
Summary:

Everyday mobility and potential use of Electric vehicles

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Analysis of car based trip chains in Norway and Denmark shows that most trips and trip chains are short. In Norway there are four percent of the trips, six percent of the chains and 12 percent of the days during a year when the distance is over the range limit for EVs (80 km in the winter and 120 km in the summer). In one year this means that the average number of days that are over the limit (without recharging) is 43 days. In Denmark the corresponding figures are, 5 percent, 14 percent and 57 days. But even if there are a number of days that either have too long single trips or too long chains there can be stops during the day making it possible to recharge. On the rather few travel days with a travel length longer than 80 km respective 120 km, 29 percent (80 km) and 24 percent (120 km) in Norway have a stop at home between 1-5 hours, which gives a possibility for recharging (partly or nearly full). In Denmark the shares are nearly the same.

Objective and data

The aim of this report is, by the help of available data, to do a comparable analysis of the potential use of EVs in Austria, Denmark and Norway. In this context primarily data from Denmark and Norway are used. We have been interested in examining for what purposes, travel lengths and different social groups the EVs are a good solution. The institutional and other contextual conditions for purchase and use of EVs are different in the three countries. What is found in one country can therefore not necessarily be transferred to one of the others, which also means that it is difficult to generalize the findings to other (European) countries.

Our main data has been the national travel survey in Denmark and Norway. Unfortunately Austria has not this type of survey, so we have to rely on the results from the two other countries.

The incentives for buying and using EVs in the three countries are very different. Norway has the most beneficial incentives of the three, which has resulted in a high level of penetration of EVs in the country and with the world's highest number of EVs relative to the population (Figenbaum and Kolbenstvedt 2013).

The number of cars per 1000 inhabitants is high in all three countries, highest in Austria and lowest in Denmark. There is also about one third of the households that have more than one car, which means that there is a rather large potential of changing one of the cars with combustion engine in the household to an EV if conditions (mainly the possibility for charging at their home) for an electric car are present.

Trip chains by car are short

When analyzing single car trips it is obvious that a great majority of them are within the limit of an Electric vehicle. In Norway only three percent of the single car trips are longer than 80 km. In Denmark the percentage is four. The characteristics of those who have more long trips than other are:

- living in sparsely populated areas and small villages
- high income
- working full time
- men
- on business and leisure trips
- have more than one car

The single trip must be seen in connection with the total travel pattern of the day. The single trip can be part of a longer chain. A trip chain in these analyses is defined as the following: A car based chain starts and ends at home, and the car is used at one or more trips. Total travel distance is calculated as distance by car, and trips with other modes in between are ignored. If the respondent does not use the car on one or more of the trips in the chain, we assume the car is parked and that no other persons are using it.

The analysis of chains is based on respondents with driving licence, car in the household and those who drove the car at the registration day.

Similar to the length of single trips, also the length of car based chains is relatively short. In Norway 85 percent of them are shorter than 50 km, and in Denmark 75 percent is shorter, indicating that car based trip chains are somewhat longer. It is only 8 percent of the chains in Norway that are longer than 80 km, in Denmark this share is 14 percent. Looking at all the chained trips in general 95 percent of them don't need recharging in Norway, about 90 percent in Denmark.

But even if there are a number of days that either have too long single trips or too long chains there can be stops during the day making it possible to recharge. On days with travel length longer than the range, between 24 and 29 percent have a stop at home between 1-5 hours, which gives a possibility for recharging (partly or nearly full) in both Norway and Denmark.

When doing the same analysis, but restrict it to stops longer than five hours, between 20 and 40 percent have such long stops at work at the weekdays in Norway, a little higher in Denmark.

On those days that exceed the limit, the home and the workplace are important for recharging; the home for stops shorter than five hours and work for the longer stops. There is however several other places people stops. A large part of the car trips is related to shopping and service. Recharging stations located at shopping centres gives these drivers a possibility to manage the total trip chain.

Little knowledge of and interest for buying EVs in Denmark

Special questions about different aspects of electric cars were added to the Danish national travel survey. As many as about 80 percent of the Danish respondents

would not consider buying an EV. The knowledge about electric cars is low, as many as 33 percent say that they have no knowledge. Two different groups stand out as potential buyers. The first group is characterized as following:

- Middle aged
- High income
- Well educated
- Pretty good knowledge about electric cars
- Access to more than one car
- Have good parking and recharge facilities at home
- Concerned about the environment

The second type of potential buyer is quite different:

- Young
- Relatively low income
- Have no access to a car, or maybe just one car.
- Live in a big city
- Have relatively bad parking/recharge facilities at home
- Relatively little knowledge about electric cars
- Few long trips
- Concerned about the environment

This indicates that the motives for buying probably are different in these two groups, and that incentives for buying also should be different.

Long trips to leisure homes in Norway

The limited range of the electric vehicles has been used as an argument against purchase of an EV. People do long car trips for holiday, leisure or business that exceed the upper range, and recharging may not always be possible for different reasons. A question is, also, how often do people carry out these long car trips, how long are they, for what purposes are they carried out, and what are the characteristics of those who do these trips?

The analyse of the long trips (100 km+) from the Norwegian travel survey from 2009 shows that the majority of these trips are connected to holidays and leisure activities, and most of them are done by car.

People living in the surrounding municipalities of Oslo are those who have the highest number of long car trips in the country. Men have more long car trips than women. People in their middle ages, 45-54 years, those with high household income, those with three or more cars, and work more than 40 hours per week have most frequent long car trips.

About 40 percent of the Norwegian population own or have access to a leisure home/cottage/summer house. People living in the large cities and the surrounding areas have the highest ownership, but few of them have a cottage within the home county. They have to travel further to visit their holiday house than people living in smaller cities and sparsely populated areas. The estimated average distance to the holiday houses is 150 km, but one third have less than 50 km to the cottage, and further 20 percent have a distance between 50 and 100 km. This is within the

range of most EV in the summer season. But not all cottages have access to electricity, about 40 percent have not electricity installed.

In the metropolitan area of Oslo about 20 percent of the cottage owners have a distance shorter than 100 km to their cottages. In the next three biggest cities and the surrounding municipalities about 50-60 percent have a cottage within their reach. In the other parts of the country this is even higher. For most EVs this is within the range of the batteries in the summer season, but in the winter season this (upper) distance is a problem for most electric vehicles without recharging on the way. This result shows the dilemma - those who take EV in use in the larger cities, where the climate and environmental benefits are greatest, have the longest distances to the holiday houses, which makes it difficult to manage with an EV as a single car.

A substitution of a traditional car with an EV considering transport to the holiday house is primarily a problem for a majority of those living in the metropolitan area of Oslo, and first of all in the winter time. Recharging on the way can solve the problem, but one question is the willingness to spend extra time on the way to and from the cottage if this is a weekend trip, which in average takes place a little more than once a month, 14 times a year. In connection with vacation seasons many will be on the way at the same time and create a capacity problem on charging stations.

End comments

The analysis above is valid for the typical EVs available in the market in 2014. Next generation vehicles coming on the market 2017-2020 will probably be equipped with batteries allowing longer range, reducing the number of days the range is insufficient. Tesla Model S is already capable of delivering a range compatible with almost all travel needs analysed in this report.