THE NORWEGIAN MODEL FOR FINANCING, BUILDING AND OPERATING CHARGING INFRASTRUCTURES FOR ELECTRIC VEHICLES

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ABSTRACT

Norway has a relatively high density of electric vehicles (EVs). Today it is about 4200 EVs in Norway. The large majority of EVs in Norway are in private use and private ownership, which is unique in a European context. This is due to generous public policy incentives promoting EVs.

Due to the *Action plan for electrification of road transport* (2009) from an advisory group formed by the Ministry of Transportation and Communication, a government programme of 6 mill Euro funded 1815 charging points, this funding was administrated by the Transnova-project. Parallel to this funding the NOBIL database was launched in June 2010, providing the backbone for current services and future prospects in ITS infrastructure and ITS business in the field of electromobility.

Addressing the question of limited range of EVs, a new programme funding approximately 40 quick-charging spots in 2011 are under way, together with a special route planner for EVs.

The main strategy in Norway is to built the infrastructure step by step, by giving state investments funding to private companies or local authorities who wants to build and operate the charging infrastructure.

1. BACKGROUND

1.1. Norway - Electric Vehicles and policy

Norway, a country of 4.9 million inhabitants, has decided to make domestic cuts of between 15 and 17 million tonnes of CO2 within 2020 compared to a reference scenario (1). In 2010 road transportation comprised approximately 19% of Norwegian greenhouse gas emissions (2), making it the third largest and the fastest growing source of emissions.

Introducing a large number of EVs could be a substantial contributor to halt this trend, especially when taking into consideration that Norwegian production and consumption of electricity mainly stems from emission free hydropower.

At present Norway has approximately 4200 electric vehicles. This brings Norway second only to the principality of Monaco on the rank of number of EVs compared to the number of inhabitants. The large majority of EVs in Norway are used as private cars. Only 29% are owned by businesses or public services. Most of these are also probably used just like ordinary private cars, but registered as businesses vehicles due to tax considerations. As of May 2010 only 66 of EVs were owned by municipalities or other public services.

Generous public policy incentives promoting the use of EVs have been substantial contributors to the situation. EVs (and hydrogen vehicles) have access to bus lanes, free parking on public parking lots, are exempted from value added tax and from tolling on roads and ferries. These are strong incentives in the Norwegian context, where taxation on cars is particularly high.

Norway also has a long tradition of taxing fossil fuels, dating back to 1931, and was the first country in the world to fix a CO2 target in 1989 (4). Though the costs of petrol and diesel fuels in general are perceived as very high among the population, the costs of fossil fuels are not particularly high compared to other European countries when adjusting for income.

In addition to the policy incentives for bying and using EVs the Ministry of Transportation and Communication in 2009 formed an advisory group to write an Action plan for electrification of road transport (3). In this action plan there is a vision of 200 000 EVs in 2020 in Norway, that means 10% of the car fleet. This Action plan also point out the needs of charging infrastructure. The estimate is that Norway needs about 30 000 public charging points, mostly normal charging but also fast or quick charging stations within 2020. This action plan do not say anything about financing, operating and ownership to the charging infrastructure. The plan has not been discussed as a political issue. During the next few months the parliament will discuss a new White paper and a climate action plan and hopefully new and more detailed goals will be established.

1.2. Transnova

In 2008 the Norwegian parliament endorsed the White Paper on Norwegian climate policy (1) that calls for a reduction of 13-16 million tonnes of C02 by 2020, with emissions from transport to be cut by 4 million tonnes. Transnova was founded in 2009 by the Government and the Ministry of Transportation and Communications as a tool to make this reduction possible.

A supplement to other existing instruments, Transnova is to contribute to a cost-effective climate policy by seeking to reduce institutional, practical and knowledge-related barriers that delay the development and introduction of environmentally friendly transport solutions, thereby helping to achieve both medium- and long-term emissions reductions.

Transnova promotes sustainable transportation by focusing on less use of fuel per vehicle-kilometre, replacing the use of fossil fuels with fuel-efficient or CO2-neutral engines, switching to more environmentally friendly forms of transport and reducing the volume of transport. Transnova has an annual budget of 50-70 MNOK. In addition, Transnova administers funding programmes for establishing charging points for electric vehicles. This programme had a budget of 50 MNOK in 2009.

Private enterprises, local and regional authorities, research institutes and various organisations can apply for financial support. Transnova focuses on pilot and demonstration projects and projects that are close to market introduction.

Transnova is currently managed by the Norwegian Public Roads Administration as a three-year trial programme (2009-2011). The aim is to become a permanent programme. An evaluation conducted in December 2010 recommends that Transnova be continued after the trial period. Read more http://www.transnova.no (5)

2. CHARGING INFRASTRUCTURE FOR ELECTROMOBILITY, FIRST STEP

In order to spur demand for EVs there is a need for both physical infrastructure such as charging stations and ITS infrastructure providing guidance and booking facility to available charging spots. In 2009 and 2010, Transnova financed the construction of nearly 1,815 charging points, based on normal charging (230V/16A) throughout the country and the developing of NOBIL (6) database containing information about charging stations, which will be presented in more detail below. The total cost of this “first generation programme” was about 6 mill Euro (MNOK 50), and the funding from Transnova has fully financed the constructions but not the operation costs. It was a set of criteria that had to be fulfilled to get

funding and a set of guidelines for locations and accessibility. This first programme for charging infrastructure was not based in an overall national plan. The idea was to invite the most interested and motivated municipalities and companies to establish a first generation of charging points to show the public that it is possible to use an EV. We think this first step has been a success, There has been a lot of focus on charging infrastructure and EVs in media and discussions in the local political councils all over Norway. Another important effect is the private investments in developing equipments and services for charging infrastructure and an increasing use of EVs. During these months there is an ongoing evaluation of the use of this infrastructure.

However, Transnova mainly grants funding for demonstrations and pilot projects in the chain between research and market introduction. Other on-going projects to support introduction of electromobility in Norway includes trials of quick charging, ridesharing and plug-in hybrids. Transnova also co-funds "Grønn Bil"(7) ("Green Car"), a project aiming to reach the goal of 200 000 EVs by the year 2020 by means of information and advice for fleet owners as well as the private market.
A substantial number of charging stations are also provided by the city of Oslo which is building 400 charging points over the course of a few years, consolidating its position as the EV capital of the world .
Altogether, by the end of 2010, Norway had 2680 charging points, based on normal charging (230V/16A) distributed at 807 different locations.

3. CURRENT ITS-SERVICES FOR ELECTROMOBILITY, THE NOBIL DATABASE

The NOBIL database contains information about charging stations in Norway in a single database. Key data, including practical and technical information, availability for users, map coordinates, and pictures are available for the general public and for planners. The database is continuously expanded as new charging stations are built. EV users keep the information that is posted up to date. The NOBIL database is free to use for commercial purposes, such as providing services for internet, smart phones or GPS navigators. Business concepts using NOBIL data have already been launched.
Transnova has made the strategic choice of keeping NOBIL in public ownership. This is because we view charging stations and the database providing information about them as a part of the public transportation infrastructure, like traffic lights and roads. Leaving the responsibility for such a database to the private sector would in our view lead to a more vulnerable solution. We want the information on NOBIL to be high quality, open and updated, using open source software non-proprietary technology. In our effort to support the growth of the Norwegian EV market, we want to prevent a situation where the public needs to use different digital applications to get a comprehensive picture of the charging infrastructure. We also want to prevent information being sold to actors who may not first and foremost be committed to serving the public interest. We regard the strategy of making NOBIL part of the public transport infrastructure as a good way of keeping it reliable and functioning in the interest of enhancing the entry of EVs into society.

3.1. NOBIL intelligence module

The next step for NOBIL will be to make it interactive with the charging stations for information and business purposes. The addition of the "NOBIL Intelligence Module" will provide a number of functions. It will provide users with information on whether the charging point is available at the moment or if it is occupied or temporarily out of order. It will also make it possible to book reservations at desired points in time. The owner of the charging station will be provided information on use, energy consumption and real-time notification if the charging point is not working properly. Solutions for collecting payment for the use of charging stations will also be made possible, by smart phones, credit cards or other means of payment.

3.2. Route planner

In order to help drivers handle the limited range of EVs, a project working to develop a route planner taking into consideration not only availability of charging stations but also routing relating to weather, topography and moveable charging infrastructure (for instance ferries, and in a longer perspective, car carrier trains or battery trailers). This project is funded by the Nordic Council of Ministers' Energy and Transport programme which seeks to identify and fund projects that contribute to strengthening the position of the Nordic region in the development, testing and use of electric transport solutions.

3.3. Offering NOBIL to other countries

Transnova offers the use of the NOBIL database to government agencies or other public service actors committed to enhancing electromobility in their country. This autumn, NOBIL will be technically adapted for use also in four other Nordic countries - Sweden, Denmark, Finland and Iceland. However, our discussions with government institutions from other Nordic countries have shown that different countries will probably choose different strategies on the question of public versus private ownership of a charging stations database.

The establishment of a charging stations database containing geographical location and other kinds of practical information was motivated to make the ride easier and without range anxiety for owners of private EVs. However, this infrastructure might be useful also for other user groups such as urban distribution services, taxi businesses and car pools as it gives them a safety net for charging beyond their own dedicated infrastructure. The infrastructure will also be useful when testing new mobility concepts.

4. NEXT STEP - FAST CHARGING PROGRAMME

In order to make EVs an attractive choice the issues of range and range anxiety have to be dealt with, Transnova launched a programme to support quick or fast charging in urban areas and along defined transport corridors. Fast charging is defined as the ability to charge up to 80% of battery capacity within 30 minutes. The technical standard we talk about is CHAdeMO, (400V and 63/32 A), but later on it also could be another solutions and standards.

In 2011 Transnova will finance 35-55% of the investment costs for approximately 40 fast charging points throughout Norway (NOK 200 000, or approximately 25 000 Euro is the maximum for Transnovas funding contribution). The fast charging programme is mainly directed towards private businesses which can demonstrate sustainable business concepts by investing in fast charging stations with public access. Petrol and service stations, shopping-centres, roadside eateries, centrally located car parks and terminal areas will be given priority. There is a set of criteria that has to be fulfilled, concerning financing and business models, net- and energy situation, operating, locating and safety issues.
Exemptions might be made for large fleet operators in the taxi business or delivery services who commit to making investments in EVs. Exemptions might also be made for municipalities or other public sector institutions who want to offer fast charging stations at well suited spots (concerning both location and number of EVs able to use fast charging in the area).

A strategy of distributing fast chargers in clusters or corridors is being chosen, or in clusters which can grow into corridors. This strategy has been discussed with different stakeholders.

The areas given priority will be the largest cities (Oslo, Bergen, Trondheim, Stavanger) and the corridors from Oslo and Trondheim towards the Swedish border, as well as corridors from Oslo to some of the smaller cities in the surrounding region.

Parallel to this fast charging programme there is an ongoing process in making regional plans and criteria for location and building public charging infrastructure. Transnova is funding this project.

5. THE PUBLIC SECTOR AND ROLE IN ESTABLISHING CHARGING INFRASTRUCTURE FOR EVS.

In Norway we have developed a model for charging infrastructure where the state has funded the investments, but the ownership and operating responsibility is mostly on private hands. In the largest cities the municipalities has taken this responsibility to charging infrastructure located in public parking areas, near public transport and near public buildings.

It has not been a political issue in Norway if the state or local authorities should have the ownership to the charging infrastructure. This could be a possibility, but the interests among private companies, special within the net- and energy sector, has been strong, so I think that this can be a sustainable and functional model in the next years. But we see that it is necessary to keep on with state funding if the network of charging infrastructure shall meet the needs of 30 000 points within 2020.

As mentioned before the NOBIL database is state owned.

Today charging is free of charge for normal charging, but in some years there will be necessary to pay for the energy and the use of the charging points. To get funding for fast charging the companies and others have to describe a long-term business model for how to finance and operate the infrastructure. There is no business in operating a charging point today, but it can be a good additional service combined with other services as food, coffee, shopping and fuels (includes bio-fuels).

5.1. Some Challenges

There are a lot of challenges that we do not have solved yet due to charging infrastructure. Today we do not have a common national standard payment systems, standards for locking and opening the charging points, (we have a standard key provides to all EV owners) and systems for identifications of cars. Neither we do not have an overall coordinating organisation to monitor the charging infrastructure network. We have just started the discussion on how to do this things, and I know that the discussion also take place in other countries.
Private initiatives have also been taken to solve these problems.

At last I will mention that Sweden and Norway has taken a common initiative to UN to make a road sign for showing up the charging stations. Our proposals will be discussed this month.

6. CONCLUDING REMARKS

In Norway we do not have a detailed national plan for establishing charging infrastructure, but we have a strategy for going step by step and meet the challenges when they arise.
By starting with this first generation of infrastructure and show the public that EVs is an alternative, and then continue with step two, introducing fast charging, to keep up with the “range anxiety” we believe that we are in the right direction for electrification of road transport. We also have a strategy in our fast charging program for adopting new fast charging standards (i.e. AC)

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