Policy Brief: eMAP final results

Introduction

The objective of the research project eMAP (electromobility – scenario based Market potential, Assessment and Policy options) has been to analyse deployment paths of electromobility until 2030. Work carried out between 2012 and 2015 has produced insights from consumer attitudes, computational vehicle market scenarios and carefully assessed policy options.

The eMAP scenarios provide decision-makers and policy planners with images of the future that show how far approaches relying on technology development or active policy support can take electromobility in the coming years. The economics of vehicle ownership as well as the socio-economic outcomes of different scenarios, when compared to business-as-usual developments, are quantified. The results are encouraging and support the view that electromobility offers a viable solution to the palette addressing environmental and health related problems but also enables national economies to develop steady and competitive.

eMAP brings to the front the consumer choice when deciding between available vehicle technologies. The overall results and impact assessments of the various scenarios are interpreted into policy recommendations addressing the whole of EU and the national perspectives of Finland, Germany and Poland.

Status quo and potential with electromobility

In order to assess the potential with electromobility in different regions around Europe a set of thorough case studies were carried out. Mobility patterns and behaviour as well as anticipated changes according to identified trends were explored in Finland, Germany and Poland. Additionally, forerunners in electromobility take-up, Norway, the Netherlands and France, were analysed.

Studies and comparisons over these countries and regions provided a range of settings and starting points. Geographical conditions and population density as well as car use or availability of public transport in daily mobility are examples of these variables. Nevertheless, urbanisation and growing demand for transport were common nominators from region to region. Signs of lifestyle changes and other societal phenomena were also identified, providing a special window of opportunity for electric vehicles to be a part of the more sustainable future.

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The overall conclusion of the case studies was that electromobility would be suitable in most regions to replace a large part of the motorised personal transport. The heterogeneity of regions however calls for regionally tailored approaches, which were already present in the forerunner countries and cities studied. Also, wholesome strategies to address electromobility as a building block of mobility was highlighted, i.e. electric vehicles as one of the technologies to replace conventional vehicles and to complement walking, cycling and public transport.

Consumer-point-of-view revealed

According to the consumer survey, currently market potential for electric cars sums up to 14% of driving licence holders in the EU.

Providing that perceived main problems (technological and economic) were solved, market potential would increase to 58%.

The online consumer survey conducted in the end of 2013 captured the views of over 6 000 private citizens owning a driving licence across the European Union (EU). As expected, the attitudes regarding electromobility were in general positive but many had doubts about technological performance and practicalities related to batteries and charging infrastructure. The main precondition to make electric vehicles attractive according to the survey respondents was nevertheless cost-competitiveness. The most decisive factor perceived was the purchase price, which outweighs the importance of total cost of ownership that may actually already be in favour of electromobility.

Consumers taking part in the survey saw that national governments were the entity that should take the strategic decisions and plan what policy measures are needed. Roles of the EU and automotive industries were seen as complementary. These views are well in line with current policy frameworks where only broad landscape is determined on the EU-level whereas individual approaches and schemes are designed nationally. On the contrary, the views of consumers differ from those of many decision-makers in terms of incentives and disincentives to use. While policy-makers may prefer disincentives to conventional fuels and powertrains, the consumer would rather receive incentives to subsidise electric vehicles. This can be explained by the interests of the decision-makers to promote technology-neutrally the most efficient transport solutions and to retain sufficient tax revenues.

Electromobility scenarios: business-as-usual, technology-driven and policy-driven

The eMAP scenarios model the European-wide passenger car markets in three settings: business-as-usual, technology-driven and policy-driven. The baseline presents future vehicle sales until 2030 under the currently adopted policies and follows the most probable trends. In comparison, the technology scenarios assume faster progress in e.g. battery performance, and policy scenarios simulate regionally tailored support measures for electromobility. Computations were carried out using the vehicle technology scenario model VECTOR21.

CO_2 limits for new passenger cars are the main driver to boost electric vehicle take-up in the internal market of the European Union.

Negotiations on regulations beyond those in effect, beyond 2020s, are in motion.

The core of the electromobility market scenarios is the boundary condition of regulation set by the European Commission (EC 443/2009), with gradually lowering CO_2 (carbon dioxide) emission limits for new passenger cars. To achieve this goal defines the baseline scenario, thus implicating that a given amount of electric vehicles need to enter the combined markets in the member states. Upper limit of average CO_2 emissions per kilometre is to be lowered in 2021, and we assume a further reduction in 2030, as shown in Figure 1.

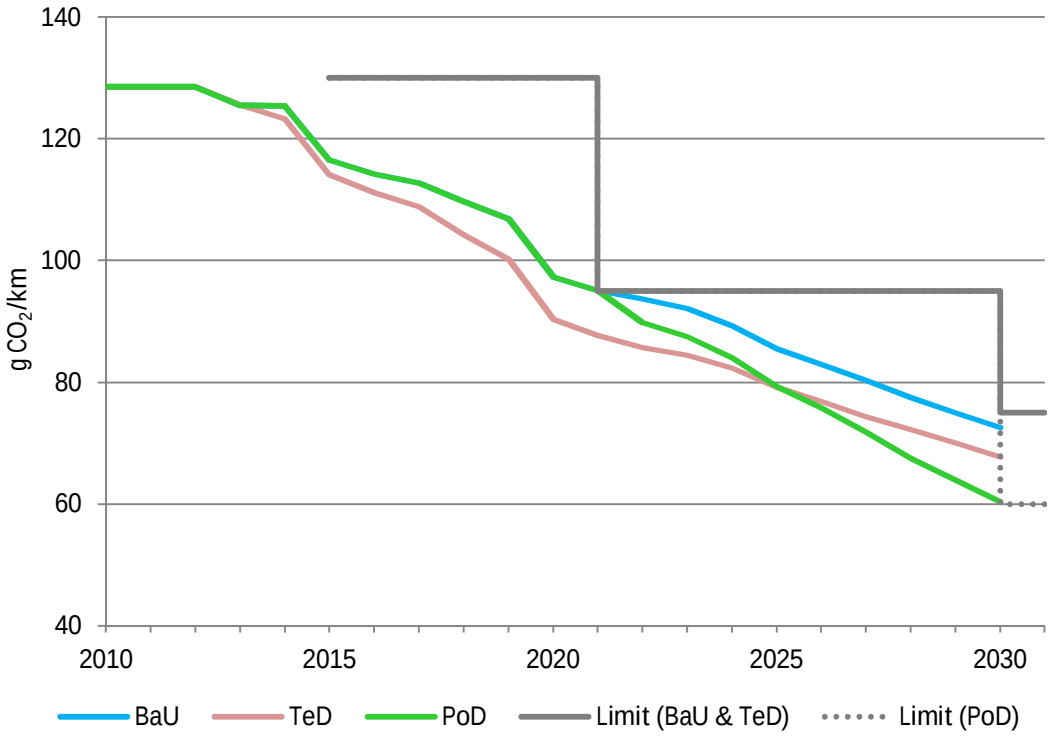

Figure 1. Average CO_2 emissions in business-as-usual (BaU), technology-driven (TeD) and policy-driven (PoD) scenarios in the EU28 and the upper limits set by the EC to control European markets.

The diffusion of electric vehicles between regions is determined by the demand side, and the scenarios simulate consumer behaviour through relevant cost of ownership as the main purchase decision criterion. To sum it up, the scenarios depict the most economic vehicle sales futures with the condition that EU-level CO_2 limits are achieved. The share of electric vehicles under three different scenario settings in the EU6 (covering Germany, France, UK, Italy, Poland and Finland, representing about 67% of the EU28 passenger car stock), Finland, Germany and Poland is illustrated in Figure 2. All electric drives with charging equipment and battery storage are accounted for.

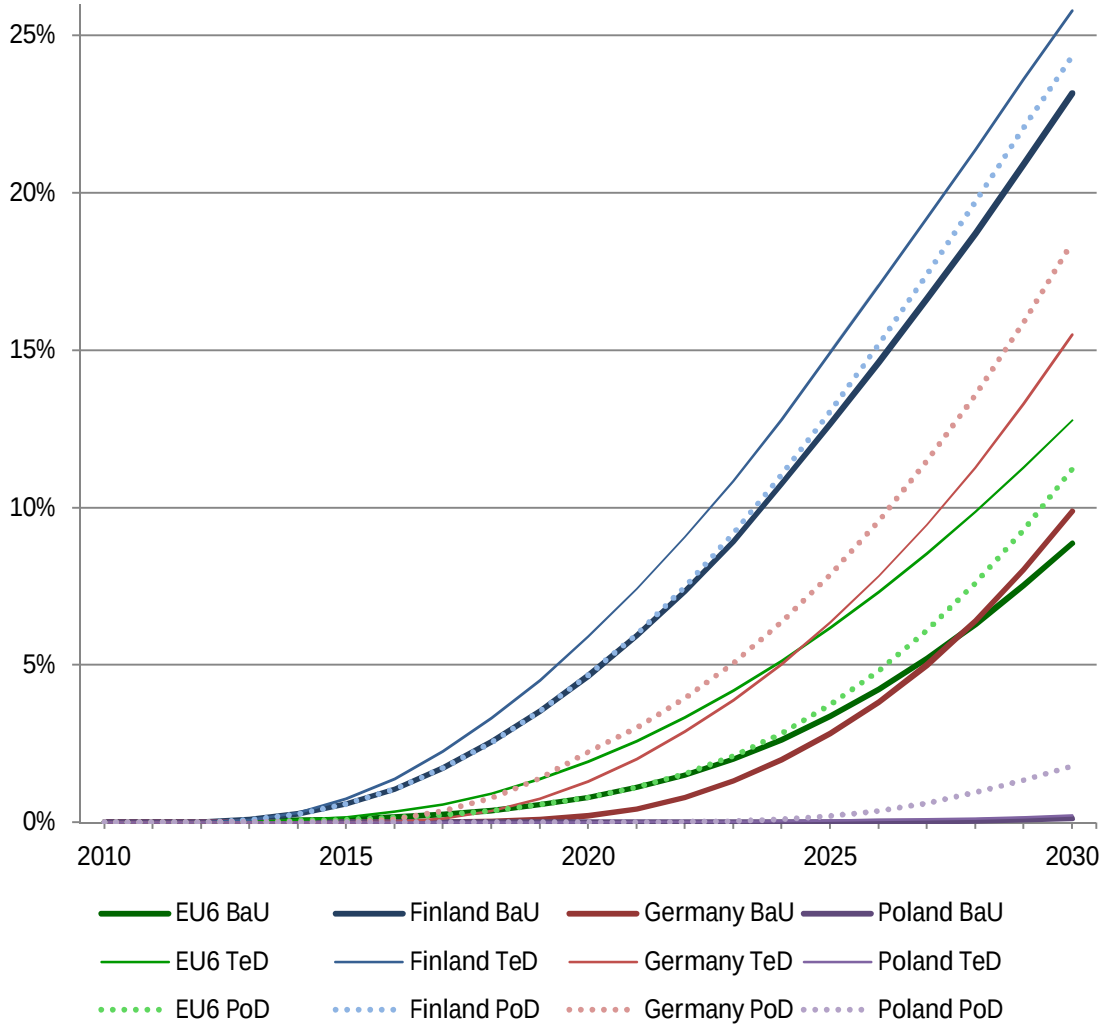

Figure 2. Share of electric vehicles (percentage of total vehicle stock) in business-as-usual (BaU), technology-driven (TeD) and policy-driven (PoD) scenarios in the EU6 (covering Germany, France, UK, Italy, Poland and Finland), Finland, Germany and Poland.

For the EU6 in 2030, the business-as-usual scenario results in to 14.6 million vehicles in stock equipped with a charging device. In combination with increasing efficiency of conventional powertrains, the overall well-to-wheel CO_2 emission reduction, compared to the starting point in 2010, equals 29%. In the scenario with rapid technological advances the take-up of electric vehicles is accelerated already around 2020, resulting in earlier market entry and over 21 million electric cars in stock in 2030. The policy-driven scenario in turn suggests a consistent market growth in the share of electric drives as more and more stringent emission regulations come into effect, and a total of 18.5 million electric vehicles in stock is reached by 2030.

Comparing scenario results between different regions, vehicle sales in Germany behave similarly to that over the EU. Taking into account the vast size of the German vehicle stock, the production capacity of electric drives poses an issue in the short- to mid-term market development, but when take-up of electromobility speeds up, growth is steep. In Finland market conditions welcome significantly higher penetration of electric vehicles early on, explained by the favourable CO_2-based taxation and low electricity prices. In contrast, the situation in Poland, where gasoline-powered vehicles dominate in the absence of support measures for clean vehicle technologies, is not receptive to electromobility. Additionally, low annual mileage per vehicle in Poland favours conventionally fuelled vehicles with lower purchase price rather than electric vehicles that are more economic only in the use phase.

Economic evaluation

Profitability and feasibility of the eMAP electromobility scenarios with reference to the business-as-usual were assessed using economic and extended multi-criteria evaluations. The cost-benefit-analysis showed that the benefits achieved in the technology-driven scenarios for all regions exceed costs incurred. In other words, savings in operating costs when combined to the value of reduced CO_2 emissions, local pollutants and noise were of more worth than investments in charging infrastructure and vehicle production. The benefit-cost-difference, in terms of net present value from 2010 to 2030 accumulated to 7.6 billion euros for the EU scenario, 460 million euros for Finland, 3.2 billion euros for Germany and 52 million euros for Poland.

In contrast, the policy-driven scenarios proved more costly, and for Poland and Finland the costs were higher than benefits whereas the German policy scenario resulted in a break-even. The benefit-cost-difference, in terms of net present value from 2010 to 2030 accumulated to -22.5 billion euros for the EU scenario, -110 million euros for Finland, break-even for Germany and -100 million euros for Poland.

Benefits exceed costs in all technology-driven scenarios.

In contrast, more costly policy-driven scenarios turned out economically inefficient for most regions.

The wider economic assessment extended the impacts under study to employment, value added and fiscal effects. Furthermore, the stakeholders that would profit or bear the burden could be identified per scenario. Positive or negative overall impact on society, car owners, industries, employees and fiscal authorities was thus specified.

The main finding of the wider economic calculations was to show how distributional effects in the economy take place when electromobility starts to replace conventional vehicles. Industries and trade of petroleum products lose their ground in favour of electricity production and trade. The overall impact of this transition remains, however, small in terms of employment or added value. Significant changes in employment were only identified for Germany, resulting in additional 20 000 person years in the technology-driven and 70 000 person years in the policy-driven scenario from 2010 to 2030.

Electromobility brings about strong distributional effects between economic sectors: petroleum industries give way to electricity industries.

The total impact on employment or value added remains negligible.

Under the taxation schemes studied, all scenarios with the exception of the Finnish policy-driven scenario lead to tax losses. Society is nevertheless the winner in the scenarios with growing rates of electromobility because of the reduced CO_2 emissions and other negative environmental impacts. The economics of car ownership and use continue with the current pattern of relatively higher purchase prices but lower operating costs for electric vehicles.

Policy recommendations

When interpreting results from eMAP as well as other electromobility research into policy advice, the fundamental goals promoting carbon-neutrality, liveable urban environments, inclusive mobility, etc. should be prioritised. From the societal point of view electromobility possesses instrumental value to help to achieve these goals, and decision-makers should acknowledge electromobility as one part of the bigger solution, where biofuels, hybrid technologies and hydrogen economy represent complementing solutions. But most importantly, support measures for electromobility should not neglect or impede walking, cycling, public transport or operational efficiency improvements.

Electromobility forerunner regions, such as Norway, California, the Netherlands or France, have all expressed strong national or regional policy support to initiate electric vehicle take-up. Support measures on the demand and supply side have been implemented in different combinations, including both carrots and sticks.

Policy implications from the eMAP results are found strongly dependent on regional characteristics. Policy recommendations are therefore case-specific and influenced by aspects such as national strategies, urban form, climate, mobility patterns and availability of technologies and services. In the following we present the top three findings from the eMAP research and interpret them into policy recommendations for the EU, Finland, Germany and Poland respectively.

Competitive edge for sustainable alternatives calls for national design of support measures catering to needs of individuals and regions.

EUROPEAN UNION
1. Finding: CO_2 emission limits (EC 443/2009) for passenger cars are an important steering measure to oblige manufacturers to supply vehicle markets with cleaner vehicle technologies. Recommendation: Monitoring and follow-up of CO_2 emission limits should be exercised to ensure compliance to regulations. Measures on greenhouse gas and local emissions should be aligned and have profound impact on supply and demand in vehicle markets.
2. Finding: While CO_2 emission limits provide a binding minimum target for CO_2 reductions, union-wide promotion mechanisms for cleaner technologies are lacking. Recommendation: Coordinated mechanisms to support progress beyond EC 443/2009 should be established. A larger reduction in CO_2 limit could be deliberated, and the time horizon should be extended to provide long-term commitment well beyond 2020s.
3. Finding: Prerequisites and opportunities regarding take up of electromobility and other clean technologies vary among member states. Recommendation: Strategies and measures should support goal-oriented approaches that allow member states and regions to adopt and combine clean technologies (e.g. electromobility and biofuels) that suit them the best. Shared responsibility of all member states to take part should be encouraged.

FINLAND
1. Finding: According to the eMAP survey, Finnish consumers are comparatively knowledgeable about electromobility but pessimistic about costs and practical performance, especially in hard winter conditions. Recommendation: Practical demonstrations, awareness raising and information on real performance and total costs of electromobility could help to dispel scepticism and promote electric vehicles as a functional alternative.
2. Finding: Baseline market scenario suggests a fast and ambitious take-up curve for electromobility in Finland. (Contradicting current sales trends.) Recommendation: Market scenarios indicate that the Finnish taxation system, especially when combined to affordable electricity price, creates economically favourable foundation for electromobility. This CO_2-based taxation is thus perceived as an important and successful approach to be continued, as it impartially supports electromobility among other clean technologies.
3. Finding: Electromobility penetration in Finland is currently low, but activities, cooperations and alliance building in e.g. R&D, charging operator business and taxation show ambition, innovativeness and environmental responsibility. Recommendation: Identified activities should be kept up and extended to involve markets and consumers as the situation approaches maturity to launch broad take-up of electromobility. Success factors, experiences and lessons learned in Norway should be acknowledged.

GERMANY

1. Finding: The baseline market scenario shows that ambitious national electromobility goals (1 million electric vehicles in 2020) will not be met in Germany. Technology-driven scenario improves the situation greatly, but only support measures in the policy scenario make it possible to achieve the goal.
   Recommendation: Powerful support measures need to be introduced urgently, most importantly to accelerate demand but also to advance technology performance and price-competitiveness.

2. Finding: The results for German respondents within the eMAP consumer survey revealed a relatively high awareness of electric vehicles. Nevertheless, the majority of German consumers adopt a wait-and-see policy in matters of new technologies compared to other European countries.
   Recommendation: In order to reach a critical mass of electric vehicles and to overcome the hesitant attitude of consumers, the charging infrastructure has to be enhanced and opportunities have to be created to enable the consumers to grasp the individual benefits of the new propulsion technologies.

3. Finding: The policy-driven scenario for Germany enables accelerated deployment of electromobility, and both employment and value added increase. However, tax revenues decrease, mainly due to reduced vehicle taxation.
   Recommendation: When introducing electromobility support measures, the impacts to tax revenue should be carefully assessed in advance. Possible approaches to avoid tax losses resulting from reduced vehicle tax and lower energy taxes include the introduction of road charging.

POLAND

1. Finding: The current situation in Poland is characterised by lack of political support for electromobility by the state administration, insufficient availability of charging infrastructure and the lack of comprehensive facilities for users of electric cars.
   Recommendation: Political support is needed from the state administration. Progressive financial support could be introduced, e.g. grants to purchase or use of electric cars. Furthermore, dynamic development of public charging points is required.

2. Finding: The eMAP survey indicated relatively high awareness of potential users in the field of electromobility in Poland. The lack of interest in buying electric cars is mainly due to the high cost of purchase and operation, associated with the need for periodic replacement of the battery pack as well as the limited range of such vehicles.
   Recommendation: At the first stage of electromobility introduction, fleet users and the wealthier part of private users should be addressed.

3. Finding: The current Polish tax system does not differentiate between the types of energy carriers used by cars nor the amount of vehicle emissions.
   Recommendation: The tax system should favour environmentally friendly technologies and penalize those that are characterized by significant CO_2 emissions.

Overall, the results from the eMAP project show that the market penetration of electric vehicles in Europe is low and will not change considerably without substantial technological improvements or massive public support. Regarding the support framework, the analysed countries differ in terms of already implemented legislative and financial measures noticeably.

In order to achieve a European-wide accelerated decarbonising of road transport, coordinated and decisive support actions are required. Nevertheless, the reduction of CO_2 emissions of vehicles can be justified for economic reasons only partially and requires therefore a strong and straightforward political will for an environmental friendly revolution of the current road transport system.

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For more information and details, see the eMAP research reports from each work package, available on the project website: www.project-emap.eu