Major primary energy resources providing the progress of modern civilization are fossil organic fuels, i.e. oil, natural gas, and coal. Their burning is attended by emission of combustion materials, which are dangerous for human health, deteriorating the state of soils and surface waters, destroying buildings, machines and equipment and generating threat of changing the climate of the planet. Particularly harmful are emissions from motor vehicles, which, as a rule, occur in urban settlements where there is a highest concentration of recipients, i.e. people, buildings, structures; and the source of emissions is situated at a small height, which makes it difficult to disperse them and which multiplies the concentration of admixtures in the atmospheric ground layer. Most hydrocarbons of the gasoline series are dangerous to health as they have narcotic quality and cause disturbance of the central nervous system. The emission of solid particles forms soot, i.e. a product of partial burning of organic fuel. Being settled on cutaneous covers, it can provoke the formation of carcinomas. The tumor response is also proper to many polycyclic aromatic compounds, of which the most dangerous (and highly stable) is benzpyrene.

Incomplete burning of hydrocarbons in the motor leads to formation of carbonic oxide (CO). The result is oxygen deficit in cells and tissues, including the nervous system. The burning of fuel in air consisting at 78% of nitrogen (N$_2$) leads to the formation of nitric oxides (NO$_x$). Nitric oxides that fall on mucous membranes, bronchia and human lung tissues inflict substantial damage on them. Car exhaust may also contain sulfur oxides (SO$_x$), which have direct correlation with the increased incidence of pulmonary diseases. Sulfur oxides catalyze the process of malignant tumors caused by cancerogens. The total volume of car emissions is directly responsible for the incidence of bronchial asthma, chronic bronchitis, heart diseases.

Pollution acts also on grass and trees growing along motor roads. The compounds of nitrogen and sulfur with oxygen (NO$_x$, SO$_x$) are sources of acid rains leading to degradation of greenery and soil. Nitrogen oxides act negatively on leaves, decreasing the intensity of photosynthesis, causing termination of fruit-bearing and growth. Sulfur oxides getting to cells lead to formation of sulfur compounds toxic to biochemical and physiological processes.

Precipitations containing nitrogen oxides and sulfur oxides destroy cement structures, marble sculptures and other architectural monuments, inflict a fatal damage to animal world of water basins.

These local pollutants shall be completed with emissions of carbonic dioxide in a global scale leading to dangerous changes of climate. So, many countries adopt lawful acts limiting emission of polluting substances to the environment.

The inclusion of environmental factors is today important for substantiation of innovation directions in many sectors of the economy. In the 1990s, the USA and Western Europe have started work on the evaluation of social consequences of various fuels [1, 2]. As a result, the levels of environmental damages for population, rural and forest economies, urban settlements and other objects vulnerable to action of pollutants attending the operation of energy facilities have been estimated. At present the conclusions from these studies become recommendations for strategies of long-run development of territories and business. The estimation of external effects in addition to direct costs allows a new approach to the choice of new technologies and design. In Russia this work is at the beginning.
The problem of environmental protection is especially acute in a context of mass exploitation of mobile transport facilities. By data of the Ministry of Natural Resources of the RF, the release of pollutants by transport vehicles increased by 14.2% between 2000 and 2005 to 15,400 tons in 2005, or 43% of the summary air emissions by all Russian fuel consumers [3]. About 75% of emissions are accounted for by carbon oxide (CO), 11–12% by volatile organic compounds (VOC) and nitrogen oxides (NOx) each. Carbon dioxide emissions reached by 2005 more than 120 million tons, which is about 30% of total CO2 emission in general Russia. According to projections [4] the growth of autofleet in Russia will exceed 5% a year, that bring to 32–35 mln autos in 2010. Such a growth in the number of vehicles, if the present structure of the automobile park holds, will lead to the growth of their emissions by about 25% in the period from 2005 to 2010.

**Alternative motor fuels.** The radical path to reduction of emissions by motor vehicles is to change to hydrogen, electric power, biofuel, i.e. to alternative energy carriers without or almost without harmful emissions. Along with visible advantages, these alternatives have limitations and shortages of their own: use of biodiesel, ethanol, methanol and other fuels of vegetable origin make the cost of agricultural products higher and only partially reduce emissions to the environment. In addition, methanol is a dangerous toxic substance, while ethanol should be excluded in Russia for social reasons; electrical accumulators require frequent and lasting charging, they are characterized by large indirect air emissions, because the generation of electric power on thermal power stations will for a long time be based on burning different carbon-bearing fuels.

High cost and low capacity of solar photoelectric converters make their users noncompetitive.

*According to this, hydrogen might be of the highest interest among the available alternatives. This path, however, not always leads to reduction of overall pollution. Though the use of alternative fuels directly on transport vehicles may yield a perceivable reduction of emissions, the production of these fuels can be attended by considerable output of pollutants. In considering innovation priorities in the motor transport, this feature must be taken into account by all means.*

Now we concentrate on hydrogen as an alternative fuel comparing to conventional motor fuels used in engines of internal combustion (gasoline, diesel and gaseous fuel).

The gasoline engine has a relatively low efficiency, being capable of converting only about 20–30% of fuel energy to useful work. The standard diesel engine has a slightly higher efficiency of up to 30–40%, and diesels with turbocharge and interim cooling even to 50%. The exhaust gases of the diesel engine have less carbon oxide (CO) than the gasoline engine. An important advantage of diesel fuel is its higher safety since it evaporates less, which decreases the probability of burning for diesel comparing to gasoline engines. The apparent drawbacks of diesels is use of the starter of a high power, possible sedimentation of paraffin in systems of fuel supply at low temperature, difficulty and relatively high cost of the maintenance of fuel equipment. Diesel engines are extremely sensitive to fuel impurities with mechanical particles and water.

The basic advantage of engines working on gaseous fuel is its lower cost comparing to liquid fuels. The lifetime of gas engines is longer since this fuel has no heavy hydrocarbons, the products of which in the process of operation are forming oil deposit on the walls of combustion chambers. The use of gas yields perceivable advantages comparing to gasoline: clearances in mechanical junctions are less, the lifetime of motor lubricant is 1.5–2 times as high, the noise from engine decreases minimum to a half and the overhaul period of engine operation increases 1.5 times and the lifetime of spark-plugs by 40% [5]. There are lower emissions of hydrocarbon, nitrogen and volatile organic compounds. Its defects are a need to manufacture a number of engine parts from special steels due to higher temperature in the combustion chamber and power of the engine 10–15% lower. In addition, natural gas is more explosive, has high volatility and its leakages multiply increase the greenhouse effect.

The major problem in the use of conventional motor fuels is that their base material is crude oil. The situation in the oil market is becoming worse. This is because of fast exhaustion of cheap reserves of oil and unavoidable rise of its price. It should be also added that natural oil reserves are distributed not uniformly, which arouses high tension in oil markets and stimulates rise of its price. In this connection, the industrial countries of the world devoid of most of own oil reserves, make efforts to find efficient substitution of more accessible fuels for the conventional ones.¹

The expedience of the choice of hydrogen as a motor fuel in motor transport is first of all associated with the development of fuel cells (FC) as a source of electric power for electric engine by means of which the displacement of the car proceeds. There are several types of fuel elements depending on the internal design and composition of electrolyte. The most known of them are

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¹ It is known a fairly broad circle of alternatives theoretically capable to substitute for conventional motor fuels of crude oil. They are: hydrogen, motor fuels from natural gas, coal, biomass, electric power, etc. However, all these alternatives are still commercially inferior to hydrocarbon fuels of crude oil. So there is an urgent task to decide on the most advantageous directions that would become successfully competitive with conventional motor fuels in a decade or two when the world is unavoidably faced with depletion of the reserves of cheap oil and with multiple increase of the price of motor fuels.