BARRIERS TO THE DEVELOPMENT OF E-MOBILITY IN THE EUROPEAN UNION

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Abstract: *One of the key goals in the White Paper is a reduction of transportation GHG emissions by 60% in 2050. In the short and medium term decarbonisation of the transport sector in the European Union (EU) will be carried out mainly as a result of further improving energy efficiency in transport. Additionally, an alternative fuel with low or no CO_2 emission is also necessary to gradually reduce the emissivity of transport. The greatest potential for reducing CO_2 have electric vehicles (EV). With the absence of an exhaust system, and therefore the absence of direct emissions, electric cars are regarded as fully eco-friendly vehicles. Lack of local emissions is undoubtedly a big plus, but other factors affecting the environment are also important. Particularly important are the production, use and disposal of batteries and energy sources used to recharge them. The biggest impact on the environment exerts itself during acquiring lithium, copper and aluminium needed to produce the batteries. However, this effect is relatively small compared to the difference in production of electric and combustion car. The development of eco-mobility, however, is currently still hampered by technological and commercial shortcomings, lack of acceptance on the part of consumers and in adequate infrastructure. Currently, the high cost of innovative solutions for electric vehicles are mainly a consequence of these shortcomings. At both EU level, there and national level need to be developed and phased implementation of a coherent and stable strategy, comprising representatives from science, business, politics and society.*

Keywords: *transport, transportation, resource-efficient and low-carbon economy, alternative fuels, electric vehicles, CO_2 emissions.*

JEL Classification: *L99*

1. INTRODUCTION

The article aims to identify the main barriers and instruments of development of e-mobility in terms of achieving the objectives of the EU low-carbon economy. In order to achieve the objectives pursued the identification of conditions for the development of e-mobility in the EU. Biasing the transport sector's role in contemporary socio-economic processes it was taken into account that this section has the dual nature and transport is a key element in the functioning of the economic and social processes. The dual nature of the transport sector causes at the same time that this sector has come under heavy influence of the general development trends [10, 12]. The ongoing process of globalization and the associated processes of transformation stimulate growth of demand for transport services. An extensive transport network determines economic growth, affects the development of the labor market, and thus contributes to raising the general standard of living. In addition to the supporting function the transport industry itself represents an important branch of the EU economy. Transportation is responsible for approx. 8% of GDP and approx. 5% of total employment in the EU [9]. Since the beginning of European integration in the transport sector has been made significant progress in improving productivity and lower costs. Transportation has also become more secure, as evidenced by the nearly 30% drop in the number of road accidents involving people that was recorded in the years 1990 to 2012 [2].

In addition, the introduction of increasingly stringent emission standards Euro resulted in a significant improvement in air quality, still pollutant emission standards in the transport sector show an increase. According to the European Environment Agency (EEA) in the years 1990 to 2013 CO_2 emissions from the transport sector increased by 13%, while at the same time, other sectors of the economy saw their decline [11].

Large technological progress, organizational changes and the development of a knowledge-based economy have contributed to improvement of fuel efficiency and energy intensity in transport. These actions, however, are insufficient in view of the growing demand for petroleum-derived raw materials reported by the transport sector. The literature shows that there are many behavioral changes in transport, which have a high potential for CO_2 reduction. These include, among others:

- buying and using an electric car or a plug-in hybrid;
- buying and using a smaller car;
- applying a fuel-efficient driving styles;
- making use of Information and Communication Technology (ICT) to decrease business travel [8].

The most promising direction of the decarbonization of transport in the medium and long term is the technology of electric vehicles.

2. SCIENTIFIC AIM, METHODOLOGY/METHODS

The study used a technique desk research includes an analysis of documents, strategies and statistics. Analysis of literature and secondary data were the basis for the scientific objective - to carry out the thought experiment using the method of analysis and logical construction. Mentioned methods have allowed for the identification of the main factors impeding the development of e-mobility and the identification of key instruments relevant to the development of the electric vehicle market.

Table 1 Maximum realistic CO_2 mitigation potential of buying and using an electric or plug-in hybrid car

BEHAVIOURAL CHANGE	2020	2030	2050
Buying and using electric cars:			
Relative reduction in CO_2 emissions per pkm	19-34%	64-72	82-90%
Absolute CO_2 mitigation potential (Mton)	96-174	330-371%	420-462
Buying and using plug-in hybrid cars:			
Relative reduction in CO_2 emissions per pkm	11-22%	39-56%	49-69%
Absolute CO_2 mitigation potential (Mton)	56-113	198-286	251-354

Source: [8]

3. FINDINGS

The In the light of the results of research can be concluded that the greatest improvement of energy efficiency and the associated reduction in fossil fuel consumption and CO_2 emissions can be achieved by increasing share of the total number of vehicles with alternative propulsion cars for example. Electric, hybrid or hydrogen fuel cell uses (Table 1).

Presented in Table 1 data show that electric vehicle technology could make a major contribution to meeting the many challenges facing the EU, such as global warming and dependence on fossil fuels. Electric vehicles have very little impact on the environment throughout their entire life cycle. Low-carbon energy sources used by them are characterized by very low levels of noise and air pollution. In addition, they can be recycled. A high rate of recycling of batteries used in electric vehicles is justified scarce and the price of certain raw materials used in their manufacture. Batteries, which, due to the reduced capacity of no longer fit for vehicles may instead be used for the storage of energy in homes [5].

Vehicles with a purely electric seem most appropriate for use in the city. This is due to the relatively limited range and the development of appropriate infrastructure. Potentially better cost-benefit ratio in the construction of infrastructure for recharging indicates that in the first place it will be built in the cities. In urban areas, the useage of electric vehicles provides for the greatest social and health benefits.

Vehicles, which use hydrogen fuel cells can bring similar benefits to those resulting from the use of electric vehicles equipped with batteries. They also have electric motors but generate electricity in a vehicle with hydrogen fuel through the use of fuel cells, producing as a combustion product only water vapor. Development and useage of vehicles equipped with batteries or hydrogen fuel cells is thus complementary.

In the medium term a greater opportunity to use electricity in transport is seen in hybrid cars, in which the primary power source is an internal combustion engine assisted by an electric motor which often has lower power and smaller range. Another example is the hybrid car "plug" where the essential drive system does not change, but the electric motor is powered by rechargeable battery also from an external source of electricity [1].

In the near future the electric car market might remain a niche, but it is expected that their sales will gradually grow along with the improvement of technology. The presented results indicate that the share of electric vehicles equipped with batteries in the market for new car sales will increase from 1-2% in 2020 to 11-30% in 2030. Forecasts for hybrid vehicles mains predict an increase in their share in the total sales of new cars from 2% in 2020 to as much as 20% in 2030 [7].

The main problem in the implementation of e-mobility in the broad market consumers is their relatively short range apart from low affordability. The current alternative technologies because of their complexity and limitations in addition to many positive aspects also have a lot of flaws that can be regarded as significant barriers in the dissemination of e-mobility (Table 2).

Currently, gradually increasing interest in the usege of electricity in transport, especially in passenger transport sector and urban sector. A report published by the German institute Zentrum für Sonnenenergie - und Wasserstoff-Forschung Baden-Württemberg (ZSW) shows that worldwide already 740 thousand cars are powered only by electricity. ZSW estimates that the total number of electric cars will exceed 1 million in the coming months. The ZSW analysis shows that the number of electric vehicles (EV) increased significantly in the last year, when 320,000 vehicles of this type were registered worldwide. German institute mentioned among the best selling electric cars: Nissan Leaf lists, Model S Tesla, Mitsubishi Outlander Plug-In and Honda Fit EV. Nissan Leaf is the most popular electric car in the world. Since the launch of the sale, which took place in 2010, about 150 thousand units of this model has been already sold. Another is the Chevrolet Volt with the sale of 75 thousand units, electric Prius (60 thous.), as well as the Tesla Model S (50 thous.). In parallel with the electric car market, the automotive industry of battery manufacturers is growing too. ZSW estimates that its revenues rose to 2,17 billion dollars last year. Electric cars' market in the USA developed especially dynamically in 2014. EV has increased there by 69%, increasing the total volume of registered in the country's electric cars to 290 thousands. On the second place in this regard was Japan, where 110 thousand electric cars was used, and only last year this number had risen by 45%. Third place was occupied by China, where about 100 thousand EV was registered so far, and last year they arrived there about 54 thousand.

Table 2 The main barriers to the dissemination of e-mobility

The electric vehicle (batteries)	The electric vehicle (fuel cell)	The hybrid vehicle
Low overall performance	Extraordinary elusiveness,	Greater weight of the vehicle (two drives)
Very high price	The need for heavy tanks for hydrogen fuel	Extensive and complicated control systems, electrical and transmission
Long battery charging time,	Expensive technology and materials for production of solar cells	The high price of the vehicle
The lack of an extensive charging network		The problem of recycling waste batteries and accumulators

Source: [4]

Table 3 The selected activities in the field of e-mobility

The activities	The content
Infrastructure supply standardization	Basis for the development of technologies to be more scattered and larger scale
Standardization relationships vehicle EV - other participants in the e-mobility	Develop procedures for the operation of e-mobility, training of drivers
Building a network of public charging points	Introduction to the draft local development plan
The introduction of free or cheaper parking	Promoting the use of e-mobility
The ability to use bus lanes	Promoting the use of e-mobility
The exemption from the registration fee	Financial incentive
Build a system of incentives	Tax incentives, subsidies for buyers preferences in public procurement
Systematic campaigns to improve awareness of e-mobility	Promoting e-mobility
Further development of the technology	The price drop

Source: [1]

This result was certainly influenced by the policy of the Chinese government to introduce tax relief for the purchase of an EV. In the list prepared by the ZSW less interest in e-mobility was observed in the EU. In Germany last year, the number of electric cars increased by 11,7 thousand. The total number of cars in Germanu amounts up to 30 thousand. A first German 100% electric car which BMW i3, is on the market for a year. Since then, already about 15 thousand copies of this car were sold [6].

The above analysis shows a gradual increase in interest in e-mobility. But it seems reasonable that in the initial period of implementation and development of e-mobility the attractive and varied activities and incentives for individual and collective should be introduced (Table 3).

The above actions and initiatives require close co-ordination in many fields such as industry, transport, energy, trade, scientific research, climate action and the environment. A coordinated approach may indeed strengthen Europe's potential to produce smart and clean vehicles.

4. DISCUSSIONS

The objective of European transport policy is to create a sustainable transport system, satisfying economic, social and environmental needs of society. Reduction of consumption of non-renewable energy is essential for all aspects of transport systems and their use. Undesirable environmental consequences of transport activity will require further actions, especially concerning noise, air pollutant emissions and greenhouse gas emissions. Technological innovation will be the most important contribution to the implementation of the above challenges associated with transportation. Development of technologies for low or zero emission vehicles and the implementation of alternative public transport solutions, require however the development of coordinated and long-term strategies to promote e-mobility and increase technological awareness of consumers. Lack of coordinated action may lead in fact to a fragmentation of the EU internal market and loss of competitive advantage in this technology area. Market introduction of vehicles with alternative propulsion systems requires first and foremost the development of uniform standards, ensuring interoperability, increasing spendings on research and development of new technologies and identifying transparent legal and regulatory framework. It is therefore important that science, industry and policy decision-makers have developed a coherent strategy for the development of low-carbon innovation in the area of alternative drives and fuels for the transport sector.

5. CONCLUSION

Eco-friendly vehicles, including vehicles that use electricity, can contribute to achieving the Europe 2020 strategy, which aims to promote new technologies [3]. These technologies are designed to provide modernization of the transport sector and reduction of its share of CO_2 emissions, while increasing the competitiveness of the EU transport sector. In the short and medium term the combustion engine is likely to remain dominant in the sector of road vehicles. Alternative fuels and propulsion technologies will, however, become increasingly important in the future. Adoption of e-mobility, however, requires further action to support research and development of necessary infrastructure and to promote e-mobility, which is expected to contribute to lowering the costs of those vehicles and improvement of their range and driveability. Technological advances in the area of green automotive propulsion technologies can also accelerate the deployment of new solutions in other modes of transport.

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