

## HYDROGEN ENERGY AS REAL ALTERNATIVE OF OIL AND GAS IN UKRAINE

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Dmitry Mendeleev told that to heat the furnace with oil is like to heat it by bank notes: because oil is unique, most valuable chemicals are raw material.

The burning (incineration) of hydrocarbons is created with appreciable environmental problems, especially by using it for needs of transport. The problem of toxic emissions can solve perfection of technologies but emissions of carbonic acid change a global climate and has inevitable consequences of the using of mineral fuel.

In Ukraine there is a powerful economic argument: there are not enough reserves of oil and gas in the country, it is not possible to buy energy carriers by the world prices, deliveries by reduced prices depend on relationship with Russia. That is for Ukraine it not an output.

Are there some alternatives for Ukraine?

There are renewed energy sources. Now in Ukraine there is a low interest of renewed sources (less than 10), but it does not mean the scarcity of these sources, it means the low level of introduction of using technologies of their using.

What are the sources? First of all it can be the solar energy, a hydraulic power, a wind energy, a power of the sea waves. The second is important issue a geothermal energy. It practically is inexhaustible and eternal, but the problem of its cost is a thorny question (thorny question). Also it is a tidal energy, using power of a biomass.

I'm going to consider in detail the use of hydrogen as fuel in a context of the concept of substances which accumulate energy.

The using of hydrogen as fuel excludes an opportunity of strengthening of a hotbed effect. Harmful substances are not allocated (the automobile engine throws out 45 toxic substances including carcinogens, are not present danger of formation of stagnant zones of hydrogen - It easily disappears.

Let's note negative qualities of hydrogen. It is low density and volumetric calorific value, wider limits of explosivity and more heat of ignition in comparison with hydrocarbons. Application of the concept of substances which accumulate the energy, described below, will allow to lower negative influence of these lacks of hydrogen as fuel which are noticeably blocked by its advantages.

There are many technological developments on application of hydrogen as fuel in the industry, on transport and in a life. So, per 1972 to the USA on proving ground of firm " General Motors " competitions of city vehicles in which 63 cars with various systems of engines participated, including on storage batteries, ammonia-prosir and two cars on hydrogen were spent. The last have borrowed the first and second places. The car of firm " Volkswagen " convertible on hydrogen in which the fulfilled gases were purer than city air sucked in in the engine has shown the best results.

How is it possible to receive hydrogen and avoid its explosion?

The using of substances which accumulate energy will solve the problem. Thus the scheme of process consists of three stages:

Reception of substances which accumulate energy, using one of the named energy sources.

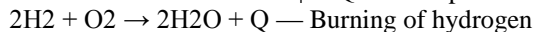
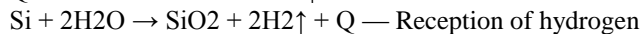
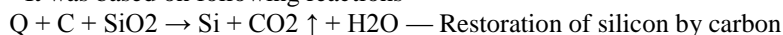
Reception of hydrogen by means of substances which accumulate energy.

The using of hydrogen as fuel.

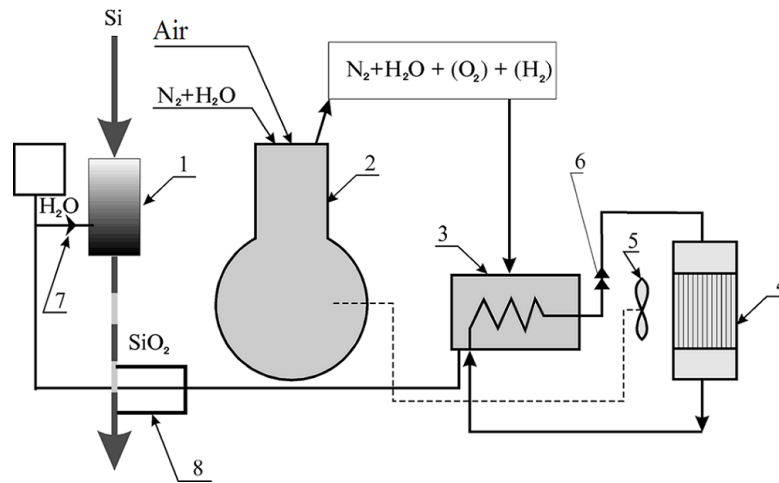
I hope you remember school experience: if you put in water sodium hydrogen it starts allocation it blows up. Now imagine, that it occurs in the chamber of combustion: hydrogen in a free kind appears only in case where it and should blow up. And onboard it is not like this - it is connected with water. In this illustrative example of substances which accumulate energy, sodium has acted.

Certainly, isn't it industrial technology? It is an example. But I'll present your attention to the industrial technology developed during USSR existence in flights to the Moon.

It was based on following reactions

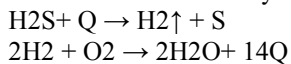


Silicon from oxide is restored, using a source of heat (for example, it can be the solar furnace) (reaction 1). Silicon represents fine substance which accumulates the energy, not demanding special conditions of storage. It is delivered to a place of necessary reception of energy (including to the transport engine). In a special reactor there is a reaction of replacement of hydrogen (reaction 2). And at last hydrogen acts in the engine as fuel. Oxide of silicon which was formed as a result of the second reaction, can to be used repeatedly. The scheme of a reactor looks as follows:



- 1 Reactor
- 2 Piston internal combustion engine
- 3 Condenser the Radiator of cooling
- 4 Stimulator of charge
- 5 Stimulator of charge
- 6 Stimulator of the charge the
- 7 Cooler of silicon

It is impossible not to pay attention to the fact, that Ukraine is located on coast enormous (1 billion tons) a warehouse of hydrogen sulphide (Black sea). Is hydrogen sulphide (H<sub>2</sub>S) a mineral? Is it native? Hydrogen in very dense packing: energy of formation of hydrogen sulphide approximately in 14 times is less, than energy of formation of water. It means, that if we spend one watt hour of energy on decomposition of hydrogen sulphide, we shall receive of 14 watt from burning the allocated hydrogen? Hour of energy. That is 1 we in this case are relieved of reaction. We still have only two reactions:



At quite real pressure hydrogen sulphide (nearby 20 atmospheres) becomes to a swill at normal temperature. It allows to receive specific density much more, than at compressed and even liquid hydrogen to conduct process of decomposition H<sub>2</sub>S in electrolytic cells.

Warsaw, Maksimenko A.I. (Ukraine) and Tereshuk in 1997 have offered extraordinarily a perspective way of reception and use of hydrogen by means of decomposition of the hydrogen sulphide extracted by an original method from deep layers of some reservoirs, in particular, from the Black sea. The given method doesn't demand expenses of national scale, and it can be applied in a national power system and even is absolutely free.

Economic preconditions of development of hydrogen technologies in Ukraine. You can ask me: Whether hydrogen power is in Ukraine now when in the country the industry is stopped. Can be engaged, the science is not financed for a long time, new technologies do not appear? I consider, that the unique chance to be pulled out (to get) in numbers of industrially developed countries of the world is given to Ukraine.

If Ukraine at restoration of power and motor industry goes traditionally, then it will choose backwardness, for long decades.

Choosing strategy of development of hydrogen power engineering, Ukraine is compared with motor industry...with BMW concern! Really, per 1968 in institute of mechanics AH the USSR converting of the car on hydrogen led work to partial loadings, and the Kharkov scientists were accepted in its active participation. Surprisingly, but in the seventieth years taxmotors and it was Moskvich 412 in Kharkov with an internal combustion engine on hydrogen!

Also it can be supposed, that a number of the western countries and the private companies will invest their money in these enterprises, they will see this new direction. New business will be more attractive for investors, than the studying of becoming outdated western technologies. Also there will be thousand new workplaces and there will be independence of deliveries of mineral energy carriers.

In this case Ukraine will take a worthy place in world economic system as the supplier of technologies of construction of power systems.

There is a dilemma in front of Ukraine: to come back to the future (buying up of the written off technologies in the West) or go to the future in other words to develop high technologies and technological leadership. Let's make a correct choice!