

# ELECTROMOBILITY IN THE EUROPEAN UNION AND IN THE SLOVAKIA AND ITS DEVELOPMENT OPPORTUNITIES<sup>1</sup>

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## ABSTRACT

The objective of the article is to analyze the current trends in the automotive industry on electromobility in the European Union and in the Slovakia. Partial goal is to identify potential uses of electric vehicles on those market. The article makes recommendations that would increase the marketability of electric vehicles in the Slovakia and gives focus on prospects of electromobility in the EU and in the Slovakia. Article contains information on benefits for the development of the Slovak economy in the event of electromobility development and SWOT analysis for its implementation.

**KEY WORDS:** electromobility, electric vehicles, automotive.

## 1. INTRODUCTION

Transport plays a macroeconomic perspective vital role in the economy of each country. It creates not only a lot of jobs for residents of the state itself, but also contributes to the GDP and provides economic growth of the internal market, which impacts on the living standards of citizens. The number of cars is growing constantly in the world, consumers demand is high, production costs are falling and this is reflected ultimately in price. Same trend has been increased care and in particular public interest in a healthy lifestyle in recent years. Traffic congestion is also increasing with growing number of cars and the boom of private transport and urban residents are in addition to emissions also exposed to excessive noise. More than half of population lives in cities precisely, while public transport is responsible for one quarter of CO<sub>2</sub> emissions from transport. We would not have to speak about emissions and about rapid increase in greenhouse gas emissions, if the majority of the industry, along with transportation are not dependent on oil supplies. Oil stocks are constantly open to debate and views are different from each other only slightly optimism or pessimism. However, the oil will be probably rarer in coming decades and its increasingly scarce resources are limited in both cases. Greater problem is a itself dependent on oil as its own reserves in the context of transportation. It was not so long ago, when there was a similar situation in our country and Slovakia

were weaned on natural gas supplies and relied on reserves. In the case of oil it would threat with economic security, accompanied by inflation, changes in the trade balance, competitiveness, etc.

Alleviate of this condition and achieve sustainable mobility require mainly the introduction of new technologies and innovations, as well as modernization of transport and infrastructure investment. Transport recently becoming greener, but due to its increased volume is slight changes and its current functioning is unsustainable in the long term. Further development of transport should be based on improving energy efficiency in vehicles, development and deployment of propulsion systems, and renewable fuels, more efficient use of transport modes and infrastructure. Problems in the field of transport is also aware of the European Commission, which responds to the unfavorable situation by issuing directives and measures binding on all member countries. Alternative fuels are extremely important in pursuit of the independence of European transport on fossil fuels and reducing greenhouse gas such as natural gas, biofuels, hydrogen. Given the fact that natural gas is already for a long time well established in the market and fuel cell cars will be launched first in 2015, we will dedicate to electromobility of third generations.

Aim of this article is analyze of current trends in the automotive industry for the use of alternative fuels with a focus on electromobility, identify possibilities of electric

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cars on the Slovak market and make recommendations that would increase the marketability of electric vehicles in EU as well as in the Slovakia.

## 2. ELECTROMOBILITY

### 2.1 E-Mobility in the European Union

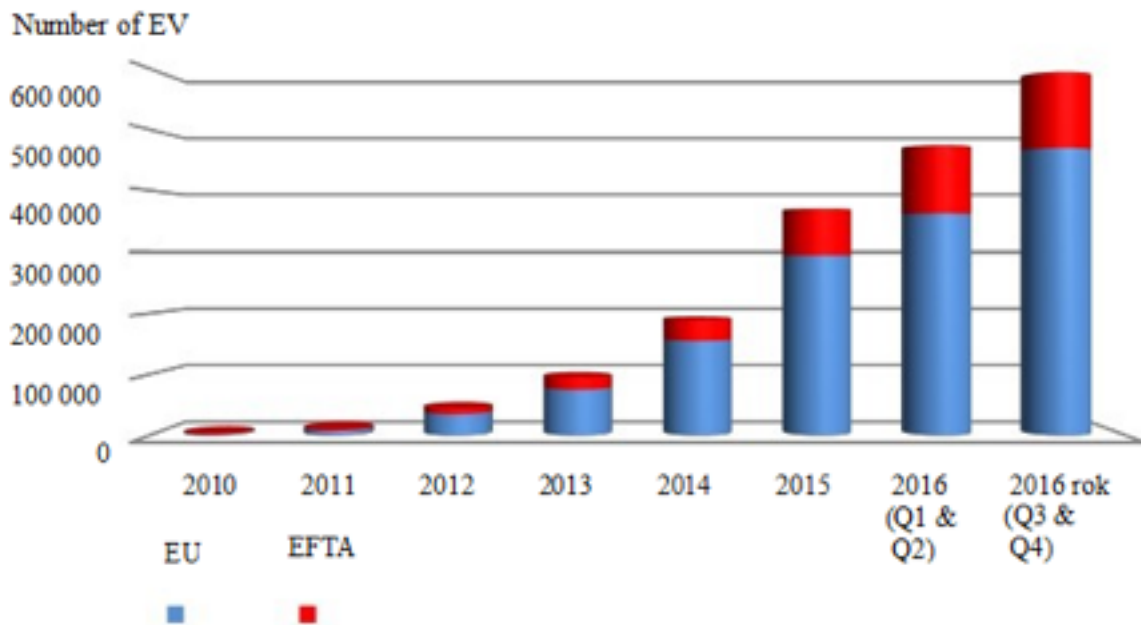
One of the most important markets for alternative fuels should be Europe for a few years. By 2030, according to the International Energy Agency (IEA), 20 million batteries should be sold in Europe.<sup>2</sup> According to a joint study by the Brussels Transport & Environment (T & E) NGO of Brussels and the European Automobile Manufacturers Association, ACEA made in 2016, 600,000 electric vehicles, including REEV and plug-in hybrids (PHEVs), are currently traveling

on European roads.<sup>3</sup> In comparison with 2014, the number of electric vehicles has almost tripled.

The development of electromobility in Europe is supported mainly in Norway, Sweden, Denmark, the BENELUX countries, the UK, Germany, France, Italy. Owners of electric cars use the benefits in the countries mentioned as free parking in city centers or no taxes or tolls.

The interest in buying electric cars by consumers and legal entities is growing in Slovakia, but more slowly than in other EU countries. We have to realize that the success of electric cars depends on the sufficiently built-in charging infrastructure, the adequate vehicle's arrival and its acceptable acquisition price. The development of the growth of registered electric vehicles is presented in the following graph.

Figure 1. Number of registered electric vehicles (including REEV and PHEV) in Europe (in pieces)



Source: TRANSPORT & ENVIRONMENT. (2016). Electric vehicle sales in Europe. In Electric Vehicles in Europe 2016 - In-house analysis by T & E. Available on: <https://www.transportenvironment.org/sites/te/files/publications/TE%20EV%20Report%202016%20FINAL.pdf> (accessed 3.4.2017).

Europe has become the second largest market for electric vehicles after the United States and the number of electric cars sold surpassed Japan. Conventional (non-plug-in) hybrid electric vehicles have been available in Europe for almost two decades. Unfortunately, past sales numbers for these types of vehicle are not easily available from official EU statistics, as national authorities have generally categorised them simply as petrol or diesel vehicles. Of the other types of electric vehicles, BEVs were the first type widely marketed in the EU, although sales in early years were very low. In 2010, fewer than 700 BEVs were sold across the EU. PHEVs have been commercially available

since around 2011. Again, statistics for plug-in hybrid sales in those early years are uncertain, as many Member State authorities have categorised them as petrol, diesel or battery electric vehicles. From 2013 onwards, petrol and diesel plug-in hybrid models became significantly more popular as both the range of vehicle models available for consumers increased and more governments promoted various subsidies to encourage electric vehicle ownership. In that year, there were just over 49 000 electric vehicles sold in the EU, of which half were BEVs, and half PHEVs. The number of electric vehicles sold has increased steeply in each year since. The latest preliminary data for 2015

<sup>2</sup> OECD / IEA. (2016). Deployment scenarios for the stock of electric cars to 2030. In Global EV Outlook 2016 – Beyond one million electric cars. Available on: [https://www.iea.org/publications/freepublications/publication/Global\\_EV\\_Outlook\\_2016.pdf](https://www.iea.org/publications/freepublications/publication/Global_EV_Outlook_2016.pdf) (accessed 1.4.2017).

<sup>3</sup> TRANSPORT & ENVIRONMENT. (2016). Electric vehicle sales in Europe. In Electric Vehicles in Europe 2016 – In-house analysis by Transport & Environment. Available on: <https://www.transportenvironment.org/sites/te/files/publications/TE%20EV%20Report%202016%20FINAL.pdf> (accessed 3.4.2017).

indicate that almost 150 000 new plug-in hybrid and battery electric vehicles were sold in the EU that year (EEA, 2016b; EAFO, 2016). Almost 40 % of these were BEVs. Collectively, just six Member States account for almost 90 % of all electric vehicle sales: the Netherlands, the United Kingdom, Germany, France, Sweden and Denmark. The largest numbers of BEV sales within the EU-28 were recorded in France (more than 17 650 vehicles), Germany (more than 12 350 vehicles) and the United Kingdom (more than 9 900 vehicles). The largest numbers of PHEV sales were recorded in the Netherlands (more than 41 000 vehicles) and the United Kingdom (more than 18 800 vehicles). In Latvia, Lithuania, Malta and Romania, fewer than 50 BEVs and PHEVs were sold in 2015. None were sold in Bulgaria and Cyprus.

French government provided subsidies for the purchase of an electric car with a value of EUR 5 000 in 2012. This financial amount increased by a further 2,000 after year, which ultimately reduces cost of electric car by 7 000, and left us to pay 13 700, to become the owner of a new car. Also remarkable is that in order to reduce the selling price to sell a vehicle with batteries, but the batteries would be rented through a contracted delivery cheap electricity. There are several tariffs in respect of the lease the battery,

but in cities the electric car is still worth it, because electric cars are exempt from congestion charges, parking or even road taxes. In the UK, customers have the opportunity to use allowance of 5,000 pounds.

The Netherlands has allocated in 2015 for the promotion of electromobility budget of EUR 9 million. These funds are used for the purpose of implementing the national action plan, ie. to stimulate electric mobility, strengthening international cooperation and creating partnerships, improving communication and science and research.

Nor other European countries are lagging in favoring electric vehicles. In Germany as the owner of an electric car is exempt from road tax for the first five years from the date of registration of the vehicle. Support of research plays an important role in this area. The result created from this platform was called Electromobility model regions 2009 – 2011. The Federal Government has allocated over these years to support electromobility around EUR 500 million and fair share of this budget stimulated just the supply side. It is expected to double that investment in the next period. The following table shows supporting tools electromobility in other European countries.

Figure 2. Summary of system tools support electromobility

Country	single		regular		Support for Business
	financial contribution	financial contribution	fee waiver / tax	nonfinancial	
Italy		5 000 €	✓	✓	
Spain	25 % of price (max.6 000 €)	63 45.32%			15 000 € resp. 30 000 € <sup>4</sup>
Belgium	3 500 €	over 9 190 €	✓		depreciation 120 %
Denmark		over 2 000 €	✓	✓	
Sweden	4 500 € <sup>5</sup>		✓		
Austria	to 4 000 € <sup>6</sup>	✓	✓	✓	30-50 % from price
Estonia	to 18 000 € (on charger 1 000 €)				to 18 000 €

Source: IEA : Global EV Outlook : Understanding the Electric Vehicle Landscape to 2020. [online]. On internet:<[http://www.iea.org/publications/globalevoutlook\\_2013.pdf](http://www.iea.org/publications/globalevoutlook_2013.pdf)>. (accessed 18.3.2017)

### 2.2 E-mobility in Slovakia

Slovakia has produced more than 1 mil. cars in 2015, which in comparison to the previous year is an increase of 5.8%. Slovakia has once again defended lead the world in the number of vehicles produced per capita based on record statistics for the past year (184 cars / 1,000 inhabitants). Although the presence of three automobile manufacturers built large logistics network, the tradition of the chemical

or electrical engineering would evoke huge prerequisite for a well functioning market electric vehicles in Slovakia. Currently, the electromobiles produced in Slovakia are the Volkswagen E-Up !, Volkswagen eGolf, Kia Soul EV, Citroën Berlingo Furgon Electric, Citroën C- Zero, Peugeot iOn and Peugeot Partner Electric. Competed on our market are brands of electric cars BMW i3, Nissan Leaf and Nissan e-NV200 Van/Kombi/Evalia. Opel brand, specific model Ampera was removed from market. It already has on offer

<sup>4</sup> 15 000 € for vehicles cat.N2; 30 000 € for buses

<sup>5</sup> Support is limited to the first 5,000 registered EVs

<sup>6</sup> True if the electric charge using electricity generated from photovoltaic system



in the category of electric vehicles has yet to prepare news. Mercedes-Benz offers to sell its electric Mercedes-Benz B Class and Smart car. Purchase of the electric car can be realized only through the dealer Motor-Car Bratislava on special request. Without subsidies is e-car very expensive. Cause low sales of electric cars in Slovakia can also be their high cost. Cheapest begins transmitted at 24,500 euros, is a Volkswagen E-Up!. Identical model with internal combustion engine can motorist procure only a third of the price relative to the battery - from 8,350 euros. Operating expenses necessary to pass 100-kilometer distance of the electric car will go out to about 1.5 to 2 euros if you charge it from your home network. When combustion engine to 5-7 euros depending on the type and whether it is gasoline or diesel. Electric vehicles are driven, while the owner of half the price, the price of the car was significantly higher, e.g., in the case of the recently tested e-Golf to be more than a quarter. But the cost may come back even faster if you use the charger for free in shopping centers.<sup>7</sup> Electric vehicles are on our roads is still a great rarity, in 2015 there were registered in Slovakia only 49. By comparison, the total number of cars registered last year reached almost 80 thousand. The main reason for the low sales of electric vehicles is their high price. Another reason is the state, which in our country is not considering, unlike other countries, the provision of support for their purchase. And finally, poor network of charging stations compared with service, even in comparison with other countries is very strong. In last year 2016 was changed the statement of state.

Starting from November 11 Slovaks can apply for state subsidies for the purchase of vehicles with electric or hybrid drive. The Ministry of Economy for this purpose allocated 5.2 million euros, with

the promise of improving awareness of alternative fuels. Confirmed: State gives the new electric or hybrid to 5 000 euros. Support package is available for both physical as well as for legal entities, towns and municipalities. The condition is that the vehicle has been allocated to the Slovak EVN. If the vehicle meets the conditions that any person who is mentioned in the registration certificate of the vehicle as the vehicle owner in the Slovak Republic may apply for the post.

While the grant is paid at once, but gradually. The conditions met by vehicles with purely electric cars or plug-in hybrids - that is, those that can be charged from an electrical outlet and the power used by electric motor combined with a conventional combustion engine. They must also fall into the category M1 (passenger cars), respectively N1 (small trucks to the total weight of 3.5 tonnes). Just such hybrid cars, although the offer manufacturers the most common, but the subsidy is not applicable. Just the possibility of charging from the mains is a key condition.

The subsidy amount is determined by fixed and not related to the total amount of the purchase price. When buying an electric state candidates offering five-strong support.

If a citizen thinks of plug-in hybrids, can count on the 3-thousand grant. Government grants are available from 11 November 2016 until the end of 2017, but only on condition that there is no depletion of the earlier allocations.

The package of subsidy is divided on three entries:

- 2000 EUR after registering their car and out the necessary formalities,
- 1500 euros in the next calendar month after the first anniversary of registration,
- 1500 euros in the next calendar month after the second anniversary of registration.

One person may use the grant to an unlimited number of vehicles. The condition remains once again that the budget for this purpose will not yet be exhausted.

Support will be bred electric and hybrid vehicles. Support will be bred and hybrid-electric vehicles. The subsidy can not be transferred to another person. If the vehicle is sold before 24 months after registration, the rest will be paid to the original owner. This does not apply if after the sale of the car will go abroad and thus loses Slovak register. The remaining part of the subsidy if forfeited already paid part of the original owner, however, remains. It also has the current measures against speculators. Just a government subsidy but this will change soon and also other manufacturers bring their modely. Now offer of thoroughbred electric are BMW, Citroen, Hyundai, Kia, Mercedes-Benz, Nissan, Smart, Volkswagen and win over customers fights and a lot of small producers of e-mobiles. The authorities also are thinking about other ways to support electric cars and hybrids. They talk about low-emission zones in cities, better parking options, or for the construction of charging stations. There are approval of the measure is to reduce the fee for the first entry of such vehicles in the registers. Its maximum height from 1 February 2017 shall not exceed 33€. State wants to support the construction of charging stations.

The first public charging station for electric vehicles in Slovakia was put into operation on Nov. 30, 2010 in Košice (VSE), followed the next year in Bratislava and Nitra Poprad. In Bratislava is also the first-ever quickcharging station (power up to 44 kW), which is accessible to the public in Petralka (Einstein Street) at the gas station Slovnaft and operated by ZSE (ZSE). The second location for such a station, but not the public, the site is the exclusive distributor of Auto-Impex. The network spread quickcharger the third station in November 2013, and situated in the the city. There you will be able to charge electric car owners to charge their vehicles without any authorization or registration by the end of 2014, depending on the location and the appropriate strategic places (public car parks, shopping centers etc..) located on the territory of Slovakia and other charging stations at which charging requires several hours (power 3.7 kW / 22 kW). The practical aspects are the main initiators of various energy companies (ZSE, SSE, VSE, SE), which

<sup>7</sup> TREND: Uvažujete o elektromobilite? Tieto (obmedzené) možnosti máte na Slovensku. [online]. On internet:<<http://www.etrend.sk/auto/uvazujete-o- elektromobile-tieto-obmedzene-moznosti-mate-na-slovensku.html>>. (accessed 16.1.2017).

are expected significant contribution and participation in the development of charging infrastructure, as well as the actual testing of electric or preparation of pilot projects.

In addition to energy companies, manufacturers of electric cars and service providers in this area would be the development of e-mobility in Slovakia, should significantly help the government and local governments. There is the concept of e-mobility under the auspices of the Ministry of Economy since 2011, which established in 2012 a working group on electromobility involving all major actors (governmental and non-governmental) in the field of electromobility to create Slovakia platform for e-mobility

modeled on Germany. The result of this collaboration was the development of an expert group key document entitled “Basis of the Strategy of development of electromobility in the Slovak Republic”, which was approved in May 2013 at the Ministry of Economy. Another goal after reaching this important step was the creation of a new concept in the form of analysis and recommendations stemming from the strategic documents, as well as draft policies to promote e-mobility in Slovakia. The outcome was a paper entitled “Strategy for the development of electric mobility and its impact on the national economy of the Slovak Republic”, part of which is presented in the following table.<sup>8</sup>

Figure 3. SWOT analysis of development of electromobility in Slovakia

Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> <li>strong position of the automotive industry in the national economy and the developed network of suppliers</li> <li>strong position electrotechnical industry in the national economy</li> <li>the availability of experts in technical fields, including IT</li> <li>relatively low labor costs compared to key markets for electromobility</li> <li>functioning platform and professional dialogue focused on the development of electromobility in Slovakia</li> <li>suitable energy mix</li> </ul>	<ul style="list-style-type: none"> <li>low expenditure on research and development</li> <li>underdeveloped research base automotive industry in Slovakia</li> <li>lagging behind neighboring countries (AU, CZ), which began systematically to promote electromobility rather</li> <li>slower economy and increased focus on price often at the expense of quality</li> <li>harmonization of norms and standards</li> <li>lack of infrastructure for charging electric vehicles</li> <li>lower sensitivity of the adoption of environmental, respectively. innovative solutions</li> </ul>	<ul style="list-style-type: none"> <li>reduce dependence on oil</li> <li>reduce emissions and pollution concentration transport locations</li> <li>creation of new skilled jobs</li> <li>developing research base in some areas related to electromobility</li> <li>impetus for innovative automotive companies and their suppliers</li> <li>creation of new innovative business models and services</li> <li>effective integration of mainly smaller, respectively local RES</li> <li>the use of electric vehicles in smart energy networks (SmartGrids)</li> </ul>	<ul style="list-style-type: none"> <li>inefficient investments made for the development of electromobility</li> <li>lag in competitor countries, failure in stimulating investment and employment</li> <li>delay reduction in input prices due to slow implementation of economies of scale in mass production</li> <li>unsystematic ad hoc solutions</li> </ul>

Source: PRACOVNÁ SKUPINA MHSR. 2013. *Návrh stratégie rozvoja elektromobility v Slovenskej republike a jej vplyv na národné hospodárstvo Slovenskej republiky*. [online]. On internet:<<https://it.justice.gov.sk/Default.aspx>>. (accessed 23.3.2014)

Slovak Association for electromobility (SEVA) was founded in 2012 in Bratislava in order to represent and promote the development of transport and transport infrastructure for passenger and commercial electric vehicles in Slovakia. The main motivating factor of representatives energy and electronics industries in establishing the association was the need of creating an effective platform for communication and cooperation between administrations, educational institutions, businesses and foreign partners. Also it participates in the preparation of essential documents, legislation and projects for the development of electromobility. The association has expanded the scope of its activities on the area of education and training in March 2014. In addition to research activities it is also aimed at providing consultation in the development of

training courses focusing on the practice of these focused on the issue of electromobility, organizing training events and presentations at high schools and colleges that offer internships and professional experience for students.<sup>9</sup>

GreenWay project focuses on environmental transport of goods through a complex system of infrastructure, logistics, technology and services. Its ultimate aim is to build an attractive and interesting business model in electromobility in Slovakia. Building a network of battery exchange stations allows to replace lengthy recharging by simply replacing the whole battery box car, while exchange stations is charging continuous in their ongoing. Given the range of services offered was founded a company called GreenWay Operator, which ensures the operation of the whole system.

<sup>8</sup> MINISTERSTVO HOSPODÁRSTVA SR : Prvé rokovanie pracovnej skupiny pre elektromobilitu. [online]. On internet:<[http://www.economy.gov.sk/aktuality-prve-rokovanie-pracovnej-skupiny-pre-elektromobilitu/10s139196c?set\\_subframe=blind](http://www.economy.gov.sk/aktuality-prve-rokovanie-pracovnej-skupiny-pre-elektromobilitu/10s139196c?set_subframe=blind)>. (accessed 11.9.2017).

<sup>9</sup> SEVA : O nás. [online]. On internet:<<http://www.seva.sk/sk/o-nas>>. (accessed 3.4.2017).

Green Way Operator includes:

- fleet of electric supply,
- the network of charging stations and battery exchange station,
- electricity for charging,
- information system for the management and operation of the system,
- service,
- operator service / call center.

Interested in the services GreenWay can choose between GW70-paid (70,000 km) or GW40 (40,000 km), the price of which receive electric vehicle charging infrastructure installation in the company, consumed energy, battery exchange stations, replacement vehicle, pay for insurance, taxes and fees, tire replacement and training of drivers.

Figure 4. Comparison of total costs for the fee GW70 and GW40



Source: GREENWAY: *Ako to funguje*. On internet: <<http://greenway.sk/sk/content/parallax>>. (accessed 3.4.2014). Explanation: column number 1 – total cost, right side - emissions saved CO<sub>2</sub> 10 290 kg; 1 143 trees.

The service is open to all companies that provide goods distribution through light commercial vehicles up to 3.5 tons or interested in “green technologies” and environmental protection. Special offer is designed for those who use electric cars far from discouraged by the high price.<sup>10</sup>

VIBRATE (Vienna Bratislava e-mobility) is the first cross-border pilot project to support electromobility in Europe, brought about by a consortium of Austrian and Slovak company in 2011. Its main aim was to implement a standardized charging infrastructure in the two countries and to establish a link between the neighboring metropolis of Vienna and Bratislava. The aim of this three-year project (January 2011 - December 2013) was also drawn to the functionality and use of electric vehicles in daily operation, which throughout the period tested a group of maybe 20 users primarily from the ranks of public institutions. Each project partner had to choose maybe 5 users ZSE (ZSE) has selected the following: City Bratislava, Bratislava Region, Municipality of Three-MoE SR MPaRV.

VIBRATE in numbers:

- the first Central European cross-border project to promote electromobility,
- Project Budget € 1,250,000,
- co-financing of 72% of public sources, primarily from CBC Programme Slovakia - Austria 2007-2013,
- 20 users of electric vehicles in the region,
- 9 charging stations in Bratislava, 4 of which are for the general public,
- 4 rýchlonabíjacie stations along the highway between Bratislava and Vienna, Bratislava 1.<sup>11</sup>

Project partners representing Slovakia were ZSE and Energy Centre Bratislava. From the Austrian company Verbund parties participated Wien Energie and EVN.

There were formed 2 types of scenarios in connection with the development and future of electromobility in Slovakia formed under the Working Group MHSR: *standard and technology*. Order to develop scenarios based on certain

<sup>10</sup> ELEKTROMOBILY.SK : GreenWay. On internet: <<http://elektromobily.sk/greenway>>. (accessed 11.9.2017).

<sup>11</sup> ZÁPADOSLOVENSÁ ENERGETIKA : VIBRATE – ekologické spojenie regiónu. On internet: <[http://www.skupinazse.sk/documents/7607/VIBRATE\\_flyer\\_A-long\\_2012.pdf](http://www.skupinazse.sk/documents/7607/VIBRATE_flyer_A-long_2012.pdf)>. (Accessed 11.9.2017).



assumptions (development of oil prices, the price of batteries and electric vehicles, public perception, business environment, consumer behavior and public infrastructure) is to create a rough picture of the impact of electromobility development on the environment, assess the degree of dependence on fossil fuels, energy intensity assess whether the development of the necessary infrastructure.

- *Standard scenario* - slight Slovakia's interest in the development sector, conservative image of global

market developments (development of prices and demand for electric vehicles in Western Europe), 7 thousand electric cars for 2020.

- *Technological scenario* - a proactive approach in Slovakia (to become a leader in e-mobility in Central Europe), optimistic developments in global markets, in accordance with the relevant forecasts, 25-thousand electric cars for 2020.

**Figure 5.** Forecast of newly registered electric vehicles in Slovakia



Source: ZÁPADOSLOVENSKÁ ENERGETIKA : VIBRATE – ekologické spojenie regiónu.

On internet: <[http://www.skupinazse.sk/documents/7607/VIBRATE\\_flyer\\_A-long\\_2012.pdf](http://www.skupinazse.sk/documents/7607/VIBRATE_flyer_A-long_2012.pdf)>. (Accessed 11.9.2017). Explanation : bottom line-Standard scenario; Technological scenario.

### 2.3. Proposals and recommendations

*State intervention* - because Slovakia is not a country like Norway, which has extensive reserves of oil and natural gas and results of operations where there is a surplus in the state treasury, it is necessary well consider in our conditions introducing specific measures for the development of e-mobility. It would be too naive expect from state direct subsidies for the purchase of an electric car, and therefore should be more focus on other supporting tools of indirect nature, without which the number of electric vehicles in Slovakia hardly grew. During the analysis of various documents and foreign studies, we came across on a number of measures that could help the current situation in the field of e-mobility, but this application requires a systematic approach. It is important to suggest a timetable for their introduction and temporal scope, because due to this sustainability can not be introduced all at once. It would be attractive for consumers remission of fees and charges associated with the operation of an electric vehicle (registration fee, road tax, tolls and tolls), the opportunity to recharge their electric vehicles for a discounted tariff for supply of electricity to park in designated areas for electric cars in the city center, as also use the lanes for public transport, which is not yet in Slovak towns too much, but their extension would certainly be worth considering municipal bodies to improve and thinking "ground" clearance and public transport. It would also still reserved for parking space for the owner of an electric car in his residence. From my own experience I can say that in some urban areas Bratislava without prepaid parking is almost impossible to find a parking space close to the apartment.

The use of dedicated lanes follows the introduction of visible signs electric car, which will give the vehicle owner feel special and by which it will be able to easily identify such. Owners of electric cars could also appreciate input into some areas closer to the center of the city, at least businesses to supply this service. City Bratislava has a plan to extend the time to enter some pedestrian zones since 4:00 arguing that electric vehicles are quiet. In such cases, the account also of the fact that in addition to the noise of the engine is noisy and the like handling and transshipment to supply this and the resulting effect can be minimized. E-mobility in Slovakia is located in a vicious circle, people do not buy electric vehicles, charging infrastructure is also in Slovak territory inadequate. Also, companies are not interested in building new charging station, until propagate the number of electric cars on the road. If state had not a clear vision in this area, support businesses and individuals, we would not have to lead these discussions. That is why it is important to consider the introduction of various tax breaks and incentives, co-financing, aid in finding financial resources, building permits for developers who think of e-mobility, procurement of electric vehicles into the ranks of police and firemen.

*Support from car manufacturers and importers* - automotive industry managers know that the future of transport belongs to alternative fuels. The production of electric cars is included in their programs. In decades, however, they have invested heavily in the development and production of internal combustion engines and their sales. The launch of the mass production of electric cars is therefore set aside. The electric vehicle is no longer

expensive due to battery, but mainly because of small-scale production. A combustion engine car is a state-of-the-art machine that can only be manufactured by technologically well-equipped and competent companies. On the other hand, simple electric vehicles can also produce smaller startups, which are not supported by the state. In such a case, the electric vehicle could help the merger of electric vehicle manufacturers as well as the outsourcing of R & D.

*Support by groups supporting the development of electromobility* - the support for the sale of electric vehicles on the Slovak market can also support the development of electric vehicles in Slovakia. In addition to electric mobility, drivers offer a comprehensive system of related services, such as the possibility of simple cross-system payment, flat-rate payment, vehicle charging management over time, a detailed overview of the functionality and availability of charging stations or customer support. Owners will also be thinking about the availability of the services provided before buying an electric vehicle in the future. The more flexible and comprehensive the portfolio of services will be offered to the driver, the sooner will deprive the customer of a feeling of uncertainty when deciding on the vehicle. It is also important to find the right balance between the services for which the customer is willing to pay.

*Segmentation* – we can argue under studied of secondary surveys that potential consumers and those interested in electric cars have emerged as modern humans, mostly to 34, interested in technology and its surroundings, open innovation and indicating trends. As Tesla Motors focuses on the premium segment, other car manufacturers should be targeted also to a specific segment based on actual surveys, particularly in Slovakia, where consumers are not favoring of direct financial subsidies from the government and the current bid price for electric ranges up to 30 000 EUR. Electric vehicle would be communicated as a vehicle whose possession reflects the image of the consumer and makes it exceptional in relation to the surroundings. Besides these characteristics, electric car owner looks like rational and educated consumer who is aware of the negative impact of industry and human activity on the environment, achieves success in work and daily raids around 20 km, ie. primarily used car for short distances within the city. Electric vehicle should therefore be exclusively presented as a vehicle for urban areas, which in comparison with conventional cars seems to be more practical and more economical. Its use nationwide traveling in Slovakia is only a matter of time and depends on the pace of infrastructure development.

*Marketing communication* - to be able to selling electric vehicles in Slovakia and in the EU, the potential owners have at least know their positive aspects. We have in mind the wider community also. Many people in electric vehicles imagine only a high price and short range. The aim should be to inform and educate the public as well as direction of advertising message to the target segment. Appropriate forms can be considered product placement, guerilla marketing, mobile marketing, internet marketing

and other less traditional forms that are somehow modern, imaginative and accepted by the target group.

*Education* - For education system are typical research and development activities in the field of electric vehicles. Probably the most famous project was the development of student electrical formulas, involving the Slovak Technical University in Bratislava and the company ZSE. As more practical benefit of the University we consider the design and development of special hybrid vehicles, while the R & D activities is no less than the University of Žilina University or Technical University of Kosice. If we consider a real expansion of electric vehicles in Slovakia and the EU in the future, we have experts in this field. It is necessary to establish cooperation at all levels, ie. we should involve all market EVs in education and forgive the outdated teaching methods. The results are not only worthy projects in student competitions. We must enable students to learn and learn about electro-accredited under the new program, elective courses or courses whose completion would guarantee success in the labor market. Courses opened by the carmakers or other commercial companies on campus seem as a supplementary education to students of the theoretical basis for their learning curve in business processes, where the company would train their future employees. This model need also the investmnet or cooperation from the side of state and public institutions.

*Partnerships, leasing and service* - cost of electric vehicles will be the biggest obstacle in Slovakia for which many consumers have not bought a vehicle. It is not possible since the long term to rely on an endless state support in the industry. Carrying high initial development costs for the customer is also unpromising. Carmakers have to consider creating global partnerships in technologies that allow them to achieve lower costs for the introduction of large-scale, as well as reduce overall risk. Electric vehicles current price could be reduced, for example, if the seller offered the most expensive components of the vehicle - battery - for leasing, or could be interested about electric vehicle designed repayment program. If carmakers want to gain new customers, they must provide certain guarantees to the consumer losing the sense of insecurity when he decides on the automobile. The battery life is one of the causes of doubt and hesitation. The battery should be warranted, during which there would be, if anything goes wrong the customer would be given a temporary replacement vehicle until the fault has been removed or replaced without charge the battery with a new one. Also, in order to avoid that the owner of an electric car remains on the road somewhere with the battery without recharging it from any source, vendor or other entity should establish a mobile assistance service, which would in an emergency recharge the electric vehicle. Other incentives could be less frequent checks and controls, free service and simple to install recharging equipment at the customer's home, enabling to comfortably recharge your electric car while you sleep and have it fully ready for each day.



### 3. CONCLUSION

The article allows us to understand the nature of e-mobility and deployment of electric vehicles in road traffic. The important elements are production of electric vehicles, charging net and infrastructure, information and communication technology and legislation. The electric mobility appears to be an alternative solution meeting the economic, ecological and social aspects of sustainability in view on the current traffic situation, which is characterized by strong growth performance and share emissions from transport.

Traffic problems are registered by European and other world countries that they have decided to implement national strategies to promote the development of e-mobility in the form of direct financial subsidies or through non-financial instruments, or a combination thereof. Funds spent in the electromobility sector should also ensure increased employment in the country while reducing dependence on fossil fuels. Not less important is the contribution of electric mobility and improve the environment by reducing CO<sub>2</sub> emissions, noise reduction or other adverse consequences for human health. Among the driving characteristics and specifications it should be emphasized efficiency of energy use, lower operating costs than conventional cars, the engine runs smoothly and energy recovery. The main disadvantages is discouragement of many potential consumers from buying an electric car, consider a limited range (up to 200 km on a single charge), battery life and recharging, the length of which depends on the type of charging station, and the high selling price.

Electromobility has currently the greatest opportunity to establish itself in the market, thanks to its great variety of international agreements and partnerships for the purpose of its development, as well as increased public interest in this topic for the last time. Mentioned national strategies help to the development of e-mobility, which not only motivate people when buying an electric car, but is also involved in the development of infrastructure. The leaders on a global scale in electro vehicles are countries like USA, Japan, the Netherlands, France, Norway, Germany and so on. We can when buying an electric vehicle to meet with government support in the form of direct financial contributions or tax credits that may in the Nordic countries such as Norway reach up to the amount of the value of a new car. Semantically equivalent are also public investment in science and research in the field of e-mobility and individual support to local governments. We have also taking into account other measures in force in foreign countries as free charging, parking in the city center, the possibility of using marked lanes for public transport, forgiveness toll, the electric vehicle becomes in the eyes of consumers attractive means of transport. The benefits can outweigh the negative aspects.

One part of this article is the view on the current situation in Slovakia, on the road which can be very rarely see the electric car, despite the fact that the country has excellent conditions for the development of electromobility. The perspective is the presence of 3 carmakers, sufficient

electricity infrastructure and long tradition in the chemical and electrical industries. One of the problems which hinder the development of e-mobility in Slovakia is lack of a network of charging stations (so far only in the cities of Bratislava, Nitra, Poprad, Košice). The exception is the capital city of Bratislava, where the current network of charging stations is sufficient for new potential owners of electric vehicles. Another challenge is the limited range. Nissan Leaf EVs is around 200km on a single charge. Linking the west and east is scarce. After charging stations come to the most serious problem and it is the selling price of an electric vehicle. It is moving around 30 000. While in some foreign countries, citizens have three times higher wages than people in Slovakia and the country still supports contributions from about 5,000 to 7,000 euro for buying an electric vehicle, the Slovak government supports e-mobility very passively, only on information - promotional way. So it will remain same in the near future, until the government does not accept and approves strategic documents submitted. The exception is the small amount of charging stations, which has the ability to recharge the car's battery charge. If we find a real candidate who is willing to pay the full amount for the electric car, the menu selection of electric vehicles is limited at some small urban vehicles. Subchapter proposals and recommendations is devoted the options how make attractive the electric vehicles in our conditions. It is necessary to focus on non-financial support programs, because direct financial subsidies are for us rather unreal as real. Other mission is create an attractive business model for entrepreneurs whose ideas of electromobility and the associated cost savings interesting rather than end consumers. It's the only way to develop electromobility in Slovakia to this times, while prices of batteries and electric vehicles doesn't decrease due to introduction of new technology and more efficient production.

The future of electric vehicles may be viewed as vehicles primarily intended to urban areas for short distances. Although the EU aims in urban transport by 2030, reduce the use of conventionally fueled cars in half, it is important to note that the role of electric vehicles is not fully replace cars with internal combustion engine and therefore comparison is sometimes not justified. Electric vehicles can be also extremely useful in meeting the objectives to be achieved by the introduction of urban logistics zero emission of CO<sub>2</sub> in the centers of large cities in 2030.

The article allows us to understand the nature of e-mobility and deployment of electric vehicles in road traffic in EU and in Slovakia. The important elements are production of electric vehicles, charging net and infrastructure, information and communication technology and legislation.

The electric mobility appears to be an alternative solution meeting the economic, ecological and social aspects of sustainability in view on the current traffic situation, which is characterized by strong growth performance and share emissions from transport. We have a new system of direct subsidies in Slovakia. Funds spent in the electromobility

sector should also ensure increased employment in the country while reducing dependence on fossil fuels. Not less important is the contribution of electric mobility and improve the environment by reducing CO<sub>2</sub> emissions, noise reduction or other adverse consequences for human health. Among the driving characteristics and specifications it should be emphasized efficiency of energy use, lower operating costs than conventional cars, the engine runs smoothly and energy recovery. The main disadvantages is discourage of many potential consumers from buying an electric car, consider a limited range (up to 200 km on a single charge), battery life and recharging, the length of which depends on the type of charging station, and the high selling price. Electromobility has currently the greatest opportunity to establish itself in the market, thanks to its great variety of international agreements and partnerships for the purpose of its development, as

well as increased public interest in this topic for the last time. We have also taking into account other measures in force in foreign countries as free charging, parking in the city center, the possibility of using marked lanes for public transport, forgiveness toll, the electric vehicle becomes in the eyes of consumers attractive means of transport. The benefits can outweigh the negative aspects. The future of electric vehicles may be viewed as vehicles primarily intended to urban areas for short distances. Although the EU aims in urban transport by 2030, reduce the use of conventionally fueled cars in half, it is important to note that the role of electric vehicles is not fully replace cars with internal combustion engine and therefore comparison is sometimes not justified. Electric vehicles can be also extremely useful in meeting the objectives to be achieved by the introduction of urban logistics zero emission of CO<sub>2</sub> in the centers of large cities in 2030.

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