

ANALYSIS OF INVESTMENT STATE SUPPORT FOR THE ELECTRIC VEHICLES SECTOR

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ABSTRACT

The following work captures the spectrum of offered incentives for stimulating the electric vehicles uptake in the most significant economies of the world. The paper contains description of popular means of stimulation along with the effects that they have taken on the society and local economies. After an in-depth analysis the evaluation model was developed which assigns weight to each and every factor in the specific national incentive program. The sum of gathered points gives the overall view of the efficiency of introduced program. As a result, different national programs can be compared against each other and the important conclusions can be drawn. Most importantly the Polish act for alternative fuels and electromobility was analyzed and compared to other incentives used by different countries around the world.

Introduction

The ultimate goal of this work is to capture the electric vehicles incentive and subsidy programs and evaluate their effects on market stimulation. The world leading economies in terms of electric vehicles adoption were chosen and their support programs were analyzed. The key components from existing support programs were analyzed taking into account their potential of influencing potential electric vehicle users and the related rating was assigned

to each component. The sum of rated components gives overall strength index for each national subsidy program. The questionnaire based study showed the most important factors for electric vehicles stimulation, are cash subsidies and tax reliefs. The Polish electromobility act was analyzed and compared against the other programs. The assumption can be made that Polish electromobility act will have a positive influence on the market. However it is difficult to evaluate if currently proposed program is enough to popularize electric vehicles in Poland.

The electric vehicle market is facing a number of challenges. Aside from the technological barriers relating to the infrastructure and the vehicles themselves, the issues of the initial up-front cost, potential servicing costs, and the residual value, still remain. For those reasons, governments wanting to facilitate the transition from the conventional automotive market are creating support initiatives, increasing the financial viability of electric vehicles. Currently, most of the government support initiatives relies on tax exemptions. This approach, however, might prove insufficient for the Polish consumer; especially when one considers the current state of the Polish economy and the consumers' view on electric vehicles. Japan was the first to start introducing such government initiatives in 1978, which led to 655 electric vehicles being introduced to the market. In 1996, the Japanese Ministry of Trade and Industry commissioned the Clean Energy Vehicle Introduction Project. As a result, between 1998 and 2002, approximately 40 000 electric and hybrid vehicles were built for the Japanese market. Financial incentives reached 50%. (Electric Vehicle Association of Asia Pacific, 2003). Such initiatives have existed for a number of years now. However, it wasn't until Tesla Motors came about for the world of electric vehicles to undergo the transformation it has seen in the past few years.

Review and Analysis of support programs in selected economies

Norway

Norway is the leading country in the world in terms of programs that stimulate the development of electromobility in both financial and non-financial terms. From the financial sphere, the legislator offers such reliefs as exemption from the 25% VAT tax or exemption from the purchase tax, which makes it more cost-effective in the Norwegian market to buy an electric car than an internal combustion vehicle. To compare, the cost of purchasing a combustion car with performance comparable to the Tesla model S will translate into a tax on the purchase in the amount of 100% of the price. (Harryson, 2015, pp. 5–6). It should be noted, however, that Tesla Motors products are often not classified in subsidy programs. It is worth mentioning, that the phenomenon of imposing high fiscal burdens when buying a car should be considered as a general penalization of the ownership of an internal combustion vehicle rather than a relief for the owners of electric cars.

Another benefit is a significantly reduced road tax, which in the case of electric cars is only NOK 455, while for petrol cars about NOK 2,800 per year (Pressman, 2017). In the case of enterprises, a 50% discount is offered for car fleet tax and increased costs of using an electric car at 4.20 NOK per km for electric vehicles and only 2.0 NOK per km for conventional vehicles which translates into lower taxes. For those who use company cars for private purposes, a 50% discount on additional income is also provided (Harryson, 2015, pp. 5–6). There is also a wide range of discounts, facilitations and tax exemptions such as no fees on toll roads, no fare for ferry crossings, free parking in urban areas, no tolls for bridges, no charge for selected charging stations, access to bus lanes, exclusion from charges in high traffic areas. The offered range of reliefs and redundancies is very wide and it should be remembered that they were introduced gradually over

many years, the first relief in the form of exemption from purchase tax was introduced in 1990 and the last in 2015 concerned exemption from VAT in the case of leased vehicles. The electric vehicle market in Norway is already mature enough that a slow withdrawal from the offered programs is planned, and tax breaks will only be available until 2018. And since 2017, local government units themselves decide on the behavior or reception of such facilities as free parking lots or access to bus lanes. No fees on toll roads will be replaced by reduced fees (Haugneland, 2017, pp. 6–8). The Norwegian government has set a goal that by 2025 all cars sold in this country are to be low-emission vehicles, which will lead to an even stronger penalization of non-ecological solutions.

Netherlands

There are many support programs available on the Dutch market both at the level of local authorities and central authorities. In early times, a vehicle tax exemption was offered there, but in 2014 such support was withdrawn in favor of a 4% registration tax. Currently, the market offers exemption from road tax, a subsidy of EUR 3,000 for commercial vehicles, exemption from vehicle purchase tax, exemption from road tax, concessions for fleet vehicles. Locally offered support programs include, for example, free parking lots, subsidies for the installation of home charging stations or a prize for scrapping the combustion car. In this way, the most popular models of electric cars are cheaper by 50/70% compared to the initial price

China

China is the country with the largest growth in sales of electric vehicles in the world and remains the largest car market in the world. In September 2017, the previous record of electric vehicles sales reached the level of 55,000, which translated into a 68% increase compared to the same period last year, same to September 2017 reached the level of registration of electric cars at the level of 282,000 (International Energy Agency, 2017). It is anticipated that by the end of 2017 China will achieve a market share of electric vehicles exceeding 2% (Pontes, 2017) which, in the case of such a large economy, is a very good result. China is set to ambitious targets for electrification, BYD, the largest manufacturer of batteries and cars in the world, predicts the total electrification of the Chinese market by 2030. China lags behind (in terms of percentage share) only to Norway, the Netherlands, and Sweden, where shares of electricity vehicles for 2016 were 29%, 7% and 4% respectively, and to better understand the phenomenon of the Chinese market, sales between PHEV and BEV should be divided, then it will become clear that China is a definite leader and together with France are markets oriented at Pure electric cars. China owes such rapid development to policies conducive to the popularization of electric cars, a very large battery industry, relatively small restrictions on environmental protection in production and, most importantly, the simplicity visible on the Chinese market, the vast majority of sold solutions significantly lags behind the products offered in the west. In the case of development factors related to the legislation, the release of electric vehicles from the registration lottery remains the basic one. Beijing draws 18k vehicles per month for which registration will be issued, with a monthly demand of approx. 1.8 million. However, in the case of electric cars, some restrictions have been introduced due to the efficiency of the power grid (Chun, 2016). The efficiency of power grids will determine the development of electric vehicles for each of the world's economies.

China offers a lot of subsidies in its strategy, including a surcharge on the purchase of a car at around \$ 10,000 for pure electric cars and \$ 6,000 for hybrid cars. Hangzhou residents can count on a surcharge of up to \$ 20,000.

Unfortunately, due to the fact that the Chinese market is protected, many types of cars are not eligible for subsidies and concessions. This may lead to the slowdown in the growth of Western brands in Asian markets.

Another of the discounts offered is the exclusion from 10% sales tax on all brands, regardless of origin. The Chinese government has decided that some of the western brands will be excluded from paying the import tax, with this kind of relief being offered only to joint venture producers with Chinese producers. The last of the offered concessions on the Chinese market is the exemption from charges related to street congestion. In many areas, other subsidies for electric vehicles are also offered for 3 years after purchase or 60,000 km.

It should be remembered that apart from purely fiscal and financial reliefs, China has invested \$ 14 billion since 2014 in the development of infrastructure for electric vehicles.

The negative effect of broad financial support on the purchase of electric vehicles has caused the effect of electric car price rises, and so Zotye or Zhi Dou products without discounts are sold at prices around EUR 20 thousand, which is not an attractive offer even compared to products of western companies. (Price: EUR 15 thousand with batteries).

France

The offered discounts include, among all, an ecological bonus for pure electric vehicles in the amount of EUR 6,000. In 2015, there began a program for the support of the exchange of old cars with a diesel engine into new electric vehicles; it took the form of an ecological bonus amounting to EUR 10,000. Apart from typically financial programs of support, there are also such facilitations as free access to parking lots or tax reliefs in the installation of chargers in residential areas. Many of the Regions of France offers their own programs of support for electric vehicles. France is one of the leading economies of the EU in terms of the prevalence of electric cars as well as vehicles in L7E and L6E homologations.

Denmark and Sweden

In the case of Sweden, discounts were offered for the purchase of new electric cars and ultra-low-carbon cars at a level of 50 grams per km. Cars with energy consumption below 37 kWh/100 km and cars with emissions below 120 grams per 1 km were exempted from road tolls for the first 5 years from the date of registration. Users of company cars for private use could enjoy a tax reduction of around 40% compared to conventional cars (Desk, Lifestyle, 2011). However, in 2014, the limit of 5,000 registered new green cars was exhausted and the program was completed (BIL Sweden, 2014), where the association of the car industry in Sweden applied for the extension of the program by another 100 million crowns, which would allow for the financing of another 2,500 cars (BIL Sweden, 2014). As a result of these efforts, the program was extended for next years until 2016.

In the case of Denmark, the available concessions and facilities are limited due to the rich and preferred cycling infrastructure in the Copenhagen region, which represents the majority of the Danish population. The most important reliefs were the exemption from 180% of tax on the purchase of a car which should be considered more in the case of the penalization of car purchases than promoting the purchase of electric cars, the discount applies only to cars with normal parameters which excludes Tesla cars from among the indirect beneficiaries. The remaining discounts include, among other things, exemption from the ecological tax and access to car parks only for electric vehicles.

Germany

The current support policy for the popularization of electric cars is not enough to achieve the 1 million cars planned by the German government by 2020. In connection with the above, the German government planned to work on subsidies for electric vehicles in 2015/7. Until 2014, implementations of the electric fleet were achieved only at the level of 24% of the planned 100,000 vehicles. In the case of leaving the market without state initiatives, it is anticipated that the German economy will be delayed by about 40% by 2020 relative to the initial plans. Many of the studies on the German market state that the average user pays more taxes in this country with an electric car than if they had an combustion one.

Subsidies available in Germany are a temporary exemption from annual road tolls for a period of 10 years from the date of the first registration of the vehicle. Free parking spaces and access to bus lanes for some low-emission vehicles.

Comparative analysis of States

Table 1. General information on electric vehicles market

	NO	CN	NL	UK	FR	DK	SE	DE
General Information								
Total population	5,086	136,9811	16,775	64,100	66,000	5,627	9,621	81,254
Total Evs	74,583	203,345	63,658	43,000	25,000	6,000	14,344	30,000
Evs per 100.000	1,466	15	379	67	38	107	149	33
EV Growth %								
2012–2013	>70	>20	>400	>100	–	–	>50	>100
2013–2014	>300	>235	>160	>120	–12	>250	>95	>75
2014–2015	>70	>75	>55	>75	>65	>120	>75	>40
Total EV Chargers (2014)	6,841	17,254	15,088	2,842	6,000	1,200	909	14,844

Source: Harryson (2015).

Analyzing the available support programs and their effects, we can clearly see the impact of fiscal exemptions on increasing the share of electric vehicles on the market. When we examine the market in 2012 and 2013, we observe a large increase in countries such as the Netherlands and Norway. In these countries, a significant share in the cost of car purchase has taxes reaching even 100% of the initial price. A large share of taxes in the cost of car purchases translates into measurable effects of fiscal subsidies in the form of an increase in the market for low-emission vehicles. Impressive increases for the years 2012–2013 also concern China, where a 20% change translates into a large volume of vehicle sales. Analyzing the years 2013–2014, we see increases of hundreds of percent, which clearly stems from the policy aimed at reducing the costs of owning an electric vehicle.

In the case of leading states, we are dealing with such a large discount of electric cars that the cars are no longer competitive. One example is the comparison on the Norwegian market of a Renault Clio available for around EUR 26 thousand, with its electric counterpart Renault ZOE, taking into account all subsidies, it will cost only EUR 23 thousand. (Harryson, 2010, pp. 10–11)

The organization of fiscal burdens presented in Figure 1 shows the essence of the policy pursued in Norway. The completely reverse structure is in Germany, where the weak impact of subsidies on strengthening the competitiveness of electric cars is visible. In order to obtain the same effect as Norway, the German state would have to subsidize cars with real money. In the case of Scandinavian countries, it is enough to apply tax breaks to make the purchase more attractive than buying a combustion car. It should be remembered that this kind of surgery is possible only because the Scandinavian countries use significant fiscal burdens.

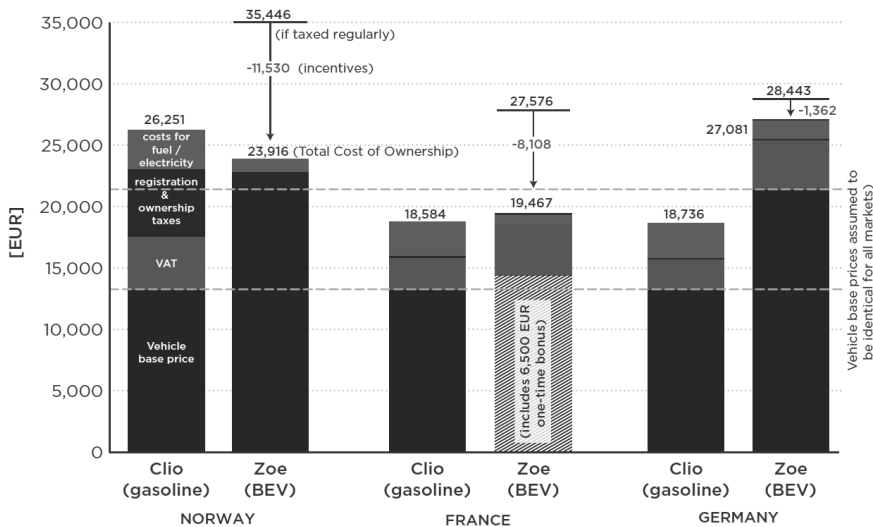


Figure 1. Subsidy influence on car cost – gasoline vs electric

Source: Mock (2014).

Currently in the world, each of the leading economies is working on electrification of transport mainly through various types of subsidies, reliefs, redundancies, facilities and incentives. Regardless of the type of support offered, they have a positive impact on market development. It should be remembered that the main factors hampering the market development are prices, electric car parameters and lack of infrastructure, these elements cannot be compensated only by support programs based mainly on tax concessions. To support the further development of low-emission vehicles, it is necessary to support the research and development sector electromobility also for large companies in the automotive industry. It should be remembered that the transformation of the market into electric cars will affect all companies in the automotive industry, in particular for companies well-established on the market of conventional solutions. In the future, these factors will also have to be addressed to prevent possible crises caused by the elimination of combustion engines and fossil fuels.

Analysis of the Polish Act on electromobility and alternative fuels

The comment below applies only to the part of the Act on electric vehicles, omitting other alternative fuels.

Table 2. List of positive and negative factors, own study

Positive	Negative
<ul style="list-style-type: none"> – Exemption from excise tax – Depreciation of 30 k EUR (Article 52) – No building permits required – Expansion of the electric fleet of public sector entities and state administration – Expansion of infrastructure charging 6,000 low and medium power stations and 400 high power charging point – New type of business – vehicle loading services (Article 54) – Timely available bus lanes (but most likely for more than one person in the car) – Electrification of public transport – GDDKiA 5-year infrastructure development plan – Public buildings, multi-family residential buildings and associated parking spaces are designed and built to provide connection power that allows them to be equipped with charging points of at least 3.7 kW – Register of Alternative Fuels Infrastructure – Reduction of fees for OSD connections – Parking spaces for EV – Definition of research on autonomous vehicles 	<ul style="list-style-type: none"> – No VAT exemption (VAT exemption practically applicable worldwide) – Clean transport areas – the obligation of OSD participation (interpretation) – Division operator, service provider, DSO, salesperson – a lot of intermediaries – Counters at each charging point – Charging station as a construction object – The Act regards only the future fleet of charging stations, omitting the existing infrastructure

Source: own study based on the Polish act for alternative fuels and electromobility.

Depending on the interpretation (interpretation of the charging point), the Act introduces the obligation to install a meter at each of the charging points, which may mean the counter on each of the charging station's connectors. In the solutions available on the market, the certified/sealed energy meter is installed in the place of connection to the power grid and the distribution for individual links is carried out by the station's IT system.

The Act imposes an obligation on the operators of generally accessible charging stations to provide services by Distribution Network Operators, which complicates the operation of the charging stations already established. The Act does not provide for charging stations using existing connections in hotels, shopping centers and other facilities. The obligation to join OSD will exclude some of the existing charging stations and forcing the use of a connection provided by energy corporations, which may lead to a longer development time of the charging network.

The Act introduces a multi charging provider services model by enabling the operation of many service providers on one physical infrastructure element under the same conditions. "The operator of the Public Charging Station (...) provides the charging service providers with access to the public charging station on an equal basis" (Ustawa o elektromobilności i paliwach alternatywnych..., 2018) what in interpretation may mean that the operator must support different service providers at the same prices, it should be remembered that each of the service providers can differentiate their offer, which in the end may lead to the creation of new cost factors on the part of the charging station operator. This solution gives the end users of the charging station a lot of flexibility and gives the opportunity to limit the number of accounts and billing, while maintaining a large coverage of the charging station grid in Poland.

Evaluation model of electric vehicle support programs

On the basis of the above study, data obtained from interviews with people interested in the electric car purchase and statistical data from Figure 2, it was established that the most important factors for potential users of electric vehicles are tax exemptions and cash subsidies for buying an electric vehicle, that is, realistically reducing the cost of owning an electric car, these factors were assigned a weight equal to 20 points. The remaining financial and non-financial elements were assigned scales equal to 5 points.

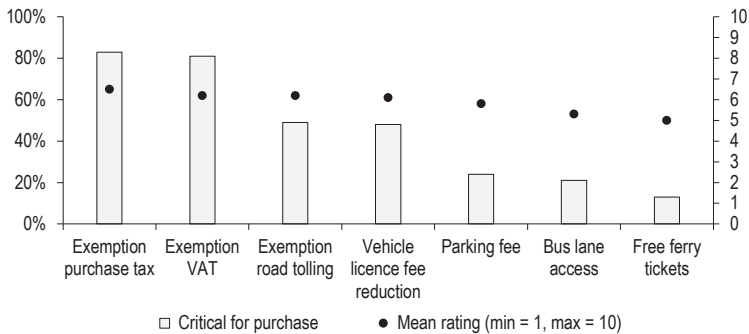


Figure 2. Role of incentives for BEV purchase

Source: Norbech (2017).

Table 3. Incentives analysis

Name	No	CN	NL	FR	DK	SE	DE	PL
Fiscal and Financial reliefs								
Exemption from purchase tax (20)	20	20	20	–	8	–	–	3
Exemption from VAT (20)	20	20	–	–	–	–	–	–
Cash subsidies (20)	–	20	–	11	–	8	–	–
Exemption from vehicle registration tax (5)	–	–	–	–	3	–	–	–
Exemption from road tax (5)	4	–	5	–	5	3	4	–
Exemption from company car tax (5)	3	–	4	1	–	4	–	–
Surcharge for scrapping an old vehicle (5)	–	–	3	4	–	–	–	–
Exemption from congestion tax (5)	5	5	–	–	–	–	–	–
Exemption from toll fees (5)	5	–	–	–	–	–	–	2
Exemption from fees for ferry crossings (5)	5	–	–	–	–	–	–	–
Exemption from bridge fees (5)	5	–	–	–	–	–	–	–
Exemption from parking fees (5)	5	–	3	3	3	–	5	1
Exemption from charging fees (5)	3	3	–	–	–	–	–	–
Co-financing for household chargers (5)	–	–	3	3	–	–	–	–
Preferential depreciation write-offs (5)	5	–	–	–	–	–	–	3
Non financial reliefs								
Access to road strips for emergency vehicles (5)	5	–	3	–	–	–	4	3
Sum	85	68	38	22	19	15	13	12

Source: own study based on Harryson (2015).

Conclusions

Incentives for electric vehicles market stimulation have long history in the world. Up till now the idea of electric vehicles was not feasible due to lack of technology and very high initial costs that potential buyer would have to overcome. However the recent years have brought an advancements both in tech and in people's thinking, therefore the incentive programs have become very important for the future of electric vehicles.

The polish electromobility act is the first step in the development of the electromobility market in Poland. The Act defines the principles of building an infrastructure base network for alternative fuels to create favorable conditions for the emergence of an electromobility ecosystem. The extension is to allow for the free movement of alternative-powered vehicles in urban agglomerations, the network of trans-European roads and in areas with high population density. The document defines the roles and responsibilities of state entities. The Act, by introducing a new type of business activity which is charging vehicles, allows to exclude a concession in this type of energy sales, which should be interpreted as a positive factor affecting the market. The legislator introduces a number of provisions in the construction law, which exclude the need to obtain construction permits for charging stations outside the charging infrastructure for road public transport. The Act introduces a number of tax reliefs, such as excise duty exemption, and a higher depreciation threshold. There is no element of VAT exemption for the first period of changes, which was widely used in the majority of leading economies. Massive tax reliefs in the Scandinavian countries allowed for the widespread popularization of electric cars. In addition to the financial concessions, the Act provides for the use of bus lanes by electric cars or free parking in paid parking zones, which can greatly facilitate the implementation of transport tasks in cities. The Act does not apply to an existing charging network or to points which cannot be defined as publicly available. In the case of the public network of charging stations, a significant restriction has been introduced which is the obligation of the Distribution Network Operators to participate in the construction of new networks and re-qualification of existing ones to "generally available" stations.

The package developed by the Polish legislator is the beginning of changes aimed at reviving vehicles powered with alternative fuels on the market. It is expected that the impact of the Act will be visible in the form of expanding the vehicle charging network and increasing the share of electric vehicles on the Polish car market as well as the development of the market environment that are sales and storage of energy for electromobility, engineering, design, repair, service and management of the electromobility ecosystem. The Act covers very important issues related to electromobility, however, it should be remembered that for the average consumer the most important factor is the total cost of ownership of a vehicle that has not been addressed by the legislator, although it is a recognized and widely used measure to popularize electric vehicles by leading global economies in the initial development phases. Analyzing the results from the table above, it is clear that, over time, the electromobility legislation will have to evolve to keep up with changes at both community and technology levels. Dissemination of alternative-powered vehicles will depend to a large extent on changes in the consumer's beliefs of mobility. Currently in the world we see a change in the trend from the ownership model to the service consumption model. This change is particularly evident in the number of new car-sharing networks in the world. The use of changes in the way we think today gives Poland the chance to appear on global markets as a provider of solutions for new integrated mobility. It should be as well remembered that Poland aspire not only to be an electric vehicles consumer but as well a part of automotive industry. In recent years Poland was strongly developing in terms of hi-tech and IT domains especially for automotive industry. These developments could be used as a leverage to create new highly innovative industry connected with electric vehicles and emerging markets such as shared economy. To have this potential used to the

fullest Poland should create an environment in which highly innovative, small businesses could be accelerated to the extent that would allow entering international markets.

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