THE EFFICIENCY OF FINANCIAL INCENTIVES IN THE DEVELOPMENT OF THE ELECTROMOBILITY SECTOR IN THE NETHERLANDS

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Abstract

The purpose of this paper is to analyse the Dutch electromobility sector in terms of the effectiveness of applying financial incentives and to investigate the hypothesis that the key to using them is not the amount of subsidies for customers to purchase vehicles or to build charging stations, but to properly coordinate time in their application. In addition, the scope of subsidies should be changed from time to time, which will allow the gradual development of various types of electric vehicles. The second hypothesis which will be examined is the claim that the effective use of financial incentives does not necessarily imply a heavy burden on the budgets of central and local administration.

Introduction

The Netherlands is a country characterized by one of the most developed sectors of electromobility in the world. This is evidenced both by the number of electric cars on the roads and by the number of charging stations. The purpose of this paper is to analyse the Dutch electromobility sector in terms of the effectiveness of applying financial incentives and to investigate the hypothesis that the key to using them is not the amount of subsidies for customers to purchase vehicles or to build charging stations, but proper time coordination in their application. In addition, the scope of subsidies should be changed from time to time, which will allow the gradual development of various types of electric vehicles. The second hypothesis which will be examined is the claim that the effective use of financial incentives does not necessarily imply a heavy burden on the budgets of central and local administration.

Considering the above, the following questions should be posed to the task of verifying the justness of these hypotheses: which conditions determine the development of the electromobility sector in the Netherlands?; which financial incentives have been implemented to increase the number of electric cars and the number of charging stations?; what effects did they bring?; when was the most rapid increase in the number of electric cars and the number of charging stations and from which did such sudden increases result? Answering these questions will allow examination of the correctness of the hypotheses set in this paper.

In this paper, the scope of research has been narrowed to the period after 2010. Since then, key financial programs have been implemented. Moreover, the aim of these programs was to encourage the purchase of electric vehicles. Additionally, due to the analysed subject, the following analysis focuses exclusively on financial incentives. Issues related to other incentives, such as the creation of low emission zones in cities, were omitted. In order to achieve the aim of the research, firstly it is reasonable to examine the conditions for the development of the Dutch electromobility sector. That's why the determinants had the greatest influence on the shape of the policy which was implemented. Subsequently, it is necessary to analyse the mechanism of coordinating the implemented policy. This is important because the adopted structure allowed

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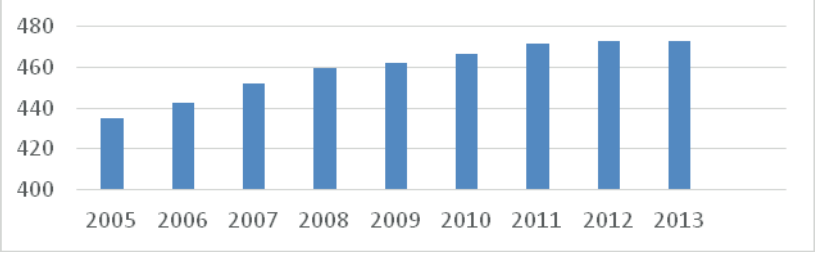
for implementing synchronized activities at many levels of governance and to realise the interests of many parties. The remaining part of the paper focuses on the analysis of financial incentives applied in the Netherlands and their effectiveness.

Conditions for the development of electromobility in the Netherlands

The analyzed country is very well conditioned in the development of new technologies in the transport sector. The Netherlands is almost entirely a lowland country, with the largest population aggregation in the west, in particular in the north and south provinces and also in Utrecht. The factors that significantly affect the level and pace of economic development are very high population density - less than 17 million inhabitants live in an area of 41 543 km^2, which gives a value of around 403.9 inhabitants per square kilometre. However, in only the Randstad agglomeration (7.1 million population), the population density is approximately 1,500 people per 1 km^2. As a result, the Netherlands is the most densely populated country in Europe. The population density and the surface area of this country, combined with a very high level of economic development (GDP in PPP at the level of 752,139 billion USD- data for 2015), cause that the Netherlands is characterized by a very high rate of urbanization. Approximately 90% of the population there live in cities (Wojtowicz 2014).

The above values have a strong impact on the shape of the Dutch transport sector. The transport infrastructure of the Netherlands is one of the most developed in Europe. This is evidenced by the omnidirectional connections between cities and neighbouring countries, a very good condition of inland waterways and port infrastructure, which allow for example for the effective provision of transhipment services. Because of its geographical location, the Netherlands is a very important element of the European transport system. However, from the viewpoint of the subject of this analysis, land transport is a key segment of the transport sector in the Netherlands. The current road network has about 139 thousand kilometres while the railway network is about 3.3 thousand kilometres. Due to the high level of urbanization of the country and relatively small distances between the largest cities, in the Netherlands road transport is the most common mode of transportation. This is evidenced by the fact that the typical Dutchman daily travels by car between 15 and 30 km (Fajczak-Kowalska 2014: 252-254). At present, there is a clear upward trend in the number of owned cars per 1000 inhabitants. This state is illustrated by the chart below.

Chart no. 1 Number of passenger cars in the Netherlands per 1,000 inhabitants



Source: own elaboration based on: Eurostat, Energy, transport and environment indicators. 2016 edition, p. 97, [Internet:] http://ec.europa.eu/eurostat/documents/3217494/7731525/KS-DK-16-001-EN-N.pdf/cc2b4de7-146c-4254-9521-dcbd6e6fafa6 (access: 10.1.2018)

While in 2005 this amount was 435 cars per person, in 2011 it was already 472. Since then, the above trend has been turned, which can be justified by the gradual development of car sharing and car-pooling services that are often associated with the resignation of owning a private car. There are now over 8 million cars on Dutch roads, which is an increase of around a quarter compared to the beginning of the 21st century (Ministerstwo Spraw Zagranicznych 2017).

The Netherlands is also a country with a high level of energy security. However, it should be noted that the above does not mean that there is sustainable economic development. This is a result of a very high share of fossil fuels in the energy balance of the state. In the overall structure of primary energy production, gas accounts for 39% and oil for 38%. On the other hand, coal has a share of 15%. One should also note the very low use of the Dutch potential in the segment of producing energy from renewable sources. However, the Netherlands has well diversified the direction and sources of energy supplies. What's more, this country is the largest natural gas trading centre in the European Union and one of its largest exporters. As a consequence of the analyzed factors, the Netherlands is very well conditioned in the development of new technologies in the transport sector, in particular electromobility (International Energy Agency 2017).

Policy coordination of the development of electromobility in the Netherlands

The development of the electromobility sector is related to the need to conduct a coherent policy in many socio-economic fields. This means that the intervention of the state in all areas of electromobility development should proceed in parallel. This is because actions taken in one area usually imply changes immediately in the other areas. For example, exemption from registration fees during the purchase of an electric vehicle results not only in the reduction of revenues of the local government unit, but also involves the necessity of making adequate legal changes. Additionally, in order to stimulate the development of electromobility in those sectors, the Netherlands has applied many incentives which can be divided into two categories: direct (i.e. financial) and indirect. Very important to highlight is that the development of the electromobility sector could have happened in the Netherlands despite the lack of functioning of a highly developed domestic automotive industry. To make it possible, it was necessary to use both direct and indirect incentives, and what is more, it was necessary to implement and apply them at all levels of management. As was mentioned above, taking into account the scope and the objective of this analysis, it is appropriate to focus only on the direct encouragement for buying electric vehicles (Van der Steen, Van Schelven, Mulder 2014: 9).

In the Netherlands, institutions functioning at all levels of governance were responsible for implementing the development policy of the corresponding sector, both at the central as well as regional and local levels. What is a kind of special feature of this country is that the centre of gravity of implementing a policy was evenly divided between the above levels of public administration. As a result, the actions taken were mutually complementary and, depending on their nature, could be appropriately distributed among various entities (Van der Steen, Van

Schelven, Mulder 2014: 27-28). In the Netherlands, the political system for the development of electromobility consists of various levels of institutions and other parties, which are responsible for the development and implementation of activities in a given section of the electromobility chain, as is shown in the table below:

Table no. 1 Parties interested in the development of electromobility in the Netherlands

Interested party	Responsibilities
Government	setting a framework for activities carried out by other entities, coordinating function, setting new directions of development
Business	providing knowledge determining the desired directions of development
NGO's	supporting and supplementing activities, drawing the attention of the authorities to areas often overlooked from the central perspective

Source: own elaboration

To sum up, in this country the organization and coordination of the undertaken activities was in line with the assumptions of the principle of subsidiarity. Taking these observations into account, the model of central coordination of development policy of electromobility in the Netherlands can be portrayed as follows:

Table no. 2 Central coordination of the development policy of electromobility in the Netherlands

Institution	Responsibilities
Formula E-Team	Strategy development, lobbying, overcoming barriers, industry integration, communication
Netherlands Enterprise Agency	Consulting, financial instruments, communication, information activities
Ministry of Infrastructure and Water Management & Ministry of Economic Affairs and Climate Policy	Policy coordination, setting the course of action

Source: own elaboration

The adopted structure allows avoidance of competency disputes and precisely defines the needs of all parties involved in the development of electromobility. The institutions mentioned above were also responsible for the development and implementation of financial incentives whose purpose was to encourage consumers to purchase electric vehicles. This is important because such a model of cooperation between many parties ensures better coordination of adoption of the incentives. However, it should be also emphasized that the key to their application was not the amount of subsidies to buy a car, but the methodology of their application.

Financial methods for developing electromobility in the Netherlands

In the Netherlands direct financial incentives have focused on increasing sales of electric vehicles and encouraging the construction of charging stations. Therefore, the main instrument used was exemption or relief for purchasers of low emission vehicles from the purchase tax and registration charge of a car or motor (Bpm). The amount of this tax was determined by the level

of CO_2 and other pollutants produced by the car (e.g. NOx) as well as the value of the vehicle. For cars emitting up to 50g CO_2 per kilometre, the regulation provided for a full exemption from the necessity to pay tax. Importantly, this regulation also referred to the production and operation of components dedicated to these vehicles, for example to fuel cells. In turn for each gram of CO_2 for low-emission vehicles in the range of 1 to 81g of produced carbon dioxide per 1 km, the fee amounted to 6 €. With regard to the amount of this tax we can conclude that, taking into account the wealthiness of Dutch society, this amount is not excessive. This is particularly evident when we realise that with an emission level between 83 and 110 g CO_2/ km, it was necessary to pay an amount of 69 € for each gram. In turn, for high-emission vehicles (i.e. up to 180 g CO_2/ km), rates increased up to 434 € for each gram of produced carbon dioxide. It should be added that such a distinction between the amounts of the fee is an expression of the state policy for strengthening the share of BEV cars in the electromobility market. As a result the amount of their total cost of ownership has reduced. What is more, the amount of rates and criteria have changed over the years. However, it is worth highlighting that key to this instrument was the progressive methodology of calculating the tax reduction, which was more important than its amount (Government of the Netherlands 2017).

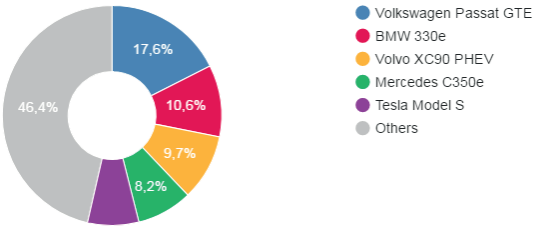
The above conclusion is clearly visible on the example of another popular instrument. In the Netherlands, for entrepreneurs who use company vehicles for private purposes (if private use exceeds 500 km per year), the income tax rate has been reduced. Its amount is calculated by adding to the tax 14% to even 25% of the value of the vehicle leased. A zero tax rate was applicable until the end of 2013 and from the beginning of 2014 the tax was calculated in the amount of 7%, 14%, and 20% according to the fuel type and CO_2 emissions if the cars are fuel efficient (Belastingdienst 2017). In relation to electric cars these values were 7% (for BEV) and 14% (for PHEV). It is estimated that the estimated savings associated with the use of EV vehicles is even around 2,000 € per year. Another attractive instrument was that the cars emitting maximum 50g CO_2/km are exempt from the annual circulation tax. Until 2016, the exemption included both new and operating cars. However, the scope of this relief has changed since 2016 and currently it includes only fully electric vehicles.

In addition to the above, two systems have been introduced which allow relief of costs of an electric vehicle against taxable profits. These programs are MIA (Environmental investment rebate) and VAMIL (Arbitrary depreciation of environmental investments). Through the MIA all entrepreneurs in the Netherlands who pay income or company tax can deduct up to 36% of the investment costs for an environmentally friendly investment on top of their regular tax deductions for investments (Van der Steen, Van Schelven, Mulder 2014: 32-33). In other words, entrepreneurs can receive rebates and subsidies, for example, for the purchase of electricity or installations necessary for the construction of a charging infrastructure. The deduction covers such costs as: costs of purchase, production, modification and/or purchase costs of new elements, as well as environmental consultancy (Nederland Elektrisch). It is also possible to exempt from taxation the profits from owned electric cars. Thus, the VAMIL

allows entrepreneurs to decide themselves when to write off these investment costs. Both programs are conducted at the central level, by the Dutch Ministry of Finance, Infrastructure, and the Environment and its direct implementation is the responsibility of the Dutch Enterprise Agency (NEA) and the Tax and Customs Administration(Netherlands Enterprise Agency 2014).

Financial incentives were also used in the Netherlands at the regional level, although these were rather rebates and subsidies than tax exemptions. Amsterdam, for example, introduced additional payment of 5 000 € to purchase an electric vehicle for business purposes and up to 10 000 € (currently reduced to 5 000 €) to purchase an electric car, a small delivery van, or a taxi. Additionally, purchase of a truck or bus can be associated with obtaining a surcharge of 20% of the purchasing price up to 40,000 € per vehicle (amsterdam.nl). Obviously, the last instrument is mainly an incentive for large entrepreneurs. Similar subsidies for the purchase of a private car or for business purposes were or are also available in Rotterdam, Utrecht, or Tilburg. In addition, some cities grant subsidies for scrapping old cars. However, considering the cost of an electric vehicle, we can realize that surcharges do not even cover the difference between this cost and the price of a traditional car. It is worth quoting here the data in the light of which in 2016 the best-selling electric car in the Netherlands was the Volkswagen Passat GTE, which was bought by 18% of drivers.

Chart no. 2 Best-selling electric car in the Netherlands in 2016



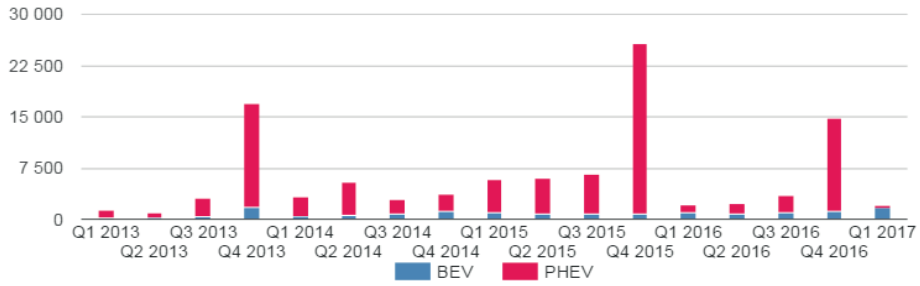
Source: European Alternative Fuels Observatory, Netherlands, [Internet:] http://www.eafo.eu/content/netherlands (access: 10.1.2018) and CBS Statistics Netherlands

The cost of this vehicle at the time was about 45,000 €, so even with these subsidies the car was much more expensive. The same observations can also be applied to other popular cars. Incidentally, the Volkswagen Passat GTE is a hybrid car, just like the BMW 330e, which was purchased by just over 10% of the Dutch. This shows that in the first phase of the electromobility development PHEV (plug in hybrid electric vehicles) cars are more popular.

The incentives analyzed above do not entail high costs of state administration. This is because those instruments usually concern tax exemptions instead of direct subsidies for customers. From the point of view of the development of electromobility, the use of these instruments has brought the expected results. The Netherlands has managed to achieve a desired increase in demand for EV cars with a relatively low burden on the central budget. However, what is important is that the amount of the subsidies was variable every few years. This means that price "manipulation" is crucial, because it affects consumer demand.

In the Netherlands the most dynamic development of electromobility took place at the beginning of the second decade of the 21st century. As a result of the activities initiated at that time, a significant increase in the number of newly registered electric cars was achieved. However, implementing the incentives analyzed above would not have been effective without their effective application. The key remark at this point is that in the Netherlands the financial incentives were limited in time. The graph below shows the growing number of newly registered electric cars between 2013 and the first quarter of 2017.

Chart no. 3 Number of newly registered electric cars (BEV & PHEV) in the Netherlands in quarterly terms 2013-2017

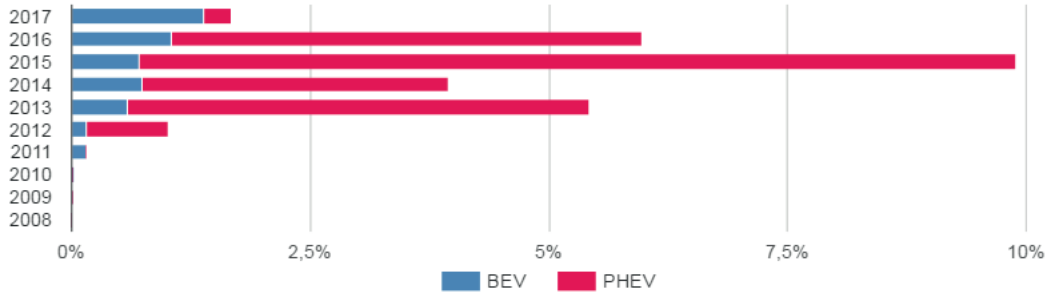


Source: European Alternative Fuels Observatory, Netherlands, [Internet:] http://www.eafo.eu/content/netherlands (access: 10.1.2018) and CBS Statistics Netherlands

The graph above clearly shows that PHEV cars are definitely more popular in Dutch society. We can also indicate three moments in which there was a very large increase in the number of newly registered electric cars. Moreover, all three moments were at the ends of the years 2013, 2015, and 2016. Noteworthy also is that throughout this period the Netherlands had various financial incentives to purchase electric cars. However, each of them ended at the end of the given years. For example, in the last quarter of 2013 there was a huge increase in the number of vehicles sold. While in 2012, 4,326 PHEVs and 828 BEVs were registered, one year later it was respectively 20,164 and 2,441. The explanation of this state is that it was related to the tax concession program and additional payment for customers purchasing electric cars, which ended with the end of 2013. Some kind of social fear of losing the chance to reduce the costs of acquiring a new vehicle led to a very large increase in the number of electric vehicles sold. A similar process can be observed between the third and fourth quarter of 2015. The number of newly registered electric vehicles between July and September 2015 was 5,964 (PHEV) and 707 (BEV). In turn between October and December 2015 it was already respectively 25,024 (PHEV) and 767 (BEV). The scale of fluctuations in the number of registered electric cars is an example of the skilful influence of the government and other institutions on society. Thanks to that policy it was possible to increase the demand for new technologies even in the month to month perspective. Thus, the state maintains some kind of control over the market, making it much easier and more effective to implement policy as well as to monitor the effectiveness of actions taken to develop electromobility.

Another example of the effectiveness of the electromobility development policy is in influencing the popularity of particular types of electric cars. As was mentioned above, during the first phase of the implementation of emobility, PHEV cars were definitely more popular in Dutch society. That's because they are characterized by the parallel operation of an internal combustion and electric engine. Their biggest advantage is their range, which reaches up to 1000 km. PHEV cars are also much cheaper than the BEV type. At this point it should also indicate the level of market share by BEV and PHEV cars. This is shown in the chart below.

Chart no. 4 Shares of BEV and PHEV cars in the electric vehicle market in the Netherlands on an annual basis



Source: European Alternative Fuels Observatory, Netherlands, [Internet:] http://www.eafo.eu/content/netherlands (access: 10.1.2018) and CBS Statistics Netherlands

The conclusion that can be deduced from the above data is that the development of hybrid cars is an intermediate step on the road to building a fully developed BEV car market. In the Netherlands during the first phase of the implementation of emobility the government supported the development of both types of vehicles. But, for the reasons mentioned above, PHEV cars were more popular. However, in the second phase the government decided to stop supporting PHEV cars and to promote only fully electric vehicles. As a result 2017 was the first year when BEV cars had more sales. Once again, it shows how government can influence society. To summarise, it is necessary to conclude that the methodology of implementation and usage of the financial incentives is definitely more important than their amount.

The level of development of the electromobility sector is determined not only by the number of electric cars that were sold, but also by the number of charging stations and the density of their system. In the Netherlands, these two parameters were growing in parallel, which is an expression of the coherence and complementarity of the implemented policy. In order to encourage entrepreneurs to build and install charging stations on their premises, the possibility of using MIA and VAMIL systems has also been opened before them. What's more, in the province of Friesland a Drive4Electric program operates, under which there have been introduced subsidies for entities undertaking such activities. They take various forms, such as discounts in using other stations and vouchers of up to 500 €. A similar program also works in Rotterdam – the Rotterdam Electric Program. It supports the first 1,000 electric car owners with their own charging station, the building of which is supported by the city. Rotterdam has installed further

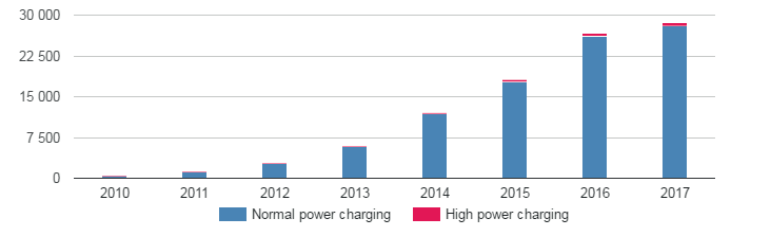
charging points in strategic locations in the city centre and popular parking places (Van der Steen, Van Schelven, Mulder 2014: 37).

A characteristic feature of the electromobility infrastructure development policy is its reliance on various forms of cooperation between state-owned institutions operating on various levels of governance and private entities, which have taken the form of public private partnership (PPP). One example of the cooperation in PPP form was the partnership established between the state-owned operator power network (TenneT) and regional network operators within the E-laad foundation. This consortium in the period of the most dynamic development of charging infrastructure, the years 2010 – 2014, had a budget of about 25 million euro. This allowed building during those four years about 3,000 charging stations. What is important is that due to the inclusion into the investment process of entities from outside the public sector, the above mentioned development was reconciled with the spatial demand for such installations and the possibilities for their construction.

On the other hand, the above analysed cooperation of many entities from various governance areas facilitated the process of identifying and overcoming barriers during the process of the developing the electromobility infrastructure. In the Netherlands, the development of charging stations is largely financed by the central government. Most often local government units are responsible for implementing programs and managing spending. They can also apply for financial support from the central administration. Importantly, such subsidies are almost exclusively provided for investments carried out jointly by local authorities and the private sector, which contributes to building partnerships between them. One example of such cooperation is Schiphol airport near Amsterdam. There is an ensemble of charging stations, which is also one of the largest in the world for that type of installation. It was created thanks to deep cooperation between the central government, the local government, and the airport authorities. As a result, construction costs of the system were evenly distributed.

The consequence of the above activities is that during the analyzed period in the Netherlands there was a multiple increase in the number of charging stations, including the so-called fast charging station, as shown in the chart below:

Chart no. 5 Development of charging stations in the Netherlands (2010-2017)



Source: European Alternative Fuels Observatory, Netherlands, [Internet:] http://www.eafo.eu/content/netherlands (access: 10.1.2018) and CBS Statistics Netherlands

While in 2010 in the Netherlands about 400 stations were installed and none enabling fast charging, there now exist about 28,000 stations with normal voltage and 640 fast-charging stations. In the above chart it is worth paying attention to two key moments: the periods between 2012 and 2013 and between 2013 and 2014. In these intervals there was more than a twofold increase in the number of charging stations per annum. While in 2012 the Netherlands had 2,782 stations, in the following year the number was 5,770. Over the next twelve months, drivers could use as many as 11,860 charging stations. Such large differences result from the fact that at the end of the years with the largest increase in the number of charging stations, the support programs for its builders were to be ended. Thus, in society, a similar phenomenon as when buying electric cars could be observed. There was a kind of social fear of losing the chance to reduce construction costs. It is also difficult not to notice that the aforementioned situation in 2013 coincides with the period of the largest increase in the number of electric cars being sold. This is an expression of the consistency of policy. However, cooperation within the PPP was also attractive. To sum up, taking into account the area of the Netherlands, population density, and the number of land roads, it should be concluded that in this country there is a very dense, highly developed network of charging stations for electric vehicles.

Conclusion

To summarise the above analysed issues, it must be noted that in the Netherlands there is a highly developed electromobility market. This is evidenced by the increase every year in the number of newly registered electric vehicles, as well as the increasing density of the charging infrastructure. Planning actions in this area, various authorities have emerged with the correct assumption that the pursued policy must be connected with the skilful use of financial incentives. First of all, as was shown above, the key was not the amount of the subsidy. The crucial thing was the temporary limitation of their use. Therefore, the main research hypothesis set in this paper was confirmed. Moreover, the incentives should be changed from time to time. The point is that in the first phase of the development of emobility, PHEV cars are definitely more popular in society than BEV cars. It can be said that the road to popularity of fully electric cars leads through the development of plug-in cars. In the first years it is worth supporting both types of vehicles, and after a few years to stop supporting hybrids.

Secondly, the Netherlands has managed to achieve the desired increase in demand for electric cars, with a relatively low burden on central and local budgets. This is important because it shows that the financial incentives do not have to be “expensive”. Thus, less wealthy, ambitious countries can afford to use them. So countries like Poland can also try to develop their own electromobility markets. As a result, the second hypothesis was confirmed. The additional conclusion that results from the analysis above is that financial incentives are the most effective element of the electric vehicles sector’s development. Without them, the pace of development of electromobility may not be satisfactory.

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