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The new Paradigm of Energy Security (Hydrogen)

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Abstract: Hydrogen is able to act as an alternative source of energy and energy carriers. Conversion of internal combustion engines to hydrogen or gasoline-hydrogen composite fuel is a topical issue. Hydrogen is an environmentally friendly fuel. The use of hydrogen in cryogenic technology will give a new impetus to the development of industry in the Republic of Uzbekistan. This will enable the industry of Uzbekistan to attract modern nanotechnological complexes. Obtaining cryogenic hydrogen in the republic will provide a unique opportunity to improve and introduce modern energy-saving technologies in industry, to obtain modern photoconverting alloys, new chemical temperature-resistant and heat-resistant materials, to produce chemical fertilizers, in fine organic and pharmaceutical chemistry instead of currently operating with the use of energy-intensive technologies.
Key words: energy, fuel, ecology, alternative, hydrogen, technology, Uzbekistan, cryogen, industry, nannotechnology.

INTRODUCTION

In connection with the depletion of hydrocarbon reserves all over the world, work is underway to find alternative energy sources and energy carriers. Today, it is relevant to transfer internal combustion engines to hydrogen or gasoline-hydrogen composite fuel. At the same time, in many countries of the world, unfortunately, they are independently developing technologies for switching to hydrogen fuel. The main focus on the development of hydrogen energy was formulated in the mid-70s of the XX century at the height of the first wave of the energy crisis. It was based on the concept of hydrogen as an alternative environmentally friendly fuel, the specific gravity of which in the fuel and energy complex was assumed to be commensurate with the specific gravity of fossil fuel. At the global level, many scientific events devoted to the hydrogen theme were organized and held, where all participants expressed the opinion that the widespread use of hydrogen in energy "provides humanity with a unique chance to survive in a world free from environmental and social disasters."

However, today this issue is more acute and harsh. On the pages of information and analytical publications, there are systematic reports of the use of hydrogen in various installations, including also in aircraft engines. Naturally, data are provided on the environmental, technological, economic and mechanical aspects of the raw materials and technology used. It should be noted that today the world has come close to the widespread implementation of the transition to hydrogen and / or gasoline-hydrogen composite fuel mixture for its use in internal combustion engines.

The relevance of the use of environmentally friendly fuel lies in the fact that in recent decades, global environmental problems have arisen on the planet (climate change, excessive pollution of the environment, etc.). It is estimated that the annual emissions of carbon dioxide into the atmosphere exceed 33 gigatons, and the volume of greenhouse gases is

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approximately 37 billion tons. In the world, the volume of harmful emissions compared to the 50s has increased by 3.7 times and has a steady upward trend.

The advantages of hydrogen as a fuel are related not only to the fact that its combustion produces "environmentally friendly" water vapor. Compared to fossil fuel, it has a large "energy reserve": when 1 ton of hydrogen is burned, the same amount of heat is released, as much when 3.5 ton of fossil fuel is burned. In addition, hydrogen, in contrast to hydrocarbon fuel, 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 power engineering.

Devices allowing this unique feature, the so-called fuel cells or electrochemical power generators, are characterized by a very high efficiency. - 70 - 80%, that is, 2 - 2.5 times higher efficiency. heat engines. Obviously, for the widespread use of any type of fuel in sectors of the economy, at least two conditions must be met:

firstly, this fuel must be available and relatively economically inexpensive.

secondly, an optimal technology for its application should be developed and industrial devices created for its implementation.

All its stages of implementation are associated with the fact that there is no hydrogen in a free state on Earth, and to obtain it, you need available chemical raw materials and primary energy sources. In other words, hydrogen is not a fuel, but an energy carrier.

The following main groups are usually distinguished among hydrogen consumers:

1) consumers of liquid hydrogen - for their service, as a rule, specialized vehicles and containers are used.

2) consumers of high-pressure hydrogen (in cylinders) - for their service, mainly high-purity gas is used - this is hydrogen obtained by electrolysis of water.

3) low-pressure hydrogen consumers - this group includes the main consumers to which gas is delivered, as a rule, by pipeline transport - local lines of the hydrogen supply system.

Consumers of the first group are not yet the main part of the operators, however, the prospect of this part is inevitable, since cryogenic technology everywhere shows the need to implement it in life, since today there is no technology that is more environmentally friendly, economically beneficial in time, many scientific centers are working on these problems in the world. Therefore, it is no coincidence that the international organization "Refrigeration", headquartered in Paris, pays special attention to the development of developments for the production and use of liquefied hydrogen in the industries of the economy.

Over the past 30 years, the production of hydrogen in the world has increased significantly. According to forecasts, by 2025 there will be a further increase in its production, ensuring the development of the chemical industry and energy.

For example, in the USA alone, dozens of enterprises of various capacities specialized in the production of hydrogen are currently operating.

There are two main industrial methods for its preparation. One of them, truly environmentally friendly, is based on electrolysis or electrochemical decomposition of water or steam. In this case, the primary source of energy is an electric current generator. The advantage of electrolysis hydrogen is that the methods of its additional purification (up to an impurity content of less than 10 "1 vol.%) Are economical and technologically simple. That is why electrolysis hydrogen is used to obtain pure and high-purity hydrogen. At the same time,

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classically, the most promising and not only ecological, but in the long term the most economical will be the production of hydrogen by electrolysis of water, that is, its decomposition under the influence of electric current.One of the obstacles to the large-scale use of the electrolytic method until today is the large consumption of electric current. the energy that will be used for electrolysis of water is a truly environmentally friendly integrated technology.If we switch to hydrogen energy, some emissions (NOx and CO) will be significantly reduced, and some (SO2 and particulate matter) will not be at all.

It should be noted that the share of electrochemical methods in the total volume of hydrogen production still does not exceed 2–4%, although in some countries, for example, Canada, Norway, and the United States, it is significantly higher. The prospects for the development of these methods and the cost or "availability" of electrolysis environmentally friendly hydrogen largely depends on the availability of "cheap" or "expensive" electricity. However, the development of science and technology is now confidently affirming in this role renewable energy sources - mainly solar (helio) energy. Additional opportunities to reduce the cost of electrolysis hydrogen are associated with the improvement of methods for electrolysis of water (steam).

In our opinion, the tasks of scientists and specialists in the development of hydrogen energy are as follows:

• search and research of new promising materials and processes in the field of hydrogen energy;

• research on the rational and efficient use of integrated, environmentally friendly and independent of natural resources technologies aimed at producing hydrogen by the electrolytic method, using the local potential of renewable energy sources;

• organize scientific support of industrial developments in hydrogen technology from all interested research institutes, experimental design organizations;

• development of forecasts for the development of hydrogen energy in the world and in the country.

It is advisable to put forward the following priority areas of work within the development of hydrogen energy in the republic:

a) development of a technology for the production of hydrogen by electrolysis of water using solar energy for this, with the subsequent creation of fuel cells for the domestic and foreign markets;

b) development of complexes for the production, purification, accumulation, storage and transportation of hydrogen;

c) creation of highly efficient environmentally friendly power plants and electrochemical generators of a wide class based on fuel cells, including for use in household electronic devices;

d) development of key elements of the hydrogen energy infrastructure;

e) introduction of technologically safe, environmentally sound modern methods of storage and transportation of hydrogen, focused on the external market.

Currently, studies carried out in the republic, taking into account the existing local conditions, show that hydrogen remains practically the only environmentally friendly fuel for road transport, and in a broader sense - for any future autonomous energy facilities. Over the past few years, our scientists have been working on the creation of a pilot plant for the production

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of hydrogen in an environmentally friendly way. It uses electrical energy generated by photoconverters to decompose a water molecule. To date, promising results have been achieved on the viability of the selected technology, since the cost of electricity generated by photocells is practically on the same level as the electricity generated by traditional technology. There is a tendency to further reduce the cost of electricity generated by solar cells.

The relevance of the chosen direction on a national scale is the development of new technologies for the production of hydrogen from water using solar energy. It is known that Uzbekistan has more than 300 sunny days a year. The application of the proposed technology will successfully serve the production of an environmentally friendly way of electric current by photoconverters. In addition, it should be noted once again that the Republic of Uzbekistan is located in the arid zone of the middle zone of the globe, which necessitates the widespread use of hydrogen, the production of which is based on cryogenic technology.

The use of hydrogen in cryogenic technology will give a new impetus to the development of industry in the Republic of Uzbekistan. It is known that many complexes of nanotechnology are connected and cover elements of cryogenic technology, the development of which makes it possible for the industry of the Republic of Uzbekistan to attract modern nanotechnological complexes. If in the development of technological processes in industry in the last century there was enough energy supply, then today's industry cannot be imagined without energy carriers, innovative technologies. Obtaining cryogenic hydrogen in the republic will provide a unique opportunity to improve and introduce modern energy-saving technologies in industry, to obtain modern photoconverting alloys, new chemical temperature-resistant and heat-resistant materials, the production of chemical fertilizers, in fine organic and pharmaceutical chemistry instead of currently operating with the use of energy-intensive technologies.

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