ELECTRIC VEHICLES IN THE MODERN WORLD

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Abstract: The relevance of the problem is due to the fact that the majority of emissions into the atmosphere of harmful toxic substances falls to the share of road transport with internal-combustion engines, which adversely affects human health and the environment state. One of the ways to solve the problem is the introduction of electric cars into the urban infrastructure. The objective of this article is to solve the problem of electric cars introduction in the urban infrastructure for improving the quality of human life. For this purpose, the modern approaches to solving this problem are systematized; the study of automobiles with internal- combustion engines impact on the Surgut city ecological situation was carried out; the necessity of electric cars introduction into the urban infrastructure has been substantiated. Theoretical methods of research: study, analysis, systematization of scientific, educational, publicist literature on the problem under consideration; the subject of research analysis; comparison and grouping of theoretical material. All the fore said allowed us to determine that electric transport is the unconditional and inevitable future of the automotive industry that caused by its cost effectiveness, noiselessness, environmental protection (no direct effect on pollution of environment), air-cooling, simplicity of design, ability to work in the generator mode, operating and maintenance costs reduction. Empirical methods have contributed to the study and analysis of documents, forms of bulletins, texts of scientific reports, monitoring of the atmospheric air state, study and analysis of data obtained in the medical institutions of Surgut city by type and number of diseases. With the help of experimental methods, the level of atmospheric air pollution measurement, as well as the processing, systematization and evaluation of the obtained data were carried out. According to data obtained, the conclusions about quality of atmospheric air, impact of exhaust gases of cars with internal-combustion engines on the atmospheric air structure and its impact on cancer morbidity of inhabitant's growth have been made. The gradual introduction of electric transport (cars, buses, trucks) to improve the quality of people life have been substantiated. The materials of the article are of practical significance and are relevant-motivational for the modernization of the urban infrastructure in sphere of transportation, as well as when considering the issue of configuration and replacing vehicles of the city enterprises. The gradual introduction of electric cars for transportations, practical taking into account by experts of the city-forming enterprises and administration of Surgut city the obtained results will improve the quality of inhabitant's life.

Keywords: electric vehicle, electric bus, electric heavy truck, environmental protection, exhaust gas.

INTRODUCTION

In modern conditions, up to 60% of hydrocarbons atmospheric emissions fall to the share of road transport. In internal-combustion engines (ICE), the duration of combustion is a split second, the chamber cold walls do not allow fuel to combust completely. As a result, the products of incomplete combustion are formed and emitted into the atmosphere. Due to the increase in the number of motor vehicles, smog over big cities became a sign of the time. Cars with internal-combustion engines produce a lot of noise, lots of smoke. Often there are traffic jams on the roads. Cars sit in these traffic jams for a long time poisoning the environment not less than under normal driving mode, but with this moving at the speed of a pedestrian. The automotive emission contains a large number of harmful substances, but most of them affect the environment locally - in the place of emission, poisoning the driver himself and the people around him. Additionally, the fuel combustion emits a large amount of greenhouse gases that are one of the causes of global warming. One of the ways to solve the problem of intraurban transport is the introduction of electric vehicles. In the near future, for intraurban transport there is no more environmentally friendly and inexpensive alternative than electric cars.

METHODS OF RESEARCH

Theoretical (study, analysis, systematization of scientific, educational, publicistic literature on the problem under consideration; the subject of the study analysis; generalization of research results); empirical (study and analysis of documents, forms of bulletins, texts of scientific reports, monitoring, study and analysis of data obtained in the medical institutions of Surgut city by type and number of diseases); experimental (measuring, making plots, systematization of data, drawing up of tables, mathematical processing of data and their estimation).

RESULTS AND DISCUSSION OF THE STUDY RESULTS

Theory and practice development of electric vehicle industry

Electric car is the unconditional and inevitable the future of the automotive industry. Many manufacturers around the world invest heavily in the development of electric cars that is abetted by the steady rise in prices for petroleum products, the need to reduce harmful emissions from cars, as well as the development of energy storage devices, technologies of energy consumption. The modern major markets of electric cars are China, USA, Japan and European countries: Norway, France, Germany, Netherlands, UK). Among the manufacturers of electric cars, the company Nissan (Leaf), Mitsubishi (I MiEV), Toyota (Rav4ev), Honda (Fitev), Ford (Focus Electric), Tesla (Roadster and Model S), Renault (Fluence Z.E. and ZOE), BMW (Active C), Volvo (C30 Electric) are highlighted. Our country stands aside from production and consumption of electric vehicles) [4].

Electric car is a vehicle that is driven by one or more electrical motors. Power of the electric motor is carried out from the storage battery (battery), solar battery, or fuel cells. The most widespread was the design of an electric vehicle powered by battery. The battery requires regular charging, that can be carried out from external sources of current, by brake energy regeneration, and also from the generator on board of an electric vehicle. The generator is driven from the internal-combustion engine but such a scheme, in fact, is no longer an electric vehicle and refers to one of the varieties of hybrid car [23]. Work on creation of electric cars is carried out in two directions - development of new models and adaptation of serial cars. The last direction is more preferable, because it is less

expensive. Depending on the purpose, the electric cars under production can be divided into three groups: urban electric cars (maximum speed up to 100 km/h); highway electric cars (maximum speed over 100 km/h); sports electric cars (maximum speed over 200 km/h).

The term Battery Electric Vehicle (BEV) means an electric vehicle suitable for movement along public-access roads and carrying all the energy necessary for its movement in the battery chargeable from the socket. These cars are called 'zero-emission vehicles' but the more correct name is 'remote-gas emission vehicles'. Electric vehicles are quite advantageous in operation. The run of electric vehicles using one battery charge is limited but the range of 50-60 km run for most people is quite sufficient to carry out daily trips. The disadvantage of electric vehicles is a fairly substantial cost of batteries. It is battery, that is the weakest point of the electric car [28]. The main electrical components are as follows: electric motor, controller, storage batteries. The controller receives currents from the batteries and supplies them on to the electric motor. A pair of potentiometers (variable resistors) installed on the accelerator pedal provide the formation of a signal to the controller about the energy it should supply. The controller reads the pulses from the potentiometers of the accelerator pedal and according to the data perceived regulates the motor power (Figure 1) [17].

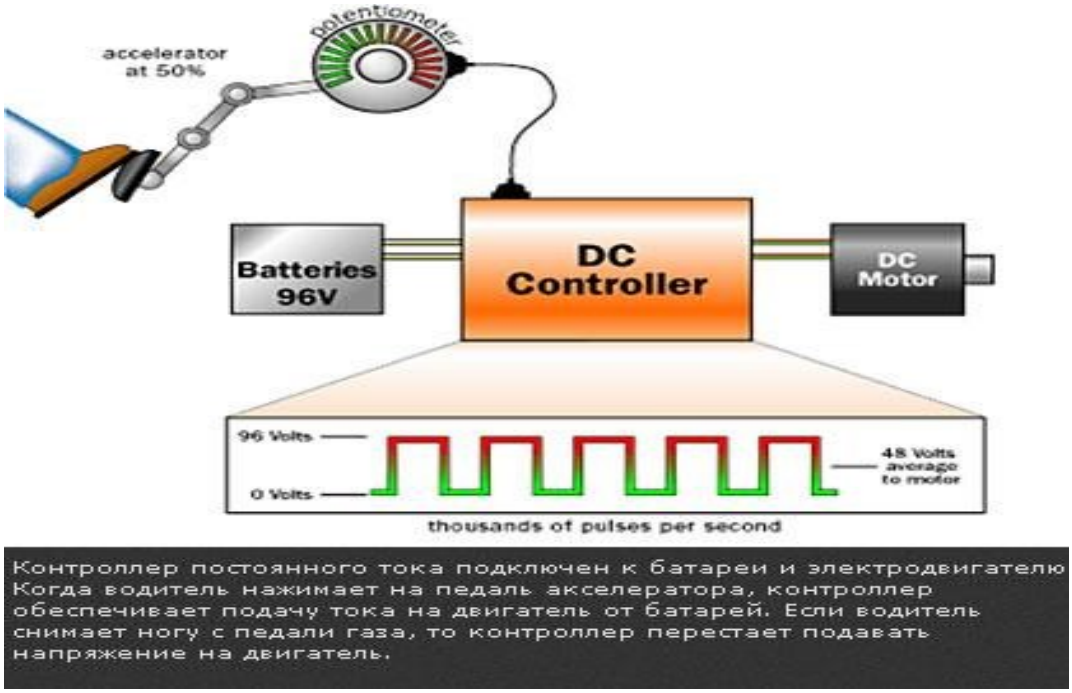

Figure 1 The controller operating principle.

The motor is powered by a traction battery. The batteries directly power the motor that drive the wheels. The use of lithium-ion storage batteries consisting of a number of modules connected in series is preferential. They are light, compact and conserve energy perfectly. Often, the electric vehicles, besides the batteries providing the motor power, have another small auxiliary battery required for car accessories operation: headlights, car stereo, dashboard, airbags, wipers, power windows and other devices. A direct current converter is also used to charge the battery. Electric vehicles use an inverter to convert the DC voltage of the storage battery into a 3-phase AC voltage to power the motor.

The electric motor is the main element of the electric vehicle. It is designed to create the torque required for movement. For completing the electric vehicle, both DC and AC motors can be used. DC motor can operate from the power of 96V-192V. The AC motor is a 3-phase engine powered by alternating current. The motor efficiency is 90%, and at internal-combustion engine (ICE) - 25% [4]. AC motors, when decelerating the vehicle, are capable to work in generator mode due to what the electric energy which is stored in batteries is produced and used further for vehicle movement (regenerative braking function allows increasing the range of electric vehicle run) [27]. Motor is the heart of electric vehicle, its main impelling power. The motor operation is based on the principle of electromagnetic induction (the phenomenon associated with emergence of the electromotive force in closed circuit when changing the magnetic flux). The motor converts electrical energy into mechanical one. The efficiency of the modern motor is 85-95% [19].

Advantages of electric motor: possibility to work in two directions without additional devices; maximum torque can be achieved within the entire speed range; air cooling; simplicity of design; possibility to work in the generator mode; reduction of operating and maintenance costs (electric motor does not require lubrication, no need to visit maintenance stations as often as with internal-combustion engine); reduction of noise level during operation (electric motors are quite capable to provide quiet and smooth starting-up at high acceleration); reduction of environmental pollution. The running motor does not emit any harmful gases or other substances, i.e. in itself it does not pollute the environment; the basis of electronic control system of electric vehicle are the input sensors, executive devices of various systems, control unit. The functions of electronic control system provide safety, energy saving and comfort of passengers: traction control; control of smooth acceleration and high voltage; optimal mode of movement; assessment of battery charge; control of regenerative braking; control of energy use; the dashboard visually reflects the main parameters of the electric vehicle operation [25].

One of the most famous brands of electric vehicles is the Tesla Model S. In addition, there are many other electric vehicles, for example, 'clean' electric cars BMW i3 and Nissan Leaf - the most sold electric car in the world. Among others, we can mention such less popular models of BEV available today on the market as Mercedes-Benz B-Class Electric drive, Smart ForTwo Electric Drive, Volkswagen e-Golf, Ford Focus Electric, Fiat 500e, Kia Soul EV, Mitsubishi i-MiEV, Porsche Panamera S E-Hybrid, and Toyota RAV-4 etc. The electric vehicle operation has significant differences from the car with IC-engine operation. It is the operational problems that hinder the mass use of electric vehicles, among which: long time of battery charge; necessity to create stations for recharge; high cost; limited autonomy [4].

Among the factors determining the electric vehicle run value without recharge are: driving style, character and conditions of traffic, battery capacity, use of auxiliary systems. The mean range of electric vehicle is 150 km at speed of 70 km/h. When the speed increases, the run decreases. So, at speed of 130 km/h, the run is about 70 km. As a result, the electric car is marketed as vehicle for urban trips. Modern technologies allow increasing the electric vehicle degree of autonomy for more than 300 km, among them it is possible to highlight as follows: regenerative braking system (returns up to 30% of energy consumed), high-capacity batteries, electronic optimization of motion processes. Battery periodic charging is an essential condition for the operation of electric vehicle. The standard 110 V socket charges the electric vehicle completely for night; special line

with 220 V and sufficiently high current (approx. 70 A) provide the same charge for 3-4 hours. The cost of charging depends on the level of electricity tariffs, the cost of charging from electric power is not more than 1/5-1/3 of the cost of fueling the car with a gasoline consumption of about 9.5 liters per 100 km, and it is advantageously different from the cost of liquid types of fuel.

The solution of electric vehicle charging is implemented in several ways: battery normal charging (is carried out from the household electric network with the power of 3-3.5 kW, and assumes the installation of a special charger on the electric vehicle, the duration of battery full charge is 8 hours); battery fast charging (is carried out at special stations with a capacity of up to 50 kW, charging time up to 80% of the battery capacity is 30 minutes); replacement of the battery discharged (is carried out automatically at special exchange stations); application of special Plugless Power chargers to charge the battery without using socket. For charging, the electric vehicle is placed in the garage, it will automatically connect to the charging station and deliver energy to battery by air [4].

Implementation of the said directions requires development of infrastructure (charging and exchange stations, parking places), standardization of technical solutions, development of rules for service providers. In the estimation of most experts, growth of electric vehicles sales will increase in connection with rapid development of the corresponding infrastructure all over the world - creation of specialized service stations for electric vehicles, charging station, spare parts shops [26].

History of electric vehicle creation

The history of electric vehicles is about 180 years. It follows that the first electric vehicles appeared almost 50 years earlier than the first car. The impetus for their development was the Faraday's discovery of the phenomenon of electromagnetic induction, after which engineers and inventors began to search for ways of its practical application. All electric vehicles of that time were heavy, moved at speed not more than 4 km/h and were not quite suitable for practical use. The development of electric vehicles was hindered by the absence of relatively small and rechargeable batteries [24]. The first electric vehicle was created by Robert Davidson, who presented his development in England in 1838 that was a huge machine with baths filled with sulfuric acid, with this the car speed was very small. The successful use of electric vehicles is focused on commercial needs. Electric taxis operated continuously in New York City from 1897 to 1912. Till the end of the First World War, electric vehicles continued to prosper but always in non-living markets or as part of larger car fleets. Electric materials-handling vehicles were used inside factories and warehouses where delicate goods cannot be exposed to dirty exhaust gas. In the 1920s in the United States and as well as after the Second World War in the UK, electric transport fleets delivered all, from mail of milk. In terms of output and speed, the original electric car kept ahead regular vehicle. By the beginning of 1912 more than 10,000 electric vehicles were manufactured in the USA, the traction electric motor of electric vehicle got power from batteries with lead accumulators and capacity of only 20 W/h * kg. But due to the lack of batteries capacity existing at that time, the electric motor did not become a competitor to the usual car [4].

The first horseless carriage in Russia was rechargeable (creator - I. Romanov, 1899). For the first time it was French designers whose electric vehicle reached the speed of 100 km/h (K. Jenatzy, France, 1898). Absence of smoke, quietness, ease of control were marketed as the main advantages of electric vehicles. The development of electric vehicles was hindered by the fact that they had limited speeds, as well as limited drive range due

to the low power capacity (about 20 W · h/kg). The unique properties of the electric vehicle are as follows: it is quiet, reliable, inexpensive, and capable for frequent starts and stops. In the mid-1960s, electric vehicle was again talked about as a car of the future, which was due to the problems of atmospheric pollution by cars with internal-combustion engines. Speed limitation up to 60 km/h, small mean daily run of cars in the city (up to 100 km), the possibility of arranging a network of charging stations for electric vehicles have contributed to the fact that in urban transport they are again popular. By this time, La batteries power capacity increased up to 50 W · h/kg; up to 100 W · h/kg. at Nickel-Zinc batteries.

In January 1990, General Motors introduced the Impact, a prototype electric vehicle that greatly increased performance and range through use of modern materials and design. Later in the year, the California Air Resources Board demanded that a part of all cars sold in the state should be zero-emission vehicles [2]. Gradually, researchers and politicians again gave up on the electric vehicles, instead of that, placing hopes on hybrid electric vehicles and hydrogen fuel cells. Many car manufacturers develop concepts hybrid cars where the electric motor supports the gasoline engine, therefore the issue of the electric vehicle remains relevant. According to statistics, sales of electric vehicles in Russia decreased by 28% in 2016, only 83 electric vehicles were sold. While in the world the sale of electric vehicles increased by 18%, to 650,000 cars. Among the leaders - China and the United States. In China, the number of registered electric vehicles increased by 53% and reached 1 (one) million units. The United States take the second place in the world with 153,000 electric vehicles sold in 2016 [18].

Overview of modern electric vehicles

Eiica was presented to the public in 2003, and in the winter of 2004 passed its first test drive, where gathered speed to 315 km/h. A little later, a record of 400 km/h was achieved. The name of the car Eliica means "electric Li-ion battery Car"-an electric car running on lithium-ion batteries. It was created at the Japanese University of Keio, with many companies assisted in its development. The car's maximum speed is 370 kilometers per hour. It is also necessary to note its graceful appearance. The car has 8 electric motors of 60 kW each (80 hp). The total power of Eliica engines is 480 kW, i.e. 640 hp. Time of full charge of lithium ion batteries is 10 hours, it is possible to charge the car from the household network. About 30% of the total cost of the car falls on the cost of the battery. Batteries are 80 elements in 4 blocks. The length of Eliica is 5.1 m. Excellent aerodynamic shape, high speed which is achieved by the presence of eight wheels, distinguish Eliika among others. Each car wheel is connected to its motor separately. Motors are in the wheels themselves. Energy for the operation of Eliica is fed from lithium-ion batteries and its charge is enough for 300-320 km. Eight-wheeled Eliica accelerates from a place up to 100 kilometers per hour in 4.2 seconds, to 160 km/h - in 7 seconds. The innovative vehicle with the body "bullet" aggregated with two AC motors, the total capacity of which is 400 horsepower. [2].

In 2008, Mitsubishi presented the electric car Colt MIEV at the exhibition in Tokyo. Since 2011, in the European countries the electric vehicles Mitsubishi I-MiEV have been selling. They are equipped with a 47-kilowatt motor and lithium batteries, thanks to which the car can run up to 160 kilometers without additional charging. Under the floor of the electric vehicle the lithium-ion battery is hidden, over the rear leading axle there is a motor and transmission (single-stage reduction gearbox with differential), above them there is a rectifier and converter. Engine power - 64 hp at 3000-6000 rpm, torque -180 N

• m from 0 to 2000 rpm. Maximum speed is about 130 km/h [1]. The electric motor is located inside the disc making the design remarkable, with this under the floor of the car, the block of alkaline batteries is located.

The electric car Mira EV, created on the basis of the serial Daihatsu Mira, drove on one charge more than 1003 km, for which it was included in the Guinness Book of Records. However, it should be noted that it is a very slow model (the motor power is only 19 hp), and to establish a record the car was completed with eight thousand batteries from laptops, and in addition, the engineers made the body as light as possible, dismantling, for example, rear seats. In terms of security, there is a certain threat in electric vehicles, he concerns of which has already been expressed by the U.S. and the United Kingdom government. It is a question that at relatively slow movement (up to 30 km/h) such vehicles practically do not make any sounds. This is a danger for blind pedestrians, and sighted people do not used to twirl their head if the road is quiet. Recently, in America, the legal requirement that all electric vehicles should be equipped with "artificial noise" for three years was codified. The Ministry of Transport of England also takes similar measures [4].

Nissan Leaf (2011) - the Japanese are ahead of the Germans in the developments of electric vehicles. We can say that Nissan LEAF is the firstborn of the newest era of electric vehicles. It is characterized by absence of emissions; controllability in combination with a speed of 145 km/h and drive range of 170 km; compatibility, both in size and engine of 80 kW (recharging from lithium-ion battery), in combination with a roomy trunk and salon. Regenerative braking, satellite navigation, parking systems, remote control of batteries, heating of the cabin, solar panels for auxiliary devices are the innovation. Nissan is fully charged in 30 minutes. If you connect an electric vehicle to a regular 120 V socket, the battery will be charged for 16-18 hours, or just for 8 at voltage of 240 V [6]. Electric vehicle Mercedes SLS AMG E-cell (2011) is equipped with four electric motors (one per each wheel), powered from lithium-ion batteries located in the floorplan, rear and front part of the car. The total power of the electric traction is 533 horsepower and the maximum torque is 880 Nm. This allows the super car powered from batteries to accelerate to 100 km/h in almost 4 seconds and develop a maximum speed of up to 300 km/h. Drive range - 200 kilometers.

Renault Fluence Z.E. (2011) is the largest of electric vehicles. Its electric modification added 13 cm in length. With this, the capacity has not grown, but has decreased a little at the expense of the storage batteries placed in trunk. The motor develops 95 hp against 113 forces at Golf and 109 hp at Leaf. Renault Kangoo Express Z.E. (2011) -electric vehicle, as a commercial transport, can be quite advantageous to those companies whose daily run is within 160 km. The van presented by the French has a relatively weak engine (60 hp, 226 N•m), although the specificity of the electric vehicle will may be manifest itself in carriage of goods the best way. The electric motor develops maximum torque, starting with the lowest speed. In 2011, the group from France that united the efforts of a number of companies (Leroy Somer, Valeo, Johnson-Control Saft, Leoni, etc.) and research centers announced the three-seat concept car VELV (Lightweight Urban Electric Vehicle). The vehicle has a 20-kilowatt power plant powered from lithium-ion batteries. Electric concept car weighing 650 kg is equipped with storage batteries with a capacity of 8.5 kilowatt-hour that allow the car to run without recharging up to 100 kilometers at a speed of 110 km/h [6].

In 2011, the company Audi introduced the electric vehicle Audi Urban Concept built on a new platform. The design is characterized by smooth contours. The wheels are

outside the body, the base is with protective elements and LED indicators. For the purpose of comfort, it was even necessary to arrange the seats in a staggered manner. The steering column and pedals can be adjusted, boarding is carried out through the rear hinged side. The roof can be opened and shifted back. Everything is focused on facilitating the design. Body of carbon. Wheels – 21inch. Two electric motors provide the urban concept with a powerful acceleration, and lithium-ion battery provides reserve of energy needed for urban trips [2]. Electric vehicle Renault Frendzy (2012) -new development of electric vehicle of Renault company. Dimensions - 4,091 x 2,172 x 1,743 (mm). Frendzy has no window on the passenger side and B-pillar. There is only a usual door and a side sliding door fitted with the built-in 37-inch screen. Sound solution is also interesting: Renault produces sound when moving in a wide range both inside and outside the cabin.

Single-seated super compact electric vehicle COMS P-COM from the Toyota Body (2012) is able to drive about 50 kilometers with battery fully charged. Of course, it is very difficult to develop a great speed on it, but COMS is not intended for this. In fact, the concept of COMS means the abbreviation in Japanese, the pronunciation of which in English letters is as follows: Chotto Odekake Machimade Suisui that in free translation means roughly the following: "Easy movement around your district in the urban environment. The electric vehicle belongs to the class "Four-wheel motor bicycle" [2]. The main difference of the new Coms is the reduced charging time, about two hours. Another undeniable advantage of Coms is a stylish design that distinguishes this model among the other cars for driving around the suburbs [4]. BYD E6 (2012), the new electric crossover from China, if you believe the technical characteristics, is superior to the Western and Japanese competitors. First, due to the battery with twice capacity more than of the rivals, (48 kW • h), it was able to increase the drive range to 330 km. The manufacturer also promises a wide range of powerful motors. The latest modification of front wheel drive is equipped with 101hp engine, and the top version has 215 hp motor for the front axle and 54 hp for the rear. Such a car is very dynamic: less than 8 sec to 100 km/h [2].

Electric car E'mo (2012god), three-seated and innovative ("light as a feather"), is designed for urban. The developers made free the vehicle owner from all the burdensome in the vehicle. A complete separation from the usual design, platform, heavy weight, power. Only lightweight materials and structurally simple compounds and mechanisms are used. Weight - only 325 kg! Payload - 275 kg. Drive range up to 100 km. Speed up to 80 km/h. There are spaces for extra batteries. Dimensions -2,725 x 1,495 x 1,500 (mm). Safety – high: two strong longitudinal side member, shockproof front part, three-point seat belt [2]. VW Golf Blue-e-Motion (2013), the model in its dynamics is comparable to the standard 1.6-liter hatchback. However, if the petrol version manages to accelerate up to 188 km/h, the electric motor fall short of 50 km/h compared to this figure. Drive range up to 145 km.

Renault Twizy (2013) with electric traction, is the smallest participant of the program Renault Z.E., it has zero CO_2 emissions. Not yet a car, but no longer a scooter: front mid-engine, rear-wheel drive layout, and spatial frame. The standard Twizy is equipped with engine with a capacity of only 13 kW, and can accelerate already up to 81 km/h. Engineers of Renault Sport branch who developed Twizy compare its acceleration with 125-cubic scooter. Twizy, when charging by 10-ampere current, consumes 2 kW like electric kettle. It takes three and a half hours to charge the batteries fully. At active driving, Twizy consumes twice more energy than declared 63 W · h/km. Twizy weighs only 474 kg. Kia Soul EV (2014), the body is reinforced for the 277-kilogram lithium-ion polymer battery with a capacity of 27 kWh, besides there are five additional crossbars in the

bottom, and the body structure itself is changed: it has more ultra-high-performance steels, and stiffness in torsion has increased by a quarter. Electric motor from under the hood is not heard at all: up to 20 km/h Soul emit an 'underwater' sound with a special sound generator in order to alert passers-by. But then, this sound subsides and the noise of rolling tires comes to the fore. Due to the 'underfloor' traction battery, the center of gravity has become lower, the rolls have decreased. Under hood, there is a motor with reduction gearbox and controlling inverter. Accessible from the first turn, the maximum torque of 285 Nm allows you to accelerate at urban speeds: up to 50 km/h - in 3.9 s., up to 100 - 11.9 s. According to Soul EV passport, it should run 200 km with full battery. In real urban life Kia Soul EV is able to drive about 100 km with a fully charged battery of 27 kW · h. Given the fact that it is not recommended you to allow full discharge of the traction battery. When connecting battery to EU socket, you will wait for its full charge 14 hours, the charging rate is approximately 7% per hour [4].

The minivan Luxgen 7 MPV EV + (2014) has under its hood 150-kilowatt electric motor and control unit. Electric vehicle runs smoothly, electric motor is almost noiseless, noise insulation is excellent. Judging by the indications of the on-board computer, the battery capacity of 43 kw · h is enough for 100 km of urban run. The electric Luxgen weighs at least 2.5 t and is able to carry five passengers. Full charge from a special terminal with a voltage of 370 V takes less than two hours and a half. For the first time, Toyota announced the creation of an electric vehicle in the summer of 2010. The car was shown in Los Angeles. By appearance, the electric vehicle differs from gasoline RAV4 by wheel arches and design of bumpers. The electric vehicle is equipped with ion-lithium batteries (30 kw), sufficient to provide a drive range of 160 km. The power of the electric transmission is 154 hp, and the performance depends on the driving mode. If the sport mode is selected, the car is accelerated for 7 s. from 0 to 100 km/h, with this, maximum speed is 160 km/h. The sales began in California at the end of the summer of 2013 [2].

In the domestic automotive industry, the attempts were made to create electric vehicles. VAZ-1111E (assembled from foreign components), based on the body of the car OKA (Avtovaz). In the work, the nickel-cadmium alkaline batteries of domestic production were used. The car develops the maximal speed of 90 km/h, in 14 seconds it accelerates up to 60 km/h. In urban mode the drive range is 100 km/h. Another electric car ZAZ-1109 provided for power from conventional batteries. The consumption is 20 kW/h per hundred kilometers, it withstood 400 recharges, with this, one charge made from the usual socket is sufficient for 100 km. There is no noise in the car and no vibrations. The downside is the cost of the battery, which deprived its benefits, namely the low price. Yo-Mobile is the first domestic electric vehicle-crossover of LLC Yo-Auto (in which 51% belongs to the car company Yarovit, the rest to Onexim of Mikhail Prokhorov). Yeo-Mobíl is a Russian project of the sequential hybrid vehicle in the construction of which it was intended to use an electric transmission with combined power from the generator rotated by gas-gasoline internal- combustion engine, and from the capacitive energy storage. Due to the use of this scheme, the Yo-crossover would have a basic full drive. The structure is based on a steel spatial frame, and the body is supposed to be made of thermoformed ABS-plastic and polypropylene [4].

The Yo-Mobile variant was demonstrated to the general public in September 2011 at "Lenexpo". It was a concept-car with doors sliding back. In the center of the instrument panel, there is a main display with data necessary on the way: speed, run, reserve, etc. The navigation map can also be projected on the screen. From the control panel you can control the car functions (multimedia, climate control, internet access). During parking,

the panel can be used to work with Android applications. In "Yo"-crossover it is possible to charge the laptop and other household devices from the car-system, for the purpose of which there is (near the driver's seat) a 220 V socket in the cabin. The sensational idea to create the first Russian hybrid, in fact, crashed: the vehicles production has been postponed for an indefinite period, and the construction of the automobile plant has been frozen for lack of financing. Problems arose when it came to the understanding that to make Yo-mobil competitive at the price will not work. However, the company has very good developments that can be in demand in the market. In particular, the authors of the project believe that other companies may be interested in both the hybrid platform itself (its design is patented) and individual elements, for example, super capacitors. Thus, the domestic automotive industry is not actively involved in the development of electric vehicles. However, the models of electric vehicles (including with hydrogen and hybrid engines) were presented at a number of exhibitions, but the case did not come to production.

Electric supercars

Porsche Carrera GT and Ferrari Enzo, whose cost exceeds a million dollars, are rightfully considered supercars due to the lightweight carbon bodies and powerful engines that provide these cars with the minimum acceleration time. The average supercar accelerates up to 100 km/h in 3.9 seconds. Modern electric vehicles can easily compete with supercars in speed: acceleration time of a number of models, such as the Tesla Roadster, is similar to the results of supercars. The fastest electric vehicle to date is the Chevy S-10 "Smoke Screen", which accelerates up to 100 km/h in less than 3 seconds. The car is equipped with an electric motor of 400 watts from General Electrical. The second place belongs to the car Datsun 1200, equipped with two electric motors of total capacity of 250 hp and developing speed of 100 km/h in just 2.9 seconds [2]. Wright speed X1 with the engine from AC Propulsion, the acceleration results of which are not much more - 3.07 seconds. The engine of the model is similar to the electric motor of Tesla Roadster vehicle. In fact, the company Tesla most of its technologies borrowed from the AC Propulsion, so two cars are quite comparable in characteristics.

Another car based on the AC Propulsion technology, model Tzero, accelerates to "hundred" in 3.6 seconds. Tzero engine was originally developed for Honda Civic by Alan Konkoni (a former engineer of the GM auto Concern) back in the late nineties. However, the front-wheel drive vehicle Honda Civic failed to demonstrate the full potential of the electric motor [6]. Finally, Tesla Roadster launched in 2008 by Tesla Motors closes the top five leaders. The Tesla Roadster accelerates up to 100 km/h in just 3.9 s. The chassis is designed and produced by the Lotus. This is the only serially produced electric vehicle capable of moving outside the city. This is due to the fact, that the full charge of the battery is enough to run 320 km of roads (with moderate driving you can drive a lot more). Another feature of Tesla is its dynamics. The sports car is able to accelerate from 0 to 100 km/h in 3.7 s. The power of the motor that drives the rear wheels is 288 hp, and the maximum torque is available from zero rpm. With impressive dynamics, the maximum speed is limited by electronics and is 200 km/h [2].

The results of the patent search showed that the issues connected with electric transport are of interest to domestic and foreign scientists. Kuno Hiromiti proposed the design of the vehicle with electric drive [8] that was taken as a basis by the Mitsubishi Corporation in the production of electric vehicles. Changes in the electric vehicle design offered by Nakamura Yohei (JP), Kazama Isamu (JP) in the form of a control device by

cessation of electric vehicle slow movement. The device includes a means of determining the velocities field for prohibiting the termination of slow movement performed with the possibility of determining whether absolute value of the vehicle speed below or not than speed value for prohibiting of movement termination in condition when the torque for slow movement is given without performing termination of slow movement. The means of prohibition of slow movement termination is carried out with the possibility of prohibition of slow movement termination, regardless of satisfying the condition of the permission to terminate movement when the means of determining the velocities field for prohibiting the termination of slow movement determines that the absolute value of the vehicle speed is in the velocities field for prohibiting the termination of slow movement [9].

Uchida Kenji has developed an electrically driven vehicle power supply device that includes a power supply device and a way to control it. The proposed power supply device is a built-in device into the electrically driven vehicle and includes the energy storage device, energy conversion device and detecting device. The energy conversion device is made with the ability to execute at least one of the following: power supply from the energy storage device to the load, external to the vehicle, and charging from the load to the energy storage device. When the load is connected to the electrical energy conversion device, the detecting device sets the threshold definition for detecting the decrease in insulation by the value lower than the threshold definition in not connected load state to the electrical energy conversion device [10]. The device for controlling the propulsion system of the electric vehicle is developed by the Japanese scientists. The energy conversion unit works as an inverter and DC voltage converter. Therefore, it is not necessary to provide a DC voltage converter separately to charge the power storage device. The advantage is that the control device of propulsion system of the electric vehicle was obtained in which the reduction in size and weight has been implemented as well as cost reduction [11]. The electric vehicle design offered by Grigorchuk V.S. provides more efficient energy consumption of the batteries, increasing electric vehicle run between the battery's charges, increasing driving speed through the use of more powerful traction motors. In addition, the electric vehicle is equipped with a DC electrically driven motor connected to the storage batteries, reduction gearbox with torque amplifier, on the cylindrical case of which the electrically driven motor is fixed inside of which the main shaft is installed. At the free end of which the following is fixed: flywheel with toothing, several movable plates with permanent magnets [12]. The proposed developments are able to improve the work of electric vehicles, some have already been introduced into production, others are in the process of development for introduction into production.

Electric buses

In today's world, the role of electric transport for passenger's transportation is steadily increasing. When using such buses, they will prove to be environmentally friendly and advantageous replacement of regular buses. Chinese company BYD Motors in 2013 presented an electric bus Lancaster eBus, which deserves the title of the world's largest electric vehicle. Articulated bus of just huge in size can carry 120 passengers in its cabin and drive more than 179 miles (288 km) on one electric charge. Lancaster eBus was designed and built by Chinese engineers for two years. The fully electric bus Lancaster eBus was designed primarily for the American market. Outwardly, the electric bus of more than 18 meters long differs a little from the usual urban trolleybuses of bendable design. Inside its body a number of advanced technologies of electric drive is hidden. The electric

bus is suitable for use in hilly urban areas, because the motors included in the wheels (motor-in-wheels) allow it to overcome the mountainous areas with a slope level of up to 21%. In this case, the battery charge is enough for almost 300 kilometers of the way even with the passenger cabin fully filled [4].

In the version of the electric bus Lancaster eBus, the branded lithium-iron-phosphate batteries are used. These batteries are able to maintain the charge to ensure the long journey of the vehicle throughout the working day. This moment is very important not only from the perspective of the electric bus ease of use without necessity of periodic charge during the day when the passenger load is maximal and down time for means of transport of a public network are extremely unprofitable. It is also very important from the point of view of money saving. The bus can be charged only at night, when electricity tariffs are significantly lower and the routes loading is less. With the batteries one charge, the electric buses can drive for day and night, while the total duration of their power supply from the mains does not exceed 2-4 hours. It is worthy of note that the batteries lifetime guaranteed by the manufacturer exceeds the lifetime of other parts of the vehicle. The batteries can serve for about 25 years, withstanding 10,000 charge/discharge cycles retaining with this up to 70% of their original capacity. It is thanks to the new technology of storage batteries that for the first time the mutual recharge of electric buses became possible when one of them becomes a charging station for another.

At the exhibition of the American Association of Public Transport in 2013, the version of the electric bus Transit was presented. In contrast to Lancaster eBus, this bus was designed not for urban but for the purpose of long journeys on suburban routes. With one battery charge, the vehicle easy covers a distance of 400 kilometers [20]. In 2014, two Japanese corporations HINO and Toyota developed an electric bus FCHV-BUS. FCHV-BUS dimension is 10515x2490x 3360 mm, capacity is provided for up to 65 passengers. The reported speed of the bus movement is up to 85 km/h. The bus is equipped with two fuel cells, the aggregate capacity of which is 180 kW and two motors, the aggregate capacity of which is 160 kW. Since 2016, buses have been operating in Japan carrying out urban transportation of passengers, replacing regular buses [4]. Russian company KamAZ has developed two models of electric buses of large and small capacity. The first prototype of electric bus in Russia was created in 2011. It is used for the rotational transportation of workers in the petrochemical company in Novosibirsk. It is estimated that the company saves on the bus operation approximately 780,000 Rub per year. One of the electric bus is designed on the basis of a 6-metre Turkish bus Otokar and has a running distance of 50 km on one charge. The second model is designed on the basis of a 12-metre bus NEFAZ and has a drive range of 100 km. In 2012, the Neftekamsk Automobile Plant certified the first Russian electric bus and called it "NefAZ-52992" [21].

The autonomous electric run is designed for more than 200 km. Lithium-iron-phosphate battery is placed on the roof, in the rear overhang, in the cabin of electric bus, its energy capacity is 313.6 kw/h. In addition, there is a battery charger with a capacity of 48 kW. The process of full charging of the vehicle takes 8 hours. Rapid charge rate during 20 – 30 minutes is carried out from power mains up to 500 kW, for this purpose the electric bus is provided with power connectors. Another innovation has been implemented in the electric bus NefAZ: a telemetry system transmitting to the remote computer of the service department the information about the condition of the main units and the battery (voltage, temperature in the cells, charge currents and other parameters).

The experimental winter operation of the electric bus confirmed the ability of the battery not to lose its performance properties and characteristics in the severe Siberian frosts [4].

In 2016, the American company Proterra introduced its electric bus E2, the advantage of which is the battery bank of 660 kW-h. The run range of E2 is 563 km (during testing on polygon, the bus was able to overcome more than 966 km without recharging). The company has already produced and sold about 300 buses throughout the Continent of North America Manufacturers have reduced the weight of the bus to 15 tones due to the use of body structure made of carbon fiber. The speed limit of E2 is 105 km/h. Maximum of 5 hours will require to charge fully the 120-kV station. The bus is provided with a charging system while driving [21].

In the Moscow region, within one month in 2016, the test operation of the bus KAMAZ-6282 took place. The advantage of the new type of transport is a reliable undercarriage and brake parts, good layout of the bus, noiseless engine and lower price of operation (almost twice lower than the maintenance of diesel bus). Among the shortcomings, the creaking of facing panels and the lack of air conditioning system (as stated by the manufacturer) was highlighted. The electric bus KAMAZ-6282 uses the modern lithium-titanate batteries, the service life of which is more than 10 thousand cycles, or about 10 years. The bus is charged from ultra-quick charging stations using pantograph for 6-20 minutes. Charging can also be carried out from the trolleybus mains. "Night Charging" is also used in the park with the help of the on-board charger from the standard three phase AC electric mains. According to information of KAMAZ manufacturer, the maximum drive range of the electric bus without recharge is 100 kilometers, that is more than enough for an average route of 50 km. The electric bus capacity is 85 passengers (25 seats), it has a low floor design meeting the modern requirements for the passengers' comfort. In the long run, the use of electric buses will significantly reduce the harmful emissions and noise pollution of cities [22].

Serdechny A.S. proposed a model of electric minibus with wind-powered generating plants that is environmentally friendly and safe for people. This vehicle is equipped with an electric drive that takes into account the noise generated by the inverter during the energy supply and receipt between the power source or electrical load outside the motor and the power storage device installed on the vehicle [13]. This device has great prospects for prototype production. The largest fleet of buses is in China, it is assumed that by 2020 in China there will be no buses running on gasoline. The maneuverability of Chinese electric buses is higher than conventional transport, which is achieved by the light material used for the construction of space vehicles.

From January 2019, the streets of Oslo will see unmanned electric buses. This bus accommodates not more than 12 passengers and makes speed not exceeding 20 km/h. You will be able to call the bus using a special mobile application. Waiting time is not more than 10 minutes. In Australia, the world's first pilot solar powered bus was produced. Tindo (translated as "Sun") is created by New Zealand company DesignLine International, and it is 100% powered by solar energy, it is able to give a ride 42 people free of charge [21]. Dan Bus Company continued to develop in the direction of the solar panels use for electric buses. The advantage of newly developed buses is the increased durability of the batteries and a long-range without charging. It takes 30 minutes to renewal 50% of the battery capacity. This was made possible by the use of iron-phosphate batteries. They are more durable and less toxic. The electric bus is equipped with solar panels, which are placed on the roof of the bus and "help" the onboard electric power system to save electricity. The use of electric buses for carrying passengers has enormous opportunities,

although the transition to such an environmentally friendly transport will require considerable costs, but it will significantly improve the environment.

Electric heavy trucks

Scania, together with partners Siemens and Bombardier, is actively developing and testing trucks equipped with a hybrid diesel-electric drive with the ability to supply power from an external electric power source. The project has already entered the second phase, as the first prototype was built in 2012. It is about two ways of electric power supply using the traditional overhead contact system (Scania-Siemens) and the noncontact bus laid under asphalt (Scania-Bombardier). Both methods are known in our country since the Soviet times: the first technology was used for construction of trolley-trucks, and in 1947 on the territory of the Sergo Ordzhonikidze Plant in Moscow the pilot load trolley with noncontact induction power supply drove. On the roof of trolley-truck Scania, the current collectors of the same width as the vehicle itself are located allowing to change lanes on the road [4]. Another truck has the inductive current collector under the bottom: through air gap reaching 10 cm, it receives up to 200 kW of electric power from the bus built-in into the road. With this, the power is supplied to bus only when it "feels" the signal from the sensors of the approaching truck. The tests take place in Germany on the 2- kilometer closed road near Berlin, equipped with the overhead contact system (Siemens called it eHighway, "Electric Highway") and on the polygon in Mannheim, where a contact bus is buried under asphalt. Where there is no overhead contact system, the vehicle will move on diesel engine, in other cases there are "advanced" trolley "horns" (pantograph), and with this, the electric movement will be carried out at speeds up to 90 km/h. Switch from diesel to electricity and back takes place automatically, without requiring a driver's participation. Yes, "horns" themselves "see" (by infrared sensors) the overhead contact system, themselves rise, "seek" the contact with wires, and etc. That is, if the driver needs to overtake the truck, traveling at a speed of 70 km/h, he just does it without thinking about anything. Unlike hybrids, no bulky and expensive batteries will be required for a truck [4]. In case of regenerative braking, electricity will be given to the electric contact system, not to mention the fact that the operation on electric motors significantly increase the torque so necessary for heavy-load trucks. The system is simple, practical and, according to Siemens calculations, fast-payback not only on the urban roads, but also on the highways, especially between large cities.

Electric vehicle charge

Any electric vehicle needs a battery charging system. The vehicle's charging system allows you to replenish battery power in almost any place where there is a power receptacle. This system provides electrical energy for the batteries with the maximum speed allowed for the batteries. While charging, the charger controls the voltage, strength of current, and temperature in the batteries. The battery charger can be both a separate unit of the electric vehicle, and can be fully integrated into it. In the future development, it is envisaged that the battery can be left at charging station, and the charged one taken. Stations with equipment for express replacement of batteries exist only in the form of conceptual developments and the current models of electric vehicles are not equipped with quick detachable batteries. Not to mention the fact that now the battery models are different and not interchangeable. Renault has announced that it is planning to invest in creation of the battery replacement stations network [6]. American company Evatran has developed a new charger Plugless Power Renault Twizy, which allows you to charge the

electric vehicle battery by air without receptacle. For electric vehicle charge, it should be placed in garage, it will automatically connect with the charging station and start to supply energy into the battery by air. The receiver is installed in the lower part of the vehicle chassis [4].

Designing of the future for charging electric vehicle

Researchers-nanotechnologists from the Queensland University of Technology (QUT) use body panels as storage batteries inside of which supercapacitors of new type are enclosed. They are capable to release a large amount of energy for a long time but they cannot store the large amount of energy. The supercapacitor consists of two carbon electrodes and an electrolyte located between them. This device can be installed in any part of the car body. The new supercapacitor can be used in conjunction with the existing lithium-ion battery, and then the large power output of the first device can be used for quick charge of the second device. Combining these devices will significantly reduce the overall weight of the vehicle. Due to the fact, that in the supercapacitor rare earth elements are not used, it is much cheaper in production and less toxic to the environment. Researchers from QUT plan to develop supercapacitors that will be able to replace completely the lithium-ion batteries, retaining the ability to release energy 10 times faster [4]. French researchers Ludo Serge, Brian Benoit, Ploix Olivier, Villeneuve Arno proposed the design of the quick charger for electric vehicle. It contains an input rectifier cascade made with the possibility of connection with mains. The output inverting cascade made with the possibility of connection with batteries contains the control means of the current average value obtaining from the input cascade relative to the current value calculated according to the maximum value of current supplied by mains. Method of the battery charge includes the regulation of current average value obtained from the rectifier of the input cascade [14]. French researcher Dupuy Philip conducted a study of the electric pulling chain for the vehicle. The technical result is in reduction of the battery charging time and increase safety during the operation of the vehicle [15]. Japanese designers have developed a vehicle design with electric drive. The vehicle comprises a secondary coil operating with self-resonant frequency, a secondary coil, a rectifier, an energy storage device and an electric motor. This design facilitates the transmission of charge energy wirelessly to the electrically driven vehicle from the external energy source in relation to the vehicle, allowing the energy storage device installed in the vehicle to be charged [16].

Analysis of the Surgut atmosphere state, assessment of the polluting factors impacts on cars with internal-combustion engines per person

Surgut is located in the north-eastern part of the West Siberian Lowland on the right high bank of the river Ob'. The town occupies an area of 210 km^2 and has a population of more than 300 thousand people. Surgut is located in the area of sharply continental climate. In the town there are 6 posts of observational network to monitor air pollution. In order to manipulate the official data, the data provided from the observation posts were used. In addition, the measurements were made by means of portable gas analyzer of atmospheric air GEOLAN-1P. The analysis of the data obtained from the observation posts and recorded by us during the experiment showed that they are identical. It is necessary to indicate that from the observation posts more detailed readings on the composition of Surgut atmospheric air were obtained. Table 1 presents data on the quality of air in Surgut on the main substances [3].

Table 1: The quality of atmospheric air in Surgut for 2015-2017, 2010

Substance	2015	2016	2017
	Percentage of MPC	Percentage of MPC	Percentage of MPC
Suspended substances	0.6	0.6	0.6
Sulphur dioxide	0.1	0.1	0.1
CARBON OXIDE	0.8	0.9	0.98
NITROGEN DIOXIDE	0.6	0.7	0.8
Nitrogen oxide	0.6	0.5	0.6
Phenol	0.7	0.9	0.8
FORMALDEHYDE	3.7	4.2	4.7
Benzene	0.1	0.2	0.2
Aromatic hydrocarbons	0.1	0.2	0.3

Components of contamination

Nitrogen dioxide and oxide. In general, the annual average concentration of nitrogen dioxide approaches to the critical level. There is a tendency of its concentration increase from year to year. Nitrogen oxides are gases generated during combustion of fuel, for example, in cars and other vehicles, heating devices and stoves. They also present in tobacco smoke. The ingress of nitric oxide into the human body can cause irritation of the respiratory tract and lungs. Carbon oxide - the mean concentration is close to critical. All areas of the town are contaminated with this admixture to the same extent. The reason of this concentration are the exhausts of motor vehicles and long-term unfavorable weather conditions, which have contributed to accumulation of harmful impurities in atmosphere. Dioxide and carbon oxide are poisonous gases. Long-term exposure of carbon oxide can lead to loss of consciousness, coma and death. Benzol is included in the composition of crude oil and gasoline. The main source of benzene ingress into the body is through air inhalation. In chronic exposure, benzene accumulates in adipose tissue. Pathological changes in blood are observed. Polynuclear aromatic hydrocarbons (PAHs) - the source of increased PAH content in the air are motor transport, industrial production. The concentration does not exceed 0.3%, but there is a tendency to increase the content in the atmosphere. It affects the lungs, causing the development of lung cancer. One of the main sources of these pollutants are exhaust gases of automobiles with IC-engine. Table 2 shows the composition of the exhaust gases [1].

Table 2: Approximate exhaust gas composition

Components	Content by volume, %		note
	Gasoline engine	Diesel engine	
Water vapor	3-5.5	0.5- 4	Nontoxic
Carbon dioxide	5-12	1-10	Nontoxic
Carbon oxide	0.1-10	0.01-5	Toxic
Hydrocarbons	0.2-3	0.009-0.5	Toxic
Aldehydes	0-0.2	0.001-0.009	Toxic
Sulphur oxide	0-0.002	0-0.03	Toxic
Soot	0-0.04	0.01-1.1	Toxic

Pheno in the form of vapors or dust penetrates the body through the respiratory tract, mucous membranes and skin. Its concentration approaches critically as related to the maximum permissible concentration (MPC). Under the influence of phenol, the

fatigue, dizziness, headache, as well as reduced immunity, exacerbation of allergic reactions is observed. Formaldehyde is included in the list of carcinogenic substances. It has a chronic toxicity, negatively affects the genetic material, reproductive organs, respiratory tract, eyes, skin. It takes a strong effect on the central nervous system. The analysis of the table showed that the contaminants under observation, during the period under consideration did not exceed MPC values except formaldehyde. Carbon oxide was at a critical mark, and there is a tendency of increasing the concentration of toxic substances. Since formaldehyde is defined as a substance provoking the development of cancer morbidity, we decided to consider the effect of formaldehyde increased concentration on population morbidity. In Surgut the dynamics of the cancer morbidity risk caused by formaldehyde effect is presented in Table 3 (Population risk (PR) was calculated for the entire population of Surgut, Individual risk (IR) was calculated for adult person, and the following restrictions were adopted: average life expectancy is 70 years, weight is 70 kg, respiration volume is 20 m^3) [5], [29].

Table 3: Dynamics of population (PR) and individual risks (IR) of cancer morbidity caused by exposure to formaldehyde inhalation

2015		2016		2017	
IR	PR, cases	IR	PR, cases	IR	PR, cases
0.000321	52	0.00045	58	0.000514	65

According to the estimation scale of the risk assessment method, the carcinogenic risk from formaldehyde exposure is on high level during the last 10 years [6], [22]. Table 4 shows the dynamics of cancer morbidity in Surgut in 2015 -2017, [5], [29].

Table 4: The cases dynamics of general cancer morbidity and additional cases caused by the exposure of carcinogen to 100,000 population

2015		2016		2017	
Number of cases	PR	Number of cases	PR	Number of cases	PR
250	52	270	58	285	65

As can be seen from Table 4, the cancer morbidity increased in 2015 – by 20.9%, in 2016 by 21.5%, in 2017 - by 22.5%. Figure 2.1 shows the structure of the cancer morbidity in Surgut in 2015-2017, 2010.

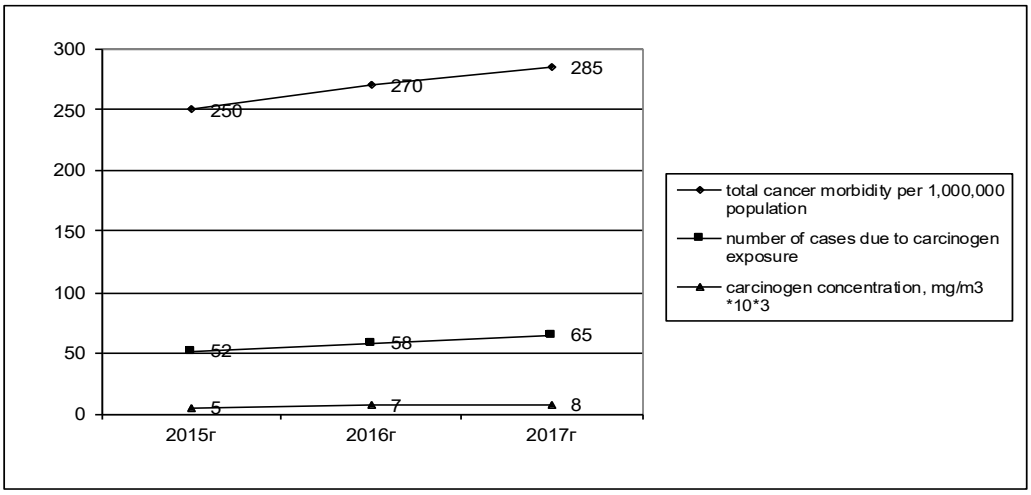

Figure 2.2. Dynamics of cancer morbidity in Surgut in 2015-2017, 2010.

The analysis of the observation data allows us to state that the gross formaldehyde emissions in Surgut are increasing (Table 5) [3].

Table 5: Gross formaldehyde emissions by major industries, t/year

Locality	2015	2016	2017	Trend of gross emissions	Concentration trend
Surgut	0.38	0.607	0.9	Increase	Increase

According to the dispersion scheme, the formaldehyde emission made by the sources located on the territory of Surgut in 2015-2017 spread in 8 zones, with 35% of the total volume directly on the town territory, i.e. 0.212 tons of formaldehyde settled in the town itself [3]. Analysis of the life environment quality in Surgut for 2015-2017 showed that in general it can be recognized as unsatisfactory on formaldehyde content, because the carcinogenic effect is high and gives a significant contribution to the growth of cancer morbidity.

CONCLUSION

In modern conditions people of the Earth possess huge sum of knowledge about the world and human being which are the result of cognitive activity of all previous generations. It is a strategic task of modern humanity to use these achievements for the benefit of society, human beings and the improvement of their natural environment. One of the main sources of these pollutants are exhaust gases of automobiles with IC-engine. Electric vehicles are "vehicles with zero-emission in atmosphere" but the more correct name is "vehicles with remote-gas emission in atmosphere". Advantages of electric motor: efficiency; noiseless; environmentally friendly; air cooling; simplicity of design; ability to work in the generator mode; maximum torque can be achieved in the entire speed range; reduced operating and maintenance costs.

The use of electric buses for carrying passengers has enormous opportunities, although the transition to such an environmentally friendly transport will require considerable costs, but it will significantly improve the environment; great prospects are laid in the application of electric heavy trucks for transport of various goods. Electric car is the unconditional and inevitable future of the automotive industry. In 2015-2017, the concentration of carbon oxide, and phenol on the territory of Surgut was at a critical point, and there is a tendency of toxic substances concentration increasing. The environmental situation quality in Surgut for 2015-2017 on formaldehyde content can be recognized to be unsatisfactory. The carcinogenic effects on atmospheric air are high and contribute significantly to the growth of cancer morbidity of people.

The gradual introduction of electric transport in urban infrastructure is a very relevant and demanded process (despite the high cost, it is necessary to recognize that the main wealth of Russia is its citizens who should be healthy). The quality of ambient air, and accordingly the quality of life directly contributes to it! Practical acceptance and using the obtained results of the study at Surgut city-forming enterprises and administration will improve the resident's quality of life. The systematized material on the development and use of electric transport, the method of determining the impact of air pollution on human health can be useful and relevant-motivational in the modernization of urban infrastructure in the field of motor transport and when considering the issue of completeness and replacing vehicles at the enterprises of the town.

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