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Electric Vehicles Market in Poland

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Abstract:

Purpose: *Identification of situations and trends in the electric vehicles market in Poland.*
Design/Methodology/Approach: *The study covers the analysis of the Polish electric vehicles market. Methods of systematic review and critical analysis have been applied. The authors of the study proposed the model of market development established on the basis of data obtained from secondary sources with the use of the Least Squares Method.*
Findings: *In consequence of the carried out study, a segment, geographic and dimension structure of the Polish market of electric vehicles has been determined. We proposed a model of market development in time in the form of the function of a linear trend. It has been proved that in the years 2019-2021, month by month, the share of electric vehicles in the market has increased by 0,016% on average. We obtained good adjustment of the linear trend (R^2=0,68).*
Practical implications: *The obtained results may be the base for the establishment of the strategy in the electric vehicles market for marketing departments as well as sales departments importers of particular brands, especially the planning of the sale advertising campaign. This is particularly important when taking into consideration present fluctuations in production and sale of vehicles.*
Originality/Value: *The novelty element is the synthetic establishment of present situation and identification of trends in the market of electric vehicles in Poland.*

Keywords: *Battery Electric Vehicle, Market.*

JEL codes: *M31, O14, O33.*

Paper Type: *Research study.*

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1. Introduction

A vehicle has become a fundamental attribute of developing societies and one of the most important goods, thanks to which people may increase their mobility and improve the comfort of travelling. Popularizing a vehicle as a mean of transport is often named as *The first automotive revolution* (Freyssenet, 2009). In 1960 there were around 100 million cars in the world. In 1990 the number increased up to 450 million in order to reach 1 billion in 2017 (Davis and Boundy, 2020). It is worth emphasizing that on the turn of the 20th and 21st century the achievement of this level was expected to emerge in the year 2030 (Urry, 2004).

The market of passenger cars is an important part of every developed economy (Stryjakiewicz *et al.*, 2021) due to: (1) the share in the volume and value of the turnover, (2) the share in the National Gross Product, (3) the scale of employment and (4) the introduction of innovations. Development of the automotive sector is connected with a number of social, economic and environmental consequences. Systematic increase of the need for transportation required taking up actions which allowed for the limitation of its negative effects. It is expected that in the future in accordance with the adopted transportation policy within the scope of the minimization of the emission of harmful substances, the electric motor vehicles should be one of the most important means of public as well as individual transport.

This results mainly from the achievement of one of the goals included in the *White Paper on Transport* (2011),which assumes the reduction of the half of the vehicles with conventional drive in the urban transport by the year 2030 and the elimination of the above mentioned vehicles from the cities by the year 2050.

Due to the volume of sale, development dynamics and consequences, the passenger car market is the object of the analyses conducted by the researchers representing various scientific disciplines. The analysis of literature allowed to indicate two groups of publications concerning the market of the passenger cars. Firstly, in Poland in publications written in the years 2011-2018 this topic was discussed by Moćko (2011), Wojciechowski and Ornowski (2011), Merkisz-Guranowska and Stańko (2014), Waśkiewicz and Gis (2014), Ambroziak (2015), Gis, Menes, and Waśkiewicz (2015), Sendek-Matysiak (2018), Łosiewicz and Sendek-Matysiak, (2018). Secondly reports concerning foreign or global market prepared by Gawilokowska-Fyk (2017), Kosowska (2018), Czuba, Konewka, and Krasowska (2019), Munzel *et al.* (2019), Du and Ouyang (2017), Palencia *et al.* (2017), Teure (1980) and Austmann (2020), are available.

The above mentioned positions concerning the Polish market, were published in the years 2011-2018, whereas the publications concerning the domestic market, are lacking in the foreign literature. Thus it has been considered that this issue deserves a scientific elaboration and in consequence the continuation of the study concerning

the domestic market. Due to the above, the purpose of this paper is *the identification of situations and trends in the Polish market of electric vehicles*.

2. Electric Vehicles – Facts and Numbers

Definition of an electric vehicle (BEV – Battery Electric Vehicle) refers to the unit which is in 100% operated by the battery. The electric vehicle is a road vehicle in which the energy is transformed by an electric machine into mechanic energy used for the drive. The unit is powered by energy coming from the deck source, most frequently by batteries (Encyklopedia PWN, 2021). According to the *Act on electromobility and alternative fuels* (Journal of Laws of 2018, item 317) the electric vehicle is a motor vehicle according to article 2 point 33 of the *Traffic Law Act* (Journal of Laws No. 98, item 602, 1997), which for its drive uses only the battery energy being connected with the external source of power. Moreover the electric vehicles have specially marked registration plates (Journal of Laws of 2018, item item 137 and may move on the lanes intended for the buses. Electric passenger cars pursuant to the *Excise Tax Act* (Journal of Laws of 2017, item 43, 60, 937, 2266 and of 2018 item 137) have been exempted from the excise tax.

Electric vehicles attract increasing interest, new models of already recognizable brands are constantly appearing in the market. Table 1 presents advantages and disadvantages of vehicles powered by energy.

Table 1. *Advantages and disadvantages of electric vehicles*

Advantages	Disadvantages
Increased efficiency – higher performance	High price
Lower failure rate (the construction of BEV engine is simple)	Limited number (and the network) of loading stations
Quiet functioning of the engine	Necessity of frequent loading
Simple operation	Repairs only at specialist service stations
Stable exploitation costs (the prices of Energy are more stable than the prices of fuel)	Necessity of grating a loading station (optional)
Long battery vivacity	Lower comfort of the ride (e.g. resignation from air-conditioning in favor of larger range)
Eco-friendly engine (possibility of using renewable energy sources and lack of the emission of toxic substances into the atmosphere)	Higher consumption of energy in low temperatures
Maximum comfort of exploitation	Silent engine operation (other participant of the road traffic can't hear the car)
Purchase subsidies (ecology-firendly granting)	
Possibility of entering limited traffic zones	
Higher safety level in case of an accident	

(no fuel- no risk of explosion)	
Possibility of driving on the *bus lanes*	
Separate often free of chargé parking places	

Source: *Author's own study based on: http://car-master.com.pl; http://elektromasters.com.pl; http://autotesto.pl; http://moje-auto.pl; http://motocontroler.com.pl; http://autoswiat.pl.*

The analysis of advantages and disadvantages presented in Table 1 and information available on specialist services allows to indicate higher performance (high torque), stabilized (prices of energy are more stable than the fuel prices) costs of exploitation and *ecology-friendly feature* as the most frequently named advantages of electric vehicles. Among disadvantages the majority of indications concerned the high price, necessity of frequent loading and limited range of electric vehicles. It should be emphasized that the low level of noise (quiet engine operation) has been indicated both as a strong (high usage standard) and weak (greater risk of an accident as the other traffic participants can't hear the engine) feature of electric vehicles.

3. Research Methodology

The empirical research, the results of which are presented in this paper, has been carried out with the use of systematic review and critical analysis of source texts, which are the techniques typical of the quality analyses (Jemielniak, 2012; Kostera, 1996; Juszczyk, 2013; Filck, 2012; Charmaz, 2009). After Bentkowski (2006) the research area was focused on the identification of trends existing in the Polish market of electric vehicles.

Table 2 presents the procedure of preparing and conducting empirical research divided into particular tasks as well as methods, tools and techniques of their realization.

Table 2. *Research procedure*

No.	Task	Methods, techniques, tools
1.	Conceptualization of the research area (identification of the research problem)	Systematic review and analysis of literature
2.	Selection of research sample	Purposive selection
3.	Conduct of empirical research	Review and analysis of identified bibliography positions
4.	Analysis and interpretation of results	Semantic and comparative text analysis
5.	Conclusion	Synthesis and generalization

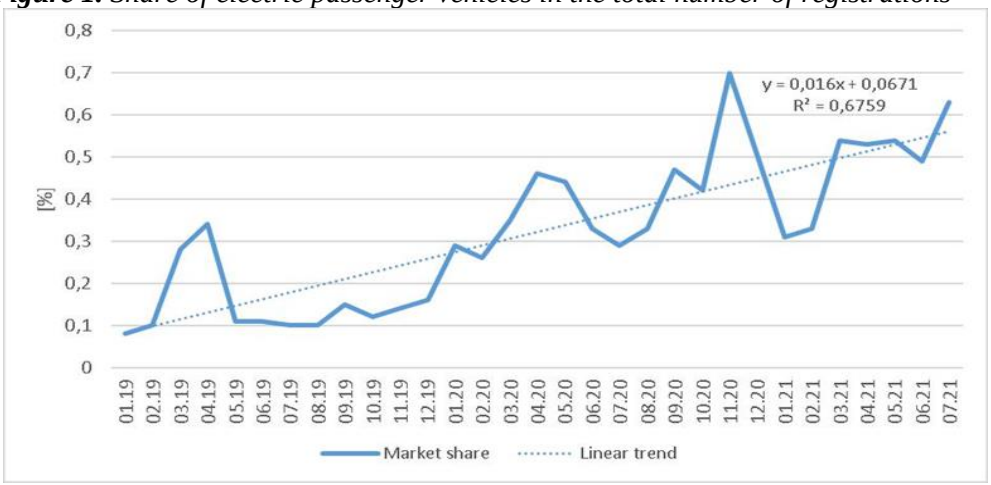
Source: *Author's own study.*

In the empirical part, the review covered 46 bibliography positions in the form of complex elaborations, scientific articles, regulations of government programs, Internet websites, reports of research institutes and commercial units.

4. Structure of the Market of Electric Vehicles in Poland

The analysis of data taken from *Elektromobility meter* kept by PZPM (Polski Związek Przemysłu Motoryzacyjnego – Polish Association of Automotive Industry) and PSPA (Polskie Stowarzyszenie Paliw Alternatywnych – Polish Society of Alternative Fuels) proves that in Poland at the end of September 2021, there were 31 633 electric passenger cars registered. In this part of vehicle park BEV units constituted 48% (15 255). In the same period of the last year this number amounted to 6056 cars, therefore an explicit increase of the share in the general number of used vehicles is visible (Electromobility meter, 2021). Figure 1 presents the share of passenger electric vehicles in the total number of registrations.

Figure 1. *Share of electric passenger vehicles in the total number of registrations*



Source: *Author's own study based on http://300godpodarka.pl.*

The analysis of data presented in Figure 1 proves that in 2019 the electric passenger vehicles constituted less than 0.1% of the number of registered units. On the turn 0f the year 2020 and 2021 the share of electric vehicles in the total number of registrations grew up to 0.7%. The model of linear trend was created with the use of Least Squares Method. In consequence it has been stated that in the analysed period, month by month, the share of the electric vehicles increased by 0.016% on average. It has been proved that the identified trend is linear and the adjustment of the model should be deemed good (R^2=0,68).

Electromobility in Poland is intensely developing only in few places. Since 2019, 80% of electric vehicles has been registered only in seven voivodships (Masovian, Lesser Poland, Upper Poland, Silesian, Łódzkie, Lower Silesian, Pomeranian

voivodship). The largest group, almost 25% has been reported in Masovian voivodship and the smallest in Łódzkie voivodship and Pomeranian voivodship – 7% (http://300godpodarka.pl).

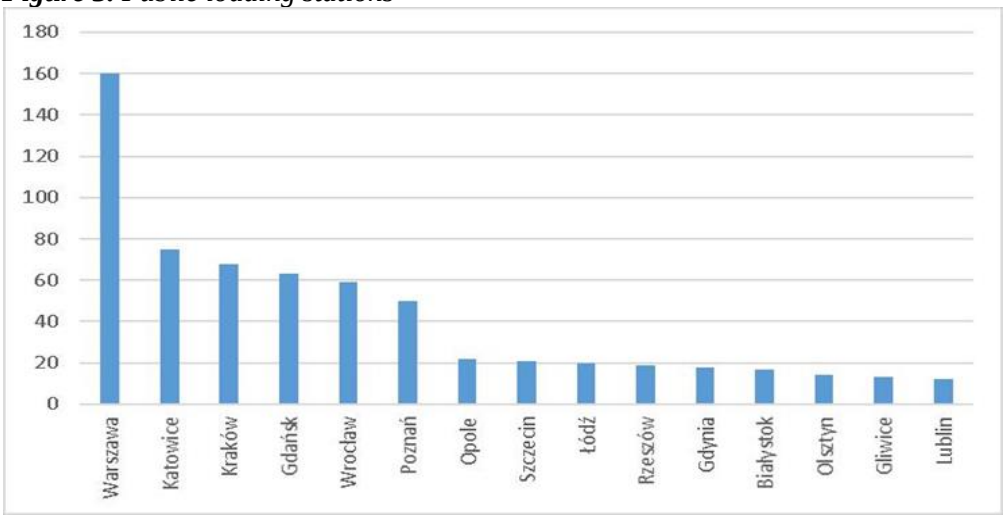
Table 3. *Electric vehicles with the widest range*

Make, model	Range (km)
Tesla Model S	652
Tesla Model 3	580
Tesla Model X	561
VW ID.3	549
VW ID.4	500
Hyunadi Kona electric	484
Jaguar I-Pace	470
BMW iX3	460
Kia e-Niro	455
Kia e-Soul	452

Source: *Author's own study based on http://e-autokult.pl; http://naprądzie.pl.*

A small percentage of the share of units with electric drive in the total number of the cars is caused by a relatively high prices of the cars (Table 6) and limited accessibility of the loading points. The ranking of the vehicles with the widest range is presented in Table 3 above. Today in Poland there are 1719 public loading stations of this kind (http://pspa.com.pl). The number of loading stations divided into cities, in which they are situated, is presented in Figure 2.

Figure 3. *Public loading stations*



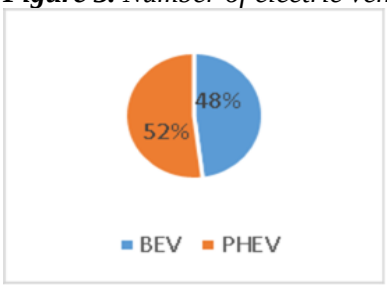
Source: *Author's own study based on http://pspa.com.pl.*

The analysis of the above diagram shows that the biggest number of loading stations for electric vehicles is located in Warsaw – 160. Almost 100 stations is situated in

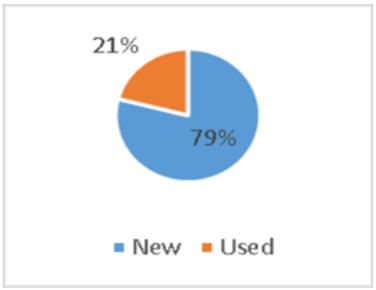
Katowice, Wrocław, Kraków, Poznań and Gdańsk, around 60 stations in each city. The smallest number of loading stations is in Gliwice (15), Lublin (16) and Białystok 918).

Figure 3 presents the number of units with electric drive in the national market with consideration of (1) type of the vehicle, (b) state of a vehicle at the moment of purchase, (c) the origin of the vehicle and (d) type of ownership.

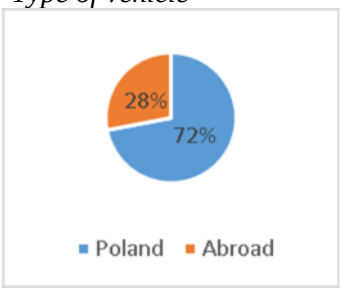
Figure 3. *Number of electric vehicles registered in Poland*



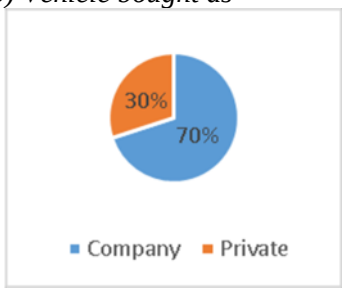
a) Type of vehicle



b) Vehicle bought as



b) Vehicle bought from



d) type of owner

Source: *Author's own study based on http://automotyw.com; http://pspa.com.pl.*

The analysis of information presented in Figure 3 proves that 79% of cars among the total number of electric vehicles registered in Poland are the brand new units, 72% of the cars is form the domestic market and 70% of the cars is the ownership of the companies.

5. The Size of the Market of Electric Vehicles in Poland

Table 4 includes data concerning the number of electric vehicles most frequently registered in Poland. The analysis of information presented in Table 5 shows a significant increase of the number of cars registered in 2020 compared to the analogous period in the year 2019. Among the models, which unchangeably keep the 2nd and 3 rd position in the ranking are Nissan Leaf and Renault Zoe. The largest decrease has been noticed for BMW i3 (2019 – 603 cars., 2020 – 205 cars).

Table 4. *The number of electric vehicles most frequently registered in Poland*

2019		**2020**		**2021***	
Make, model	Number (item)	Make, model	Number (item)	Make, model	Number (item)
BMW i3	603	Skoda Citigo e	516	Renault Zoe	23
Nissan Leaf	106	Nissan Leaf	491	Mercedes EQC	23
Renault Zoe	50	Renault Zoe	355	Peugeot e-208	17
Jaguar I-Pace	43	Mazda MX30	222	Audi e-tron	14
Audi e-tron	42	Kia e-Niro	210	Tesla Model 3	11
VW e-Golf	27	Hyundai Kona	206	Fiat 500 e	8
Hyundai Kona	23	BMW i3	205	Nissan Leaf	6
Tesla Model 3	16	Mercedes EQC	191	VW ID.3	6
Tesla Model S	10	VW ID.3	189	Peugeot e-2008	5
Tesla Model X	8	Opel Corsa e	159	BMW i3	5

Note: ** state as of 31.01.2021;*
Source: *Author's own study based on http://e-autokult.pl; http://naprądzie.pl.*

As it was mentioned above, the most frequently indicated disadvantage of an electric vehicle is its high price. The prices of the cars with electric drive is presented in Table 5.

Table 5. *Prices of electric vehicles in Poland – state as of 31.07.2021*

Segment A and A-SUV			
Make, model	Price* (zł)		
Dacia Spring el	84 700		
Smart EQ For Two	96 900		
Smart EQ For Four	98 400		
Segment B		**Segment B SUV**	
Make, model	Price* (zł)	Make, model	Price* (zł)
Renault Zoe	124 900 – 147 400	Hyundai Kona electric	118 800 – 201 900
Peugeot e-208	124 900	Kia e-Soul	139 990 – 160 990
Mini Cooper SE	142 000	Opel Mokka e	142 800
BMW i3	169 700 – 184 200	Peugeot e-2008	149 400
Opel Corsa e	132 490		
Segment C		**Segment C SUV**	

Make, model	Price* (zł)	Make, model	Price* (zł)
Nissan Leaf	123 900 – 157 600	Mazda MX-30	142 900
Citroen e C4	137 400	Kia e-Niro	146 990 – 167 990
VW ID.3	139 990 – 185 790	VW ID.4	160 990 – 226 190
Hyundai Ioniq	180 200	Skoda Enyaq	184 400 – 216 900
electric			
		Audi Q4 e-tron	195 100 – 219 100
		Mercedes EQA	199 900 – 235 800
Segment D		**Segment D SUV**	
Make, model	Price* (zł)	Make, model	Price* (zł)
Kia EV6	179 900 – 216 900	Porsche Tycan	389 000 – 463 000
Tesla Model 3	199 900 – 269 900	Tesla Model S	395 990 – 569 990
BMW id 4	245 200	Audi e-tron GT RS	445 230 – 599 230
Segment E		**Segment E SUV**	
Hyundai Ioniq 5	189 900 – 239 900	Audi e-tron 55	308 400 – 426 200
Ford Mustang Mach E	216 120 – 286 310	BMW iX xDrive	357 900
BMW iX3	268 900	Tesla Model X	434 990
Tesla Model Y	275 173		
Mercedes EQC	299 000		
Jaguar I-Pace EV	364 000		

Note: ** base prices taken from configurators and price lists*
Source: *Author's own study based on http://elektrowoz.pl.*

The analysis of data included in Table 5 shows that the lowest price – PLN 76 900 was reported for the car Dacia Spring electric, and the highest for the car Audi e-tron GT RS – PLN 599 230. Three models, Nissan Leaf, Kia e-Soul and Hyundai Kona electric are included in the price range between PLN 120 000 – PLN 150 000. Taking into consideration the costs of additional payments to the electric vehicles (program My electric) among the models whose price does not exceed PLN 225 000 we may indicate, VW ID.4, Skoda Enyaq IV, Audi Q4 e-tron and Tesla Model Y. Model of premium makes such as Tesla (Model Y i V), Ford (Mustang Mach), BMW (Xi3, i4), Porsche (Tycan), Mercedes (EQC) and Audi (e-tron GT) are above this price threshold.

Due to relatively high purchase prices (Table 6) electric vehicles constitute a small percentage of vehicles on the Polish roads. In 2021 within the framework of the National Fund for Environmental Protection and Water Management another subsidies program called "*My electric*" has been launched (Electromobility, 2021).

The purpose of this enterprise is the avoiding of the increased emission of pollution by way of giving support for the purchase of zero-emission vehicles, among others electric vehicles. This project is not brand new, it is another opening of an enterprise established in 2020. In this year the novelty is the possibility of purchasing a car in the form of a *leasing* (http://superauto.pl).

In the current edition of the competition, the value of the payments amounts to PLN 18 750 for physical persons; in this group the owners of *Large Family Cards* may be granted higher funding.– PLN 27 000. The remaining petitioners (who are not physical persons) obtain subsidies the amount of which depends on the category of a vehicle and declared annual mileage.

The amounts of subsidies are included in the range PLN 27 000 – PLN 70 000 (http://muratorplus.pl).

6. Conclusions

Electric vehicles, despite numerous disadvantages enjoy constantly increasing interest among consumers in the Polish automotive market. According to data taken from the *Electromobility Meter* over 30 000 cars have been registered in Poland. Nissan Leaf and Renault Zoe are the three most frequently registered models.

The analyzed market is developing in distinct linear trend. In the last two years, month by month, the share of the electric vehicles in the entire market has been increasing by 0.016% on average.

The greatest problem of the purchasers of electric vehicles is their high price. The cheapest electric vehicle available in the Polish market is Dacia Spring el and its price is PLN 84 700. Limited number (and network) of loading stations is another weakness of electric vehicles. If a vehicle is used in urban conditions the range of 400 km is not a problem, however when the owner has to drive longer distances this may constitute a significant purchase barrier. Stabilized costs of exploitation are a considerable advantage, because the prices of energy are more stable than the prices of other fuels, as well as the *ecology-friendly* features of the vehicle.

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