User perceptions of EVs and the role of EVs in the transition to low-carbon mobility

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Abstract

Transport play a central role to reach global greenhouse gas emission targets. Reducing emissions from privately owned cars is of high priority, and the sustainable transition of road transport by electrification is one strategy launched to meet this end. Norway has been a forerunner when it comes to this and is today the country with the highest proportion of privately owned electric vehicles in Europe. Summarizing and publishing Norwegian experiences with electric mobility will therefore be useful for those working with transport electrification in other countries.

In this paper, we study user perceptions of different models of EVs. The paper focuses on how different models of EVs have been domesticated into Norwegian households. The importance of the incentives and policies related to the adoption of EVs are particularly highlighted and discussed in relation to other perceived properties related to EV driving, such as comfort and environmental concerns. The paper is based on qualitative interviews with different segments of EV drivers from 2013-2015, as well as a quantitative analysis of 3654 EV drivers in Norway from 2016.

The paper aims to strengthen the understanding of individuals' perceptions of EV policies and the possible consequences for policy makers. Also, it seeks to investigate how changing patterns of acting at the individual level may create normality and reconfigure the architecture of choice for others. The study shows that economic and technical aspects of EVs were important for Norway's successful introduction of the technology, in addition to symbolic aspects related to EVs, such as feeling more environmentally friendly. Hence, we argue that the combination of strong economic incentives, environmental awareness and a comfortable driving experience fostered the successful introduction of the electric car.

Introduction

The car has become an essential part of our transportation system, and individual car-based transport dominates in terms of satisfying mobility transportation needs. Cars are also embedded in social and cultural practices, meaning that apart from providing the possibility to travel almost anywhere, anytime, it is also a symbol of freedom since it signals social status and expresses one's identity (Hoogma et al., 2002). The first EV models appeared as early as late nineteenth century (Hoogma et al., 2002) and there have been many waves of interest in developing and testing electrically powered personal vehicles since. Nonetheless, the gasoline vehicle became, and has thus far remained, the dominant technology. But during the last years, EVs have begun to challenge the market for petrol cars. One of the few places where this has happened is Norway – a country where transport is mostly by road and mostly by car.

The year 2016 was listed as having the third highest sale of cars in Norwegian history with 154 603 new private cars registered (2.6% more than the year before), a record only beaten by the years 1986 and 1985 (Bilsalget i 2016, n.d.). Moreover, 35% of all EVs sold in Western Europe in 2014 were sold in Norway, and about 15 to

25% of all new cars sold in Norway the last years have been electric. Thus, Norway has taken a lead role in the introduction of electric cars, acting as a kind of laboratory for experiments in developing a market for EVs. Analyzing and discussing Norwegian experiences with regard to electric mobility will therefore be useful for those working with electrification in other countries. However, when trying to learn from these Norwegian experiences, we have to take into consideration some rather peculiar properties of Norway as an energy nation.

Norway has a unique position when it comes to energy production, as 99% of the electricity generated comes from hydro power (Vannkraft, n.d.) which means that electricity is considered CO_2-emission free in Norway. Electricity is also relatively cheap in Norway. Not all countries have an equally beneficiary environment for electrification of the transport sector, although there is an ongoing shift towards renewable energy sources.

E-mobility in Norway: Goals, incentives and experiences

There is a political drive for greenhouse gas reductions in the transport sector in Norway, and a comprehensive package of local and economic incentives, as well as the establishment of Transnova – now merged with Enova, a body giving financial support to charging facilities – have been identified as main reasons for the rapid expansion of EVs in Norway (Figenbaum and Kolbeinstvedt, 2013; Ryghaug and Toftaker, 2014). Thus, the development of the EV market in Norway has been strongly promoted by central government.

Incentives to promote electromobility in Norway are exemptions from tax on purchase, vehicle registration, and value added tax (VAT). Further, electric cars are afforded exemption from road tolls and tunnel-use charges, reduced fares on national road ferries, the freedom to use bus lanes, free public parking (with or without free charging), and a dispersed network of charging stations. The import of petrol cars is heavily controlled in Norway through strict import regimes and purchase taxes, and as electric cars are not susceptible to the same tax regimes, they become financially viable alternatives for many Norwegian households. Although it depends on the model, in practice an EV will cost about the same as a petrol car in the same class (i.e. the electric version of a VW Golf costs almost the same when bought new as its petrol counterpart, benefiting from tax redemptions from 7000 to 8000 euros[1]). Another important factor is that operational cost of EVs is also relatively low compared to petrol cars, due to effective engines running on cheap electricity produced from hydropower in Norway. The total savings of driving electric will also depend on a variety of factors such as driving style, use of toll roads, ferries, etc., but the fuel costs (electricity) are about one-fourth to one-fifth of the cost for petrol. For instance, driving a Nissan Leaf costs about 2800 euros less per year than a comparable petrol car, considering an annual mileage of 15 000 kilometres over five years.

In a White Paper of 2012, the Norwegian government stated that the comprehensive package of electric car incentives would be continued either until 2017 or until the number of battery electric vehicles (BEV) rose to 50 000. As the number of 50 000 BEVs limit was reached already in 2015, the incentives have been widely discussed by national policy makers and by the public. In December 2016, Norway reached 100 000 BEVs, several years earlier than expected. Thus, the incentives will be revised and adjusted in parallel with the market development in the years to come. The tax incentives are however promised until 2018, at which point they will be revised. Local governments have become responsible to decide on incentives, such as access to bus lanes and free municipal parking, and some municipalities have already removed these benefits. Further, free toll roads will probably be replaced with a new system with differentiated prices depending on CO_2 and NOx emissions (Norsk elbilforening, n.d.). The Norwegian Parliament have decided on a goal that all new cars sold by 2025 should be either zero emission (electric or hydrogen) or low emission (plug-in hybrids).

Apart from regulatory and economic incentives, the successful introduction of electric vehicles is often seen in relation to the technological progress of electric cars, in particular battery technology. The aim of this paper is to highlight a user-oriented perspective, since real users often have been neglected in research processes of technological innovation, policy development and policy implementation (Shove and Walker, 2007). As we aim to explore the interplay between technology, policies and user preferences regarding the introduction of electric cars in Norway, the paper demonstrates the way techno-economic factors are co-constructed with user-practices. Thus, we employ a socio-technical perspective to analyze the introduction of electric vehicles in Norway.

Previous research and theoretical perspectives on EV deployment

Previous studies about EV usage have focused on various aspects of adoption and non-adoption behavior (Rezvani et al., 2015), but it is important to enhance our understanding of both actual EV users as well as non-users. Non-users have been known to have different perceptions, particularly of barriers related to driving

[1] An interesting comparison with Denmark and Sweden show that the price difference between a petrol car and an electric car model in these two countries are 48% in Denmark, 98% in Sweden and -1% in Norway (Elbilforeningen, 2016).

electric vehicles. For instance, a study of both EV users and petrol car drivers revealed that petrol drivers assumed it would be a lot more demanding to drive electric cars compared to driving petrol cars (Ingeborgrud, 2014). Ingeborgrud (2014) showed that driving range was brought up as the greatest barrier to buy an electric car by petrol car drivers, as this included planning when and where to charge the car. This made non-adopters envisioning electric car driving practices as something of a puzzle to figure out in everyday life (Ingeborgrud, 2014). EV drivers, however, did not perceive range limitations to be as significant as petrol car drivers envisioned (Ingeborgrud, 2014). Such non-user understandings of EVs are interesting to compare with the experiences of actual EV users.

Many scholars have pointed out that cars do not only satisfy consumers' practical needs for mobility, but they also have symbolic meanings and are identity markers expressing who people are (e.g. Skippon and Garwood, 2011; Burgess et al., 2013). This means that affective attributes, such as pleasure and joy, are also likely to influence EV purchase intentions (Schuitema et al., 2013). In an exploratory study of Graham-Rowe et al. (2012), various emotions were expressed by consumers who drove EVs for a trial period. On one hand, "feeling good" or "less guilty" about driving an environmentally friendly car was mentioned by some consumers. This was also documented in a Norwegian study on EV user preferences (Ryghaug and Toftaker, 2014), where EV users expressed that the feeling of being a non-polluter contributed to a comfortable driving experience. The EV drivers in the same study expressed they had become more conscious of their own energy consumption and more environmentally aware after buying the EV. Environmental awareness did not, however, seem to be the reason they changed their petrol car for an EV in the first place, but saving time and money was seen as very important (Ryghaug and Toftaker, 2014).

We know from previous studies that consumer perceptions of current policies related to the environment, fuels, vehicles and EVs can shape attitudes towards EVs (Lane and Potter, 2007; Sovacool, 2009). In Jensen et al.'s (2013) study of how drivers responded to test-driving EVs for three months, they found that individual preferences changed significantly after getting real experience with an EV in their household. Environmental concern had a positive effect on the preference for EVs both before and after the test period, and people with higher environmental concern tended to have a greater preference for EVs.

A review article of research on EV adoption by Rezvani et al. (2015) points to two areas that future research should draw attention to, both of which are covered in this paper: First, there is a need to disentangle consumers' perception of certain policies related to EVs and how this shapes attitudes towards and intentions to buy EVs. Second, it is important to study real (unforced) adoption, in contrast to the number of studies that only focus on the intention to adopt or test-driving experiments. Studies of real users are vital to enhance our understanding of the way attitudes influence EV adoption and how this may change over time, as well as the way EV adoption shapes attitudes and practices. In this paper, we will dig deeper into these questions and, hopefully, provide further understanding of individuals' perceptions of policies that may be effective in changing practices. Little is for instance known about real EV user's support for different EV policies, both at the time of the EV purchase and after some time driving an EV (Rezvani et al., 2015).

Economic incentives have generally been portrayed in the public debate as the reason for the fast and widespread adoption of electric cars in Norway. Thus, we are particularly interested in how these incentives influence drivers' EV choice and driving experiences. Also, questions regarding changes in attitudes or consumption behavior in the wake of getting EV experience are interesting, as suggested by previous literature. In order to analyze socio-technological change, one also has to recognize how technologies are used and embedded in everyday life. To illuminate these processes, this paper draws on theoretical concepts from Science and Technology Studies (STS), in particular the idiom of co-production (Jasanoff, 2004) and the domestication perspective (Sørensen, 1994; 2005).

Jasanoff (2004:3) explains that the idiom of co-production is a way of interpreting and accounting for complex phenomena. Co-production focuses on how the production of science and technology – in this case the electric car as a technological artifact – becomes entangled with social norms and hierarchies. Thus, we will explore these technology-society relations and how the electric car is attempted being stabilized by Norwegian EV policy. The domestication perspective is particularly suited for analyzing the process where a technology – in this case an electric car – is integrated into users' everyday lives and becomes part of micro-networks of humans, artifacts, knowledge and institutions (Sørensen, 1994). This perspective highlights that technologies are not fixed, stable or immutable entities, but that they rather acquire specific meanings and forms of use, as they are adapted to households (Hargreaves, 2012). By describing how practices are transformed when a new technology is introduced and used, we can strengthen our understanding of how values and meanings change and how new communities of practice emerge (Lave and Wenger, 1991). Sørensen and Sørgaard (1994) use driving to work as an example. They demonstrate how this practice can be analyzed as a network consisting of the driver and his

skills, the car, the road system and other infrastructure, altogether producing symbolic, cognitive and practical aspects that result in an observable style of driving and an identity. Thus, this paper explores the (overlapping) practical, cognitive and symbolic dimensions (Sørensen, 1994; 2005) of electric car use.

Methods

This paper has both a quantitative and a qualitative research design. Our study is based on semi-structured interviews with 18 electric car drivers in order to provide in-depth knowledge of experiences among EV drivers in Norway. Eight of the interviews were conducted from April to September 2013, while a second round of interviews were conducted from October to November 2015. In the first group of respondents, six drove a Nissan Leaf, one drove i-MiEV and one a Buddy model.[2] The second round of interviews was conducted with people driving Tesla, and this decision was based on an interest of how the new EV models (larger, more luxurious and with longer range) potentially attracted new groups of users. The main topics in the qualitative interviews were the use of the electric car in everyday life, the car seen in relation to environment and climate issues, and reflections on the Norwegian incentives for electric cars and charging infrastructure. Interviews lasted from one to almost two hours, and every interview was recorded and transcribed verbatim. The quotes are translated from Norwegian into English. The interviews were analyzed inspired by Grounded Theory (Charmaz, 2006), with first open coding of the transcriptions, and later a more focused coding. In this process, pieces of text were given an analytic code and further grouped into larger categories.

The quantitative data material is a yearly survey carried out among the 40 000 members driving EVs in Norway. The Norwegian Electric Vehicle Organization (NEVO) and the Norwegian Automobile Association (NAF) distributed the survey (from now referred to as NEVO & NAF, 2016). The survey questioned why EV drivers choose to buy an electric car, what they use it for, and their reflections about their electric car and EV policy.

Results and discussion: The domestication of EVs into Norwegian households

In this study, we are interested in EV drivers' perceptions and practices related to acquiring and driving electric cars. In this section, we will highlight (overlapping) technological, environmental and economic aspects of EV adoption and use. We will discuss how EVs are domesticated (cognitively, symbolically and practically) and pay attention to particular types of EV and EV ownership, as this has been neglected in previous studies.

Technology related user experiences: the comfort car

One of the most discussed points related to EVs, and what makes them extraordinary compared to other cars, is the set of practices related to charging of batteries. Our interviews demonstrate that electric car drivers perceived the charging process as very easy and actually easier than filling "the traditional way" at petrol stations. One of our interviewees stated the following:

> *I am glad I don't have to care about filling gas at the station anymore. Electric cars are easier for me; they are actually more comfortable than petrol cars, because I can charge at home.*

Thus, we see that the EV use did not require new skills and was seen as practical to fit into everyday life, as far as charging is concerned. Some more planning of the driving, however, were required in some instances. In fact, EV drivers explained that their electric car felt *more comfortable* than petrol cars, both in terms of technical equipment and driving experiences. A woman driving a Nissan Leaf told us that her family had some doubts about buying an EV, but they got convinced after trying one. She described her EV as with "a very good automatic gear shift, quick and solid, with very good driving characteristics." She is clearly stressing the techno-related driving properties of the car. The same goes for those driving Tesla, who were extremely enthusiastic about driving comfort. They often referred to the extreme acceleration of the car and described this as making it "fun to drive," an opinion shared even by people who never before had been interested in cars. The Tesla was also described as very comfortable – as an extraordinary car with an "X-factor." Some drivers even reported they felt they were driving a "space craft." As one of the interviewees said, laughingly: "Do not try it if you do not have in mind to buy it!"

Interviews with Tesla users illustrated that these users were not necessarily interested in electric cars in particular but were interested in technology more than the average person. The Tesla was domesticated practically as a high-tech and spacious car, and one interviewee explained that the Tesla had the acceleration of a sports car,

[2] This is a small compact EV, developed from the Danish Kewet. It was introduced as "Buddy" to the Norwegian market more than 20 years ago, and is produced in the Norwegian capital of Oslo.

even while being able to hold six kids. Tesla was often described as a "computer on wheels," highlighting the high-tech equipment exceeding "ordinary" cars. The larger battery capacity and the network of superchargers was also highlighted as features that made Tesla stand out compared to other EVs, and a feature that also made long distance travel convenient.

Regardless of type of EV, all the EV owners in our study described their EVs as very comfortable to drive. The comfort aspects were also related to the EV as a safe, silent, aesthetically pleasing and exciting technology. These experiences were not only related to the technological and practical aspects but were also partly co-produced with symbolic aspects.

Environmental aspects to EV ownership and driving

There was a clear symbolic dimension present in the domestication process, as many respondents stressed the rewarding feeling of driving a green and non-polluting vehicle. A woman driving a Nissan Leaf stated:

> *I think of myself as a more environmentally friendly person when I am driving the EV. I drive with a better conscience, and it feels less polluting to drive the electric car. That is very important to me.*

She also interpreted the EV driving as part of a greater common non-polluting project, laughingly admitting that she clearly identified with other Nissan Leaf drivers and that it happened that they waved and greeted each other when out driving. This demonstrates the way EV driving had become part of a common environmental project among some interviewees. Previous research has pointed to a need for collective action with respect to climate change (Aune et al., 2016), and that such action has been found to be hard to carry out because of a perceived lack of available options (Næss and Ryghaug, 2007). Following this, acquiring and driving electric cars was a way to engage in climate change issues, providing EV users with an ability to cut their own CO_2 emissions and promote a pro-environmental identity. This is also confirmed in the survey where 68.3% of all respondents listed "EVs are environmentally sound" as a reason for buying an electric car (NEVO & NAF, 2016).

From the qualitative study, we found that driving small and compact EVs, such as Mitsubishi i-MiEV, Buddy and Nissan Leaf, seemed to be related to having pro-environmental attitudes and self-image. An interesting finding from a previous study showed that EV drivers, that were not motivated by environmental aspects when buying an EV, claimed to become more energy and environmentally aware as a result of driving EVs (Ryghaug and Toftaker, 2014). This was also the trend among many of the Tesla drivers in our study, who claimed they had not been motivated by pro-environmental attitudes to buy the car. Many of the Tesla drivers reported that they regarded the environmental aspects as "a positive consequence" or as a "bonus" of their choice of car. Nevertheless, these drivers explained that the Tesla had triggered an interest in sustainable mobility and energy consumption, in similar ways that having a photovoltaic system on the roof produces pro-environmental attitudes (Throndsen et al., 2017; Naus et al., 2015). This manifested itself in different ways. Some EV users got very interested in driving in an energy optimal way. For example, one said:

> *I am very aware trying to drive energy efficiently and thus go as far as possible with the electricity available.*

Others got interested in microgeneration of electricity and considered installing a photovoltaic system in order to become self-sufficient in electricity. As one of the Tesla drivers reported:

> *It is an intriguing idea to be self-sufficient in fuel for the car and energy for the house, for instance by using solar panels. (…) This thought accelerated after getting the car, as Tesla has these home batteries* (…).

Substituting air plane travel by car travel was also mentioned by several Tesla owners, reporting that they now went from Trondheim to Oslo (about 500 km) on summer holiday by car instead of plane (perhaps mainly motivated by economic reasons, but with positive environmental implications). The pro-environmental framing of EVs made driving with spiked tires (producing more local pollution) incompatible with the image of the car. Thus, many highlighted that driving a Tesla was efficient in terms of reducing local pollution. Further, some interviewees also explained that their family got rid of their second car after buying a Tesla.

We found that EVs were domesticated as environmentally friendly cars. The fact that some EV drivers reported they had become more environmentally aware is also backed by the quantitative survey from 2016 (NEVO & NAF, 2016), where almost 60% claimed to have become more energy aware after acquiring an EV. A large portion of the respondents also said they were very interested in technology and considered installing a photovoltaic system in their houses (40%), as did many of our Tesla respondents in the qualitative interviews.

As stated, the EV incentives have been pointed out as main driver for the rapid expansion of EVs in Norway. How did our interviewees perceive the impact of these incentives?

EV incentives – the core of the rising EV market?

Economic incentives have been highlighted as an important factor of the rising market for EVs in Norway, but how are these incentives perceived? Are they understood as a kind of "birth help" for the introduction of EV technology in its infancy, as a shielding mechanism in the development of a technological niche, as a monetary compensation, or perhaps not that important at all, compared to other types of motivation?

Many of our respondents voiced strong opinions regarding the incentive system. However, the perceived importance of the different incentives varied strongly according to where the EV drivers lived, their family situation, and not least their established driving routines. A Nissan Leaf driver living outside the city center stated clearly that:

> *They should never remove incentives such as free public parking and free toll roads. But, the free use of bus lanes is not that important to me. I don't care if that is removed.*

This interviewee saw the free passage through toll roads as most important since she and her family used the toll road station daily. The free admission had been integrated to her driving routines and become an important part of being an EV driver. This view was confirmed in the quantitative survey of EV drivers (NEVO & NAF, 2016), which also revealed that economic benefits such as free driving on toll roads had been decisive for their choice of car (65.8%), while driving in the bus lane was considered less important (23.4%). However, the most common reason given for having changed to an electric car was "lower operating costs" (81.8%), while other economically related arguments, such as reduced annual fee (56.4%), free public parking (37.8%) and free ferries (11.7%) were considered less important. Table 1 gives an overview of the importance of incentives.

Table 1: EV incentives in Norway and their importance as reported by interviewees

Incentives	No purchase or Value added tax	No road tolls	Free use of ferries	Access to bus lanes	Free public parking	Lower operating costs (cheap fuel)	Reduced annual fee
Less important			X	X			
Some important					X		
Important		X					X
Highly important	X					X	

The majority of the first round of interviewees were satisfied with the incentive system in Norway and the fact that it would be kept until 2017, as promised by the Norwegian government. These drivers saw the economic benefits given to electric cars as crucial for the EV market to succeed. Some still considered electric cars a bit expensive and therefore considered purchase tax redemption as important. The incentives were credited for the rising EV market, as voiced by a Buddy driver:

> *The incentives had to be realized – just look to the development of EVs in Norway the last four years. The incentives are kind of compensations for everything that apparently does not work with the EVs. Especially the cut in purchase tax is important, due to high taxes in Norway on petrol cars*.

Thus, we see there were many ways to view the rationale behind the economic incentives. They were regarded as a tool to make electric cars affordable as well as a kind of compensation for how early adopters had to deal with the technology's teething problems. Considering this last perspective, the incentives had to be kept until electric cars were as good as petrol cars, technologically speaking. In this view, the incentives did not only have a market creation motive, but also a technology development motive. It is worth noting that this view was particularly advocated by one of the interviewees driving a Buddy, one of the early models available on the Norwegian EV market. The problems related to the Buddy were first and foremost centered on its size (and range), as well as some issues related to safety – problems that we did not often come across among drivers of newer EVs. Those driving newer models such as Tesla, Nissan Leaf and Mitsubishi i-MiEV perceived their cars as similar to petrol cars (in terms of both size and safety). These interviewees saw the incentives rather as an extra bonus given to EV drivers, claiming incentives did not play a central part in their enthusiasm for EVs.

For most Tesla drivers, the performance of the car outweighed the performance of most petrol cars. In this case, the incentives were not seen as a compensation for technological teething problems, but rather as "a catalyst that get the sales going." Most Tesla drivers pointed out how the Norwegian EV incentives had been very beneficial for them and contributed to their choice of car as they "got a lot of car for the money." Many argued that if you compared the Tesla to similar cars (like the Mercedes S-class, costing about 190 000 euros), the Tesla was

almost 110 000 euros cheaper with the economic incentives applied[3]. Even though it was still an expensive car, the calculation was very attractive when taking operating costs into account. Calculated savings of approximately 500 euros a month on just toll fees and fuel was mentioned by several Tesla drivers. Thus, the purchase tax exemption was clearly important to this group. Many of them did not consider buying an EV before they learned about the Tesla.

Driving in the bus lane was generally not considered important by our informants since congestion problems were not a part of their daily challenges, and free public parking was not really an advantage they expected to be kept by the government. The EV policy was generally described as successful by our interviewees, and the importance of long term consistency was underlined by many.

As we have seen, EV drivers had different perceptions of the incentives due to what type of EV they drove, where they lived, and their economic situation. Even though the incentives enabled the purchase of the EV for some respondents, an EV driver pointed to the fact that some of these economic incentives had existed long before the introduction of the family cars Nissan Leaf and Mitsubishi i-MiEV. According to him,

> *(…) before these new bigger EVs were available, not that many people bought electric cars despite the fact that the EV incentives did exist at that point too.*

This interviewee connected the relevance of incentives to a certain technical level of the EV. This points to the fact that the desirability of EVs was not only a result of economic incentives, but clearly also co-produced with technological improvements. It needs to be emphasized though, that newer EVs are more expensive to produce, although prices will probably drop as more cars are sold. Thus, exemption from sales tax, in particular, is a greater financial benefit for these cars (and especially high-end cars such as the Tesla), compared to the small, first generation EVs such as "Think" and "Buddy", which are cheaper to produce.

In the beginning, the incentives were most often framed in relation to the disadvantages of driving EVs, which were seen as less functional and appealing than petrol cars. Indeed, the incentives did play a major role when users considered buying an electric car, but how was the incentives perceived after a while? One argument made was:

> *Once you've got used to the electric car, the incentives are not that important anymore. But for a first-time buyer, I think they play an important role. They prevent economic risk.*

Many of our respondents expressed similar attitudes. Thus, the incentives played an important role in the recruitment process of EV drivers. This was also supported in the survey (NEVO & NAF, 2016), where 22.9% claimed they would have bought an electric car even without the purchase tax, while 42.6% would have bought an EV without the user-advantages such as free toll roads and free public parking. About 66% claimed they would not buy an EV tomorrow if the purchase tax were removed. This gives some clear signals of the importance of economic support in giving EVs a market advantage. Also, access to cheap fuel (electricity) was important for today's EV drivers (68%).

We found the importance of the incentives to be relative to the drivers' experience, situation and car model. The incentives seemed to encourage some users to try out a new technology at the same time that the total package of incentives signaled that EVs were a technology prioritized by national governments and thus a more environmentally friendly choice.

Conclusion: Bringing together technical, economic and environmental aspects of EV ownership

In this paper, we have highlighted that bringing an electric car into everyday life had clear symbolic and practical consequences for the interviewees. The cognitive aspects were less prominent, as driving an EV did not require any more skills than does driving a petrol car – except for learning how and when to charge the batteries. Further, we have pointed to how the co-production of strong economic incentives, environmental awareness and a comfortable driving experience fostered the domestication of the electric car as a charitable driving technology. For this reason, the electric car is well under way of being stabilized in the Norwegian comfort-oriented driving culture. This was also backed by the small number (3%) of the EV drivers who would buy a petrol car if they were to buy a new car tomorrow (NEVO & NAF, 2016). As we have discussed in this paper, the symbolic value of driving a less polluting car was important in addition to monetary savings. Hence, the EV incentives can be interpreted as playing a double role: On the one hand, they provide economic benefits to EV buyers and users;

[3] This has raised a discussion about incentives being too generous; benefitting the privileged and the need for reforming these so they favour cheaper EVs as much as expensive ones.

on the other hand, they contribute to the (symbolic) value of EVs as green cars. Based on this, we argue that the incentives should be understood as a certification of electric cars as green technologies compared to petrol cars. The fact that policy acceptance can have positive effects on consumers' attitudes and intention to act pro-environmentally has also been stressed by others (Stern et al., 1999; Næss and Ryghaug, 2007:68).

As technologies and batteries have developed and new EV models have entered the market and pushed the prices down, EVs have become adopted by different segments of users. An interesting point from our study was that EV drivers perceived their EV as an even better and more comfortable car compared to their (earlier) petrol cars, regardless of model. For many, getting a "pure electric driving pleasure" became a positive sensation and a means to engage in pro-environmental actions and practices.

EVs were interpreted differently by various user groups, such as environmentalists, techno-enthusiasts, commuters, families etc., and they were further domesticated in different ways. Thus, we will argue that EVs have "interpretative flexibility" (Pinch and Bijker, 1984). This point is often overlooked, since EVs are often considered as one type of technology with a specific use. As we have demonstrated, technology-user relations should be nurtured using different political and economic incentives. This paper has highlighted the way EV technology is co-constructed with policies and user practices, working to stabilize the electric car as a viable transport technology.

Both the qualitative interviews and the quantitative survey confirmed the importance of incentives. However, we found that the understanding of the economic incentives was more complex: For some, the incentives were important to promote initial adoption in the transition from petrol to electric cars. For others, the driving pleasure related to EVs as green non-polluting cars was even more important than the economic benefits. Despite this, Norwegian EV policy was perceived positively, and most respondents expressed that environmentally friendly technologies should be given economic advantages to speed up deployment. It is also worth noting that the incentives have become an integrated part of Norwegian EV culture, although they have changed in meaning over the years, depending on the situation of the users.

The incentives will change in the years to come as the market of electric cars grow. Following this, it will be interesting to see how the development of new car models, technology and changes in policies will affect future domestication of electric cars. On the one hand, removing incentives could be seen as a threat to the stabilization of Norway's EV market. On the other, we have seen that electric cars possess qualities that petrol cars struggle to compete with in the transition towards low-carbon mobility.

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