

SECTION XXII. TRANSPORT AND TRANSPORT TECHNOLOGIES

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DOES HUMANITY NEED A FULL TRANSITION TO ELECTRIC VEHICLES IN THE CURRENT CONDITIONS

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Since the beginning of the 20th century, cars have become an integral part of our lives, from which we have become quite dependent, and this dependence is manifested both in the use of vehicles at the household level and in industry. Cars, which at the beginning of their existence were not used by the broad masses of the population, over the years have become part of the transport industry, which performs a service function for enterprises and the economy as a whole.

Internal combustion engines (hereinafter referred to as internal combustion engines) have been installed on most cars since the beginning of their existence, which mostly use gasoline and diesel as fuel.

In the 20th century, which is widely known for its technical discoveries and engineering achievements, there were many attempts to invent the perfect car. That is why many discoveries were made that related to the type of fuel on which vehicles would move. Thus appeared electric, gas engine, gas generator or water engines. Since we are talking about electric cars in the context of our research, we will focus further attention on this type of car.

The first electric cars appeared earlier than cars with internal combustion engines and their number at the beginning of the 20th century, along with cars with a steam engine, significantly exceeded the number of cars with internal combustion engines, which in a short period of time monopolized this market. Many conspiracy theories are associated with the decline of electric cars at the beginning of the 20th century, especially about oil tycoons and some representatives of the Government [1], but the revival of interest in electric cars took place in the 1960s due to the environmental problems of road transport and reached its peak in the early 1970s. x years, when the fuel crisis occurred, as a result of which gasoline prices increased significantly due to a significant shortage.

Table 1

Characteristics of electric cars

Advantages	Disadvantages
No harmful emissions	High price for most consumers
Reduced operation and maintenance costs due to design simplification	Frequent need for recharging, and only at special stations
High level of efficiency (-90%) and torque	Harmful production and disposal of batteries due to the presence of toxic elements
Reduction of noise pollution	Difficulty of operation in frost
Regenerative braking and electromagnetic brakes	Lack of necessary infrastructure, especially in remote and provincial regions
Increased comfort, safety and dynamics	Longer battery charging time compared to refueling

[author's development]

To date, people have not stopped talking about changes in the global climate. Researchers identify many factors that cause this, and not the last role in influencing these processes is played by cars, since the number of cars in the world reaches almost 2 billion units (and as we have already noted, most of them use internal combustion engines), it is not difficult to understand that this is a huge the number of daily harmful emissions into the atmosphere. Therefore, a logical question arose about an alternative to cars with internal combustion engines, and due to a number of reasons, the automotive industry again returned to electric cars [5].

We should begin our research with an analysis of the state of modern world energy. In general, more than 60% of all electricity is produced at thermal power plants (TPP), about 20% - at hydroelectric power plants (HPP), about 17% - at nuclear power plants (NPP), and about 1% - at geothermal, tidal, solar, wind power plants, however, the state of the energy industry in comparison with world statistics is somewhat different. On the eve of the full-scale invasion of Ukraine, more than 50% of energy was produced by nuclear power plants, TPPs and thermal power plants accounted for almost 30% of the total energy produced in the country, and hydroelectric power plants and hydroelectric power plants accounted for about 7%.

Analyzing these data, we come to the following conclusion: in Ukraine, most of the energy is produced with the help of ecological nuclear power plants, which have one significant drawback - they are ecological until an accident occurs. Since mankind has been trying to put the «peaceful atom» into practice for more than 50 years, if in the future the shortcoming of nuclear power plants, which was just mentioned, is eliminated, then the energy produced in this way should be relied upon. However, since at the moment humanity is not able to fully control the atom, which is confirmed by various accidents that occur at various nuclear power plants around the world, the production of energy with the help of nuclear power plants is dangerous in the long term, and since with the complete transition to electric cars, the amount of energy consumed will larger, and nuclear power plants are the best way to produce a lot of energy, then the transition to electric cars in the case of Ukraine, which mostly produces energy with the help of nuclear power plants, is dangerous.

Next after nuclear power plants in the share of energy produced are TPPs and CHPs, which produce energy by burning coal or oil. With the increase in the number

of electric cars, the demand for electricity will increase, and since Ukraine has a rich raw material base of just these two types of fuel for power plants, most likely, the government will increase the amount of coal and oil extracted, which it will direct to power TPPs. Thus, the environmental friendliness of electric cars is questioned, since the main idea of an electric car is not to burn oil products that pollute the environment, however, the modern energy and fuel system of Ukraine is not able to meet the demand for electricity that will be used by electric cars, without using thermal power plants.

The share of energy produced by hydroelectric power plants is insignificant, so at the moment this type of power plants is not able to meet the demand for energy, especially when the number of electric cars increases. The share of «green energy» is almost zero, if statistical indicators are taken into account, therefore, at the moment, in the case of Ukraine, it is inappropriate to talk about the environmental friendliness of electric cars in terms of energy consumption, as a type of fuel, because of the environmental problems associated with production and disposal electric cars, we will come back later.

Returning to the statistics and analyzing the state of world energy, it should be noted that the Ukrainian energy and fuel system, in relation to thermal power plants to other types, is in a sufficiently advantageous position, however, as we have already concluded, even in the case of Ukraine, the increase in the share of electric vehicles on our roads will lead to an increase in the burning of coal and oil at TPPs. Speaking about global energy, we come to the conclusion that global energy is not able to produce ecologically clean energy (even if we add up the shares of nuclear power plants, hydroelectric power plants, thermal power plants, wind power plants, thermal power plants, geoelectric power plants, etc.), because the share of thermal power plants is 60%. Analyzing the results of the latest research, it should also be noted that the construction and commissioning of new NPP power units is significantly reduced in the world, which is associated with significant investments of the world economy in «green energy», but here we are faced with the fact that even the development of wind power plants and thermal power stations is not able to meet the global demand for electricity.

Therefore, having analyzed all of the above, we came to the conclusion that until the share of «green energy» together with «peaceful atom», hydropower plants and geoelectric power plants reaches at least 70% of the energy produced, *the complete transition* to electric vehicles will not solve the environmental problems that, thanks to full transition to electric transport, must be resolved. In order to speed up this process, humanity should start building autonomous buildings, which has recently started, because autonomy will reduce the load and strategic power plants. Households will be satisfied with SES on the roofs of buildings or wind turbines in the yard (if we talk about the private sector). In this way, people will be able to store their own electricity and use it for electric cars (which is one of the arguments for the environmental friendliness of electric cars, but not in the current world conditions). Unloaded power plants can direct the released energy to the additional power of electric cars and then, summing up all this, it is possible to achieve a more or less ecological use of electric cars, because at the moment it is impossible to name the use of electric cars (even with the theoretical presence of the above conditions), since the world has not solved the problem of harmless production and disposal of batteries used by electric vehicles.

The main advantage of home automation, which we talked about in the last paragraph, is the fact that the connection of residential and industrial objects, premises, etc., to the general energy network makes them vulnerable in case of

malfunctions that may occur at power plants. An example can be Ukraine in 2022 during the «missile terror», when energy infrastructure facilities were targeted for destruction or damage [2-4] . Problems with electricity and obstacles in its supply literally stopped the activity of the state and the economy as a whole. That is why the automation of building structures will reduce the load on the power grid, which can be used as a source of additional power for electric vehicles.

Of course, the production of gasoline, diesel and other petroleum products is accompanied by significant pollution of the environment, from the beginning of production to the moment of transportation and direct consumption. However, we have already found out that at the moment, with a complete transition to electric vehicles, due to the significant number of TPPs, their use will not be ecological. However, we also touched on batteries, which we will now focus our attention on.

Most people who advocate the environmental friendliness of electric cars say that batteries are environmentally friendly because they do not emit harmful substances into the atmosphere when they are used. This is certainly true, but the battery manufacturing process is not as environmentally friendly as it seems at first glance.

There are many types of batteries used in various industries, but the most common in electric vehicles are lithium-ion batteries. They have a high energy density, which means they can store a large amount of energy in a relatively small size. They also have a high charging speed and a long service life. However, production requires such substances as: lithium, nickel, cobalt and a number of other rare metals. The process of extracting these metals requires a lot of energy, contributes to pollution and anthropogenesis, and also leads to changes in the natural balance.

It should also be noted that in the production of lithium-ion batteries, factories use chemical substances and compounds, which, in addition to requiring significant costs for their production, are also environmentally friendly, and in case of improper disposal, lead to chemical pollution of the environment and changes in the natural environment

If we talk about the disadvantages of lithium-ion batteries, we should also mention the vulnerability to thermal effects, which explains the sudden ignition of electric cars, which sometimes led to accidents. Hydrogen vehicles are also endowed with a similar property, which is why they have not been widely implemented in the world. This is further evidence that while the electric car has its advantages, it also has a combination of disadvantages from vehicles and several different fuels at the same time.

At the moment, the disposal of lithium-ion batteries is also a priority task, which the widespread introduction of electric cars into our lives poses to humanity. Expensiveness, complexity, harmfulness to the environment and the lack of ability to cope with the growing volume of disposal of spent lithium-ion batteries make this process not only unfriendly, but not acceptable. Until humanity invents a method of disposal of lithium-ion batteries without at least such significant damage to the environment, the environmental friendliness of electric cars is once again called into question, especially saddening the above facts as well.

In the current situation: ICE cars pollute the environment, and electric cars are not environmentally friendly enough to replace ICE cars, solving one environmental problem and not creating new ones; we offer an option of hybridization of vehicles, which is partially embodied in modern conditions.

The use of an internal combustion engine and an electric motor, in our opinion, is the most effective solution in modern conditions in the presence of all other factors,

because as long as the world energy industry continues to develop to the level of predominance of ecologically clean energy over the burning of coal and oil, humanity will use a vehicle that combines the advantages of these two types of engines.

Currently, hybrids have become widespread in the modern automotive industry. For domestic use, they are the most acceptable because, at least, in the absence of light, you use the car thanks to the internal combustion engine, and in the absence of fuel and the availability of electricity, you use the car thanks to an alternative type of fuel.

Modern engineers who build special versions of cars for motor sports have noticed that the use of hybrids on race tracks is also more efficient compared to the use of a purely electric car or a car with an internal combustion engine. Thanks to the high torque, the electric motor enables a quick start from a standstill, from the moment the car reaches a certain speed, the internal combustion engine takes over the main work, thanks to which both a quick acceleration from a standstill and a higher maximum speed are achieved, compared to using a specific type of car.

Conclusion. In conclusion, it is safe to say that the process of production, use and disposal of an electric vehicle and its components is equal to, and in some cases even more harmful than, a traditional internal combustion engine car. Therefore, we believe that until the moment until the world energy and the energy of Ukraine, respectively, will not be able to produce a sufficient amount of clean energy to meet the demand, as well as until the moment until humanity finds an analogue of harmful lithium-ion batteries, and not will find a method of their safe disposal; electric cars will not be as environmentally friendly as they are currently being talked about.

We believe that at the moment it is better to focus not on the full transition to electric vehicles (which is a transition from one extreme to the other), but to focus our attention on hybrid vehicles that simultaneously provide the opportunity to enjoy the advantages of both types of cars, and which are sufficiently have proven themselves well for the period of time during which they exist and are used.

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