



Low-carbon Transport in Czech-Polish Cross Border Area: Attitude of Czech and Polish Public to Electromobility

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INTRODUCTION

Emission of exhaust gases

Conventional transport based on diesel and petrol engine presents an environmental-unfriendly mobility inseparable from emission of exhaust gases such as CO, CO₂, NO_x, SO₂, Pb, hydrocarbons and particular matters. According to the European Strategy for low-emission, mobility transport represents almost a quarter of Europe's GHG emissions and is the main cause of air pollution in cities (Konstanciak, 2017). Within this sector, road transport is by far the biggest emitter accounting for more than 70% of all GHG emissions from transport in 2014. The statistics reveals that road transport contributes about one-fifth of the EU's total emissions of carbon dioxide (CO₂), the main greenhouse gas. While these emissions fell by 3.3% in 2012, they are still 20.5% higher than in 1990. Transport is the only major sector in the EU where GHG emissions are still rising. (Burchart-Korol et al., 2018). Figures 1 and 2 present development of CO₂ emission in Central Europe countries. The biggest emitter of CO₂ emissions in this area is Germany. It emits more than double amount of CO₂ than Poland, the second emitter in the presented comparative order (Fig. 1). However, the CO₂ emission calculated per capita (Fig. 2) reveals that the biggest emitter is the Czech Republic with emission of CO₂ above 12 tonne per capita. Germany is the second one with emission lower than 12 tonne per capita (Jursova et al., 2019).

Reducing greenhouse gases emissions is one of the priorities of the European Commission (Jursova et al., 2014). There are two possibilities to fulfill it: an increase in efficiency of combustion engine or application of alternative fuels for vehicles.

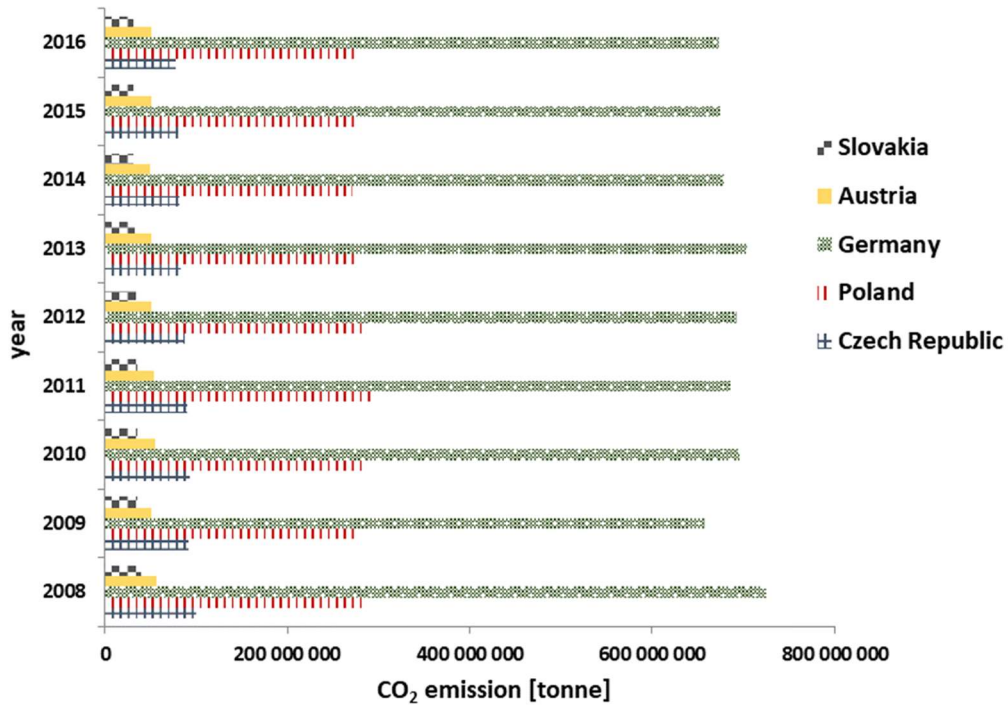


Fig. 1 CO₂ emissions in central Europe countries

Source: (based on data of Eurostat, Jursova et al 2018)

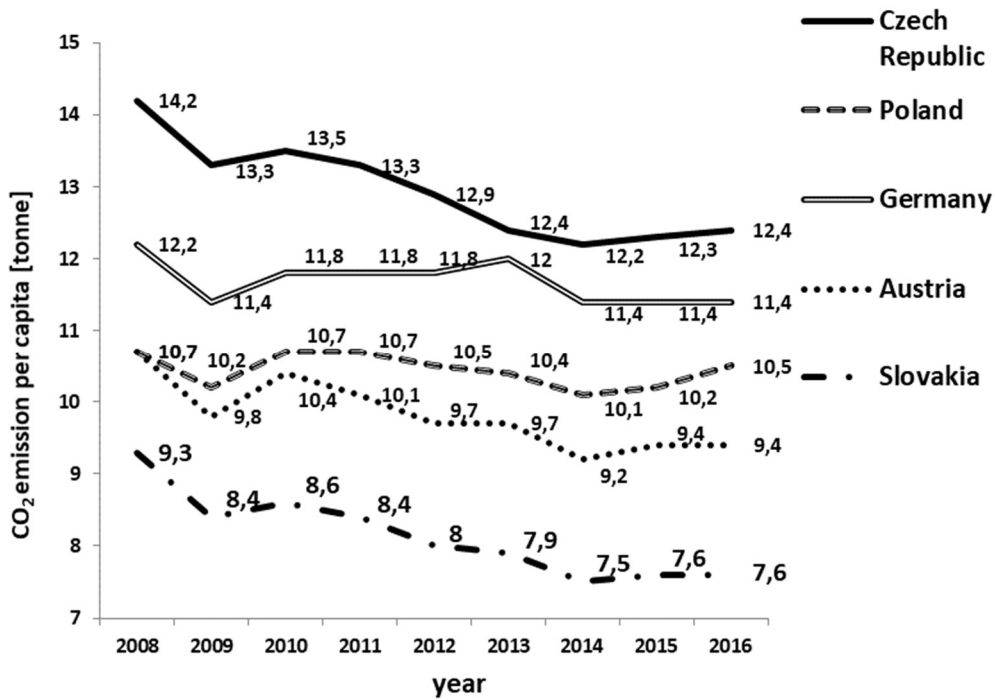


Fig. 2 CO₂ emissions per capita in central Europe countries

Source: (based on data of Eurostat, Jursova et al., 2019)

The White Paper includes proposals to reduce Europe’s dependence on imported oil and to cut carbon emissions in transport by 60% by 2050 (Jursova et al., 2019) It is a reason for development of electric vehicles market. Europe is slowly coming to terms with the need to switch to electric or hydrogen mobility. Nowadays, the European Commission is considering the introduction of minimum quotas for the production and sales of zero-emission vehicles that Europe’s car makers will have to comply with. These initiatives have also been

adopted by the national governments of participating countries. Electromobility development programs are developed in most EU countries. There are adopted action plans, supporting packages and research programmes for development of electric mobility in municipalities, companies and research institutions. Between 2018-2019 ENET Centre, VSB-Technical University of Ostrava and Faculty of Transport, Silesian University of Technology cooperated on project Electromobility in Czech-Polish Cross-boarder Area coo financed by EU fund for regional development in frame of programme Interreg V-A Czech Republic-Poland through Fund of microprojects 2014-2020. The project objective was definition of possibilities for electromobility development in Czech-Polish cross boarder area. Within the project, life cycle assessment of electromobility was analysed and survey of Czech and Polish attitude to electromobility was carried out. The chapter objective is a comprehensive presentation of results of the survey with the synergical background information about mobility and transport in the area.

Passenger car production

The world passenger car production has been growing since 2009. The greatest passenger car producer is China. According to data of European Automobile Manufacturer Association (ACEA), it produced 23272408 cars in 2018. It makes 29% of all passenger cars produced worldwide. A quarter of all passenger cars produced worldwide are made in Europe (ACEA, 2019). The leader in European cars production is Germany followed by Spain, France and Great Britain. The economy of the Czech Republic is also oriented on automotive. The passenger cars production in this country has increased significantly since 2008 (Fig. 3). On the contrary, passenger cars production in Poland has decreased since 2008 (Fig. 4).

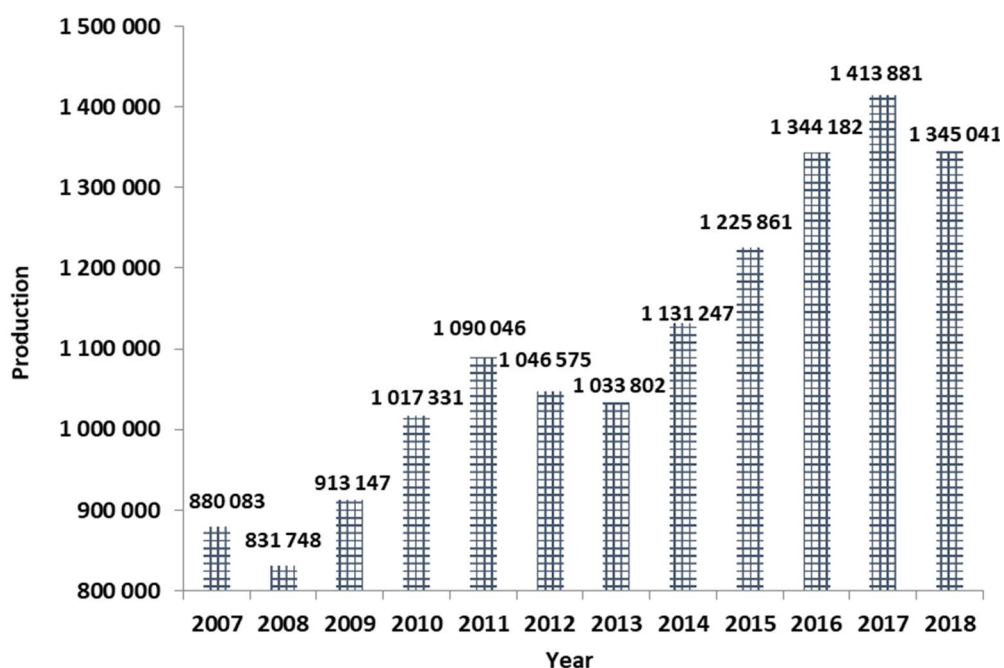


Fig. 3 Development of passenger cars production in the Czech Republic based on data of ACEA

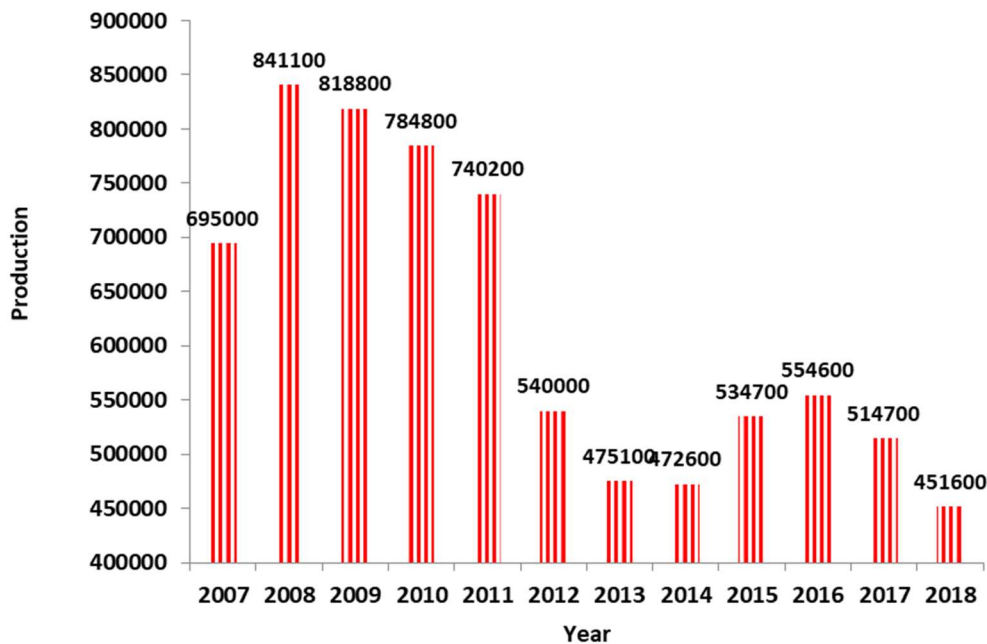


Fig. 4 Development of passenger cars production in Poland based on data of ACEA

Electric cars in the market of EU

According to data by the ACEA, over 5% of all passenger cars on European roads run on alternative fuels. Petrol cars remain the most sold cars in the EU, where they represented 49.4% of market share in 2017. In Poland, market share of electric cars was 0.2%. In the CR, electrically-chargeable vehicles amounted to 0.1% of sold cars in 2017. In comparison with other EU countries, this is the lowest market share (Table 1). The leader is Sweden with 5.2%, followed by the Netherlands (2.7%), Belgium (2.6%), and Finland (2.6%) (Jursova et al., 2019).

Table 1 Market Share of Sold Electrically-Chargeable Vehicles in the EU

Country	Share [%]	Country	Share [%]	Country	Share [%]	Country	Share [%]
Austria	2	Estonia	0.2	Italy	0.2	Portugal	1.8
Belgium	2.6	Finland	2.6	Latvia	0.3	Romania	0.2
Bulgaria	0.3	France	1.7	Lithuania	0.2	Slovakia	0.2
Croatia	data not available	Germany	1.6	Luxembourg	data not available	Slovenia	0.6
Cyprus	data not available	Greece	0.2	Malta	data not available	Spain	0.6
Czech Republic	0.1	Hungary	1	Netherlands	2.7	Sweden	5.2
Denmark	0.6	Ireland	0.7	Poland	0.2	United Kingdom	1.9

Source: (ACEA, 2019)

Electric vehicles are the future of road transport. Electromobility constitutes an important point in reducing air pollution. The increase in the share of renewable energy in the energy systems of European countries will result in the greenhouse gases reduction. The previous analysis has shown that both in the Czech Republic and Poland, despite the high share of fossil fuels in the domestic energy system used to charge batteries of electric vehicles, the emission of greenhouse gases is lower than in the case of internal combustion engine vehicle. Table 2 sums up the results of environmental impact comparison of

electric vehicle and internal combustion engine vehicle which was studied within the above mentioned project Electromobility in Czech-Polish Cross-Border Area. The analysis of electric vehicles was carried out for energy mix of the Czech Republic and Poland in 2015 with its perspective to 2050 (Burchart-Korol, 2018).

Table 2 Comparative analysis of electric vehicle (EV) and internal combustion engine vehicle (ICEV)

Impact categories	Unit	ICEV	EV PL 2015	EV PL 2050	EV CZ 2015	EV CZ 2050
Greenhouse gas emission	kg CO ₂ eq	51649	40919	25164	31311	21191
Fossil fuel depletion	MJ	750991	488194	330243	339306	260940
Acidification	kg SO ₂ eq	153	262	147	137	109
Eutrophication	kg PO ₄ eq	45	160	86	149	87
Human toxicity	kg 1.4-DB eq	16611	47094	32554	43304	32464
Particulate matter formation	kg PM10 eq	69	91	65	60	56

Source: (Burchart-Korol et al, 2018)

METODOLOGY OF RESEARCH

Within the project Electromobility in Czech-Polish Cross-Border Area, CZ.11.4.120/0.0/0.0/16013/0001585 ENET Centre, VSB-Technical University of Ostrava cooperated with Faculty of Transport, Silesian University of Technology on the survey of public attitude to electromobility. The survey was aimed at the public of Czech-Polish cross-boarder area including municipalities of Moravian-Silesian Region on side of the Czech Republic and agglomeration of Katowice on side of Poland. Into the survey, the public above 18 years old was included neglecting the gender or education. The methodology of the survey was based on email questionnaire of potential respondents of companies and public institutions as it is applied in other sources (Ingaldi, Ulewicz, 2018). Beside it, personal questioning during university and municipal events was carried out. The questionnaire was created in two language modifications according to the area of its application – in Czech or in Polish. There were questions regarding respondent’s view of electromobility and his/her knowledge about it in the place of his/her living.

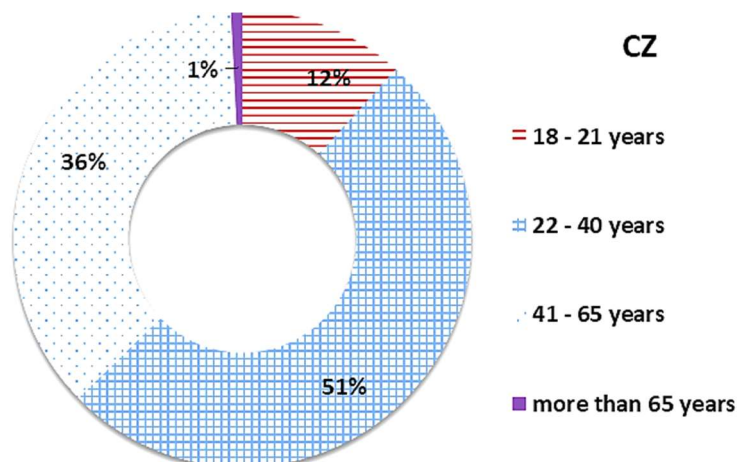


Fig. 5 Respondents’ age of the survey in the Czech Republic

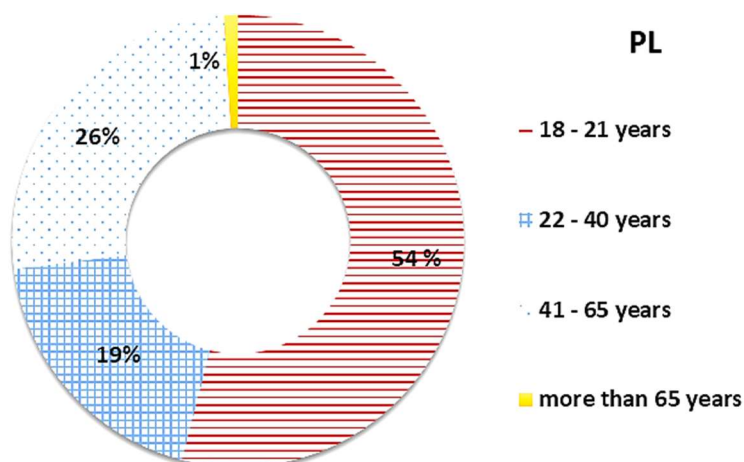


Fig. 6 Respondents' age of the survey in Poland

The respondents had a possibility to record more answers for every question. In total, between August-October 2018, answers of 510 respondents were summed up. On Czech side, 252 respondents were included in the survey, on Polish side 258. Figures 5 and 6 present age of respondents. In the Czech Republic the group which was most interested in it was created by people between 22-40 years old.

In Poland the survey recorded much bigger interest of young people and students between 18-21 years old. This group created 54% of respondents while just 12% in the Czech Republic. It might show enthusiasm of Polish young people in sustainable and environmental-friendly transport.

RESULTS

The recorded answers were summed up in the following figures (Fig. 7-11) presenting the results of the survey in the Czech Republic and in Poland.

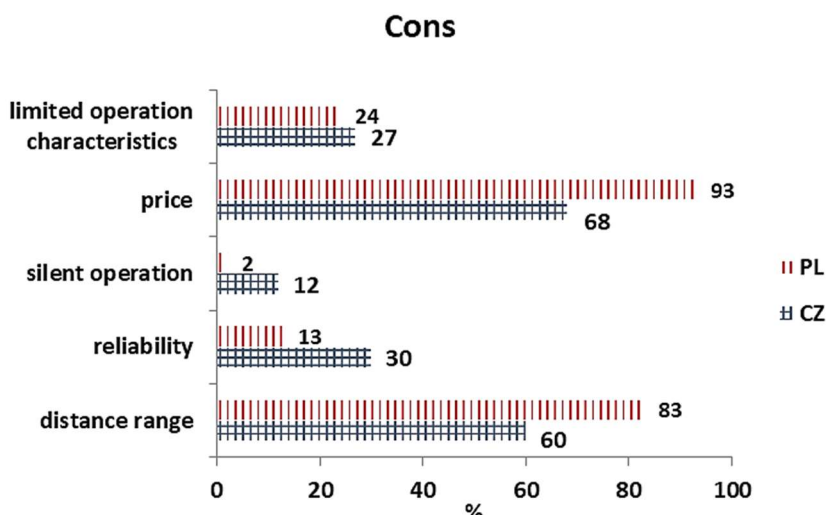


Fig. 7 What advantages of electromobility can you see?

Czech and Polish respondents were asked for several questions which were aimed at the survey of their attitude to electromobility, what advantages and disadvantages they see in it, what plus and minus sides they differ.

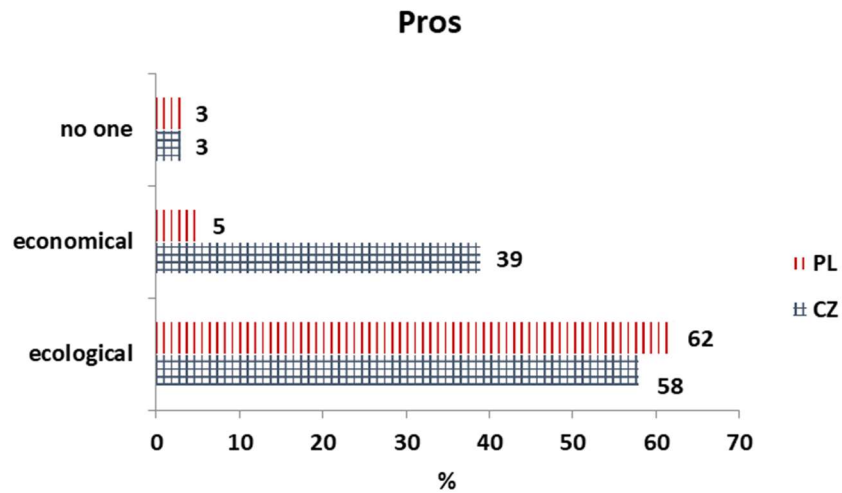


Fig. 8 What disadvantages of electromobility can you see?

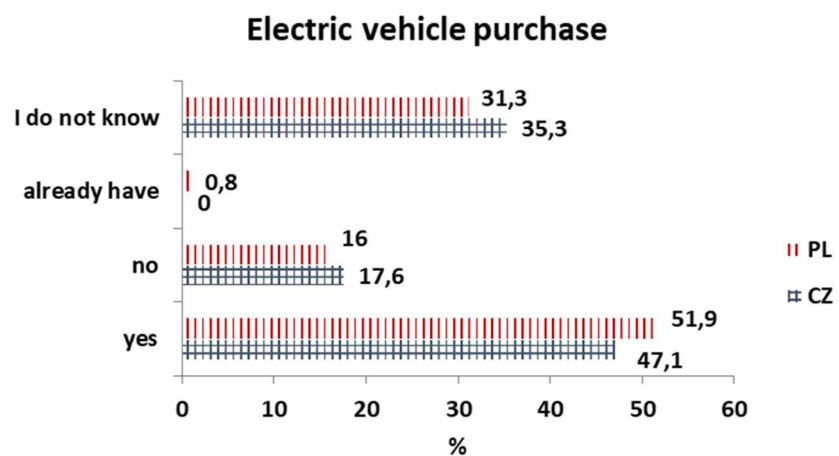


Fig. 9 Do you want to buy an electric vehicle?

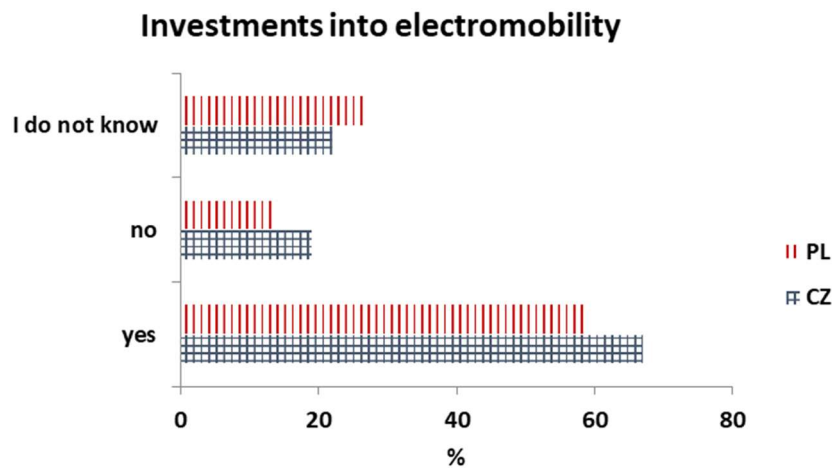


Fig. 10 Do you consider the investments into electromobility to be sufficient?

Following questions of the questionnaire were objected on respondents' willingness to buy an electrical vehicle to differ what obstacles are in it, what concerns they have about it and what slows down electromobility development. The questionnaire also included the questions to define respondents opinion on popularization of electromobility if they are satisfied with its promotion, if they

have sufficient information about possibilities of its development, if they consider the investments into this progressive transport to be sufficient.

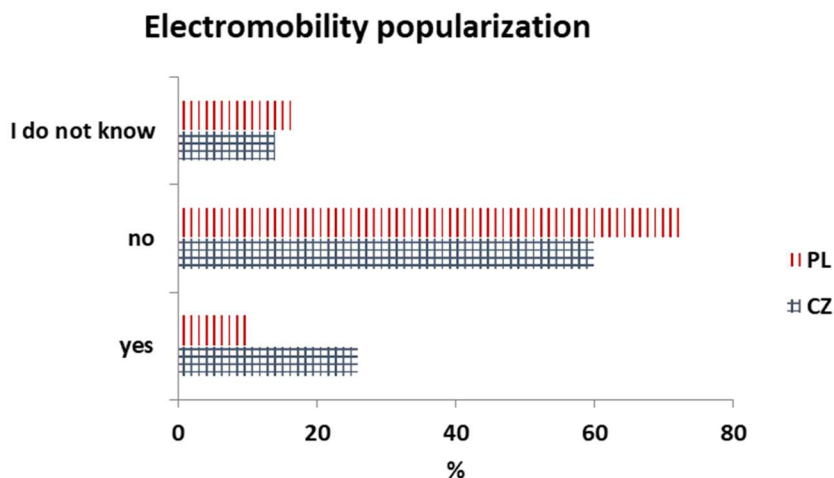


Fig. 11 Do you consider the popularization of electromobility to be sufficient?

DISCUSSION

The results gained during respondents questioning showed several interesting facts. The public opinion was similar in the Czech Republic and Poland. Respondents of both countries consider electric vehicles to be innovative and environmental friendly alternative to conventional transport and appreciate mainly its contribution on the environment in view of less emission and silent operation. 39% of Czech respondents appreciated also economical operation of electric vehicles, which is affected by supportive tools for electromobility development in the Czech Republic. In many public places charging stations have been opened where the electricity provider offers low cost charging just for annual fee. There are employers on which park places their employees are able to charge their electric vehicles free of charge. The survey, on the other hand, reveals many disadvantages which the respondents see in electromobility. The biggest is the purchase price of electric vehicles which is much higher than for vehicle with conventional engine. The results show the respondents willingness to buy an electrical vehicle. Both in the Czech Republic and Poland, the half of respondents are interested in it. There is about 30% on doubts and quite significant amount (17.6% of Czech and 16% of Polish respondents) who strictly reject it. The results show that electromobility is a new technology which is not widely spread. Neither percentage of respondents indicates they have already had an electric vehicle. The opinion of electromobility disadvantages affects it. Respondents are afraid of operation limits of electric vehicles. 13% of Polish respondents are concerned about its reliability, while in the Czech Republic 30% of them. More Czechs also see a disadvantage in the silent operation of electric vehicle which presents danger for pedestrians. 83% of Polish respondents are afraid about distance range of electric vehicle. In the Czech Republic just 60% are scared about it. It is connected with the low popularization of this kind of mobility and lack information about this topic in the society. Nowadays, the market offers vehicles guaranteeing distance range of 500 km. The answers

confirm that the respondents feel lack of information. The respondents consider investments in the development and application electromobility to the municipality and passenger transport system to be sufficient. Both in the Czech Republic and Poland it was about 60% of respondents. 20% of Czech and Polish respondents consider the investments to be low and insufficient for massive electromobility application into daily life.

CONCLUSION

The research carried out on electromobility within the Czech Polish cross-boarder cooperation show some interesting fact. The inhabitants of the area are interested in this new progressive kind of transport which electromobility is. They believe in its ecological contributions and at reasonable price they would buy an electric vehicle for their daily use in spite of worries still remaining in the society about distance range and electric car reliability. Both Czech and Polish respondents indicate lack of information about this technology, which is a clear sign for better and more intensive propagation and popularization of it.

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Abstract.

The chapter deals with results of cooperation within the project Electromobility in Czech-Polish Cross border Area. The electromobility is presented in comprehensive environmental and social background. The introduction is aimed at transport emission of exhaust gases resulting in global warming and harmful impact on the environment quality. The environment analysis is reflected in view of transport and passenger cars production. The chapter presents results of society analysis defining its attitude to electromobility in the region. The methodology of public questioning was chosen to reveal possibilities for electromobility development in Czech-Polish cross border area. The questions of the survey were formulated to record a public attitude and view of electromobility. The respondents' answers reflect their awareness of this new sustainable transport.

Keywords: electromobility, emission, greenhouse gas, society, survey