Likewise, R106 feels that the difference between a subsidy or tax exemption is a technicality. However, for others there is more to it, especially when it comes to the relation between direct subsidies and taxation derived benefits following exemptions or differential pricing levels. In Finland, which has no specific additional EV incentives, the options include a VAT reduction (R143) or a subsidy (R138). However, R134 reflected how the government would probably focus on taxation.

If the government would give money, [that] if you buy [an] electric car you would get some kind of grant - I mean that is the discussion - I think that wouldn't fly. It's more about the, I think, for the Ministries of Finance and Transport, it's more about taxation.

This focus returned in the other countries, for instance in Iceland when discussing the import taxes and in Denmark when discussing the phase out of EV tax exemptions.

In fact, the only country with an explicit subsidy scheme, Sweden, is shifting (July 2018) to a tax based incentive scheme inspired on the French *bonus-malus* system. A system where high CO2 emitting cars pay a malus, while desirable non-emitting cars receive a bonus. The reason for this is, as R059 describes it, that the existing Swedish incentive actually has had no impact and should have been increased to have an effect:

I think that it, more or less, is too little money that they give. Roughly, in Sweden, four thousand euros or something. [While] the one that buys the electric vehicle, I guess - I am not sure, but I guess - they could have bought it anyway and would have bought it anyway.

While as part of a *bonus-malus* system, R076 argues, it makes more sense, especially if the malus aspect is higher:

The bonus part is good. I mean, 50.000 [SEK, roughly 5200 euros] per car is a large amount, but we see that the malus part, which I think is more important, is too small or is not enough and we believe the malus part is more important.

With the Swedes considering a tax-based incentive system, our experts seemed to favour incentives organized through taxation as the best instrument to lower the purchase price of new electric cars.

These tax exemptions or differentiations were justified based on multiple reasons, including climate change and other externalities. However, the justifications do not always connect optimally to the final policies. R017 for example was not alone (e.g. R225) when he critically reflected on the level of tax exemptions that the Icelandic government put in place, a level that might not reflect actual climate impact:

Well I mean, in a perfect world, the authorities monetize all the negative externalities and lower the import tariffs based on that. They haven't done so. They ... I think they just pulled a number out of a hat.

Another justification that came up, for example in the interview with R085, related to the high share of renewable electricity produced in these countries:

It is the scheme for tax that is the most obvious one. And they should start talking positive about electric vehicles being not a problem but a solution to a lot of issues we have here. And having so much green power, it is completely stupid not to use it ourselves.

This domestic focus returned as well in a number of interviews with experts arguing for the new business opportunities that come with such a shift to a new technology. R147 for instance expresses concern that not supporting EVs might mean that Finland is left behind in the technological race, potentially hurting the Finnish economy.

Well I'm hoping that they would take more weight on the subsidizing of this adaption of electric vehicles, since that brings new technology and new business opportunities to the market, which then requires more service providers and provides in general more business opportunities, perhaps also abroad. And it would be a shame if all the good business or the market shares would go to foreign companies, already equipped with this kind of business models and practices.

Similar concerns returned in Norway and Denmark. In contrast to these justifications only a few experts brought up arguments against taxation exemptions or subsidies and then mainly in relation to potential distortion effects from subsidies and exemptions on markets, as exemplified by R164:

I am not really sure. The main principle should be that what happens should be based on the market. It is not really a sustainable solution if it's based on subsidies. But we have some industry sectors that as you mention are doing well and could promote also electric vehicles but it should be based on the market.

These views were a small minority however, mainly voiced by economists and taxation experts. In short, the interviewed experts preferred taxation measures to direct subsidies, unless these taxes do not exist in the local context and thus cannot be exempted (as for instance in Sweden). This is of interest as a recent study by Lévy, Drossinos and Thiel [39] concluded that tax exemptions seem to favour expensive segment cars, while lump-sum subsidies favour smaller EVs, meaning that this preference for taxes already has clear consequences for the EV market.

The discussion whether to provide incentives through subsidies or tax exemptions was often followed by a discussion about what to support and how to incentivize as efficient as possible. First, some of our experts, like R067, voiced their concern about how support for electrification relates to methane vehicles, hydrogen fuel cell vehicles, and so on.

You have to be [aware] that electric vehicles are not going to be the only solution. So they have to think of the big picture and look into that.

Or R044 who discussed the interaction between biofuels and electricity:

We always say you have to stick to several pathways at the same time. You need those biofuels for the heavy duty traffic. And perhaps in twenty, thirty or fifty years we have a total electrified road transportation, but then you need the biofuels for the air transport.

This relates to the notion in policy reports that different technologies are suited for specific aspects of the transport sector. Biofuels for long-distance heavy duty road, sea and air transport; electricity for urban regions, short distance travel and light duty vehicles; and hydrogen a future option [10]. At the same time, the government is asked to make choices within such a comprehensive transport policy. R070, for instance, calls for a clear choice for electric vehicles:

I think the government should step forward and try to help such a transition take place as quickly as possible and also maybe - now it's easy for me to say since I work for an all electrical [anonymized] - but maybe to point mainly [to] one main alternative.

While R070 admits to a clear bias and his choice is questioned by those working from other technologies (see 3.1.3), other more general transport and environmental experts, lobby groups and market parties also argued for clearer choices. They did so primarily because they feared that without clear government signals and targeted support schemes it is possible that certain fuel types will enter the same transport segment, cannibalizing each other and reducing the overall cost efficacy of the support schemes.

Second, there is the question of how to organize the tax exemptions without creating potential unwanted side effects or, potentially worse, invest wrongly (R163). Examples that came up throughout the interviews of 'incentives gone wrong' were the 2006-2007 diesel incentives and the minivan incentive in Norway (R192, R231), the overly successful parking regulations in Trondheim and Gothenburg (see 3.1.2), and the tax exemption in Denmark. In Denmark, the value-added car taxation meant that an exemption resulted in a relative higher discount for more expensive cars, thereby effectively countering the initial Danish policy to tax expensive (heavy and luxurious) cars more in favour of smaller cars. The tax exemption for EVs resulted in very competitive luxury EVs, while the smaller EVs remained more expensive than similar sized ICE cars [see also 39]. In the words of R088:

I think the government has a dilemma there. Because the government, they want to have more electric cars [and] one way to do that is to lower the tax on these cars. On the other hand, if you lower the tax you make a shift but you also get more cars out there. I think their intention was to have a lot of small cars, but it turned out that it was the expensive cars. So, it's a tax reduction for very exclusive cars.

This effect and the resulting image of a rich man's tax exemption, together with fiscal restraints led the Danish

government to phase-out its tax exemption.

Third, while taxation can favour segments unintendedly, it can also be done on purpose and aimed not only on the private market (with or without a focus on the size of the cars), but also on commercial markets: taxation for fleet operators, semi- or heavy duty commercial vehicles or company car leasing plans. Actually, quite some experts favoured an adjustment of the latter for its fast turnover rate. Leasing contracts often last 12 – 36 months, so every 3 years you would get more desirable cars on the market. Moreover, R051 notes how the risk of the resale value and potential technical failures no longer are the concern of the driver:

I should say that the Swedish car market is very driven by companies. Some 60% of all car sales are for companies. And we have a system with benefit cars. [...] But if the company offers you this car for a fixed price and a fixed value for years, then you have no risk. You have only the monthly cost. So that's quite a good concept for Swedish companies to help their employee

At the same time, R051 also highlights one specific policy that needs adjustment for this to work, namely that there is no tax regulation yet about home charging for company cars.

Whereas the company car scheme in Sweden is already underway favouring CO2 neutral cars (R049), it is one of the suggestions in Denmark and Finland, as it is considered relatively inexpensive for governments (R151). In addition, R236 makes the connection to consumer experience that people get if they drive electric vehicles through their companies:

Because that is where you can make experience without having to make an investment yourself. You can drive your company's car and see "ohh that is fun and I actually get where I want to get".

This cost-experience argument returned repeatedly also in relation to commercial fleets (taxis and public transport), rental fleets and shared car fleets. Another shared alternative is to offer company cars that are available to the general public outside office hours. Programs like that exist in both Denmark and Finland in relation to municipal fleets (R133, R167). The benefit of such a scheme is that it opens up car sharing programs in less urban regions, as the municipality takes the brunt of the costs. Company car programs are hence one way to apply tax exemptions to a particular segment in the market. Unfortunately, commercial fleet operators (taxis) and commercial light/medium duty freight traffic are more difficult to support, often, ironically, due to the lack of available taxation that can be exempted or levied differently.

3.1.2 Non-financial Incentives to increase the value of EVs

Besides subsidies and tax exemptions, the so-called "secondary benefits" or non-financial incentives implemented extensively in Norway returned regularly in our interviews (37), although not nearly as often as expected. As the interviews show, this has primarily to do with specific local contexts. Free or reduced parking came up most (73% of the 37 interviews), then the access to HOV/bus lanes (49%). Free charging (19%) returned minimally in Finland and Norway. The free ferry option was only mentioned twice and never actually reflected on. In turn, the toll road exemption (35%) mainly came up in Norway and Sweden; the two countries that actually have toll roads and congestion taxes to work with.

The importance of local context returns in Finland, where R156 argues that the overall enthusiasm for the secondary incentives is quite low:

I know there has been a lot of debate whether there should be some kind of road tolls or if the EVs should be allowed to use taxi stands or bus lanes or have similar incentives that Oslo for instance is trying, especially during rush hour. But, for some reason, it's not seen as a very tempting option in a way...

When secondary incentives were discussed, interviewees noted the difficulty of doing so. In both Sweden and Denmark experts explained that EU regulations meant that EV owners could not receive specific free parking spots. R076:

Then we have in Sweden a policy maker that says that it cannot change the parking directive in Sweden that the municipalities use. It's a state policy or state directive, and it says that one can't give EV car drivers an access to a parking spot over some other groups, that would be [] non-compliant to EU regulations.

Interestingly, supranational regulatory boundaries also returned in Norway as the VAT exemption is subject to approval of the European Free Trade Agreement surveillance authority (R193).

In addition to adhering to the state aid regulations of the EU, incentives also need to fit with local regulations and existing practices. In Denmark, R082 argues that free parking is one of the few things they can do as they do not have toll or environmental zones:

Parking is a very good issue because we do not have any toll, we do not have these environmental zones or something in our city. We have it, but not for private cars.

And even if both supranational and local conditions enable the introduction of secondary benefits, there still is the matter of preferences and political choices. Some believe in HOV access, others lament it (R096); some believe in free parking, others reject it in crowded cities. A process of weighing the possible options, summarized by R176:

Parking is a good benefit, but not used in some cities. They allow the use of the bus lanes. I do not think that is such a good idea because public transport is public transport for masses. It needs to be quick and accurate, the timetable is exact. If there is an EV driving slower, then it can slow it down. It is not a problem right now, but in the next few years, it could be. Why build these barriers for public transport? [...] We have done an electric vehicle strategy [in our city] and listed the costs and benefits. [For us] it is about what are the possibilities to use, [and those possibilities are] parking and EV only areas.

That said, in countries where secondary benefits do fit and can be arranged, they are seen as welcome and relatively low-cost mechanisms.

These incentives are not just about costs, there is also a social aspect to them. For example, for R120 and R233 such HOV/bus lanes are about getting to work faster, which they argue is even more important than a cost reduction. For others there is another element involved besides time and costs savings, as described by R169:

The most effective way of changing attitudes? Jealousy. You see someone driving in a bus lane and you're standing there [in traffic and wonder:] "how come he doesn't have to pay [for] parking?"

These non-financial incentives thus offer immediate emotive responses and increase the visibility of EVs in society in general. And these social mechanisms are also part of what makes HOV lanes and toll road or

congestion exemptions successful. As R236 explains the repeated confirmation of the toll road exemption in Norway:

You have to have the same kind of remote thing in your car as a normal car, but you do not pay. So, it registers that you are allowed to drive there for free and every time you drive through one of those toll stations you get a green light and say, "ha now I didn't pay again". And that seems to be a very strong effect.

In other words, there are other aspects besides costs to these secondary benefits that help increase the value of an EV and impact a consumers' willingness to pay. In addition, they increase the visibility of EVs by enhancing their status, which in turn, increases consumer awareness—a commonly cited EV barrier [19].

At the same time, experts told stories about overly successful secondary benefits, related to EVs and environmental cars in general, that made local authorities hesitant to implement similar incentives again. Besides the discussions in Norway around crowded bus lanes, parking came up as a sensitive issue. For instance, R062 describes how in Gothenburg (Sweden), the city authorities are reluctant to repeat an earlier decision that allowed environmental friendly cars to park for free, following the backlash after it had to be withdrawn:

These types of cars were allowed to park for free on municipal parking. There were rules around this. But there were strong parking subsidies from the city. And as a result, almost all of the new cars sold in Gothenburg were environmental cars. So that was great, but it worked too well, because if everybody had an environmental car, everybody was allowed to park for free. And there was no parking and the situation got very complicated. So, they had to remove this incentive. And I think the city, now, rightly, is quite afraid of adding that kind of incentives again, because it's difficult to know what's going to happen and it becomes very unpopular when you remove it.

In Trondheim (Norway), a similar decision was made to remove the free parking for EVs. An unpopular decision among EV owners, not just for its outcome, but also for its political representation as a choice between either full incentives or no incentives at all (R246).

In section 4.2, this paper will discuss a bit more how to deal with successful incentives and how to phase them out. For now, it can be concluded that even though the secondary benefits are shown to be effective, local conditions and historic fears of these measures being too successful limit their popularity in other local contexts.

3.1.3 Increasing the costs of ICE cars

In addition to policies geared towards new vehicles, experts also suggested ways to deal with the existing fleet. For example, an alternative to reducing the cost differential is to increase the costs of owning and driving a fossil fuel powered car. In the words of R053:

I think one of the issues is making the bad choice less attractive.

The point here is not just the financial incentive but also the signalling that results from it (R202). Specific to taxation, three options came up in our interviews: increase fuel taxes, increase the purchase taxes on ICE vehicles or introduce CO2 taxes. Frequently, experts included elements of all three, like R113 who combines purchase taxes as well as fuel taxes for Denmark:

So, we need to make all the cars available expensive. That's the sad truth. Nobody wants to say it loudly, but that's how it is. We should put small cars to be a little more expensive, but still much cheaper than big cars. And we should put a little more taxation on gasoline and diesel as well. That would be the correct thing to do now.

At the same time, R023 in Iceland is not alone when noting how this is a very difficult political position. The difficulty on raising the costs for ICE vehicles, in whatever form, was also seen by R085 in Denmark as a communication failure of the government:

The current government does not want to give more tax on petrol and diesel and the petrol car. However, normally you put tax on what you don't want and lower the tax on what you really want, so the amount of money would be the same. [...] If you start doing that you tell people that this is the way we are going to move forward in the future, [...] but when you do not even start that, you aren't telling people how you want it in the future, so that is the really big problem.

In connecting policies and communication, this quote underlines the importance of stable and clear policies, which will be discussed in section 4.2.

Before turning to the other focus points mentioned in the interviews, another program aimed at converting the existing fleet came up, albeit infrequently, namely buyback programs. Or as R011 argues:

So, they could have some type of buyback programs [...] because of course you need to get rid of the old gas-guzzling vehicles. Adding just one more vehicle to the household is not going [to] do much, in a way. [We need] to get the old vehicles out of the system.

Especially in Finland, buyback programs were reflected upon a couple of times as they had a program in place scrapping 8000 vehicles. Opinions differed however on its successfulness. R152 measured successfulness in terms of the speed with which the program ran through its budget (two months), while R164 measured its *unsuccessfulness* in terms of the reduction of CO2 emissions gained for the 8 million euros spent and argued against such measures that ultimately still promote private vehicles. In other words, buyback programs can be helpful, but their climate effect needs to be studied [40].

Lastly, while ICE taxes and buyback options make it harder for new fossil fuel cars to enter the market and more profitable to get rid of old ones, a number of experts highlighted that cars have a life time of up to 20 years or more and that all the cars sold today could still be in operation in the 2030s. The question for these experts was therefore not how to shift the fleet to emission free vehicles, but how to reduce the emissions from the fossil fuel powered fleet that exists in the interim. The suggestion, by (bio)fuel experts and general transport scholars, was a further increase of the blending requirement of the latest generation biofuels. This was said to be a low cost, relative efficient CO2 reducer in the intermediate phase. Moreover, it would also support domestic industries, which is an important consideration in Finland and Sweden in terms of employment and rural development. Then again, opponents to biofuels listed insufficient biofuel supplies, suspect CO2 efficacy, health effects and costs as counter arguments. Still, as discussed in 3.1.3, while many experts agreed that both technologies have their place and are actually necessary to reach the 2050 targets, these and other technologies like hydrogen are to some extent competing for the same public funds. Thereby confirming that EV support results, amongst others, from a combination of local availability, political priorities (including domestic employment opportunities) and expectations about the development of transportation and technology.

3.2 CHARGING INFRASTRUCTURE

The second most discussed theme involved recharging infrastructure (83 interviews). Most of these discussed incentives are for public charging infrastructure (70) while a select few focused on home, work, destination and apartment charging opportunities (19) arguing that EV drivers use these daily as opposed to the infrequent use of public chargers. When looking at the differences between the countries, infrastructure comes up more or less equally across the countries, except for Denmark (only 16% of the interviews). The reason for that is probably the overwhelming focus on the tax situation in Denmark as well as the fact that Denmark has a relative extensive nationwide network after early investment decisions by CLEVER and the partners around Better Place. Infrastructure came up most in Finland (48%), which relates to the strong focus on domestic charging infrastructure companies and smart charging opportunities. This contrast with the situation in Norway, where foreign companies offer a lot of the infrastructure, but charging is mainly discussed in line with the growing number of EVs in need of charging.

First, in terms of public fast recharging infrastructure, some experts are really clear and state that it is the primary need for consumers (R011). Others classified this not as a need but as 'peace of mind' (R013) for the EV drivers. As R153 describes it in the Finnish case:

Well, I do not know the political decision, but of course there have to be loading stations. Spread evenly or spread in the places, so that we can, as consumers, we can feel that we can always load the car if needed. So that we do not have to check the map.

Whether a need, a peace of mind for first-time buyers or both, experts agreed that public fast charging stations have a specific target and travel pattern, with most people using them infrequently for longer trips or emergencies. This argument led in some cases to discussions about the relationship between charging and the size of the batteries. While larger battery sizes were preferred generally, R042 argued differently and hoped that people would realize that they 'do not need big batteries' and can use lighter cars with corresponding smaller battery capacity. In other words, that they do not need more than 500 km (R218) or more than 200-300 km (R234) provided the infrastructure is in place.

Besides the actual or perceived need for public recharging stations, a few experts gave different reasons why investing in recharging infrastructure is smart. For instance, R159 highlighted the fact that those investments are domestic investments:

And I think it's, at least here in Finland, it makes more sense for the government to put money in the infrastructure than to support people buying Teslas.

Similarly, R143, also in Finland, placed it in an equality perspective by arguing that public infrastructure is public, not private:

But anyway [...], if the government gives you let's say five thousand euros, okay it's nice to you, but it has nothing to do with me because I already have car, or that guy walking there he doesn't get anything. But if the government puts that for example in the charging infrastructure, then it's good to me, even to you, and even that guy who doesn't drive an electrical car yet.

This is a sentiment that also returned in the reply from R152 who made the comparison with public transport and felt that incentives are necessary in areas that are more rural and where traffic is low.

Most however justified incentives for recharging stations on the deplorable business case that results from current EV dispersal rates offset against the need to build a network with nationwide coverage, if only to offer that peace of mind for first time EV buyers. R073 for instance describes the business case as limited, not because of the investment, but because of the operational costs:

It's not like we have developed a fantastic business model, it's more like, okay, we would like to be a part of the transition for a more sustainable system, [...] One part is brand and another part is content - that we are really helping with the transition to a more sustainable transport sector. Another part is that we really believe in this area so of course there will be business opportunities in the future. [...] I think there is funding for public infrastructure which is good and we use that. The investment does not hurt as much. But we need the volume to cover the operational expenses.

Alternatively, as R157, an outside expert, remarked:

Yes, it is too low. [...] The investment versus what you get as an income flow is too slow in Finland. Basically, it's a no-go. I am so happy that there are companies who are kind of swimming [laughs] towards the stream and do it nevertheless, but I think they should have more support.

The deficient business case returned in every country, even though in Denmark, with its easier geography, some companies went ahead (amongst others with projects like Better Place) and are now running losses awaiting the growth of the EV market.

Furthermore, looking at how the experts describe the organization of the public charging incentives, striking is the infrastructure dispersal and who is involved in organizing the charging opportunities. First, most of the infrastructure is constructed by private companies with public support. In Finland, where the charging infrastructure is minimal (as is the share of EVs), the notion seems to be that the infrastructure comes with a growing share of EVs, as R170 highlights in contrast to the Danish situation:

I think the consensus in Finland regarding charging stations is that it will be market-oriented, so the government would not subsidise charging station investments. At least not very much.

While companies await the Finnish EV market, even with 35% subsidy on the investment (R139), R176 describes how certain local public authorities feel obliged to get things going:

The way to deal with this is that we have to make some charging spots in the first phase, so you can see these charging spots in the city centre. But after that, it is the responsibility of the private sector to build this structure.

This market-based approach is shared across the countries. Oslo offers an exception as its local authority took it upon itself to install and operate a massive share of free-to-use slow roadside chargers. Even though this was instrumental in accommodating the growing share of EVs, the city currently struggles to have companies take over the infrastructure, as they do not see a business case in those slow chargers.

What both local examples show however, is that charging is not just a national or local affair (R030). While national governments are shifting their focus to nationwide coverage projects, like Iceland's national ring road project of fast chargers, and supranational bodies are supporting cross country corridors (the GREAT project crossing Sweden, Denmark and Germany), local authorities play an increasing role to create nationwide coverage beyond the highways and popular urban cities. As R118 argues, they do so partly for economic reasons, supporting local entrepreneurs:

Some municipalities have chosen to supplement the charging nets where, not where there's a business case in itself, but where they would like [that it is] possible for people to charge, like a big destination for tourists for example.

That said, not everybody agrees. For R168 it is not the mandate for local and regional authorities to construct and maintain public charging stations. Likewise, R119 feels that it is primarily a national issue also because he connects it to the electricity grids behind the chargers:

Also preparing the infrastructure. We are also in [name of town] now addressing the infrastructure; [but] it ought to be a national level and maybe perhaps on European level, preparing the grids and the whole electrical system for the future.

Interestingly, this takes place in a phase where companies are already stepping in and engage with the prime locations. In some cases, for the charging itself, but often for the service that charging delivers to their customers. As R065 reflects about travelling:

But when you're traveling, when you stop to take your ice cream, you want to charge.

Charging takes time, but that is time one is able to spend on buying an ice cream, coffee or a sandwich. What this actually highlights from a more abstract level is the diversification in travel and living types with subsequent charging behaviour: long distance trips, shopping, commuting, or living in villa's or apartments, rural or urban, each comes with its own charging demands and charging patterns. Subsequently, incentives need to be tailor-made to these different demands, with choices about when to offer support and when not.

Second, the above already points to the timing of these incentives [see also 20]. On the one hand, there are discussions in Iceland and Finland where they are still setting up basic infrastructure. On the other, in Norway and certain cities the discussion is shifting to the next phase: extending the existing coverage as well as reducing the time spent on charging, among others, to accommodate the peak demand at fast charging stations during holidays, which is leading to long delays. A "freighting" vision that even came up in Finland (R175). However, this again highlights the difficult business case of charging; many of these fast charging stations to the 'cabin' or other popular holiday destinations are only used amass during the holidays. Without ridiculous pricing schemes, the investment and especially operational cost (in remote areas) cannot be recovered in a timely fashion. It is, however, an open question whether that justifies public support; support that not only has to cover the charger and its maintenance, but also the grid connection to that recharging station.

Third, a number of experts stressed the need to focus more public attention on private or semi-public charging at home, work or apartments. Especially the latter was framed as a fast growing concern in need of public support, for example by R078:

From the beginning, it was only purely public charging spots that could get funding [in Denmark], and we, together with lots of other colleagues, have tried to get them to rethink and also give funding [to] companies or apartment buildings who want to build the infrastructure that's not necessarily public.

Our interviewees offered two ways to go about this: incentives schemes or building regulations. The incentives returned on a local level with some cities, like Oslo and Trondheim, taking steps to support apartment block charging infrastructure. However, in relation to these support schemes, it is not just the financial aspect that is difficult, but also the choice whether to support the (smart) chargers or also the grid connection of the building,

as the latter is often not strong enough to accommodate charging for all apartments (R198).

As an alternative to incentives, a select few experts mentioned the need for building and zoning regulations as a way to prepare private, commercial and shared housing buildings for charging facilities (R171). R155 argues for this, not so much from a costs perspective, but from an organizational and information perspective:

Let's give the private customers, the [...] housing companies, the possibility to install their own home charger, slow charges, so that when building new houses and renovating old houses [it] really [is] part of the design [...] standards and also renovation instructions. That they are kind of taken into account when the enlightened customer [says] "now I want to get my EV".

Likewise, R176 argues for such guidelines, not just for the construction, but also in terms of payment and ownership structures. Such building regulations would thus fulfil a double purpose: they obligate but also provide guidelines and information on what to install and how. This would not only be welcomed by private actors, but also by semi-public companies, like parking authorities who are increasingly obligated to install chargers but have no expertise to do so.

3.3 CONSUMER AWARENESS

A third recurring advice during the interviews involved a focus on the consumer and the information and experience that they have and receive (64 of the interviews). This was brought up almost twice as often in Sweden as in the other countries where it was mentioned more or less evenly. In this theme, information came up most (37). And as experience (27) and visibility (17), the two other elements of this theme, are more justifications than policy mechanisms, this paper focusses primarily on the discussion around consumer information.

The missing awareness and knowledge of consumers about electric vehicles, about range, charging, running costs and so on, was discussed in multiple ways. Typically experts, like R003, argued that the government should raise awareness:

So that's something that the government could do more, to inform and create awareness, not just be and impose the regulations and law but also awareness, general awareness for the public and other industries.

Or more specific, R104 argues to use actual policies as a way to convey a message to the consumers:

If we agree that the larger introduction of electrical cars is a good cause, if we politically agree that is the way to go, I think we could go a long way simply by saying the opposite of what the public understands at the moment. And that can be done within taxation – that is a big problem within politics – but it could be done in many other ways. [...] It's not like we have to use eight hundred million a year on electrical cars, or we have to subsidize it big time, we probably have to subsidize it for some time more because at the moment, electrical cars are still fairly more expensive than petrol cars or combustion cars. But I think that it is down to the message.

This led to a number of remarks on who actually should organize information campaigns. On the one hand, there was a call for governments to “step up” as people felt that the government was one of the only parties able to deliver neutral information. R075 makes this case when arguing:

So, we need the government to put, this time not the money where the mouth is, but the mouth where the policy is. There is a need for better understanding about what your range is, how quick charging works and, you know, just official maps of where you can charge and how much that would cost and whether the charging station is occupied or free. Those things, I feel, are sort of beyond the market and at least initially the government could [give] a push...

At the same time, R011 for instance, questions whether the government should indeed organize such information campaigns, as ultimately the companies would be the ones to profit from it:

The government really needs to be careful with that, because that's where the market should step in. So there are questions whether the government should engage in information campaigns, shouldn't that rather come from those actually benefiting from increased use of electric vehicles and the purchase of electric vehicles?

However, when it comes to the market, the interaction between tax exemptions and sales results in a situation where advertisement, test drives and all these factors that normally generate awareness only make sense when sales actually take place. In this respect, the team noticed the absence of BEV advertisements in Finland during the fieldwork, especially in contrast to the many street sign posters in Norway. A logical situation given the respective EV markets, but also another chicken-and-egg relationship.

Besides governments and commercial parties, there are other sources of information that are important and deserving of public support, including specific electric vehicle consumer associations (as opposed to industry EV associations, which do important work but lack the primary consumer focus) and online fora. As R105 summarizes the information infrastructure in Denmark:

I think Facebook and some of these groups, they are vital for some of this. And Danske Elbil Alliance, they are, that is the OEMs and the DSOs behind them, so they have their own agenda. They do not provide large consumer organization, they don't understand that basically, and they shouldn't. FDM [the general car consumer organization] is picking up, they are providing more and more information. And some of it is actually getting better and better. So, they will get there eventually. And then we have a magazine [Go] that is disappearing now. [...] So, it comes to FDEL [the EV consumer club] to know the information.

In line with the literature highlighting the value of peer-to-peer networks [26,27], the notion that “consumers trust consumers” returned regularly in one way or another. R042:

I think the best way to educate people is by hearing from other electric vehicle owners. There are lots of people ... we have a chat forum, and lots of people are asking questions about range and charging, et cetera, and they get real answers from owners. Because if you are an electric car manufacturer, or even if you are some governmental organization writing a paper, people do not trust that information. But they do trust information from people who actually own vehicles.

Likewise, R037 remarked from a governmental point of view:

It will most likely be very difficult for us to inform people from a governmental side, of course we do on our website, but what really matters is that your neighbour buys one. That makes a difference, and that is what the Norwegian research says. And I guess that's the same in Sweden.

It seems all these actors have a role to play. Governments, by providing or supporting factual information and guidance through incentive policies (R184) or recognition programs like the Norwegian number plate system

(R236). Industry, through advertisement, branding (R178) and the visibility of the existing charging infrastructure (R040, R129) in order to create awareness and interest. Yet, then the attention of a buyer shifts to consumer organizations and 'real life' experience from consumers through official (EV consumer organization) or unofficial networks (online fora, peer-to-peer) to see if EVs fit their travel routines. While public authorities are perhaps rightly reluctant to create information campaigns themselves, supporting these consumer-to-consumer groups with a technology neutral fund aimed at information dissemination might be worth investigating.

Besides discussions about who should inform consumers, a number of experts discussed the content of that information. For some, the information just needs to show that they are 'really fun to drive' (R072) or that 'it's simple and it works' (R069). Others focussed on correct information, especially around the driving range (R044). Another expert argued that the message should actually be more complex and should show the connection between the current technological status and the huge changes in the electricity system that are around the corner, which will change most of today's resistance against EVs (R246). At the same time, R061 warned against too much focus on factual information:

Of course, you should mention the numbers and it shouldn't be too expensive, but cars are emotional. So you should be very careful to only base your information about costs. Because a lot of people buy cars based on a feeling, and how they like this brand or have been buying this brand for a very long time and they have knowledge about the guy [who] sells the car to them.

Simultaneously, the message should not only focus on EVs, but also about charging. This returned especially in discussions around peak loads and the impact on local electricity grids, both towards consumers to delay charging (R013, R027) and towards housing associations, contractors, parking authorities and other similar parties who are responsible for constructing shared charging equipment in their buildings (R078, R242).

4. DISCUSSION: GOVERNANCE REFORMS AND PRINCIPLES OF POLICY ADVICE

In addition to the shortlist of policy advice offered so far, two broader principles of policy governance and regulatory design [41] came up to guide policy making around EV incentives. In brief, our experts voiced their opinion about this in 106 interviews. Here this paper develops two of the arguments mentioned: the creation of stability and predictability through long term planning and clear signalling (34 interviews) and the continuation (50) or potential phase out of incentives (19). While the first, stability and predictability, returned more or less evenly across the countries with the exception of Iceland, experts from Norway (70%) and Iceland (22%) are practically alone in arguing for a continuation of current policies, with almost only Norwegian experts focussing on the long-term phase-out of EV policies (89%).

4.1 PREDICTABILITY AND CONSISTENCY

The one thing that keeps returning in most of the discussion so far is that incentives need clear signaling and long-term planning. Even though only 34 interviews mentioned it explicitly, the need for stability and predictability, and what happens if that is not upheld ran through most of the interviews. For consumers, as R071 remarks about the Swedish incentives:

No, they are not sufficient. There are two things: of course, the producers and the ones who want to change always want as many benefits as possible. So, they'll never say that it's enough. But I don't think it's enough the way it is right now, but maybe more importantly, people need to know what the rules will be for [the] long term. They need stability.

But also for companies, as R107 remarked when reflecting on the Danish EV tax exemption:

It is not the fact that people do not want to drive EVs. One of the big obstacles in terms of how the government is reacting is they do it so much shorter. They keep changing [their policies]. So you don't know what to believe in. [...] You don't know how to behave and react and it's the same with the companies. We are saying, put the taxes on, do whatever you want to. Just do it. Because then we know how to react. We might take away the EVs. And that is maybe the business case then. But do something that is long term.

Predictability is hence key for both consumers and companies, and experts provided at least three reasons why. First, the symbolic value of a strong policy signal (for instance through incentives themselves or through targets) provides a signal of approval by the government for one technology over another (R246). Second, such a clear policy signal not only acts as a sign of approval to private consumers but also to businesses, communities, and local governments in deciding to allocate budgets (R175). Third, predictability leads to financial stability, for consumers who can estimate the value of a product (R046) but also for companies and institutes who help promote EVs (R211).

The interviews suggest that predictability results from strong incentives, strong disincentives, leading by example or targets. The first three have been discussed above. Targets are another way to create predictability if there is broad political support for them, as discussed by R117:

And about the mental side. I think that the policy target for 250,000 EVs in the market is exactly what the policy makers can do for the mental. [...] Because there have been so many times that EVs were said to come soon, that many people are probably [thinking], ok hmm, there are some gas cars, there's some thousands of them, and some people talk about fuel cells or hydrogen, some people talk about biofuels. So they may be a bit confused that this is something that we do. So I think this is important that the government says this is our target. 250,000 EVs is a serious number already. It is quite likely that there will be a[n infrastructure] system that will charge them.

While such targets are helpful in generating awareness and 'buzz' (R144), R201 remarks in relation to the Norwegian sales ban on fossil fuel cars by 2025 that they do not work without a plan. Basically, you do not only need 'a vision' but a 'clear policy structure' (R041). In other words, a target without follow up and without broadly shared public support is in danger of becoming an empty shell. The difficulty of course remains how to set a target, come up with a plan to reach it and find the means to support it in an area where 'things move on exponential development curves' (R118).

4.2 PHASE OUT, NOT ONLY IN

Continuing the discussion on stable policies, it should not come as a surprise that Norway and Iceland are alone in arguing for a continuation of existing policies, following their VAT and purchase tax exemptions. The difference between Norway and the other countries becomes even clearer in the actual responses from our experts, like R236, who answered in relation to another question that the main challenge for Norway is to keep the incentives where they are:

I do not see it could be even quicker. The uptake was extremely quick, I would say, for something that big. So I think, from like a governance perspective, it was costly for the government but they obviously chose the right incentives and made it work. So now it's more the question how do we sustain this transition, without having to pay that much for another 300,000 cars.

This sentiment returned repeatedly, often with a call not to reduce the incentives too fast but wait until the technology and battery price is down to a competitive level (R223). While some experts were willing to give an estimate for when this would be (ranging from 2020 to 2025 and a bit over), most of them seem to agree that the incentives remain necessary for the short term.

At the same time, the Norwegian success forces experts to think about how to end them without having the market collapse, like in Denmark. Here again the rest of the world can learn from Norway. For, where experts in other countries discuss this in terms of a complicated policy issue (R061):

So you need to consider how you will reduce the subsidies over time. And I think that will be complicated ... for a lot of countries. So that's, I don't know if it is a barrier, I don't know what a barrier is, but I think it's a complicated policy issue to take for several countries.

In Norway, however, parties agree and while the issue remains complex, it is not seen as complicated. R198 summarizes the Norwegian political position for the intermediate term, as one where incentives are reduced and made flexible based on local priorities, on a level with or just above public transport and with the guarantee that driving an EV is always cheaper than other private vehicles.

I think a steady course is always important; you should not shake the boat too much. But eventually of course I think most will accept that if they charge they should pay a little bit, like using public transportation. And it should be comparable, and I think what the politicians in Norway at the moment are discussing from the left to the right and all in the middle, and that's the good thing, it's always been broad political settlement, which creates stability, it's very, very important. Both on national and local level. And I think the good thing about that is the acceptance: no you cannot continue with it forever, of course not, but what you can do is to make sure for the consumers that it's always a good idea [...] for him or her to buy an EV. It should always be half the price. That is more the focus at the moment. Half the price, half the price in the toll gates, half the price for parking, maybe free electricity, so it should always be the best choice.

This focus was confirmed in discussions with other Norwegian EV experts. For instance, in the case of Oslo, experts shared how toll prices would be increased as of 2019; how parking would remain free for a while (although the city would install parking zones within the city for local residents as well); how new fast charging stations would be paid charging stations, and so on. For cities, interests collide here. On the one hand, they prefer EVs for their health and pollution effects, but they struggle with the space that they occupy, and how, in relation to the incentives, EVs currently outcompete public transport (R208, R252) [10].

Interestingly, opinions differ somewhat on when to start the phase out. R204 believes the 'point of no return' has already been reached, others, like R223 above, feel that it needs to be kept up for another couple of years. Then there are some experts who argue for more selectivity. R245, for instance, while agreeing with a phase out, still urged to keep the purchase incentives going. Not because the market would collapse otherwise, but because the incentives so far are primarily focussed on urban commuters. The next step for R245 would be

to help people living more rurally to shift. That means precisely supporting the long-distance more luxurious cars (against the rich-man's EV discussions):

Of course, there will be taxation on electric vehicles. And they are starting now to reduce the incentives. I think [...] the speed of changing these regulations, these incentives, is quite okay. But I think the most important part is to have the one-time tax zero for the EVs, for a long time. [...] Because now you have succeeded in that people living in or close to cities having their own homes, they have bought EVs for their [...] daily commute, yes, due to tolling and parking and so on. But the next step [is] how to make people in more rural areas buy the EVs. And probably the only vehicles that work for these people will be the long-range vehicles, the Tesla or ... [...] and they are really expensive. So, you still need to [be sure] that those vehicles are comparable to a traditional vehicle. There have been some ... proposals to make a max limit on the tax exemption. But I think that is a really stupid idea, because now we have the possibility to show that EVs also work in the rural areas.

Yet, it is precisely this purchase tax exemption, the VAT specifically, that raises questions. In Norway, Finland, but also in Iceland for example where R001 considered the yearly renewal of the incentives a good thing, because it allows the government to make fair policy:

For now, I can accept that, because I know it is environment friendly, and good for our nation, because the 100% pure clean energy we are using. But up to certain point, when the number of cars is X, I would think that this is not fair any more. These guys are using the roads. We need to fix the roads, they have to pay something. It is not fair. I think that the system in Iceland is fair, the fact that the government is renewing this incentive. They are detecting when it is time to take them off.

Unfortunately, while this type of policy prevents inequity, it also brings uncertainty (R031, R035). Moreover, such remarks bring this paper right back to its beginning with the discussion of the justification of these incentives. Primarily, that transport is one of the few sectors where the Nordics can still gain emission reductions and that these reductions will not come for free. As R201 argues:

We often get that sort of question, 'but Norway is so rich we can't afford to do it like you are doing', but basically were just taxing the emissions, and everyone can do that. Of course, it is not necessarily very popular to do it, but start small and increase it.

The discussion above shows many different ways of doing this, as well as many different context and reasons why people would or would not.

5. CONCLUSION

In sum, this paper emphasizes that strong and stable national targets accompanied by purchase price incentives and flexible local *variable* secondary benefits are needed to promote EVs, in addition to more attention towards consumer information and awareness campaigns. However, the goal of this paper was not to confirm what is known from quantitative research, but to show qualitatively how these policy mechanisms are discussed across the Nordic countries. As such, this paper shows how taxation measures are favoured over subsidies, except where no taxation exemptions are possible. It shows how secondary benefits are implemented based on local

conditions. Conditions that include the actual sociotechnical availability of toll roads, HOV lanes and so on, but also local experience with earlier preferential policy programs. In that sense, the paper shows how all policies (local and national) have to weight short-term impact and long-term stability. Simultaneously, it shows how consumer awareness programs are still left out of most of the public support incentives. It shows how public authorities can become front-runners themselves, but that this involves more than simply allocating budgets. And it shows the importance of incentives, not just as an enabler but also as a sign of approval.

Many of the mechanisms discussed here return in the literature, but by placing them in local context it becomes possible to understand the reasoning against or in favour of particular measures over others. Sometimes for valid reasons and conflicting priorities, sometimes because of fears and negative expectations, and yes, sometimes because of ignorance. It also shows the complexity of a transition that crosses electricity and transport, two sectors that previously were not related. In such a shift, new supply chains are perhaps the biggest but certainly not the only challenge. For instance, regulatory chains play a role as well (one actor waiting for approval/guidelines of another), just as it takes time to gain expertise (technological, regulatory and market). Focusing public support on only the financial barrier or the charging infrastructure might be the most obvious and the easiest policy mechanism, but there are many other aspects that public authorities can focus on, including consumer information and awareness, expertise and capacity development, or the regulation around personal transport, EVs and charging.

Besides policy advice, this paper breaks with the literature that tends to focus on EVs as a singular transformation. It shows the underlying debates that highlight both the importance of local contexts on a city level, regional level as well as national level and the importance of timing in terms of market and fleet shares. It also touches on the placement of EVs within a larger transportation context, especially the growing transport demand with its congestion and health effects and subsequent strong public desire to reduce private traffic in cities. These different elements influence local priorities and subsequently the potential and willingness to support electric mobility. What is more, and taking the biases underneath semi-structured interviews into account, this paper supports the conclusion of Nilsson and Nykvist [29] that almost everybody involved is a winner; except perhaps for traditional oil producers and engine producers. However, during a transition not everybody is a winner straight away. There are winners and losers along the way, with shifting expertise and financial streams that alter social power distributions, just as there are losers in other sectors that miss attention and means to support their transformative idea. And while policy mechanisms can facilitate and speed up such a transformation, they cannot sort or solve all of these distributions. That public authorities cannot do it all, however, is not an excuse for not doing anything.

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¹ The focus was on light private passenger battery electric (BEV) and plug-in hybrid (PHEV) vehicles, but experts also discussed other forms of electric mobility such as trucks, fleets, light duty vehicles, and public transportation.

² At the same time, the literature [10] highlights how much that drives EV adoption stems from the global market. Reductions in battery prices, new models in more car segments, but also fossil fuel prices and so on, are all developments where the Nordics have little influence over, except by offering a market where these products are sold.