PROMISING ENERGY RESOURCES OF THE FUTURE

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Abstract: The paper presents the results of producing hydrogen by electrolysis of water using alternative types of energy.

Key words: Hydrogen, alternative types of energy, fuel cells, environmentally friendly energy carrier.

Global warming of the planet is already causing serious consequences that affect many countries around the world, and also damages the economies of many countries. In the future, climate change may lead to even more significant consequences, including the question of the very existence of humanity. Because, as a result of climate change, mainly due to warming of the hydrosphere, glaciers melt and thermal expansion of the upper layer of the world's oceans occurs, which leads to an increase in its level and, as a consequence, flooding of territories, climate and landscape changes in various regions of the globe. Over the past 50 years, the area of Arctic glaciers has decreased by at least 10%, and their thickness by 40%. Melting glaciers also has a negative impact on mountain ecosystems and waterways. The level of the World Ocean has increased by 10-20 cm, in the future the melting of glaciers and warming of the upper layers of the water of the World Ocean will lead to an increase in its level by another 30-60 cm, and by the end of this century - by 50-90 cm (according to some other sources , at 120-180 cm).

The advantages of hydrogen as a fuel are associated not only with the fact that its combustion produces “environmentally friendly” water vapor. Compared to organic fuel, it has a large “energy reserve”: the combustion of 1 ton of hydrogen releases the same amount of heat as the combustion of 3.5 tons of organic fuel. In addition, hydrogen, unlike hydrocarbon fuels, is capable of catalytic oxidation at low temperatures with direct conversion of chemical oxidation energy into electrical energy, which may be a decisive argument for the use of hydrogen in the energy sector. Devices that make it possible to implement this unique feature, the so-called fuel cells or electrochemical energy generators, are characterized by very high efficiency - about 70 - 80%, that is, 2 - 2.5 times higher than the efficiency of heat engines. It is obvious, however, that for the widespread use of any type of fuel in the national economy, at least two conditions must be met. But the main problem is not warming as such, but a disruption of the thermal balance of the climate, and subsequently a change in the material balance, i.e., a change in the stability of the circulation systems of air and

water masses. This leads to an increase in the occurrence of natural disasters: hurricanes, typhoons, droughts, floods. Changes in climate conditions on Earth occur unevenly in both geographical and temporal distribution. In recent decades, it has become obvious that the further intensive development of modern energy and transport associated with the emissions of huge amounts of gases with greenhouse effects is leading humanity to a large-scale environmental crisis. Since the emergence of conscious life on planet Earth, the environment has begun to receive environmental stress from human activities. This led to an imbalance in the ecological balance. In the first couples, this violation was of a massive nature, which became the influence of humanity on the conservation of biological diversity. With the development of handicrafts with subsequent industrialization, as well as the introduction of industrialization into agriculture, the volume of anthropological impacts began to have an even greater negative impact on the environment and, as a result, these impacts developed and became global.

All internal combustion engines today are a vital necessity. The development of road, rail, river and air transport is accompanied by a number of undesirable consequences (since internal combustion engines are considered to be the source of toxic substances), which, in particular, include noise and air pollution from engine exhaust gases. Given this alarming trend, many scientists and practitioners are definitely in favor of an accelerated search for alternative non-traditional energy sources. In particular, their eyes turn to hydrogen, the reserves of which are inexhaustible in the waters of the World Ocean. In addition, the undeniable advantages of this fuel are the relative environmental safety of its use, suitability for heat engines without significant changes in their design, high calorie content, the possibility of long-term storage, transportation through the existing transport network, non-toxicity, etc. Obviously, it is promising to create hybrid hydrogen engines, consisting of an electric motor powered by a battery, which is charged from a fuel cell or an internal combustion engine running on hydrogen. The advantage of hydrogen over all other types of fuel lies not only in the absence of pollutant emissions, but also in the practical inexhaustibility and renewability of the main energy carrier - hydrogen: hydrogen produced by the electrochemical decomposition of water subsequently forms water again during combustion. Thus, the process can be infinitely cyclical. The fuel and nutrient system for the use of hydrogen as an alternative fuel for engines depends on the success of the development of solar energy, designed to generate cheap electricity for the electrochemical production of hydrogen. Currently, hydrogen engines have become a priority in the innovation policy of transport companies, including aviation. Many of the world's largest manufacturers are attempting to create or are already creating commercially viable fuel cell engines. Already in London, Berlin, Paris and some other developed cities of the European continent there are several hydrogen car

filling stations. In the future, we will create a trans-European highway network that will ensure uninterrupted refueling along the entire route. Many aircraft manufacturing concerns are working on the creation of aircraft engines powered by hydrogen fuel. Hydrogen is not only an environmentally friendly source of energy for cars, but can also be used for stationary applications in autonomous energy sources, in particular for environmentally friendly decentralized energy supply. About 2 thousand stationary installations on fuel cells with a power of 1-100 kW have already been created in the world (the efficiency of fuel cells is 90%) which provide electricity and heat to municipal residential and other facilities not only in remote areas, but also in large cities .

A joint creative team has developed a concept diagram of photo-eco-hydrogen energy that allows the production of an environmentally friendly energy carrier of the future - hydrogen, using solar energy. Algorithms have been developed for calculating the main and auxiliary components of the hydrogen production plant complex, taking into account technical and economic factors. The algorithms allow calculations of laboratory installations, as well as industrial installations, in a flexible mode. Mathematical models can be used individually or in a single complex. When developing a schematic diagram of the installation, all the requirements set before the experimenter were taken into account. The developed installation is equipped with autonomous units that operate independently of other units. All parameters of a laboratory installation for hydrogen production are controlled using instrumentation and automation. For the developed installation, the optimal version of the parameters was calculated taking into account the complex of uncertainties. A laboratory installation for experimental research of hydrogen production has been developed and investigated, taking into account the power supply to the installation from solar energy.

The main parameters of the process for producing hydrogen in laboratory experimental installations have been determined. Hydrogen is produced in an environmentally friendly way using solar energy.

At the beginning of the period of energy shortages, the main place of hydrogen among economic sectors will be in energy and transport.

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