Analysis of Electric Mobility Support using Various Infrastructure

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ABSTRACT: *Across countries traffic is the main concern for people who commute, and systems are being introduced to ease the traffic. There are many complexities involved in solving the issues. Many solutions are advocated, such as traffic interconnections, national economy, capital investments, infrastructure, traffic technology improvement and limiting non-renewable energy sources. Traffic policies that include both macro and microsystems are available. The major development is the transport sector's electric vehicles, which is more challenging. To reduce the distribution overload the charging systems should be made more effective. A cluster of more charging points and the charging speed is required in highly densely populated regions. Hence, effective solutions to reduce the additional investment requirements are indicated in networks.*

The solutions that will reduce the negative effects on the electrical grid caused by electric vehicles and devices for their charging. The work has addressed electric mobility support. The measures include encouraging the use of renewable electricity and smart charging, introducing the standard charging infrastructure, and supporting battery research. Electric mobility is a crucial measure to ensure the implementation of electric vehicles.

Keyword: European Union, Transport Policy, Electric Vehicles, Distribution Grid, Smart Meters, Smart Grids

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1. Introduction

With advances in technology and changes in society, the way people and goods travel from point A to point B on the road is evolving drastically. In general, cars and other vehicles are becoming increasingly efficient, cleaner, automated and connected. More and more people are open to car- pooling, car-sharing and ridesharing. As demand for mobility rises, the transport network grows and becomes increasingly congested. Along with these trends, electric vehicles (whether hybrid or all- electric) are also gaining in popularity.

Electric vehicles are not a new invention. They were among the first vehicles in the 1800s, and by 1900 accounted for around a third of all vehicles on the road. However, battery and electrical network weaknesses and the rise of the cheap oil era, together with the technological advancement of diesel and petrol vehicles, shifted interest away from electric vehicles for many decades. Although all vehicles can be electric, this briefing focuses only on electric road vehicles (EVs).

With the cheap oil era drawing to an end and climate change posing an increasingly serious threat, EVs have once again come into the spotlight. All levels of governance within the EU have recognised that EVs are needed to make transport smarter and more sustainable. However, the EU market for EVs is still in its infancy and is largely dependent on support policies. The EU still needs to address problems, such as high upfront cost and limited offer of electric models compared to the conventional ones, as well as limitations of the electrical network, charging infrastructure and batteries. In broader terms, the development of the EV market also depends on the level of ambition of the EU emission regulations; the incentives offered to users of EVs; fuel prices; general travel behavior and advances in research.

2. A Growing Market

The EU market is still dominated by petrol and diesel vehicles, but the share of electric vehicles is growing fast. According to the European Automobile Manufacturers' Association (ACEA), the market share of electric cars in the EU was about 2 % in the third quarter of 2018, around 30% higher than in 2017. While most of these cars are in use in a few northern and western Member States, their largest sales growth in recent years has been registered in southern and eastern ones. In most Member States, hybrid car sales exceed fully electric car sales.

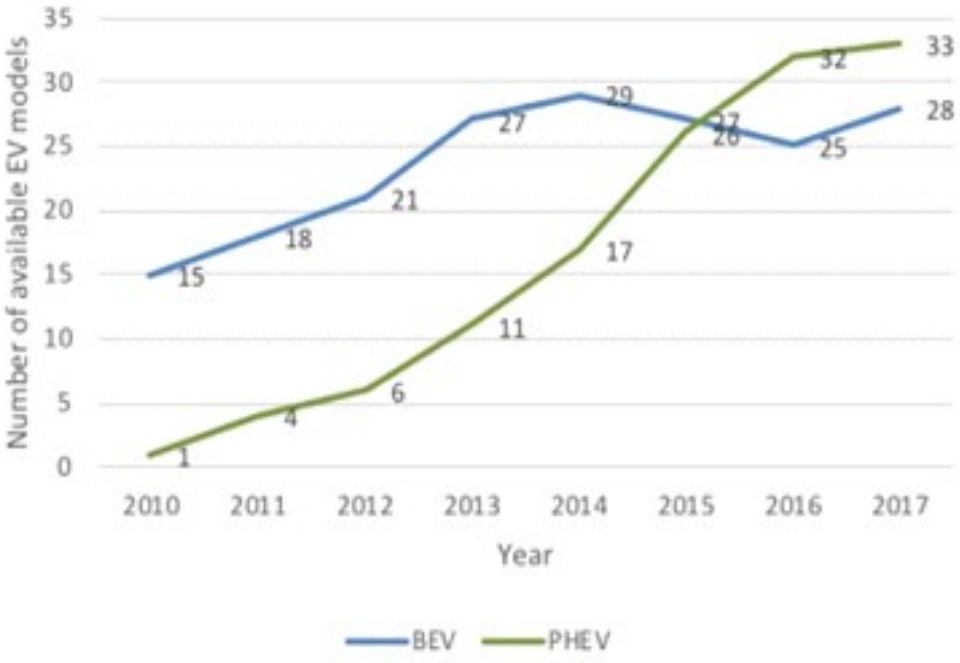

Figure 1. Number of electric vehicle models available in Europe, 2010-2017

3. Environmental and Health Impacts

3.1. Greenhouse Gas Emissions

Despite technological improvements, transport is still responsible for around one quarter of Europe's greenhouse gas (GHG) emissions, which are a substantial contributor to climate change. While in other sectors GHG emissions have gradually declined since 1990, those from transport only started to decrease in 2007 and still remain higher than in 1990 (see Figure 4). Within the transport sector, road transport is by far the biggest emitter, accounting for about 80 % of all EU GHG emissions from transport.

The EU is committed to reducing GHG emissions from transport and other sectors. Overall, its aim is to cut GHG emissions by at least 40 % below 1990 levels by 2030. For transport in particular, the aim is to cut GHG emissions by 60 % compared to 1990 levels by 2050.

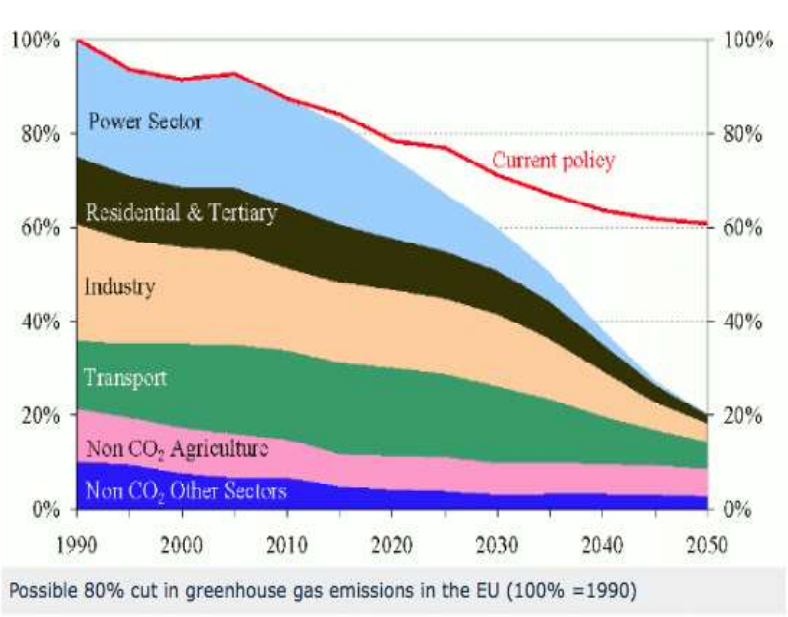

Figure 2. EU emissions of greenhouse gases by 80% reduction by 2050

3.2. Air pollution

Transport is the main cause of air pollution in cities. Fossil fuels used in transport emit a range of substances, including nitrogen oxides (NOX) and particulate matter (PM), which inflict significant harm to air quality and human health; more than 400 000 citizens in the EU die prematurely each year and millions more have respiratory and cardiovascular diseases as a result of poor air quality.

Road transport is responsible for around 40 % of NOX emissions in the EU, most of which come from diesel-powered vehicles. The pollution from road transport is all the more harmful, as emissions released by vehicles occur close to the ground, often in areas where many people live and work.

Electric mobility could significantly reduce air pollution caused by transport, due to less fossil fuel use, especially if the electricity is produced from renewable sources. EVs emit no tailpipe CO2 and have significantly lower NOX emissions than conventional vehicles. However, EVs still emit PM from road-, tyre- and brake wear. Besides, EVs are often heavier than equivalent conventional vehicles and vehicle weight tends to correlate with an increase in non-exhaust emissions of PM. In addition, electricity generation also produces pollution; however, since power stations are usually located away from cities, the pollution they cause has a lower impact on human health than pollution from conventional vehicles.

3.3. Noise

Transport is also a major source of noise pollution. High-levels of noise can lead to hearing loss, sleep disturbance, poor mental

health and well-being, increased risk of heart disease and change in blood pressure, among other effects. According to 2018 data from the European Environment Agency, almost 88 million people living in urban areas and almost 41 million people living outside urban areas in the EU are exposed to road, rail and air traffic noise levels exceeding EU thresholds.

In general, EVs have lower noise levels than conventional vehicles, especially at lower speed, where the minimal noise they produce can even pose a risk for other road users if they do not hear the EV coming.3 However, on rural roads or motorways, where speeds are higher, the difference in noise levels is much smaller. The extent of noise reduction also depends on the proportion of EVs in the overall vehicle fleet. In brief, even though EVs do make some noise, if they are used mostly in urban areas and once their proportion in the overall vehicle fleet becomes significant, they can help to achieve noise levels that are less harmful for human health and well-being.

3.4. EU Support

Electric mobility is an area where the EU has shared competences with the Member States. The latter promote electric mobility through local, regional and national incentives such as lower taxes or free public parking for EVs. The EU complements these efforts by encouraging measures aimed at increasing resource efficiency and recycling, as well as measures to help break the oil dependency, optimise and improve the efficiency of the transport system, develop sustainable fuels, scale up the use of renewable electricity and remove obstacles to the electrification of transport. Often actions in support of electric mobility are part of wider measures taken with a view to developing a more sustainable transport system.

As part of the next long-term (2021-2027) EU budget, in June 2018 the Commission proposed to spend 60 % of the CEF €42.3 billion budget on projects that contribute to achieving climate objectives, for instance, through the development of charging infrastructure for EVs. The Parliament and the Council are now negotiating on the proposal. In its negotiating position (adopted in December 2018), the Parliament voiced its support for allocating 60 % of the CEF budget to projects contributing to climate action, while also calling for an increase of the overall CEF budget by almost €6 billion compared to the Commission's proposal.

3.5. Electrical Network

Replacing millions of petrol and diesel vehicles with electric ones also means placing a bigger load on the electrical network that is already under pressure at certain times of the day in some areas. According to a 2018 JRC study, the EV is normally the biggest consumer of electricity in its owner's home. The same study calculates that if 15 % of the cars on EU roads were electric in 2030, this would place an extra demand on the electrical network of about 95 TWh per year. This would be about 3 % of total electricity consumption in the EU in 2030. However, by promoting charging at the most convenient times for the electricity grid and at the lowest cost for consumers (smart charging), the EU can limit the costs needed for investing in the electricity grid and shorten the delays in the uptake of EVs. Some electricity grid reinforcements will still most likely be needed, especially for high-power recharging points. In the long run, EVs could also feed energy back to the electricity grid and even earn their owners money, if charging occurs during non-peak electricity times and selling back to the grid occurs during peak times.

To help to connect EV recharging points to the distribution network while increasing the share of renewable energy in the electricity grid, in 2016 the Commission proposed a directive setting new rules for the internal electricity market (on which the Council and the Parliament reached a provisional agreement in December 2018). In this proposal, the Commission called on Member States to create a framework that facilitates the connection of EV recharging points to the distribution network. It furthermore proposed that customers have access to electricity price comparison tools, smart charging, and dynamic electricity price contracts.

4. Conclusion

It is hard to tell how the future of electric mobility will evolve, but it is clear that it holds a lot of potential to make mobility more sustainable and smarter. Electric road vehicles could reduce the EU's dependence on foreign oil, while lowering the pollution from transport. However, the extent to which EVs will effectively lower pollution will depend on their share in the overall vehicle fleet as well as on how environmentally friendly they remain during their whole life cycle.

Most likely, electric mobility will continue to blend with other trends such as digitalisation and connectedness, automation and shared mobility. Instead of owning an EV, people might choose to order an automated EV from a shared fleet with a click on their smartphone. This could also help to reduce congestion, especially in urban areas.

turers and governments are also continuing to develop their charging infrastructure for EVs and are helping customers to find the nearest recharging point (for instance via an app). However, whether these technological advancements will indeed convince customers to replace their diesel or petrol car with an electric one, will also depend on other factors, such as fuel prices.

The EU has an important role to play in supporting the transition to a more sustainable and smarter mobility. The more ambitious it is in its policies that drive vehicle technology

improvements and encourage the use of renewable energy and smart electricity networks, the more impressive the uptake of EVs is likely to be. The future of electric mobility will also be determined by incentives at the local, regional and national levels of governance. Namely, countries that offer generous EV incentives and good charging infrastructure, are typically observing a bigger increase in EVs than countries with low or no incentives. Whether they continue to see growth in the share of EVs will largely depend on how persevering they are in applying these incentives.

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