COMPARATIVE STUDY OF COOPERATION OF UNIVERSITIES WITH INDUSTRY IN DESIGN AND PRODUCTION OF AN ELECTRIC VEHICLES

Vilayat VALIYEV
Rector, prof., Azerbaijan Technical University
rector@aztu.edu.az

Fuad DASHDAMİROV
Azerbaijan Technical University
fuad.dashdamirov@aztu.edu.az

Gasim MANAFOV
Azerbaijan Technical University
qmanafov@aztu.edu.az

Aynura ISMAYILOVA
Azerbaijan Technical University
aynura.ismayilova@aztu.edu.az

ABSTRACT

The article analyzes the problems associated with a change in the environmental situation associated with an increase in the number of vehicles, steps taken to change the current situation, scenarios proposed to protect energy resources within the framework of university-industry cooperation, analyzes the characteristics of alternative energy vehicles. In modern conditions, taking into account energy savings in the Republic of Azerbaijan, for the production and operation of promising vehicles, creating infrastructure, increasing the attractiveness of this area, creating cooperation between universities and industry, recommendations and current research areas are proposed.

Keywords: environmental issues, energy, electric car, university and industry

INTRODUCTION

The use of available resources in various sectors of the economy at an increasing pace, the opening of new industries leads to a rapid reduction in resources. The steps taken in the direction of resource conservation require fundamental research work, a broad discussion and application of the results obtained. To conserve resources can be through efficient use, application of new technologies, alternatives, etc. approaches. The protection of energy resources is a priority task for every country, it creates the basis for the growth of economic and political power and the improvement of the social well-being of the population.

Energy resources qualitatively include mineral raw materials used as fuel, solar and space energy, energy from geothermal and other sources. The energy resources of the Earth are divided into energy resources collected by nature, non-renewable (oil, natural gas, etc.) and renewable (solar, wind, wave, etc.) energy resources. Energy resources, in particular oil and oil products, are used in the production of electricity and in the fuel industry. Despite the fact that the volume of oil

reserves in the world is approaching 400 billion, by the middle of the 21st century, their sharp reduction in reserves and their production is predicted.

The decline in oil production (Fig. 1) requires the search for alternative directions [1]. Efficient use of alternative energy sources is a promising direction for the future in order to prevent pollution of nature. This area is given a special place in the Republic of Azerbaijan, Azerbaijan cooperates with international organizations in this area,

European Economic Development Program under the United Nations, the European Union and other international and regional levels.

On October 21, 2001, the decree of the President of the Republic of Azerbaijan on the approval of the "State Program for the Use of Alternative and Renewable Energy Sources in the Republic of Azerbaijan laid the foundation for a special approach in this area [2].

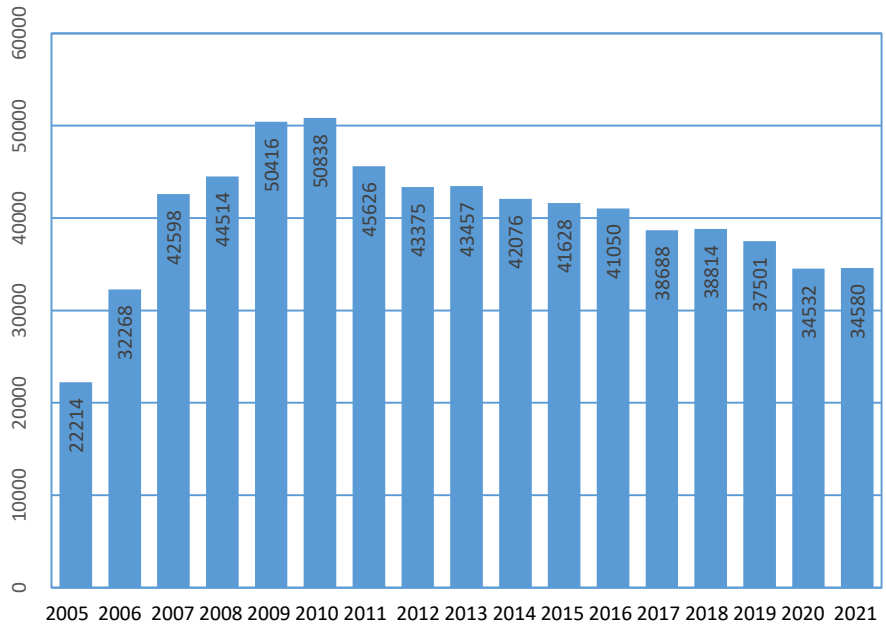


Figure 1. Change in the dynamics of oil production in the Republic of Azerbaijan

Economic development, the creation of new jobs, an increase in the need for transportation have led to a rapid increase in the number of vehicles, and the latter to a sharp increase in the consumption of fuel obtained from oil in various ways. An increase in the number of vehicles, environmental problems require the production of vehicles running on alternative fuels and increased attention to this area. In recent years, the annual number of cars imported and registered in the country has doubled compared to 2005 and is approaching the milestone of 100,000 cars. In general, the number of vehicles in the country as of 01.01.2022 is more than 1.35 million. In recent years, the growth dynamics of vehicles running on alternative fuels and energy has also been determined. For 8 months of this year, up to 18% of cars imported into the country are hybrids, and the number of electric vehicles is 4...5%.

Transport has a strong impact on the environment and people's lives. As cities grow, the problem of traffic becomes critical. In some cities, air pollutant gases emitted by them are 68-80%. More than 2 billion tons of petroleum fuel are used annually in the world's automobile engines. At this time, the efficiency of work is on average 23%. The remaining 77% is used for heating the environment. On average, a car traveling 15,000 km per year uses 4,350 kg of oxygen. At the same time, it poisons the air, emitting 3250 kg of CO2, 350 kg of CO and 93 kg of other harmful gases

into the atmosphere. When a car travels 100 km, it consumes as much oxygen as a person consumes in a year. The concentration of harmful gases emitted by cars into the atmosphere depends not only on the type of engine, but also on the technical condition of the cars, the maintenance provided to them, the condition of the fuel system and the combustion system, and the nature of the engine. Most cars operated in the country are 10- summer and more "age". More than 50% of used cars are located in the capital of the republic, Baku. Cars circulate in the atmosphere not only with toxic components of exhaust gases, but also with fuel vapors and tire dust. Each car emits 10 kg of rubber dust into the atmosphere per year. The composition of gases emitted by engines in urban conditions is also affected by the mode of operation of vehicles. With low-speed movement and frequent changes in speed, frequent braking and overtaking, harmful gases increase [3].

At the same time, the decline in oil production, the deterioration of the geopolitical, man-made and environmental situation is the use of alternative fuels relevant. Cars with an internal combustion engine cause damage to the environment, people, flora and fauna, caused by more than 200 components emitted into the atmosphere during the operation of vehicles, noise levels, electromagnetic radiation, leading to the use of alternative energy sources. Changes in consumer demand, growth of industries, changes in the balance between supply and demand, problems in the use of non-renewable resources and reducing their impact require a scientifically based approach [4].

For this reason, it is important to implement incentive measures to reduce emissions of harmful waste into the atmosphere. The "role" of traditional internal combustion engines in creating the "greenhouse effect", "acid rain" and other global cataclysms is great. Among hazardous waste, the amount and influence of carbon oxides is much higher.

The Paris Agreement, approved in 2015, can be considered one of the steps aimed at reducing the use of hydrocarbon reserves as fuel. [5].

As a result, it is planned to reduce by 15% (by 2025), by 55% (by 2030) internal combustion engines that create a "greenhouse effect" and run on hydrocarbon fuel, and by 2050. In a number of European countries, they will completely replaced by electric vehicles.

RESEARCH METHODS

By realizing the rejection of the production and operation of traditional vehicles that cause serious damage to the environment, it provides opportunities for the introduction of electric vehicles and hydrogen fuel engines, allowing the use of "green technologies in production."

The reason for the switch to alternative energy vehicles can be summarized as follows:

- external causes: climate change and a sharp reduction in natural resources;
- technological reasons: simplicity of the production process;
- legal reasons: tightening of environmental requirements;
- changes in customer satisfaction, etc.

The transition of cars with alternative energy can occur according to different scenarios. In the world experience, the transition is carried out according to one of three scenarios:

- - Rapid transition - implementation of political contextual measures aimed at raising taxes for the use of hydrocarbon fuels. The goal is to drastically reduce the number of cars running on hydrocarbon fuels, increase the production and operation of cars running on alternative energy sources, and switch from traditional fuel to electric energy, which is considered promising. In the initial periods, no major changes are made to the design of vehicles and the existing infrastructure.

The risk of environmental hazards is still close to the previous level. In this regard, it is necessary to carry out reforms in both technology and infrastructure.

- Total rejection (Net Zero) - the rejection of traditional modes of transport by introducing high-speed transport, promoting the priority of the population in this matter. As a result, the amount of hazardous waste is reduced by 90...95%, the use of "black gold" in vehicles is minimized. To do this, the type of energy carriers and engines is fundamentally updated, traditional technologies are replaced by more efficient, promising ones. For this, the creation of devices that generate energy (especially electrical) in a centralized and decentralized way in cars is considered.
- "business as usual" - government policy, technology and social preferences continue as before, the demand for oil remains unchanged and the law of demand is gradually decreasing. Thus, reaching the peak of oil production can be delayed for several decades, the amount of natural resources changes at a slower pace, and the damage caused by hazardous waste to the environment will continue to increase.

The application of new technologies in numerous scenarios is associated with an interest in the problem of environmental protection and economic development. Environmental protection requires the indication of the operations required in the applied technologies:

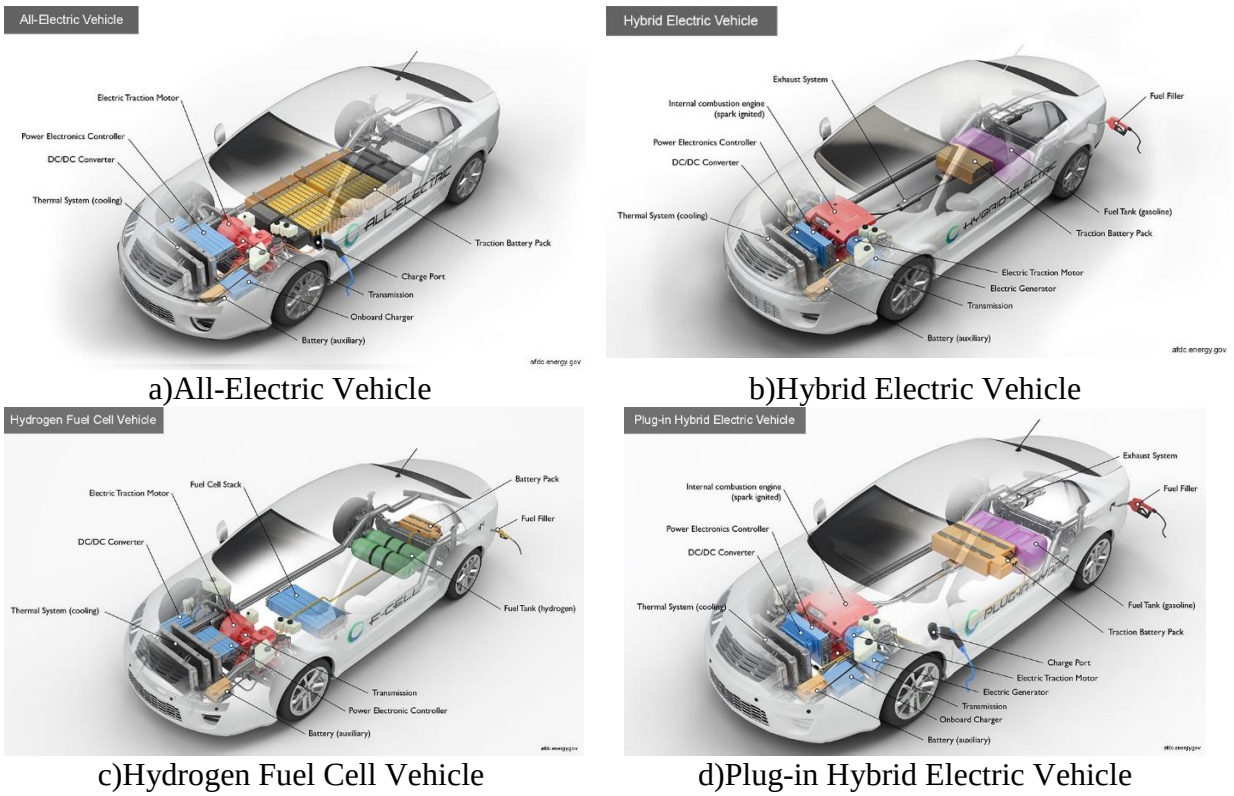
- in the context of the dynamic development of various factors, it is advisable to consider indicators not for a short period of time, but in the life cycle of the technology used;
- agree on the integral indicators of the technologies being introduced (the totality of energy consumption, individual toxic wastes released into the environment, social issues, etc.);
- determination of total costs by determining the costs associated with energy consumption;
- determination of the "social" value of energy.

Determining this parameter makes it possible to assess how the applied technology is perceived by society [6].

The transition to technological and structural changes in the automotive industry is mainly due to economic and environmental reasons. Economic conditions are closely related to the balance of supply and demand, prices, market structure and segmentation, cooperation and competition. The current situation requires the creation of a technically and technologically efficient machine that minimizes hazardous waste.

Currently, in the automotive industry, preference is given to vehicles running on hydrogen and electric energy, as qualitatively alternative modes of transport, their production and operation are considered more promising. Figure 2 shows the main types of vehicles with an alternative form of energy [7].

The use of hydrogen as a quality fuel in internal combustion engines has led to a partial reduction in the concentration of exhaust gases. The use of hydrogen in a mixture with gasoline allows you to achieve certain results. Currently, hydrogen electric motors are recommended as an energy source. Unlike electric vehicles, hydrogen vehicles are filled with hydrogen at traditional filling stations. The filling time is short, hydrogen has large reserves due to the fact that it is obtained by pyrolysis of water. Hydrogen is very sensitive to ambient temperature. A decrease in temperature by 10 0C reduces the rate of a chemical reaction by four times, and the energy efficiency of the fuel sharply decreases. The use of large-sized devices for a chemical reaction increases the dimensions of the vehicle (weight, dimensions, etc.). The technology for creating these cars is complex, expensive component materials, as a result, the development technology is weakened and demand is reduced [8].



a)All-Electric Vehicle b)Hybrid Electric Vehicle

c)Hydrogen Fuel Cell Vehicle d)Plug-in Hybrid Electric Vehicle

Rice. 2. Types of alternative fuel vehicles

According to global automakers, electric vehicles are capable of "zero" emissions of foreign gases. The history of electric vehicles is much older than that of vehicles with internal combustion engines. At that time, the relatively small amount of energy produced, the "oil boom" and other factors caused electric vehicles to lag behind hydrocarbon-fueled vehicles.

In recent years, the environmental situation has increased the relevance of electric vehicles powered by alternative energy. Electric vehicles have a number of important advantages over traditional thermal energy vehicles:

- relatively cheap cost of electricity (the cost of electricity for traveling one distance is much lower);
- an environmentally friendly method of transportation (the amount of toxic components and noise emitted into the atmosphere is incomparably less);
- optimal characteristics of the power unit (the amount of useful work is more than 90%);
- reduction in the range of elements (the number of units and mechanisms used in electric vehicles is much less).

Despite the mentioned advantages, there are also disadvantages of operating electric vehicles:

- limited mileage;
- long-term charging;
- infrastructure problems;
- relatively high production costs;
- safety of power plants during operation;
- high risk of accidents and consequences.

Expanding the use of alternative vehicles, especially electric vehicles, requires strategic steps. At the same time, work should be carried out towards the development of national projects for the

creation of electric vehicles and other vehicles using alternative fuel sources. It is important to work in the unity of "science-education and production-operation". Implementation of national projects" within the framework of university-industrial cooperation is considered one of the main factors that can lead to the strengthening of business relations with the education system.

Traditional educational institutions are places where the leading forces of science gather and basic scientific research is carried out. The rapid globalization of modernity, the ever more rapid dissemination of information and other factors have proved that knowledge cannot keep pace with development. Adaptation of universities to modern conditions is possible with the help of new concepts "university 3.0", "university 4.0" [9]. Moving to new concepts, they must move from traditional education and research to international innovation centers, to establishing business on demand in the framework of mutual cooperation with various sectors of the economy. Applying scientific achievements in the work of enterprises, updating technologies, building a business case based on theoretically obtained results, it is possible to ensure the transition without deformation [10]. Organizational and institutional barriers are considered to be the main problems that may hinder the transition. Participation of interested companies in the educational process, involvement of the leading forces of the business environment in the development of educational plans, increasing the mobility of university staff and requirements, ensuring regular releases in order to quickly integrate them into the business environment, creating special funds to stimulate research work, the relevance of scientific and research topics for enterprise problems, the organization of seminars and training courses, continuing education, the organization of satraps, etc. will be able to achieve the best results.

RESULTS AND DISCUSSION

The production and operation of electric vehicles can lead to economical use of energy resources and improve the environmental situation. The steps taken in this direction can be summarized as follows:

- formation of incentive proposals to increase sales (provision of subsidies on a preferential basis);
- providing benefits to the owners of these vehicles during operation (parking, extraordinary and accelerated service);
-planning of the optimal "center of gravity" for carrying out maintenance and refueling work and organizing mobile services;
- simplification of insurance, tax, registration procedures;
- sensitivity to social issues of personnel working in the field of production, operation and maintenance;
- increasing the attractiveness of projects related to the production, operation and maintenance of an electric vehicle, establishing advertising work at the level of requirements;
- taking measures related to the teaching of subjects that study the device, problems of operation and maintenance of alternative, especially promising, vehicles in technical universities, as well as ways to solve them, and the introduction of a suitable specialty into the nomenclature (taking into account the extensive experience of the Republic of Turkey in this area and close ties with Turkish universities). Strengthening cooperation between universities and industry requires the following strategic steps:
- Identification of innovation in the technological field and ensuring the orientation and adaptation of educational institutions to new innovations;
- Choice of a high-quality and competitive direction of training and cooperation;
- Protection of the principles of sustainable development;

- Definition of environmentally friendly technologies;
- Optimization through the use of advanced technologies, modernization of traditional areas, structural reforms;
- Introduction of modern mechanisms aimed at recruitment and a long-term perspective for closer cooperation;
- Use of scientific and technological achievements in industry;
- Creation of motivation systems aimed at solving the social problems of workers, increasing transferability, cooperation and labor mobility;
- Teaching in a foreign language, exchange with high-ranking universities, providing strong intellectual resources for education at the international level;

The application of cooperation between universities and industry, the study of world experience in the field of protection of existing energy resources requires the adoption of appropriate measures in this area as well. The decline in energy resources, the environmental situation indicates the importance of taking action. The accelerated consumption of fuel and energy resources confirms that the use of alternative energy is inevitable, and the environmental situation requires special control over this work. At the same time, a large number of cars, especially their "age", indicates that the situation is more critical. It is possible to delay the “peak” situation by taking appropriate measures towards the disposal, barter and compensation of vehicles. The mentioned ones require time to develop appropriate measures, prepare a roadmap for implementation, etc.

CONCLUSIONS

In order to study the creation and functioning of the production base of electric vehicles and alternative fuel vehicles, research should be carried out in the following areas:

- Conduct a comparative analysis of the current environmental situation in Azerbaijan with other countries;
- Composition of the vehicle fleet (share of vehicles with electric and hybrid engines);
- Number of existing electric filling stations in Azerbaijan;
- Forecasting the demand for charging stations (according to the growth rate of the number of electric vehicles under different scenarios);
- The level of organization of maintenance of electric vehicles in Azerbaijan;
-Organization of training on the study of vehicles on alternative energy sources in higher technical educational institutions;
-Training of technical service specialists (professional training);
-Prospects for research in the direction of the creation and operation of electric vehicles;
-Current state and prospects for the development of university-industrial cooperation;
-Methodology for the development of technical documents for the design and operation of promising vehicles within the framework of university and industrial cooperation.

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