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Strengths and Weaknesses of the Russian Concept for the Development of Production and Use of Electric Vehicles Until 2030

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ABSTRACT

Russia has not yet paid due attention to the issues of the transition to electric transport. Only in August 2021, the Russian Government approved a Concept for the development of production and use of electric road transport in the Russian Federation for the period up to 2030. The aim of this study is analysis the Concept from the point of view of world experience in stimulating the development of the electric vehicle market. The study showed that the most elaborated directions of the Concept for the development of production and use of electric road transport in the Russian Federation for the period up to 2030 are the direction of creating a national production of batteries and hydrogen fuel cells, as well as the direction of creating national production facilities and localizing foreign production of electric vehicles, including cars with hydrogen fuel cells. The least developed direction of the Concept is the direction of creating a national base for certification and testing of electric vehicles, which indicates the problem of a lack of competencies in the scientific and technical sphere.

Keywords: Electric Vehicles, Climate Policy, Special Investment Contracts, Forecast

JEL Classifications: O33, Q42, Q47, Q48

1. INTRODUCTION

Conversion of transport to electricity is considered today one of the key directions of decarbonization of the world economy (IEA, 2021). According to the recent scenario of the International Energy Agency NetZero by 2050, the pace of development of electric vehicles should increase exponentially in the coming years, especially in the passenger electric vehicle sector, where technology has matured. By 2030, the share of electric vehicles in new sales on average around the world should be at least 60% against 5% in 2020. By 2050, the entire vehicle fleet should be electrified, i.e. consist of electric vehicles and fuel cell vehicles. In the freight transport sector, electrification is expected to be slower as there are still technological barriers to it. However, by 2030, about 25% of all new trucks should be electrified, and by 2050, their share should reach about two-thirds.

Many countries have already made significant progress towards the electrification of road transport. In 2020, more than 930 thousand

electric vehicles were sold in China, more than 230 thousand in the USA, more than 190 thousand in Germany, and about 110 thousand in France and the UK (Global EV Outlook, 2021). The largest share of electric vehicles in the total number of cars on the road now in Norway (almost 17%), Iceland (6.16%), Sweden (3.62%), the Netherlands (3.19%), Denmark and Finland (about 2.35%). The experience of these countries shows that for the successful electrification of the transport sector, it is necessary to overcome a whole set of barriers (technical, economic, infrastructural, cultural), which is impossible without government support (Wang et al., 2018; Habich-Sobieggalla et al., 2018; Santos and Davies, 2020).

However, many other countries, including quite technologically advanced ones, have not yet paid due attention to the issues of the transition to electric transport. In particular, in Russia, as of the beginning of 2021, only slightly more than 10.8 thousand electric vehicles were registered, while the total fleet of passenger cars is about 45 million.

Statistics on the number of electric vehicles in Russia are still collected only by private agencies, and therefore vary significantly (Ratner and Zaretskaya, 2018). Nevertheless, comparing data from various sources, we can conclude that the electric vehicle market in Russia has shown an upward trend in recent years, even in the absence of any government support measures (Figure 1). So far, the main share in the total fleet of electric vehicles is made up of used cars, since Russia does not have its own serial production of electric vehicles.

However, in August 2021, the Russian Government approved a concept for the development of production and use of electric road transport in the Russian Federation for the period up to 2030 ((hereinafter - the Concept). This concept is the first official document to set targets for the production of electric vehicles and the development of charging infrastructure in Russia for the period up to 2030.

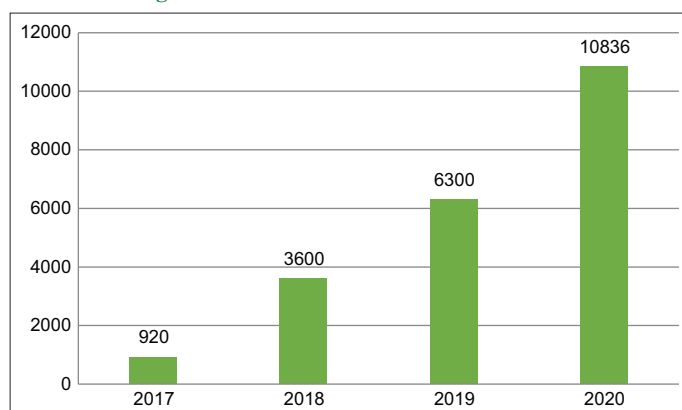
The purpose of this work is to analyze the main provisions of the Concept from the point of view of world experience in stimulating the development of the electric vehicle market. In this work, we attempted to answer the following research questions: (1) What measures are provided in the Concept to overcome economic, infrastructural and cultural barriers to the development of electric vehicles; (2) what are the risks of not achieving the planned development indicators of the Russian electric saw market; (3) what contribution will Russia make to the development of the global electric vehicle market if the Concept is successfully implemented.

The paper is structured as follows: Section 2 presents the results of literature review on the topic of efficient policies promoting the wide introductions of EVs and systemizes the study's theoretical framework. Then, Section 3 analyses the Concept and highlights its strong and weak points. Section 4 estimates the possible contribution of Russian automotive industry in Net Zero by 2050 scenario. Finally, conclusions and policy applications are presented in Section 5.

2. GOVERNMENT REGULATION FOR THE PROMOTION OF ELECTRIC VEHICLE USE: LITERATURE REVIEW

Benefits and discounts on purchase are considered to be the most effective measures to stimulate the development of electric

Figure 1: The number of EV stock in Russia



Source: Authoring based on data from <https://eng.autostat.ru/>

vehicles in the academic literature (Lieven, 2015; Wang et al., 2018; Urrutia-Mosquera and Fábrega, 2021). Since one of the main obstacles to wider use of this mode of transport is its high cost, measures aimed at reducing the one-time payment for the purchase of an electric vehicle are undoubtedly effective (Santos and Davies, 2020). In addition, measures aimed at reducing the operating cost or improving the usability of an electric vehicle are also highly effective (Landbroek et al., 2016). Therefore, at present, each country chooses its own scheme to support the development of electric vehicles.

For example, in China, the purchase of a battery electric vehicle (BEV) or a plug-in hybrid electric vehicle (PHEV) is exempt from sales tax and excise duty. The tax incentives BEVs are generally higher than those for hybrid electric vehicles. Besides, electric vehicles are not subject to property tax (Shi et al., 2016). In addition to benefits at the national level, local authorities in some cities are introducing their own measures to stimulate the population to switch to electric vehicles. So, in Wuhan, since 2014, travel by electric car on toll sections of city roads, bridges and tunnels is free of charge.

In Denmark, electric vehicles weighing less than 2 tons are not subject to transport tax. In addition, municipalities, which have the right to charge differentiated parking fees, often use this opportunity to fully or partially exempt electric vehicle owners from parking fees. Savings on this type of vehicle maintenance cost for electric vehicle owners can be up to \$ 735/year (Haustein et al., 2021). In Sweden, a subsidy of SEK 40,000 (approximately € 4,000 or US \$ 4,400) has been provided for the purchase of a passenger car with emissions below 50 g CO₂/km since 2011. In addition, electric vehicles are exempted from transport taxes (which are also calculated on the basis of CO₂ emissions), as well as part of taxes on corporate vehicles (Nurhadi et al., 2017; Haustein et al., 2021).

In France, a partial subsidy program for the purchase of an electric vehicle has been in place since 2013. The subsidy for a battery electric vehicle is € 6,300 (\$ 7,100), a hybrid electric vehicle with emissions ranging from 20 g CO₂/km to 60 g CO₂/km € 1,000 (\$ 1,100). Recycling a diesel vehicle allows one to receive an additional bonus of € 10,000 (US \$ 11,000) on the purchase of a BEV, and € 3,500 (US \$ 4,000) on the purchase of a hybrid electric vehicle (PHEV). In addition, both electric vehicles and hybrids are tax exempt if owned by any company (Leurent and Windisch, 2015; Künle and Minke, 2020). In Germany, electric vehicles and hybrids are not subject to vehicle tax. In addition, the country's legislation provides for the right of municipalities to exempt certain types of vehicles from paying for parking spaces, which is often implemented in relation to electric vehicles (Bickert et al., 2015; Künle and Minke, 2020).

In Japan, the subsidy for the purchase of an electric vehicle is calculated based on the price difference between an electric vehicle and a conventional vehicle of a comparable class. The maximum amount of subsidies is \$ 7,800, the average is between \$ 3,500 and \$ 5,500. In addition, electric vehicles are exempt from tonnage tax and are subject to a concessional transport tax, and at the

municipal level they are exempt from tolls for bridges, tunnels and toll sections of city highways (METI, 2016; Khan et al., 2020).

In the Netherlands, since 2016, owners of cars with zero CO₂ emissions are completely exempt from registration tax. All other vehicles have a differentiated taxation scheme with five levels of taxation corresponding to five levels of CO₂ emissions: Hybrid vehicles (PHEV) are classified in the first level (below 80 g CO₂/km) and are taxed at € 6 per g CO₂/km, while diesel vehicles with emissions over 70 g CO₂/km are taxed at 86 € per g CO₂/km (Hoen and Koetse, 2014; Deuten et al., 2020). This taxation scheme provides significant advantages for electric vehicles and hybrids over traditional vehicles. As for the measures in force at the operational stage, they include the exemption of vehicles with zero emissions from paying transport taxes. Until 2015, this measure also applied to hybrids with an emission level of less than 50 g CO₂/km, however, starting in 2016, such vehicles are subject to taxation at the rate of 50% of the amount of transport tax for a regular car.

In Norway, EVs are free of purchase tax, which averages around NOK 100,000 (US \$ 12,000), and VAT, which is set at 25% of the vehicle's pre-tax value. The VAT exemption does not apply to hybrid vehicles (Mersky et al., 2017; Deuten et al., 2020; Hasan, 2021). To reduce costs during the operation phase, Norwegian legislation provides for the exemption of owners of electric vehicles from tolls through bridges, tunnels and other sections of the toll transport network. In Portugal, electric vehicles are exempt from vehicle registration tax, which averages € 1,250 (USD 1,400) and vehicle taxes (Morgadinho et al., 2015; Heymann et al., 2019). Scrapping vehicles to convert to electric vehicles also qualifies for a € 4,500 (US \$ 5,000) subsidy (IEA, 2016).

In the UK, the purchase of an electric light vehicle is accompanied by a subsidy of up to £ 4,500 (US \$ 6,300), a light commercial vehicle with electric power - 8,000 GBP (US \$ 11,200). Hybrid purchases up to £ 60,000 (\$ 84,000) are stimulated by a grant of £ 2,500 (\$ 3,500). Transport does not apply to electric vehicles and many types of hybrids, as it is calculated based on the amount of CO₂ emissions per km of run. In addition, corporate electric vehicles are not taxed (Mock and Yang, 2014).

In the United States, a nationwide incentive for the purchase of electric vehicles is a tax credit of \$ 7,500. For hybrids with an electric range of 18-40 km, a tax credit of \$ 2,500 to \$ 4,000 is available. Some PHEV models with relatively long range electric vehicles (such as the Chevrolet Volt) can receive a maximum tax credit of \$ 7,500 (Jin et al., 2014; Jenn et al., 2018). Some states offer additional incentive measures. For example, California offers subsidies of \$ 2,500 for an electric vehicle and \$ 5,000 for a light commercial vehicle (Jaller et al., 2021). For certain groups of consumers with low income, the amount of the subsidy may be increased. Colorado is offering an electric vehicle tax credit of up to \$ 6,000, Connecticut is offering up to \$ 3,000 in rebate, and Delaware is offering up to \$ 2,200. During the operational phase, incentives for electric vehicles are provided at the state level through exemptions from the vehicle tax (IEA, 2016).

Another important constraint to the development of electric vehicles is the need for concomitant growth and development of electric vehicle charging infrastructure (Lin and Green, 2012; Kulkarni, 2016; Li, 2016; IEA, 2015]. Almost all countries with an EV penetration rate above 0.5 % (in 2015, these are China, Denmark, France, Germany, Japan, the Netherlands, Norway, Portugal, Sweden, the United Kingdom and the United States) provide at the national level either direct financial support (subsidies) or indirect tax incentives for the installation of private charging points. For example, the Danish government offers a tax rebate on home charger installation of up to DKK 18,000 (US \$ 2,700) (Li, 2016), and the UK government provides co-financing for home charger installation up to 75% of the cost of the equipment and up to £ 500 (\$ 700) for installation work. Some countries (for example, France) have developed and legislated requirements for the mandatory equipment of all newly built residential and public buildings with charging points for electric vehicles.

The incentives for public charging networks are even more varied. For example, in France, tax deductions are applied for private operators who invest in the maintenance or operation of charging points in public places in at least two different regions in order to develop a national charging point network (IEA, 2015). In Japan, retailers are co-financed by 2/3 of the cost and installation of the equipment when installing chargers in their stores (METI, 2016). In the United States, the federal public network development program established 36,500 public charging points in 2015 with budget funds (Lieven, 2015). In the UK, the installation of chargers is subsidized by the Ecotricity program for the development of long-distance electric vehicles and a "switched on @ work" charging system (IEA, 2016).

3. ANALYSIS OF THE RUSSIAN CONCEPT FOR THE DEVELOPMENT OF PRODUCTION AND THE USE OF ELECTRIC VEHICLES

As the name of the Concept itself suggests, the main emphasis in it is placed not only on the development of electric vehicles, but on the development of the national production of electric vehicles. Therefore, the target indicators for the development of the electric vehicle market in comparison with other countries are quite modest. So, taking into account the rates of production of all types of electric vehicles set by the Concept (Figure 2), by 2030, 730,800 electric vehicles should appear on the roads of Russia. If the current level of motorization is maintained, this will amount to only 1.6% of the total vehicle fleet.

The target indicators for the development of the charging infrastructure are shown in Figure 3. Taking these indicators into account, the total number of charging stations for electric vehicles should be almost 73 thousand in 2030, of which 61% are slow charging stations and 39% are fast charging stations.

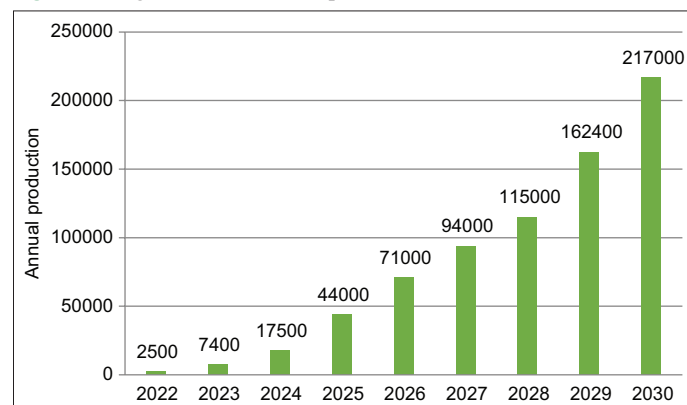
In addition, the Concept provides for the development of infrastructure for hydrogen refueling, for which targets are also presented (Figure 4). According to the presented plans for the

development of a hydrogen refueling infrastructure, the number of refueling stations by 2030 should reach 1 thousand units.

To achieve these indicators, the Concept provides for a set of state policy measures in the following key areas:

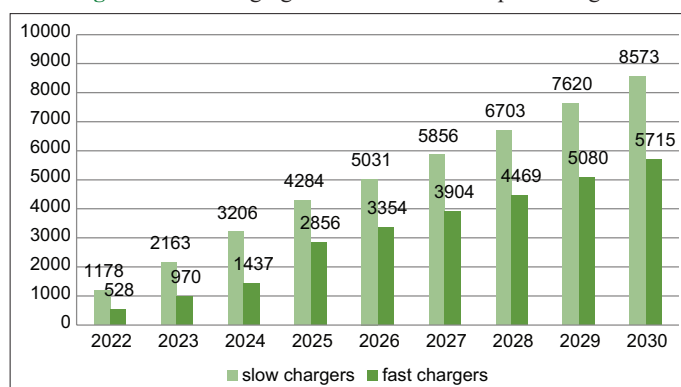
1. Creation of Russian production of EV batteries and components for them, as well as hydrogen fuel cells and related systems;
2. Creation of Russian production facilities and localization of foreign production facilities for electric vehicles, including those based on hydrogen fuel cells;

Figure 2: Target indicators for the production of electric vehicles in Russia



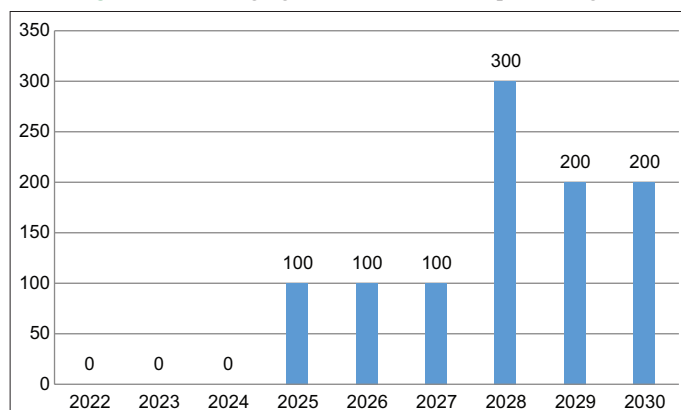
Source: Authoring based on data from <http://static.government.ru/media/files/bW9wGZ2rDs3BkeZHf7ZsaxnlbJzQbJJt.pdf>

Figure 3: EV charging infrastructure development targets



Source: Authoring based on data from <https://eng.autostat.ru/>

Figure 4: H2 charging infrastructure development targets



Source: Authoring based on data from <http://static.government.ru/media/files/bW9wGZ2rDs3BkeZHf7ZsaxnlbJzQbJJt.pdf>

3. Creation of a testing base for certification and development work in the design of vehicles with a low carbon footprint;
4. Stimulating demand for domestic electric vehicles;
5. Stimulating the development of charging infrastructure for electric and fuel cell vehicles for pilot regions;
6. Improving the legislation of the Russian Federation and the regulatory framework, removing regulatory barriers.

Analyzing the text of the Concept, it can be noted that the first two directions of state policy are worked out best of all and are based on the existing experience in the development of high-tech industries in Russia using the tool of special investment contracts (Ratner and Klochkov, 2017; Ratner and Nizhegorodtsev, 2017). As part of a special investment contract, an investor (usually a foreign one) undertakes to implement an investment project with the aim of introducing or developing and introducing modern technology that makes it possible to produce globally competitive industrial products in Russia. In turn, the Russian Federation, a constituent entity of the Russian Federation and a municipality undertake to implement measures to stimulate activities in the field of industry, provided for by federal and regional legislation. The set of incentives includes access to government procurement, tax breaks, government subsidies for new plant construction, and export support (Ratner and Khrustalev, 2018).

The signing of special investment contracts for the creation in the territory of the Russian Federation of production of cells for batteries is planned for December 2021; the signing of special investment contracts for the production of electric vehicles is scheduled for March 2022, and the signing of contracts for power and control electronics, cathode and anode materials and system components, as well as contracts for hydrogen fuel cells is scheduled for December 2022.

Direction number 3 is still the least developed. The Concept only declares the absence in Russia of a testing base for certification and development work in the design of cars with a low carbon footprint (which obviously means electric and fuel cell vehicles). The first document indicating measures to support the creation and development of such a base should appear in January 2022.

It is planned to stimulate demand for Russian-made electric vehicles in the following ways:

- Introduction of privilege for transport tax, free parking, etc. (a more specific list of measures should appear in January 2022);
- Introduction of target indicators for state and municipal organizations for the share of Russian-made electric vehicles in the fleet (the specification of these measures should occur by December 2023);
- Inclusion of Russian-made electric vehicles in the existing government programs of concessional leasing and concessional lending for electric vehicles (December 2021);
- Carrying out an experiment on free passage of electric vehicles on toll sections of federal highways (January 2022).
- It is planned to stimulate the development of charging infrastructure for electric and fuel cell vehicles mainly with the help of government subsidies.

Measures to improve the legislation of the Russian Federation to remove administrative barriers are defined in the Concept quite clearly and in detail and include the following actions:

- Changes to fire safety rules for car parking (planned for December 2021);
- Changes to urban planning rules regarding the allocation of a certain proportion of parking spaces for electric vehicles (planned as of January 2022);
- Development of national standards for describing technical requirements for components of electric vehicles, electric buses and chargers and procedures for testing their safety (planned for December 2023 -2024, depending on the type of components).

Therefore, we can highlight the strengths of the analyzed Concept as follows:

1. The availability of specific quantitative targets for the development of the electric vehicle market and charging infrastructure for the period up to 2030;
2. The use of well-established mechanisms for stimulating the production of electric vehicles, which have been well established in the implementation of other industrial development programs and have proven their effectiveness;
3. The use of international experience in the development of measures to stimulate demand for electric vehicles;
4. The availability of a detailed plan to remove administrative barriers.

We also can identify the following weaknesses of the Concept:

1. Lack of understanding of how the basis for certification and testing of electric vehicles should be created, which indicates the problem of lack of competencies in the scientific and technical sphere;
2. Limited range of measures to stimulate the development of charging infrastructure. Unfortunately, in this matter, the developers of the Concept did not take into account the available world experience, described in the previous paragraph. In addition, the development of the Concept did not take into account the high rates of development of micro-generation based on renewable energy in Russia (Balashova et al., 2020), which make it possible to predict the development of private charging infrastructure.

It should also be noted that the Concept does not at all touch upon the issue of the need to modernize power grids on the territory of at least those regions of Russia that will be selected as pilot ones for the development of charging infrastructure. Studies by Russian authors show that the technical condition of Russian power grids is not always satisfactory and requires significant investments in order to ensure the required level of energy management (Ratner and Nizhegorodtsev, 2018; Ratner et al., 2021). In addition, the Concept does not take into account the “human factor”, namely, the lack of environmental motives for the majority of Russian consumers when purchasing goods and services (Ratner et al., 2021).

4. ASSESSMENT OF RUSSIA'S CONTRIBUTION TO THE IMPLEMENTATION OF THE NET ZERO BY 2050 SCENARIO

To forecast the development of electric vehicles in Russia, let us single out long-term trends in time series describing the historical growth in the number of sales of foreign electric vehicles (Figure 1) and the planned growth in the production of Russian electric vehicles in the Concept (Figure 2). When modeling the trend with different forks of functions, it was found that the observed dynamics of both time series are best described by power functions. Equations of trends and coefficients of approximation are presented in Table 1.

Further, to calculate the total number of electric vehicles in the national fleet, we summed up the annual sales and annual production volumes for all years of the forecast period and subtracted the number of electric vehicles that were produced/imported 12 years ago. By subtracting we take into account the disposal of old electric vehicles from the vehicle fleet. The estimate for the average life of an electric vehicle was taken from sources (IEA, 2021; Ratner and Zaretskaya, 2018). Thus, the following formula was used for the forecast:

$$N_{2050} = \sum_{t=2022}^{2050} (Y_{production}(t) - Y_{production}(t-12)) + \sum_{t=2017}^{2050} (Y_{import}(t) - Y_{import}(t-12))$$

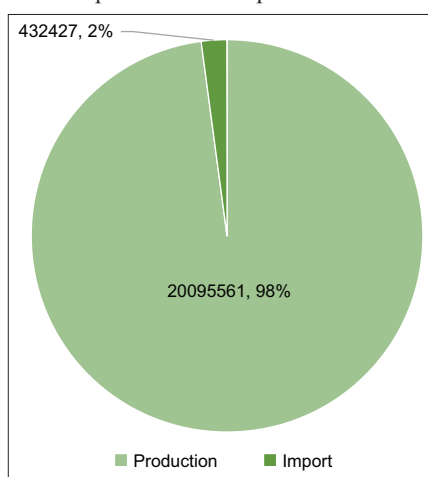
Our calculations indicate that, while maintaining the outlined trends, the number of passenger electric vehicles in Russia by 2050 should reach about 20.5 million. The share of electric vehicles produced in Russia is 98% (Figure 5).

It should be noted that this forecast is cautious in terms of forecasting imports. Taking into account the fact that, as the world experience shows, the development of the charging infrastructure itself is an incentive for the development of the electric vehicle market, it can be expected that the sales of foreign electric vehicle manufacturers in Russia will grow at a faster pace than in the period from 2017 to 2020. Therefore, while maintaining the current level of motorization, Russia may well approach the threshold of 68% of electric vehicles in the total vehicle fleet. However, for this it is very important to restrain the further growth of motorization at the current level, which currently amounts to 315.5 cars per 1000

Table 1: Equations of trends and coefficients of approximation

Variable	Equations of trend	R ²
Annual sales of foreign EV's (Y_{import})	$Y_{import} = 999,56t^{1,07}$	0,93
Annual production of national EV's ($Y_{production}$)	$Y_{production} = 2139,2t^{2,09}$	0,99

Source: authoring

Figure 5: Share of produced and imported EV's in 2050 forecast

Source: Authoring

people in Russia. Stimulating further growth in the level of use of personal vehicles is a dead-end development direction from an environmental point of view.

5. CONCLUSION

The study showed that the most elaborated directions of the Concept for the development of production and use of electric road transport in the Russian Federation for the period up to 2030 are the direction of creating a national production of batteries and hydrogen fuel cells, as well as the direction of creating national production facilities and localizing foreign production of electric vehicles, including cars with hydrogen fuel cells. The least developed direction of the Concept is the direction of creating a national base for certification and testing of electric vehicles, which indicates the problem of a lack of competencies in the scientific and technical sphere. In addition, the set of measures envisaged in the Concept to stimulate the development of charging infrastructure does not correspond to the best world practices and does not poorly take into account modern problems of the development of electrical grids.

If the target indicators for the development of the electric vehicle market by 2030 are successfully achieved and the achieved rates of production of low-carbon vehicles are maintained, Russia has a good chance of reaching the targets for electrification of transport set forth in the Net Zero by 2050 scenario by 2050. However, for this, the country also needs to contain further growth in the use of personal road transport and maintain the current level of motorization. This requires the development of electrified public transport and urban micromobility systems.

6. ACKNOWLEDGEMENT

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