JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205

Volume 15 Issue 08, August 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

ADVANTAGES OF CAR FUEL DEVELOPMENT THROUGH HYDROGEN ENERGY

B. Akhmatohunov
Andijan State Technical Institute
Assistant of the Department of Transport Logistics

Annotation: This article examines the advantages of developing the fuel system through the use of hydrogen energy for automobiles. Hydrogen fuel is environmentally friendly, renewable, and highly energy-efficient, offering a sustainable alternative to traditional fuels. The study highlights the integration of hydrogen technologies into the automotive industry, their impact on the environment, economic efficiency, and role in ensuring energy security. Global experience and prospects of this technology are also analyzed. The article shows the possibilities of solving fuel problems and forming a sustainable transport system through the introduction of hydrogen energy.
Keywords: Hydrogen, technology, transport, fuel

Introduction. In recent years, energy products derived from hydrogen gas have been included in the list of alternative energy sources. Since this sector, like other types of alternative energy sources, has not received strong attention for years, currently there is no clear economically and constructively acceptable mechanism for its acquisition and use.

First, let's clarify the following questions. What is hydrogen? ***Hydrogen is a light gas that, when burned, can produce several times more heat than the usual methane gas.*** Hydrogen gas is colorless and odorless. When combined with other types of chemicals, it does not form toxic components. Not dangerous for the human body. Therefore, its use in the economy is very important. Energy can be produced by oxidizing hydrogen, and as a result of this chemical process, clean and environmentally safe drinking water is produced. Since it is possible to obtain hydrogen again, hydrogen gas can be obtained and used indefinitely. A very important advantage of hydrogen energy is that the efficiency of the hydrogen element has higher values compared to all types of alternative energy sources. In a word, its efficiency reaches 60%. If we say that solar power plants currently account for 20%, and wind power plants for 40%, then we know that it is time to seriously engage in hydrogen energy, develop it, and intensify research on it. There is another important reason for such a conclusion. That is, wind and solar power plants are highly dependent on weather and climatic conditions, not always achieving the expected results.

Currently, hydrogen energy is mainly used in space exploration. However, if you think about it, one of the most abundant elements in nature and the world is hydrogen. However, the technology for obtaining it is more complex. More specifically, the technology of isolating hydrogen itself from other substances is more challenging. Because, as is known from current scientific and popular publications, there are three methods of hydrogen extraction: chemical, electrolytic, and heat-chemical processing technologies. Among extraction technologies, one of the most effective methods is the use of methane gas. If methane is combined with water vapor under high pressure, a gas containing up to 75% hydrogen is formed. However, the complexity of this problem lies in the large size of the device used to obtain hydrogen gas, and the transportation of methane gas is also associated with problems [see Figure 1!]. If we try to obtain it by a simpler electrolysis method, then it becomes necessary to use additional energy. The products obtained as a result of

JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 08, August 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

such technology are very inefficient and inexpedient. The fuel raw materials required for hydrogen production currently do not meet demand due to their high cost. In conclusion, there are currently major problems in using hydrogen energy, but considering that hydrogen itself is a carrier of very large volumes of energy, we understand that scientists around the world face a number of tasks.

Result and discussion. Now let us dwell on what research and studies are being conducted on these issues. Currently, a compact device using hydrogen is being used **by the company Toshiba** at the H2One power plant. At this station, the electricity necessary for electrolysis is generated by solar panels. Of course, in these structures, excess electrical energy obtained by solar cells is stored using special batteries. This process prevents the risk of technological work stoppage in unfavorable climatic conditions. The produced hydrogen is sent either directly for energy production or for storage in special tanks. As a result, this station always has hydrogen reserves. At this station, 2m3 of hydrogen is produced per hour, and 5m3 of water is consumed for this purpose. The power of the device is 55 kW.

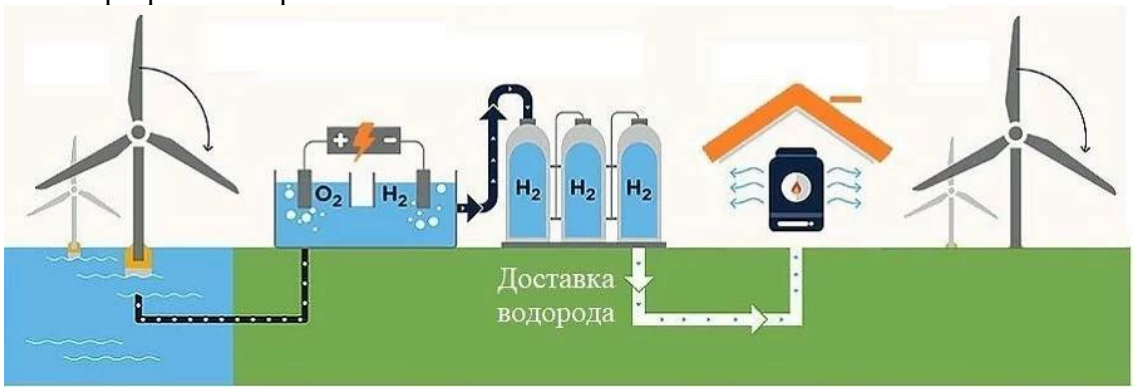

Figure 1. Technology of obtaining and delivering hydrogen to the consumer.

According to information on social networks, Japan allocated $107.5 billion over 15 years for the development of hydrogen energy (Fig. 2). Because this country is striving to improve science and technology on the path to a faster transition to an economy that uses as few hydrocarbons as possible. Currently, hydrogen is stored in gaseous, absorbed, and compressed gas states. If this technology is developed, then it will be possible to meet the needs of villages and smaller cities for hydrogen energy. This is done by trucks and trains, transported over short distances. Currently, scientists face many problems. In this direction of hydrogen technology, its absorption is considered more effective. With such works, French scientists were awarded the European Inventor Award. They developed a technology for storing in solid "magnesium tablets."

Currently, Japan produces 2 million tons of hydrogen per year. This indicator will reach 12 million by 2040. Ga (within a year!) is expected. A profit of $2.5 trillion is expected from hydrogen energy produced in such volumes.

Similar efforts exist in shipbuilding and maritime activities to utilize hydrogen energy. In addition, some leading countries are used as fuel for trains in Germany. In the USA, a hydrogen-powered passenger aircraft was tested for flying for 15 minutes. If a number of agreements and contracts are implemented, by 2030 the volume of hydrogen energy here will reach 3.5 GW. Figure 3 shows a diagram of the technology for obtaining energy from hydrogen for cars[1]. The operating principle of the car's engine using this is as follows. At special filling stations, the

JOURNAL OF APPLIED SCIENCE AND SOCIAL SCIENCE
eISSN 2229-3113 pISSN 2229-3205
Volume 15 Issue 08, August 2025
Impact factor: 2019: 4.679 2020: 5.015 2021: 5.436, 2022: 5.242, 2023: 6.995, 2024 7.75

vehicle's fuel tank is filled with compressed hydrogen. It enters the fuel cell, where the membrane is located. The membrane separates the anode and cathode chambers in the chamber where the anode and cathode are located. Hydrogen is introduced into the first, and oxygen is introduced into the second through an air intake device. Each of the electrodes located on the membrane is coated with a layer of catalyst. Platinum is used more often as a coating. It is also necessary to take into account the high cost of this material. However, its electrophysical properties are better compared to other materials. Due to the introduction of oxygen, hydrogen begins to lose its negatively charged particles - electrons. It is at these moments that positively charged protons arrive at the cathode through the membrane.

They can combine with electrons, releasing water vapor and electrical energy at the device's output. In essence, such hydrogen-powered cars are similar to regular cars, but there is a difference in their batteries. The capacity of a hydrogen storage battery is ten times greater than that of a lithium-ion battery. A 5 kg cylinder is filled in 3 minutes, and this fuel is enough to cover a distance of 500 km. As can be seen from this brief information, the possibilities of hydrogen energy are invaluable. Therefore, physicists and young researchers should focus their attention on research on obtaining and using hydrogen. A major positive shift in the energy sector of Uzbekistan will depend on the development and widespread use of hydrogen energy.

References.

1. T. Mo, Y. Li, and Y. Luo, "Advantages and Technological Progress of Hydrogen Fuel Cell Vehicles," World Electric Vehicle Journal, vol. 14, no. 6, p. 162, 2023.
2. Q. Hassan, I. D. J. Azzawi, A. Z. Sameen, and H. M. Salman, "Hydrogen Fuel Cell Vehicles: Opportunities and Challenges," Sustainability, vol. 15, no. 15, Art. 11501, 2023.
3. Y. Manoharan, S. E. Hosseini, B. Butler, H. Alzhahrani, B. T. F. Senior, T. Ashuri, and J. Krohn, "Hydrogen Fuel Cell Vehicles; Current Status and Future Prospect," Applied Sciences, vol. 9, no. 11, Art. 2296, 2019.
4. H. T. Arat, B. Tanç, and N. O'zaslan, "Sustainability Analyses for Hydrogen Fuel Cell Electric Vehicles," in Sustainable Mobility, B. Llamas, M. F. Ortega Romero, and E. Sillero, Eds., IntechOpen, 2020, ch. Intech Open Acc., OI: 10.5772/intechopen.90675
5. Z. Duan, L. Zhang, L. Feng, S. Yu, Z. Jiang, X. Xu, and J. Hong, "Research on Economic and Operational Characteristics of Hydrogen Fuel Cell Cars Based on Real Vehicle Tests," Energies, vol. 14, no. 23, Art. 7856, 2021.
6. A. Chapman, D. H. Nguyen, H. Farabi-As, K. Itaoka, K. Hirose, and Y. Fujii, "Hydrogen Penetration and Fuel Cell Vehicle Deployment in the Carbon Constrained Future Energy System," arXiv preprint, 2020.
7. D. T. Machacek, N. O. Yazar, T. Huber, and C. H. Onder, "Energy Management of Hydrogen Hybrid Electric Vehicles -- A Potential Study," arXiv preprint, 2023.
8. S. Hussain, R. Saidur, N. Razali, F. S. Anuar, and A. R. Saleman, "An Overview of Hydrogen as a Vehicle Fuel," Renewable and Sustainable Energy Reviews, vol. 16, no. 8, pp. 5511-5528, Oct. 2012