

HYBRID CARS ARE THE TRANSPORTATION VEHICLE OF THE FUTURE

Shukurov Nuritdin Rakhimovich

*Candidate of Technical Sciences, Associate Professor Academy of the Ministry of
Internal Affairs of the Republic of Uzbekistan*

Abstract: *This article discusses the structure, advantages, types and status of hybrid cars in the world and Uzbek markets. The economic and environmental advantages of hybrid technologies are analyzed, as well as the factors hindering development and their solutions. Comparative analyses between traditional and hybrid cars are presented based on tables and diagrams.*

The article also pays special attention to the prospects of hybrid cars in Uzbekistan and their impact on the country's economy and ecology.

Keywords: *hybrid car, energy efficiency, CO₂ emissions, ecological transport, parallel hybrid, series hybrid, battery technologies.*

In recent years, environmental problems, depletion of oil resources and increasing road safety have become increasingly important issues in the world. At the same time, new technologies are being introduced in vehicles to ensure efficient use of energy and reduce the amount of harmful gases emitted into the atmosphere. Hybrid cars occupy a special place among these technologies. A hybrid car is a vehicle in which an internal combustion engine and an electric motor work together, and is considered a key part of the future transport system [1].

A hybrid vehicle is a vehicle that uses two energy sources. They usually combine a gasoline or diesel engine with an electric motor. This system consists of the following main components:

- internal combustion engine;
- electric motor;
- batteries;
- energy recovery system;
- electronic control unit.

In hybrid vehicles, energy is recovered during braking and stored in batteries [2]. This helps to save fuel and reduce emissions (Figure 1).

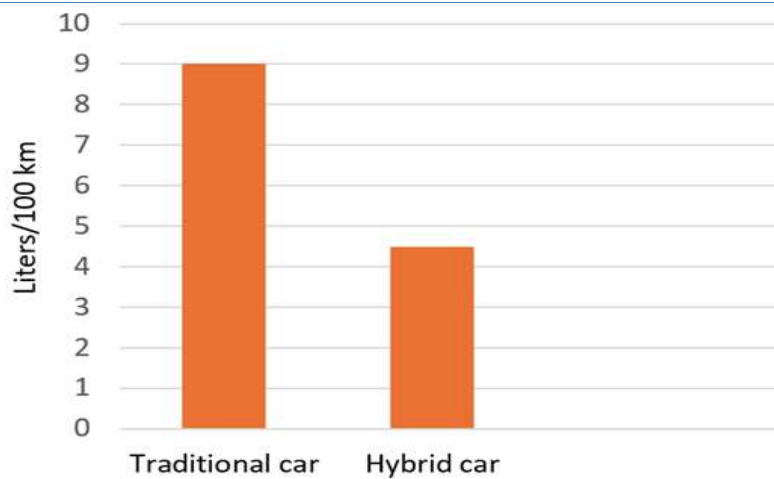


Figure 2. Fuel consumption of conventional and hybrid cars (l/100 km).

Hybrid cars have a number of advantages over conventional cars equipped with an internal combustion engine (table):

- higher fuel efficiency;
- lower CO₂ and other harmful substances emitted into the atmosphere;
- lower noise level;
- greater use of electric energy when driving in urban conditions;
- the ability to save engine life.

Table

Comparative indicators of hybrid and conventional cars

Indicators	Traditional car	Hybrid car
Fuel consumption, 100 km / liter	8-10	4-5
SO ₂ emissions, g/km	180 - 200	90 - 110
Noise level	High	Low
Maintenance cost	Average	Few

Hybrid cars are classified according to their structure as follows:

- parallel hybrids - the internal combustion engine and the electric motor operate simultaneously;
- series hybrids - the main drive is provided by the electric motor, while the internal combustion engine powers the battery;
- mixed hybrids - combine the advantages of series and parallel hybrids.

Recently, the hybrid car market has been developing rapidly in the world. In countries such as Japan, the USA, and Germany, the demand for this type of vehicle is very high. For example, the Toyota Prius model is known as the best-selling hybrid car in the world. In European countries, increasing environmental requirements are driving the increase in the number of hybrid cars [3].

According to statistics, global sales of hybrid cars will exceed 12 million in 2024. In China, in particular, the share of hybrid and electric cars in the domestic market is growing rapidly, as a result of special incentives for them.

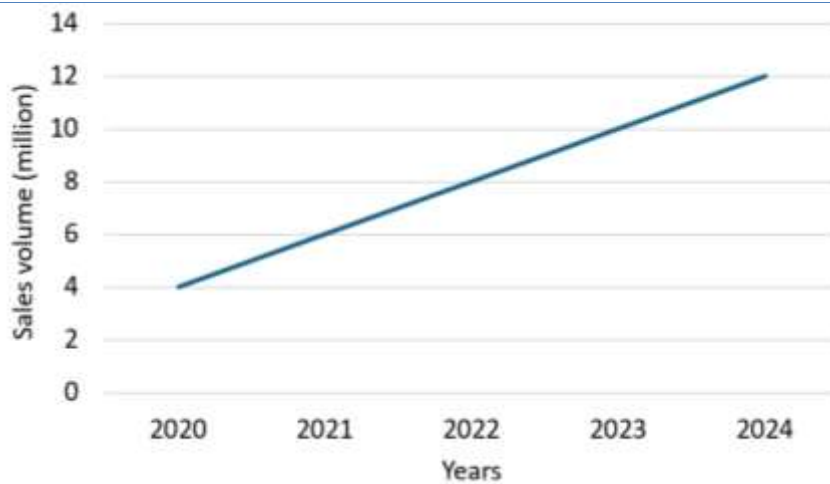


Figure 3. Global hybrid car sales (2020-2024).

In recent years, Uzbekistan has been undergoing reforms in the automotive industry. The production of electric and hybrid cars has also been included in the agenda. The use of hybrid cars is of great importance in the country in order to save energy resources, protect the environment, and introduce modern technologies [4].

In addition, the road infrastructure in Uzbekistan is being modernized at a rapid pace. Work is underway to create favorable conditions for hybrid and electric vehicles on new highways [5].

Currently, there are a number of problems that negatively affect the development and widespread use of hybrid cars:

- their high cost;
- insufficient charging infrastructure;
- lack of technical service centers;
- technologies for producing powerful batteries are still at the development

stage.

The most important feature of hybrid cars is their environmental friendliness [6]. For example, hybrid cars emit 30-40% less carbon than their conventional gasoline cars (Figure 2). This is important in slowing down global warming.

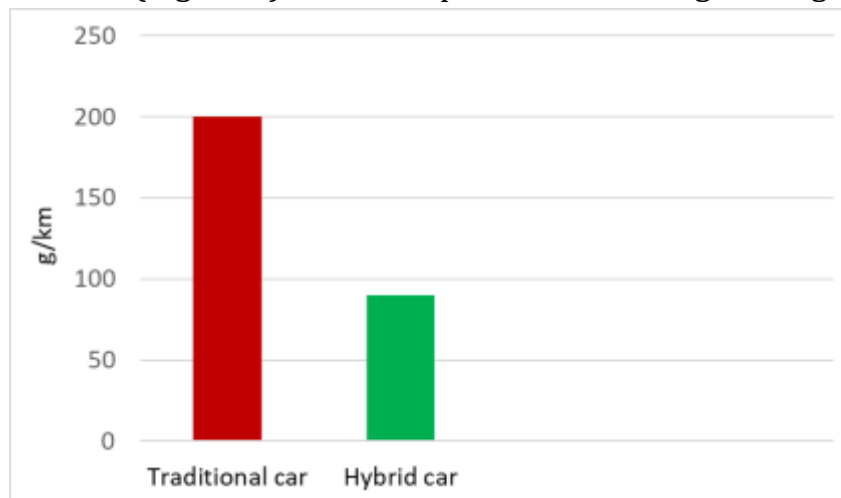


Figure 2. Relative amount of CO2 emissions.

Hybrid cars are beneficial not only for the environment, but also for the

economy. Due to fuel efficiency, their operating costs are reduced. At the same time, new jobs are created by organizing new production capacities [7].

In conclusion, hybrid cars are of great interest all over the world as one of the means of transport of the future. They are distinguished by their fuel efficiency, environmental friendliness and are based on modern technologies. In Uzbekistan, by developing this industry, not only economic efficiency can be achieved, but also environmental protection. Therefore, the future importance of hybrid cars is incalculable.

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