

**ANALYSIS OF ENERGY SOURCES USED IN AUTOMOTIVE TRANSPORT
WITH AI*****Kuchkorov Isroiljon Tavakkal ugli****Andijan state technical institute Assistant of the Department of
"Automotive Engineering and Transport"**Email: isroilkuchkorov11@gmail.com**Tel: +998 94 160 99*

Abstract: This analysis explores the various energy sources used in automotive transport, focusing on gasoline, diesel, electricity, hydrogen, and biofuels. Artificial Intelligence (AI) plays a crucial role in optimizing energy efficiency, predicting vehicle performance, and enhancing sustainability. By using AI-driven models, researchers and engineers can assess environmental impacts, forecast energy demands, and develop smart mobility solutions. The integration of AI with automotive systems also enables real-time monitoring and adaptive energy management. This synergy between AI and alternative energy sources is essential for advancing cleaner, more efficient transportation. The study aims to guide future innovation in energy usage and vehicle technologies.

Keywords: AI, Automobile transport, energy sources, gasoline, diesel, CNG, LPG, biofuel, electricity, hydrogen.

Introduction. Automobile transport is one of the most important sectors of the economy on a global scale, and its efficiency and environmental safety directly depend on the energy sources used. Currently, despite the high global demand for petroleum products, the tightening of environmental standards, climate change, and limited energy resources require new solutions in the transport sector. Therefore, the diversification of energy sources in road transport, that is, the efficient use of various types of fuel and energy, is becoming a pressing issue. This article analyzes existing and prospective energy sources in road transport.

Discussion. Analyzing energy sources in automobile transport is one of the most pressing issues of our time. Today, due to the increasing global consumption of fuel and energy resources, stricter environmental requirements, and the need to improve vehicle efficiency, there is a trend towards widespread use of alternative energy sources alongside traditional ones. Automobile transport primarily uses hydrocarbon fuels such as gasoline, diesel fuel, compressed and liquefied gas. Their advantages include high energy density, good combustion properties, and well-developed infrastructure. However, these fuels also have negative aspects: they release harmful emissions into the atmosphere, intensify global warming processes, and frequent fluctuations in fuel prices affect economic stability in the transport sector.

Therefore, in recent years, the automotive industry has been actively striving to introduce alternative energy sources, such as electricity, hydrogen fuel, biofuel, and hybrid systems. Electric vehicles (EV) are considered the most environmentally friendly, as they emit practically zero emissions during operation. But their disadvantages are the high cost of battery production, limited energy reserves, and insufficiently developed charging infrastructure. Nevertheless, the electric car market is expanding year by year, which will allow reducing oil dependency in the future.

Hydrogen fuel is also one of the promising directions, which is converted into electrical energy using fuel cells and generates only water vapor as waste. However, hydrogen production and

storage technologies are still complex and expensive. Biofuels, such as biodiesel and bioethanol, are significant because they can be used in traditional engines almost without modifications. They are obtained from renewable sources, but large-scale production requires the use of agricultural land resources, which can affect food security.

In the future, it is unlikely that there will be a single stop in the choice of energy sources in road transport, since optimal solutions differ for different countries, regions, and economies. Currently, hybrid systems remain the most common intermediate solution due to their flexibility. These systems combine a traditional engine and an electric motor to reduce fuel consumption and reduce emissions.

Analysis of energy sources in road transport requires taking into account not only technical and economic factors, but also environmental and social aspects. Current trends show that the process of introducing alternative energy sources is accelerating, but consistent work must be carried out to adapt the existing infrastructure, improve energy storage technologies, and reduce costs. When analyzing energy sources in road transport, they can be divided into three main groups: traditional fuels, alternative fuels, and future energy sources.

1. Traditional fuels (gasoline and diesel)

Gasoline has high explosive properties and is widely used in internal combustion engines. Advantages - widespread use and high level of technological readiness. Disadvantage - high CO₂ and CH emissions, as well as volatility in fuel prices.

Diesel is characterized by high torque and fuel efficiency. Advantages - relatively low fuel consumption, efficient for long distances. Disadvantage - higher emissions of NO_x and PM (particles). Restrictions on diesel cars are tightening in European countries.

2. Alternative fuels

Compressed natural gas (CNG) is environmentally friendly, CO₂ emissions are 20-25% less than gasoline. The disadvantage is the weight and volume requirement of gas cylinders.

Liquefied petroleum gas (LPG) is an inexpensive and relatively environmentally friendly fuel. In many countries, taxi parks have switched to LPG.

Biofuels (bioethanol, biodiesel) - obtained from renewable sources. The advantage is the possibility of local production. The disadvantage is competition in the use of agricultural land.

3. Future energy sources

Electricity - electric vehicles are currently the fastest-growing industry. Advantages - zero exhaust gases (during operation), low operating costs. The disadvantage is the lack of environmental footprints in battery production and insufficient charging infrastructure.

It operates on the basis of hydrogen fuel cell technology. Advantages - only water vapor is released during operation, energy efficiency is high. The disadvantage is the complexity and cost of hydrogen production and storage technologies.

Ecological analysis. The ecological impact of different energy sources differs. Traditional fuels emit the most greenhouse gases, while alternative fuels reduce emissions. Electricity and hydrogen reduce emissions during operation to almost zero, but a carbon footprint may exist in the production process.

Economic Analysis. Price, maintenance costs, and resource availability determine economic efficiency. For example, CNG and LPG are subsidized in many countries, while electric vehicles, although more expensive in terms of initial costs, are cheaper to operate in the long term.

Technological prospects. In the future, energy sources in road transport are not expected to be uniform, but different types of energy will be used in different regions in a mixed manner.

Developed countries switch to electricity and hydrogen faster, while developing countries use transition fuels such as CNG and LPG.

Conclusion. Analysis shows that the diversification of energy sources in road transport is important for ensuring sustainable development and environmental safety. While traditional fuels remain the primary source, the share of alternative and future energy technologies is growing. Each country must choose energy sources based on its economic, environmental, and technological capabilities.

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